Appendix C: Air Quality Worksheets

RAP - FORMER KAST PROPERTY

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Appendix C: Air Quality Assessment

Provided by PCR Services Corporation

- Applicant's Proposed Remedy Calculation Files – Average Day
    - Calculation Cover Sheet and Assumptions
    - On-Site Haul Roads – Re-entrained Dust
    - Fugitive Dust Emissions During Soil and Excavation and Handling
    - Dust Emissions during Concrete Breaking
    - On-Site Construction Equipment Emissions
    - On-Site Road Emissions
    - On-Site Road – Re-entrained Dust
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Applicant's Proposed Remedy Calculation Files – Average Day

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Calculation Delivery Cover Sheet

URS Santa Ana Air Quality Group

Date:	*10/10/2014*
Project:	Kast Remediation Project - Option 1 (Hard and Softscape Excavation) ***5 foot with 10 foot Excavation, 4 Houses at a Time, Phase Overlap***
Project number:	*49194119*
Requestor:	*PCR Consulting*
Project manager:	*Roy Patterson*
Air Quality originator:	*Irma Buenrostro*
Air Quality project lead:	*Shirley Pearson*
Air Quality internal reviewer:	*Shirley Pearson*
Date review completed:	*19-Sep-14*
Detail check internal reviewer:	*Irma Buenrostro*
Date review completed:	*10-Oct-14*
Brief description of analysis:	*Calculating emission rates of criteria pollutants and toxic air contaminates during excavating activities at the former Kast property. Calculations will be used to assess air quality impacts in the form of an Environmental Impact Report.*
Reference MXD:	S:\Shirley Pearson\!Kast\10 Oct 2014 Updates
Model used:	*AP-42 equations and assumptions were used.*

Version 10-10-14

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Kast Air Emissions Calculations

I. Project Phasing

				Hours/Task per House									
#	Equipment	Engine Type	HP	Demo	Excavation	SVE Well/Piping Instal	Subslab Vent Install	Backfill/Comp.	Slurry Backfill	Site Resto.	Total Hrs./ House	Houses	Total Hrs.
2	15,000 lbs Excavator	D	60	0	87	0	0	0		0	87	237	20,619
1	Dump Truck	D	450	4	45	0	0	69		0	118	237	27,966
2	Bobcat	D	22	12	87	4	4	69		0	176	237	41,712
1	Bucket Auger	D	65	0	30	0	0	0		0	30	237	7,110
1	6000 Watt Generato	G	10	2	45	1	1	0		2	51	237	12,087
1	Water Pump	G	5	6	45	0	0	69		0	120	237	28,440
1	Chain Saw	G	0.5	2	0	0	0	0		0	2	237	474
1	Small Compactor (W	G	3	0	0	0	0	69		0	69	237	16,353
1	Concrete Mix Truck	D	450	0	0	0	0	0	20	6	26	237	6,162
1	Concrete Pump	D	80	0	0	0	0	0	20	6	26	237	6,162
2	Pickup Truck	G	200										
1	Flatbed Truck	D	350										

	Street Work (Hours/day)					
#	Equipment	Engine Type	HP	Trenching/Pipe Installation	Street Grinding	Street Paving
1	Backhoe	D	350	1		
1	Compressor	G	49	1		
1	Generator	G	10	1		
1	Concrete Saw	D	13	1		
1	Vacuum Excavator	D	155	6		
1	Drill Rig	D	250	6		
1	Cold Plane Grinding I	D	600		6	
1	Dump Truck	D	450		6	
1	Street Sweeper	G	200		6	
1	Paving Machine	D	150			6
1	Super 10 Dump Trucl	D	450			6
1	Steam Roller	D	50			6
1	Street Sweeper	G	200			6
1	Steam Roller	D	50			6
1	Street Sweeper	G	200			6

II. General Assumptions

General Assumptions			
Parameter	**Value**	**Units**	**Reference**
Number of Homes Yards Excavated at a Time	4	Yards	Information provided by project staff
Number of Homes	237	Homes	Information provided by project staff
Hours of Operation	8	Hours	working hours 8AM - 3PM, from project description
Duration (phase overlap)	253	weeks	Information provided by project staff
Days of Operation per Week	5	days	Monday - Friday
Number of Holidays per Year	9	days	Based on URS' holiday schedule
Number of people at houses	15	people	Information provided
Trenching/pipe installation	10	people	Information provided
Air-vac borehole clearance	3	people	Information provided
Drilling and SVE well install	4	people	Information provided
Number of people during street grinding	10	people	Information provided
Number of people during street paving	12	people	Information provided
Worker trips for various reasons	32	trips	Assumed value (e.g., shuttling workers to site, workers going to lunch, mgt. going to and from site)
Mitigation (% Reduction)	84%	%	WARP Fugitive Dust Handbook, September 2006, Table 3-7. Apply water every 1 hour: 74% control per MRI, April 2001, test series 701. Apply dust suppressant: 84% control per CARB April 2002; for actively disturbed areas
U (mean wind speed)	1.88	m/s	Based on mean wind speed met data from the SCAQMD Long Beach Station from 2006 to 2011.
U (mean wind speed)	4.21	mph	Based on mean wind speed met data from the SCAQMD Long Beach Station from 2006 to 2011.
s (silt content) - Overburden	6.9	%	AP-42, Chapter 11.9, Table 11.9-3. Bulldozer Overburden Silt Content.
s (silt content) - Paved road	3.4	%	AP-42, Chapter 13.2.1.1, Table 13.2.1-3
M (material moisture content)	7.9	%	AP-42 Chapter 11.9-9. Table 11.9-3. Overburden default value.
Silt Content Range	0.44-19	%	AP-42, Chapter 13.2.4, Page 4. Assumed range. No adjustments required.

