Appendix F Air Quality Calculations and Summary Tables

Table F-1

Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards		Federal Standards[1]	
		ppmv	µg/m^3	ppmv	µg/m^3
Ozone (O_3)	1-hour	0.09	177	--	--
	8-hour	0.07	137	0.075	147
Nitrogen Dioxide (NO_2)	1-hour	0.18	338	--	--
	Annual	0.03	56	0.053	100
Sulfur Dioxide (SO_2)	1-hour	0.25	655	--	--
	3-hour (secondary)	--	--	0.50	1,309
	24-hour	0.04	105	0.14	367
	Annual	--	--	0.03	79
Carbon Monoxide (CO)	1-hour	20	22,898	35	40,071
	8-hour	9	10,304	9	10,304
Particulates (PM_{10})	24-hour	--	50	--	150
	Annual	--	20	--	--
Particulates ($PM_{2.5}$)	24-hour	--	--	--	35
	Annual	--	12	--	15
Lead (Pb)	30-day	--	1.5	--	--
	Rolling 90-day	--	--	--	0.15
	Quarterly	--	--	--	1.5
Sulfates (SO_4)	24-hour	--	25	--	--
Hydrogen Sulfide (H_2S)	1-hour	0.03	42	--	--
Vinyl Chloride (C_2H_3Cl)	24-hour	0.01	26	--	--
Visibility Reducing Particles	8-hour	Extinction coefficient of 0.23 per km; visibility of 10 miles or more due to particles when relative humidity is less than 70%.		--	--

Notes:

[1] Commonly known as the National Ambient Air Quality Standards (NAAQS)

ppmv = parts per million by volume; µg/m^3 = micrograms per cubic meter; -- = not applicable

For gases, µg/m^3 is calculated from ppmv based on pollutant molecular weight and standard conditions (Standard Temperature = 25 °C [77 °F]; Standard Molar Volume = 24.465 liter/g-mole)

Sources: CARB 2010, USEPA 2010

Table F-2

Attainment Status Summary - San Diego County

Criteria Pollutant	Federal Designation	State Designation
Ozone (O_3) (1-hour)	Attainment[1]	Nonattainment
Ozone (O_3) (8-hour)	Nonattainment[2]	Nonattainment
Nitrogen Dioxide (NO_2)	Attainment	Attainment
Sulfur Dioxide (SO_2)	Attainment	Attainment
Carbon Monoxide (CO)	Attainment	Attainment
Particulates (PM_{10})	Unclassified[3]	Nonattainment
Particulates ($PM_{2.5}$)	Attainment	Nonattainment
Lead (Pb)	Attainment	Attainment
Sulfates (as SO_4)	(no federal standard)	Attainment
Hydrogen Sulfide (H2S)	(no federal standard)	Unclassified
Vinyl Chloride (C_2H_3Cl)	(no federal standard)	Unclassified
Visibility	(no federal standard)	Unclassified

Notes:

[1] The federal 1-hour standard of 0.12 ppmv was in effect from 1979 through June 15, 2005. The revoked standard is referenced here because it was employed for such a long period and because this benchmark is addressed in the SIP (per SDAPCD).

[2] The 0.08 ppmv federal 8-hour ozone standard applied until May 27, 2008; after that the standard was changed to 0.075 ppmv.

[3] At the time of designation, if the available data does not support a designation of attainment or nonattainment, the area is designated as unclassified.

Source: SDAPCD 2008

Table F-3

Ambient Air Quality in Project Vicinity - Regional Maxima and Averages[1]

Pollutant	Period	Units	2008	2007	2006	2005	2004
Ozone (O_3)[2]	1-hour max	ppmv	0.140	0.130	0.120	0.110	0.110
	8-hour max	ppmv	0.110	0.090	0.100	0.090	0.090
Nitrogen Dioxide (NO_2)	1-hour max	ppmv	0.047	0.057	0.057	0.061	0.063
	Annual avg	ppmv	0.008	0.010	0.010	0.011	0.011
Sulfur Dioxide (SO_2)	24-hour max	ppmv	0.004	0.004	0.006	0.005	0.015
	Annual avg	ppmv	0.002	0.003	0.003	0.003	0.003
Carbon Monoxide (CO)	1-hour max	ppmv	5.6	5.2	5.7	5.9	5.3
	8-hour max	ppmv	2.8	3.2	3.6	3.1	3.6
Particulates (PM_{10})	24-hour max	$\mu g/m^3$	40	48	47	48	55
	Annual avg	$\mu g/m^3$	27	26	27	28	30
Particulates ($PM_{2.5}$)	24-hour max	$\mu g/m^3$	31	43	38	41	44
	Annual avg	$\mu g/m^3$	13	12	11	11	13

Notes:

[1] Data are reported for the nearest air quality monitoring station that measures each pollutant, as follows:
O_3 and NO_2 – Alpine Monitoring Station (40 miles (64 km) northwest of the corridors)
SO_2 – Chula Vista Monitoring Station (55 miles (88 km) west-northwest of the corridors)
CO – Escondido Monitoring Station (65 miles (105 km) northwest of the corridors)
PM_{10} and $PM_{2.5}$ – El Cajon Monitoring Station (49 miles (79 km) west-northwest of the corridors)

[2] The 0.08 ppmv federal 8-hour ozone standard applied until May 27, 2008; 0.075 ppmv thereafter.

