Appendix E

Existing Conditions – 2009

Summary of Operational Emissions (2009) - 50% Scenario[1]

Activities	Unmitigated Operational Emisions (tons/ year)						
	VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2e
Indirect Emissions							
Changes in VMT emissions	-314.6	-7,078.1	-812.6	-102.2	-44.3	-9.0	-749,287
Changes in airplane emissions	-1.3	-18	-14	-0.25	-0.25	-1.7	-12,887
Changes in power plant emissions	8.5	86.3	65.5	12.4	11.4	7.3	217,755
Direct Emissions							
Station operation[2]	33.4	900	101.3	11.3	5.1	0.8	79,606
HMF onsite emissions	0.56	9.0	3.5	0.13	0.12	0.47	19,498
HMF offsite mobile source emissions	2.93	77	11.9	1.10	0.51	0.07	7,057
MOWF offsite emissions	0.83	23	2.6	0.3	0.1	0.0	2,182
Fugitive dust from train operations	N/A	N/A	N/A	29	4.3	N/A	N/A
Total	**-270**	**-6,000**	**-642**	**-48.2**	**-23.0**	**-2.04**	**-436,076**

Summary of Operational Emissions (2009) - 83% Scenario[1]

Activities	Unmitigated Operational Emisions (tons/ year)						
	VOC	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	CO_2e
Indirect Emissions							
Changes in VMT emissions	-210.1	-4,726.6	-542.6	-68.3	-29.6	-6.0	-500,353
Changes in airplane emissions	-0.9	-12	-9	-0.17	-0.17	-1.1	-8,635
Changes in power plant emissions	5.7	57.6	43.7	8.3	8.0	4.9	145,910
Direct Emissions							
Station operation[2]	33.4	900	101.3	11.3	5.1	0.8	79,606
HMF onsite emissions	0.56	9.0	3.5	0.13	0.12	0.47	19,498
HMF offsite mobile source emissions	2.93	77	11.9	1.10	0.51	0.07	7,057
MOWF offsite emissions	0.83	23	2.6	0.32	0.14	0.02	2,182
Fugitive dust from train operations	N/A	N/A	N/A	29	4.3	N/A	N/A
Total	**-168**	**-3,672**	**-389**	**-18.3**	**-11.6**	**-0.88**	**-254,735**

1. 50% and 83% scenarios correspond to HST ticket price at 50% and 83% of airfare ticket, respectively

2. The operation contains indirect GHG emissions associated with energy use, water use, and solid waste.

Fresno Station: Operational Emissions

Operational VMT Emissions

Emission Source	Number of Round Trips per Day	Round Trip Distance (miles)	Emissions (tpy)							
			ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$	CO_2	CH_4
Operational Year 2009										
Employees [2,3]	35	40	0.081	2.251	0.240	0.002	0.028	0.013	192	0.020
Passengers by Shuttle / Bus [4]	35	40	0.157	2.462	1.315	0.004	0.025	0.010	297	0.007
Passengers by Car [5]	5,800	40	13.371	370.942	39.554	0.327	4.667	2.100	31,655	3.267
2009 Total	**--**	**--**	**13.610**	**375.655**	**41.109**	**0.333**	**4.721**	**2.123**	**32,145**	**3.294**

Notes:

1. 400 passengers would arrive at the station via biking or walking which would not generate air emissions. (Technical Memorandum: Station Area Parking Guidance, created by Bryan Porter and Nick Brand, 06/09/2010)
2. No. of employess is based on the number of employee for the Merced station (40) ratioed by daily boarding. There were 7,600 daily boardings at Merced station and 8,400 daily boarding at Fresno station.
3. Assumed percentage of employees that carpool: 20%
4. 700 passengers travel by bus to board at the station (Technical Memorandum: Station Area Parking Guidance, created by Bryan Porter and Nick Brand, 06/09/2010). Each bus is expected to hold 40 people (Swathi Korpu, Personal Communication).
5. Passenger arrive by vehicle (kiss and ride, vehicle, rental cars or taxis) was provided by transportation consultants. (Swathi Korpu, Personal Communication)
6. An equal number of people are anticipated to alight from the station per day as board per day. All except autos dropping off passengers are assumed to be one-way trips, thus there is one roundtrip for a boarding and alighting pair.

Vehicle Emission Factors

Vehicle Type	Vehicle Emission Factor (g/mile) [1]							
	ROG	CO	NOx	SOx	PM_{10} [2]	$PM_{2.5}$ [2]	CO_2	CH_4
Operational Year 2009								
Passenger	0.143	3.974	0.424	0.004	0.050	0.023	339.132	0.035
Shuttle / Bus [3]	0.280	4.371	2.335	0.008	0.045	0.018	527.847	0.013

Notes:

1. Emission factors are from EMFAC2011-LDV for passenger vehicles (50% LDA-All and 50% of the average of LDT1-All and LDT2-All) traveling at 35 mph. Temperaure of 65 F (annual average for Fresno 5 NE station, Western Regional Climate Center) and RH of 41% was used.
2. Emission factors for PM_{10} and $PM_{2.5}$ include contributions from exhaust, brake-wear, and tire-wear.
3. Emission factors are from EMFAC2011-web and EMFAC2011-PL for urban buses (UBUS-GAS) traveling at 35 mph. All buses and shuttles coming to the Fresno station in 2009 will be natural gas powered. The bus emission factors were determined using only 1997 - 2009 model years based on a 12-year usable life span for city buses (FTA, Useful Life of Transit Buses and Vans, April 2007).

Operational Area Source Emissions

Emission Source	Emissions (tpy) [1]						
	ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$	CO_2
Operational Year 2009							
Natural Gas Usage	0.010	0.120	0.150	0.000	0.000	0.000	176
Landscaping	0.010	0.140	0.000	0.000	0.000	0.000	0
Emergency Generator	0.034	0.617	0.118	0.002	0.005	0.005	134.341
2009 Total	**0.054**	**0.877**	**0.268**	**0.002**	**0.005**	**0.005**	**310.971**

Notes:

1. Emissions calculated in URBEMIS2007 using the General Light Industry land use category.

Operational Indirect Emissions

Emission Source	Building Size (sqft)	Electricity Usage Rate (kWh/sqft/year) [1]	Emissions (tpy)		
			CO_2	CH_4	N_2O
Operational Year 2009					
Station Buildings [2]	75,000	13.55	346	0.014	0.003
2009 Total	**--**	**--**	**346**	**0.014**	**0.003**

Notes:

1. Electricity Usage Rate from Table A9-11-A (CEQA Handbook, 1993). The Station Buildings are considered 'Retail'.
2. Station building size was provided in memomrandum by Bob Lagomarsino (URS) (March 31, 2011)

Electricity Emission Factors

	Emission Factor (lb/MWh) [1, 2]		
	CO_2	CH_4	N_2O
Purchased Electricity	681.01	0.0283	0.00623

Notes:

1. Emission factors from U.S. EPA eGRID2010 Version 1.0 (2007 data) for the WECC California subregion.
2. Emission factors are not available for future years. As a result, the available emission factors were applied to 2009 operations.

Operational Indirect Emissions (Water and Wastewater)

Source	Volume[4] (million gallons/year)	Indirect Electricity[1] (kWhr/million gallons)	Emission Factor Electricity[2] CO_2e (lb/kwhr)	Direct Emissions[3] CO_2e (Metric Tons/year)	Indirect Emissions CO_2e (Metric Tons/year)	Total Emissions CO_2e (Metric Tons/year)
Operational Year 2035						
Fresno Station Water	15.33	3500	0.6835356	--	16.64	16.64
Fresno Station Wastewater	8.43	1911	0.6835356	2.18106E-06	5.00	5.00
2035 Total	**--**	**--**	**--**	**--**	**--**	21.63

Notes:

1. Electricity consupmtion is based on average for Northern California.
2. Electricity emission factor is based on the average for the state.

3. Direct emissons assume the wastewater is 100% aerobic and only emits nitrogen at a rate of 8.3445 x 10^{-10} N_2O per million gallons.

4. The water volume is based on data from the Public Utilities analysis.

Operational Indirect Emissions (Solid Waste)

Source	Volume[3] (short tons/year)	Emission Factors[1] (Metric ton per		Emissions (Metric tons)		CO_2e (Metric Tons/year)
		CO_2	CH_4	CO_2	CH_4	
Operational Year 2035						
Fresno Station Waste	412.45	0.207663449	0.010297457	85.65	4.25	174.84
2035 Total	--	--	--	--	--	174.84

Notes:

1. The landfill is assumed to have a land fill gas capture system and combustion of land fill gas. The capture efficiency is assumed to be 75% and the distruction efficiency is assumed to be 98%.

2. To obtain the total emissions as carbon dioxide equivalents (CO_2e), the individual GHG emissions are multiplied by their global warming potential (GWP). The GWP for CO_2 is 1 and for CH_4 is 21.

3. Volume assumes a rate of 1.3 tons generated per year per employee at the HMF facility and 0.48 tons/day, 1.13 tons/day, and 1.3 tons/day for the Kings/Tulare, Fresno, and Bakersfield stations respectively.

2009 Total Operational Emissions

Emission Source	Emissions (tpy) [1]									
	ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$	CO_2e	CO_2	CH4	N2O
Operational VMT	13.610	375.655	41.109	0.333	4.721	2.123	32,213.945	32,144.770	3.294	--
Area Source	0.054	0.877	0.268	0.002	0.005	0.005	310.971	310.971	--	--
Indirect Electricity	--	--	--	--	--	--	347.32142	346	0.014	0.003
Indirect Water and Wastewater	--	--	--	--	--	--	23.84429885	--	--	--
Indirect Solid Waste	--	--	--	--	--	--	192.729752	--	--	--
Total	**13.663**	**376.532**	**41.377**	**0.335**	**4.726**	**2.128**	**33,088.811**	**32,801.779**	**3.308**	**0.003**

Kings/ Tulare Regional (KTR) Station: Operational Emissions

Operational VMT Emissions

Emission Source	Number of Round Trips per Day	Round Trip Distance (miles)	Emissions (tpy)							
			ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$	CO_2	CH_4
Operational Year 2009										
Employees [2,3]	14	40	0.044	1.072	0.126	0.001	0.011	0.005	74	0.009
Passengers by Shuttle / Bus [4]	15	40	0.002	0.050	0.066	0.002	0.011	0.004	127	0.000
Passengers by Car [5]	2,200	40	7.187	173.461	20.376	0.124	1.779	0.797	12,022	1.434
2009 Total	**--**	**--**	**7.234**	**174.584**	**20.567**	**0.127**	**1.801**	**0.806**	**12,224**	**1.443**

Notes:

1. 200 passengers would arrive at the station via biking or walking which would not generate air emissions. (Technical Memorandum: Station Area Parking Guidance, created by Bryan Porter and Nick Brand, 06/09/2010)
2. No. of employess is based on the number of employee for the Merced station (40) ratioed by daily boarding. There were 7,600 daily boardings at Merced station and 3,300 daily boarding at the KTR station
3. Assumed percentage of employees that carpool: 20%
4. 300 passengers travel by bus to board at the station (Technical Memorandum: Station Area Parking Guidance, created by Bryan Porter and Nick Brand, 06/09/2010). Each bus is expected to hold 40 people (Swathi Korpu, Personal Communication).
5. Passenger arrive by vehicle (kiss and ride, vehicle, rental cars or taxis) was provided by transportation consultants. (Swathi Korpu, Personal Communication)
6. An equal number of people are anticipated to alight from the station per day as board per day. All except autos dropping off passengers are assumed to be one-way trips, thus there is one roundtrip for a boarding and alighting pair.

Vehicle Emission Factors

Vehicle Type	Vehicle Emission Factor (g/mile) [1]							
	ROG	CO	NOx	SOx	PM_{10} [2]	$PM_{2.5}$ [2]	CO_2	CH_4
Operational Year 2009								
Passenger	0.203	4.899	0.576	0.004	0.050	0.023	339.559	0.041
Shuttle / Bus [3]	0.010	0.208	0.272	0.008	0.045	0.018	527.846	0.001

Notes:

1. Emission factors are from EMFAC2011-LDV for passenger vehicles (50% LDA-All and 50% of the average of LDT1-All and LDT2-All) traveling at 35 mph. Temperaure of 62 F (annual average for Hanford station, Western Regional Climate Center) and RH of 41% was used.
2. Emission factors for PM_{10} and $PM_{2.5}$ include contributions from exhaust, brake-wear, and tire-wear.
3. Emission factors are from EMFAC2011-web and EMFAC2011-PL for urban buses (UBUS-GAS) traveling at 35 mph. All buses and shuttles coming to the KTR station in 2009 will be natural gas powered. The bus emission factors were determined using only 1997 - 2009 model years based on a 12-year usable life span for city buses (FTA, Useful Life of Transit Buses and Vans, April 2007).

Operational Area Source Emissions

Emission Source	Emissions (tpy) [1]						
	ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$	CO_2
Operational Year 2009							
Natural Gas Usage	0.010	0.120	0.150	0.000	0.000	0.000	176
Landscaping	0.010	0.140	0.000	0.000	0.000	0.000	0
Emergency Generator	0.034	0.617	0.118	0.002	0.005	0.005	134.341
2009 Total	**0.054**	**0.877**	**0.268**	**0.002**	**0.005**	**0.005**	**310.971**

Notes:

1. Emissions calculated in URBEMIS2007 using the General Light Industry land use category.

Operational Indirect Emissions

Emission Source	Building Size (sqft)	Electricity Usage Rate (kWh/sqft/year) [1]	Emissions (tpy)		
			CO_2	CH_4	N_2O
Operational Year 2009					
Station Buildings [2]	40,000	13.55	185	0.008	0.002
2009 Total	**--**	**--**	**185**	**0.008**	**0.002**

Notes:

1. Electricity Usage Rate from Table A9-11-A (CEQA Handbook, 1993). The Station Buildings are considered 'Retail'.
2. Station building size was provided in memomrandum by Bob Lagomarsino (URS) (March 31, 2011)

Electricity Emission Factors

	Emission Factor (lb/MWh) [1, 2]		
	CO_2	CH_4	N_2O
Purchased Electricity	681.01	0.0283	0.00623

Notes:

1. Emission factors from U.S. EPA eGRID2010 Version 1.0 (2007 data) for the WECC California subregion.
2. Emission factors are not available for future years. As a result, the available emission factors were applied to 2035 operations.

Operational Indirect Emissions (Water and Wastewater)

Source	Volume[4] (million gallons/year)	Indirect Electricity[1] (kWhr/million gallons)	Emission Factor Electricity[2] CO_2e (lb/kwhr)	Direct Emissions[3] CO_2e (Metric Tons/year)	Indirect Emissions CO_2e (Metric Tons/year)	Total Emissions CO_2e (Metric Tons/year)
Operational Year 2035						
Kings/Tulare Station Water	18.07	3500	0.6835356	--	19.61	19.61
Kings/Tulare Station Wastewater	9.86	1911	0.6835356	2.55165E-06	5.84	5.84
2035 Total	**--**	**--**	**--**	**--**	**--**	25.45

Notes:

1. Electricity consupmtion is based on average for Northern California.
2. Electricity emission factor is based on the average for the state.
3. Direct emissons assume the wastewater is 100% aerobic and only emits nitrogen at a rate of 8.3445×10^{-10} N_2O per million gallons.
4. The water volume is based on data from the Public Utilities analysis.

Operational Indirect Emissions (Solid Waste)

Source	Volume[3] (short tons/year)	Emission Factors[1] (Metric ton per		Emissions (Metric tons)		CO_2e (Metric Tons/year)
		CO_2	CH_4	CO_2	CH_4	
Operational Year 2035						
Kings/Tulare Station Waste	175.2	0.207663449	0.010297457	36.38	1.80	74.27
2035 Total	**--**	**--**	**--**	**--**	**--**	74.27

Notes:

1. The landfill is assumed to have a land fill gas capture system and combustion of land fill gas. The capture efficiency is assumed to be 75% and the distruction efficiency is assumed to be 98%.

2. To obtain the total emissions as carbon dioxide equivalents (CO_2e), the individual GHG emissions are multiplied by their global warming potential (GWP). The GWP for CO_2 is 1 and for CH_4 is 21.

3. Volume assumes a rate of 1.3 tons generated per year per employee at the HMF facility and 0.48 tons/day, 1.13 tons/day, and 1.3 tons/day for the Kings/Tulare, Fresno, and Bakersfield stations respectively.

2009 Total Operational Emissions

Emission Source	Emissions (tpy) [1]									
	ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$	CO_2e	CO_2	CH4	N2O
Operational VMT	7.234	174.584	20.567	0.127	1.801	0.806	12,254.342	12,224.039	1.443	--
Area Source	0.054	0.877	0.268	0.002	0.005	0.005	310.971	310.971	--	--
Indirect Electricity	--	--	--	--	--	--	185.238	185	0.008	0.002
Indirect Water and Wastewater	--	--	--	--	--	--	28.055	--	--	--
Indirect Solid Waste	--	--	--	--	--	--	81.868	--	--	--
Total	**7.288**	**175.461**	**20.836**	**0.128**	**1.806**	**0.811**	**12,860.473**	**12,719.564**	**1.451**	**0.002**

Bakersfield Station: Operational Emissions

Operational VMT Emissions

Emission Source	Number of Round Trips per Day	Round Trip Distance (miles)	Emissions (tpy)							
			ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$	CO_2	CH_4
Operational Year 2009										
Employees [2,3]	38	40	0.080	2.239	0.247	0.002	0.031	0.014	209	0.020
Passengers by Shuttle / Bus [4]	45	40	0.053	0.888	0.650	0.006	0.033	0.013	382	0.003
Passengers by Car [5]	5,900	40	12.296	344.080	37.957	0.332	4.724	2.089	32,183	3.038
2009 Total	**--**	**--**	**12.430**	**347.208**	**38.854**	**0.340**	**4.787**	**2.116**	**32,775**	**3.061**

Notes:

1. 500 passengers would arrive at the station via biking or walking which would not generate air emissions. (Technical Memorandum: Station Area Parking Guidance, created by Bryan Porter and Nick Brand, 06/09/2010)
2. No. of employess is based on the number of employee for the Merced station (40) ratioed by daily boarding. There were 7,600 daily boardings at Merced station and 9,200 daily boarding at the Bakersfield station
3. Assumed percentage of employees that carpool: 20%
4. 900 passengers travel by bus to board at the station (Technical Memorandum: Station Area Parking Guidance, created by Bryan Porter and Nick Brand, 06/09/2010). Each bus is expected to hold 40 people (Swathi Korpu, Personal Communication).
5. Passenger arrive by vehicle (kiss and ride, vehicle, rental cars or taxis) was provided by transportation consultants. (Swathi Korpu, Personal Communication)
6. An equal number of people are anticipated to alight from the station per day as board per day. All except autos dropping off passengers are assumed to be one-way trips, thus there is one roundtrip for a boarding and alighting pair.

Vehicle Emission Factors

Vehicle Type	Vehicle Emission Factor (g/mile) [1]							
	ROG	CO	NOx	SOx	PM_{10} [2]	$PM_{2.5}$ [2]	CO_2	CH_4
Operational Year 2009								
Passenger	0.130	3.624	0.400	0.004	0.050	0.022	338.940	0.032
Shuttle / Bus [3]	0.074	1.226	0.897	0.008	0.045	0.018	527.846	0.004

Notes:

1. Emission factors are from EMFAC2011-LDV for passenger vehicles (50% LDA-All and 50% of the average of LDT1-All and LDT2-All) traveling at 35 mph. Temperaure of 64 F (annual average for Bakersfield station, Western Regional Climate Center) and RH of 33% was used.
2. Emission factors for PM_{10} and $PM_{2.5}$ include contributions from exhaust, brake-wear, and tire-wear.
3. Emission factos are from EMFAC2011-web and EMFAC2011-PL for urban buses (UBUS-GAS) traveling at 35 mph. All buses and shuttles coming to the Bakersfield station in 2009 will be natural gas powered. The bus emission factors were determined using only 1997 - 2009 model years based on a 12-year usable life span for city buses (FTA, Useful Life of Transit Buses and Vans, April 2007).

Operational Area Source Emissions

Emission Source	Emissions (tpy) [1]						
	ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$	CO_2
Operational Year 2009							
Natural Gas Usage	0.010	0.120	0.150	0.000	0.000	0.000	176
Landscaping	0.010	0.140	0.000	0.000	0.000	0.000	0
Emergency Generator	0.034	0.617	0.118	0.002	0.005	0.005	134
2009 Total	**0.054**	**0.877**	**0.268**	**0.002**	**0.005**	**0.005**	**311**

Notes:

1. Emissions calculated in URBEMIS2007 using the General Light Industry land use category.

Operational Indirect Emissions

Emission Source	Building Size (sqft)	Rate (kWh/sqft/year) [1]	Emissions (tpy)		
			CO_2	CH_4	N_2O
Operational Year 2009					
Station Buildings [2]	56,000	13.55	258	0.011	0.002
2009 Total	**--**	**--**	**258**	**0.011**	**0.002**

Notes:

1. Electricity Usage Rate from Table A9-11-A (CEQA Handbook, 1993). The Station Buildings are considered 'Retail'.
2. Station building size was provided in memomrandum by Bob Lagomarsino (URS) (March 31, 2011)

Electricity Emission Factors

	Emission Factor (lb/MWh) [1, 2]		
	CO_2	CH_4	N_2O
Purchased Electricity	681.01	0.0283	0.00623

Notes:

1. Emission factors from U.S. EPA eGRID2010 Version 1.0 (2007 data) for the WECC California subregion.
2. Emission factors are not available for future years. As a result, the available emission factors were applied to 2035 operations.

Operational Indirect Emissions (Water and Wastewater)

Source	Volume[4] (million gallons/year)	Indirect Electricity[1] (kWhr/million gallons)	Emission Factor Electricity[2] CO_2e (lb/kwhr)	Direct Emissions[3] CO_2e (Metric Tons/year)	Indirect Emissions CO_2e (Metric Tons/year)	Total Emissions CO_2e (Metric Tons/year)
Operational Year 2035						
Bakersfield Station Water	16.79	3500	0.6835356	--	18.22	18.22
Bakersfield Station Wastewater	9.23	1911	0.6835356	2.38878E-06	5.47	5.47
2035 Total	**--**	**--**	**--**	**--**	**--**	23.69

Notes:

1. Electricity consupmtion is based on average for Northern California.
2. Electricity emission factor is based on the average for the state.
3. Direct emissons assume the wastewater is 100% aerobic and only emits nitrogen at a rate of 8.3445×10^{-10} N_2O per million gallons.
4. The water volume is based on data from the Public Utilities analysis.

Operational Indirect Emissions (Solid Waste)

Source	Volume[3] (short tons/year)	Emission Factors[1] (Metric ton per		Emissions (Metric tons)		CO_2e (Metric Tons/year)
		CO_2	CH_4	CO_2	CH_4	
Operational Year 2035						
Bakersfield Station Waste	474.5	0.207663449	0.010297457	98.54	4.89	201.15
2035 Total	**--**	**--**	**--**	**--**	**--**	201.15

Notes:

efficiency is assumed to be 98%.

2. To obtain the total emissions as carbon dioxide equivalents (CO_2e), the individual GHG emissions are multiplied by their global warming potential (GWP). The
Fresno, and Bakersfield stations respectively.

2009 Total Operational Emissions

Emission Source	Emissions (tpy) [1]									
	ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$	CO_2e	CO_2	CH4	N2O
Operational VMT	12.430	347.208	38.854	0.340	4.787	2.116	32,838.895	32,774.616	3.061	--
Area Source	0.054	0.877	0.268	0.002	0.005	0.005	310.971	310.971	--	--
Indirect Electricity	--	--	--	--	--	--	259.333	258	0.011	0.002
Indirect Water and Wastewater	--	--	--	--	--	--	26.115	--	--	--
Indirect Solid Waste	--	--	--	--	--	--	221.724	--	--	--
Total	**12.483**	**348.085**	**39.122**	**0.342**	**4.792**	**2.121**	**33,657.039**	**33,343.962**	**3.072**	**0.002**

Regional Vehicle Miles Traveled - 50% Scenario[3]

County [1]	No Build VMT	Build VMT	Change in Emissions with HST (Tons/Day)							Change in Emissions with HST (Tons/Year) [2]						
	Total Traffic	Total Traffic	ROG	CO	NOx	PM_{10}	$PM_{2.5}$	CO_2	SO_2	ROG	CO	NOx	PM_{10}	$PM_{2.5}$	CO_2	SO_2
Fresno County	17,311,000	17,311,000	-0.33	-7.39	-0.85	-0.11	-0.05	-779	-0.01	-119.47	-2,697.42	-310.40	-39.00	-16.89	-284,227	-3.45
Kings County	2,151,000	2,151,000	-0.06	-1.30	-0.16	-0.02	-0.01	-136	0.00	-21.56	-475.17	-57.74	-6.79	-2.93	-49,506	-0.60
Tulare County	6,046,000	6,046,000	-0.05	-1.01	-0.12	-0.01	-0.01	-105	0.00	-16.45	-369.42	-43.99	-5.34	-2.30	-38,417	-0.47
Kern County	22,379,000	22,379,000	-0.43	-9.69	-1.10	-0.14	-0.06	-1,033	-0.01	-157.16	-3,536.12	-400.50	-51.09	-22.17	-377,137	-4.51
Regional Total	**47,887,000**	**47,887,000**	**-0.86**	**-19.39**	**-2.23**	**-0.28**	**-0.12**	**-2053**	**-0.02**	**-314.64**	**-7,078**	**-813**	**-102.22**	**-44.29**	**-749,287**	**-9.03**

Regional Vehicle Miles Traveled - 83% Scenario[3]

County [1]	No Build VMT	Build VMT	Change in Emissions with HST (Tons/Day)							Change in Emissions with HST (Tons/Year) [2]						
	Total Traffic	Total Traffic	ROG	CO	NOx	PM_{10}	$PM_{2.5}$	CO_2	SO_2	ROG	CO	NOx	PM_{10}	$PM_{2.5}$	CO_2	SO_2
Fresno County	17,311,000	15,970,000	-0.22	-4.93	-0.57	-0.07	-0.03	-519	-0.01	-79.67	-1,798.78	-206.99	-26.01	-11.26	-189,534	-2.30
Kings County	2,151,000	1,920,000	-0.04	-0.86	-0.10	-0.01	-0.01	-89	0.00	-14.18	-312.51	-37.97	-4.47	-1.93	-32,576	-0.40
Tulare County	6,046,000	5,860,000	-0.03	-0.68	-0.08	-0.01	0.00	-71	0.00	-11.09	-249.04	-29.66	-3.60	-1.55	-25,892	-0.32
Kern County	22,379,000	20,620,000	-0.29	-6.48	-0.73	-0.09	-0.04	-691	-0.01	-105.17	-2,366.31	-268.01	-34.18	-14.83	-252,352	-3.02
Regional Total	**47,887,000**	**44,370,000**	**-0.58**	**-12.95**	**-1.49**	**-0.19**	**-0.08**	**-1371**	**-0.02**	**-210.11**	**-4,727**	**-543**	**-68.25**	**-29.57**	**-500,353**	**-6.03**

Notes:

1. VMT analysis was provided by Cambridge Systematics
2. Annualization factor (365) was used, based on conversation between Alice Lovegrove (Parsons Brinkerhoff) and Avanti Tamhane (URS)
3. 50% and 83% scenarios correspond to HST ticket price at 50% and 83% of airfare ticket, respectively

Regional Aircraft Travel - 50% Scenario[3]

Origin [1]	No. of Flights	Change in Emission Burdens due to HST (Tons/Day)							Change in Emission Burdens due to HST (Tons/Year) [2]						
	Removed	ROG	CO	NOx	PM_{10}	$PM_{2.5}$	CO_2	SO_2	ROG	CO	NOx	PM_{10}	$PM_{2.5}$	CO_2	SO_2
San Joaquin	-4	-0.00358417	-0.04864231	-0.03840183	-0.00069174	-0.00068893	-35.3068493	-0.00460822	-1.30822222	-17.7544444	-14.0166667	-0.25248689	-0.251459	-12,887	-1.682

Regional Aircraft Travel - 83% Scenario[3]

Origin [1]	No. of Flights	Change in Emission Burdens due to HST (Tons/Day)							Change in Emission Burdens due to HST (Tons/Year) [2]						
	Removed	ROG	CO	NOx	PM_{10}	$PM_{2.5}$	CO_2	SO_2	ROG	CO	NOx	PM_{10}	$PM_{2.5}$	CO_2	SO_2
San Joaquin	-3	-0.00240139	-0.03259035	-0.02572922	-0.00046347	-0.00046158	-23.6572603	-0.00308751	-0.87650889	-11.8954778	-9.39116667	-0.16916622	-0.16847753	-8,635	-1.12694

Notes:

1. VMT analysis was done in EDMS, provided by PMT
2. Annualization factor (365) was used, based on conversation between Alice Lovegrove (Parsons Brinkerhoff) and Avanti Tamhane (URS)
3. 50% and 83% scenarios correspond to HST ticket price at 50% and 83% of airfare ticket, respectively

Regional Electricity - 50% Scenario[4]

Electricity required [1]		Change in Emissions due to HST (Tons/Day)							Change in Emissions due to HST (Tons/Year)[2]						
Area	(GWH per day)	HC	CO	NO_x	PM_{10}	$PM_{2.5}$	CO_2	SO_2	HC	CO	NO_x	PM_{10}	$PM_{2.5}$	CO_2	SO_2
Statewide	13.17	0.17	1.69	1.28	0.24	0.22	4,263	0.14	61.00	616.00	468.00	88.00	81.00	1,555,870	52.00
Regional [2]	1.84	0.02	0.24	0.18	0.03	0.03	597	0.02	8.50	86.30	65.50	12.40	11.40	217,755	7.30

Regional Electricity - 83% Scenario[4]

Electricity required [1]		Change in Emissions due to HST (Tons/Day)							Change in Emissions due to HST (Tons/Year)[2]						
Area	(GWH per day)	HC	CO	NO_x	PM_{10}	$PM_{2.5}$	CO_2	SO_2	HC	CO	NO_x	PM_{10}	$PM_{2.5}$	CO_2	SO_2
Statewide	8.78	0.11	1.13	0.85	0.16	0.15	2,854	0.10	40.0	411.0	312.0	59.0	54.0	1,041,737	35.0
Regional [2]	1.22	0.02	0.16	0.12	0.02	0.02	400	0.01	5.7	57.6	43.7	8.3	8.0	145,910	4.9

Notes:

1. VMT analysis was done in EDMS, provided by PMT
2. Regional analysis is based on ratioing the total power requirements for the entire HST alignment and the lengths of the entire alignment, and the Fresno to Bakersfield alignment

Total length of HST = 830 miles

Length of Fresno to Bakersfield Alignment = 114 miles

3. Annualization factor (365) was used, based on conversation between Alice Lovegrove (Parsons Brinkerhoff) and Avanti Tamhane (URS)
4. 50% and 83% scenarios correspond to HST ticket price at 50% and 83% of airfare ticket, respectively

Maintenance-of-Way (MOWF) : Offsite Emissions

Data Assumptions / Inputs

	# / period	VMT (RT)	Average Speed (mph)
Employees (# / day) [1]	400	40	35
Working Days per Yr	365		

Notes:

1. The number of employees and speed for trucks and patrol vehicles is based on information from the PMT Technical Memorandum (TM 5.1), Drawing No. TM 5.1-A

Offsite MOWF Emissions

Emission Source	Emissions (tpy)							
	ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$	CO_2	CH_4
Passenger Vehicles	0.83	23.33	2.57	0.02	0.32	0.14	2181.89	0.21
Total Emissions	**0.83**	**23.33**	**2.57**	**0.02**	**0.32**	**0.14**	**2181.89**	**0.21**

Vehicle Emission Factors

	ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$	CO_2	CH_4
Passenger Vehicles (g/mile) [1]	0.13	3.62	0.40	0.00	0.05	0.02	338.94	0.03

Notes:

1. The MOWF will be located at the Shafter-West HMF site, which is in Kern County. Emission factors are from EMFAC2011-LDV for passenger vehicles (50% LDA-All and 50% of the average of LDT1-All and LDT2-All). Temperaure of 64 F (annual average for Bakersfield station, Western Regional Climate Center) and RH of 33% was used.