Kast Air Emissions Calculations

Soil Density	3,400	lbs/cy	Information provided by project staff
Density of Asphalt	3,915	lbs/cy	Information provided by project staff
Density of Asphalt	1.95	Tons/cy	Information provided by project staff
Typical Density of Concrete	150	lbs/cf	Information provided by project staff
Typical Density of Concrete	2.01	ton/cy	Information provided by project staff
Max Depth of Excavation at Residential Homes	10	ft	Information provided by project staff
Concrete Removed per House	35	cy	Information provided by project staff. 1,675 SF and 6 inches thick concrete slab.
Concrete Removed per Day during Street Trenching	810	cy	Information provided by project staff. Assumed 100 feet of trench per day, trench would be 5 feet in width and asphalt is 6 inches thick.
Debris Disposal Haul Route Total Length, One Way	30	miles	Google maps, address destination 12017 Greenstone, Santa Fe Springs, CA 90670
Offsite Disposal Route total Length, One Way	100	miles	Google maps, address destination 12328 Hibiscus Rd, Adelanto
Backfill Import Route Total Length, One Way	4	miles	Google maps, address destination 26311 Palos Verdes Dr. East, Rolling Hilles Estates, CA 90274
Concrete Batch Plant Route Total Length, One Way	10	miles	Google maps, address destination 2521 E. Artesia Blvd., Long Beach, CA 90805
Plastic Pipe Company, Chino, CA, One Way	50	miles	Google maps, destination Chino, CA
All American Asphalt, Corona, CA, One Way	50	miles	Google maps, destination Corona, CA
Green Waste Disposal, One Way	5	Miles	Google maps, 321 Francisco Street, Carson, CA
Distance of project within South Coast Air Basin	75	miles	Based on informational maps obtained from CARB and distance estimate from Google maps.
Distance of project activities within Mojave Desert Distance	25	miles	Based on furthest trip outside of SCAB/within MDAB, informational maps obtained from CARB, and distance estimate from Google maps.

Kast Air Emissions Calculations

Average On-Site Haul Route Distance	1,900	feet	Measured distance from the furthest northern and southern homes in the community.
Employee/Worker Trip Distance	21.6	miles	CalEEMod Default Construction Worker Trip (Round Trip)
Passenger Vehicle Trips	9	trips	Visitor trips/traffic adjustment provided by project staff
Street Grinding and Paving Worker trips for various reasons	16	trips	Assumed value (e.g., shuttling workers to site, workers going to lunch, mgt. going to and from site)

III. Cubic Yard and Trip Estimates

Cubic Yard and Trip Estimates during Yard Excavation

Parameter	Option 1 - Hard&Softscape Value	Units
Duration	253	weeks (Phase Overlap)
Work Hours	8	hours
Total Work Days - 8 Homes	42	days
Total Work Days - 237 Homes	1,256	days
Total Work Days in Year	251	days
Total Houses	237	homes
Number of Homes at a time	4	homes
Total Volume Soil - 237 Homes	177,000	cy
Passenger Vehicle Trips	9	trips/day
Demo	11,599	cy
Excavation	177,000	cy
Subslab Vent	0	cy
Backfill/Compact	148,700	cy
Slurry Backfill	28,300	cy
Site Resto.	8,295	cy
Concrete Removed per Home	35	CY
Total Loads -Debris Disposal	971	loads
Total Loads -Debris Disposal (green waste only)	237	loads
Total Loads -Offsite Disposal	12,643	loads
Total Loads -Backfill Import	12,764	loads
Total Loads -Concrete Batch Plant	4,057	loads
Slurry Backfill	1,556	loads
Site Resto.	884	loads
Total Loads -Flatbed Truck	474	loads
Total Loads -Pipe Delivery	40	loads
Demo	12	cy/load
Excavation	14	cy/load
SVE Well/Piping	0	cy/load
Subslab Vent	0	cy/load
Backfill/Compact	12	cy/load
Slurry Backfill	18	cy/load
Site Resto.	0	cy/load

Kast Air Emissions Calculations

Option 1 Phase	Duration to Complete One Home (days)	Phase Duration (days)	Round Trips Hourly	Daily	8 Home Clusters	Annually	Project
Demo - Truck Trips	2	119	1.05	8.4	134	991	991
Green Waste - Truck Trips	1	59	0.50	4.0	32	237	237
Excavation - Truck Trips	15	889	1.86	14.9	1,787	3,530	13,238
SVE Well/Piping - Truck Trips	1	59	0.13	1.1	9	63	63
Subslab Vent - Truck Trips	1	59	0.00	0.0	0	0	0
Backfill/Compact - Truck Trips	12	711	1.99	15.9	1,529	3,776	11,327
Slurry Backfill - Truck Trips	7	415	0.64	5.1	287	1,214	2,124
Site Resto. - Truck Trips	10	593	0.37	3.0	237	702	1,755
Worker Trips	49	1,256	4.00	32	12,544	8,032	40,192
Passenger Vehicle Trips	1	1,256	1.13	9	0	2,259	11,304

Option 1 Phase	Cubic Yard (CY) of Soil/Material Moved Hourly	Daily	8 Home Clusters	Annually	Project
Demo	12	100	1,599	11,840	11,840
Excavation	7	209	25,024	49,423	185,336
SVE Well/Piping[1]	0	0	0	0	0
Subslab Vent[1]	0	0	0	0	0
Backfill/Compact	23	186	17,818	43,988	131,964
Slurry Backfill	12	93	5,216	22,077	38,634
Site Resto.[1]	0	0	0	0	0

Note: 1 - No soil excavation associated with SVE Well/Piping, Subslab Vent or Site Restoration phases