Source: SDAPCD 2010

Table F-4

Ambient Air Quality in Project Vicinity - Compliance History[1]

Pollutant	Period	Criteria	2008	2007	2006	2005	2004
Ozone (O_3)[2]	1-hour	State	Exceed	Exceed	Exceed	Exceed	Exceed
		days	13	17	21	13	5
	8-hour	Federal	Exceed	Exceed	Exceed	Exceed	Exceed
		days	10	6	14	5	2
Nitrogen Dioxide (NO_2)	1-hour	State	Meet	Meet	Meet	Meet	Meet
	Annual	State	Meet	Meet	Meet	Meet	Meet
Sulfur Dioxide (SO_2)	24-hour	State	Meet	Meet	Meet	Meet	Meet
	Annual	Federal	Meet	Meet	Meet	Meet	Meet
Carbon Monoxide (CO)	1-hour	State	Meet	Meet	Meet	Meet	Meet
	8-hour	State	Meet	Meet	Meet	Meet	Meet
Particulates (PM_{10})	24-hour	State	Meet	Meet	Meet	Meet	Exceed
	Annual	State	Exceed	Exceed	Exceed	Exceed	Exceed
Particulates ($PM_{2.5}$)	24-hour	Federal	Meet	Exceed	Exceed	Exceed	Exceed
	Annual	State	Exceed	Meet	Meet	Meet	Exceed

Notes:

[1] Data are reported for the nearest air quality monitoring station that measures each pollutant, as follows:

O_3 and NO_2 – Alpine Monitoring Station (40 miles (64 km) northwest of the corridors)
SO_2 – Chula Vista Monitoring Station (55 miles (88 km) west-northwest of the corridors)
CO – Escondido Monitoring Station (65 miles (105 km) northwest of the corridors)
PM_{10} and $PM_{2.5}$ – El Cajon Monitoring Station (49 miles (79 km) west-northwest of the corridors)

[2] The 0.08 ppmv federal 8-hour ozone standard applied until May 27, 2008; 0.075 ppmv thereafter.

[3] days = number of days standards were exceeded in the year

Source: SDAPCD 2010

Table F-5

Emissions Significance Thresholds

Criteria Pollutant and GHG Emissions	Construction		Operation	
	lb/day	tons/yr	lb/day	tons/yr
Reactive Organic Gases (ROG as CH_4)	75	14	55	n/a
Carbon Monoxide (CO)	550	100	550	n/a
Nitrogen Dioxide (NO_X as NO_2)	250	40	55	n/a
Sulfur Dioxide (SO_X as SO_2)	250	40	150	n/a
Particulates (PM_{10})	100	15	150	n/a
Particulates ($PM_{2.5}$)	55	10	55	n/a
Carbon Dioxide Equivalents (CO_2 eqv)	n/a	7,716	n/a	7,716

Note:

lb/day = pounds per day; tons/yr = tons per year

Sources: SDAPCD 1998; ICAPCD 2007; County of San Diego 2007a; CARB 2008.

Table F-6

Estimated Equipment and Vehicle Use During Construction

Activity	Equipment and Vehicles				Working days	hours per day	Daily		Total
	Type	Category	BHP	quantity			VMT	VKT	VMT
Survey Sites	pickup truck	onroad LD		1	6		50	80	300
Worker Commuting	pickup truck	onroad LD		20	54[1]		1,000	1,609	
Hauling, fill dirt	dump truck, 18 cubic yards	onroad HHD		25	24		1,250	2,012	54,000
Aerial Support	helicopter	aircraft	420	1	3	8			
Marshalling Yards	pickup truck	onroad LD		3	54		150	241	8,100
	water truck	onroad HHD		1	54		50	80	2,700
	tractor truck w/trailer	onroad HHD		1	48		50	80	2,400
	hydraulic crane, 25 ton	offroad	300	1	36	3.33			
	loader, model 980	offroad	300	1	48	3.75			
	forklift, 5 ton	offroad	155	1	48	3.75			
	portable generator	offroad	5	1	48	3.75			
Grading & Road Work	pickup truck	onroad LD		2	12		100	161	1,200
	water truck	onroad HHD		1	12		50	80	600
	bulldozer	offroad	285	1	12	8			
	steamroller	offroad	80	1	12	8			
Foundations	pickup truck	onroad LD		2	12		100	161	1,200
	water truck	onroad HHD		1	12		50	80	600
	concrete truck	onroad HHD		2	12		200	322	2,400
	drill rig	offroad	600	1	12	10			
Steel Assembly & Erection	pickup truck	onroad LD		3	12		150	241	1,800
	water truck	onroad HHD		1	12		50	80	600
	tractor truck w/trailer	onroad HHD		1	12		50	80	600
	crane, 40 ton	offroad	350	1	12	10			
	air compressor	offroad	75	1	12	10			
	portable generator	offroad	5	1	12	10			
Conductor Installation	pickup truck	onroad LD		2	12		100	161	1,200
	water truck	onroad HHD		1	12		50	80	600
	flatbed truck w/reels	onroad MD		1	12		50	80	600
	rigging truck	onroad MD		5	12		250	402	3,000
	dump truck	onroad HHD		1	6		50	80	300
	puller tensioner	offroad	165	1	12	10			
	splice rig	offroad	300	1	6	10			
	portable generator	offroad	5	1	12	10			
Cleanup	pickup truck	onroad LD		2	12		100	161	1,200
Peak Daily and Total Construction Mileage by Vehicle Type									
	Vehicle Type	**Category**							
	Light Duty	onroad LD					1,150		69,000
	Medium Duty	onroad MD					300		3,600
	Heavy Heavy Duty	onroad HHD					1,500		40,800
	Total						2,950		112,400

Notes:

[1] Section 2 (Project Description) indicates that work would be completed over a six-month period; however, the work is expected to occur over a number of sporadic intervals. In no case would a continuous period of work exceed 54 days.

LD = light duty; MD = medium duty; HHD = heavy heavy duty; VMT = vehicle miles traveled; VKT = vehicle kilometers traveled

For on-road vehicles, weight class applies in lieu of BHP rating

BHP = brake horsepower (measure of an engine's output without the loss in power caused by the gearbox, generator, differential, water pump, and other auxiliary components such as alternator, power steering pump, exhaust system, etc.)