Heavy Maintenance Facility (HMF): Onsite Emissions

Switch Locomotive Horsepower and Load Factors [1]

Notch	Horsepower	Percent Horsepower in Use	Percent Time in Notch	Actual Percent Time in Use	Engine Horsepower	Equivalent Horsepower Used in Analysis	Load Factors
Idle	13	0.3%	38.0%	100.0%	7	7	0.3%
Dynamic Brake	128	3.4%	12.5%	20.2%	68	14	--
1	211	5.6%	6.5%	10.5%	112	12	--
2	457	12.1%	6.5%	10.5%	242	25	--
3	928	24.6%	5.2%	8.4%	492	41	--
4	1,084	28.7%	4.4%	7.1%	575	41	--
5	1,666	44.2%	3.8%	6.1%	883	54	--
6	2,375	62.9%	3.9%	6.3%	1,259	79	--
7	3,182	84.3%	3.0%	4.8%	1,687	82	--
8	3,773	100.0%	16.2%	26.1%	2,000	523	--
Total for Moving Locomotives	--	--	100%	100%	--	877	0.44

Notes:

1. Data was prepared by Parsons Brinckerhoff in July 2011 and was provided in a spreadsheet called "CA HMF All EmissionsR.xls"

Onsite Operational Emission Factors

HMF Operations	Mode	Average Number of Equipment	Engine Horespower	Load Factor (%) [3]	Emission Factors (g/bhp-hr)						
					PM_{10}	$PM_{2.5}$	NOx	VOC	CO	SOx [6,8]	CO_2 [5]
Locomotive [1,2,4]	Idle	2	2,000	0.3%	0.03	0.03	1.3	0.08	1.83	0.006	672.19
	Moving	2	2,000	44.0%	0.03	0.03	1.3	0.08	1.83	0.006	672.19
Diesel Equipment [7,9]	--	6	200	60.0%	0.015	0.015	0.3	0.14	2.6	0.2	1756.33
Diesel Trucks [10,11]	--	20	--	--	0.596	0.514	11.03	1.45	3.56	0.01	1437.39
Total	--	--	--	--	--	--	--	--	--	--	--

Notes:

1. Number of trains operated in the yard (2), duration of operation in each mode, and number of pieces of diesel equipment (6) were provided by the project engineers
It is assumed that locomotive will be continously moving and/or idling for 2 hours over 24-hours period
2. The horse-power of the switching train locomotive is assumed to be 2,000 hp; horse-power of equipment was assumed to be 200 hp
3. Load factors for locomotives are weighted-average factors that were estimated for idling and moving modes based on in-use power at each notch settings (see Table AQ-1)
4. Locomotive will be purchased after 2015 and, therefore, will be subject to Tier 4 emission standards. PM Emission factors are most stringent Tier 4 federal standards for switch locomotives that were introduced in May 2008 (73 FR 88 25098-25352, May 6, 2008) and are also povided in Table 4, Switch Locomotive Tier 4 Emission Standards on online source
http://dieselnet.com/standards/us/
5. CO2 emission factors for locomotives are based on the carbon content and fuel density
6. SOx emission factors for locomotives are based on the carbon content and fuel density
7. Equipment emission factors are Tier 4 federal standards for on-road (off-road) diesel engines that were introduced in May, 2004 (69 FR 38957-39273, 29 June, 2004) and are also provided in Table 3, Tier 4 Emission Standards for engines up to 560 kw on online source
http://dieselnet.com/standards/us/
8. SO2 emission factor was obtained from "Technical Information and References", Table 2, Santa Barbara County Air Pollution Control District "Construction Equipment Controlled Emission Factors" (such as loaders, graders, dozers, etc.). These emission factors reflect usage of low (0.05%) sulfur content in the fuel. http://www.sbcapcd.org/eng/tech/apcd-24.htm
9. Each piece of equipment was assumed to operate for 8 hours over 24-hours period; load factor for equipment was assumied to be 0.6
10. PM emission factors are for 2017 year for HDD vehicles from EMFAC2007 model that are sum of the running, tire wear, and break wear emissions and expressed in grams per mile
NOx, VOC and CO emission factors are for 2017 year for HDD vehicles from EMFAC2007 model
11. Number of delivery trucks and its operations were assumed to be 20 trucks per hour that will operate 8 hours over 24-hr time period

Onsite Operational Emissions

HMF Operations	Mode	Emissions (lbs/year)							Emissions (tpy) [1]						
		PM_{10}	$PM_{2.5}$	NOx	VOC	CO	SOx	CO_2	PM_{10}	$PM_{2.5}$	NOx	VOC	CO	SOx	CO_2
Locomotive [1,4]	Idle	0.665	0.645	28.8	1.770	40.600	0.14	12970	0.0003	0.0003	0.014	0.001	0.020	0.000	6
	Moving	84.7	82.2	3,670	226.0	5170.0	17.51	3094354	0.042	0.041	1.835	0.113	2.585	0.009	1547
Diesel Equipment [5,6,7]	--	69.5	67.4	1,390	649.0	12100.0	927.00	8133277	0.035	0.034	0.695	0.325	6.050	0.464	4067
Diesel Trucks [8,9]	--	104.0	89.6	1,920	253.0	621.0	1.74	25885746	0.052	0.045	0.960	0.127	0.311	0.001	12943
Indirect Water and Wastewater	--	--	--	--	--	--	--	--	--	--	--	--	--	--	24
Indirect Solid Waste	--	--	--	--	--	--	--	--	--	--	--	--	--	--	911
Total	--	**259**	**240**	**7009**	**1130**	**17932**	**946**	**37126346**	**0.129**	**0.120**	**3.504**	**0.565**	**8.966**	**0.473**	**19498**

Notes:

1. Emissions (lbs/year) were converted to Emissions (tpy) using the following conversion: 2,000 lbs/ton

Operational emissions from electricity consumption were considered negligible for the Heavy Maintenance Facility and were, therefore, not estimated.

Heavy Maintenance Facility (HMF): Offsite Emissions

Offsite Operational VMT Emissions

Emission Source [1]	Number of Round Trips per Day	Round Trip Distance (miles)	Emissions (tpy)							
			ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$	CO_2	CH_4
Operational Year 2009										
Employees [2]	1,200	40	2.752	76.066	7.503	0.068	0.966	0.435	6,548	0.676
Deliveries	20	120	0.179	0.725	4.430	0.005	0.135	0.077	508	0.008
2009 Total	**--**	**--**	**2.931**	**76.790**	**11.933**	**0.072**	**1.101**	**0.512**	**7,057**	**0.684**

Notes:
1. Onsite diesel-fueled vehicle emissions were included with the stationary source combustion calculations.
2. Assumed percentage of employees that carpool: 20%

Vehicle Emission Factors

Vehicle Type	Vehicle Emission Factor (g/mile)							
	ROG	CO	NOx	SOx	PM_{10} [2]	$PM_{2.5}$ [2]	CO_2	CH_4
Operational Year 2009								
Passenger [1]	0.143	3.939	0.389	0.004	0.050	0.023	339.070	0.035
Delivery Truck [3]	0.185	0.750	4.588	0.005	0.140	0.080	526.532	0.009

Notes:
1. Emission factors are from EMFAC2011-LDV for passenger vehicles (50% LDA-All and 50% of the average of LDT1-All and LDT2-All) traveling at 35 mph. Temperaure of 67 F and RH of 55% was used.
2. Emission factors for PM_{10} and $PM_{2.5}$ include contributions from exhaust, brake-wear, and tire-wear.
3. Emissions factors are from EMFAC2011-PL for delivery trucks (average of LHD1-DSL and LHD2-DSL for the San Joaquin Valley Air Basin) traveling at 35 mph.

Train Wake Dust: Fugitive Dust Emissions

Train Velocity	97.0 m/s	217 mph	
	98.3 m/s	220 mph	
At grade length	91 miles		

$P = 58(u^* - ut^*)^2 + 25(u^* - ut^*)$

$P = 0$ for $u^* < ut^*$

$ut^* =$ 0.19 m/s

Wind speed Profile

$$u = (1.2319)^{0.072v-4} \times (0.4575\,d^2 - 3.5496\,d + 9.1545)$$

Where:

u: the maximum wind velocity around human body near the train (m/s).

d: human-train distance (m).

v: train running speed (m/s).

EF (per event) = k x P

k is a particle size multiplier

k = 0.5 for particles < 10 um

k = 0.075 for particles < 2.5 um

$u(z) = (u^*/0.4)\ln(z/zo)$

z = 288 cm

z0 = 0.01 cm

u* = Friction Velocity for the Fastest Mile (m/s)

ut* = Threshold friction velocity (m/s), 0.5 m/s (lowest number from AP42, for coal pile)

0.19 m/s based on the lowest value for disturbed desert soil

u(z) = wind speed at a certain height above the surface (cm/s)

u* = friction velocity for fastest mile. Based on disturbed desert soils (DRI Study)

z = height above the surface (288 cm), based on 1/2 of the train height (1.88 m) & embankment height (1m)

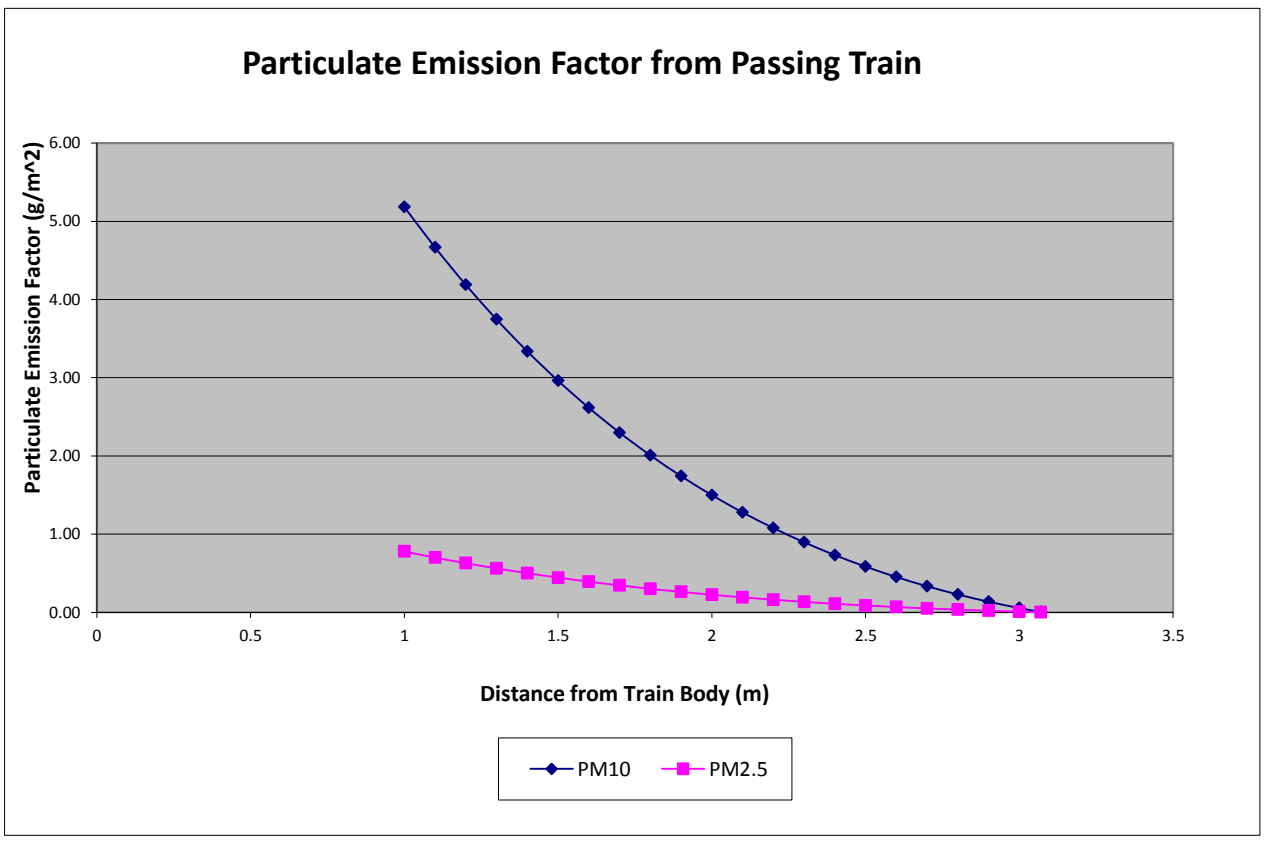
zo = surface roughness height (cm), assume 0.01 cm for the at grade right of way

0.4 is von Karman's constant, dimensionless

Input Parameters and Emissions Factors

Train-Object Distance	Wind Speed from 217 mph Train	Wind Speed from 220 mph Train	Friction Velocity	Erosion Potential	Emission Factor	
(m)	u (m/s)		u*(m/s)	P (g/m^2)	PM_{10} (g/m^2)	$PM_{2.5}$ (g/m^2)
1	11.30	11.53	0.45	10.37	5.18	0.78
1.1	10.81	11.03	0.43	9.33	4.67	0.70
1.2	10.35	10.56	0.41	8.38	4.19	0.63
1.3	9.90	10.10	0.39	7.49	3.75	0.56
1.4	9.47	9.66	0.38	6.68	3.34	0.50
1.5	9.06	9.24	0.36	5.92	2.96	0.44
1.6	8.66	8.83	0.34	5.23	2.62	0.39
1.7	8.28	8.45	0.33	4.60	2.30	0.34
1.8	7.92	8.08	0.31	4.02	2.01	0.30
1.9	7.57	7.72	0.30	3.48	1.74	0.26
2	7.24	7.39	0.29	3.00	1.50	0.22
2.1	6.93	7.07	0.28	2.56	1.28	0.19
2.2	6.63	6.77	0.26	2.16	1.08	0.16
2.3	6.36	6.48	0.25	1.79	0.90	0.13
2.4	6.09	6.22	0.24	1.46	0.73	0.11
2.5	5.85	5.97	0.23	1.17	0.58	0.09
2.6	5.62	5.74	0.22	0.90	0.45	0.07
2.7	5.41	5.53	0.22	0.67	0.33	0.05
2.8	5.22	5.33	0.21	0.46	0.23	0.03
2.9	5.05	5.15	0.20	0.27	0.14	0.02
3	4.89	4.99	0.19	0.11	0.05	0.01
3.07	4.79	4.88	0.19	0.01	0.00	0.00

Emissions		
PM_{10} Emissions	$PM_{2.5}$ Emissions	Emissions Units
3.74	0.56	grams/meter traveled
6023.03	903.45	grams/VMT (one side)
26.53	3.98	lb/miles (both sides)
28.974	4.346	Tpy (24 disturbances)



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Detail Report for Annual Area Source Unmitigated Emissions (Tons/Year)

File Name: U:\5020 Air Quality\5000 Technical\5200 Emission Calculations\Building Operation Emissions\Building Operation Emissions.urb924

Project Name: HST Fresno Station Operation emissions

Project Location: San Joaquin Valley APCD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

AREA SOURCE EMISSION ESTIMATES (Annual Tons Per Year, Unmitigated)

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	**0.01**	**0.15**	**0.12**	**0.00**	**0.00**	**0.00**	**176.38**
Hearth							
Landscape	**0.01**	**0.00**	**0.14**	**0.00**	**0.00**	**0.00**	**0.25**
Consumer Products							
Architectural Coatings	0.00						
TOTALS (tons/year, unmitigated)	0.02	0.15	0.26	0.00	0.00	0.00	176.63

Area Source Changes to Defaults

Page: 1
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Urbemis 2007 Version 9.2.4

Detail Report for Annual Area Source Unmitigated Emissions (Tons/Year)

File Name: T:\5020 Air Quality\5000 Technical_Operational\Building Operation Emissions\VTH Station Operation Emissions_v2.urb924

Project Name: HST KTR Station Operation emissions

Project Location: San Joaquin Valley APCD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

AREA SOURCE EMISSION ESTIMATES (Annual Tons Per Year, Unmitigated)

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	**0.01**	**0.15**	**0.12**	**0.00**	**0.00**	**0.00**	**176.38**
Hearth							
Landscape	**0.01**	**0.00**	**0.14**	**0.00**	**0.00**	**0.00**	**0.25**
Consumer Products	0.00						
Architectural Coatings	0.00						
TOTALS (tons/year, unmitigated)	0.02	0.15	0.26	0.00	0.00	0.00	176.63

Area Source Changes to Defaults

Page: 1
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Urbemis 2007 Version 9.2.4

Detail Report for Annual Area Source Unmitigated Emissions (Tons/Year)

File Name: T:\5020 Air Quality\5000 Technical_Operational\Building Operation Emissions\Bakersfield Station Operation Emissions_v2.urb924

Project Name: HST Bakersfield Station Operation emissions 2009

Project Location: San Joaquin Valley APCD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

AREA SOURCE EMISSION ESTIMATES (Annual Tons Per Year, Unmitigated)

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	**0.01**	**0.15**	**0.12**	**0.00**	**0.00**	**0.00**	**176.38**
Hearth							
Landscape	**0.01**	**0.00**	**0.14**	**0.00**	**0.00**	**0.00**	**0.25**
Consumer Products	0.00						
Architectural Coatings	0.00						
TOTALS (tons/year, unmitigated)	0.02	0.15	0.26	0.00	0.00	0.00	176.63

Area Source Changes to Defaults

Appendix F

Potential Air Quality Impacts of Heavy Maintenance Facility (HMF) Operations

APPENDIX TO
AIR QUALITY CHAPTER

POTENTIAL AIR QUALITY IMPACTS OF HEAVY MAINTENANCE FACILITY (HMF) OPERATIONS

Parsons Brinckerhoff

February 2014

TABLE OF CONTENTS

1.0 INTRODUCTION 1

2.0 POLLUTANTS OF CONCERN 1

3.0 EMISSION FACTORS AND RATES 2

4.0 DISPERSION MODELING 5

5.0 HEALTH RISK METHODOLOGY 5

5.1 CANCER RISK 5

5.1.1 Daily Breathing Rate (DBR) 6

5.1.2 Cancer Potency Factor (CPF) 6

5.1.3 Exposure Value Factors 7

5.2 CHRONIC NONCANCER RISK 7

5.3 ACUTE HAZARD RISK 7

6.0 RESULTS 7

6.1 CRITERIA POLLUTANTS 7

6.2 TOXIC POLLUTANTS 8

6.2.1 Chronic Noncancer Risk 8

6.2.2 Acute Risk 8

6.2.3 Cancer Risks 8

7.0 CONCLUSIONS 9

TABLES

TABLE 1 SWITCH LOCOMOTIVE HORSE-POWER AND LOAD FACTORS 1

TABLE 2 PM_{10} EMISSION RATES FOR SWITCH LOCOMOTIVE AND DIESEL EQUIPMENT 2

TABLE 3 $PM_{2.5}$ EMISSION RATES FOR SWITCH LOCOMOTIVE AND DIESEL EQUIPMENT 3

TABLE 4 NO_2 EMISSION RATES FOR SWITCH LOCOMOTIVES AND DIESEL EQUIPMENT 4

TABLE 5 TOTAL ESTIMATED CONCENTRATIONS OF THE CRITERIA POLLUTANTS AT THE PROPERTY LINE 8

TABLE 6 CHRONIC NON-CANCER HAZARD INDEX AT THE HMF PROPERTY LINE 10

TABLE 7 TOTAL ACUTE HAZARD INDEX AT THE HMF PROPERTY LINE 11

TABLE 8 DIESEL PM AND TAC CANCER RISK CALCULATIONS AT THE DISTANCE OF 1,300 FEET FROM HMF BOUNDARY 12

1.0 Introduction

The HST project will include a heavy maintenance facility (HMF) that would service and repair the rail cars and locomotives. The facility would include locomotives, diesel equipment (e.g., cranes, backhoes, loaders, etc.), heavy-duty diesel trucks, and a spray booth for painting the trains. While measures would be incorporated to minimize atmospheric emissions from these sources, such as the use of electric yard trains to move the rail cars and electric locomotives around the site, the use of diesel-retrofits on heavy-duty diesel engines, etc., the activities at the HMF site would generate emissions that could impact nearby sensitive land uses. The major sources of HMF emissions include:

- Switch diesel locomotive activities associated with maintenance of way operations;
- Spray booth painting operations;
- Diesel equipment; and
- Diesel trucks.

While only one HMF will be needed for the HST project, several sites are currently being considered. Some of these may have sensitive land uses located nearby. As no one site has been selected, an air quality analysis was conducted for a prototypical facility (using the current facility design and anticipated activities) to determine whether HMF operations have the potential to significantly impact nearby sensitive land uses.

2.0 Pollutants of Concern

Criteria pollutants (i.e. pollutants for which national ambient air quality standards [NAAQS] have been established), pollutants for which California ambient air quality standards [CAAQS] have been established, and non-criteria toxic air contaminants (TACs) were considered in this analysis of potential localized impacts. The criteria pollutants considered are:

- Nitrogen dioxide (NO_2) from diesel locomotives, diesel equipment, and trucks; and
- Particulate matter smaller than 10 microns (PM_{10}) and particulate matter smaller than 2.5 microns ($PM_{2.5}$) from diesel locomotives, diesel equipment, and trucks, spray booth operations.

The TACs considered are contaminants identified by the California Air Resources Board (CARB) and the California Office of Environmental Health Hazard Assessment (OEHHA) that may be emitted from HMF operations, including diesel engines and spray booth activities. Of these, the most critical pollutant for determining the potential health effects of the HMF operations is diesel particulate matter (diesel PM), which has been identified by CARB as a TAC based on its potential to cause cancer and other adverse health problems, including respiratory illnesses, and increased risk of heart disease. There are also a number of toxic pollutants of (with various toxicities) that are either caricnogenic or non-carconogenic that can also be potentially released from spray booth operations and diesel vehicular exhaust.

Analyses were conducted that considered chronic (long-term) carcinogenic, chronic non-carcinogenic, and acute (short-term) health risks. These analyses were conducting following San Joaquin Valey Air Pollution Control District (SJVAPCD) modeling guidance for a diesel "only" facility, which is defined as a facility where diesel PM is the predominant toxic air contaminant and where emissions of other toxic pollutants will not contribute significantly (i.e., greater than 1 in one million) to the overall risk.

3.0 Emission Factors and Rates

Emissions factors from the locomotives and diesel-powered engines of the equipment and trucks and spray booth operations were estimated as follows:

- PM_{10}, $PM_{2.5}$, and NO_2 emissions from switch locomotives were estimated assuming these vehicles would comply with EPA Tier 4 emission standards (which are standards also adopted by CARB) applicable for newly manufactured (after 2015) locomotives (73 FR 88 25098-25352, May 6, 2008) that utilize stringent control technologies and use ultra-low sulfur diesel fuel, and locomotive emission rates were estimated based on locomotive type, notch setting, activity time, and duration;
- For other diesel equipment, EPA's Tier 4 emission standards for non-road diesel engines were used (69 FR 38957-39273, 29 June 2004);
- PM_{10} emission factors were used to represent diesel PM.
- Diesel truck emissions were estimated using EMFAC2007, CARB's latest vehicular emission factor algorithm; and
- Volatile organic compounds (VOCs) from paint booth emissions were estimated using conservative volatility rates and paint usage projections assuming that the paint booths would be equipped with conventional filters with 90% control efficiency. Speciation of VOC compounds from these emissions was obtained from *CARB's Organic Speciation Profile for Surface Coating Operations.* Speciation of VOC compounds from diesel combustion emissions was obtained from CARB's *Organic Speciation Profile for Diesel Light & Heavy Equipment*.

Emission rates for the locomotives, diesel equipment and trucks were estimated based on the following HMF operating scenario, which was supplied by the project's design engineers:

- Two (2) switch locomotives (for maintenance-of-way operations) and six (6) pieces of diesel-fueled equipment would be operating at the HMF;
- Two (2) maintenance-of-way locomotives, which are assumed to be 2,000 horse-power (hp) each, would be idling for 2 hours and moving around the HMF site for 2 hours over a 24-hr period, and the locomotives would go through all notches (gears) when moving (see Table 1 for the hp and load factors used in this analysis);
- The diesel equipment, which is assumed to be 200 hp each, would be operating continuously for 8 hours over a 24-hour period; and
- Twenty (20) diesel trucks would be operating on the site continuously for 8 hours over each 24-hr time period.

Tables 2, 3, and 4 present estimated PM_{10}, $PM_{2.5}$, and NO_2 emission rates estimated for locomotives, diesel equipment and trucks, respectively, together with the parameters and references used to develop these estimates.

Table 1
Switch Locomotive Horse-Power and Load Factors

Notch	HP (1)	% HP in use	Percent Time in Notch (2)	Actual % time in use	Engine HP (3)	Equivalent HP Used in Analysis	Load Factors (4)
Idle	13	0.3%	38%	100%	7	7	0.3%
Dynamic Brake	128	3.4%	12.5%	20.2%	68	14	
1	211	5.6%	6.5%	10.5%	112	12	
2	457	12.1%	6.5%	10.5%	242	25	
3	928	24.6%	5.2%	8.4%	492	41	
4	1,084	28.7%	4.4%	7.1%	575	41	
5	1,666	44.2%	3.8%	6.1%	883	54	
6	2,375	62.9%	3.9%	6.3%	1259	79	
7	3,182	84.3%	3.0%	4.8%	1687	82	
8	3,773	100.0%	16.2%	26.1%	2,000	523	
Total for Moving Locomotives			100%	100%		877	44%

Assumptions:

1. Notch horsepower usage was obtained from tests conducted by MotivePower, a Wabtec company, for the MP36PH-3C locomotive.
2. Percent time in each notch is based on EPA-estimated high power duty-cycles for locomotives.
3. Each switch locomotive is assumed to be 2,000 hp.
4. Average load factors were estimated for two operational modes: idling and moving. It is assumed that the engines would go through all notches when moving.

Table 2
PM_{10} Emission Rates for Switch Locomotive and Diesel Equipment

HMF Operations	Mode	Average Number of Locomotives[1] or Pieces of Diesel Equipment	Engine Horsepower (hp) [2]	Load Factor[3] (%)	Tier 4 Emission Factors [4] (g/bhp-hr)	PM_{10} Emission Rates	
						24-hour	Annual
						g/sec	lb/year
Locomotive	Idle	2	2,000	0.3%	0.03	9.57E-06	6.65E-01
	Moving	2	2,000	44%	0.03	1.22E-03	8.47E+01
Diesel Equipment[5,6]	—	6	200	60%	0.02	1. 33E-03	9.27E+01
Diesel Trucks[7,8]	—	20	—	—	0.21 [7]	5.33E-04	3.71E+01
Total	**—**		**—**	**—**	**—**	**3.09E-03**	**2.15E+02**

Assumptions:

1. Number of locomotives operating in yard, duration of operation in each mode, and number of pieces of diesel equipment were provided by the project engineers. It is assumed that each locomotive would be moving and idling continuously for 2 hours over a 24-hours period.

2. The switch locomotive is assumed to be 2,000 hp; the diesel equipment is assumed to be 200 hp.

3. Load factors for locomotives are weighted-average factors idling and moving modes were based on in-use power at each notch setting (see Table 1).

4. Locomotive would be purchased after 2015 and, therefore, subject to Tier 4 emission standards (http://dieselnet.com/standards/us/). The emission factors used are most stringent locomotive Tier 4 federal standards for switch locomotives (73 FR 88 25098-25352, May 6, 2008).

5. PM10 emission factors used for diesel for equipment are Tier 4 federal standards for on-road (off-road) diesel engines introduced in May, 2004 (69 FR 38957-39273, 29 June, 2004) and are provided in Table 3, Tier 4 Emission Standards for engines up to 560 KW on online source: http://dieselnet.com/standards/us/

6. Each piece of diesel equipment was assumed to operate for 8 hours over a 24-hours period; the load factor for this equipment was assumed to be 0.6.

7. Emission factors for the diesel trucks, which are for 2017, were estimated using California's EMFAC2011 model and are in units of grams of PM per vehicle-mile. Values are for running exhaust emissions at 10 mph, and include tire wear, and brake wear emissions for diesel trucks.

8. It was assumed that 20 trucks would operate on the site for 8 hours over each 24-hr time period.

Table 3
$PM_{2.5}$ Emission Rates for Switch Locomotive and Diesel Equipment

HMF Operations	Mode	Average Number of Locomotives(1) or Pieces of Diesel Equipment	Engine Horsepower (hp) (2)	Load Factor 3) (%)	Tier 4 Emission Factors (4) (g/bhp-hr)	$PM_{2.5}$ Emission Rates	
						24-hour	Annual
						g/sec	lb/year
Locomotive	**Idle**	2	2,000	0.3%	0.03	8.81E-06	6.12E-01
	Moving	2	2,000	44%	0.03	1.12E-03	7.79E+01
Diesel Equipment(5,6)	—	6	200	60%	0.02	1.23E-03	8.53E+01
Diesel Trucks(7,8)	—	20	—	—	0.14 (7)	3.52E-04	2.45E+01
Total	**—**		**—**	**—**	**—**	**2.71E-03**	**1.88E+02**

Assumptions:

1. Number of locomotives operating in yard, duration of operation in each mode, and number of pieces of diesel equipment were provided by the project engineers. It is assumed that each locomotive would be moving and idling continuously for 2 hours over a 24-hours period.

2. The switch locomotive is assumed to be 2,000 hp; the diesel equipment is assumed to be 200 hp.

3. Load factors for locomotives are weighted-average factors idling and moving modes were based on in-use power at each notch setting (see Table 1).

4. Locomotive would be purchased after 2015 and, therefore, subject to Tier 4 emission standards (http://dieselnet.com/standards/us/). The emission factors used are most stringent locomotive Tier 4 federal standards for switch locomotives (73 FR 88 25098-25352, May 6, 2008). PM2.5 emission factors are assumed to be 92 percent of the PM10 emission factors.

5. PM2.5 emission factors used for diesel for equipment are Tier 4 federal standards for on-road (off-road) diesel engines introduced in May, 2004 (69 FR 38957-39273, 29 June, 2004) and are provided in Table 3, Tier 4 Emission Standards for engines up to 560 KW on online source: http://dieselnet.com/standards/us/

6. Each piece of diesel equipment was assumed to operate for 8 hours over a 24-hours period; the load factor for this equipment was assumed to be 0.6.

7. Emission factors for the diesel trucks, which are for 2017, were estimated using California's EMFAC2011 model and are in units of grams of PM per vehicle-mile. Values are for running exhaust emissions at 10 mph, and include tire wear, and brake wear emissions for diesel trucks.

8. It was assumed that 20 trucks would operate on the site for 8 hours over each 24-hr time period.

Table 4
NO_2 Emission Rates for Switch Locomotives and Diesel Equipment

HMF Operations	Mode	Average Number of Locomotive (1) or Pieces of Equipment	Engine Horsepower (2) (hp)	Load Factor (3) (%)	Tier 4 Emission Factors (4) (g/bhp-hour)	Annual NO_2 Emission Rates[5]	
						g/sec	lb/year
Locomotive	**Idle**	2	2,000	0.3%	1.3	4.15E-04	2.88E+01
	Moving	2	2,000	44%	1.3	5.28E-02	3.67E+03
Diesel Equipment (6,7)		6	200	60%	0.3	2.00E-02	1.39E+03
Diesel Trucks (8,9)		20			9.3	2.31E-02	1.61E+03
Total						**9.63E-02**	**6.70E+03**

Assumptions:

1. Number of locomotives operating in yard, duration of operation in each mode, and number of pieces of diesel equipment were provided by the project engineers. It is assumed that each locomotive would be moving and idling continuously for 2 hours over a 24-hours period.

2. The switch locomotive is assumed to be 2,000 hp; the diesel equipment is assumed to be 200 hp.

3. Load factors for locomotives are weighted-average factors idling and moving modes were based on in-use power at each notch setting (see Table 1).

4. Locomotive would be purchased after 2015 and, therefore, subject to Tier 4 emission standards (http://dieselnet.com/standards/us/). The emission factors used are most stringent locomotive Tier 4 federal standards for switch locomotives that were introduced in May 2008 (73 FR 88 25098-25352, May 6, 2008)

5. It is conservatively assumed that all of the nitrogen oxides released from the diesel exhaust would be in the form of NO_2.

6. Emission factors used for diesel for equipment are Tier 4 federal standards for on-road (off-road) diesel engines introduced in May, 2004 (69 FR 38957-39273, 29 June, 2004) and are provided in Table 3, Tier 4 Emission Standards for engines up to 560 kW on online source. http://dieselnet.com/standards/us/

7. Each piece of diesel equipment was assumed to operate for 8 hours over a 24-hours period; the load factor for this equipment was assumed to be 0.6.

8. NOx emission factors for the diesel trucks, which are for 2017, were estimated using California's EMFAC2011 model.

9. It was assumed that 20 trucks would operate on the site for 8 hours over each 24-hr time period.

4.0 Dispersion Modeling

As the operation of the HMF has the potential to cause health impacts on nearby sensitive land uses, detailed dispersion modeling analyses were conducted whether these impacts would be significant. USEPA's AERMOD atmospheric dispersion model was used to simulate physical conditions and predict pollutant concentrations at the facility's property line and at specified distances from the boundaries of a prototypical HMF facility.

AERMOD is generally applied to estimate impacts from simple point-source emissions from stacks as well as emissions from volume and area sources. The model accepts actual hourly meteorological observations and directly estimates hourly and average concentrations for various time periods. Regulatory default options and the rural dispersion algorithm of the AERMOD model were conservatvely used in these analyses.

The final site of the HMF has not as yet been selected and there are several potential sites between Merced and Bakersfield that are being considered. As such, site-specific coordinates that include locations of nearby sensitive land uses cannot be considered at this time. Instead, a prototypical site was analyzed (using a conceptual design and anticipated HMF activities), and pollutant concentrations were estimated at the site's property line and distances of approximately 500, 1,000, 1,300, 2,000, 3,000, and 5,000 feet from the site boundary. Receptors were located around the property boundary in increments of 25 meters, as specified in SJVAPCD modeling guidance. The maximum concentrations found at any location were used to estimate potential impacts, and these values were compared with applicable federal and state air quality standards and health-related guidelines.

Emissions from all operations were simulated as one area source spread out over the approximately 400 acre prototypical HMF site. An emissions release height was assumed to be 4.5 meters (14.8 feet) to approximate the stack heights of the locomotive engines, diesel trucks, and spray booth stack(s). Five years of meteorological data (i.e., 2005 through 2009) from Merced County Airport, as compiled by SJVAPCD, were used for all analyses.

The results of these analyses were used to estimate worst-case pollutant (criteria and TAC) concentrations for:

- Comparison with the NAAQS and CAAQS; and
- Input to the health risk analysis.

5.0 Health Risk Methodology

Maximum estimated dispersion modeling concentrations of diesel PM and other representative TACs were used to calculate cancer risks, chronic noncancer health risks, and acute health risks associated with HMF operations. The following methodologies were applied.

5.1 Cancer Risk

From the multiple pollutants that may be emitted from diesel vehicular exhaust, and spray booth operations, six pollutants, are considered by OEHHA as carcinogens for which cancer potency factors (or unit risk factors) were developed. These are diesel PM, benzene, 1, 3-butadiene, acetaldehyde, formaldehyde, and methylene chloride. The maximum individual cancer risk for each pollutant and total incremental cancer risks associated with these pollutants releases were calculated as described below. The 5-years average AERMOD-estimated concentrations were used for these calculations, as recommended by the SJVAPCD. Metal elements bounded to PM from vehicular exhaust, such as arsenic, cadmium, nickel, and others, were considered as part of the diesel PM.

The cancer risk calculation procedures developed by OEHHA, together with OEHHA/CARB-approved health values for health risk assessments, that were used are based on the following:

- Guidance for Air Dispersion Modeling, San Joaquin Valley Air Pollution Control District, Section 2.7 Alternative Modeling Procedures, Diesel "Only" Facilities, Page 81, Calculation of the Diesel PM Adjustment Factor; and
- OEHHA Air Toxics Hot Spots Program Risk Assessment Guidelines, OEHHA, 2003, OEHHA/ARB Approved Health Values for Use in Hot Spot Facility Risk Assessments, Appendix L – Table 1, Cancer Risk, Inhalation Cancer Potency Factors and Chronic Inhalation REL and Acute REL values.
- OEHHA (2012) Air Toxics Hot Spots Program Risk Assessment Guidelines, Technical Support Document for Exposure Assessment and Stochastic Analysis.

The detailed procedures and equations used in these calculations are as follows:

Inhalation Dose = C_{air} x DBR x A x EF x 10^{-6} (Eq. 3-1 Page 3-7)

Where,

C_{air} = concentration in air (ug/m3)

DBR = Daily Breathing Rate Normalized to Body Weight (L/kg body weight-day)

A = Inhalation absorption factor

EF = Exposure frequency (days/365 days)

10^{-6} = Conversion Factor (µg to mg, L to m^3)

Cancer Risk (per million) = Inhalation Dose x CPF × ASF × ED / AT (Eq. 3-2 Page 3-8)

Where,

CPF = Cancer potency factor $(mg/kg\text{-}day)^{-1}$

ASF = Age Sensitivity Factors

ED = Exposure Duration (Years)

AT = Averaging Time for Lifetime Cancer Risks (70 years)

The following are detailed descriptions of some of the parameters used in health risk assessment:

5.1.1 Daily Breathing Rate (DBR)

Exposure to airborne chemicals occurs through inhalation and subsequent absorption into the body, potentially resulting in adverse health effects depending on toxicological properties of the chemical and concentration in air. The dose of a substance through inhalation is a function of the concentration of the substance and the amount of air inhaled. DBR values used in these procedures, expressed in liters per kilogram-day (L/kg-day), as recommended by SJVAPCD for diesel PM, is 393 l/kg L/kg body weight-day. This DBR value was also used for calculations of the cancer risk of other carcinogenic pollutants.