Kast Air Emissions Calculations

Cubic Yard and Trip Estimates during Street Trenching/Pipe Installation

Parameter	Street Trenching Value	Units
Duration	36	weeks
Work Hours	8	hours
Total Work Days	180	days
Total Work Days in Year	251	days
Trenching per day	100	feet
Linear feet of trenching	8,715	feet
Total Volume Soil	8,100	cy
Total Volume of Asphalt	810	cy
Demo	810	cy
Excavation	8,100	cy
Slurry Backfill	5,000	cy
Restoration	1,100	cy
Total Loads -Debris Disposal	70	loads
Total Loads -Offsite Disposal	600	loads
Total Loads -Backfill Import	0	loads
Total Loads -Concrete Batch Plant	556	loads
Pipe Delivery	180	loads
Total Loads - Restoration	95	loads
Demo - Asphalt	12	cy/load
Excavation	14	cy/load
Slurry Backfill	9	cy/load
Restoration - Asphalt	12	cy/load

Street Trenching	Round Trips			
Phase	Hourly	Daily	Annually	Project
Demo - Truck Trips	0.12	1	178	178
Excavation - Truck Trips	0.4	3	600	600
Slurry Backfill - Truck Trips	0.4	3	556	556
Restoration - Truck Trips	0.1	1	113	113
Pipe Delivery - Truck Trips	0.1	1	180	180
Worker Trips	5.3	42	7,560	7,560

Street Trenching	Cubic Yard (CY) of Soil/Material			
Phase	Hourly	Daily	Annually	Project
Demo	1	11	2,060	2,060
Excavation	6	45	8,100	8,100
Slurry Backfill	3	28	5,000	5,000
Restoration	1	7	1,308	1,308

Kast Air Emissions Calculations

Cubic Yard and Trip Estimates during Well Installation

Parameter	Street Trenching Value	Units
Work Hours	8	hours
Total Work Days	63	days
Total Work Days in Year	63	days
Total round trips to Wilmington soil storage area	126	Trips
Total trips from Wilmington soil storage area to	10	Trips
Waste Collection	12	cy/load

Well Installation Phase	Round Trips Hourly	Daily	Annually	Project
Air Vac- Borehole Clearance - Truck Trips	0.13	1.0	63	63
Drilling and SVE Well Installation - Truck Trips	0.13	1.0	63	63
Waste Collection - Truck Trips	0.25	2.0	126	126
Waste Transport to Offsite Disposal - Truck Trips	0.12	1.0	60	60
Worker Trips	4.88	39	2,457	2,457

Well Installation Phase	Cubic Yard (CY) of Soil/Material Hourly	Daily	Annually	Project
Air Vac- Borehole Clearance	0	0	0	0
Drilling and SVE Well Installation	0	0	0	0
Waste Collection	3	24	1,512	1,512
Waste Transport to Offsite Disposal	1.4	12	725	725

Cubic Yard and Trip Estimates during Street Paving

Parameter	Street Grinding Value	Street Grinding Units	Street Paving Value	Street Paving Units
Duration	5	days	10	days
Work Hours	6	hours	6	hours
Trucks per day	14	Dump Trucks	7	Dump Trucks
Total Mass of Asphalt	2,000	tons	2,000	tons
Total Volume of Asphalt	1,025	cy	1,025	cy
Total Loads -Debris Disposal	80	loads	0	loads
Total Loads - Asphalt Delivery	0	loads	80	loads
Cubic Yard per Load	12	cy/load	12	cy/load

Street Paving	Round Trips			
Phase	Hourly	Daily	Annually	Project
Street Grinding - Truck Trips	3	16	80	80
Street Paving - Truck Trips	1	8	80	80
Worker Trips - Grinding	3	16	80	80
Worker Trips - Paving	3	16	160	160

Street Paving	Cubic Yard (CY) of Soil/Material			
Phase	Hourly	Daily	Annually	Project
Street Grinding	32	192	960	960
Street Paving	16	96	960	960

IV. On-Site Haul Roads - Re-entrained Dust

Summary: This section calculates the dust emissions (PM2.5, PM10) from the on-site haul roads at the residential homes. The on-site haul roads consist of off-road equipment transporting soil to-and-from the dump truck.

$$E = k(s/12)^a(W/3)^b$$

Where:
E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
M = surface material moisture content (%)
S = mean vehicle speed (mph)
a = empirical constant
b = empirical constant
k = empirical constant
Source: AP-42 13.2.2-4, Equation (1a)

Assumptions Parameters	Value	Unites	Notes
s (silt content)	6.4	%	Western Governors' Association, Western Regional Air Partnership (WRAP) Fugitive Dust Handbook, Table 6-2. Average silt content for gravel/crushed limestone road surface material.
W (vehicle weight)	18,000	lbs	Weight of excavator
a (empirical constant)	0.9	-	AP-42, Chapter 13.2.2, Table 13.2.2-2. Industrial Roads (PM10 and PM2.5)
b (empirical constant)	0.45	-	AP-42, Chapter 13.2.2, Table 13.2.2-2. Industrial Roads (PM10 and PM2.5)
k (empirical constant) - PM10	1.5	-	AP-42, Chapter 13.2.2, Table 13.2.2-2. Industrial Roads (PM10)
k (empirical constant) - PM2.5	0.15	-	AP-42, Chapter 13.2.2, Table 13.2.2-2. Industrial Roads (PM2.5)
Shovel Load (soil) Bobcat	1.25	cy	volume of soil a bucket can hold, http://www.bobcat.com/attachments/bucket_loader_general
Shovel Load (soil) Excavator	1.75	cy	volume of soil a bucket can hold
Weight of a bobcat	3.11	tons	Based on spec information from a S185 Skide-Steer Loader, http://www.bobcat.com/loaders/models/skidsteer/s185
Mitigation (% Reduction)	84%	%	Apply dust suppressants on inactive areas. SCAQMD mitigation measures examples. Table X1-A.
Haul Route length	200	ft	Assumed distance soil would have to be hauled on each property