Construction activities occur six days per week maximum; Daily operating hours, VMT and VKT are maximum estimates

Source: Sempra 2009, as cited in EDAW 2009b

Table F-7

Estimated Maximum Construction Emissions[1]

Criteria Pollutant Emissions	Peak lb/day	Threshold lb/day	Significant Yes/No	Total tons[2]	Threshold tons[2]	Significant Yes/No
Reactive Organic Gases (ROG as CH_4)	8	75	No	0.18	14	No
Carbon Monoxide (CO)	39	550	No	0.83	100	No
Nitrogen Dioxide (NO_X as NO_2)	80	250	No	1.55	40	No
Sulfur Dioxide (SO_X as SO_2)	0	250	No	0.00	40	No
Combustion Particulates (C-PM_{10})	4	100	No	0.07	15	No
Combustion Particulates (C-$PM_{2.5}$)	3	55	No	0.06	10	No
Fugitive Dust (F-PM_{10})	282	100	Yes	3.82	15	No
Fugitive Dust (F-$PM_{2.5}$)	38	55	No	0.49	10	No

Notes:

[1] Includes dust suppression measures required by the SDAPCD

[2] Entire project

Fugitive dust and combustion particulates are determined exclusively; C = combustion particle, F = fugitive dust

Sources: SCAQMD 2008; USEPA 2006; SDAPCD 1998; ICAPCD 2007; County of San Diego 2007a

Table F-8

Estimated Maximum Construction Greenhouse Gas Emissions

Greenhouse Gas Emissions	Peak lb/day	Total tons[1]	Threshold tons[1]	Significant Yes/No
Carbon Dioxide (GHG - CO_2)	11,890	217	n/a	n/a
Methane (GHG - CH_4)	0.6	0.01	n/a	n/a
Nitrous Oxide (GHG - N_2O)	0.4	0.01	n/a	n/a
Carbon Dioxide Equivalents (CO_2 eqv)[2]	11,993	220	7,716	No

Notes:

[1] Entire project

[2] Carbon dioxide equivalents (CO_2 eqv) are calculated by summing the products of mass GHG emissions by species times their respective GWP coefficients.

Sources: SCAQMD 2008; USEPA 2009; CARB 2008

Table F-9

Estimated Vehicle Use for Wind Turbine Trucking

Point of Origin	Category	Truckloads per System	Days per Shipment	Number of Shipments	Daily VMT	Daily VKT	Total VMT	Total VKT
San Diego	onroad HHD	15	1	52	600	966	31,200	50,212
Houston	onroad HHD	15	6	52	7,500	12,070	2,340,000	3,765,865
Midwest[1]	onroad HHD	15	8	52	7,500	12,070	3,120,000	5,021,153

Notes:

[1] As estimated from major cities in the Midwest (e.g., Chicago, Minneapolis) to the Otay Mesa border crossing

HHD = heavy heavy duty; VMT = vehicle miles traveled; VKT = vehicle kilometers traveled

Daily VMT and VKT are maximum estimates

Source: Sempra 2009, as cited in EDAW 2009b

Table F-10

Estimated Wind Turbine Trucking Greenhouse Gas Emissions

Greenhouse Gas Emissions	via San Diego		via Houston		via Midwest	
	Peak	Total	Peak	Total	Peak	Total
	lb/day	tons[1]	lb/day	tons[1]	lb/day	tons[1]
Carbon Dioxide (GHG - CO_2)	2,532	66	31,653	4,938	31,653	6,584
Methane (GHG - CH_4)	0.1	0.00	1.0	0.15	1.0	0.20
Nitrous Oxide (GHG - N_2O)	0.1	0.00	0.9	0.14	0.9	0.19
Carbon Dioxide Equivalents (CO_2 eqv)[2]	2,557	66	31,956	4,985	31,956	6,647

Notes:

[1] Entire project

[2] Carbon dioxide equivalents (CO_2 eqv) are calculated by summing the products of mass GHG emissions by species times their respective GWP coefficients.

Sources: SCAQMD 2008; USEPA 2009

Table F-11

South Coast Air Quality Management District Emission Factors[1]

Activity	Equipment and Vehicles			ROG	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O
	Type	Category	BHP	lb/unit[2]	lb/unit[2]	lb/unit[2]	lb/unit[2]	lb/unit[2,3]	lb/unit[2,3]	lb/unit[2]	lb/unit[2]	lb/unit[2,4]
Survey Sites	pickup truck	onroad LD		0.00085	0.00826	0.00084	0.00001	0.00009	0.00006	1.10	0.00008	0.00003
Worker Commuting	pickup truck	onroad LD		0.00085	0.00826	0.00084	0.00001	0.00009	0.00006	1.10	0.00008	0.00003
Hauling, fill dirt	dump truck, 18 cy	onroad HHD		0.00280	0.01112	0.03456	0.00004	0.00166	0.00144	4.22	0.00013	0.00012
Aerial Support	helicopter	aircraft	420	0.20155	0.60611	2.09084	0.00226	0.07121	0.06551	223.87	0.01819	0.00808
Marshalling Yards	pickup truck	onroad LD		0.00085	0.00826	0.00084	0.00001	0.00009	0.00006	1.10	0.00008	0.00003
	water truck	onroad HHD		0.00280	0.01112	0.03456	0.00004	0.00166	0.00144	4.22	0.00013	0.00012
	tractor truck w/trailer	onroad HHD		0.00280	0.01112	0.03456	0.00004	0.00166	0.00144	4.22	0.00013	0.00012
	hydraulic crane, 25 ton	offroad	300	0.12818	0.38484	1.25163	0.00136	0.04679	0.04305	125.75	0.01157	0.00514
	loader, model 980	offroad	300	0.15390	0.46433	1.53790	0.00181	0.05581	0.05135	166.58	0.01389	0.00617
	forklift, 5 ton	offroad	155	0.06313	0.29091	0.44339	0.00053	0.03125	0.02875	47.03	0.00570	0.00253
	portable generator	offroad	5	0.00548	0.02375	0.03700	0.00005	0.00217	0.00199	3.40	0.00049	0.00022
Grading & Road Work	pickup truck	onroad LD		0.00085	0.00826	0.00084	0.00001	0.00009	0.00006	1.10	0.00008	0.00003
	water truck	onroad HHD		0.00280	0.01112	0.03456	0.00004	0.00166	0.00144	4.22	0.00013	0.00012
	bulldozer	offroad	285	0.20665	0.62495	1.92350	0.00196	0.07658	0.07046	179.17	0.01865	0.00829
	steamroller	offroad	80	0.12371	0.38394	0.47914	0.00055	0.03628	0.03337	45.70	0.01116	0.00496
Foundations	pickup truck	onroad LD		0.00085	0.00826	0.00084	0.00001	0.00009	0.00006	1.10	0.00008	0.00003
	water truck	onroad HHD		0.00280	0.01112	0.03456	0.00004	0.00166	0.00144	4.22	0.00013	0.00012
	concrete truck	onroad HHD		0.00280	0.01112	0.03456	0.00004	0.00166	0.00144	4.22	0.00013	0.00012
	drill rig	offroad	600	0.21104	0.78140	2.67080	0.00431	0.07919	0.07286	434.70	0.01904	0.00846
Steel Assembly & Erection	pickup truck	onroad LD		0.00085	0.00826	0.00084	0.00001	0.00009	0.00006	1.10	0.00008	0.00003
	water truck	onroad HHD		0.00280	0.01112	0.03456	0.00004	0.00166	0.00144	4.22	0.00013	0.00012
	tractor truck w/trailer	onroad HHD		0.00280	0.01112	0.03456	0.00004	0.00166	0.00144	4.22	0.00013	0.00012
	crane, 40 ton	offroad	350	0.14638	0.45651	1.42892	0.00155	0.05345	0.04918	145.45	0.01321	0.00587
	air compressor	offroad	75	0.10444	0.29475	0.35383	0.00038	0.03496	0.03217	31.09	0.00942	0.00419
	portable generator	offroad	5	0.00548	0.02375	0.03700	0.00005	0.00217	0.00199	3.40	0.00049	0.00022