5.1.2 Cancer Potency Factor (CPF)

The inhalation cancer potency factor is a measure of the cancer potency of a carcinogen. It is the estimated probability that a person will contract cancer as a result of inhalation of a concentration of 1

milligram of the TAC per kilogram of body weight continuously over a period of 70 years. The inhalation cancer potency factors used in this analysis (see Table 8) were obtained from OEHHA.

5.1.3 Exposure Value Factors

In order to protect public health, and in accordance with the recommendations of OEHHA, a 70-year lifetime exposure is assumed for all receptor locations. In addition to the 70-year exposure duration (ED) values, exposure values used to calculate cancer risk are exposure frequency (EF), which is the number of days per year of exposure, and the averaging time period in days over which exposure is averaged (AT). For EF, OEHHA and SJVAPCD recommend the use of 350 days/year for residential exposure. For AT, OEHHA and SJVAPCD recommend the use of 25,550 days (70 years x 365 days/year). For ED values used to calculate chronic noncancer risk, EPA recommends the use of 30 years.

5.2 Chronic Noncancer Risk

Calculations for estiimating the chronic noncancer hazard quotient (**HQ**) are based on methodology and equations in OEHHA Air Toxics Hot Spots Program Risk Assessment Guidelines, OEHHA, 2003, as follows:

HQ = Ca / Chronic REL (Page 8-14)

Where,

HQ = hazard quotient for direct inhalation of noncarcinogen (unitless)

Ca = annual concentration estimated by the AERMOD, ug/m3

REL = Chronic Reference Exposure Level (ug/m3)

5.3 Acute Hazard Risk

Acute hazard index analyses are based on OEHHA methodology and equations. Acute Reference Exposure Levels are available from Table 6.1 in OEHHA Guidelines.

AHQ = C_{acute} / Acute REL (Page 8-16)

Where,

AHQ acute hazard quotient, unitless

C_{acute}=1-hr estimated concentration, ug/m3

REL = Acute Reference Exposure Levels, ug/m3

Diesel PM has no acute health value; therefore it was not included in acute hazard index calculations.

6.0 Results

6.1 Criteria Pollutants

Total estimated concentrations of the criteria pollutants at the HMF property line are provided in Table 5. In general, HMF emissions of criteria pollutants would not cause an exceedance of an NAAQS or CAAQS at the facility's property line. However, because ambient values currently being monitored at the Merced, Madera, Drummond, and/or Fresno monitoring stations currently exceed the 24-hour and annual PM2.5 NAAQS and the 24-hour and annual PM10 CAAQS, and may continue to exceed these standards under

future No Build conditions, there is a potential that HMF emissions could exacerbate future exceedances even though even the maximum estimated project impacts at the property line are minimal.

Table 5
Total Estimated Concentrations of the Criteria Pollutants at the Property Line

Pollutant	Time Period	CAAQS (ug/m3)	NAAQS (ug/m3)	Estimated Impacts (ug/m3)	Background Conc. (ug/m3)	Total Estimated Concentrations (ug/m3)	Exceed CAAQS ?	Exceed NAAQS ?
NO_2	1-hour	339	188	12.24	81.8	94.0	No	No
	Annual	57	100	0.86	30.1	31.0	No	No
PM_{10}	24-hr	50	150	0.10	99.5	99.6	Yes	No
	Annual	20	—	0.03	40.5	40.5	Yes	—
$PM_{2.5}$	24-hr	—	35	0.06	81.6	81.7	—	Yes
	Annual	12	15	0.02	15.23	15.3	Yes	Yes

6.2 Toxic Pollutants

6.2.1 Chronic Noncancer Risk

The results of hazard chronic noncancer index calculations are summarized in Table 6. Pollutants listed are those for which non-cancer REL (Reference Exposure Limit) values from OEHHA Air Toxics Hot Spots Program Risk Assessment Guidelines, OEHHA, 2003, OEHHA/ARB Approved Health Values for Use in Hot Spot Facility Risk Assessments.

As shown the total maximum chronic noncancer hazard index at the HMF property line is estimated to be less than 1 – using both EPA and OEHHA health risk values. As such, potential chronic noncancer risks associated with HMF operations are not considered to be significant.

6.2.2 Acute Risk

The results of acute hazard index calculations are summarized in Table 7. Pollutants listed are those for which acute inhalation exposute criteria values are available from the Prioritized Chronic Dose-Response Values for Screening Risk Assessments (EPA, Table 1, June 2007) and acute REL values from OEHHA Air Toxics Hot Spots Program Risk Assessment Guidelines, OEHHA, 2003, OEHHA/ARB Approved Health Values for Use in Hot Spot Facility Risk Assessments.

As shown the total maximum acute hazard index at the HMF property line are estimated to be less than 1 – using both EPA and OEHHA health risk values. As such, potential acute health risks associated with HMF operations are not considered to be significant.

6.2.3 Cancer Risks

Maximum cancer risks were estimated at various distances from the HMF boundary until impacts were not considered to be significant. Based on the results of these preliminary analyses, it was determined that at a distance of approximately 1,300 from the facility boundary, the overall incremental cancer impacts would be below applicable significant thresholds.

As shown (Table 8), the total incremental cancer risk due to all these pollutant release at 1,300 feet from HMF property does not exceed (i.e.., are within) the 10 in a million (10×10^{-6}) significance threshold. As such, the estimated cancer risk at distances greater than 1,300 feet from the HMF boundary is not considered to be significant.

7.0 Conclusions

The results of the air quallity analyses for a prototypical HMF facility are as follows:

1. Criteria pollutant impacts at the HMF property line are not considered to be significant. However, there could be minimal criteria pollutant impacts in areas that would exceed a NAAQS or CAAQS under future No Build conditions. Therefore, prior to the issuance of the final EIS for the HST project, a more detailed analysis, using an actual facility design, actual nearby sensitive land uses, and a more detailed consideration of future background values near the selected site, will be conducted. More stringent emission reduction strategies may also be considered.;
2. The total chronic noncancer hazard index at the HMF propery line is less than the threshold value of 1 and, therefore, is not considered to be significant;
3. The total acute hazard index at the HMF propery line is less than threshold value of 1 and, therefore, is not considered to be significant; and
4. Total incremental cancer risk found at the distance of 1,300 feet from HMF boundary is less than 10 per million and, therefore, is not considered to be significant. However, until detailed analyses are conducted for an actual (as opposed to a prototypical) HMF facility, the potential cancer risks at sensitive land uses that are located closer than 1,300 feet from the HMF boundary are considered to be significant.

Table 6
Chronic Non-Cancer Hazard Index at the HMF Property Line

Contaminant	CAS No.	Annual Conc. (C_a) ug/m^3	Exposure Conc. (EC) ug/m^3	Reference Dose Conc. (RfC) mg/m^3	OEHHA Chronic Inhalation Exposure (REL) ug/m^3	Hazard Quotients (HQ) based on EPA RfC	Hazard Quotients (HQ) based on OEHHA REL
ethyl benzene	100-41-4	5.30E-03	5.09E-03	1.0E+00	2.0E+03	5.09E-06	2.65E-06
1,3-butadiene	106-99-0	2.30E-05	2.21E-05	2.0E-03	2.0E+01	1.10E-05	1.15E-06
formaldehyde	50-00-0	1.78E-03	1.71E-03	9.8E-03	3.0E+00	1.74E-04	5.94E-04
naphthalene	91-20-3	1.03E-05	9.88E-06	3.0E-03	9.0E+00	3.29E-06	1.14E-06
acetaldehyde	75-07-0	8.91E-04	8.54E-04	9.0E-03	9.0E+00	9.49E-05	9.90E-05
xylene	1330-20-7	5.13E-04	4.92E-04	1.0E-01	7.0E+02	4.92E-06	7.33E-07
ethylene dibromide	106-93-4	3.76E-04	3.61E-04	9.0E-03	8.0E-01	4.01E-05	4.70E-04
ethylene glycol	107-21-1	2.51E-04	2.41E-04	4.0E-01	4.0E+02	6.01E-07	6.27E-07
toluene	108-88-3	8.45E-02	8.10E-02	5.0E+00	3.0E+02	1.62E-05	2.82E-04
n-hexane	110-54-3	5.16E-03	4.95E-03	7.0E-01	7.0E+03	7.07E-06	7.37E-07
methanol	67-56-1	4.18E-02	4.01E-02	4.0E+00	4.0E+03	1.00E-05	1.04E-05
dimethyl formamide	68-12-2	4.18E-02	4.00E-02	3.0E-02	8.0E+01	1.33E-03	5.22E-04
benzene	71-43-2	8.70E-04	8.34E-04	3.0E-02	6.0E+01	2.78E-05	1.45E-05
ethyl chloride	75-00-3	2.51E-04	2.41E-04	1.0E+01	3.0E+04	2.41E-08	8.36E-09
methylene chloride	75-09-2	2.76E-03	2.65E-03	1.0E+00	4.0E+02	2.65E-06	6.90E-06
methyl ethyl ketone (mek)	78-93-3	6.92E-02	6.63E-02	5.0E+00		1.33E-05	
phthalic anhydride	85-44-9	3.76E-04	3.61E-04	2.0E-02	2.0E+01	1.80E-05	1.88E-05
Diesel PM	9901	2.59E-02	2.48E-02	5.0E-03	5.0E+00	4.97E-03	5.18E-03
Total Hazard Index						6.73E-03	7.20E-03
Hazard Index Threshold						1	1

Table 7
Total Acute Hazard Index at the HMF Property Line

Contaminant	CAS No.	1-hr Estimated Conc. (C_{acute}) (ug/m3)	EPA Acute Inhalation Exposure Criteria (AIEC) mg/m3	OEHHA Acute Inhalation Exposure Criteria (Acute REL) ug/m3	Hazard Quotients (AHQ) Based on AIEC	Acute Hazard Quotients Based on Acute REL
ethylbenzene	100-41-4	8.5E-02	3.5E+02		2.44E-07	
1,3-butadiene	106-99-0	3.7E-04	1.5E+03		2.47E-10	
formaldehyde	50-00-0	2.9E-02	1.1E+00	9.40E+01	2.61E-05	3.05E-04
naphthalene	91-20-3	1.7E-04	1.3E+02		1.27E-09	
acetaldehyde	75-07-0	1.4E-02	8.1E+01		1.77E-07	
xylene	106-42-3	8.2E-03	2.2E+01	2.20E+04	3.75E-07	3.75E-07
ethylene dibromide	106-93-4	6.0E-03	1.3E+02		4.65E-08	
ethylene glycol	107-21-1	4.0E-03	1.3E+00		3.10E-06	
toluene	108-88-3	1.4E+00	3.7E+01	3.70E+04	3.67E-05	3.67E-05
n-hexane	110-54-3	8.3E-02	1.2E+04		6.91E-09	
methanol	67-56-1	6.7E-01	2.8E+01	2.80E+04	2.40E-05	2.40E-05
dimethyl formamide	68-12-2	6.7E-01	2.7E+02		2.49E-06	
benzene	71-43-2	1.4E-02	1.3E+00	1.30E+03	1.08E-05	1.08E-05
ethyl chloride	75-00-3	4.0E-03	4.0E+01		1.01E-07	
methylene chloride	75-09-2	4.4E-02	1.4E+01	1.40E+04	3.17E-06	3.17E-06
methyl ethyl ketone (mek)	78-93-3	1.1E+00	1.3E+01	1.30E+04	8.55E-05	8.55E-05
phthalic anhydride	85-44-9	6.0E-03	6.0E+00		1.01E-06	
Total Estimated Acute Hazard Index					1.94E-04	4.65E-04
Hazard Index threshold					1	1

Table 8
Diesel PM and TAC Cancer Risk Calculations at the distance of 1,300 feet from HMF Boundary

Exposure Type	Inhalation Dose Equation 3-1 Parameter Values						C_{air}	Inhalation Dose	CPF	Cancer Risk
	BR/BW	A	ASF	EF	ED	AT				
	L/kg BW-day			days/year	years	days	(ug/m^3)	(mg/kg-day)	(mg/kg-day)$^{-1}$	
Third Trimester	**322**	**1**	**10**	**350**	**0.25**	**70**				
Diesel PM							9.02E-03	2.78E-06	1.10E+00	1.09E-07
Benzene							3.03E-04	9.35E-08	1.00E-01	3.34E-10
Acetaldehyde							3.10E-04	9.58E-08	1.00E-02	3.42E-11
1,3-Butadiene							8.02E-06	2.48E-09	6.00E-01	5.31E-11
Formaldehyde							6.21E-04	1.92E-07	2.10E-02	1.44E-10
Naphthalene							3.59E-06	1.11E-09	1.20E-01	4.75E-12
Methylene Chloride							9.61E-04	2.97E-07	3.50E-03	3.71E-11
Ethyl Benzene							1.85E-03	5.70E-07	8.70E-03	1.77E-10
Cancer Risk for Third Trimester Age Group										1.10E-07
0<2 Age Group	**1372**	**1**	**10**	**350**	**2**	**70**				
Diesel PM							0.00902	1.19E-05	1.10E+00	3.73E-06
Benzene							0.00030	3.98E-07	1.00E-01	1.14E-08
Acetaldehyde							0.00031	4.08E-07	1.00E-02	1.17E-09
1,3-Butadiene							0.000008	1.05E-08	6.00E-01	1.81E-09
Formaldehyde							0.00062	8.17E-07	2.10E-02	4.90E-09
Naphthalene							0.000004	4.72E-09	1.20E-01	1.62E-10
Methylene Chloride							0.00096	1.26E-06	3.50E-03	1.26E-09
Ethyl Benzene							0.00185	2.43E-06	8.70E-03	6.04E-09
Cancer Risk for 0<2 years Age Group										3.75E-06
2<9 Age Group	**776**	**1**	**3**	**350**	**7**	**70**				
Diesel PM							0.00902	6.71E-06	1.10E+00	2.21E-06
Benzene							0.00030	2.25E-07	1.00E-01	6.76E-09
Acetaldehyde							0.00031	2.31E-07	1.00E-02	6.93E-10
1,3-Butadiene							0.000008	5.97E-09	6.00E-01	1.07E-09
Formaldehyde							0.00062	4.62E-07	2.10E-02	2.91E-09
Naphthalene							0.000004	2.67E-09	1.20E-01	9.61E-11

Exposure Type	Inhalation Dose Equation 3-1 Parameter Values						C_{air}	Inhalation Dose	CPF	Cancer Risk
	BR/BW	A	ASF	EF	ED	AT				
	L/kg BW-day			days/year	years	days	(ug/m^3)	(mg/kg-day)	(mg/kg-day)$^{-1}$	
Methylene Chloride							0.00096	7.15E-07	3.50E-03	7.51E-10
Ethyl Benzene							0.00185	1.37E-06	8.70E-03	3.59E-09
Cancer Risk for 2<9 years Age Group										2.23E-06
2<16 Age Group (3)	**595**	**1**	**3**	**350**	**14**	**70**				
Diesel PM							0.00902	5.14E-06	1.10E+00	3.40E-06
Benzene							0.00030	1.73E-07	1.00E-01	1.04E-08
Acetaldehyde							0.00031	1.77E-07	1.00E-02	1.06E-09
1,3-Butadiene							0.000008	4.58E-09	6.00E-01	1.65E-09
Formaldehyde							0.00062	3.54E-07	2.10E-02	4.46E-09
Naphthalene							0.000004	2.05E-09	1.20E-01	1.47E-10
Methylene Chloride							0.00096	5.48E-07	3.50E-03	1.15E-09
Ethyl Benzene							0.00185	1.05E-06	8.70E-03	5.50E-09
Cancer Risk for 2<16 years Age Group										3.42E-06
16<30 Age Group	**296**	**1**	**1**	**350**	**14**	**70**				
Diesel PM							0.00902	2.56E-06	1.10E+00	5.63E-07
Benzene							0.00030	8.60E-08	1.00E-01	1.72E-09
Acetaldehyde							0.00031	8.81E-08	1.00E-02	1.76E-10
1,3-Butadiene							0.000008	2.28E-09	6.00E-01	2.73E-10
Formaldehyde							0.00062	1.76E-07	2.10E-02	7.40E-10
Naphthalene							0.000004	1.02E-09	1.20E-01	2.44E-11
Methylene Chloride							0.00096	2.73E-07	3.50E-03	1.91E-10
Ethyl Benzene							0.00185	5.24E-07	8.70E-03	9.12E-10
Cancer Risk for 16<30 years Age Group										5.67E-07
16<70 Age Group	**299**	**1**	**1**	**350**	**54**	**70**				
Diesel PM							0.00902	2.58E-06	1.10E+00	2.19E-06
Benzene							0.00030	8.68E-08	1.00E-01	6.70E-09
Acetaldehyde							0.00031	8.90E-08	1.00E-02	6.86E-10
1,3-Butadiene							0.000008	2.30E-09	6.00E-01	1.06E-09

Exposure Type	Inhalation Dose Equation 3-1 Parameter Values						C_{air}	Inhalation Dose	CPF	Cancer Risk
	BR/BW	A	ASF	EF	ED	AT				
	L/kg BW-day			days/year	years	days	(ug/m^3)	(mg/kg-day)	(mg/kg-day)$^{-1}$	
Formaldehyde							0.00062	1.78E-07	2.10E-02	2.88E-09
Naphthalene							0.000004	1.03E-09	1.20E-01	9.52E-11
Methylene Chloride							0.00096	2.76E-07	3.50E-03	7.44E-10
Ethyl Benzene							0.00185	5.30E-07	8.70E-03	3.55E-09
Cancer Risk for 16<70 years Age Group										2.21E-06
Total Lifetime Risk (for 70 years Residency)										9.49E-06
Risk for 30 years Residency										7.85E-06
Risk for 9 years Residency										6.09E-06

Notes:

1. Guidance for Air Dispersion Modeling, San Joaquin Valley Air Pollution Control District, Section 2.7 Alternative Modeling Procedures, Diesel "Only" Facilities, Page 81, Calculation of the Diesel PM Adjustment Factor

2. OEHHA Air Toxics Hot Spots Program Risk Assessment Guidelines, OEHHA, 2003, OEHHA/ARB Approved Health Values for Use in Hot Spot Facility Risk Assessments, Appendix L - Table 1, Cancer Risk, Inhalation Cancer Potency Factors.

Appendix G

Quarry and Ballast Hauling Memoranda

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MEMORANDUM

To:	**Rebecca Kohlstrand/PMT; Bryan Porter/PMT**
From:	**David Joe/URS/HMM/Arup**
Date:	**04/16/2014**
Subject:	**Revised Ballast Volumes and EMFAC2011 Updates to Estimated Emissions from Hauling Ballast Material – Merced to Fresno and Fresno to Bakersfield Sections of the California High-Speed Train Project**

The Estimated Emissions from Hauling Ballast Material – Merced to Fresno and Fresno to Bakersfield Sections of the California High-Speed Train Project memorandum dated March 23, 2012 (2012 memorandum) presented estimates of emissions from the hauling of ballast material associated with the Merced to Fresno and Fresno Bakersfield Sections of the California High-Speed Train Project (URS/HHM/Arup, 2012). The 2012 memorandum described the methodology and calculations used to estimate these emissions.

Since the preparation of the 2012 memorandum, several updates have been made to the analysis of these ballast hauling emissions. The current memorandum describes these revisions (which include updates to emission factors, ballast requirements, hauling schedules, and federal attainment designations and classifications) and presents the updated results. The current memorandum follows the same format as the 2012 memorandum, and identifies where assumptions and information have been updated. For methods and assumptions that have not been revised since the 2012 memorandum, the reader is referred to the 2012 memorandum for more detailed descriptions.

Air Pollutant Analysis

Analysis of air pollutant emissions that are associated with hauling railway ballast material needed for the Merced to Fresno and Fresno to Bakersfield Sections of the California High-Speed Train Project are included in the air quality analysis section in Chapter 3 of the *California High-Speed Train Project Environmental Impact Report/Environmental Impact Statement*. Since the construction period for the Merced to Fresno Section and the Fresno to Bakersfield would overlap, the total amount of material and the associated emissions for both sections are analyzed in this memorandum. Air pollutant emissions were proportioned based on the material requirement for each section and were then compared to the General Conformity de minimis thresholds as well as the CEQA thresholds.

The analysis presented in this memorandum assumes that the rail will be constructed using a combination of ballast, sub-ballast, and slab track. The analysis assumes that sub-ballast and the material necessary for concrete manufacture will be available within the SJVAB. Also, worst case emissions for one year are shown. The 2012 memorandum identified the worst case years as

2014, 2015, and 2016. This current memorandum identifies the years 2018, 2019, and 2020 as the worst case years for hauling. This update is based on more recent estimates of ballast hauling schedules. The emissions from ballast hauling in the remaining years would be less than these worst case years.

Over the course of the construction period, the Merced to Fresno and Fresno to Bakersfield Sections will require about 2 million cubic yards (cy) of ballast material for alignment construction, however, this total amount is not currently available within San Joaquin Valley Air Basin (SJVAB), and there would be a need to haul it from quarries located in other air basins. If project material is hauled through other air basins, the associated emissions must be analyzed with respect to pollutant thresholds in the air basins traversed.

This memorandum describes the analysis performed to determine (1) the potential amount of railroad ballast material available from California quarries for the Merced to Fresno and Fresno to Bakersfield Sections of the California High-Speed Train Project and (2) pollutant emissions associated with hauling the materials to the SJVAB boundary.

Quarries Evaluated

A number of quarries were identified and researched to determine potential sources of ballast material. The selection of the evaluated quarries is described in the *Estimated Emissions from Hauling Ballast Material – Merced to Fresno and Fresno to Bakersfield Sections of the California High-Speed Train Project* memorandum dated March 23, 2012. The quarries evaluated in the 2012 memorandum were also evaluated in this current memorandum. These quarries and relevant information are shown in Table 1.

Table 1
Quarry Information

Quarry Name and Address	Distance to SJVAB (rail miles)	AREMA 4 Ballast Availability	Distance to Nearest Railhead	Annual Ballast Production Capacity
Kaiser Eagle Mountain Quarry 1 Court Street Desert Center, CA 92239 (Mojave Air Basin)	350	Yes	Railhead onsite	1,000,000 cy/yr
Napa Quarry 2301 Napa-Vallejo Highway Napa, CA 94558 (San Francisco Bay Air Basin)	70	Yes	Railhead onsite	150,000 tons/yr

Table 1
Quarry Information

Quarry Name and Address	Distance to SJVAB (rail miles)	AREMA 4 Ballast Availability	Distance to Nearest Railhead	Annual Ballast Production Capacity
Lake Herman Quarry 885 Lake Herman Road Vallejo, CA 94591 (San Francisco Bay Air Basin)	70	Yes	15 miles	200,000 tons/yr
San Rafael Rock Quarry 1000 Point San Pedro Road San Rafael, CA 94901 (San Francisco Bay Air Basin)	55	Yes	15 miles	150,000 tons/yr
Bangor Rock Quarry – Site A 5522 LaPorte Road Bangor, CA 92194 (Sacramento Valley Air Basin)	85	Yes	15 miles	300,000 tons/yr

Methodology for Estimating Pollutant Emissions from Hauling Ballast to the Project Site

As the construction schedules of the Merced to Fresno and Fresno to Bakersfield Sections of the California High Speed Train Project overlap, the ballast material hauling analysis took into account the requirements for both sections to ensure realistic emission estimates. Five ballast hauling scenarios were developed to represent a range of combinations of different quarries and hauling methods. The development of the five scenarios for hauling ballast materials from quarries is described in the *Estimated Emissions from Hauling Ballast Material – Merced to Fresno and Fresno to Bakersfield Sections of the California High-Speed Train Project* memorandum dated March 23, 2012. The scenarios evaluated in the 2012 memorandum were also evaluated in this current memorandum. Descriptions of the scenarios are provided below:

- Scenario 1: All Ballast Hauled from Kaiser Eagle Mountain Quarry by Rail Only – Haul all of the ballast material, for both sites, via rail from the Kaiser Eagle Mountain Quarry (the longest hauling distance).
- Scenario 2: Ballast from Quarries Nearest to the Project by Truck and Rail and Balance from Kaiser Eagle Mountain Quarry by Truck and Rail - Haul all of the ballast material from the quarries closest to the project site (Napa Quarry, Lake Herman Quarry, and San Rafael Rock

Quarry) via truck to the nearest railhead, then by railway the remainder of the distance and the balance from Bangor Rock Quarry by truck and rail.

- Scenario 3: Ballast from Quarries Nearest to the Project by Truck and Rail and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry - Haul the maximum amount of ballast available from the quarries closest to the project site (Napa Quarry, Lake Herman Quarry, and San Rafael Rock Quarry), the maximum amount from Bangor Rock Quarry – Site A (which is closer than Kaiser Eagle Mountain Quarry) up to ballast production limits; and then the balance from Kaiser Eagle Mountain Quarry. Haul ballast by truck to the nearest railhead, then by rail the remainder of the distance.
- Scenario 4: Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only – Haul the maximum amount of ballast from the quarries closest to the project site (Napa Quarry, Lake Herman Quarry, and San Rafael Rock Quarry), and obtain the balance of material needed from Bangor Rock Quarry – Site A (closer than Kaiser Eagle Mountain Quarry) and Kaiser Eagle Mountain Quarry, transported by truck for the entire distance.
- Scenario 5: – Maximum Ballast from Quarries Nearest Project and Balance from Kaiser Eagle Mountain Quarry by Truck Only - Haul the maximum amount of ballast up to emission threshold limits from the quarries closest to the project site (Napa Quarry, Lake Herman Quarry, and San Rafael Rock Quarry), and obtain the balance of material needed from Kaiser Eagle Mountain Quarry transported by truck the entire distance.

For each scenario, emissions were calculated using year 2018 emission factors. Year 2018 would be the first year that ballast is required for the project, and emission factors for that year are the most conservative within the project schedule because they are expected to decrease each year as vehicle technology improves. The 2012 memorandum used 2014 emission factors and assumed 2014 would be the first year that ballast would be required for the project. This current memorandum uses 2018 emissions factors and assumes 2018 would be the first year that ballast would be required for the project, based on revised estimates of ballast hauling schedules, which have been updated since the preparation of the 2012 memorandum.

Table 2 provides the emission factors used in the analysis. Truck emissions were obtained from EMFAC2011. The use of EMFAC2011 in this current memorandum is an update from the 2012 memorandum, which used emission factors from EMFAC2007. EMFAC2011 is an update to the EMFAC2007 emissions factor software from the California Air Resources Board.

For unmitigated truck emissions, emission factors were based on a fleet composed of model years 1969-2018. Mitigated haul truck emission factors are for a fleet composed of model year 2010 and newer trucks.

Note that emissions estimates for material hauling within the SJVAB (contained in the *California High-Speed Train Project Fresno to Bakersfield Air Quality Technical Report*) do not

reflect the ballast hauling schedule updates used in the analysis for this current memorandum. The emissions estimates contained in the Air Quality Technical Report assume ballast hauling would first occur in the year 2014, and are therefore conservative, given that emission factors would be expected to decrease in later years.

Table 2
Ballast Hauling Emission Factors

Emission Source	Emission Factors						
	VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2
Unmitigated Haul Trucks (grams/mile)[a]	0.175	1.435	2.862	0.011	0.133	0.078	1,055
Mitigated Haul Trucks (grams/mile)[a]	0.108	0.763	1.070	0.011	0.126	0.070	1,116
Large Haul Rail (grams/ton-mile)[b]	0.009	0.055	0.22	0.0002	0.006	0.005	21.1

[a] Truck emission factors were developed using the EMFAC2011 emissions model and statewide average emission factors.

[b] Railway emission factors were developed using the *Emission Factors for Locomotives* (EPA 2009)

Notes:

CO = carbon monoxide
NO_x = nitrogen oxide

$PM_{2.5}$ = particulate matter less than 2.5 micrometers in aerodynamic diameter
PM_{10} = particulate matter less than 10 micrometers in aerodynamic diameter
SO_2 = sulfur dioxide
VOC = volatile organic compound

For each scenario, emissions were calculated by multiplying the emission factor by the distance traveled and the amount of material hauled per trip for each hauling method. The following pollutant emissions were calculated: CO, NOx, $PM_{2.5}$, PM_{10}, SO_2, and VOC. Greenhouse gas (GHG) emissions were also estimated. Emissions were calculated separately for each federal nonattainment or maintenance area through which the materials would be hauled (reference Attachment A). The results were compared to the General Conformity (GC) de minimis values to determine if an exceedance would occur. Emissions were also calculated for each air quality management district (AQMD) that the material was hauled through and compared to daily and annual CEQA significance threshold values for each of the air districts (reference Attachment B). Although the quantity of ballast material being considered was the combined amounts from both sections to ensure plausible scenarios, the emissions for each section were calculated by proportioning out the total air emissions based on the material requirements for each section.

For each scenario, the maximum material hauled in one year was used to estimate the annual emissions. The daily emissions calculations were estimated by assuming that the annual material requirements would be hauled by trucks that would operate 260 days per year and trains that would run twice weekly (104 days per year) from each of the railheads to the SJVAB.

Since the preparation of the 2012 memorandum, the EPA has adopted new designations and classifications of some nonattainment areas within the studied air basins. General Conformity de minimis levels are based on designations and classifications, and may therefore be impacted by these new designations and classifications. This current memorandum incorporates these changes to designations and classifications, as well as the corresponding changes in the applicable General Conformity de minimis levels:

- On May 8, 2012, the Western Mojave Desert ozone nonattainment area was reclassified from "Moderate" to "Severe-15" for the 1997 8-hour ozone standard. To reflect this reclassification, the General Conformity de minimis level for NOx for the area has been changed from 100 tons per year to 25 tons per year, and the de minimis level for VOC has been changed from 50 tons per year to 25 tons per year.
- On June 26, 2013, the Los Angeles South Coast Air Basin was redesignated to attainment for the PM_{10} standard, and is currently classified as a maintenance area for PM_{10}. The General Conformity de minimis level for PM_{10} in this analysis has been revised from 70 tons per year to 100 tons per year to reflect this change.

Estimated Pollutant Emissions from Hauling Ballast to the Project Site

Tables 3 shows the amounts of material hauled from the quarries for each scenario in cubic yards (cy) per year. For daily emissions calculations, it was assumed trucks would operate 260 days per year and that trains would run twice weekly from each of the railheads to the SJVAB. The amounts presented in this current memorandum are revised quantities that have been updated since the preparation of the *Estimated Emissions from Hauling Ballast Material – Merced to Fresno and Fresno to Bakersfield Sections of the California High-Speed Train Project* memorandum dated March 23, 2012.

Table 3
Amount of Material Hauled from Each Quarry Under Scenarios 1-5

Scenario / Quarry Name	1 (cy/yr)	2 (cy/yr)	3 (cy/yr)	4 (cy/yr)	5 (cy/yr)
Kaiser Eagle Mountain Quarry	683,942	445,846	302,989	302,989	445,846
Napa Quarry	0	71,429	71,429	71,429	71,429
Lake Herman Quarry	0	95,238	95,238	95,238	95,238
San Rafael Rock Quarry	0	71,429	71,429	71,429	71,429
Bangor Rock Quarry – Site A	0	0	142,857	142,857	0

Tables C-1 through C-10 (reference Attachment C) show the estimated unmitigated emissions for the five scenarios relative to the GC de minimis thresholds for the air basins traversed. Tables D-1 through D-20 (reference Attachment D) show the estimated unmitigated emissions relative to CEQA significance thresholds for the AQMDs traversed. Tables E-1 through E-8 (reference Attachment E) show estimated mitigated emissions for scenarios 2 through 5 relative to GC de minimis thresholds for the air basins traversed. Tables F-1 through F-16 (reference Attachment F) show the estimated mitigated emissions for scenarios 2 through 5 relative to CEQA significance thresholds for the AQMDs traversed. Scenario 1 did not change under the mitigated scenario since all the material was transported by rail. Please note that a particular air basin could be under the jurisdiction of more than one AQMD.

The following results reflect the analysis presented in this current memorandum, and are different than the results presented in the 2012 memorandum.

Scenario 1 exceeds GC de minimis thresholds for NOx for both the Merced to Fresno and Fresno to Bakersfield sections in the South Coast Air Basin, and the Fresno to Bakersfield section would also exceed the GC de minimis threshold for NOx in the Salton Sea Air Basin and Mojave Desert Air Basin. Scenarios 2 and 3, for the Fresno to Bakersfield section, exceed the GC de minimis threshold for NOx in the South Coast Air Basin. Scenario 4, for the Fresno to Bakersfield section, does not exceed any GC de minimis thresholds. Scenario 5, for the Fresno to Bakersfield section, exceeds GC de minimis threshold for NOx in the South Coast Air Basin.

No other pollutants for any scenarios exceed their respective GC de minimis threshold. With a mitigation measure to use a fleet of model year 2010 and newer trucks, Scenario 5 no longer exceeds any de minimis thresholds in any air basin for either section.

Annual CEQA emission threshold limits would not be exceeded by any of the scenarios for either section. Daily CEQA thresholds for NO_X would be exceeded under Scenario 1 in the South Coast AQMD for both sections, and the Fresno to Bakersfield section would also exceed daily CEQA threshold limits for NO_X for Mojave Desert AQMD. Emissions from Scenario 2 would exceed the daily CEQA threshold limit for NO_X in the South Coast AQMD for the Merced to Fresno section, and would exceed the daily CEQA threshold limits for NO_X in the Bay Area, Mojave Desert, and South Coast AQMDs for the Fresno to Bakersfield section. Emissions from Scenario 3 would exceed the daily CEQA threshold limit for NO_X in the South Coast AQMD for the Merced to Fresno section, and would exceed the daily CEQA threshold limits for NO_X in the Bay Area and South Coast AQMDs for the Fresno to Bakersfield section. Scenario 4 would exceed daily CEQA threshold limit for NO_X in the South Coast AQMD for the Fresno to Bakersfield section. Scenario 5 would also exceed daily CEQA threshold limit for NO_X in the South Coast AQMD for the Fresno to Bakersfield section. With the proposed mitigation for haul trucks, Scenarios 4 and 5 would no longer exceed any daily CEQA threshold limits for either section.

GHG emissions (in units of CO_2e) from ballast hauling range were calculated by assuming methane and nitrogen dioxide impacts were 5% of the total CO_2 impacts. Total CO_2e impacts

ranged from 4,806 to 10,090 metric tons annually, depending on the chosen scenario. The year 2008 total statewide emissions of CO_2e were 477,740,000 metric tons. Material hauling for this project will have a negligible impact (less than 0.01%) on statewide greenhouse gas emissions.

Conclusion

The following conclusions reflect the analysis presented in this current memorandum, and are different than the results presented in the 2012 memorandum. According to this analysis, sufficient ballast material of the type needed for the project is available from quarries within the state of California. General Conformity de minimis pollutant thresholds in nonattainment areas for NO_X would be exceeded in some air basin for Scenarios 1, 2, 3, and 5 without mitigation. With mitigation, Scenario 5 no longer exceeds GC de minimis threshold limits for any pollutant for either section. Annual CEQA threshold limits would not be exceeded for either section in any scenario. Daily CEQA NO_X thresholds would be exceeded for certain AQMDs in all scenarios for both sections without mitigation. With mitigation, scenarios 4 and 5 would no longer exceed daily CEQA NO_X thresholds for either section. Additionally, material hauling for this project will have a negligible impact on statewide greenhouse gas emissions.