Option 1 Phases	Hourly Round Trips	Daily Round Trips	8 Home Clusters	Annual Round Trips	Equipment Type	Average Vehicle Weight (tons)	Round Trip length (SCAB)	Hourly VMT	Daily VMT
Demo	1.0	8	134	991	Bobcat	3.11	0.08	0.08	2.53
Excavation	1.9	15	14,300	28,242	Excavator	9	0.08	0.14	4.51
SVE Well/Piping	0.1	1	0	0	0	0	0	0	0.00
Subslab Vent	0.0	0	0	0	0	0	0	0	0.00
Backfill/Compact	2.0	16	10,182	25,136	Excavator	9	0.08	0.15	4.83
Site Resto.	0.0	3	0	0	0	0	0	0	0.00

Emission Calculation

Daily:

Option 1 Phases	Daily VMT (SCAB)	W (tons)	k (PM10)	k (PM2.5)	Mitigation %	PM10 EF (lbs/mi.)	PM2.5 EF (lbs/mi.)	PM10 Emissions (lbs/day)	PM2.5 Emissions (lbs/day)
Demo	2.5	3.11	1.5	0.15	84%	0.87	0.09	0.35	0.04
Excavation	4.5	9	1.5	0.15	84%	1.40	0.14	1.01	0.10
SVE Well/Piping	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	4.8	9	1.5	0.15	84%	1.40	0.14	1.08	0.11
Site Resto.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

V. Fugitive Dust Emissions During Soil Excavation and Handling

Summary: This section calculates the dust emissions (PM2.5, PM10) from the on-site soil handling and excavation at the residential homes and during street trenching. The on-site soil handing and excavation consists of two parts: 1) Excavating soil 2)Dropping soil

$$E = k(0.0032) \frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \text{ (pound [lb]/ton)}$$

Where:

E = emission factor
k = particle size multiplier (dimensionless)
U = mean wind speed, meters per second (m/s) (miles per hour [mph])
M = material moisture content (%)

Source: AP-42 13.2.4-3, Equation (1)

Assumptions Equation parameters	Value	Units	Notes
k - PM10	0.35	-	AP-42, Chapter 13.2.4, Page 4. Nov 2006
k - PM2.5	0.053	-	AP-42, Chapter 13.2.4, Page 4. Nov 2006
U	4.21	mph	Average wind speed
M	7.9	%	AP-42 Chapter 11.9-9. Table 11.9-3. Overburden default value.
Soil Density	3,400	lbs/CY	Information provided by project staff
Mitigation (% Reduction) - Watering	84%	%	WARP Fugitive Dust Handbook, September 2006, Table 3-7. Apply water every 1 hour: 74% control per MRI, April 2001, test series 701. Apply dust suppressant: 84% control per CARB April 2002; for actively disturbed areas
Times Soil is Handled	2	time	1) Excavating soil 2) Dropping soil

Emission Calculation (PM10)

Daily Dust Emissions During Soil Excavation and Handling								
Phase	Daily CY	Daily (tons)	k (PM10)	U (mph)	M%	EF (lbs/ton)	Mitigation (%)	PM10 Emissions (lbs/day)
Option 1								
Demo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavation	209	354.5	0.35	4.20556	7.9	1.31E-04	84%	1.48E-02
SVE Well/Piping	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	186	315.5	0.35	4.20556	7.9	1.31E-04	84%	1.32E-02
Slurry Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Site Resto.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Trenching								
Demo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavation	45	76.5	0.35	4.20556	7.9	1.31E-04	84%	3.20E-03
Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Restoration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Emission Calculation (PM2.5)

Daily Dust Emissions During Soil Excavation and Handling								
Phase	**Daily CY**	**Hourly (tons)**	**k (PM2.5)**	**U (mph)**	**M%**	**EF (lbs/ton)**	**Mitigation (%)**	**PM2.5 Emissions (lbs/day)**
Option 1								
Demo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavation	209	354.5	0.053	4.21	7.9	1.98E-05	84%	2.25E-03
SVE Well/Piping	0	0	0.00	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	186	315.5	0.053	4.21	7.9	1.98E-05	84%	2.00E-03
Slurry Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Site Resto.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Trenching								
Demo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavation	45	76.5	0.053	4.21	7.9	1.98E-05	84%	4.85E-04
Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Restoration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

VI. Dust Emissions during Concrete Breaking

Summary: This section calculates the dust emissions (PM2.5, PM10) during on-site concrete breaking at residential homes, street trenching and street paving. The on-site dust emissions from concrete breaking consists of two parts: 1) Mechanical dismemberment and 2) Debris loading

Mechanical Dismemberment Equations

$$EF_D = k \times (0.0032) \times \frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

U = Mean wind speed

M = material moisture content (%). The moisture contents of different materials are listed in Table 13.2.4-1 of AP 42. The program uses the moisture content of cover (12%) as default.

Where:

EF_D = emission factor (lb PM/ton of debris)

$EF_{D\text{-}PM10}$ = 0.0011 lb PM_{10}/ton of debris

$EF_{D\text{-}PM2.5}$ = 0.00017 lb $PM_{2.5}$/ton of debris

k = particle size multiplier. The AP-42 default value for PM_{10} is 0.35 and that for $PM_{2.5}$ is 0.053.

Source: CalEEMod, Appendix A, Page 11

$$E_D = EF_D \times W$$

Where:

E_D = emissions (lb of PM)

EF_D = emission factor (lb of PM/ton of debris)

W = building waste (ton of debris)

Source: CalEEMod, Appendix A, Page 12

Assumptions Equation parameters	Value	Units	Notes
Mean wind speed (U)	4.21	mph	Based on mean wind speed met data from the SCAQMD Long Beach Station from 2006 to 2011.
M (material moisture content)	7.9	%	AP-42 Chapter 11.9-9. Table 11.9-3. Overburden default value.
Typical Density of Concrete	150	lbs/ft^3	Information provided by project staff
Mitigation (% Reduction)	84%	%	WARP Fugitive Dust Handbook, September 2006, Table 3-7. Apply water every 1 hour: 74% control per MRI, April 2001, test series 701. Apply dust suppressant: 84% control per CARB April 2002; for actively disturbed areas