Table F-11

South Coast Air Quality Management District Emission Factors[1]

Activity	Equipment and Vehicles			ROG	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O
	Type	Category	BHP	lb/unit[2]	lb/unit[2]	lb/unit[2]	lb/unit[2]	lb/unit[2,3]	lb/unit[2,3]	lb/unit[2]	lb/unit[2]	lb/unit[2,4]
Conductor Installation	pickup truck	onroad LD		0.00085	0.00826	0.00084	0.00001	0.00009	0.00006	1.10	0.00008	0.00003
	water truck	onroad HHD		0.00280	0.01112	0.03456	0.00004	0.00166	0.00144	4.22	0.00013	0.00012
	flatbed truck w/reels	onroad MD		0.00242	0.01693	0.01893	0.00003	0.00070	0.00060	2.75	0.00012	0.00018
	rigging truck	onroad MD		0.00242	0.01693	0.01893	0.00003	0.00070	0.00060	2.75	0.00012	0.00018
	dump truck	onroad HHD		0.00280	0.01112	0.03456	0.00004	0.00166	0.00144	4.22	0.00013	0.00012
	puller tensioner	offroad	165	0.14251	0.55713	1.01760	0.00102	0.06659	0.06127	89.77	0.01286	0.00572
	splice rig	offroad	300	0.15156	0.42067	1.60242	0.00174	0.05329	0.04903	161.55	0.01367	0.00608
	portable generator	offroad	5	0.00548	0.02375	0.03700	0.00005	0.00217	0.00199	3.40	0.00049	0.00022
Cleanup	pickup truck	onroad LD		0.00085	0.00826	0.00084	0.00001	0.00009	0.00006	1.10	0.00008	0.00003
Turbine Trucking, San Diego	tractor truck w/trailer	onroad HHD		0.00280	0.01112	0.03456	0.00004	0.00166	0.00144	4.22	0.00013	0.00012
Turbine Trucking, Houston	tractor truck w/trailer	onroad HHD		0.00280	0.01112	0.03456	0.00004	0.00166	0.00144	4.22	0.00013	0.00012
Turbine Trucking, Midwest	tractor truck w/trailer	onroad HHD		0.00280	0.01112	0.03456	0.00004	0.00166	0.00144	4.22	0.00013	0.00012

Notes:

[1] Emission factors weighted for calendar year 2011 (SCAQMD 2008)

[2] Units are operating hours for offroad engines, vehicle miles traveled (VMT) for onroad vehicles

[3] Offroad diesel exhaust $PM_{2.5}$ = 92% of PM_{10} ; Onroad HHD particulate emission factors include allowances for tire and brake wear (SCAQMD 2008)

[4] Onroad N_2O emissions are based on Annex 3, Table A-99; Offroad N_2O emissions are based on Annex 3, Table A-101 (EPA 2009)

Table F-12

Estimated Daily Project Emissions[1]