References

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Attachment A
Air Basins and Nonattainment/Maintenance Areas

Table A-1
Air Basins and Nonattainment/Maintenance Areas

Nonattainment/Maintenance Area	Pollutant(s)
Mojave Desert Air Basin	
East Kern County	8-hour ozone, PM_{10}
Western San Bernardino/Los Angeles County	8-hour ozone, PM_{10}
Sacramento Valley Air Basin	
Chico, Butte County	8-hour ozone, $PM_{2.5}$ (2006)
Sacramento Metropolitan Area	8-hour ozone, PM_{10}, $PM_{2.5}$ (2006)
Yuba City	8-hour ozone, $PM_{2.5}$ (2006)
Salton Sea Air Basin	
Coachella Valley, Riverside County	8-hour ozone, PM_{10}
San Francisco Bay Air Basin	
Bay Area	8-hour ozone, $PM_{2.5}$ (2006)
South Coast Air Basin	
Los Angeles County	8-hour ozone, PM_{10}, $PM_{2.5}$ (2006)

Notes:

$PM_{2.5}$ = particulate matter less than 2.5 micrometers in aerodynamic diameter

PM_{10} = particulate matter less than 10 micrometers in aerodynamic diameter

Attachment B
Air Quality Management Districts and CEQA Thresholds

Table B-1
Air Quality Management Districts and CEQA Thresholds

	Daily CEQA Thresholds (lb/day)						Annual CEQA Thresholds (tpy)					
	VOC	**CO**	**NOx**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**	**VOC**	**CO**	**NOx**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Antelope Valley AQMD	137	548	137	137	82	82	25	100	25	25	15	15
Bay Area AQMD	54	-	54	-	82	54	-	-	-	-	-	-
Butte County AQMD	25	-	-	-	80	-	-	-	-	-	-	-
Kern Country APCD	-	-	-	-	-	-	-	-	-	-	-	-
Feather River AQMD	-	-	-	-	80	-	4.5	-	4.5	-	-	-
Mojave Desert AQMD	137	548	137	137	82	82	25	100	25	25	15	15
Sac Metro AQMD	-	-	85	-	-	-	-	-	-	-	-	-
South Coast AQMD	75	550	100	150	150	55	-	-	-	-	-	-

Notes:

– = no applicable CEQA threshold for this pollutant in the AQMD

$PM_{2.5}$ = particulate matter less than 2.5 micrometers in aerodynamic diameter

PM_{10} = particulate matter less than 10 micrometers in aerodynamic diameter

tpy = tons per year

Attachment C
Emission Calculations for Scenarios Compared to GC de minimis Thresholds

Table C-1

Emissions for Scenario 1 – All Ballast from Kaiser Eagle Mountain Quarry by Rail (Merced to Fresno Section), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area(Air Basin)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Riverside County (Salton Sea)	3.55	14.40	0.35	0.36	0.01	0.56	1,236
General Conformity de Minimis	100	25	-	70	-	25	-
Western San Bernardino/Los Angeles County (Mojave Desert)	1.33	5.38	0.13	0.13	0.00	0.21	461
East Kern County (Mojave Desert)	1.38	5.58	0.14	0.14	0.00	0.22	479
Total Mojave Desert Air Basin	2.70	10.95	0.27	0.27	0.01	0.43	940
General Conformity de Minimis	100	25	-	100	-	25	-
Los Angeles County (South Coast)	2.50	10.14	0.25	0.25	0.01	0.39	871
General Conformity de Minimis	100	10	100	100	100	10	-

Notes:

– = no de minimis threshold for this pollutant in the air basin

Table C-2

Emissions for Scenario 2 – Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Merced to Fresno Section), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	0.68	2.54	0.06	0.07	0.00	0.10	274
General Conformity de Minimis	100	100	100	-	100	50	-
Riverside County (Salton Sea)	2.31	9.39	0.23	0.23	0.01	0.37	806
General Conformity de Minimis	100	25	-	70	-	25	-
Western San Bernardino/Los Angeles County (Mojave Desert)	0.86	3.50	0.08	0.09	0.00	0.14	301
East Kern County (Mojave Desert)	0.90	3.64	0.09	0.09	0.00	0.14	312
Total Mojave Desert Air Basin	1.76	7.14	0.17	0.18	0.01	0.28	613
General Conformity de Minimis	100	25	-	100	-	25	-
Los Angeles County (South Coast)	1.63	6.61	0.16	0.17	0.01	0.26	567
General Conformity de Minimis	100	10	100	100	100	10	-

Notes:

– = no de minimis threshold for this pollutant in the air basin

Table C-3
Emissions for Scenario 3 – Ballast from a Mixture of Quarries by Truck and Rail (Merced to Fresno Section), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	0.68	2.54	0.06	0.07	0.00	0.10	274
General Conformity de Minimis	100	100	100	-	100	50	-
Chico, CA (Sacramento Valley)	0.15	0.41	0.01	0.01	0.00	0.02	83
Yuba City (Sacramento Valley)	0.21	0.87	0.02	0.02	0.00	0.03	75
Sacramento Metropolitan Area (Sacramento Valley)	0.18	0.72	0.02	0.02	0.00	0.03	62
Total Sacramento Valley Air Basin	0.54	1.99	0.05	0.05	0.00	0.08	219
General Conformity de Minimis	100	25	100	100	100	25	-
Riverside County (Salton Sea)	1.57	6.38	0.16	0.16	0.01	0.25	548
General Conformity de Minimis	100	25	-	70	-	25	-
Western San Bernardino/Los Angeles County (Mojave Desert)	0.59	2.38	0.06	0.06	0.00	0.09	204
East Kern County (Mojave Desert)	0.61	2.47	0.06	0.06	0.00	0.10	212
Total Mojave Desert Air Basin	1.20	4.85	0.12	0.12	0.00	0.19	417
General Conformity de Minimis	100	25	-	100	-	25	-
Los Angeles County (South Coast)	1.11	4.49	0.11	0.11	0.00	0.17	386
General Conformity de Minimis	100	10	100	100	100	10	-

Note:

– = no de minimis threshold for this pollutant in the air basin

Table C-4

Emissions for Scenario 4 – Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Merced to Fresno Section), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area(Air Basin)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay Air Basin)	0.70	1.39	0.04	0.06	0.01	0.09	465
General Conformity de Minimis	100	100	100	-	100	50	-
Chico, CA (Sacramento Valley Air Basin)	0.12	0.24	0.01	0.01	0.00	0.01	80
Yuba City (Sacramento Valley Air Basin)	0.27	0.54	0.01	0.03	0.00	0.03	182
Sacramento Metro (Sacramento Valley Air Basin)	0.23	0.45	0.01	0.02	0.00	0.03	152
Total Sacramento Valley Air Basin	0.62	1.24	0.03	0.06	0.00	0.08	413
General Conformity de Minimis	100	25	100	100	100	25	-
Riverside County (Salton Sea Air Basin)	1.61	3.21	0.09	0.15	0.01	0.20	1,074
General Conformity de Minimis	100	25	-	70	-	25	-
Los Angeles County (South Coast Air Basin)	1.86	3.70	0.10	0.17	0.01	0.23	1,240
General Conformity de Minimis	100	10	100	100	100	10	-

Note:

– = no de minimis threshold for this pollutant in the air basin

Table C-5

Emissions for Scenario 5 – Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only (Merced to Fresno Section), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area(Air Basin)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	0.70	1.39	0.04	0.06	0.01	0.09	465
General Conformity de Minimis	100	100	100	-	100	50	-
Riverside County (Salton Sea)	2.37	4.72	0.13	0.22	0.02	0.29	1,581
General Conformity de Minimis	100	25	-	70	-	25	-
Los Angeles County (South Coast)	2.73	5.45	0.15	0.25	0.02	0.33	1,824
General Conformity de Minimis	100	10	100	100	100	10	-

Note:

– = no de minimis threshold for this pollutant in the Air Basin

Table C-6

Emissions for Scenario 1 – All Ballast from Kaiser Eagle Mountain Quarry by Rail (Fresno to Bakersfield Section), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area(Air Basin)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Riverside County (Salton Sea)	8.82	35.76	0.87	0.89	0.03	1.39	3,069
General Conformity de Minimis	100	25	-	70	-	25	-
Western San Bernardino/Los Angeles County (Mojave Desert)	3.29	13.35	0.32	0.33	0.01	0.52	1,146
East Kern County (Mojave Desert)	3.41	13.85	0.34	0.35	0.01	0.54	1,189
Total Mojave Desert Air Basin	6.71	27.20	0.66	0.68	0.02	1.06	2,334
General Conformity de Minimis	100	25	-	100	-	25	-
Los Angeles County (South Coast)	6.21	25.18	0.61	0.63	0.02	0.98	2,161
General Conformity de Minimis	100	10	100	100	100	10	-

Notes:

– = no de minimis threshold for this pollutant in the air basin

Table C-7

Emissions for Scenario 2 – Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Fresno to Bakersfield Section), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area(Air Basin)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	1.70	6.30	0.15	0.17	0.01	0.26	681
General Conformity de Minimis	100	100	100	-	100	50	-
Riverside County (Salton Sea)	5.75	23.31	0.57	0.58	0.02	0.91	2,001
General Conformity de Minimis	100	25	-	70	-	25	-
Western San Bernardino/Los Angeles County (Mojave Desert)	2.14	8.70	0.21	0.22	0.01	0.34	747
East Kern County (Mojave Desert)	2.23	9.03	0.22	0.23	0.01	0.35	775
Total Mojave Desert Air Basin	4.37	17.73	0.43	0.44	0.02	0.69	1,522
General Conformity de Minimis	100	25	-	100	-	25	-
Los Angeles County (South Coast)	4.05	16.42	0.40	0.41	0.01	0.64	1,409
General Conformity de Minimis	100	10	100	100	100	10	-

Notes:

– = no de minimis threshold for this pollutant in the air basin

Table C-8

Emissions for Scenario 3 – Ballast from a Mixture of Quarries by Truck and Rail (Fresno to Bakersfield Section), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area(Air Basin)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	1.70	6.30	0.15	0.17	0.01	0.26	681
General Conformity de Minimis	100	100	100	-	100	50	-
Chico, CA (Sacramento Valley)	0.37	1.01	0.03	0.04	0.00	0.05	206
Yuba City (Sacramento Valley)	0.53	2.16	0.05	0.05	0.00	0.08	185
Sacramento Metropolitan Area (Sacramento Valley)	0.44	1.79	0.04	0.04	0.00	0.07	153
Total Sacramento Valley Air Basin	1.34	4.95	0.12	0.13	0.01	0.20	545
General Conformity de Minimis	100	25	100	100	100	25	-
Riverside County (Salton Sea)	3.91	15.84	0.38	0.40	0.01	0.62	1,360
General Conformity de Minimis	100	25	-	70	-	25	-
Western San Bernardino/Los Angeles County (Mojave Desert)	1.46	5.91	0.14	0.15	0.01	0.23	507
East Kern County (Mojave Desert)	1.51	6.14	0.15	0.15	0.01	0.24	527
Total Mojave Desert Air Basin	2.97	12.05	0.29	0.30	0.01	0.47	1,034
General Conformity de Minimis	100	25	-	100	-	25	-
Los Angeles County (South Coast)	2.75	11.16	0.27	0.28	0.01	0.43	958
General Conformity de Minimis	100	10	100	100	100	10	-

Note:

– = no de minimis threshold for this pollutant in the air basin

Table C-9

Emissions for Scenario 4 – Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area(Air Basin)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	1.73	3.45	0.09	0.16	0.01	0.21	1,156
General Conformity de Minimis	100	100	100	-	100	50	-
Riverside County (Salton Sea)	4.00	7.97	0.22	0.37	0.03	0.49	2,667
General Conformity de Minimis	100	25	-	70	-	25	-
Los Angeles County (South Coast)	4.61	9.20	0.25	0.43	0.04	0.56	3,078
General Conformity de Minimis	100	10	100	100	100	10	-
Chico, Butte County (Sacramento Valley)	0.30	0.59	0.02	0.03	0.00	0.04	199
Sacramento Metropolitan Area (Sacramento Valley)	0.68	1.35	0.04	0.06	0.01	0.08	451
Yuba City (Sacramento Valley)	0.56	1.12	0.03	0.05	0.00	0.07	376
Total Sacramento Valley Air Basin	1.54	3.07	0.08	0.14	0.01	0.19	1,027
General Conformity de Minimis	100	25	100	100	100	25	-

Note:

– = no de minimis threshold for this pollutant in the air basin

Table C-10

Emissions for Scenario 5 – Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area(Air Basin)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	1.73	3.45	0.09	0.16	0.01	0.21	1,156
General Conformity de Minimis	100	100	100	-	100	50	-
Riverside County (Salton Sea)	5.88	11.73	0.32	0.55	0.04	0.72	3,925
General Conformity de Minimis	100	25	-	70	-	25	-
Los Angeles County (South Coast)	6.79	13.53	0.37	0.63	0.05	0.83	4,529
General Conformity de Minimis	100	10	100	100	100	10	-

Note:

– = no de minimis threshold for this pollutant in the Air Basin

Attachment D
Emission Calculations for Scenarios Compared to CEQA Thresholds

Table D-1

Emissions for Scenario 1 – All Ballast from Kaiser Eagle Mountain Quarry by Rail (Merced to Fresno Section), Comparison to CEQA Annual Thresholds

Air Quality Management District (AQMD)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
San Bernardino/Los Angeles County (Mojave Desert AQMD)	1.33	5.38	0.13	0.13	0.00	0.21	461
CEQA Annual Threshold Limits	100	25	15	15	25	25	-
Los Angeles County/Riverside County (South Coast AQMD)	6.05	24.55	0.60	0.61	0.02	0.95	2,107
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
East Kern County APCD	1.38	5.58	0.14	0.14	0.00	0.22	479
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Notes:

– = no CEQA annual threshold for this pollutant in the AQMD

Table D-2

Emissions for Scenario 2 – Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Merced to Fresno Section), Comparison to CEQA Annual Thresholds

Air Quality Management District (AQMD)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area AQMD	0.68	2.54	0.06	0.07	0.00	0.10	274
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	0.86	3.50	0.08	0.09	0.00	0.14	301
CEQA Annual Threshold Limits	100	25	15	15	25	25	-
Los Angeles County/Riverside County (South Coast AQMD)	3.94	16.00	0.39	0.40	0.01	0.62	1,373
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
East Kern County APCD	0.90	3.64	0.09	0.09	0.00	0.14	312
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Notes:

– = no CEQA annual threshold for this pollutant in the AQMD

Table D-3
Emissions for Scenario 3 – Ballast from a Mixture of Quarries by Truck and Rail (Merced to Fresno Section), Comparison to CEQA Annual Thresholds

Air Quality Management District (AQMD)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area AQMD	0.68	2.54	0.06	0.07	0.00	0.10	274
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Butte County AQMD	0.15	0.41	0.01	0.01	0.00	0.02	83
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Sacramento Metropolitan Area AQMD	0.18	0.72	0.02	0.02	0.00	0.03	62
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Feather River AQMD	0.21	0.87	0.02	0.02	0.00	0.03	75
CEQA Annual Threshold Limits	-	4.5	-	-	-	4.5	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	0.59	2.38	0.06	0.06	0.00	0.09	204
CEQA Annual Threshold Limits	100	25	15	15	25	25	-
Los Angeles County/Riverside County (South Coast AQMD)	2.68	10.87	0.26	0.27	0.01	0.42	933
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
East Kern County APCD	0.61	2.47	0.06	0.06	0.00	0.10	212
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Note:

– = no CEQA annual threshold for this pollutant in the AQMD

Table D-4

Emissions for Scenario 4 – Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Merced to Fresno Section), Comparison to CEQA Annual Thresholds

Air Quality Management District (AQMD)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area AQMD	0.70	1.39	0.04	0.06	0.01	0.09	465
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Los Angeles County/Riverside County (South Coast AQMD)	3.47	6.92	0.19	0.32	0.03	0.42	2,314
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Butte County AQMD	0.12	0.24	0.01	0.01	0.00	0.01	80
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Sacramento Metropolitan Area AQMD	0.23	0.45	0.01	0.02	0.00	0.03	152
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Feather River AQMD	0.27	0.54	0.01	0.03	0.00	0.03	182
CEQA Annual Threshold Limits	-	4.5	-	-	-	4.5	-

Note:

– = no CEQA annual threshold for this pollutant in the AQMD

Table D-5

Emissions for Scenario 5 – Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only (Merced to Fresno Section), Comparison to CEQA Annual Thresholds

Air Quality Management District (AQMD)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area AQMD	0.70	1.39	0.04	0.06	0.01	0.09	465
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Los Angeles County/Riverside County (South Coast AQMD)	5.10	10.18	0.28	0.47	0.04	0.62	3,405
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Note:

– = no CEQA annual threshold for this pollutant in the AQMD

Table D-6

Emissions for Scenario 1 – All Ballast from Kaiser Eagle Mountain Quarry by Rail (Fresno to Bakersfield Section), Comparison to CEQA Annual Thresholds

Air Quality Management District (AQMD)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
San Bernardino/Los Angeles County (Mojave Desert AQMD)	3.29	13.35	0.32	0.33	0.01	0.52	1,146
CEQA Annual Threshold Limits	100	25	15	15	25	25	-
Los Angeles County/Riverside County (South Coast AQMD)	15.02	60.95	1.48	1.52	0.05	2.37	5,231
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
East Kern County APCD	3.41	13.85	0.34	0.35	0.01	0.54	1,189
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Notes:

– = no CEQA annual threshold for this pollutant in the AQMD

Table D-7

Emissions for Scenario 2 – Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Fresno to Bakersfield Section), Comparison to CEQA Annual Thresholds

Air Quality Management District (AQMD)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area AQMD	1.70	6.30	0.15	0.17	0.01	0.26	681
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	2.14	8.70	0.21	0.22	0.01	0.34	747
CEQA Annual Threshold Limits	100	25	15	15	25	25	-
Los Angeles County/Riverside County (South Coast AQMD)	9.79	39.73	0.96	0.99	0.04	1.55	1,409
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
East Kern County APCD	2.23	9.03	0.22	0.23	0.01	0.35	775
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Notes:

– = no CEQA annual threshold for this pollutant in the AQMD

Table D-8

Emissions for Scenario 3 – Ballast from a Mixture of Quarries by Truck and Rail (Fresno to Bakersfield Section), Comparison to CEQA Annual Thresholds

Air Quality Management District (AQMD)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area AQMD	1.70	6.30	0.15	0.17	0.01	0.26	681
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Butte County AQMD	0.37	1.01	0.03	0.04	0.00	0.05	206
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Sacramento Metropolitan Area AQMD	0.44	1.79	0.04	0.04	0.00	0.07	153
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Feather River AQMD	0.53	2.16	0.05	0.05	0.00	0.08	185
CEQA Annual Threshold Limits	-	4.5	-	-	-	4.5	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	1.46	5.91	0.14	0.15	0.01	0.23	507
CEQA Annual Threshold Limits	100	25	15	15	25	25	-
Los Angeles County/Riverside County (South Coast AQMD)	6.66	27.00	0.65	0.67	0.02	1.05	958
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
East Kern County APCD	1.51	6.14	0.15	0.15	0.01	0.24	527
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Note:

– = no CEQA annual threshold for this pollutant in the AQMD

Table D-9

Emissions for Scenario 4 – Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section), Comparison to CEQA Annual Thresholds

Air Quality Management District (AQMD)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area AQMD	1.73	3.45	0.09	0.16	0.01	0.21	1,156
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Butte County AQMD	0.30	0.59	0.02	0.03	0.00	0.04	199
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Sacramento Metropolitan Area AQMD	0.56	1.12	0.03	0.05	0.00	0.07	376
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Feather River AQMD	0.68	1.35	0.04	0.06	0.01	0.08	451
CEQA Annual Threshold Limits	-	4.5	-	-	-	4.5	-
Los Angeles County/Riverside County (South Coast AQMD)	8.61	17.17	0.47	0.80	0.07	1.05	3,078
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Note:

– = no CEQA annual threshold for this pollutant in the AQMD

Table D-10

Emissions for Scenario 5 – Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section), Comparison to CEQA Annual Thresholds

Air Quality Management District (AQMD)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO2 (Metric Tons)
Bay Area AQMD	1.73	3.45	0.09	0.16	0.01	0.21	1,156
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Los Angeles County/Riverside County (South Coast AQMD)	12.67	25.26	0.69	1.18	0.10	1.55	4,529
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Note:

– = no CEQA annual threshold for this pollutant in the AQMD

Table D-11

Emissions for Scenario 1 – All Ballast from Kaiser Eagle Mountain Quarry by Rail (Merced to Fresno Section), Comparison to Daily CEQA Daily Thresholds

Air Quality Management District (AQMD)	Emissions (pounds per day) Merced to Fresno					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
San Bernardino/Los Angeles County (Mojave Desert AQMD)	25.49	103.38	2.51	2.58	0.09	4.02
CEQA Daily Threshold Limits	548	137	82	82	137	137
Los Angeles County/Riverside County (South Coast AQMD)	116.37	472.06	11.45	11.80	0.42	18.36
CEQA Daily Threshold Limits	550	100	55	150	150	75
East Kern County APCD	26.45	107.29	2.60	2.68	0.10	4.17
CEQA Daily Threshold Limits	-	-	-	-	-	-

Notes:

– = no CEQA daily threshold for this pollutant in the AQMD

Table D-12

Emissions for Scenario 2 – Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Merced to Fresno Section), Comparison to CEQA Daily Thresholds

Air Quality Management District (AQMD)	Emissions (pounds per day) Merced to Fresno					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Bay Area AQMD	11.84	46.22	1.13	1.19	0.05	1.84
CEQA Daily Threshold Limits	-	54	54	82	-	54
San Bernardino/Los Angeles County (Mojave Desert AQMD)	16.61	67.39	1.63	1.68	0.06	2.62
CEQA Daily Threshold Limits	548	137	82	82	137	137
Los Angeles County/Riverside County (South Coast AQMD)	75.86	**307.72**	7.46	7.69	0.27	11.97
CEQA Daily Threshold Limits	550	**100**	55	150	150	75
East Kern County APCD	17.24	69.94	1.70	1.75	0.06	2.72
CEQA Daily Threshold Limits	-	-	-	-	-	-

Notes:

– = no CEQA daily threshold for this pollutant in the AQMD

Table D-13
Emissions for Scenario 3 – Ballast from a Mixture of Quarries by Truck and Rail (Merced to Fresno Section), Comparison to CEQA Daily Thresholds

Air Quality Management District (AQMD)	Emissions (pounds per day) Merced to Fresno					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Bay Area AQMD	11.84	46.22	1.13	1.19	0.05	1.84
CEQA Daily Threshold Limits	-	54	54	82	-	54
Butte County AQMD	1.75	5.57	0.14	0.17	0.01	0.25
CEQA Daily Threshold Limits	-	-	-	80	-	25
Sacramento Metropolitan Area AQMD	3.41	13.85	0.34	0.35	0.01	0.54
CEQA Daily Threshold Limits	-	85	-	-	-	65
Feather River AQMD	4.12	16.70	0.41	0.42	0.01	0.65
CEQA Daily Threshold Limits	-	-	-	80	-	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	11.29	45.80	1.11	1.14	0.04	1.78
CEQA Daily Threshold Limits	548	137	82	82	137	137
Los Angeles County/Riverside County (South Coast AQMD)	51.55	209.12	5.07	5.23	0.19	8.13
CEQA Daily Threshold Limits	550	100	55	150	150	75
East Kern County APCD	11.72	47.53	1.15	1.19	0.04	1.85
CEQA Daily Threshold Limits	-	-	-	-	-	-

Note:

– = no CEQA daily threshold for this pollutant in the AQMD

Table D-14

Emissions for Scenario 4 – Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Merced to Fresno Section), Comparison to CEQA Daily Thresholds

Air Quality Management District (AQMD)	Emissions (pounds per day) Merced to Fresno					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Bay Area AQMD	5.37	10.70	0.29	0.50	0.04	0.66
CEQA Daily Threshold Limits	-	54	54	82	-	54
Los Angeles County/Riverside County (South Coast AQMD)	26.68	53.19	1.45	2.48	0.20	3.26
CEQA Daily Threshold Limits	550	100	55	150	150	75
Butte County AQMD	0.92	1.84	0.05	0.09	0.01	0.11
CEQA Daily Threshold Limits	-	-	-	80	-	25
Sacramento Metropolitan Area AQMD	1.75	3.48	0.09	0.16	0.01	0.21
CEQA Daily Threshold Limits	-	85	-	-	-	65
Feather River AQMD	2.10	4.18	0.11	0.19	0.02	0.26
CEQA Daily Threshold Limits	-	-	-	80	-	-

Note:

– = no CEQA daily threshold for this pollutant in the AQMD

Table D-15

Emissions for Scenario 5 – Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only (Merced to Fresno Section), Comparison to CEQA Daily Thresholds

Air Quality Management District (AQMD)	Emissions (pounds per day) Merced to Fresno					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Bay Area AQMD	5.37	10.70	0.29	0.50	0.04	0.66
CEQA Daily Threshold Limits	-	54	54	82	-	54
Los Angeles County/Riverside County (South Coast AQMD)	39.26	78.28	2.13	3.64	0.30	4.80
CEQA Daily Threshold Limits	550	100	55	150	150	75

Note:

– = no CEQA daily threshold for this pollutant in the AQMD

Table D-16

Emissions for Scenario 1 – All Ballast from Kaiser Eagle Mountain Quarry by Rail (Fresno to Bakersfield Section), Comparison to CEQA Daily Thresholds

Air Quality Management District (AQMD)	Emissions (pounds per day) Fresno to Bakersfield					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
San Bernardino/Los Angeles County (Mojave Desert AQMD)	63.28	256.69	6.22	6.42	0.23	9.98
CEQA Daily Threshold Limits	548	137	82	82	137	137
Los Angeles County/Riverside County (South Coast AQMD)	288.93	1,172.03	28.42	29.30	1.04	45.58
CEQA Daily Threshold Limits	550	100	55	150	150	75
East Kern County APCD	65.67	266.37	6.46	6.66	0.24	10.36
CEQA Daily Threshold Limits	-	-	-	-	-	-

Notes:

– = no CEQA daily threshold for this pollutant in the AQMD

Table D-17

Emissions for Scenario 2 – Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Fresno to Bakersfield Section), Comparison to CEQA Daily Thresholds

Air Quality Management District (AQMD)	Emissions (pounds per day) Fresno to Bakersfield					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Bay Area AQMD	29.39	114.76	2.80	2.96	0.11	4.56
CEQA Daily Threshold Limits	-	54	54	82	-	54
San Bernardino/Los Angeles County (Mojave Desert AQMD)	41.25	167.33	4.06	4.18	0.15	6.51
CEQA Daily Threshold Limits	548	137	82	82	137	137
Los Angeles County/Riverside County (South Coast AQMD)	188.35	764.02	18.53	19.10	0.68	29.71
CEQA Daily Threshold Limits	550	100	55	150	150	75
East Kern County APCD	42.81	173.64	4.21	4.34	0.15	6.75
CEQA Daily Threshold Limits	-	-	-	-	-	-

Notes:

– = no CEQA daily threshold for this pollutant in the AQMD

Table D-18

Emissions for Scenario 3 – Ballast from a Mixture of Quarries by Truck and Rail (Fresno to Bakersfield Section), Comparison to CEQA Daily Thresholds

Air Quality Management District (AQMD)	Emissions (pounds per day) Fresno to Bakersfield					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Bay Area AQMD	29.39	**114.76**	2.80	2.96	0.11	4.56
CEQA Daily Threshold Limits	-	**54**	54	82	-	54
Butte County AQMD	4.35	13.82	0.35	0.43	0.02	0.62
CEQA Daily Threshold Limits	-	-	-	80	-	25
Sacramento Metropolitan Area AQMD	8.48	34.39	0.83	0.86	0.03	1.34
CEQA Daily Threshold Limits	-	85	-	-	-	65
Feather River AQMD	10.22	41.48	1.01	1.04	0.04	1.61
CEQA Daily Threshold Limits	-	-	-	80	-	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	28.03	113.71	2.76	2.84	0.10	4.42
CEQA Daily Threshold Limits	548	137	82	82	137	137
Los Angeles County/Riverside County (South Coast AQMD)	128.00	**519.22**	12.59	12.98	0.46	20.19
CEQA Daily Threshold Limits	550	**100**	55	150	150	75
East Kern County APCD	29.09	118.00	2.86	2.95	0.10	4.59
CEQA Daily Threshold Limits	-	-	-	-	-	-

Note:

– = no CEQA daily threshold for this pollutant in the AQMD

Table D-19

Emissions for Scenario 4 – Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section), Comparison to CEQA Daily Thresholds

Air Quality Management District (AQMD)	Emissions (pounds per day) Fresno to Bakersfield					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Bay Area AQMD	13.32	26.56	0.72	1.24	0.10	1.63
CEQA Daily Threshold Limits	-	54	54	82	-	54
Los Angeles County/Riverside County (South Coast AQMD)	66.24	132.07	3.59	6.15	0.50	8.09
CEQA Daily Threshold Limits	550	100	55	150	150	75
Butte County AQMD	2.29	4.57	0.12	0.21	0.02	0.28
CEQA Daily Threshold Limits	-	-	-	80	-	25
Sacramento Metropolitan Area AQMD	4.34	8.65	0.23	0.40	0.03	0.53
CEQA Daily Threshold Limits	-	85	-	-	-	65
Feather River AQMD	5.21	10.38	0.28	0.48	0.04	0.64
CEQA Daily Threshold Limits	-	-	-	80	-	-

Note:

– = no CEQA daily threshold for this pollutant in the AQMD

Table D-20

Emissions for Scenario 5 – Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section), Comparison to CEQA Thresholds

Air Quality Management District (AQMD)	Emissions (pounds per day) Fresno to Bakersfield					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Bay Area AQMD	13.32	26.56	0.72	1.24	0.10	1.63
CEQA Daily Threshold Limits	-	54	54	82	-	54
Los Angeles County/Riverside County (South Coast AQMD)	97.47	194.34	5.28	9.04	0.74	11.91
CEQA Daily Threshold Limits	550	100	55	150	150	75

Note:

– = no CEQA daily threshold for this pollutant in the AQMD

Attachment E
Mitigated Emission Calculations for Scenarios Compared to GC de minimis Thresholds

Table E-1

Mitigated Emissions for Scenario 2 – Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Merced to Fresno Section), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	0.63	2.40	0.06	0.07	0.00	0.10	279
General Conformity de Minimis	100	100	100	-	100	50	-
Riverside County (Salton Sea)	2.31	9.39	0.23	0.23	0.01	0.37	806
General Conformity de Minimis	100	25	-	70	-	25	-
Western San Bernardino/Los Angeles County (Mojave Desert)	0.86	3.50	0.08	0.09	0.00	0.14	301
East Kern County (Mojave Desert)	0.90	3.64	0.09	0.09	0.00	0.14	312
Total Mojave Desert Air Basin	1.76	7.14	0.17	0.18	0.01	0.28	613
General Conformity de Minimis	100	25	-	100	-	25	-
Los Angeles County (South Coast)	1.63	6.61	0.16	0.17	0.01	0.26	567
General Conformity de Minimis	100	10	100	100	100	10	-

Notes:

– = no de minimis threshold for this pollutant in the air basin

Table E-2

Mitigated Emissions for Scenario 3 – Ballast from a Mixture of Quarries by Truck and Rail (Merced to Fresno Section), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	0.63	2.40	0.06	0.07	0.00	0.10	279
General Conformity de Minimis	100	100	100	-	100	50	-
Chico, CA (Sacramento Valley)	0.10	0.28	0.01	0.01	0.00	0.02	87
Yuba City (Sacramento Valley)	0.21	0.87	0.02	0.02	0.00	0.03	75
Sacramento Metropolitan Area (Sacramento Valley)	0.18	0.72	0.02	0.02	0.00	0.03	62
Total Sacramento Valley Air Basin	0.50	1.87	0.05	0.05	0.00	0.08	223
General Conformity de Minimis	100	25	100	100	100	25	-
Riverside County (Salton Sea)	1.57	6.38	0.15	0.16	0.01	0.25	548
General Conformity de Minimis	100	25	-	70	-	25	-
Western San Bernardino/Los Angeles County (Mojave Desert)	0.59	2.38	0.06	0.06	0.00	0.09	204
East Kern County (Mojave Desert)	0.61	2.47	0.06	0.06	0.00	0.10	212
Total Mojave Desert Air Basin	1.20	4.85	0.12	0.12	0.00	0.19	417
General Conformity de Minimis	100	25	-	100	-	25	-
Los Angeles County (South Coast)	1.11	4.49	0.11	0.11	0.00	0.17	386
General Conformity de Minimis	100	10	100	100	100	10	-

Note:

– = no de minimis threshold for this pollutant in the air basin

Table E-3

Mitigated Emissions for Scenario 4 – Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Merced to Fresno Section), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	0.37	0.52	0.03	0.06	0.01	0.05	492
General Conformity de Minimis	100	100	100	-	100	50	-
Riverside County (Salton Sea)	0.86	1.20	0.08	0.14	0.01	0.12	1,136
General Conformity de Minimis	100	25	-	70	-	25	-
Los Angeles County (South Coast)	0.99	1.39	0.09	0.16	0.01	0.14	1,311
General Conformity de Minimis	100	10	100	100	100	10	-
Chico, Butte County (Sacramento Valley)	0.06	0.09	0.01	0.01	0.00	0.01	85
Sacramento Metropolitan Area (Sacramento Valley)	0.12	0.17	0.01	0.02	0.00	0.02	160
Yuba City (Sacramento Valley)	0.14	0.20	0.01	0.02	0.00	0.02	192
Total Sacramento Valley Air Basin	0.33	0.46	0.03	0.05	0.00	0.05	437
General Conformity de Minimis	100	25	100	100	100	25	-

Note:

– = no de minimis threshold for this pollutant in the air basin

Table E-4

Mitigated Emissions for Scenario 5 – Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only (Merced to Fresno Section), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	0.37	0.52	0.03	0.06	0.01	0.05	492
General Conformity de Minimis	100	100	100	-	100	50	-
Riverside County (Salton Sea)	1.26	1.77	0.11	0.21	0.02	0.18	1,671
General Conformity de Minimis	100	25	-	70	-	25	-
Los Angeles County (South Coast)	1.45	2.04	0.13	0.24	0.02	0.21	1,928
General Conformity de Minimis	100	10	100	100	100	10	-

Note:

– = no de minimis threshold for this pollutant in the Air Basin

Table E-5

Mitigated Emissions for Scenario 2 – Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Fresno to Bakersfield), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	1.57	5.95	0.15	0.17	0.01	0.24	692
General Conformity de Minimis	100	100	100	-	100	50	-
Riverside County (Salton Sea)	5.75	23.31	0.57	0.58	0.02	0.91	2,001
General Conformity de Minimis	100	25	-	70	-	25	-
Western San Bernardino/Los Angeles County (Mojave Desert)	2.14	8.70	0.21	0.22	0.01	0.34	747
East Kern County (Mojave Desert)	2.23	9.03	0.22	0.23	0.01	0.35	775
Total Mojave Desert Air Basin	4.37	17.73	0.43	0.44	0.02	0.69	1,522
General Conformity de Minimis	100	25	-	100	-	25	-
Los Angeles County (South Coast)	4.05	16.42	0.40	0.41	0.01	0.64	1,409
General Conformity de Minimis	100	10	100	100	100	10	-

Notes:

– = no de minimis threshold for this pollutant in the air basin

Table E-6
Mitigated Emissions for Scenario 3 – Ballast from a Mixture of Quarries by Truck and Rail (Fresno to Bakersfield Section), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	1.57	5.95	0.15	0.17	0.01	0.24	692
General Conformity de Minimis	100	100	100	-	100	50	-
Chico, CA (Sacramento Valley)	0.26	0.71	0.02	0.03	0.00	0.04	216
Yuba City (Sacramento Valley)	0.53	2.16	0.05	0.05	0.00	0.08	185
Sacramento Metropolitan Area (Sacramento Valley)	0.44	1.79	0.04	0.04	0.00	0.07	153
Total Sacramento Valley Air Basin	1.23	4.65	0.12	0.13	0.01	0.19	554
General Conformity de Minimis	100	25	100	100	100	25	-
Riverside County (Salton Sea)	3.91	15.84	0.38	0.40	0.01	0.62	1,360
General Conformity de Minimis	100	25	-	70	-	25	-
Western San Bernardino/Los Angeles County (Mojave Desert)	1.46	5.91	0.14	0.15	0.01	0.23	507
East Kern County (Mojave Desert)	1.51	6.14	0.15	0.15	0.01	0.24	527
Total Mojave Desert Air Basin	2.97	12.05	0.29	0.30	0.01	0.47	1,034
General Conformity de Minimis	100	25	-	100	-	25	-
Los Angeles County (South Coast)	2.75	11.16	0.27	0.28	0.01	0.43	958
General Conformity de Minimis	100	10	100	100	100	10	-

Note:

– = no de minimis threshold for this pollutant in the air basin

Table E-7

Mitigated Emissions for Scenario 4 – Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	0.92	1.29	0.08	0.15	0.01	0.13	1,222
General Conformity de Minimis	100	100	100	-	100	50	-
Riverside County (Salton Sea)	2.13	2.98	0.19	0.35	0.03	0.30	2,820
General Conformity de Minimis	100	25	-	70	-	25	-
Los Angeles County (South Coast)	2.45	3.44	0.22	0.41	0.04	0.35	3,254
General Conformity de Minimis	100	10	100	100	100	10	-
Chico, Butte County (Sacramento Valley)	0.16	0.22	0.01	0.03	0.00	0.02	210
Sacramento Metropolitan Area (Sacramento Valley)	0.30	0.42	0.03	0.05	0.00	0.04	398
Yuba City (Sacramento Valley)	0.36	0.50	0.03	0.06	0.01	0.05	477
Total Sacramento Valley Air Basin	0.82	1.15	0.07	0.14	0.01	0.12	1,085
General Conformity de Minimis	100	25	100	100	100	25	-

Note:

– = no de minimis threshold for this pollutant in the air basin

Table E-8

Mitigated Emissions for Scenario 5 – Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	0.92	1.29	0.08	0.15	0.01	0.13	1,222
General Conformity de Minimis	100	100	100	-	100	50	-
Riverside County (Salton Sea)	3.13	4.39	0.29	0.52	0.05	0.44	4,150
General Conformity de Minimis	100	25	-	70	-	25	-
Los Angeles County (South Coast)	3.61	5.06	0.33	0.60	0.05	0.51	4,788
General Conformity de Minimis	100	10	100	100	100	10	-

Note:

– = no de minimis threshold for this pollutant in the Air Basin

Attachment F
Mitigated Emission Calculations for Scenarios Compared to CEQA Thresholds

Table F-1

Mitigated Emissions for Scenario 2 – Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Merced to Fresno Section), Comparison to CEQA Annual Thresholds

Air Quality Management District (AQMD)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area AQMD	0.63	2.40	0.06	0.07	0.00	0.10	279
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	0.86	3.50	0.08	0.09	0.00	0.14	301
CEQA Annual Threshold Limits	100	25	15	15	25	25	-
Los Angeles County/Riverside County (South Coast AQMD)	3.94	16.00	0.39	0.40	0.01	0.62	1,373
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
East Kern County APCD	0.90	3.64	0.09	0.09	0.00	0.14	312
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Notes:

– = no CEQA annual threshold for this pollutant in the AQMD

Table F-2

Mitigated Emissions for Scenario 3 – Ballast from a Mixture of Quarries by Truck and Rail (Merced to Fresno Section), Comparison to CEQA Annual Thresholds

Air Quality Management District (AQMD)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area AQMD	0.63	2.40	0.06	0.07	0.00	0.10	279
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Butte County AQMD	0.10	0.28	0.01	0.01	0.00	0.02	87
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Sacramento Metropolitan Area AQMD	0.18	0.72	0.02	0.02	0.00	0.03	62
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Feather River AQMD	0.21	0.87	0.02	0.02	0.00	0.03	75
CEQA Annual Threshold Limits	-	4.5	-	-	-	4.5	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	0.59	2.38	0.06	0.06	0.00	0.09	204
CEQA Annual Threshold Limits	100	25	15	15	25	25	-
Los Angeles County/Riverside County (South Coast AQMD)	2.68	10.87	0.26	0.27	0.01	0.42	933
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
East Kern County APCD	0.61	2.47	0.06	0.06	0.00	0.10	212
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Note:

– = no CEQA annual threshold for this pollutant in the AQMD

Table F-3

Mitigated Emissions for Scenario 4 – Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Merced to Fresno Section), Comparison to CEQA Annual Thresholds)

Air Quality Management District (AQMD)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area AQMD	0.37	0.52	0.03	0.06	0.01	0.05	492
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Los Angeles County/Riverside County (South Coast AQMD)	1.84	2.59	0.17	0.31	0.03	0.26	2,446
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Butte County AQMD	0.06	0.09	0.01	0.01	0.00	0.01	85
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Sacramento Metropolitan Area AQMD	0.12	0.17	0.01	0.02	0.00	0.02	160
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Feather River AQMD	0.14	0.20	0.01	0.02	0.00	0.02	192
CEQA Annual Threshold Limits	-	4.5	-	-	-	4.5	-

Note:

– = no CEQA annual threshold for this pollutant in the AQMD

Table F-4

Mitigated Emissions for Scenario 5 – Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only (Merced to Fresno Section), Comparison to CEQA Annual Thresholds

Air Quality Management District (AQMD)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area AQMD	0.37	0.52	0.03	0.06	0.01	0.05	492
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Los Angeles County/Riverside County (South Coast AQMD)	2.71	3.81	0.25	0.45	0.04	0.38	3,600
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Note:

– = no CEQA annual threshold for this pollutant in the AQMD

Table F-5

Mitigated Emissions for Scenario 2 – Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Fresno to Bakersfield Section), Comparison to Annual CEQA Thresholds

Air Quality Management District (AQMD)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area AQMD	1.57	5.95	0.15	0.17	0.01	0.24	692
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	2.14	8.70	0.21	0.22	0.01	0.34	747
CEQA Annual Threshold Limits	100	25	15	15	25	25	-
Los Angeles County/Riverside County (South Coast AQMD)	9.79	39.73	0.96	0.99	0.04	1.55	1,409
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
East Kern County APCD	2.23	9.03	0.22	0.23	0.01	0.35	775
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Notes:

– = no CEQA annual threshold for this pollutant in the AQMD

Table F-6
Mitigated Emissions for Scenario 3 – Ballast from a Mixture of Quarries by Truck and Rail (Fresno to Bakersfield Section), Comparison to Annual CEQA Thresholds

Air Quality Management District (AQMD)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area AQMD	1.57	5.95	0.15	0.17	0.01	0.24	692
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Butte County AQMD	0.26	0.71	0.02	0.03	0.00	0.04	216
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Sacramento Metropolitan Area AQMD	0.44	1.79	0.04	0.04	0.00	0.07	153
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Feather River AQMD	0.53	2.16	0.05	0.05	0.00	0.08	185
CEQA Annual Threshold Limits	-	4.5	-	-	-	4.5	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	1.46	5.91	0.14	0.15	0.01	0.23	507
CEQA Annual Threshold Limits	100	25	15	15	25	25	-
Los Angeles County/Riverside County (South Coast AQMD)	6.66	27.00	0.65	0.67	0.02	1.05	958
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
East Kern County APCD	1.51	6.14	0.15	0.15	0.01	0.24	527
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Note:

– = no CEQA annual threshold for this pollutant in the AQMD

Table F-7

Mitigated Emissions for Scenario 4 – Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section), Comparison to Annual CEQA Thresholds

Air Quality Management District (AQMD)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area AQMD	0.92	1.29	0.08	0.15	0.01	0.13	1,222
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Butte County AQMD	0.16	0.22	0.01	0.03	0.00	0.02	210
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Sacramento Metropolitan Area AQMD	0.30	0.42	0.03	0.05	0.00	0.04	398
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Feather River AQMD	0.36	0.50	0.03	0.06	0.01	0.05	477
CEQA Annual Threshold Limits	-	4.5	-	-	-	4.5	-
Los Angeles County/Riverside County (South Coast AQMD)	4.58	6.42	0.42	0.76	0.07	0.65	3,254
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Note:

– = no CEQA annual threshold for this pollutant in the AQMD

Table F-8

Mitigated Emissions for Scenario 5 – Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section), Comparison to Annual CEQA Thresholds

Air Quality Management District (AQMD)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area AQMD	0.92	1.29	0.08	0.15	0.01	0.13	1,222
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Los Angeles County/Riverside County (South Coast AQMD)	6.74	9.45	0.61	1.12	0.10	0.95	4,788
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Note:

– = no CEQA annual threshold for this pollutant in the AQMD

Table F-9

Mitigated Emissions for Scenario 2 – Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Merced to Fresno Section), Comparison to CEQA Daily Thresholds

Air Quality Management District (AQMD)	Emissions (pounds per day) Merced to Fresno					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Bay Area AQMD	11.43	45.13	1.12	1.19	0.05	1.80
CEQA Daily Threshold Limits	-	54	54	82	-	54
San Bernardino/Los Angeles County (Mojave Desert AQMD)	16.61	67.39	1.63	1.68	0.06	2.62
CEQA Daily Threshold Limits	548	137	82	82	137	137
Los Angeles County/Riverside County (South Coast AQMD)	75.86	307.72	7.46	7.69	0.27	11.97
CEQA Daily Threshold Limits	550	100	55	150	150	75
East Kern County APCD	17.24	69.94	1.70	1.75	0.06	2.72
CEQA Daily Threshold Limits	-	-	-	-	-	-

Notes:

– = no CEQA daily threshold for this pollutant in the AQMD

Table F-10
Mitigated Emissions for Scenario 3 – Ballast from a Mixture of Quarries by Truck and Rail (Merced to Section), Comparison to Daily CEQA Thresholds

Air Quality Management District (AQMD)	Emissions (pounds per day) Merced to Fresno					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Bay Area AQMD	11.43	45.13	1.12	1.19	0.05	1.80
CEQA Daily Threshold Limits	-	54	54	82	-	54
Butte County AQMD	1.40	4.63	0.14	0.17	0.01	0.21
CEQA Daily Threshold Limits	-	-	-	80	-	25
Sacramento Metropolitan Area AQMD	3.41	13.85	0.34	0.35	0.01	0.54
CEQA Daily Threshold Limits	-	85	-	-	-	65
Feather River AQMD	4.12	16.70	0.41	0.42	0.01	0.65
CEQA Daily Threshold Limits	-	-	-	80	-	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	11.29	45.80	1.11	1.14	0.04	1.78
CEQA Daily Threshold Limits	548	137	82	82	137	137
Los Angeles County/Riverside County (South Coast AQMD)	51.55	209.12	5.07	5.23	0.19	8.13
CEQA Daily Threshold Limits	550	100	55	150	150	75
East Kern County APCD	11.72	47.53	1.15	1.19	0.04	1.85
CEQA Daily Threshold Limits	-	-	-	-	-	-

Note:

– = no CEQA daily threshold for this pollutant in the AQMD

Table F-11

Mitigated Emissions for Scenario 4 – Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Merced to Fresno Section), Comparison to Daily CEQA Thresholds

Air Quality Management District (AQMD)	Emissions (pounds per day) Merced to Fresno					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Bay Area AQMD	2.85	4.00	0.26	0.47	0.04	0.40
CEQA Daily Threshold Limits	-	54	54	82	-	54
Los Angeles County/Riverside County (South Coast AQMD)	14.18	19.89	1.29	2.35	0.21	2.01
CEQA Daily Threshold Limits	550	100	55	150	150	75
Butte County AQMD	0.49	0.69	0.04	0.08	0.01	0.07
CEQA Daily Threshold Limits	-	-	-	80	-	25
Sacramento Metropolitan Area AQMD	0.93	1.30	0.08	0.15	0.01	0.13
CEQA Daily Threshold Limits	-	85	-	-	-	65
Feather River AQMD	1.11	1.56	0.10	0.18	0.02	0.16
CEQA Daily Threshold Limits	-	-	-	80	-	-

Note:

– = no CEQA daily threshold for this pollutant in the AQMD

Table F-12

Mitigated Emissions for Scenario 5 – Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only (Merced to Fresno Section), Comparison to Daily CEQA Thresholds

Air Quality Management District (AQMD)	Emissions (pounds per day) Merced to Fresno					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Bay Area AQMD	2.85	4.00	0.26	0.47	0.04	0.40
CEQA Daily Threshold Limits	-	54	54	82	-	54
Los Angeles County/Riverside County (South Coast AQMD)	20.87	29.27	1.90	3.46	0.31	2.95
CEQA Daily Threshold Limits	550	100	55	150	150	75

Note:

– = no CEQA daily threshold for this pollutant in the AQMD

Table F-13

Mitigated Emissions for Scenario 2 – Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Fresno to Bakersfield Section), Comparison to Daily CEQA Thresholds

Air Quality Management District (AQMD)	Emissions (pounds per day) Fresno to Bakersfield					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Bay Area AQMD	28.38	112.05	2.78	2.95	0.12	4.46
CEQA Daily Threshold Limits	-	54	54	82	-	54
San Bernardino/Los Angeles County (Mojave Desert AQMD)	41.25	167.33	4.06	4.18	0.15	6.51
CEQA Daily Threshold Limits	548	137	82	82	137	137
Los Angeles County/Riverside County (South Coast AQMD)	188.35	764.02	18.53	19.10	0.68	29.71
CEQA Daily Threshold Limits	550	100	55	150	150	75
East Kern County APCD	42.81	173.64	4.21	4.34	0.15	6.75
CEQA Daily Threshold Limits	-	-	-	-	-	-

Notes:

– = no CEQA daily threshold for this pollutant in the AQMD

Table F-14

Mitigated Emissions for Scenario 3 – Ballast from a Mixture of Quarries by Truck and Rail (Fresno to Bakersfield Section), Comparison to Daily CEQA Thresholds

Air Quality Management District (AQMD)	Emissions (pounds per day) Fresno to Bakersfield					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Bay Area AQMD	28.38	112.05	2.78	2.95	0.12	4.46
CEQA Daily Threshold Limits	-	54	54	82	-	54
Butte County AQMD	3.48	11.50	0.34	0.42	0.02	0.53
CEQA Daily Threshold Limits	-	-	-	80	-	25
Sacramento Metropolitan Area AQMD	8.48	34.39	0.83	0.86	0.03	1.34
CEQA Daily Threshold Limits	-	85	-	-	-	65
Feather River AQMD	10.22	41.48	1.01	1.04	0.04	1.61
CEQA Daily Threshold Limits	-	-	-	80	-	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	28.03	113.71	2.76	2.84	0.10	4.42
CEQA Daily Threshold Limits	548	137	82	82	137	137
Los Angeles County/Riverside County (South Coast AQMD)	128.00	519.22	12.59	12.98	0.46	20.19
CEQA Daily Threshold Limits	550	100	55	150	150	75
East Kern County APCD	29.09	118.00	2.86	2.95	0.10	4.59
CEQA Daily Threshold Limits	-	-	-	-	-	-

Note:

– = no CEQA daily threshold for this pollutant in the AQMD

Table F-15

Mitigated Emissions for Scenario 4 – Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section), Comparison to Daily CEQA Thresholds

Air Quality Management District (AQMD)	Emissions (pounds per day) Fresno to Bakersfield					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Bay Area AQMD	7.08	9.93	0.65	1.17	0.11	1.00
CEQA Daily Threshold Limits	-	54	54	82	-	54
Los Angeles County/Riverside County (South Coast AQMD)	35.21	49.39	3.21	5.83	0.53	4.98
CEQA Daily Threshold Limits	550	100	55	150	150	75
Butte County AQMD	1.22	1.71	0.11	0.20	0.02	0.17
CEQA Daily Threshold Limits	-	-	-	80	-	25
Sacramento Metropolitan Area AQMD	2.31	3.23	0.21	0.38	0.03	0.33
CEQA Daily Threshold Limits	-	85	-	-	-	65
Feather River AQMD	2.77	3.88	0.25	0.46	0.04	0.39
CEQA Daily Threshold Limits	-	-	-	80	-	-

Note:

– = no CEQA daily threshold for this pollutant in the AQMD

Table F-16

Mitigated Emissions for Scenario 5 – Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section), Comparison to Daily CEQA Thresholds

Air Quality Management District (AQMD)	Emissions (pounds per day) Fresno to Bakersfield					
	CO	NOx	PM2.5	PM10	SO2	VOC
Bay Area AQMD	7.08	9.93	0.65	1.17	0.11	1.00
CEQA Daily Threshold Limits	-	54	54	82	-	54
Los Angeles County/Riverside County (South Coast AQMD)	51.81	72.68	4.73	8.59	0.78	7.33
CEQA Daily Threshold Limits	550	100	55	150	150	75

Note:

– = no CEQA daily threshold for this pollutant in the AQMD

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MEMORANDUM

To:	**Rebecca Kohlstrand/PMT; Bryan Porter/PMT**
From:	**David Joe/URS/HMM/Arup**
Date:	**04/16/2014**
Subject:	**Update to Ballast Hauling NO_X Emission Offset Availability in the Bay Area, Mojave Desert, and South Coast Air Basins – Merced to Fresno and Fresno to Bakersfield Sections of the California High-Speed Train Project**

Analysis of pollutant emissions that are associated with hauling railway ballast material needed for the Merced to Fresno and Fresno to Bakersfield sections of the California High-Speed Train Project determined that the project could potentially exceed CEQA NO_X emission thresholds in the South Coast Air Basin (South Coast AQMD), Mojave Desert Air Basin (Mojave Desert AQMD), and San Francisco Bay Area Air Basin (Bay Area AQMD) (URS/HHM/Arup, 2014). Since the construction period for the Merced to Fresno Section and the Fresno to Bakersfield may overlap, the total amount of emission offsets required for both sections were analyzed together to ensure enough NO_X offsets were available in each basin to offset the CEQA exceedances.

The maximum exceedances, and therefore the amount of potential offsets required, would occur under Hauling Scenario 1 for the South Coast Air Basin (South Coast AQMD) and Mojave Desert Air Basin (Mojave Desert AQMD) and in Hauling Scenarios 2 and 3 for the San Francisco Bay Area Air Basin (Bay Area AQMD).

Maximum Potential Offsets Required for Mitigated Scenarios

	Pollutant	Threshold Exceeded	Offsets Required (tons/year)
Bay Area Air Basin	NO_X	CEQA	3.2
South Coast Air Basin	NO_X	CEQA	75.1
Mojave Desert Air Basin	NO_X	CEQA	6.2

Notes:
Maximum offsets required were calculated based on per day exceedances of CEQA thresholds multiplied by number of days of hauling per year (260 days per year via truck and 104 days per year via rail).

San Francisco Bay Area Air Basin

Bay Area Air Quality Management District (BAAQMD)

The BAAQMD's emissions bank currently holds 2,681 tons of NO_X emission offsets (BAAQMD 2012). While the entirety of these offsets are not currently for sale, as large entities typically hold on to their offsets for use with their own future projects, in 2010, 91.48 tons of NO_X credits were traded in the BAAQMD in a total of five transactions, at a price ranging from

$10,000 to $13,000/ton (CARB 2012a). In 2009, 265.95 tons of NO_X credits were traded over 8 transactions, with the price ranging from $11,000 to $16,800/ton (CARB 2012b). This data shows that even though the entirety of ERCs are not available for sale, enough are seemingly traded on a yearly basis to cover the amount required by the potential maximum emission exceedances.

While the BAAQMD does not have a formal program to use emission reduction credits (ERCs) to offset construction emissions, such as the SCAQMD's RECLAIM program, it is likely feasible to use them in this manner. Looking at the past few years of data, and the amount of ERCs currently in the BAAQMD emissions bank, it would seem likely that offsetting the NO_X emissions from construction would not be hindered by the quantity of emission credits available.

Mojave Desert Air Basin

Mojave Desert Air Quality Management District (MDAQMD)

The MDAQMD's emissions bank currently holds 2,061 tons of available, Class A (approved for use as emission offsets), NO_X emission credits (MDAQMD 2012). In 2010, 17 tons of NO_X credits were traded in the MDAB at an average price of $10,000/ton (CARB 2012a) although in 2009, no NO_X credits were traded in the MDAB (CARB 2012b).

The MDAQMD, similar to the BAAQMD, does not have a formal construction emission offset program. It is likely, however, that emission offsets could be purchased to offset the potential maximum 6.2 tons of NO_X per year.

South Coast Air Basin

South Coast Air Quality Management District (SCAQMD)

Mobile Source Emission Reduction Credits (MSERC)

MSERCs have, and can be used, in the SCAQMD to offset NO_X construction emissions. Unfortunately, MSERCs are not being generated as quickly as they have been in past years, and it is unlikely, without new legislation encouraging generation of new MSERCs, that sufficient amounts would be available to offset the hauling emissions the South Coast Air Basin.

Regional Clean Air Incentives Market (RECLAIM)

Formal guidance is available from the SCAQMD specifying how RECLAIM credits can be used to offset construction emissions, specifically NO_X. The following criteria must be met prior to utilizing RECLAIM credits for mitigation:

- Utilize alternative technology mitigation
- Provide localized air quality modeling analysis to show localized impacts are less than significant

- Purchase the emission credits prior to the commencement of construction
- Retire the entire amount of NO_X emission credits prior to construction commencement
- Reconcile disparities (emissions higher than anticipated) in a timely manner
- Record construction equipment usage and submit monthly reports
- Post contact information at construction site

In a report, published by the SCAQMD in April 2012, the total amount of NO_X RECLAIM Trading Credits (RTCs) traded in the year ending April 2012, for compliance year 2011 was 1,198.6 tons at an average price of $1,013/ton. As of April 2012, 234.8 tons of NO_X RTCs were traded for compliance year 2012 at an average price of $4,121/ton (SCAQMD 2012).

Based on the amount of trades and volume of credits traded in the past two years, it would seem likely that enough credits would be available to cover the potentially maximum 75.1 tons a year. The HST Project meets the RECLAIM criteria by exhausting technological mitigation and would not require localized air quality monitoring as the emissions are not occurring at one specific site, but are going to be spread over the air basin.

Conclusion

According to this analysis, sufficient offsets for NO_X emissions are available in the Bay Area, Mojave Desert, and South Coast AQMDs for the maximum potential offsets required under the various scenarios. This conclusion is based on the amount of emission offsets available in emission banks, as well as recent activity regarding emission trade in each air basin.

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Appendix G

Quarry and Ballast Hauling Memorandum

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MEMORANDUM

To: **Rebecca Kohlstrand/PMT; Bryan Porter/PMT**
From: **Jonathan Tamimi /URS/HMM/Arup; Avanti Tamhane /URS/HMM/Arup**
Date: **03/23/2012**
Subject: **Estimated Emissions from Hauling Ballast Material – Merced to Fresno and Fresno to Bakersfield Sections of the California High-Speed Train Project**

Analysis of pollutant emissions that are associated with hauling railway ballast material needed for the Merced to Fresno and Fresno to Bakersfield Sections of the California High-Speed Train Project are included in the air quality analysis section in Chapter 3 of the *California High-Speed Train Project Environmental Impact Report/Environmental Impact Statement*. Since the construction period for the Merced to Fresno Section and the Fresno to Bakersfield would overlap, the total amount of material and the associated emissions for both sections are analyzed in this memorandum. Air emissions were proportioned based on the material requirement for each section and were then compared to the General Conformity de minimis thresholds as well as the CEQA thresholds.

The analysis presented in this memorandum assumes that the rail will be constructed using a combination of ballast, sub-ballast, and slab track. The analysis assumes that sub-ballast and the material necessary for concrete manufacture will be available within the SJVAB. Also, worst case emissions for one year are shown. This corresponds to hauling in the years of 2014, 2015, and 2016, while the remaining years would have emissions less than presented in this memo.

Over the course of the construction period, the Merced to Fresno and Fresno to Bakersfield Sections will require about 2 million cubic yards (cy) of ballast material for alignment construction, however, this total amount is not currently available within San Joaquin Valley Air Basin (SJVAB), and there would be a need to haul it from quarries located in other air basins. If project material is hauled through other air basins, the associated emissions must be analyzed with respect to pollutant thresholds in the air basins traversed.

This memorandum describes the analysis performed to determine (1) the potential amount of railroad ballast material available from California quarries for the Merced to Fresno and Fresno to Bakersfield Sections of the California High-Speed Train Project and (2) pollutant emissions associated with hauling the materials to the SJVAB boundary.

Quarries Evaluated

The Office of Mine Reclamation (California Department of Conservation [CDC]) provided a list of quarries within the state of California (CDC 2010). The list was screened for active rock quarries with 200 or more acres of permitted area because they are considered to be of sufficient size to serve the demand effectively. Quarries that are in the planning stage and have not received

a permit, such as the Jesse Morrow Mountain Quarry in Fresno County and Liberty Quarry in Riverside County, were not considered in the analysis.

A general inquiry call (which did not identify the project) was made to the five quarries that met the screening criteria. The quarries were asked (1) if they could manufacture ballast material to American Railway Engineering and Maintenance-of-Way Association (AREMA) 4 specifications, (2) the distance from the quarry to the nearest railhead for transport, and (3) the amount of ballast material that could be produced by the quarry in 1 year. Table 1 summarizes the results. Two quarries, Bowman Quarry and Mountain Avenue Pit No. 1 (Elsinore Ready Mix Concrete) met the screening criteria but contact information was not available and, therefore, they were not considered in this analysis.

TABLE 1
Quarry Information

Quarry Name and Address	Distance to SJVAB (rail miles)	AREMA 4 Ballast Availability	Distance to Nearest Railhead	Annual Ballast Production Capacity
Kaiser Eagle Mountain Quarry 1 Court Street Desert Center, CA 92239 (Mojave Air Basin)	350	Yes	Railhead onsite	1,000,000 cy/yr
Napa Quarry 2301 Napa-Vallejo Highway Napa, CA 94558 (San Francisco Bay Air Basin)	70	Yes	Railhead onsite	150,000 tons/yr
Lake Herman Quarry 885 Lake Herman Road Vallejo, CA 94591 (San Francisco Bay Air Basin)	70	Yes	15 miles	200,000 tons/yr
San Rafael Rock Quarry 1000 Point San Pedro Road San Rafael, CA 94901 (San Francisco Bay Air Basin)	55	Yes	15 miles	150,000 tons/yr
Bangor Rock Quarry – Site A 5522 LaPorte Road Bangor, CA 92194 (Sacramento Valley Air Basin)	85	Yes	15 miles	300,000 tons/yr

Methodology for Estimating Pollutant Emissions from Hauling Ballast to the Project Site

As the construction schedules of the Merced to Fresno and Fresno to Bakersfield Sections of the California High Speed Train Project overlap, the ballast material hauling analysis took into account the requirements for both sections to ensure realistic emission estimates. Five scenarios were developed for hauling ballast materials from quarries listed in Table 1 to the boundary of SJVAB to develop a range of emission estimates (the actual hauling scenario during construction is uncertain). The scenarios represent a range of combinations of supply from the different quarries and different methods of hauling (either by truck to the nearest railhead and railway the remainder of the distance, or by truck the entire distance). The scenarios include the following:

- Scenario 1: All Ballast Hauled from Kaiser Eagle Mountain Quarry by Rail Only – Haul all of the ballast material, for both sites, via rail from the Kaiser Eagle Mountain Quarry (the longest hauling distance).
- Scenario 2: Ballast from Quarries Nearest to the Project by Truck and Rail and Balance from Kaiser Eagle Mountain Quarry by Truck and Rail - Haul all of the ballast material from the quarries closest to the project site (Napa Quarry, Lake Herman Quarry, and San Rafael Rock Quarry) via truck to the nearest railhead, then by railway the remainder of the distance and the balance from Bangor Rock Quarry by truck and rail.
- Scenario 3: Ballast from Quarries Nearest to the Project by Truck and Rail and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry - Haul the maximum amount of ballast available from the quarries closest to the project site (Napa Quarry, Lake Herman Quarry, and San Rafael Rock Quarry), the maximum amount from Bangor Rock Quarry – Site A (which is closer than Kaiser Eagle Mountain Quarry) up to ballast production limits; and then the balance from Kaiser Eagle Mountain Quarry. Haul ballast by truck to the nearest railhead, then by rail the remainder of the distance.
- Scenario 4: Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only – Haul the maximum amount of ballast from the quarries closest to the project site (Napa Quarry, Lake Herman Quarry, and San Rafael Rock Quarry), and obtain the balance of material needed from Bangor Rock Quarry – Site A (closer than Kaiser Eagle Mountain Quarry) and Kaiser Eagle Mountain Quarry, transported by truck for the entire distance.
- Scenario 5: – Maximum Ballast from Quarries Nearest Project and Balance from Kaiser Eagle Mountain Quarry by Truck Only - Haul the maximum amount of ballast up to emission threshold limits from the quarries closest to the project site (Napa Quarry, Lake Herman Quarry, and San Rafael Rock Quarry), and obtain the balance of material needed from Kaiser Eagle Mountain Quarry transported by truck the entire distance.

For each scenario, emissions were calculated using year 2014 emission factors. Year 2014 would

be the first year that ballast is required for the project, and emission factors for that year are the most conservative within the project schedule because they are expected to decrease each year as vehicle technology improves. Table 2 provides the emission factors used in the analysis. For unmitigated truck emissions, emission factors were based on a fleet composed of the last 45 model years (1969-2014). Mitigated haul truck emission factors are for a fleet composed of model year 2010 and newer trucks.

TABLE 2
Ballast Hauling Emission Factors

Emission Source	Emission Factors						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2
Unmitigated Haul Trucks (grams/mile)[a]	2.76	7.89	0.313	0.34	0.015	0.423	1561
Mitigated Haul Trucks (grams/mile)[a]	1.02	1.18	0.063	0.068	0.015	0.096	1600
Large Haul Rail (grams/ton-mile)[b]	0.055	0.28	0.0072	0.0074	0.0002	0.013	21.1

[a] Truck emission factors were developed using the EMFAC2007 emissions model and statewide average emission factors.
[b] Railway emission factors were developed using the *Emission Factors for Locomotives* (EPA 2009)

Notes:
CO = carbon monoxide
NO_x = nitrogen oxide
$PM_{2.5}$ = particulate matter less than 2.5 micrometers in aerodynamic diameter
PM_{10} = particulate matter less than 10 micrometers in aerodynamic diameter
SO_2 = sulfur dioxide
VOC = volatile organic compound

For each scenario, emissions were calculated by multiplying the emission factor by the distance traveled and the amount of material hauled per trip for each hauling method. The following pollutant emissions were calculated: CO, NOx, $PM_{2.5}$, PM_{10}, SO_2, and VOC. Greenhouse gas (GHG) emissions were also estimated. Emissions were calculated separately for each federal nonattainment or maintenance area through which the materials would be hauled (reference Attachment A). The results were compared to the General Conformity (GC) de minimis values to determine if an exceedance would occur. Emissions were also calculated for each air quality management district (AQMD) that the material was hauled through and compared to daily and annual CEQA significance threshold values for each of the air districts (reference Attachment B). Although the quantity of ballast material being considered was the combined amounts from both sections to ensure plausible scenarios, the emissions for each section were calculated by proportioning out the total air emissions based on the material requirements for each section.

For each scenario, the maximum material hauled in one year was used to estimate the annual emissions. The daily emissions calculations were estimated by assuming that the annual material requirements would be hauled by trucks that would operate 260 days per year and trains that would run twice weekly from each of the railheads to the SJVAB.

Estimated Pollutant Emissions from Hauling Ballast to the Project Site

Tables 3 shows the amounts of material hauled from the quarries for each scenario in cubic yards (cy) per year. For daily emissions calculations, it was assumed trucks would operate 260 days per year and that trains would run twice weekly from each of the railheads to the SJVAB.

TABLE 3

Amount of Material Hauled from Each Quarry Under Scenarios 1-5

Scenario / Quarry Name	1 (cy/yr)	2 (cy/yr)	3 (cy/yr)	4 (cy/yr)	5 (cy/yr)
Kaiser Eagle Mountain Quarry	491,219	253,124	110,267	110,267	253,124
Napa Quarry	0	71,429	71,429	71,429	71,429
Lake Herman Quarry	0	95,238	95,238	95,238	95,238
San Rafael Rock Quarry	0	71,429	71,429	71,429	71,429
Bangor Rock Quarry – Site A	0	0	142,857	142,857	0

Tables C-1 through C-10 (reference Attachment C) show the estimated unmitigated emissions for the five scenarios relative to the GC de minimis thresholds for the air basins traversed. Tables D-1 through D-20 (reference Attachment D) show the estimated unmitigated emissions relative to CEQA significance thresholds for the AQMDs traversed. Tables E-1 through E-8 (reference Attachment E) show estimated mitigated emissions for scenarios 2 through 5 relative to GC de minimis thresholds for the air basins traversed. Tables F-1 through F-16 (reference Attachment F) show the estimated mitigated emissions for scenarios 2 through 5 relative to CEQA significance thresholds for the AQMDs traversed. Scenario 1 did not change under the mitigated scenario since tall the material was transported by rail. Please note that a particular air basin could be under the jurisdiction of more than one AQMD.

Scenarios one and five both exceed GC de minimis thresholds for NOx for both the Merced to Fresno and Fresno to Bakersfield sections in the South Coast Air Basin. Scenario one, for the Fresno to Bakersfield section, also exceeds GC de minimis thresholds for NOx in the Salton Sea Air Basin. No other pollutants for any scenarios exceed their respective GC de minimis threshold. With a mitigation measure to use a fleet of model year 2010 and newer trucks, Scenario 5 no longer exceed any de minimis thresholds in any air basin for either section.