Phase	Hourly Weight of Concrete (tons)	Daily Weight of Concrete (tons)	Weight of Concrete per 8 Home Cluster (tons)	Annual Weight of Concrete (tons)	Total Weight of Concrete (tons)
Option 1					
Demo	25	201	3,213	23,798	23,798
Excavation	0.00	0.00	0.00	0.00	0.00
SVE Well/Piping	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	0.00	0.00	0.00	0.00	0.00
Slurry Backfill	0.00	0.00	0.00	0.00	0.00
Site Resto.	0.00	0.00	0.00	0.00	0.00
Street Trenching					
Demo	3	22	0.00	4,016	4,016
Excavation	0.00	0.00	0.00	0.00	0.00
Backfill	0.00	0.00	0.00	0.00	0.00
Restoration	0.00	0.00	0.00	0.00	0.00
Street Paving					
Street Grinding	62	374	0.00	1,872	1,872

Mechanical Dismemberment Emissions Calculations

Concrete Breaking Emissions - Daily

Phase	Particle Size Multiplier for PM10 (k)	Particle Size Multiplier for PM2.5 (k)	Emission Factor PM10 (lb PM/Ton of Concrete)	Emission Factor for PM2.5 (lb PM/Ton of Concrete)	Mitigation (%)	Concrete Breaking Emissions for PM10 (lbs of PM10)	Concrete Breaking Emissions PM2.5 (lbs of PM2.5)
Option 1							
Demo	0.35	0.053	1.31E-04	1.98E-05	84%	4.20E-03	6.36E-04
Excavation	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SVE Well/Piping	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Slurry Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Site Resto.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Trenching							
Demo	0.35	0.053	1.31E-04	1.98E-05	84%	4.67E-04	7.07E-05
Excavation	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Restoration	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Paving							
Street Grinding	0.35	0.053	1.31E-04	1.98E-05	84%	7.83E-03	1.19E-03

Debris Loading Equations

$$EF_L = k \times EF_{L\text{-}TSP}$$

Where:

EF_L = emission factor (lb/ton)

k = particle size multiplier. The AP-42 default value for PM_{10} is 0.35 and that for $PM_{2.5}$ is 0.053.

Source: CalEEMod, Appendix A, Page 12

The default value for $EF_{L\text{-}TSP}$ is 0.058 lb/ton, the average of the two TSP factor (i.e. 0.053 and 0.063 lb/ton) measured from two tests of the filling of trucks with crushed limestone using a front-end loader.

Source: CalEEMod, Appendix A, Page 13

$$E_D = EF_D \times W$$

Where:

E_D = emissions (lb of PM)

EF_D = emission factor (lb of PM/ton of debris)

W = building waste (ton of debris)

Source: CalEEMod, Appendix A, Page 12

Assumptions Equation parameters	Value	Units	Notes
Emission Factor for Total Suspended Particulates (TSP)	0.058	lb/ton	CalEEMod, Appendix A, Page 13

Debris Loading Emissions Calculations

Concrete Debris Loading - Daily Phase	Particle Size Multiplier for PM10 (k)	Particle Size Multiplier for PM2.5 (k)	Emission Factor PM10 (lb PM/Ton of Concrete)	Emission Factor for PM2.5 (lb PM/Ton of Concrete)	Mitigation (%)	Concrete Breaking Emissions for PM10 (lbs of PM10)	Concrete Breaking Emissions PM2.5 (lbs of PM2.5)
Option 1							
Demo	0.35	0.053	0.0203	0.003074	84%	6.52E-01	9.88E-02
Excavation	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SVE Well/Piping	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Slurry Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Site Resto.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Trenching							
Demo	0.35	0.053	0.0203	0.003074	84%	7.25E-02	1.10E-02
Excavation	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Restoration	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Paving							
Street Grinding	0.35	0.053	0.0203	0.003074	84%	1.22E+00	1.84E-01

Total Concrete Breaking Emissions (Mechanical Dismemberment + Debris Loading)

Total Concrete Breaking Emissions - Daily		
Phase	**Concrete Breaking Emissions for PM10 (lbs of PM10)**	**Concrete Breaking Emissions PM2.5 (lbs of PM2.5)**
Option 1		
Demo	6.56E-01	9.94E-02
Excavation	0.00	0.00
SVE Well/Piping	0.00	0.00
Subslab Vent	0.00	0.00
Backfill/Compact	0.00	0.00
Slurry Backfill	0.00	0.00
Site Resto.	0.00	0.00
Street Trenching		
Demo	7.29E-02	1.10E-02
Excavation	0.00	0.00
Backfill	0.00	0.00
Restoration	0.00	0.00
Street Paving		
Street Grinding	1.22E+00	1.85E-01
Total	1.95E+00	2.96E-01

VII. On-Site Construction Equipment Emissions

Summary: This section calculates the emissions of criteria pollutants from off-road equipment.

Emission Equation

Emission (Off-road Construction Equipment) = E x bhp-hr

Where:

E = size-specific emission factor (g/bhp-hr)

Source:

EMFAC2011

Assumptions	Value	Value	Units	Notes
Equipment Engine Tier		3	-	Refers to EPA emission standards (Tier 1-4) for Off-road equipment

Off-road Engine Emission Ratings

USEPA TABLE I - EPA Tier 1-3 Nonroad Diesel Engine Emission Standards (g/bhp-hr)

Engine Power		Tier	CO
(25 ≤ hp < 50)	50	1	4.9
(25 ≤ hp < 50)	50	2	4.9
(50 ≤ hp < 100)	100	1	-
(50 ≤ hp < 100)	100	2	3.7
(50 ≤ hp < 100)	100	3	3.7
(100 ≤ hp < 175)	175	1	-
(100 ≤ hp < 175)	175	2	3.7
(100 ≤ hp < 175)	175	3	3.7
(175 ≤ hp < 300)	300	1	8.5
(175 ≤ hp < 300)	300	2	2.6
(175 ≤ hp < 300)	300	3	2.6
(300 ≤ hp < 600)	600	1	8.5
(300 ≤ hp < 600)	600	2	2.6
(300 ≤ hp < 600)	600	3	2.6