Activity	Equipment and Vehicles[2]				ROG	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2 eqv
	Type	Category	hrs	VMT	lbs	lbs	lbs	lbs	lbs[3]	lbs[3]	lbs	lbs	lbs[4]	lbs[5]
Survey Sites	pickup truck	onroad LD		50	0.0	0.4	0.0	0.0	0.0	0.0	55.1	0.0	0.0	56
Worker Commuting	pickup truck	onroad LD		1,000	0.9	8.3	0.8	0.0	0.1	0.1	1,102.4	0.1	0.0	1,114
Hauling, fill dirt	dump truck, 18 cy	onroad HHD		1,250	3.5	13.9	43.2	0.0	2.1	1.8	5,275.6	0.2	0.2	5,326
Aerial Support	helicopter	aircraft	8		1.6	4.8	16.7	0.0	0.6	0.5	1,790.9	0.1	0.1	1,814
Marshalling Yards	pickup truck	onroad LD		150	0.1	1.2	0.1	0.0	0.0	0.0	165.4	0.0	0.0	167
	water truck	onroad HHD		50	0.1	0.6	1.7	0.0	0.1	0.1	211.0	0.0	0.0	213
	tractor truck w/trailer	onroad HHD		50	0.1	0.6	1.7	0.0	0.1	0.1	211.0	0.0	0.0	213
	hydraulic crane, 25 ton	offroad	3.33		0.4	1.3	4.2	0.0	0.2	0.1	419.2	0.0	0.0	425
	loader, model 980	offroad	3.75		0.6	1.7	5.8	0.0	0.2	0.2	624.7	0.1	0.0	633
	forklift, 5 ton	offroad	3.75		0.2	1.1	1.7	0.0	0.1	0.1	176.3	0.0	0.0	180
	portable generator	offroad	3.75		0.0	0.1	0.1	0.0	0.0	0.0	12.8	0.0	0.0	13
Grading & Road Work	pickup truck	onroad LD		100	0.1	0.8	0.1	0.0	0.0	0.0	110.2	0.0	0.0	111
	water truck	onroad HHD		50	0.1	0.6	1.7	0.0	0.1	0.1	211.0	0.0	0.0	213
	bulldozer	offroad	8		1.7	5.0	15.4	0.0	0.6	0.6	1,433.3	0.1	0.1	1,457
	steamroller	offroad	8		1.0	3.1	3.8	0.0	0.3	0.3	365.6	0.1	0.0	380
Foundations	pickup truck	onroad LD		100	0.1	0.8	0.1	0.0	0.0	0.0	110.2	0.0	0.0	111
	water truck	onroad HHD		50	0.1	0.6	1.7	0.0	0.1	0.1	211.0	0.0	0.0	213
	concrete truck	onroad HHD		200	0.6	2.2	6.9	0.0	0.3	0.3	844.1	0.0	0.0	852
	drill rig	offroad	10		2.1	7.8	26.7	0.0	0.8	0.7	4,347.0	0.2	0.1	4,377
Steel Assembly & Erection	pickup truck	onroad LD		150	0.1	1.2	0.1	0.0	0.0	0.0	165.4	0.0	0.0	167
	water truck	onroad HHD		50	0.1	0.6	1.7	0.0	0.1	0.1	211.0	0.0	0.0	213
	tractor truck w/trailer	onroad HHD		50	0.1	0.6	1.7	0.0	0.1	0.1	211.0	0.0	0.0	213
	crane, 40 ton	offroad	10		1.5	4.6	14.3	0.0	0.5	0.5	1,454.5	0.1	0.1	1,475
	air compressor	offroad	10		1.0	2.9	3.5	0.0	0.3	0.3	310.9	0.1	0.0	326
	portable generator	offroad	10		0.1	0.2	0.4	0.0	0.0	0.0	34.0	0.0	0.0	35
Conductor Installation	pickup truck	onroad LD		100	0.1	0.8	0.1	0.0	0.0	0.0	110.2	0.0	0.0	111
	water truck	onroad HHD		50	0.1	0.6	1.7	0.0	0.1	0.1	211.0	0.0	0.0	213

Table F-12
Estimated Daily Project Emissions[1]

Activity	Equipment and Vehicles[2]				ROG	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2 eqv
	Type	Category	hrs	VMT	lbs	lbs	lbs	lbs	lbs[3]	lbs[3]	lbs	lbs	lbs[4]	lbs[5]
	flatbed truck w/reels	onroad MD		50	0.1	0.8	0.9	0.0	0.0	0.0	137.6	0.0	0.0	141
	rigging truck	onroad MD		250	0.6	4.2	4.7	0.0	0.2	0.1	688.0	0.0	0.0	703
	dump truck	onroad HHD		50	0.1	0.6	1.7	0.0	0.1	0.1	211.0	0.0	0.0	213
	puller tensioner	offroad	10		1.4	5.6	10.2	0.0	0.7	0.6	897.7	0.1	0.1	918
	splice rig	offroad	10		1.5	4.2	16.0	0.0	0.5	0.5	1,615.5	0.1	0.1	1,637
	portable generator	offroad	10		0.1	0.2	0.4	0.0	0.0	0.0	34.0	0.0	0.0	35
	pickup truck	onroad LD		100	0.1	0.8	0.1	0.0	0.0	0.0	110.2	0.0	0.0	111
Total Daily Emissions by Activity														
Survey Sites					0.04	0.41	0.04	0.00	0.00	0.00	55	0.00	0.00	56
Worker Commuting					0.85	8.26	0.84	0.01	0.09	0.06	1,102	0.08	0.03	1,114
Hauling, fill dirt					3.49	13.91	43.20	0.05	2.08	1.81	5,276	0.16	0.15	5,326
Aerial Support					1.61	4.85	16.73	0.02	0.57	0.52	1,791	0.15	0.06	1,814
Marshalling Yards					1.67	6.56	15.32	0.02	0.67	0.60	1,820	0.14	0.07	1,844
Grading & Road Work					2.87	9.45	21.03	0.02	0.99	0.91	2,120	0.25	0.12	2,161
Foundations					2.89	11.42	35.43	0.05	1.22	1.10	5,512	0.23	0.12	5,554
Steel Assembly & Erection					2.97	10.10	21.78	0.03	1.09	0.99	2,387	0.26	0.12	2,429
Conductor Installation					4.09	17.03	35.79	0.04	1.61	1.45	3,905	0.33	0.19	3,971
Cleanup					0.09	0.83	0.08	0.00	0.01	0.01	110	0.01	0.00	111
Maximum Single Activity Emissions, lb/day					**4.09**	**17.03**	**35.79**	**0.05**	**1.61**	**1.45**	**5,512**	**0.33**	**0.19**	**5,554**
Peak Daily Construction Emissions, lb/day[6]					**8.43**	**39.20**	**79.83**	**0.11**	**3.77**	**3.31**	**11,890**	**0.56**	**0.37**	**11,993**

Notes:

[1] Emission weighted for calendar year 2011 (SCAQMD 2008)

[2] Units are operating hours for offroad engines, vehicle miles traveled (VMT) for onroad vehicles

[3] Offroad diesel exhaust $PM_{2.5}$ = 92% of PM_{10} ; Onroad HHD particulate emission factors include allowances for tire and brake wear (SCAQMD 2008)