Annual CEQA emission threshold limits would not be exceeded by any of the scenarios for either section. Daily CEQA thresholds for NO_X would be exceeded under Scenario 1 in the South Coast AQMD for both sections, and the Fresno to Bakersfield section would also exceed daily CEQA threshold limits for Mojave Desert and East Kern AQMDs. Emissions from Scenarios 2 and 3 would exceed the daily CEQA threshold limits for NO_X in the Bay Area and South Coast AQMDs for both sections. Emissions from Scenarios 4 would not exceed any daily CEQA limits for the Merced to Fresno section, but would exceed daily CEQA threshold limits for NO_X in the Bay Area Air Basin for the Fresno to Bakersfield section. Scenario 5 would exceed daily CEQA threshold limits for NO_X in the South Coast AQMD for both sections, and the Fresno to Bakersfield section would also exceed daily CEQA threshold limits for NO_X in the Bay Area Air

Basin. With the proposed mitigation for haul trucks, Scenarios 4 and 5 would no longer exceed any daily CEQA threshold limits for both sections.

GHG emissions (in units of CO_2e) from ballast hauling range were calculated by assuming methane and nitrogen dioxide impacts were 5% of the total CO_2 impacts. Total CO_2e impacts ranged from 3,665 to 12,355 metric tons annually, depending on the chosen scenario. The total statewide emissions in 2008 of CO_2e was 477,740,000 metric tons. Material hauling for this project will have a negligible impact (less than 0.1%) on statewide greenhouse gas emissions.

Conclusion

According to this analysis, sufficient ballast material of the type needed for the project is available from quarries within the state of California. General Conformity de minimis pollutant thresholds in nonattainment areas for NO_X would be exceeded in some air basin for scenarios 1 and 5 without mitigation. With mitigation, scenario 5 no longer exceed GC de minimis threshold limits for any pollutant for either section. Annual CEQA threshold limits would not be exceeded for either section in any scenario. Daily CEQA NO_X thresholds would be exceeded for certain AQMDs for every scenario for both sections without mitigation, except scenario 4 for the Merced to Fresno section. With mitigation, Scenarios 4 and 5 would no longer exceed daily CEQA NO_X thresholds for either section. Additionally, material hauling for this project will have a negligible impact on statewide greenhouse gas emissions.

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Attachment A
Air Basins and Nonattainment/Maintenance Areas

TABLE A-1
Air Basins and Nonattainment/Maintenance Areas

Nonattainment/Maintenance Area	Pollutant(s)
Mojave Desert Air Basin	
East Kern County	8-hour ozone, PM_{10}
Western San Bernardino/Los Angeles County	8-hour ozone, PM_{10}
Sacramento Valley Air Basin	
Chico, Butte County	8-hour ozone, $PM_{2.5}$ (2006)
Sacramento Metropolitan Area	8-hour ozone, PM_{10}, $PM_{2.5}$ (2006)
Yuba City	8-hour ozone, $PM_{2.5}$ (2006)
Salton Sea Air Basin	
Coachella Valley, Riverside County	8-hour ozone, PM_{10}
San Francisco Bay Air Basin	
Bay Area	8-hour ozone, $PM_{2.5}$ (2006)
South Coast Air Basin	
Los Angeles County	8-hour ozone, PM_{10}, $PM_{2.5}$ (2006)

Notes:

$PM_{2.5}$ = particulate matter less than 2.5 micrometers in aerodynamic diameter

PM_{10} = particulate matter less than 10 micrometers in aerodynamic diameter

Attachment B
Air Quality Management Districts and CEQA Thresholds

TABLE B-1

Air Quality Management Districts and CEQA Thresholds

	Daily CEQA Thresholds (lb/day)						Annual CEQ Thresholds (tpy)					
	VOC	**CO**	**NOx**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**	**VOC**	**CO**	**NOx**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Antelope Valley AQMD	137	548	137	137	82	82	25	100	25	25	15	15
Bay Area AQMD	54	-	54	-	82	54	-	-	-	-	-	-
Butte County AQMD	25	-	-	-	80	-	-	-	-	-	-	-
Kern Country APCD	137	-	137	-	-	-	-	-	-	-	-	-
Feather River AQMD	-	-	-	-	80	-	4.5	-	4.5	-	-	-
Mojave Desert AQMD	137	548	137	137	82	82	25	100	25	25	15	15
Sac Metro AQMD	65	-	85	-	-	-	-	-	-	-	-	-
South Coast AQMD	75	550	100	150	150	55	-	-	-	-	-	-

Notes:

– = no CEQA annual threshold for this pollutant in the AQMD

$PM_{2.5}$ = particulate matter less than 2.5 micrometers in aerodynamic diameter

PM_{10} = particulate matter less than 10 micrometers in aerodynamic diameter

tpy = tons per year

Attachment C
Emission Calculations for Scenarios Compared to GC de minimis Thresholds

TABLE C-1
Emissions for Scenario 1 - All Ballast from Kaiser Eagle Mountain Quarry by Rail (Merced to Fresno Section), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Riverside County (Salton Sea)	3.55	18.0	0.47	0.48	0.01	0.81	1,236
General Conformity de Minimis	100	25	–	70	–	25	–
Western San Bernardino/Los Angeles County (Mojave Desert)	1.33	6.72	0.17	0.18	0.00	0.30	461
East Kern County (Mojave Desert)	1.38	6.97	0.18	0.19	0.00	0.32	479
Total Mojave Desert Air Basin	2.70	13.6	0.35	0.37	0.01	0.62	940
General Conformity de Minimis	100	100	–	100	–	50	-
Los Angeles County (South Coast)	2.50	***12.7***	0.33	0.34	0.01	0.57	871
General Conformity de Minimis	100	***10***	100	70	100	10	-

Notes:
– = no de minimis threshold for this pollutant in the air basin

TABLE C-2
Emissions for Scenario 2 –Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Merced to Fresno), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	1.10	4.89	0.14	0.14	0.00	0.23	432
General Conformity de Minimis	100	100	100	–	100	50	–
Riverside County (Salton Sea)	1.83	9.28	0.24	0.25	0.01	0.42	637
General Conformity de Minimis	100	25	–	70	–	25	-
Western San Bernardino/Los Angeles County (Mojave Desert)	0.68	3.46	0.09	0.09	0.00	0.16	238
East Kern County (Mojave Desert)	2.27	11.5	0.30	0.31	0.01	0.52	247
Total Mojave Desert Air Basin	1.39	7.06	0.18	0.19	0.01	0.32	484
General Conformity de Minimis	100	100	–	70	–	50	-
Los Angeles County (South Coast)	1.29	6.53	0.17	0.17	0.00	0.30	449
General Conformity de Minimis	100	10	100	70	100	10	-

Notes:
– = no de minimis threshold for this pollutant in the air basin

TABLE C-3
Emissions for Scenario 3 - Ballast from a Mixture of Quarries by Truck and Rail (Merced to Fresno Section), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	1.10	4.89	0.14	0.14	0.00	0.23	432
General Conformity de Minimis	100	100	100	–	100	50	-
Chico, CA (Sacramento Valley)	0.33	1.11	0.04	0.04	0.00	0.06	159
Yuba City (Sacramento Valley)	0.30	1.51	0.04	0.04	0.00	0.07	104
Sacramento Metropolitan Area (Sacramento Valley)	0.25	1.25	0.03	0.03	0.00	0.06	86
Total Sacramento Valley Air Basin	0.88	3.88	0.11	0.12	0.00	0.18	349
General Conformity de Minimis	100	25	100	100	100	25	-
Riverside County (Salton Sea)	0.80	4.04	0.11	0.11	0.00	0.18	277
General Conformity de Minimis	100	25	–	70	–	25	-
Western San Bernardino/Los Angeles County (Mojave Desert)	0.30	1.51	0.04	0.04	0.00	0.07	104
East Kern County (Mojave Desert)	0.31	1.57	0.04	0.04	0.00	0.07	107
Total Mojave Desert Air Basin	0.61	3.07	0.08	0.08	0.00	0.14	211
General Conformity de Minimis	100	100	–	100	–	50	-
Los Angeles County (South Coast)	0.56	2.85	0.07	0.08	0.00	0.13	195
General Conformity de Minimis	100	10	100	70	100	10	-

Note:
– = no de minimis threshold for this pollutant in the air basin

TABLE C-4
Emissions for Scenario 4 - Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Merced to Fresno Section) , Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	1.87	5.34	0.21	0.23	0.01	0.29	958
General Conformity de Minimis	100	100	100	–	100	50	-
Riverside County (Salton Sea)	1.57	4.49	0.18	0.19	0.01	0.24	805
General Conformity de Minimis	100	25	–	70	–	25	-
Los Angeles County (South Coast)	1.81	5.18	0.21	0.22	0.01	0.28	929
General Conformity de Minimis	100	10	100	70	100	10	-
Chico, Butte County (Sacramento Valley)	0.32	0.92	0.04	0.04	0.00	0.05	165
Sacramento Metropolitan Area (Sacramento Valley)	0.61	1.74	0.07	0.07	0.00	0.09	312
Yuba City (Sacramento Valley)	0.73	2.09	0.08	0.09	0.00	0.11	374
Total Sacramento Valley Air Basin	1.66	4.74	0.19	0.20	0.01	0.25	851
General Conformity de Minimis	100	25.0	100	100	100	25	-

Note:
– = no de minimis threshold for this pollutant in the air basin

TABLE C-5
Emissions for Scenario 5 - Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only (Merced to Fresno Section) , Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	1.87	5.34	0.21	0.23	0.01	0.29	958
General Conformity de Minimis	100	100	100	–	100	50	-
Riverside County (Salton Sea)	3.61	10.30	0.41	0.44	0.02	0.55	1,848
General Conformity de Minimis	100	25	–	70	–	25	-
Los Angeles County (South Coast)	4.16	***11.88***	0.47	0.50	0.02	0.64	2,133
General Conformity de Minimis	100	***10***	100	70	100	10	-

Note:
– = no de minimis threshold for this pollutant in the Air Basin

TABLE C-6
Emissions for Scenario 1 - All Ballast from Kaiser Eagle Mountain Quarry by Rail (Fresno to Bakersfield Section), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Riverside County (Salton Sea)	5.33	***27.0***	0.70	0.72	0.02	1.22	1,856
General Conformity de Minimis	100	***25***	–	70	–	25	–
Western San Bernardino/Los Angeles County (Mojave Desert)	1.99	10.1	0.26	0.27	0.01	0.46	693
East Kern County (Mojave Desert)	2.06	10.5	0.27	0.28	0.01	0.47	719
Total Mojave Desert Air Basin	4.05	20.6	0.53	0.55	0.01	0.93	1,412
General Conformity de Minimis	100	100	–	100	–	50	-
Los Angeles County (South Coast)	3.75	***19.0***	0.49	0.51	0.01	0.86	1,307
General Conformity de Minimis	100	***10***	100	70	100	10	-

Notes:
– = no de minimis threshold for this pollutant in the air basin

TABLE C-7
Emissions for Scenario 2 –Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Fresno to Bakersfield), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	1.65	7.35	0.21	0.22	0.01	0.34	649
General Conformity de Minimis	100	100	100	–	100	50	–
Riverside County (Salton Sea)	2.75	13.93	0.36	0.37	0.01	0.63	956
General Conformity de Minimis	100	25	–	70	–	25	-
Western San Bernardino/Los Angeles County (Mojave Desert)	1.03	5.20	0.13	0.14	0.00	0.23	357
East Kern County (Mojave Desert)	1.06	5.40	0.14	0.14	0.00	0.24	370
Total Mojave Desert Air Basin	2.09	10.59	0.27	0.28	0.01	0.48	727
General Conformity de Minimis	100	100	–	70	–	50	-
Los Angeles County (South Coast)	1.93	9.81	0.25	0.26	0.01	0.44	674
General Conformity de Minimis	100	10	100	70	100	10	-

Notes:
– = no de minimis threshold for this pollutant in the air basin

TABLE C-8
Emissions for Scenario 3 - Ballast from a Mixture of Quarries by Truck and Rail (Fresno to Bakersfield Section), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	1.65	7.35	0.21	0.22	0.01	0.34	649
General Conformity de Minimis	100	100	100	–	100	50	-
Chico, CA (Sacramento Valley)	0.50	1.67	0.06	0.06	0.00	0.08	239
Yuba City (Sacramento Valley)	0.45	2.27	0.06	0.06	0.00	0.10	156
Sacramento Metropolitan Area (Sacramento Valley)	0.37	1.88	0.05	0.05	0.00	0.09	129
Total Sacramento Valley Air Basin	1.32	5.82	0.17	0.17	0.01	0.27	524
General Conformity de Minimis	100	25	100	100	100	25	-
Riverside County (Salton Sea)	1.20	6.07	0.16	0.16	0.00	0.27	417
General Conformity de Minimis	100	25	–	70	–	25	-
Western San Bernardino/Los Angeles County (Mojave Desert)	0.45	2.26	0.06	0.06	0.00	0.10	156
East Kern County (Mojave Desert)	0.46	2.35	0.06	0.06	0.00	0.11	161
Total Mojave Desert Air Basin	0.91	4.62	0.12	0.12	0.00	0.21	317
General Conformity de Minimis	100	100	–	100	–	50	-
Los Angeles County (South Coast)	0.84	4.27	0.11	0.11	0.00	0.19	293
General Conformity de Minimis	100	10	100	70	100	10	-

Note:
– = no de minimis threshold for this pollutant in the air basin

TABLE C-9
Emissions for Scenario 4 - Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section) , Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	2.81	8.02	0.32	0.34	0.02	0.43	1,439
General Conformity de Minimis	100	100	100	–	100	50	-
Riverside County (Salton Sea)	2.36	6.73	0.27	0.29	0.01	0.36	1,209
General Conformity de Minimis	100	25	–	70	–	25	-
Los Angeles County (South Coast)	2.72	7.77	0.31	0.33	0.01	0.42	1,395
General Conformity de Minimis	100	10	100	70	100	10	-
Chico, Butte County (Sacramento Valley)	0.48	1.38	0.05	0.06	0.00	0.07	248
Sacramento Metropolitan Area (Sacramento Valley)	0.91	2.61	0.10	0.11	0.00	0.14	469
Yuba City (Sacramento Valley)	1.10	3.13	0.12	0.13	0.01	0.17	562
Total Sacramento Valley Air Basin	2.49	7.12	0.28	0.30	0.01	0.38	1,278
General Conformity de Minimis	100	25.0	100	100	100	25	-

Note:
– = no de minimis threshold for this pollutant in the air basin

TABLE C-10
Emissions for Scenario 5 - Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section) , Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	2.81	8.02	0.32	0.34	0.02	0.43	1,439
General Conformity de Minimis	100	100	100	–	100	50	-
Riverside County (Salton Sea)	5.42	15.46	0.61	0.66	0.03	0.83	2,775
General Conformity de Minimis	100	25	–	70	–	25	-
Los Angeles County (South Coast)	6.25	***17.84***	0.71	0.76	0.03	0.96	3,202
General Conformity de Minimis	100	***10***	100	70	100	10	-

Note:
– = no de minimis threshold for this pollutant in the Air Basin

Attachment D
Emission Calculations for Scenarios Compared to CEQA Thresholds

TABLE D-1

Emissions for Scenario 1 - All Ballast from Kaiser Eagle Mountain Quarry by Rail (Merced to Fresno Section), Comparison to CEQA Annual Thresholds

	Emissions (tons per year) Merced to Fresno						
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**	**CO_2 (Metric Tons)**
San Bernardino/Los Angeles County (Mojave Desert AQMD)	1.33	6.72	0.17	0.18	0.00	0.30	461
CEQA Annual Threshold Limits	100	25	15	15	25	25	-
Los Angeles County/Riverside County (South Coast AQMD)	6.05	30.68	0.79	0.82	0.02	1.39	2,107
CEQA Annual Threshold Limits	–	–	–	–	–	–	-
East Kern County APCD	1.38	6.97	0.18	0.19	0.00	0.32	479
CEQA Annual Threshold Limits	–	–	–	–	–	–	-

Notes:
– = no CEQA annual threshold for this pollutant in the AQMD

TABLE D-2
Emissions for Scenario 2 –Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Merced to Fresno Section), Comparison to CEQA Annual Thresholds

	Emissions (tons per year) Merced to Fresno						
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**	**CO_2 (Metric Tons)**
Bay Area AQMD	1.10	4.89	0.14	0.14	0.00	0.23	432
CEQA Annual Threshold Limits	–	–	–	–	–	–	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	0.68	3.46	0.09	0.09	0.00	0.16	238
CEQA Annual Threshold Limits	100	25	15	15	25	25	-
Los Angeles County/Riverside County (South Coast AQMD)	3.12	15.81	0.41	0.42	0.01	0.71	1,086
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
East Kern County APCD	0.71	3.59	0.09	0.10	0.00	0.16	247
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Notes:
– = no CEQA annual threshold for this pollutant in the AQMD

TABLE D-3
Emissions for Scenario 3 - Ballast from a Mixture of Quarries by Truck and Rail (Merced to Fresno Section), Comparison to CEQA Annual Thresholds

	Emissions (tons per year) Merced to Fresno						
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**	**CO_2 (Metric Tons)**
Bay Area AQMD	1.10	4.89	0.14	0.14	0.00	0.23	432
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Butte County AQMD	0.33	1.11	0.04	0.04	0.00	0.06	159
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Sacramento Metropolitan Area AQMD	0.25	1.25	0.03	0.03	0.00	0.06	86
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Feather River AQMD	0.30	1.51	0.04	0.04	0.00	0.07	104
CEQA Annual Threshold Limits	-	4.5	-	-	-	4.5	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	0.30	1.51	0.04	0.04	0.00	0.07	104
CEQA Annual Threshold Limits	100	25	15	15	25	25	-
Los Angeles County/Riverside County (South Coast AQMD)	1.36	6.89	0.18	0.18	0.00	0.31	473
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
East Kern County APCD	0.31	1.57	0.04	0.04	0.00	0.07	107
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Note:
– = no CEQA annual threshold for this pollutant in the AQMD

TABLE D-4
Emissions for Scenario 4 - Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Merced to Fresno Section), Comparison to CEQA Annual Thresholds

	Emissions (tons per year) Merced to Fresno						
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**	**CO_2 (Metric Tons)**
Bay Area AQMD	1.87	5.34	0.21	0.23	0.01	0.29	958
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Los Angeles County/Riverside County (South Coast AQMD)	3.38	9.66	0.38	0.41	0.02	0.52	1,734
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Butte County AQMD	0.32	0.92	0.04	0.04	0.00	0.05	165
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Sacramento Metropolitan Area AQMD	0.61	1.74	0.07	0.07	0.00	0.09	312
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Feather River AQMD	0.73	2.09	0.08	0.09	0.00	0.11	374
CEQA Annual Threshold Limits	-	4.5	-	-	-	4.5	-

Note:
– = no CEQA annual threshold for this pollutant in the AQMD

TABLE D-5
Emissions for Scenario 5 - Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only (Merced to Fresno Section), Comparison to CEQA Annual Thresholds

	Emissions (tons per year) Merced to Fresno						
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**	**CO_2 (Metric Tons)**
Bay Area AQMD	1.87	5.34	0.21	0.23	0.01	0.29	958
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Los Angeles County/Riverside County (South Coast AQMD)	7.77	22.18	0.88	0.94	0.04	1.19	3,981
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Note:
– = no CEQA annual threshold for this pollutant in the AQMD

TABLE D-6
Emissions for Scenario 1 - All Ballast from Kaiser Eagle Mountain Quarry by Rail (Fresno to Bakersfield Section), Comparison to CEQA Annual Thresholds

	Emissions (tons per year) Fresno to Bakersfield						
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**	**CO_2 (Metric Tons)**
San Bernardino/Los Angeles County (Mojave Desert AQMD)	1.99	10.09	0.26	0.27	0.01	0.46	693
CEQA Annual Threshold Limits	100	25	15	15	25	25	-
Los Angeles County/Riverside County (South Coast AQMD)	9.09	46.07	1.19	1.23	0.03	0.86	3,163
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
East Kern County APCD	2.06	10.47	0.27	0.28	0.01	0.47	719
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Notes:
– = no CEQA annual threshold for this pollutant in the AQMD

TABLE D-7
Emissions for Scenario 2 –Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Fresno to Bakersfield Section), Comparison to CEQA Annual Thresholds

	Emissions (tons per year) Fresno to Bakersfield						
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**	**CO_2 (Metric Tons)**
Bay Area AQMD	1.65	7.35	0.21	0.22	0.01	0.34	649
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	1.03	5.20	0.13	0.14	0.00	0.23	357
CEQA Annual Threshold Limits	100	25	15	15	25	25	-
Los Angeles County/Riverside County (South Coast AQMD)	3.76	19.09	0.49	0.51	0.01	0.86	674
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
East Kern County APCD	1.06	5.40	0.14	0.14	0.00	0.24	370
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Notes:
– = no CEQA annual threshold for this pollutant in the AQMD

TABLE D-8
Emissions for Scenario 3 - Ballast from a Mixture of Quarries by Truck and Rail ((Fresno to Bakersfield Section), Comparison to CEQA Annual Thresholds

	Emissions (tons per year) Fresno to Bakersfield						
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**	**CO_2 (Metric Tons)**
Bay Area AQMD	1.65	7.35	0.21	0.22	0.01	0.34	649
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Butte County AQMD	0.50	1.67	0.06	0.06	0.00	0.08	239
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Sacramento Metropolitan Area AQMD	0.37	1.88	0.05	0.05	0.00	0.09	129
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Feather River AQMD	0.45	2.27	0.06	0.06	0.00	0.10	156
CEQA Annual Threshold Limits	-	4.5	-	-	-	4.5	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	0.45	2.26	0.06	0.06	0.00	0.10	156
CEQA Annual Threshold Limits	100	25	15	15	25	25	-
Los Angeles County/Riverside County (South Coast AQMD)	2.04	10.34	0.27	0.28	0.01	0.47	293
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
East Kern County APCD	0.46	2.35	0.06	0.06	0.00	0.11	161
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Note:
– = no CEQA annual threshold for this pollutant in the AQMD

TABLE D-9
Emissions for Scenario 4 - Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section), Comparison to CEQA Annual Thresholds

	Emissions (tons per year) Fresno to Bakersfield						
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**	**CO_2 (Metric Tons)**
Bay Area AQMD	2.81	8.02	0.32	0.34	0.02	0.43	1,439
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Butte County AQMD	0.48	1.38	0.05	0.06	0.00	0.07	248
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Sacramento Metropolitan Area AQMD	0.91	2.61	0.10	0.11	0.00	0.14	469
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Feather River AQMD	1.10	3.13	0.12	0.13	0.01	0.17	562
CEQA Annual Threshold Limits	-	4.5	-	-	-	4.5	-
Los Angeles County/Riverside County (South Coast AQMD)	4.29	12.26	0.49	0.52	0.02	0.66	1,395
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Note:
– = no CEQA annual threshold for this pollutant in the AQMD

TABLE D-10
Emissions for Scenario 5 - Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section), Comparison to CEQA Annual Thresholds

	Emissions (tons per year) Fresno to Bakersfield						
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**	**CO_2 (Metric Tons)**
Bay Area AQMD	2.81	8.02	0.32	0.34	0.02	0.43	1,439
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Los Angeles County/Riverside County (South Coast AQMD)	9.86	28.14	1.12	1.19	0.05	1.51	3,202
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Note:
– = no CEQA annual threshold for this pollutant in the AQMD

TABLE D-11
Emissions for Scenario 1 - All Ballast from Kaiser Eagle Mountain Quarry by Rail (Merced to Fresno Section), Comparison to Daily CEQA Daily Thresholds

	Emissions (pounds per day) Merced to Fresno					
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
San Bernardino/Los Angeles County (Mojave Desert AQMD)	25.49	129.23	3.34	3.45	0.09	5.84
CEQA Daily Threshold Limits	548	137	82	82	137	137
Los Angeles County/Riverside County (South Coast AQMD)	116.37	***590.07***	15.26	15.74	0.42	26.66
CEQA Daily Threshold Limits	550	***100***	55	150	150	75
East Kern County APCD	26.45	134.11	3.47	3.58	0.10	6.06
CEQA Daily Threshold Limits	-	137	-	-	-	137

Notes:
– = no CEQA daily threshold for this pollutant in the AQMD

TABLE D-12
Emissions for Scenario 2 –Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Merced to Fresno Section), Comparison to CEQA Daily Thresholds

	Emissions (pounds per day) Merced to Fresno					
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Bay Area AQMD	17.61	***84.10***	2.27	2.35	0.07	3.86
CEQA Daily Threshold Limits	-	***54***	54	82	-	54
San Bernardino/Los Angeles County (Mojave Desert AQMD)	13.13	66.59	1.78	1.72	0.05	3.01
CEQA Daily Threshold Limits	548	137	82	82	137	137
Los Angeles County/Riverside County (South Coast AQMD)	59.97	***304.06***	8.11	7.87	0.22	13.74
CEQA Daily Threshold Limits	550	***100***	55	150	150	75
East Kern County APCD	13.63	69.10	1.84	1.79	0.05	3.12
CEQA Daily Threshold Limits	-	137	-	-	-	137

Notes:
– = no CEQA daily threshold for this pollutant in the AQMD

TABLE D-13
Emissions for Scenario 3 - Ballast from a Mixture of Quarries by Truck and Rail (Merced to Fresno Section), Comparison to CEQA Daily Thresholds

	Emissions (pounds per day) Merced to Fresno					
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Bay Area AQMD	17.61	***84.10***	2.27	2.35	0.07	3.86
CEQA Daily Threshold Limits	-	***54***	54	82	-	54
Butte County AQMD	3.41	12.82	0.41	0.43	0.02	0.63
CEQA Daily Threshold Limits	-	-	-	80	-	25
Sacramento Metropolitan Area AQMD	4.75	24.11	0.62	0.64	0.02	1.09
CEQA Daily Threshold Limits	-	85	-	-	-	65
Feather River AQMD	5.73	29.07	0.75	0.78	0.02	1.31
CEQA Daily Threshold Limits	-	-	-	80	-	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	5.72	29.01	0.75	0.77	0.02	1.31
CEQA Daily Threshold Limits	548	137	82	82	137	137
Los Angeles County/Riverside County (South Coast AQMD)	26.12	***132.46***	3.43	3.53	0.09	5.99
CEQA Daily Threshold Limits	550	***100***	55	150	150	75
East Kern County APCD	5.94	30.10	0.78	0.80	0.02	1.36
CEQA Daily Threshold Limits	-	137	-	-	-	137

Note:
– = no CEQA daily threshold for this pollutant in the AQMD

TABLE D-14
Emissions for Scenario 4 - Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Merced to Fresno Section), Comparison to CEQA Daily Thresholds

Air Quality Management District (AQMD)	Emissions (pounds per day) Merced to Fresno					
	CO	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Bay Area AQMD	14.39	41.07	1.63	1.74	0.08	2.20
CEQA Daily Threshold Limits	-	54	54	82	-	54
Los Angeles County/Riverside County (South Coast AQMD)	26.03	74.32	2.95	3.16	0.14	3.98
CEQA Daily Threshold Limits	550	100	55	150	150	75
Butte County AQMD	2.48	7.07	0.28	0.30	0.01	0.38
CEQA Daily Threshold Limits	-	-	-	80	-	25
Sacramento Metropolitan Area AQMD	4.68	13.37	0.53	0.57	0.03	0.72
CEQA Daily Threshold Limits	-	85	-	-	-	65
Feather River AQMD	5.62	16.05	0.64	0.68	0.03	0.86
CEQA Daily Threshold Limits	-	25	-	80	-	25

Note:
– = no CEQA daily threshold for this pollutant in the AQMD

TABLE D-15
Emissions for Scenario 5 - Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only (Merced to Fresno Section), Comparison to CEQA Daily Thresholds

Air Quality Management District (AQMD)	Emissions (pounds per day) Merced to Fresno					
	CO	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Bay Area AQMD	14.39	41.07	1.63	1.74	0.08	2.20
CEQA Daily Threshold Limits	-	54	54	82	-	54
Los Angeles County/Riverside County (South Coast AQMD)	59.76	***170.60***	6.77	7.24	0.32	9.15
CEQA Daily Threshold Limits	550	***100***	55	150	150	75

Note:
– = no CEQA daily threshold for this pollutant in the AQMD

TABLE D-16
Emissions for Scenario 1 - All Ballast from Kaiser Eagle Mountain Quarry by Rail (Fresno to Bakersfield Section), Comparison to CEQA Daily Thresholds

	Emissions (pounds per day) Fresno to Bakersfield					
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
San Bernardino/Los Angeles County (Mojave Desert AQMD)	38.27	***194.03***	5.02	5.17	0.14	8.77
CEQA Daily Threshold Limits	548	***137***	82	82	137	137
Los Angeles County/Riverside County (South Coast AQMD)	174.72	***885.95***	22.92	23.63	0.63	16.54
CEQA Daily Threshold Limits	550	***100***	55	150	150	75
East Kern County APCD	39.71	***201.35***	5.21	5.37	0.14	9.10
CEQA Daily Threshold Limits	-	***137***	-	-	-	137

Notes: – = no CEQA daily threshold for this pollutant in the AQMD

TABLE D-17
Emissions for Scenario 2 –Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Fresno to Bakersfield Section), Comparison to CEQA Daily Thresholds

	Emissions (pounds per day) Fresno to Bakersfield					
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Bay Area AQMD	26.44	***126.27***	3.40	3.53	0.10	5.79
CEQA Daily Threshold Limits	-	***54***	54	82	-	54
San Bernardino/Los Angeles County (Mojave Desert AQMD)	19.72	99.98	2.59	2.67	0.07	4.52
CEQA Daily Threshold Limits	548	137	82	82	137	137
Los Angeles County/Riverside County (South Coast AQMD)	72.39	***367.06***	9.49	9.79	0.26	16.59
CEQA Daily Threshold Limits	550	***100***	55	150	150	75
East Kern County APCD	20.46	103.76	2.68	2.77	0.07	4.69
CEQA Daily Threshold Limits	-	137	-	-	-	137

Notes:

– = no CEQA daily threshold for this pollutant in the AQMD

TABLE D-18
Emissions for Scenario 3 - Ballast from a Mixture of Quarries by Truck and Rail (Fresno to Bakersfield Section), Comparison to CEQA Daily Thresholds

	Emissions (pounds per day) Fresno to Bakersfield					
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Bay Area AQMD	26.44	***126.27***	3.40	3.53	0.10	5.79
CEQA Daily Threshold Limits	-	***54***	54	82	-	54
Butte County AQMD	5.11	19.25	0.62	0.65	0.02	0.94
CEQA Daily Threshold Limits	-	-	-	80	-	25
Sacramento Metropolitan Area AQMD	7.14	36.20	0.94	0.97	0.03	1.64
CEQA Daily Threshold Limits	-	85	-	-	-	65
Feather River AQMD	8.61	43.65	1.13	1.16	0.03	1.97
CEQA Daily Threshold Limits	-	-	-	80	-	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	8.59	43.55	1.13	1.16	0.03	1.97
CEQA Daily Threshold Limits	548	137	82	82	137	137
Los Angeles County/Riverside County (South Coast AQMD)	39.22	***198.87***	5.14	5.30	0.14	8.99
CEQA Daily Threshold Limits	550	***100***	55	150	150	75
East Kern County APCD	8.91	45.20	1.17	1.21	0.03	2.04
CEQA Daily Threshold Limits	-	137	-	-	-	137

Note:
– = no CEQA daily threshold for this pollutant in the AQMD

TABLE D-19
Emissions for Scenario 4 - Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section), Comparison to CEQA Daily Thresholds

Air Quality Management District (AQMD)	Emissions (pounds per day) Fresno to Bakersfield					
	CO	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Bay Area AQMD	21.60	***61.67***	2.45	2.62	0.12	3.31
CEQA Daily Threshold Limits	-	***54***	54	82	-	54
Los Angeles County/Riverside County (South Coast AQMD)	33	94	4	4	0	5
CEQA Daily Threshold Limits	550	100	55	150	150	75
Butte County AQMD	3.72	10.61	0.42	0.45	0.02	0.57
CEQA Daily Threshold Limits	-	-	-	80	-	25
Sacramento Metropolitan Area AQMD	7.03	20.08	0.80	0.85	0.04	1.08
CEQA Daily Threshold Limits	-	85	-	-	-	65
Feather River AQMD	8.44	24.09	0.96	1.02	0.05	1.29
CEQA Daily Threshold Limits	-	-	-	80	-	-

Note:
– = no CEQA daily threshold for this pollutant in the AQMD

TABLE D-20
Emissions for Scenario 5 - Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section), Comparison to CEQA Thresholds

Air Quality Management District (AQMD)	Emissions (pounds per day) Fresno to Bakersfield					
	CO	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Bay Area AQMD	21.60	***61.67***	2.45	2.62	0.12	3.31
CEQA Daily Threshold Limits	-	***54***	54	82	-	54
Los Angeles County/Riverside County (South Coast AQMD)	75.82	***216.43***	8.59	9.19	0.41	11.60
CEQA Daily Threshold Limits	550	***100***	55	150	150	75

Note:
– = no CEQA daily threshold for this pollutant in the AQMD

Attachment E
Mitigated Emission Calculations for Scenarios Compared to GCR de minimis Thresholds

TABLE E-1
Mitigated Emissions for Scenario 2 –Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Merced to Fresno), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	0.91	4.16	0.11	0.11	0.00	0.19	436
General Conformity de Minimis	100	100	100	–	100	50	–
Riverside County (Salton Sea)	1.83	9.28	0.24	0.25	0.01	0.42	637
General Conformity de Minimis	100	25	–	70	–	25	–
Western San Bernardino/Los Angeles County (Mojave Desert)	0.68	3.46	0.09	0.09	0.00	0.16	238
East Kern County (Mojave Desert)	0.71	3.59	0.09	0.10	0.00	0.16	247
Total Mojave Desert Air Basin	1.39	7.06	0.18	0.19	0.01	0.32	484
General Conformity de Minimis	100	100	–	70	–	50	-
Los Angeles County (South Coast)	1.29	6.53	0.17	0.17	0.00	0.30	449
General Conformity de Minimis	100	10	100	70	100	10	-

Notes:

– = no de minimis threshold for this pollutant in the air basin

TABLE E-2
Mitigated Emissions for Scenario 3 - Ballast from a Mixture of Quarries by Truck and Rail (Merced to Fresno Section), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	0.91	4.16	0.11	0.11	0.00	0.19	436
General Conformity de Minimis	100	100	100	–	100	50	-
Chico, CA (Sacramento Valley)	0.17	0.48	0.02	0.02	0.00	0.03	162
Yuba City (Sacramento Valley)	0.30	1.51	0.04	0.04	0.00	0.07	104
Sacramento Metropolitan Area (Sacramento Valley)	0.25	1.25	0.03	0.03	0.00	0.06	86
Total Sacramento Valley Air Basin	0.71	3.25	0.09	0.09	0.00	0.15	352
General Conformity de Minimis	100	25	100	100	100	25	-
Riverside County (Salton Sea)	0.80	4.04	0.105	0.11	0.00	0.18	277
General Conformity de Minimis	100	25	–	70	–	25	-
Western San Bernardino/Los Angeles County (Mojave Desert)	0.30	1.51	0.04	0.04	0.00	0.07	104
East Kern County (Mojave Desert)	0.31	1.57	0.04	0.04	0.00	0.07	107
Total Mojave Desert Air Basin	0.61	3.07	0.08	0.08	0.00	0.14	211
General Conformity de Minimis	100	100	–	100	–	50	-
Los Angeles County (South Coast)	0.56	2.85	0.07	0.08	0.00	0.13	195
General Conformity de Minimis	100	10	100	70	100	10	-