Tiers 1, 2,3 &4 Off-Road Engine Emission Standards

HP Range	Tier	Nox	ROG	PM
75 - 99	1	6.9	1.19	0.552
100 - 174	1	6.9	0.82	0.304
175 - 299	1	6.9	1	0.4
300 - 600	1	6.9	1	0.4
75 - 99	2	5.32	0.28	0.3
100 - 174	2	4.655	0.245	0.22
175 - 299	2	4.655	0.245	0.15
300 - 600	2	4.56	0.24	0.15
75 - 99	3	3.325	0.175	0.3
100 - 174	3	2.85	0.15	0.22
175 - 299	3	2.85	0.15	0.15
300 - 600	3	2.85	0.15	0.15
75 - 99	4	2.5	0.14	0.015
100 - 174	4	2.5	0.14	0.015
175 - 299	4	1.5	0.14	0.015
300 - 600	4	1.5	0.14	0.015

Note: Based on SCAQMD Table II-B Tiers 1, 2,3 &4 Off-Road Engine Emission Standards

Table 3.3 OFFROAD Default Horsepower and Load Factors

OFFROAD Equipment Type	Horsepower	Load Factor
Aerial Lifts	63	0.31
Air Compressors	78	0.48
Bore/Drill Rigs	206	0.50
Cement and Mortar Mixers	9	0.56
Concrete/Industrial Saws	81	0.73
Cranes	226	0.29
Crawler Tractors	208	0.43
Crushing/Proc. Equipment	85	0.78
Dumpers/Tenders	16	0.38
Excavators	163	0.38
Forklifts	89	0.20
Generator Sets	84	0.74
Graders	175	0.41
Off-Highway Tractors	123	0.44
Off-Highway Trucks	400	0.38
Other Construction Equipment	172	0.42
Other General Industrial Equipment	88	0.34
Other Material Handling Equipment	167	0.40
Pavers	126	0.42
Paving Equipment	131	0.36
Plate Compactors	8	0.43
Pressure Washers	13	0.30
Pumps	84	0.74
Rollers	81	0.38
Rough Terrain Forklifts	100	0.40
Rubber Tired Dozers	255	0.40
Rubber Tired Loaders	200	0.36
Scrapers	362	0.48
Signal Boards	6	0.82
Skid Steer Loaders	65	0.37
Surfacing Equipment	254	0.30
Sweepers/Scrubbers	64	0.46
Tractors/Loaders/Backhoes	98	0.37
Trenchers	81	0.50
Welders	46	0.45

Notes:

1. Based on the weighted average horsepower (by equipment population) and load factors for the mode of the engine groupings in 2011 OFFROAD

Equipment List by Phase												Emissions Factors (g/bhp-hr)						
Phase	Phase Duration (days)	Hours per Day	Equipment	HP/Size	CalEEMod Category	Load Factor[1]	Output (bhp-hour)	Output (bhp-day)	Engine Size Class	Engine Size Class (CO)	Engine Tier	ROG	CO	NOx	CO2[2]	PM10	PM2.5	SOx[2]
Option 1																		
Demolition	119	8	Bobcat (Bobcat S510)	22	Tractors/Loaders/Backhoes	0.57	12.54	100.32	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Demolition	119	2	6000 Watt Generator	10	Generator Sets	0.74	7.4	14.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Demolition	119	2	Chain Saw	0.5	Concrete/Industrial Saws	0.73	0.365	0.73	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Demolition	119	8	Water Pump	5	Pumps	0.74	3.7	29.6	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Excavation	889	8	18,000 lbs Excavator (Kubota KX80-4)	70	Excavator	0.38	26.6	212.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Excavation	889	8	Bobcat (Bobcat S510)	22	Tractors/Loaders/Backhoes	0.37	8.14	65.12	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Excavation	889	2	6000 Watt Generator	10	Generator Sets	0.74	7.4	14.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Excavation	889	8	Water Pump	5	Pumps	0.74	3.7	29.6	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
SVE Well Installation	59	4	Bobcat with Auger (Bobcat S510)	22	Tractors/Loaders/Backhoes	0.37	8.14	32.56	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
SVE Well Installation	59	1	6000 Watt Generator	10	Generator Sets	0.74	7.4	7.4	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Subslab Vent Installation	59	4	Bobcat with Auger (Bobcat S510)	22	Tractors/Loaders/Backhoes	0.37	8.14	32.56	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Subslab Vent Installation	59	1	6000 Watt Generator	10	Generator Sets	0.38	3.8	3.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Backfill and Compaction	415	8	Bobcat (Bobcat S510)	22	Tractors/Loaders/Backhoes	0.37	8.14	65.12	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Backfill and Compaction	593	4	Small Compactor (Wacker)	3	Plate compactors	0.43	1.29	5.16	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Backfill and Compaction	1256	4	Water Pump	5	Pumps	0.74	3.7	14.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Slurry Backfill	415	8	Concrete Pump	2	Pumps	0.74	1.48	11.84	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Site Restoration	593	1	6000 Watt Generator	10	Generator Sets	0.74	7.4	7.4	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Site Restoration	593	2	Concrete Pump	2	Pumps	0.74	1.48	2.96	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Street Trenching																		
Street Trenching/Pipe installation	180	8	Backhoe	100	Tractors/Loaders/Backhoes	0.57	57	456	100-174	100<hp<175	3	0.15	3.7	2.85	568.3	0.3	0.3	0.0050
Street Trenching/Pipe installation	180	8	Compressor	49	Generator Sets	0.74	36.26	290.08	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Street Trenching/Pipe installation	180	2	Generator	10	Generator Sets	0.74	7.4	14.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Street Trenching/Pipe installation	180	1	Concrete Saw	48	Concrete/Industrial Saws	0.73	35.04	35.04	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Well Installation																		
Drilling and SVE Well Installation	63	8	Drill Rig	155	Bore/Drill Rigs	0.5	77.5	620	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Street Paving																		
Street - Grinding	5	8	Cold Plane Grinding Machine	600	Scrapers	0.48	288	2304	300-600	300<hp<600	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Street - Grinding	5	8	Street Sweeper	200	Crawler Tractors	0.5	100	800	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Street - Paving	10	8	Paving Machine	150	Other Construction Equipment	0.42	63	504	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Street - Paving	10	8	Steam Roller	50	Rollers	0.38	19	152	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Street - Paving	10	8	Street Sweeper	200	Crawler Tractors	0.5	100	800	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050

1 - Load Factor obtained from CalEEMod Appendix D Defaults

2- Emission factors for CO2 and SOx were obtained from Table 3.4, Off-road Equipment Emission Factors, CalEEMod Appendix D Default Data Tables.