[4] Onroad N_2O emissions are based on Annex 3, Table A-99; Offroad N_2O emissions are based on Annex 3, Table A-101 (USEPA 2009)

[5] Carbon dioxide equivalents (CO_2 eqv) are calculated by summing the products of mass GHG emissions by species times their respective GWP coefficients (USEPA 2009)

[6] Peak daily construction emissions include worker commuting, fill dirt hauling, plus maximum single activity; excludes wind turbine trucking emissions

Table F-13

Estimated Total Project Emissions[1]

Activity	Equipment and Vehicles[2]				ROG	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2 eqv
	Type	Category	hrs	VMT	lbs	lbs	lbs	lbs	lbs[3]	lbs[3]	lbs	lbs	lbs[4]	lbs[5]
Survey Sites	pickup truck	onroad LD		300	0.3	2.5	0.3	0.0	0.0	0.0	330.7	0.0	0.0	334
Worker Commuting	pickup truck	onroad LD		54,000	46.0	446.2	45.6	0.6	4.8	3.1	59,527.0	4.1	1.7	60,134
Hauling, fill dirt	dump truck, 18 cy	onroad HHD		30,000	83.9	333.7	1,036.7	1.2	49.8	43.3	126,613.7	3.9	3.6	127,825
	tractor truck w/trailer	onroad HHD		31,200	87.2	347.1	1,078.2	1.2	51.8	45.1	131,678.3	4.0	3.8	132,938
	tractor truck w/trailer	onroad HHD		2,340,000	6,541.3	26,031.6	80,865.9	92.9	3,886.4	3,381.0	9,875,868.9	302.1	284.3	9,970,351
	tractor truck w/trailer	onroad HHD		3,120,000	8,721.7	34,708.8	107,821.3	123.9	5,181.9	4,508.0	13,167,825.2	402.8	379.1	13,293,801
Aerial Support	helicopter	aircraft	24		4.8	14.5	50.2	0.1	1.7	1.6	5,372.8	0.4	0.2	5,442
Marshalling Yards	pickup truck	onroad LD		8,100	6.9	66.9	6.8	0.1	0.7	0.5	8,929.0	0.6	0.3	9,020
	water truck	onroad HHD		2,700	7.5	30.0	93.3	0.1	4.5	3.9	11,395.2	0.3	0.3	11,504
	tractor truck w/trailer	onroad HHD		2,400	6.7	26.7	82.9	0.1	4.0	3.5	10,129.1	0.3	0.3	10,226
	hydraulic crane, 25 ton	offroad	120		15.4	46.2	150.2	0.2	5.6	5.2	15,089.7	1.4	0.6	15,310
	loader, model 980	offroad	180		27.7	83.6	276.8	0.3	10.0	9.2	29,984.9	2.5	1.1	30,382
	forklift, 5 ton	offroad	180		11.4	52.4	79.8	0.1	5.6	5.2	8,464.6	1.0	0.5	8,627
	portable generator	offroad	180		1.0	4.3	6.7	0.0	0.4	0.4	612.5	0.1	0.0	627
Grading & Road Work	pickup truck	onroad LD		1,200	1.0	9.9	1.0	0.0	0.1	0.1	1,322.8	0.1	0.0	1,336
	water truck	onroad HHD		600	1.7	6.7	20.7	0.0	1.0	0.9	2,532.3	0.1	0.1	2,557
	bulldozer	offroad	96		19.8	60.0	184.7	0.2	7.4	6.8	17,199.9	1.8	0.8	17,484

Table F-13

Estimated Total Project Emissions[1]

Activity	Equipment and Vehicles[2]				ROG	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2 eqv
	Type	Category	hrs	VMT	lbs	lbs	lbs	lbs	lbs[3]	lbs[3]	lbs	lbs	lbs[4]	lbs[5]
	steamroller	offroad	96		11.9	36.9	46.0	0.1	3.5	3.2	4,387.4	1.1	0.5	4,558
Foundations	pickup truck	onroad LD		1,200	1.0	9.9	1.0	0.0	0.1	0.1	1,322.8	0.1	0.0	1,336
	water truck	onroad HHD		600	1.7	6.7	20.7	0.0	1.0	0.9	2,532.3	0.1	0.1	2,557
	concrete truck	onroad HHD		2,400	6.7	26.7	82.9	0.1	4.0	3.5	10,129.1	0.3	0.3	10,226
	drill rig	offroad	120		25.3	93.8	320.5	0.5	9.5	8.7	52,164.4	2.3	1.0	52,527
Steel Assembly & Erection	pickup truck	onroad LD		1,800	1.5	14.9	1.5	0.0	0.2	0.1	1,984.2	0.1	0.1	2,004
	water truck	onroad HHD		600	1.7	6.7	20.7	0.0	1.0	0.9	2,532.3	0.1	0.1	2,557
	tractor truck w/trailer	onroad HHD		600	1.7	6.7	20.7	0.0	1.0	0.9	2,532.3	0.1	0.1	2,557
	crane, 40 ton	offroad	120		17.6	54.8	171.5	0.2	6.4	5.9	17,453.6	1.6	0.7	17,705
	air compressor	offroad	120		12.5	35.4	42.5	0.0	4.2	3.9	3,730.2	1.1	0.5	3,910
	portable generator	offroad	120		0.7	2.8	4.4	0.0	0.3	0.2	408.3	0.1	0.0	418
Conductor Installation	pickup truck	onroad LD		1,200	1.0	9.9	1.0	0.0	0.1	0.1	1,322.8	0.1	0.0	1,336
	water truck	onroad HHD		600	1.7	6.7	20.7	0.0	1.0	0.9	2,532.3	0.1	0.1	2,557
	flatbed truck w/reels	onroad MD		600	1.5	10.2	11.4	0.0	0.4	0.4	1,651.1	0.1	0.1	1,686
	rigging truck	onroad MD		3,000	7.3	50.8	56.8	0.1	2.1	1.8	8,255.4	0.3	0.5	8,431
	dump truck	onroad HHD		300	0.8	3.3	10.4	0.0	0.5	0.4	1,266.1	0.0	0.0	1,278
	puller tensioner	offroad	120		17.1	66.9	122.1	0.1	8.0	7.4	10,772.3	1.5	0.7	11,017
	splice rig	offroad	60		9.1	25.2	96.1	0.1	3.2	2.9	9,693.0	0.8	0.4	9,823
	portable	offroad	120		0.7	2.8	4.4	0.0	0.3	0.2	408.3	0.1	0.0	418