Note:
– = no de minimis threshold for this pollutant in the air basin

TABLE E-3
Mitigated Emissions for Scenario 4 - Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Merced to Fresno Section) , Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	0.69	0.80	0.04	0.05	0.01	0.06	982
General Conformity de Minimis	100	100	100	–	100	50	-
Riverside County (Salton Sea)	0.58	0.67	0.04	0.04	0.01	0.05	825
General Conformity de Minimis	100	25	–	70	–	25	-
Los Angeles County (South Coast)	0.67	0.78	0.04	0.04	0.01	0.06	952
General Conformity de Minimis	100	10	100	70	100	10	-
Chico, Butte County (Sacramento Valley)	0.12	0.14	0.01	0.01	0.00	0.01	169
Sacramento Metropolitan Area (Sacramento Valley)	0.23	0.26	0.01	0.01	0.00	0.02	320
Yuba City (Sacramento Valley)	0.27	0.31	0.02	0.02	0.00	0.03	384
Total Sacramento Valley Air Basin	0.61	0.71	0.04	0.04	0.01	0.06	873
General Conformity de Minimis	100	25	100	100	100	25	-

Note:
– = no de minimis threshold for this pollutant in the air basin

TABLE E-4
Mitigated Emissions for Scenario 5 - Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only (Merced to Fresno Section) , Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Merced to Fresno						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	0.69	0.80	0.04	0.05	0.01	0.06	982
General Conformity de Minimis	100	100	100	–	100	50	-
Riverside County (Salton Sea)	1.33	1.54	0.08	0.09	0.02	0.13	1,894
General Conformity de Minimis	100	25	–	70	–	25	-
Los Angeles County (South Coast)	1.54	1.78	0.09	0.10	0.02	0.14	2,186
General Conformity de Minimis	100	10	100	70	100	10	-

Note:
– = no de minimis threshold for this pollutant in the Air Basin

TABLE E-5
Mitigated Emissions for Scenario 2 –Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Fresno to Bakersfield), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	1.36	6.24	0.17	0.17	0.01	0.29	655
General Conformity de Minimis	100	100	100	–	100	50	–
Riverside County (Salton Sea)	2.75	13.93	0.36	0.37	0.01	0.63	956
General Conformity de Minimis	100	25	–	70	–	25	-
Western San Bernardino/Los Angeles County (Mojave Desert)	1.03	5.20	0.13	0.14	0.00	0.23	357
East Kern County (Mojave Desert)	1.06	5.40	0.14	0.14	0.00	0.24	370
Total Mojave Desert Air Basin	2.09	10.59	0.27	0.28	0.01	0.48	727
General Conformity de Minimis	100	100	–	70	–	50	-
Los Angeles County (South Coast)	1.93	9.81	0.25	0.26	0.01	0.44	674
General Conformity de Minimis	100	10	100	70	100	10	-

Notes:

– = no de minimis threshold for this pollutant in the air basin

TABLE E-6
Mitigated Emissions for Scenario 3 - Ballast from a Mixture of Quarries by Truck and Rail (Fresno to Bakersfield Section), Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	1.36	6.24	0.17	0.17	0.01	0.29	655
General Conformity de Minimis	100	100	100	–	100	50	-
Chico, CA (Sacramento Valley)	0.25	0.72	0.02	0.02	0.00	0.04	244
Yuba City (Sacramento Valley)	0.45	2.27	0.06	0.06	0.00	0.10	156
Sacramento Metropolitan Area (Sacramento Valley)	0.37	1.88	0.05	0.05	0.00	0.09	129
Total Sacramento Valley Air Basin	1.07	4.87	0.13	0.14	0.01	0.23	529
General Conformity de Minimis	100	25	100	100	100	25	-
Riverside County (Salton Sea)	1.20	6.07	0.16	0.16	0.00	0.27	417
General Conformity de Minimis	100	25	–	70	–	25	-
Western San Bernardino/Los Angeles County (Mojave Desert)	0.45	2.26	0.06	0.06	0.00	0.10	156
East Kern County (Mojave Desert)	0.46	2.35	0.06	0.06	0.00	0.11	161
Total Mojave Desert Air Basin	0.91	4.62	0.12	0.12	0.00	0.21	317
General Conformity de Minimis	100	100	–	100	–	50	-
Los Angeles County (South Coast)	0.84	4.27	0.11	0.11	0.00	0.19	293
General Conformity de Minimis	100	10	100	70	100	10	-

Note:
– = no de minimis threshold for this pollutant in the air basin

TABLE E-7

Mitigated Emissions for Scenario 4 - Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section) , Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	1.04	1.20	0.06	0.07	0.02	0.10	1,475
General Conformity de Minimis	100	100	100	–	100	50	-
Riverside County (Salton Sea)	0.87	1.01	0.05	0.06	0.01	0.08	1,239
General Conformity de Minimis	100	25	–	70	–	25	-
Los Angeles County (South Coast)	1.01	1.16	0.06	0.07	0.01	0.09	1,430
General Conformity de Minimis	100	10	100	70	100	10	-
Chico, Butte County (Sacramento Valley)	0.18	0.21	0.01	0.01	0.00	0.02	254
Sacramento Metropolitan Area (Sacramento Valley)	0.34	0.39	0.02	0.02	0.00	0.03	480
Yuba City (Sacramento Valley)	0.41	0.47	0.03	0.03	0.01	0.04	576
Total Sacramento Valley Air Basin	0.92	1.07	0.06	0.06	0.01	0.09	1,310
General Conformity de Minimis	100	25	100	100	100	25	–

Note:
– = no de minimis threshold for this pollutant in the air basin

TABLE E-8

Mitigated Emissions for Scenario 5 - Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section) , Comparison to GC de Minimis Thresholds

Nonattainment/Maintenance Area (Air Basin)	Emissions (tons per year) Fresno to Bakersfield						
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2 (Metric Tons)
Bay Area (San Francisco Bay)	1.04	1.20	0.06	0.07	0.02	0.10	1,475
General Conformity de Minimis	100	100	100	–	100	50	-
Riverside County (Salton Sea)	2.00	2.32	0.12	0.13	0.03	0.19	2,844
General Conformity de Minimis	100	25	–	70	–	25	-
Los Angeles County (South Coast)	2.31	2.67	0.14	0.15	0.03	0.22	3,282
General Conformity de Minimis	100	10	100	70	100	10	-

Note:
– = no de minimis threshold for this pollutant in the Air Basin

Attachment F
Mitigated Emission Calculations for Scenarios Compared to CEQA Thresholds

TABLE F-1
Mitigated Emissions for Scenario 2 –Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Merced to Fresno Section), Comparison to CEQA Annual Thresholds)

	Emissions (tons per year) Merced to Fresno						
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**	**CO_2 (Metric Tons)**
Bay Area AQMD	0.91	4.16	0.11	0.11	0.00	0.19	436
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	0.68	3.46	0.09	0.09	0.00	0.16	238
CEQA Annual Threshold Limits	100	25	15	15	25	25	-
Los Angeles County/Riverside County (South Coast AQMD)	3.12	15.8	0.41	0.42	0.01	0.71	1,086
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
East Kern County APCD	0.71	3.59	0.09	0.10	0.00	0.16	247
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Notes:

– = no CEQA annual threshold for this pollutant in the AQMD

TABLE F-2
Mitigated Emissions for Scenario 3 - Ballast from a Mixture of Quarries by Truck and Rail (Merced to Fresno Section), Comparison to CEQA Annual Thresholds)

	Emissions (tons per year) Merced to Fresno						
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**	**CO_2 (Metric Tons)**
Bay Area AQMD	0.91	4.16	0.11	0.11	0.00	0.19	436
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Butte County AQMD	0.17	0.48	0.02	0.02	0.00	0.03	162
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Sacramento Metropolitan Area AQMD	0.25	1.25	0.03	0.03	0.00	0.06	86
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Feather River AQMD	0.30	1.51	0.04	0.04	0.00	0.07	104
CEQA Annual Threshold Limits	-	4.5	-	-	-	4.5	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	0.30	1.51	0.04	0.04	0.00	0.07	104
CEQA Annual Threshold Limits	100	25	15	15	25	25	-
Los Angeles County/Riverside County (South Coast AQMD)	1.36	6.89	0.18	0.18	0.00	0.31	473
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
East Kern County APCD	0.31	1.57	0.04	0.04	0.00	0.07	107
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Note:
– = no CEQA annual threshold for this pollutant in the AQMD

TABLE F-3
Mitigated Emissions for Scenario 4 - Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Merced to Fresno Section), Comparison to CEQA Annual Thresholds)

	Emissions (tons per year) Merced to Fresno						
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**	**CO_2 (Metric Tons)**
Bay Area AQMD	0.69	0.80	0.04	0.05	0.01	0.06	982
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Los Angeles County/Riverside County (South Coast AQMD)	1.25	1.45	0.08	0.08	0.02	0.12	1,777
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Butte County AQMD	0.12	0.14	0.01	0.01	0.00	0.01	169
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Sacramento Metropolitan Area AQMD	0.23	0.26	0.01	0.01	0.00	0.02	320
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Feather River AQMD	0.27	0.31	0.02	0.02	0.00	0.03	384
CEQA Annual Threshold Limits	-	4.5	-	-	-	4.5	-

Note:
– = no CEQA annual threshold for this pollutant in the AQMD

TABLE F-4
Mitigated Emissions for Scenario 5 - Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only (Merced to Fresno Section), Comparison to CEQA Annual Thresholds)

	Emissions (tons per year) Merced to Fresno						
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**	**CO_2 (Metric Tons)**
Bay Area AQMD	0.69	0.80	0.04	0.05	0.01	0.06	982
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Los Angeles County/Riverside County (South Coast AQMD)	2.87	3.32	0.18	0.19	0.04	0.27	4,080
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Note:
– = no CEQA annual threshold for this pollutant in the AQMD

TABLE F-5
Mitigated Emissions for Scenario 2 –Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Fresno to Bakersfield Section), Comparison to Annual CEQA Thresholds

	Emissions (tons per year) Fresno to Bakersfield						
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**	**CO_2 (Metric Tons)**
Bay Area AQMD	1.36	6.24	0.17	0.17	0.01	0.29	655
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	1.03	5.20	0.13	0.14	0.00	0.23	357
CEQA Annual Threshold Limits	100	25	15	15	25	25	-
Los Angeles County/Riverside County (South Coast AQMD)	3.76	19.09	0.49	0.51	0.01	0.86	674
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
East Kern County APCD	1.06	5.40	0.14	0.14	0.00	0.24	370
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Notes:

– = no CEQA annual threshold for this pollutant in the AQMD

TABLE F-6
Mitigated Emissions for Scenario 3 - Ballast from a Mixture of Quarries by Truck and Rail (Fresno to Bakersfield Section), Comparison to Annual CEQA Thresholds

	Emissions (tons per year) Fresno to Bakersfield						
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**	**CO_2 (Metric Tons)**
Bay Area AQMD	1.36	6.24	0.17	0.17	0.01	0.29	655
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Butte County AQMD	0.25	0.72	0.02	0.02	0.00	0.04	244
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Sacramento Metropolitan Area AQMD	0.37	1.88	0.05	0.05	0.00	0.09	129
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Feather River AQMD	0.45	2.27	0.06	0.06	0.00	0.10	156
CEQA Annual Threshold Limits	-	4.5	-	-	-	4.5	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	0.45	2.26	0.06	0.06	0.00	0.10	156
CEQA Annual Threshold Limits	100	25	15	15	25	25	-
Los Angeles County/Riverside County (South Coast AQMD)	0.84	4.27	0.11	0.11	0.00	0.19	293
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
East Kern County APCD	0.46	2.35	0.06	0.06	0.00	0.11	161
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Note:
– = no CEQA annual threshold for this pollutant in the AQMD

TABLE F-7
Mitigated Emissions for Scenario 4 - Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section), Comparison to Annual CEQA Thresholds

	Emissions (tons per year) Fresno to Bakersfield						
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**	**CO_2 (Metric Tons)**
Bay Area AQMD	1.04	1.20	0.06	0.07	0.02	0.10	1,475
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Butte County AQMD	0.18	0.21	0.01	0.01	0.00	0.02	254
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Sacramento Metropolitan Area AQMD	0.34	0.39	0.02	0.02	0.00	0.03	480
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Feather River AQMD	0.41	0.47	0.03	0.03	0.01	0.04	576
CEQA Annual Threshold Limits	-	4.5	-	-	-	4.5	-
Los Angeles County/Riverside County (South Coast AQMD)	1.59	1.84	0.10	0.11	0.02	0.15	1,430
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Note:
– = no CEQA annual threshold for this pollutant in the AQMD

TABLE F-8
Mitigated Emissions for Scenario 5 - Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section), Comparison to Annual CEQA Thresholds

	Emissions (tons per year) Fresno to Bakersfield						
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**	**CO_2 (Metric Tons)**
Bay Area AQMD	1.04	1.20	0.06	0.07	0.02	0.10	1,475
CEQA Annual Threshold Limits	-	-	-	-	-	-	-
Los Angeles County/Riverside County (South Coast AQMD)	3.64	4.21	0.22	0.24	0.05	0.34	3,282
CEQA Annual Threshold Limits	-	-	-	-	-	-	-

Note:
– = no CEQA annual threshold for this pollutant in the AQMD

TABLE F-9
Mitigated Emissions for Scenario 2 –Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Merced to Fresno Section), Comparison to CEQA Daily Thresholds)

	Emissions (pounds per day) Merced to Fresno					
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Bay Area AQMD	16.13	***78.41***	2.06	2.12	0.07	3.58
CEQA Daily Threshold Limits	-	***54***	54	82	-	54
San Bernardino/Los Angeles County (Mojave Desert AQMD)	13.13	66.59	1.78	1.72	0.05	3.01
CEQA Daily Threshold Limits	548	137	82	82	137	137
Los Angeles County/Riverside County (South Coast AQMD)	59.97	***304.06***	8.11	7.87	0.22	13.74
CEQA Daily Threshold Limits	550	***100***	55	150	150	75
East Kern County APCD	13.63	69.10	1.84	1.79	0.05	3.12
CEQA Daily Threshold Limits	-	137	-	-	-	137

Notes:

– = no CEQA daily threshold for this pollutant in the AQMD

TABLE F-10
Mitigated Emissions for Scenario 3 - Ballast from a Mixture of Quarries by Truck and Rail (Merced to Section), Comparison to Daily CEQA Thresholds

	Emissions (pounds per day) Merced to Fresno					
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Bay Area AQMD	16.13	***78.41***	2.06	2.12	0.07	3.58
CEQA Daily Threshold Limits	-	***54***	54	82	-	54
Butte County AQMD	2.14	7.95	0.23	0.24	0.02	0.39
CEQA Daily Threshold Limits	-	-	-	80	-	25
Sacramento Metropolitan Area AQMD	4.75	24.11	0.62	0.64	0.02	1.09
CEQA Daily Threshold Limits	-	85	-	-	-	65
Feather River AQMD	5.73	29.07	0.75	0.78	0.02	1.31
CEQA Daily Threshold Limits	-	-	-	80	-	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	5.72	29.01	0.75	0.77	0.02	1.31
CEQA Daily Threshold Limits	548	137	82	82	137	137
Los Angeles County/Riverside County (South Coast AQMD)	26.12	***132.46***	3.43	3.53	0.09	5.99
CEQA Daily Threshold Limits	550	***100***	55	150	150	75
East Kern County APCD	5.94	30.10	0.78	0.80	0.02	1.36
CEQA Daily Threshold Limits	-	137	-	-	-	137

Note:

– = no CEQA daily threshold for this pollutant in the AQMD

TABLE F-11

Mitigated Emissions for Scenario 4 - Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Merced to Section), Comparison to Daily CEQA Thresholds

	Emissions (pounds per day) Merced to Fresno					
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Bay Area AQMD	5.32	6.15	0.33	0.35	0.08	0.50
CEQA Daily Threshold Limits	-	54	54	82	-	54
Los Angeles County/Riverside County (South Coast AQMD)	9.63	11.13	0.59	0.64	0.14	0.90
CEQA Daily Threshold Limits	550	100	55	150	150	75
Butte County AQMD	0.92	1.06	0.06	0.06	0.01	0.09
CEQA Daily Threshold Limits	-	-	-	80	-	25
Sacramento Metropolitan Area AQMD	1.73	2.00	0.11	0.12	0.03	0.16
CEQA Daily Threshold Limits	-	85	-	-	-	65
Feather River AQMD	2.08	2.40	0.13	0.14	0.03	0.20
CEQA Daily Threshold Limits	-	25	-	80	-	25

Note:
– = no CEQA daily threshold for this pollutant in the AQMD

TABLE F-12

Mitigated Emissions for Scenario 5 - Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only

	Emissions (pounds per day) Merced to Fresno					
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Bay Area AQMD	5.32	6.15	0.33	0.35	0.08	0.50
CEQA Daily Threshold Limits	-	54	54	82	-	54
Los Angeles County/Riverside County (South Coast AQMD)	22.10	25.56	1.36	1.47	0.32	2.08
CEQA Daily Threshold Limits	550	100	55	150	150	75

Note:
– = no CEQA daily threshold for this pollutant in the AQMD

TABLE F-13
Mitigated Emissions for Scenario 2 –Ballast from Quarries Nearest Project and Balance From Kaiser Eagle Quarry by Rail and Truck (Fresno to Bakersfield Section), Comparison to Daily CEQA Thresholds

	Emissions (pounds per day) Fresno to Bakersfield					
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Bay Area AQMD	24.22	117.73	3.09	3.19	0.10	5.37
CEQA Daily Threshold Limits	-	54	54	82	-	54
San Bernardino/Los Angeles County (Mojave Desert AQMD)	19.72	99.98	2.59	2.67	0.07	4.52
CEQA Daily Threshold Limits	548	137	82	82	137	137
Los Angeles County/Riverside County (South Coast AQMD)	72.39	367.06	9.49	9.79	0.26	16.59
CEQA Daily Threshold Limits	550	100	55	150	150	75
East Kern County APCD	20.46	103.76	2.68	2.77	0.07	4.69
CEQA Daily Threshold Limits	-	137	-	-	-	137

Notes:

– = no CEQA daily threshold for this pollutant in the AQMD

TABLE F-14
Mitigated Emissions for Scenario 3 - Ballast from a Mixture of Quarries by Truck and Rail (Fresno to Bakersfield Section), Comparison to Daily CEQA Thresholds

	Emissions (pounds per day) Fresno to Bakersfield					
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Bay Area AQMD	24.22	***117.73***	3.09	3.19	0.10	5.37
CEQA Daily Threshold Limits	-	***54***	54	82	-	54
Butte County AQMD	3.21	11.94	0.34	0.36	0.02	0.59
CEQA Daily Threshold Limits	-	-	-	80	-	25
Sacramento Metropolitan Area AQMD	7.14	36.20	0.94	0.97	0.03	1.64
CEQA Daily Threshold Limits	-	85	-	-	-	65
Feather River AQMD	8.61	43.65	1.13	1.16	0.03	1.97
CEQA Daily Threshold Limits	-	-	-	80	-	-
San Bernardino/Los Angeles County (Mojave Desert AQMD)	8.59	43.55	1.13	1.16	0.03	1.97
CEQA Daily Threshold Limits	548	137	82	82	137	137
Los Angeles County/Riverside County (South Coast AQMD)	16.21	82.18	2.13	2.19	0.06	3.71
CEQA Daily Threshold Limits	550	100	55	150	150	75
East Kern County APCD	8.91	45.20	1.17	1.21	0.03	2.04
CEQA Daily Threshold Limits	-	137	-	-	-	137

Note:
– = no CEQA daily threshold for this pollutant in the AQMD

TABLE F-15

Mitigated Emissions for Scenario 4 - Maximum Ballast from Quarries Nearest to the Project and Balance from Bangor Rock Quarry and Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section), Comparison to Daily CEQA Thresholds

	Emissions (pounds per day) Fresno to Bakersfield					
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Bay Area AQMD	7.99	9.24	0.49	0.53	0.12	0.75
CEQA Daily Threshold Limits	-	54	54	82	-	54
Los Angeles County/Riverside County (South Coast AQMD)	12.2	14.1	0.8	0.8	0.2	1.1
CEQA Daily Threshold Limits	550	100	55	150	150	75
Butte County AQMD	1.37	1.59	0.08	0.09	0.02	0.13
CEQA Daily Threshold Limits	-	-	-	80	-	25
Sacramento Metropolitan Area AQMD	2.60	3.01	0.16	0.17	0.04	0.24
CEQA Daily Threshold Limits	-	85	-	-	-	65
Feather River AQMD	3.12	3.61	0.19	0.21	0.05	0.29
CEQA Daily Threshold Limits	-	-	-	80	-	-

Note:
– = no CEQA daily threshold for this pollutant in the AQMD

TABLE F-16
Mitigated Emissions for Scenario 5 - Maximum Ballast from Quarries Nearest Project Balance from Kaiser Eagle Mountain Quarry by Truck Only (Fresno to Bakersfield Section), Comparison to Daily CEQA Thresholds

	Emissions (pounds per day) Fresno to Bakersfield					
Air Quality Management District (AQMD)	**CO**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Bay Area AQMD	7.99	9.24	0.49	0.53	0.12	0.75
CEQA Daily Threshold Limits	–	54	54	82	–	54
Los Angeles County/Riverside County (South Coast AQMD)	28.03	32.42	1.73	1.87	0.41	2.63
CEQA Daily Threshold Limits	550	100	55	150	150	75

Note:
– = no CEQA daily threshold for this pollutant in the AQMD

Appendix G.1

Material Hauling NOx Offset Memo

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MEMORANDUM

To: **Rebecca Kohlstrand/PMT; Bryan Porter/PMT**
From: **Jonathan Tamimi /URS/HMM/Arup; Avanti Tamhane /URS/HMM/Arup**
Date: **06/22/2012**
Subject: **Ballast Hauling NO_X Emission Offset Availability in the Bay Area, Mojave Desert, and South Coast Air Basins – Merced to Fresno and Fresno to Bakersfield Sections of the California High-Speed Train Project**

Analysis of pollutant emissions that are associated with hauling railway ballast material needed for the Merced to Fresno and Fresno to Bakersfield Sections of the California High-Speed Train Project determined that the project could potentially exceed CEQA NO_X emission thresholds in the South Coast, Mojave Desert, and Bay Area Air Basins (URS/HHM/Arup, 2012). Since the construction period for the Merced to Fresno Section and the Fresno to Bakersfield would overlap, the total amount of emission offsets required for both sections were analyzed together to ensure enough NO_X offsets were available in each basin to offset the CEQA exceedances. Representatives from all air districts were consulted to determine the amount of offset availability from each district to offset potential hauling emissions.

The maximum exceedances, and therefore the amount of potential offsets required, would occur under Hauling Scenario 1 for the South Coast and Mojave Desert Air Basins and in Hauling Scenarios 2 and 3 for the Bay Area Air Basin.

Maximum Potential Offsets Required for Mitigated Scenarios

	Pollutant	Threshold Exceeded	Offsets Required (tons/year)
Bay Area Air Basin	NO_X	CEQA	11.5
South Coast Air Basin	NO_X	CEQA	20.3
Mojave Desert Air Basin	NO_X	CEQA	2.9

Notes:
Maximum offsets required were calculated based on per day exceedances of CEQA thresholds multiplied by number of days of hauling per year (260 for Bay Area via truck, and 104 for Mojave Desert and South Coast via rail).

Bay Area Air Quality Management District (BAAQMD)

The BAAQMD's emissions bank currently holds 2,681 tons of NO_X emission offsets (BAAQMD 2012). While the entirety of these offsets are not currently for sale, as large entities typically hold on to their offsets for use with their own future projects, in 2010, 91.48 tons of NO_X credits were traded in the BAAQMD in a total of five transactions, at a price ranging from $10,000 to $13,000/ton (CARB 2012a). In 2009, 265.95 tons of NO_X credits

were traded over 8 transactions, with the price ranging from $11,000 to $16,800/ton (CARB 2012b). This data shows that even though the entirety of ERCs are not available for sale, enough are seemingly traded on a yearly basis to cover the amount required by the potential maximum emission exceendances.

While the BAAQMD does not have a formal program to use emission reduction credits (ERCs) to offset construction emissions, such as the SCAQMD's RECLAIM program, it is likely feasible to use them in this manner. Looking at the past few years of data, and the amount of ERCs currently in the BAAQMD emissions bank, it would seem likely that offsetting the NO_X emissions from construction would not be hindered by the quantity of emission credits available.

Mojave Desert Air Quality Management District (MDAQMD)

The MDAQMD's emissions bank currently holds 2,061 tons of available, Class A (approved for use as emission offsets), NO_X emission credits (MDAQMD 2012). In 2010, 17 tons of NO_X credits were traded in the MDAB at an average price of $10,000/ton (CARB 2012a) although in 2009, no NO_X credits were traded in the MDAB (CARB 2012b).

The MDAQMD, similar to the BAAQMD, does not have a formal construction emission offset program. It is likely, however, that emission offsets could be purchased to offset the potential maximum 2.9 tons of NO_X per year.

South Coast Air Quality Management District (SCAQMD)

Mobile Source Emission Reduction Credits (MSERC)

MSERCs have, and can be used, in the SCAQMD to offset NO_X construction emissions. Unfortunately, MSERCs are not being generated as quickly as they have been in past years, and it is unlikely, without new legislation encouraging generation of new MSERCs, that sufficient amounts would be available to offset the hauling emissions the South Coast Air Basin.

Regional Clean Air Incentives Market (RECLAIM)

Formal guidance is available from the SCAQMD specifying how RECLAIM credits can be used to offset construction emissions, specifically NO_X. The following criteria must be met prior to utilizing RECLAIM credits for mitigation:

- Utilize alternative technology mitigation
- Provide localized air quality modeling analysis to show localized impacts are less than significant
- Purchase the emission credits prior to the commencement of construction
- Retire the entire amount of NO_X emission credits prior to construction commencement
- Reconcile disparities (emissions higher than anticipated) in a timely manner
- Record construction equipment usage and submit monthly reports

- Post contact information at construction site

In a report, published by the SCAQMD in April 2012, the total amount of NO_X RECLAIM Trading Credits (RTCs) traded in the year ending April 2012, for compliance year 2011 was 1,198.6 tons at an average price of $1,013/ton. As of April 2012, 234.8 tons of NOX RTCs were traded for compliance year 2012 at an average price of $4,121 (SCAQMD 2012).

Based on the amount of trades and volume of credits traded in the past two years, it would seem likely that enough credits would be available to cover the potentially maximum 20 tons a year. The HST Project meets the RECLAIM criteria by exhausting technological mitigation and would not require localized air quality monitoring as the emissions are not occurring at one specific site, but are going to be spread over the air basin.

Conclusion

According to this analysis, sufficient offsets for NO_X emissions are available in the Bay Area, Mojave Desert, and South Coast Air Basins for the maximum potential offsets required under the various scenarios. This conclusion is based on the amount of emission offsets available in emission banks, as well as recent activity regarding emission trade in each air basin.

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Appendix H

Localized Impacts from Construction

Table of Contents

Page

1.0 Introduction 1-3
2.0 Pollutants of Concern 2-1
3.0 Modeled Construction Sites 3-1
4.0 Emissions and Emission Rates 4-1
4.1 Emissions from Construction Activities 4-1
4.2 Emissions for Modeled Construction Work Areas 4-3
5.0 Dispersion Modeling 5-1
5.1 Inputs 5-1
5.2 Output Options 5-4
6.0 Comparison to the Ambient Air Quality Standards 6-1
7.0 Health Impacts 7-1
7.1 Exposure 7-1
7.2 Toxicity Assessment 7-1
7.3 Risk Characterization 7-2
7.3.1 Carcinogenic Effects 7-2
7.3.2 Non-Carcinogenic Effects 7-4
7.4 Health Risk Assessment Results 7-5
8.0 Conclusions 8-1
9.0 References 9-1

Tables

Table 1 Total Project Construction Emissions 4-2
Table 2 Construction Emissions used in Modeling 4-4
Table 3 AERMOD Model Source Parameters 5-3
Table 4 Carbon Monoxide Concentrations from Construction Emissions 6-2
Table 5 Sulfur Dioxide Concentrations from Construction Emissions 6-3
Table 6 Nitrogen Dioxide Concentrations from Construction Emissions 6-4
Table 7 Particulate Matter Concentrations from Construction Emissions 6-5
Table 8 Toxicity Factors 7-2
Table 9 Exposure Factors 7-3
Table 10 Diesel Particulate Matter Excess Cancer Risk Associated with Construction Emissions 7-5
Table 11 Health Impacts Associated with Concrete Batch Plants 7-5

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1.0 Introduction

The High Speed Train (HST) project will include several different types of construction activities that will occur in numerous locations along the Fresno to Bakersfield portion of the project. Since the total construction project area covers over a hundred miles, it is not practical to analyze the entire construction project as a whole. Furthermore, it is unlikely that emissions beyond a short localized distance will influence one another for the sake of localized air quality impacts[1] and health risk assessments. Based on the construction activities, the following construction work areas were evaluated for the potential to cause localized air quality impacts:

- Construction of the Rail Segment
- Construction of the Fresno Station
- Construction of the Bakersfield Station
- Construction of the Kings/Tulare Regional Station
- Construction of the Heavy Maintenance Facility (HMF)
- Construction of the Maintenance of Way Facility (MOWF)
- Construction of Road over or under crossings
- Operation of Concrete Batch Plants (CBP) to support construction

Each of these types of construction sites was evaluated independently of each other. This report describes the methods used to develop construction emission rates, perform air dispersion modeling of construction emissions, and estimate associated health risk impacts. Air dispersion modeling results were used to predict the ambient impacts of criteria pollutant emissions and evaluate these impacts with respect to the National Ambient Air Quality Standards (NAAQS) and California Ambient Air Quality Standards (CAAQS). Health risk calculations were performed to evaluate the excess cancer risks, and acute and chronic non-cancer health impacts on sensitive receptors located near the construction work areas.

[1] Ozone and its precursors are classified as regional impacts due to the atmospheric transport and chemical conversions that take place over long distances and time scales. Therefore, they are not analyzed in terms of localized impacts. Furthermore, the project will be offsetting to zero any ozone precursor emissions above the General Conformity Rule de minimis thresholds under the VERA entered with the San Joaquin Air Pollution Control District (SJVAPCD). Per SJVAPCD guidance (SJVAPCD 2012), emissions offset through a VERA are deemed to reduce the project emissions to less than significant.

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2.0 Pollutants of Concern

Criteria pollutants and toxic air contaminants (TACs)[2] were assessed for localized impacts.

The following criteria pollutants were considered in this analysis of potential localized impacts[3]:

- Carbon Monoxide (CO)
- Nitrogen Dioxide (NO_2)
- Particulate matter smaller than or equal to 10 microns (PM_{10})
- Particulate matter smaller than or equal to 2.5 microns ($PM_{2.5}$)
- Sulfur Dioxide (SO_2)

Non-criteria TACs were also analyzed for potential localized impacts. Sources of TACs include construction equipment exhaust and fugitive dust from concrete batch plant processes. The California Air Resources Board (CARB) and the California Office of Environmental Health Hazard Assessment (OEHHA) have identified TACs that may be emitted from these sources. Construction equipment exhaust may contain diesel particulate matter (DPM), and fugitive dust emissions from concrete batch plants may contain a number of toxic pollutants (in particular, heavy metals with various toxicities). DPM has been identified by CARB as a TAC based on its potential to cause cancer and other adverse health problems, including respiratory illnesses, and increased risk of heart disease. Heavy metals associated with concrete batch plant emissions present potential carcinogenic and non-carcinogenic health risks.

Analyses were conducted that considered chronic (long-term) carcinogenic, chronic non-carcinogenic, and acute (short-term) health risks. These analyses were conducted following SJVAPCD modeling guidance.

[2] TACs are similar to hazardous air pollutants (HAPs) which is a federal term for non-criteria pollutants that pose health impacts.

[3] Ozone and its precursors (reactive organic gases [ROG] and oxides of nitrogen [NOx]) are classified as regional impacts due to the atmospheric transport and chemical conversions that take place over long distances and time scales. Therefore, they are not analyzed in terms of localized impacts.

Lead (Pb) emissions are not considered because the mass emissions are very small and they are unlikely to exceed the ambient air quality standards. Lead is quantified as part of the TACs since it has health toxicity factors.

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3.0 Modeled Construction Sites

As described in Section 1.0, the following construction sites were evaluated for the potential to cause localized air quality impacts:

- Construction of the Rail Segment
- Construction of the Fresno Station
- Construction of the Bakersfield Station
- Construction of the Kings/Tulare Regional Station
- Construction of the Heavy Maintenance Facility (HMF)
- Construction of the Maintenance of Way Facility (MOWF)
- Construction of Road over or under crossings
- Operation of Concrete Batch Plants (CBP) to support construction

A brief description of the approach and study area for each construction site is provided below. More detailed modeling source parameters are provided in Section 5.0.

Construction of the Rail Segment – The construction emissions associated with the construction of the Rail Segment include several different phases such as mobilization, demolition, earth moving, land clearing, track construction at grade, and elevated structures. For the Rail Segment, it would not be practical to analyze construction of the entire 114 mile alignment as a whole. Therefore, for localized impacts, the analysis evaluated construction of a 2-mile long portion of the track. It was assumed that emissions from construction of other portions of the alignment beyond this distance would not substantially contribute to localized impacts. Because various receptors may be located along the alignment, the Rail Segment was conservatively modeled with sensitive receptors located adjacent to the work area.

Construction of the Fresno Station – There are multiple alternatives for the proposed Fresno Station. For this analysis, the Fresno Station-Mariposa Alternative was evaluated for localized construction impacts. This alternative is consistent with the BNSF Alternative alignment, and is representative of the other Fresno Station alternatives with respect to site size and location of nearby sensitive receptors.

Construction of the Bakersfield Station – There are multiple alternatives for the proposed Bakersfield Station. For this analysis, the Bakersfield Station-North Alternative was evaluated for localized construction impacts. This alternative is consistent with the BNSF Alternative alignment, and is representative of the other Bakersfield Station alternatives with respect to site size and location of nearby sensitive receptors.

Construction of the Kings/Tulare Regional Station – There are multiple alternatives for the proposed Kings/Tulare Regional Station. For this analysis, the Kings/Tulare Regional Station-East Alternative was evaluated for localized construction impacts. This alternative is consistent with the BNSF Alternative alignment, and is representative of the other Kings/Tulare Regional Station alternatives with respect to site size and location of nearby sensitive receptors.