Off-Road Emissions Calculations					Daily Emissions (lb)			
Phase	Equipment	ROG	CO	NOx	CO2	PM10	PM2.5	SOx
Option 1								
Demolition	Bobcat (Bobcat S510)	3.9E-02	1.1E+00	7.4E-01	1.3E+02	6.6E-02	6.6E-02	1.1E-03
Demolition	6000 Watt Generator	5.7E-03	1.6E-01	1.1E-01	1.9E+01	9.8E-03	9.8E-03	1.6E-04
Demolition	Chain Saw	2.8E-04	7.9E-03	5.4E-03	9.1E-01	4.8E-04	4.8E-04	8.0E-06
Demolition	Water Pump	1.1E-02	3.2E-01	2.2E-01	3.7E+01	2.0E-02	2.0E-02	3.3E-04
Excavation	18,000 lbs Excavator (Kubota KX80-4)	8.2E-02	2.3E+00	1.6E+00	2.7E+02	1.4E-01	1.4E-01	2.3E-03
Excavation	Bobcat (Bobcat S510)	2.5E-02	7.0E-01	4.8E-01	8.2E+01	4.3E-02	4.3E-02	7.2E-04
Excavation	6000 Watt Generator	5.7E-03	1.6E-01	1.1E-01	1.9E+01	9.8E-03	9.8E-03	1.6E-04
Excavation	Water Pump	1.1E-02	3.2E-01	2.2E-01	3.7E+01	2.0E-02	2.0E-02	3.3E-04
SVE Well Installation	Bobcat with Auger (Bobcat S510)	1.3E-02	3.5E-01	2.4E-01	4.1E+01	2.2E-02	2.2E-02	3.6E-04
SVE Well Installation	6000 Watt Generator	2.9E-03	8.0E-02	5.4E-02	9.3E+00	4.9E-03	4.9E-03	8.2E-05
Subslab Vent Installation	Bobcat with Auger (Bobcat S510)	1.3E-02	3.5E-01	2.4E-01	4.1E+01	2.2E-02	2.2E-02	3.6E-04
Subslab Vent Installation	6000 Watt Generator	1.5E-03	4.1E-02	2.8E-02	4.8E+00	2.5E-03	2.5E-03	4.2E-05
Backfill and Compaction	Bobcat (Bobcat S510)	2.5E-02	7.0E-01	4.8E-01	8.2E+01	4.3E-02	4.3E-02	7.2E-04
Backfill and Compaction	Small Compactor (Wacker)	2.0E-03	5.6E-02	3.8E-02	6.5E+00	3.4E-03	3.4E-03	5.7E-05
Backfill and Compaction	Water Pump	5.7E-03	1.6E-01	1.1E-01	1.9E+01	9.8E-03	9.8E-03	1.6E-04
Slurry Backfill	Concrete Pump	4.6E-03	1.3E-01	8.7E-02	1.5E+01	7.8E-03	7.8E-03	1.3E-04
Site Restoration	6000 Watt Generator	2.9E-03	8.0E-02	5.4E-02	9.3E+00	4.9E-03	4.9E-03	8.2E-05
Site Restoration	Concrete Pump	1.1E-03	3.2E-02	2.2E-02	3.7E+00	2.0E-03	2.0E-03	3.3E-05
Street Trenching								
Street Trenching/Pipe installation	Backhoe	1.5E-01	3.7E+00	2.9E+00	5.7E+02	3.0E-01	3.0E-01	5.0E-03
Street Trenching/Pipe installation	Compressor	1.1E-01	3.1E+00	2.1E+00	3.6E+02	1.9E-01	1.9E-01	3.2E-03
Street Trenching/Pipe installation	Generator	5.7E-03	1.6E-01	1.1E-01	1.9E+01	9.8E-03	9.8E-03	1.6E-04
Street Trenching/Pipe installation	Concrete Saw	1.2E-02	2.0E-01	2.2E-01	4.4E+01	2.3E-02	2.3E-02	3.9E-04
Well Installation								
Drilling and SVE Well Installation	Drill Rig	2.1E-01	3.6E+00	3.9E+00	7.8E+02	4.1E-01	4.1E-01	6.8E-03
Street Paving								
Street - Grinding	Cold Plane Grinding Machine	7.6E-01	1.3E+01	1.4E+01	2.9E+03	1.5E+00	1.5E+00	2.5E-02
Street - Grinding	Street Sweeper	2.6E-01	4.6E+00	5.0E+00	1.0E+03	5.3E-01	5.3E-01	8.8E-03
Street - Paving	Paving Machine	1.7E-01	2.9E+00	3.2E+00	6.3E+02	3.3E-01	3.3E-01	5.6E-03
Street - Paving	Steam Roller	5.0E-02	8.7E-01	9.6E-01	1.9E+02	1.0E-01	1.0E-01	1.7E-03
Street - Paving	Street Sweeper	2.6E-01	4.6E+00	5.0E+00	1.0E+03	5.3E-01	5.3E-01	8.8E-03