Table F-13

Estimated Total Project Emissions[1]

Activity	Equipment and Vehicles[2]				ROG	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2 eqv
	Type	Category	hrs	VMT	lbs	lbs	lbs	lbs	lbs[3]	lbs[3]	lbs	lbs	lbs[4]	lbs[5]
	generator													
	pickup truck	onroad LD		1,200	1.0	9.9	1.0	0.0	0.1	0.1	1,322.8	0.1	0.0	1,336
Total Construction Emissions, lbs[6]					**356**	**1,664**	**3,092**	**4**	**142**	**126**	**433,905**	**27**	**15**	**439,046**
Total Construction Emissions, tons[6]					**0.18**	**0.83**	**1.55**	**0.002**	**0.07**	**0.06**	**217**	**0.01**	**0.01**	**220**

Notes:

[1] Emission weighted for calendar year 2011 (SCAQMD 2008)

[2] Units are operating hours for offroad engines, vehicle miles traveled (VMT) for onroad vehicles

[3] Offroad diesel exhaust $PM_{2.5}$ = 92% of PM_{10} ; Onroad HHD particulate emission factors include allowances for tire and brake wear (SCAQMD 2008)

[4] Onroad N_2O emissions are based on Annex 3, Table A-99; Offroad N_2O emissions are based on Annex 3, Table A-101 (EPA 2009)

[5] Carbon dioxide equivalents (CO_2 eqv) are calculated by summing the products of mass GHG emissions by species times their respective GWP coefficients (EPA 2009)[6]

[6] Total construction emissions include worker commuting, fill dirt hauling, plus all activities; excludes wind turbine trucking emissions

Table F-14
Fugitive Dust Estimation Calculations - Earthmoving

Construction Earthmoving	Pk. Daily hours	Project hours	PM_{10} lb/hr	$PM_{2.5}$ lb/hr	PM_{10} lb/day	$PM_{2.5}$ lb/day	PM_{10} lbs	$PM_{2.5}$ lbs
Grading & Road Work								
bulldozer	8	96	1.01126	0.52282	8.09	4.18	97.08	50.19
steamroller	8	96	0.10328	0.00513	0.83	0.04	9.91	0.49
Subtotals					**8.92**	**4.22**	**107.00**	**50.68**
Foundations								
drill rig	10	120	0.00487	0.00074	0.05	0.01	0.58	0.09
Subtotals					**0.05**	**0.01**	**0.58**	**0.09**
Peak Daily Earthmoving Emissions, lbs/day					**8.9**	**4.2**		
Total Earthmoving Emissions, tons							**0.05**	**0.03**

Notes:

Based on USEPA 2006.

AP-42 Section 11.9 for dozing (Table 11.9-1):

$E = 0.75 * (s)^{1.5} / (M)^{1.4}$ for PM_{10}

$E = 0.105 * 5.7 \times (s)^{1.2} / (M)^{1.3}$ for $PM_{2.5}$

E = lb/hr fugitive

s = Silt Content assumed to be 8.5% for construction sites

M = moisture content = 8% (assumes unwatered subsoil)

AP-42 Section 11.9 for grading, rolling, and excavating (Table 11.9-1) :

$E = S * 0.60 * 0.051 \times (S)^{2.0}$ for PM_{10}

$E = S * 0.031 * 0.040 \times (S)^{2.5}$ for $PM_{2.5}$

Simplifies to $E = 0.60 * 0.051 \times (S)^{3.0}$ for PM_{10}

Simplifies to $E = 0.031 * 0.040 \times (S)^{3.5}$ for $PM_{2.5}$

E = lb/VMT * VMT/hr = lb/hr fugitive

S = Mean Vehicle Speed assumed to be 3 mph for graders, 1.5 mph for excavators & rollers

Assumes VMT = S * hours of use

AP-42 Section 13.2.4 Loading/Handling (digger, driller, backhoe, loader):

$E = W * 0.35 * 0.0032 * (U/5)^{1.3} / (M/2)^{1.4}$ for PM_{10}

$E = W * 0.053 * 0.0032 * (U/5)^{1.3} / (M/2)^{1.4}$ for $PM_{2.5}$

E = lb/ton * tons/hr = lb/hr fugitive

U = average wind speed is 7.8 mph for Yuma, AZ (NOAA 2002)

M = moisture content = 8% (assumes unwatered subsoil)

Amount of material moved is assumed to be 120 cy/tower and materials will be dropped twice (2 x 120 = 240 cy/site)

Daily earth movement = 100 cy/day total (12 days/5 towers = 2.4 days/site)

Material is assumed to be 1.7 tons/cy (sp gr = 2) for 170 tons/day total for tower foundations

W = (tons/day) / daily hours = tons/hr

W for tower foundations:		
	120	cy/tower
	2	drop twice
	240	cy/site
	2.4	days/site
	100	cy/day
	1.7	tons/cy
	170	tons/day