Construction of the Heavy Maintenance Facility (HMF) – There are multiple alternatives for the proposed HMF. For this analysis, a representative site was modeled based on the range of potential HMF site alternatives. Because various receptors may be located around the proposed HMF site alternatives, the HMF was conservatively modeled with sensitive receptors located adjacent to the work area.

Construction of the Maintenance of Way Facility (MOWF) – There are multiple alternatives for the proposed MOWF. For this analysis, a representative site was modeled based on the range of potential MOWF site alternatives. Because various receptors may be located

around the proposed MOWF site alternatives, the MOWF was conservatively modeled with sensitive receptors located adjacent to the work area.

Construction of Road over or under crossings – There are multiple road over and under crossings that would be constructed, and each would vary widely in terms of size and shape. For this analysis, a representative construction area was modeled based on the range of sizes and lengths of the proposed road crossings. Because various receptors may be located around the proposed road crossings, the road crossing was conservatively modeled with sensitive receptors located adjacent to the work area.

Operation of Concrete Batch Plants (CBP) to support construction – Concrete Batch Plants may be located at various locations near the alignment, but site details and locations for the CBPs have not been determined. Therefore, CBP modeled work areas were conservatively sized based on preliminary production capacity estimates. Because site locations have not been determined, the CBP was conservatively modeled with sensitive receptors located adjacent to the work area.

4.0 Emissions and Emission Rates

4.1 Emissions from Construction Activities

The California High-Speed Train Project FEIR/EIS Fresno to Bakersfield Air Quality Technical Report (Authority and FRA 2014) presented emissions by construction activity (e.g., demolition, earthmoving, land clearing). These construction activities would occur at specific construction areas (e.g., construction of Fresno Station would occur at the Fresno Station construction work area). These construction areas and associated construction activities are shown in Table 1. Emissions from these construction activities are also shown in the table.

Table 1
Total Project Construction Emissions

Construction Work Area	Construction Activity	Duration (working days)	Total Emissions (tons)[1]						
			CO	NOx	PM_{10}[2]	$PM_{2.5}$[2]	SO_2	VOC	DPM
Rail Segment[3]	Demobilization	128	4.3	6.5	0.8	0.4	0.02	0.6	0.30
	Demolition	78	1.6	1.0	12.6	1.4	0.01	0.2	0.06
	Earth Moving	522	104.5	169.9	63.6	7.7	0.30	12.8	7.50
	Elevated Structures	579	116.1	227.5	12.3	9.1	0.45	15.3	9.05
	Land Clearing	91	18.7	34.8	13.5	1.5	0.05	2.4	1.49
	Mobilization	65	6.3	10.3	2.4	0.7	0.02	0.9	0.47
	Track at Grade	181	2.7	8.5	0.3	0.3	0.01	0.5	0.31
	Track Elevated	141	4.4	10.8	0.5	0.4	0.01	0.7	0.40
Concrete Batch Plant[4]	Concrete Batch Plants	1000	--	--	33.4	33.4	--	--	--
HMF	HMF Phase 1 & 3	390	3.6	5.0	0.5	0.3	0.01	0.4	0.27
	HMF Track Phase 3	110	1.6	2.1	0.2	0.1	0.00	0.2	0.11
MOWF	MOWF	389	2.1	3.2	0.2	0.2	0.00	0.3	0.16
	MOWF Track	45	0.5	0.7	0.1	0.04	0.00	0.1	0.03
Fresno Station	Fresno Station	750	4.1	3.9	4.2	0.3	0.00	0.4	0.23
Bakersfield Station	Bakersfield Station	750	3.9	3.6	4.2	0.2	0.00	0.4	0.20
Kings-Tulare Station	Kings-Tulare Station	750	3.8	3.4	4.5	0.2	0.00	0.4	0.18
Road Crossing[5]	Road Crossing	522	251.4	279.8	28.2	15.0	0.59	24.6	14.06

Notes:
[1] The emissions used in this analysis are from on-site construction equipment exhaust, except as noted for PM_{10} and $PM_{2.5}$.
[2] The PM_{10} and $PM_{2.5}$ emissions are from on-site construction equipment exhaust and fugitive dust.
[3] The Rail Segment emissions presented here represent emissions from construction of the entire alignment
[4] The Concrete Batch Plant emissions presented here represent emissions from all concrete batch plants
[5] The Road Crossing emissions presented here represent emissions from construction of all road crossings along the alignment

4.2 Emissions for Modeled Construction Work Areas

The emissions shown in Table 1 were applied to the representative construction work areas for use in air dispersion modeling. For the Rail Segment, Concrete Batch Plants, and Road Crossings, the modeled construction work area only accounts for a portion of the total construction activity.

For example, the total emissions for the Rail Segment represent the emissions from construction of the entire 114-mile long alignment, but the modeled construction work area only represent a 2-mile long segment of the alignment. To properly allocate the total emissions to the modeled construction work area, a "work area weighting" adjustment was needed. This "work area weighting" is the number of modeled construction work areas that is represented by the total emissions. For the Rail Segment, the emissions presented in Table 1 represent the total emissions for construction of the entire alignment. Because the analysis for this construction area was limited to a 2-mile segment of the rail, only emissions associated with construction of the 2-mile rail segment are used in the analysis. Since there are 57 of these 2-mile rail segments in the entire 114-mile long alignment, the "work area weighting" for the Rail Segment is 57.

Similarly, the Road Crossing emissions presented in Table 1 represent the total emissions for construction of all road crossings associated with the project, but the analysis for this construction area was limited to a single road crossing. The Concrete Batch Plant emissions in Table 1 represent the total emissions from all Concrete Batch Plants, but the analysis was limited to a single CBP. These "work area weighting" values are listed in Table 2. Emissions for each construction work area are also shown in this table.

Table 2
Construction Emissions used in Modeling

Modeled Construction Work Area	Construction Phase	Work Area Weighting	Emissions for Modeled Construction Work Area (tons)[1]						
			CO	NOx	PM_{10}[2]	$PM_{2.5}$[2]	SO_2	VOC	DPM
Rail Segment	Demobilization	57	0.08	0.11	0.01	0.01	0.00	0.01	0.01
	Demolition	57	0.03	0.02	0.22	0.02	0.00	0.00	0.00
	Earth Moving	57	1.83	2.98	1.12	0.14	0.01	0.22	0.13
	Elevated Structures	57	2.04	3.99	0.22	0.16	0.01	0.27	0.16
	Land Clearing	57	0.33	0.61	0.24	0.03	0.00	0.04	0.03
	Mobilization	57	0.11	0.18	0.04	0.01	0.00	0.01	0.01
	Track at Grade	57	0.05	0.15	0.01	0.01	0.00	0.01	0.01
	Track Elevated	57	0.08	0.19	0.01	0.01	0.00	0.01	0.01
Concrete Batch Plant	Concrete Batch Plants	3			11.13	11.13			
HMF	HMF Phase 1 & 3	1	3.59	5.04	0.46	0.26	0.01	0.42	0.27
	HMF Track Phase 3	1	1.59	2.14	0.16	0.11	0.00	0.17	0.11
MOWF	MOWF	1	2.05	3.19	0.18	0.16	0.00	0.27	0.16
	MOWF Track	1	0.50	0.66	0.06	0.04	0.00	0.06	0.03
Fresno Station	Fresno Station	1	4.06	3.85	4.24	0.25	0.00	0.42	0.23
Bakersfield Station	Bakersfield Station	1	3.88	3.57	4.17	0.24	0.00	0.39	0.20
Kings-Tulare Station	Kings-Tulare Station	1	3.83	3.39	4.53	0.22	0.00	0.36	0.18
Road Crossing	Road Crossing	108	2.33	2.59	0.26	0.14	0.01	0.23	0.13

Notes:
[1] The emissions used in this analysis are from on-site construction equipment exhaust, except as noted for PM_{10} and $PM_{2.5}$.
[2] The PM_{10} and $PM_{2.5}$ emissions are from on-site construction equipment exhaust and fugitive dust.

5.0 Dispersion Modeling

As the construction activities of the Fresno to Bakersfield section of the HST have the potential to cause health impacts on nearby sensitive receptors, detailed dispersion modeling analyses were conducted to determine whether these impacts would be significant. The USEPA's AERMOD atmospheric dispersion model was used to simulate physical conditions and predict pollutant concentrations near the construction work areas. This allowed for an analysis of the localized impacts of these construction emissions.

AERMOD is generally used to estimate impacts from point source emissions from stacks as well as emissions from volume and area sources. The model accepts actual hourly meteorological observations and directly estimates hourly and average concentrations for various time periods. The detailed information on the methodology and data used to conduct the air dispersion modeling is summarized below.

5.1 Inputs

Model: AERMOD version 12345 was used to conduct the modeling analysis.

Meteorological Data: AERMOD requires meteorological data as input into the model. These are typically processed using AERMET, a pre-processor to AERMOD. AERMET requires surface meteorological data, upper air meteorological data and surface parameter data. The SJVAPCD has several meteorological datasets that have been processed using AERMET available on its website[4]. For the HST stations, the nearest representative meteorological data were used. The Fresno station used the Fresno airport dataset, the Bakersfield station used the Bakersfield airport dataset, and the Kings/Tulare station used the Hanford airport dataset. For the HMF, MOWF, Rail Segment, Road Crossing, and CBP, where construction may occur anywhere along the length of the alignment, the pre-processed data for Fresno was used since the SJVAPCD Air Dispersion Modeling Guidance indicates that this station has the most conservative wind speeds for the air district (SJVAPCD 2007)[5]. Five years of meteorological data from 2005 through 2009 were used or as many complete years that were available.

Terrain: It was assumed that the terrain in the project was flat, and therefore no terrain data was used.

Receptors: Receptors were modeled using a nested tier grid with various receptor spacing from 20-500 meters. For the Fresno Station, Bakersfield Station, and Kings/Tulare Regional Station, the location of sensitive receptors were determined by visual examination of aerial imagery and parcel and zoning information. For the HMF, MOWF, Rail Segment, Road Crossing, and CBP, the sites were conservatively modeled with sensitive receptors located adjacent to the modeled construction work areas. All receptors were modeled at a height of 1.8 meters.

Source Parameters: Construction work areas were modeled as either an area source or a group of adjacent volume sources. The Rail Segment construction work area was modeled as a group of adjacent volume sources. All other construction work areas were modeled as area sources. The volume sources and area sources were assumed to have a release height of 5 meters (SCAQMD 2008), with the exception of the Concrete Batch Plant, which was assumed to

[4] In December of 2012, the USEPA released a new version of AERMET and AERMOD which included some updates involving the meteorological data. At the time of preparation of this document, the SJVAPCD has not reprocessed the meteorological data sets.

[5] This guidance states the Fresno airport dataset should be used for unspecified location permits where units may be operated throughout the district, as meteorological data from Fresno airport represents worst case conditions.

be elevated 10 meters. A summary of model source parameters is shown in Table 3. Sources were modeled using the rural land use option.

Table 3
AERMOD Model Source Parameters

Construction Work Area	Source Type	Size of Modeled Area[1]	Release Height (meters)
Rail Segment	Group of volume sources	3200 m x 40 m	5
Road Crossings	Area	2000 m x 50 m	5
Fresno Station	Areapoly	125,700 m2	5
Bakersfield Station	Areapoly	167,900 m2	5
Kings/Tulare Regional Station	Areapoly	209,900 m2	5
Concrete Batch Plant	Area	63.6 m x 63.6 m	10
HMF	Area	3200 m x 500 m	5
MOWF	Areapoly	562,400 m2	5

Notes:

[1] Sizes of modeled areas are shown as dimensions of length and width where the modeled work area is a rectangular shape. For irregularly shaped modeled work areas, such as those modeled as polygon area sources (Areapoly), the approximate area of source is shown.

5.2 Output Options

The dispersion model can provide results for different averaging time periods, such as hourly, daily, and annual. The averaging times used for the ambient air quality standards and concentration thresholds are different for each pollutant. To compare the model results to the applicable ambient air quality standards and thresholds, criteria pollutant concentrations were calculated as outlined below.

- Particulate Matter: The 24-hour average and the annual average concentrations were calculated. For the 24-hour average, the 6th highest 24-hour average value based on the concatenated 5 years of meteorological data is used to be consistent with the statistical description of the ambient air quality standard (i.e., not to exceed the standard more than once per year on average). For the annual average, the average of the concatenated 5 years of meteorological data was calculated.

- Nitrogen Dioxide: The 1-hour average was calculated using the multiyear average of the 8th highest 1-hour daily maximum value for each year, consistent with the statistical description of the ambient air quality standard. The annual average concentration was calculated using the average of the concatenated 5 years of meteorological data. In order to convert the nitrogen oxides (NOx) emissions to NO_2 emissions, a ratio representing the extent of conversion by distance is applied. This method is described in South Coast AQMD's (SCAQMD) Localized Significance Threshold guidance[6]. It was conservatively assumed that the distance was from the center of the group of volume sources or area source for each source type.

- Carbon Monoxide: The 1-hour and 8-hour averages were calculated. The maximum 1-hour and 8-hour concentrations for the concatenated 5 years of meteorological data were used.

- Sulfur Dioxide: The 1-hour and 24-hour averages were calculated. The maximum 1-hour and 24-hour concentrations for the concatenated 5 years of meteorological data were used.

[6] SCAQMD. 2008. Final Localized Significance Threshold Methodology. page 2-8 to 2-9. This is adapted from the work of Arellano, J.V., A.M. Talmon, and P.J.H Builtjes, 1990. A Chemically Reactive Plume Model for the NO-NO2-O3 System, Atmospheric Environment 24A, 2237-2246. This method was selected since specific information on the locations for many sources is not precisely known at this time and more refined methods of incorporating the chemical conversions in the atmosphere would not be appropriate since selection of appropriate representative monitoring data would be difficult in the absence of location specifics.

6.0 Comparison to the Ambient Air Quality Standards

In order to determine if the incremental concentrations associated with construction emissions would cause or contribute to exceedances of the NAAQS and CAAQS, the appropriate background concentrations for all attainment pollutants are required. For a given pollutant, the appropriate background concentration is added to the incremental concentration estimated from the air dispersion modeling. If the combined value exceeds the NAAQS or CAAQS of that pollutant, then the emissions could contribute to exceedances (SJVAPCD 2012). The background concentrations were based on the SJVAPCD reported monitoring background values where available. For pollutants and averaging times that did not have reported background values from the SJVAPCD, the highest recent values of ARB monitors near the high speed rail alignment were conservatively used, as noted for each pollutant in the following tables.

Tables 4 through 6 show the estimated NO_2, CO, and SO_2 ambient air concentrations for each of the construction work areas, respectively. The predicted NO_2, CO, and SO_2 ambient impacts for all of the work areas are below the NAAQS and CAAQS.

Pre-project concentrations of PM_{10} and $PM_{2.5}$ in the San Joaquin Valley Air Basin exceed their respective ambient air quality standards. Total PM_{10} is therefore evaluated in accordance with the SJVAPCD recommended significant impact level (SIL) for fugitive PM_{10} and $PM_{2.5}$ emissions (Villalvazo 2014). If the project's incremental increase in concentration is below the SJVAPCD's SIL, the project would not cause or contribute significantly to exceedances of the ambient air quality standards. Table 7 shows the incremental increase in PM_{10} concentration for each of the work areas. As shown in this table, PM_{10} increases would not exceed the SIL values for the 24-hour and annual averaging periods after mitigation of the concrete batch plant. SJVAPCD recommends that the fugitive PM_{10} SILs should also be used to evaluate fugitive PM2.5 emissions (Villalvazo 2014). Because $PM_{2.5}$ emissions would be less than or equal to PM_{10} emissions (see Table 1), the incremental increase in $PM_{2.5}$ concentration would not be greater than the incremental increase in PM_{10} concentrations. Therefore, the incremental increase in $PM_{2.5}$ would also not be expected to exceed the SIL values for the 24-hour and annual averaging periods after mitigation of the concrete batch plant.

Table 4
Carbon Monoxide Concentrations from Construction Emissions

Construction Area	Maximum Incremental Off-site 1-hour Average CO Concentration (µg/m³)	Background[2] 1-hour CO Concentration (µg/m³)	Total Off-site 1-hour CO Concentration (µg/m³)	NAAQS	CAAQS
	Unmitigated		Unmitigated	µg/m³ equivalent	
Concrete Batch Plant	NA[1]	4,025	NA[1]	40,000	23,000
Road Crossings	103.9		4,129		
Rail Segment	48.73		4,074		
HMF	129.3		4,154		
MOWF	104.0		4,129		
Fresno Station	109.9		4,135		
Bakersfield Station	70.4		4,095		
Kings-Tulare Station	88.7		4,114		
Construction Area	**Maximum Incremental Off-site 8-hour Average CO Concentration (µg/m³)**	**Background[3] 8-hour CO Concentration (µg/m³)**	**Total Off-site 8-hour CO Concentration (µg/m³)**	**NAAQS**	**CAAQS**
	Unmitigated		**Unmitigated**	**µg/m³ equivalent**	
Concrete Batch Plant	NA[1]	2,461	NA[1]	10,000	10,000
Road Crossings	63.5		2,525		
Rail Segment	28.3		2,489		
HMF	29.8		2,491		
MOWF	73.1		2,534		
Fresno Station	57.1		2,518		
Bakersfield Station	47.7		2,509		
Kings-Tulare Station	59.9		2,521		

Notes:

[1] The concrete batch plant does not have any substantial CO emissions.

[2] The highest monitored 1-hour value from the Fresno, Hanford, or Bakersfield stations was used as the background concentration.

[3] The highest monitored 8-hour value from the Fresno, Hanford, or Bakersfield stations was used as the background concentration.

Table 5
Sulfur Dioxide Concentrations from Construction Emissions

Construction Area	Maximum Incremental Off-site 1-hour Average SO_2 Concentration ($\mu g/m^3$)	Background[2] 1-hour SO_2 Concentration ($\mu g/m^3$)	Total Off-site 1-hour SO_2 Concentration ($\mu g/m^3$)	NAAQS	CAAQS
	Unmitigated		Unmitigated	$\mu g/m^3$ equivalent	
Concrete Batch Plant	NA[1]	19.2	NA[1]	196	655
Road Crossings	0.24		19.44		
Rail Segment	0.18		19.38		
HMF	0.81		20.01		
MOWF	4.16		23.36		
Fresno Station	1.08		20.28		
Bakersfield Station	0.73		19.93		
Kings-Tulare Station	0.93		20.13		
Construction Area	**Maximum Incremental Off-site 24-hour Average SO_2 Concentration ($\mu g/m^3$)**	**Background[3] 24-hour SO_2 Concentration ($\mu g/m^3$)**	**Total Off-site 24-hour SO_2 Concentration ($\mu g/m^3$)**	**NAAQS**	**CAAQS**
	Unmitigated		**Unmitigated**	**$\mu g/m^3$ equivalent**	
Concrete Batch Plant	NA[1]	5.24	NA[1]	NA	105
Road Crossings	0.02		5.26		
Rail Segment	0.01		5.25		
HMF	0.03		5.27		
MOWF	0.36		5.60		
Fresno Station	0.10		5.34		
Bakersfield Station	0.07		5.31		
Kings-Tulare Station	0.12		5.36		

Notes:

[1] The concrete batch plant does not have any substantial SO_2 emissions.

[2] Background 1-hour concentration based on the monitoring background values presented by SJVAPCD (SJVAPCD 2014).

[3] The highest monitored 24-hour value from the Fresno, Hanford, or Bakersfield stations was used as the background concentration.

Table 6
Nitrogen Dioxide Concentrations from Construction Emissions

Construction Area	Maximum Incremental Off-site 1-hour Average NO_2 Concentration ($\mu g/m^3$)	Background[2] 1-hour NO_2 Concentration ($\mu g/m^3$)	Total Off-site 1-hour Average NO_2 Concentration ($\mu g/m^3$)	NAAQS	CAAQS
	Unmitigated		Unmitigated	$\mu g/m^3$ equivalent	
Concrete Batch Plant	NA[1]	115.10	NA[1]	188	339
Road Crossings	48.8		163.9		
Rail Segment	70.4		185.5		
HMF	52.9		168.0		
MOWF	69.5		184.6		
Fresno Station	27.1		142.2		
Bakersfield Station	19.5		134.6		
Kings-Tulare Station	18.6		133.7		
Construction Area	**Maximum Incremental Off-site Annual Average NO_2 Concentration ($\mu g/m^3$)**	**Background[3] Annual NO_2 Concentration ($\mu g/m^3$)**	**Total Off-site Annual Average NO_2 Concentration ($\mu g/m^3$)**	**NAAQS**	**CAAQS**
	Unmitigated		**Unmitigated**	**$\mu g/m^3$ equivalent**	
Concrete Batch Plant	NA[1]	38.4	NA[1]	100	57
Road Crossings	0.07		38.5		
Rail Segment	0.76		39.2		
HMF	2.65		41.1		
MOWF	0.08		38.5		
Fresno Station	0.21		38.6		
Bakersfield Station	0.14		38.5		
Kings-Tulare Station	0.27		38.7		

[1] The concrete batch plant does not have any substantial NO_2 emissions.

[2] Background concentration based on the monitoring background values presented by SJVAPCD (SJVAPCD 2014). The highest background value from the Fresno, Hanford, or Bakersfield stations was used as these were determined to be appropriate monitors to characterize the background conditions.

[3] The highest monitored annual concentration value from the Fresno, Hanford, or Bakersfield stations was used as the background concentration.

Table 7
Particulate Matter Concentrations from Construction Emissions

Construction Area	Unmitigated Maximum Incremental Off-site 24-hour Average PM_{10} Concentration (µg/m^3)	Significant Impact Level (SIL)[1] (µg/m^3)	Mitigated Maximum Incremental Off-site 24-hour Average PM_{10} Concentration (µg/m^3)
Concrete Batch Plant	**14.38**	10.4	5.66
Road Crossings	1.86		--
Rail Segment	2.64		--
HMF	0.37		--
MOWF	1.08		--
Fresno Station	7.82		--
Bakersfield Station	6.45		--
Kings-Tulare Station	6.82		--
Construction Area	**Unmitigated Maximum Incremental Off-site Annual Average PM_{10} Concentration (µg/m^3)**	**Significant Impact Level (SIL)[1] (µg/m^3)**	**Mitigated Maximum Incremental Off-site Annual Average PM_{10} Concentration (µg/m^3)**
Concrete Batch Plant	**4.50**	2.08	1.28
Road Crossings	0.18		--
Rail Segment	0.20		--
HMF	0.22		--
MOWF	0.07		--
Fresno Station	1.53		--
Bakersfield Station	1.33		--
Kings-Tulare Station	1.37		--

Notes:

1. The background concentrations already exceed ambient air quality standards. Thus, the appropriate comparison is to determine if the project will contribute to further exceedances. The modeled concentrations show the incremental increase in concentration due to construction emissions.
2. The appropriate threshold used for the project is 10.4 micrograms per cubic meter for the 24-hour average and 2.08 micrograms per cubic meter for the annual average, based on the SJVAPCD recommended Significant Impact Levels (SILs). These SILs apply to both PM_{10} and $PM_{2.5}$. (Villalvazo 2014)
3. Exceedances of the SILs shown in **bold**.
4. Mitigation is only needed for the concrete batch plant. Other construction areas do not exceed the SILs before mitigation.
5. Mitigated concrete batch plant emissions are after incorporation of a 1,000 foot buffer distance for concrete batch plant.

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7.0 Health Impacts

TACs can result in a variety of health impacts. Health impacts are typically classified as carcinogenic or non-carcinogenic. The severity of these adverse health impacts from TACs are typically based on the amount of exposure to the TAC. The methodology used to determine the severity of a health impact is described below for both carcinogenic and non-carcinogenic impacts. Carcinogenic health impacts are typically represented as the estimated excess lifetime cancer risk. SJVAPCD considers an excess cancer risk of 10 in a million or greater to be significant. Non-carcinogenic health impacts are measured as a hazard index. SJVAPCD considers a hazard index of 1 or greater to be significant (SJVAPCD 2012).

7.1 Exposure

The exposure parameters used for estimating excess lifetime cancer risks and chronic non-cancer Hazard Index (HI) for all potentially exposed populations were obtained using risk assessment guidelines from OEHHA, unless otherwise noted, and are presented in Table 7.

The inhalation dose is a function of the concentration of a chemical and the intake of that chemical. The dose can be calculated as follows:

$$Dose = \frac{Conc * TAF * DBR * ET * EF * ED * CF}{AT}$$

Where:

Dose	=	Dose of chemical (mg/kg-day)
Conc	=	Chemical concentration in air (μg/m^3)
TAF	=	Time Adjustment Factor[7] (unitless)
DBR	=	Daily Breathing Rate (L/kg-day)
ET	=	Exposure Time (hours/day)
EF	=	Exposure Frequency (days/year)
ED	=	Exposure Duration (years)
CF	=	Conversion Factor (m^3/L and mg/μg)
AT	=	Averaging Time (days)

7.2 Toxicity Assessment

The toxicity assessment characterizes the relationship between the magnitude of exposure and the nature and magnitude of adverse health effects that may result from such exposure. Toxicity values are used in conjunction with the calculated exposures to estimate the likelihood of adverse effects occurring. These adverse health effects are classified into two broad categories: cancer and non-cancer endpoints. This section presents the toxicity assessments for diesel particulate matter (DPM) and concrete batch plant fugitive dust.

Diesel exhaust, a complex mixture that includes hundreds of individual constituents, is identified by the State as a known carcinogen. Consistent with California regulatory guidelines, this Health Risk Assessment (HRA) used diesel particulate matter (DPM) as a surrogate measure of carcinogen exposure for the mixture of chemicals that make up diesel exhaust as a whole. The toxicity values for DPM are shown in Table 8. Although certain components of DPM may pose acute and chronic non-cancer health risks, cancer risk is typically the driving health impact for DPM (CARB 2003). For this analysis, it is assumed that acute and chronic risks would not be

[7] This adjusts the concentration to account for overlap in time of sources and receptors. This is used for the school and daycare receptors.

substantial compared to potential cancer risks from DPM. Therefore, acute and chronic risks from diesel exhaust were not considered.

The concrete batch plant fugitive dust contains several metals that are classified as having carcinogenic and non-carcinogenic health impacts. These metals include arsenic, beryllium, cadmium, lead, manganese, nickel, selenium and phosphorus. The toxicity values for each of these metals are shown in Table 8. The concrete batch plant emissions of PM and individual pollutants of concern were calculated according to US Environmental Protection Agency's (USEPA) AP-42 Emission Factors for Concrete Batch Plants (USEPA 2006).

Table 8
Toxicity Factors

Pollutant	Cancer Potency Factor	Chronic REL	Acute REL
DPM	1.1	5	
Arsenic	12	0.015	0.2
Beryllium	8.4	0.007	
Cadmium	15	0.02	
Lead	0.042		
Manganese		0.09	0.17
Nickel	0.91	0.014	0.2
Selenium		20	

1. Cancer potency factors were restricted to inhalation risks.

Abbreviations

REL - reference exposure level

Sources

OEHHA. Hot Spots Unit Risk and Cancer Potency Values. Available at: http://oehha.ca.gov/air/hot_spots/2009/AppendixA.pdf

OEHHA. Air Toxicology and Epidemiology. All OEHHA Acute, 8-hour and Chronic Reference Exposure Levels as on February 2012. Available at: http://oehha.ca.gov/air/allrels.html

7.3 Risk Characterization

SJVAPCD generally categorizes potential health impacts from TACs into two groups: carcinogenic (cancer causing) and non-carcinogenic (non-cancer causing) effects. The following sections describe how these risks are characterized and calculated.

7.3.1 Carcinogenic Effects

Excess lifetime cancer risks are estimated as the upper-bound incremental probability that an individual will develop cancer over a lifetime as a direct result of exposure to potential carcinogens. The estimated risk is expressed as a unitless probability. The cancer risk attributed to a chemical is calculated by multiplying the chemical intake or dose at the human exchange boundaries (e.g., lungs) by the chemical-specific cancer potency factor (CPF). Table 9 lists the specific CPFs used in this analysis.

The estimated excess lifetime cancer risk for a resident child, daycare child, and school child were adjusted using the cancer risk adjustment factors (CRAF) recommended by OEHHA (OEHHA 2009). This approach accounts for an "anticipated special sensitivity to carcinogens" of infants and children. Cancer risk estimates are weighted by a factor of 10 for exposures that occur from the third trimester of pregnancy to two years of age and by a factor of three for exposures that occur from two years through 15 years of age. No weighting factor (i.e., a CRAF of one, which is equivalent to no adjustment) is applied to ages 16 to 70 years.

The equation used to calculate the potential excess lifetime cancer risk for the inhalation pathway is as follows:

$$Risk_i = Dose * CPF_i * CRAF$$

Where:

$Risk_i$	=	Cancer Risk; the incremental probability of an individual developing cancer as a result of inhalation exposure to a particular potential carcinogen (unitless)
Dose	=	Dose of chemical (mg/kg-day)
CPF_i	=	Cancer Potency Factor for Chemical i (mg chemical/kg body weight-day)$^{-1}$
CRAF	=	Cancer Risk Adjustment Factor (unitless)

Table 9
Exposure Factors

Population	Age	TAF	DBR (L/kg-day)	ET	EF (days)	ED	CF	AT (days)	CRAF
Resident Child	0	1	658	0.85	350	1	0.000001	25,550	10
Resident Child	1	1	658	0.85	350	1	0.000001	25,550	10
Resident Child	2	1	535	0.72	350	1	0.000001	25,550	3
Resident Child	3	1	535	0.72	350	1	0.000001	25,550	3
Resident Child	4	1	535	0.72	350	1	0.000001	25,550	3
School Child	0	4.2	452	1	180	1	0.000001	25,550	3
School Child	1	4.2	452	1	180	1	0.000001	25,550	3
School Child	2	4.2	452	1	180	1	0.000001	25,550	3
School Child	3	4.2	452	1	180	1	0.000001	25,550	3
School Child	4	4.2	452	1	180	1	0.000001	25,550	3

Notes
1. The time adjustment factor (TAF) is used to adjust the modeled concentration to account for overlap in time of construction emissions and school exposure. This is an adjustment from 24 hours to 8 hours and from seven days a week to five days a week. This is consistent with OEHHA guidance.
2. The mean daily breathing rate (DBR) was used based on recommendations from OEHHA 2012.
3. The exposure time (ET) accounts for the fraction of time an individual is at the location based on recommendations from OEHHA 2012.
4. The exposure frequency (EF) accounts for the number of days of exposure per year.
5. The exposure duration (ED) accounts for the amount of time in years an individual is at the location based on recommendations from OEHHA.
6. The averaging time (AT) is based on a seventy-year exposure.
7. Cancer risk adjustment factors (CRAF) are included to adjust the cancer potency factor for early age exposure based on recommendations from OEHHA 2009.

Table 9
Exposure Factors

Population	Age	TAF	DBR (L/kg-day)	ET	EF (days)	ED	CF	AT (days)	CRAF
Abbreviations: AT – Averaging Time CF – Conversion Factor CRAF – Cancer Risk Adjustment Factor DBR – Daily Breathing Rate ED – Exposure Duration EF – Exposure Frequency ET – Exposure Time kg – kilograms L – liters OEHHA – Office of Environmental Health Hazard Assessment Sources: OEHHA. 2009. Technical Support Document for Cancer Potency Factors: Methodologies for derivation, listing of available values and adjustments to allow for early life stage exposures. May. OEHHA. 2012. Air Toxics Hot Spots Program Risk Assessment Guidelines Technical Support Document for Exposure Assessment and Stochastic Analysis. August.									

7.3.2 Non-Carcinogenic Effects

The potential for exposure to result in chronic non-cancer effects is evaluated by comparing the estimated annual average air concentration (which is equivalent to the average daily air concentration) to the chemical-specific non-cancer chronic reference exposure levels (RELs). When calculated for a single chemical, the comparison yields a ratio termed a hazard quotient (HQ). To evaluate the potential for adverse chronic non-cancer health effects from simultaneous exposure to multiple chemicals, the HQs for all chemicals are summed, yielding a Hazard Index (HI). Conservatively, Hazard Indices are the sum of individual hazard quotients, regardless of organ system. Table 8 lists the specific RELs used in this analysis.

The equations used to calculate the chemical-specific HQs and the overall HI are:

$$Chronic\ HQ_i = C_i \quad REL_i$$

$$Chronic\ HI = \quad HQ_i$$

Where:

Chronic HQ_i	=	Chronic Hazard Quotient for $Chemical_i$ (unitless)
Chronic HI	=	Hazard Index (unitless)
Ci	=	Annual Average Air Concentration for $Chemical_i$ (µg/m^3)
REL_i	=	Chronic Non-cancer Reference Exposure Level for $Chemical_i$ (µg/m^3)

7.4 Health Risk Assessment Results

For cancer impacts a threshold of 10 excess cancers in a million is used. For chronic and acute HI a threshold of 1.0 is used. Tables 9 and 10 show the values at the maximally exposed individual (MEI) sensitive receptor location modeled for each work area.

Table 10
Diesel Particulate Matter Excess Cancer Risk Associated with Construction Emissions

Construction Area	Unmitigated Excess Cancer Risk (in a million)	Excess Cancer Risk Threshold (in a million)
Road Crossings	6.34	10
Rail Segment	8.10	
HMF	6.59	
MOWF	9.82	
Fresno Station	2.94	
Bakersfield Station	9.45	
Kings-Tulare Station	9.16	

Notes

1. Construction emissions were provided by Parsons' Brinckerhoff and are consistent with the mass emissions reported in the Air Quality Technical Report (Authority and FRA 2014).

2. Risk was estimated based on the projected ambient air concentrations estimated from air dispersion modeling along with exposure factors and cancer potency factors.

Table 11
Health Impacts Associated with Concrete Batch Plants

Chemical	Cancer Risk (in a million)	Chronic HQ	Acute HQ
Nickel	0.01	0.006	0.015
Arsenic	0.12	0.004	0.01
Cadmium	0.07	0.001	N/A
Beryllium	0.002	0.0002	N/A
Lead	0.0001	N/A	N/A
Manganese	N/A	0.006	0.12
Selenium	N/A	0.0000001	
Total	0.20	0.02	0.14

1. Conservatively, Hazard Indices (HI) are the sum of individual hazard quotients (HQ) regardless of organ system.

2. Cancer Risk represents the incremental increase in the number of cancers in a population of one million. Only inhalation risks were quantified.

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8.0 Conclusions

The HST Fresno to Bakersfield portion was evaluated to determine whether the emissions associated with construction would result in localized adverse air quality impacts. These impacts were assessed by evaluating the increased pollutant concentrations as well as conducting a health risk assessment. This evaluation used prototypical work areas to allocate emissions and model the air dispersion of emissions from construction activities. After appropriate mitigation, the analysis shows that there would not be significant localized air quality impacts from increased ambient air concentrations or from excess health risks.

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9.0 References

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