Table F-15
Fugitive Dust Estimation Calculations - Road Dust

Construction Road Dust	Pk. Daily VMT	Project VMT	PM_{10} lb/VMT	$PM_{2.5}$ lb/VMT	PM_{10} lb/day	$PM_{2.5}$ lb/day	PM_{10} lbs	$PM_{2.5}$ lbs
All Roads (onsite only totals)								
Light Duty (pickup trucks)	1,150	69,000						
Medium Duty (work trucks)	300	3,600						
Heavy Heavy Duty (tractor/trailers)	1,500	40,800						
Subtotals	**2,950**	**113,400**						
Unpaved Roads								
Light Duty (pickup trucks)	115	6,900	0.11578	0.01158	13	1	760	76
Medium Duty (work trucks)	60	720	0.18002	0.01800	11	1	123	12
Heavy Heavy Duty (tractor/trailers)	300	8,160	0.32632	0.03263	98	10	2,531	253
Subtotals	**475**	**15,780**			**122.0**	**12.2**	**3,414**	**341**
Paved Roads								
Light Duty (pickup trucks)	1,035	62,100	0.00334	0.00021	3	0	205	13
Medium Duty (work trucks)	240	2,880	0.01613	0.00213	4	1	46	6
Heavy Heavy Duty (tractor/trailers)	1,200	32,640	0.12004	0.01772	144	21	3,870	571
Subtotals	**2,475**	**97,620**			**151.4**	**22.0**	**4,121**	**590**
Peak Daily Road Dust Emissions, lbs/day					**273.4**	**34.2**		
Total Road Dust Emissions, tons							**3.77**	**0.47**
Composite Peak Daily Fugitive Dust Emissions, lbs/day					**282.3**	**38.4**		
Composite Total Fugitive Dust Emissions, tons							**3.82**	**0.49**

Notes:

Based on USEPA 2006

Construction emissions include worker commuting, fill dirt hauling, plus activities; excludes wind turbine trucking emissions

Unpaved Road Dust (AP-42 Section 13.2.2):
E = 1.5 *(s/12)0.9 * (W/3)0.45 * PC * (1-CE) for PM10
E = 0.15 *(s/12)0.9 * (W/3)0.45 * PC * (1-CE) for PM2.5
E = lb/VMT fugitive
s = surface silt content = 9% (average for unpaved roads and construction sites, AP-42 Table 13.2.2-1)
W = average vehicle weight (see below)
PC = (365-P)/365
P = Number of wet days over 0.01 in precipitation for averaging period (18 days/year average for Desert)

Note: precipitation correction not used (PC = 1) for worst case day calculations
CE = Control Efficiency for watering = 90% for M between 4 and 5 (AP-42 Figure 13.2.2-2)
Light Duty = 3 tons average
Medium Duty = 8 tons average
Heavy Heavy Duty = 30 tons average (loaded 40 tons, unloaded 20 tons)
Assumes 90% paved mileage, 10% unpaved mileage for LD
Assumes 80% paved mileage, 20% unpaved mileage for MD & HHD
Heavy Heavy Duty includes water trucks

Paved Road Dust (AP-42 Section 13.2.1)
E = [0.016*(sL/2)0.65 *(W/3)1.5 - 0.00047] * PC for PM10
E = [0.0024*(sL/2)0.65 *(W/3)1.5 - 0.00036] * PC for PM2.5
E = lb/VMT fugitive
sL = Silt Loading assumed to be 0.22 g/m2 for average ADT categories from Table 13.2.1-3
W = Average weight of vehicles in tons (below)
C = Correction for exhaust, break wear, tire wear: 0.00047 lb/VMT for PM10, 0.00036 lb/VMT for PM2.5
PC = (1-P/4N)
P = Number of wet days over 0.01 in precipitation for averaging period (18 days/year average for Desert)
N = days of period = 365 days (4N = 1460)

Note: precipitation correction not used (PC = 1) for worst case day calculations
Light Duty = 3 tons average
Medium Duty = 8 tons average
Heavy Heavy Duty = 30 tons average (loaded 40 tons, unloaded 20 tons)
Assumes 90% paved mileage, 10% unpaved mileage for LD
Assumes 80% paved mileage, 20% unpaved mileage for MD & HHD
HHD includes water trucks

Table F-16

Supplemental Activity Calculations - Hauling, Aircraft, and Trucking

Parameter / Description	Value	Units	Reasons & Remarks
Hauling/Dump Trucks (HHD)			
Number of Hauls	600	trips	per ESJ-U.S.
Round Trip (RT) Distance	50	miles	assumption as "typical"
Total Distance	30,000	miles	
Helicopter (aircraft)			
Engine Rating	420	BHP	assume same as similar project elsewhere
Number of Days	3	days	assume same as similar project elsewhere
Daily Hours	8	hours/day	assume same as similar project elsewhere
Total Hours	24	hours	assume same as similar project elsewhere
Wind Turbine Transport (highway trucking)			
Port of San Diego RT	40	miles	to Otay Mesa border crossing RT
	1	day	to Otay Mesa border crossing RT
Port of Houston RT	3,000	miles	to Otay Mesa border crossing RT
	6	days	to Otay Mesa border crossing RT
Midwest City RT	4,000	miles	to Otay Mesa border crossing RT
	8	days	to Otay Mesa border crossing RT
Total System Weight	306	tons	each system
Truckload (HHD)	20	tons	assume 40,000 lbs/load
Truckloads (HHD)	15	trips	each system (rounded)
Installed Capacity	130	MW	from Project Description for Phase 1
Turbine Rating	2.5	MW	from Project Description for Phase 1
Number of Turbines (2.5 MW)	52	systems	from Project Description for Phase 1
Number of Truckloads	780	trips	for all components
via Port of San Diego	**31,200**	miles	Total RT for all systems
	40	miles/day	each day per truckload
	600	miles/day	each day per system
via Port of Houston	**2,340,000**	miles	Total RT for all systems
	500	miles/day	each day per truckload
	7,500	miles/day	each day per system
via Midwest City	**3,120,000**	miles	Total RT for all systems
	500	miles/day	each day per truckload
	7,500	miles/day	each day per system

Notes:

Wind turbine trucking emissions determined separately from (exclusive of) construction activities

"Midwest City" assumed to be either Des Moines, IA; Minneapolis, MN; or Chicago, IL as "typical" (c. 3,000 miles)

Otay Mesa border crossing is approximately 5.4 miles east of the San Ysidro (Tijuana) border crossing

RT = round trip; HHD = heavy heavy duty; BHP = brake horsepower; MW = megawatt

Source: EDAW 2009b

Air Quality Appendix References

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