Off-Road Emissions Calculations				Daily Emissions (lb)			
Phase	ROG	CO	NOx	CO2	PM10	PM2.5	SOx
Option 1							
Demolition	5.6E-02	1.6E+00	1.1E+00	1.8E+02	9.6E-02	9.6E-02	1.6E-03
Excavation	1.2E-01	3.5E+00	2.4E+00	4.0E+02	2.1E-01	2.1E-01	3.6E-03
SVE Well/Piping	1.5E-02	4.3E-01	2.9E-01	5.0E+01	2.6E-02	2.6E-02	4.4E-04
Subslab Vent Installation	1.4E-02	3.9E-01	2.7E-01	4.6E+01	2.4E-02	2.4E-02	4.0E-04
Backfill and Compaction	3.3E-02	9.2E-01	6.2E-01	1.1E+02	5.6E-02	5.6E-02	9.4E-04
Slurry Backfill	4.6E-03	1.3E-01	8.7E-02	1.5E+01	7.8E-03	7.8E-03	1.3E-04
Site Restoration	4.0E-03	1.1E-01	7.6E-02	1.3E+01	6.9E-03	6.9E-03	1.1E-04
Well Installation							
Drilling and SVE Well Installation	2.1E-01	3.6E+00	3.9E+00	7.8E+02	4.1E-01	4.1E-01	6.8E-03
Street Trenching							
Street Trenching/Pipe installation	2.8E-01	7.2E+00	5.3E+00	1.0E+03	5.3E-01	5.3E-01	8.8E-03
Street Paving							
Street - Grinding	1.0E+00	1.8E+01	2.0E+01	3.9E+03	2.1E+00	2.1E+00	3.4E-02
Street - Paving	4.8E-01	8.3E+00	9.1E+00	1.8E+03	9.6E-01	9.6E-01	1.6E-02

VIII. On-Site Road Emissions

Summary: This section calculates the emissions of criteria pollutants from on-site paved roads.

Emissions Factors

Running Emissions						g/mi					
Veh Class	Fuel	MdlYr	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
LDA/LDT	All	All	6.4E-02	2.5E+00	2.8E-01	6.9E+02	3.0E-03	3.0E-04	7.0E-03	4.5E-02	1.8E-02
HHDT	DSL	All	7.8E-01	4.0E+00	1.4E+01	1.6E+03	8.0E-01	7.4E-01	1.7E-02	7.8E-02	3.1E-02
HHDT	DSL	2007	1.2E-01	8.6E-01	2.2E+00	1.6E+03	6.1E-02	5.6E-02	1.7E-02	5.9E-03	5.5E-03

Source: EMFAC 2011

Running Emissions						lbs/mi					
Veh Class	Fuel	MdlYr	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
LDA/LDT	All	All	1.4E-04	5.5E-03	6.1E-04	1.5E+00	6.6E-06	6.6E-07	1.5E-05	9.9E-05	4.0E-05
HHDT	DSL	All	1.7E-03	8.8E-03	3.1E-02	3.6E+00	1.8E-03	1.6E-03	3.7E-05	1.7E-04	6.8E-05
HHDT	DSL	2007	2.7E-04	1.9E-03	4.8E-03	3.5E+00	1.4E-04	1.2E-04	3.7E-05	1.3E-05	1.2E-05

Source: EMFAC 2011

Heavy Truck Trip Data								SCAB			
Phase	Hourly Round Trips	Daily Round Trips	8 Home Cluster Round Trips	Annual Round Trips	Truck Type	Average Vehicle Weight (tons)	Trip length (SCAB)	Hourly VMT	Daily VMT	8 Home Cluster VMT	Annual VMT
Option 1											
Demo	1.05	8	134	991	Dump Truck	25	0.72	0.75	6	96	713
Green Waste	0.50	4	32	237	Dump Truck	25	0.72	0.36	3	23	171
Excavation	1.86	15	1,787	3,530	Dump Truck	25	0.72	1.34	11	1286	2541
SVE Well/Piping	0.1	1.1	8.5	63.2	Dump Truck	25	0.72	0.10	0.8	6	45
Subslab Vent	0.00	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	1.99	16	1,529	3,776	Dump Truck	25	0.72	1.43	11	1101	2717
Slurry Backfill	0.64	5	287	1,214	Concrete Truck	25	0.72	0.46	4	206	874
Site Resto.	0.37	3	237	702	Concrete Truck	25	0.72	0.27	2	171	505
Street Trenching											
Demo	0.12	1	0	178	Dump Truck	25	0.72	0.09	0.7	0.00	128
Excavation	0.42	3	0	600	Dump Truck	25	0.72	0.30	2	0.00	432
Backfill	0.39	3	0	556	Dump Truck	25	0.72	0.28	2	0.00	400
Restoration	0.08	1	0	113	Concrete Truck	25	0.72	0.06	0.5	0.00	81
Pipe Delivery	0.13	1	0	180	Dump Truck	25	0.72	0.09	1	0.00	130
Well Installation											
Air Vac- Borehole Clearance	0.13	1	0	63	Air-Vac	25	0.72	0.09	1	0.00	45
Drilling and SVE Well Installation	0.13	1	0	63	Drill Rig	25	0.72	0.09	1	0.00	45
Waste Collection	0.25	2	0	126	Dump Truck	25	0.72	0.18	1	0.00	91
Street Paving											
Street Grinding	3	16	0	80	Dump Truck	25	0.72	1.92	12	0.00	58
Street Paving	1	8	0	80	Dump Truck	25	0.72	0.96	6	0.00	58
Visitor Trips											
Passenger Vehicle Trips	1.13	9	0	2,259	Passenger Vehicle	25	0.72	0.81	6	0	1626

Daily Truck Trip Emission Calculations (SCAB)						lbs/day				
Phase	Daily VMT (SCAB)	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
Option 1										
Demo	6.0	1.6E-03	1.1E-02	2.9E-02	2.1E+01	8.1E-04	7.5E-04	2.2E-04	7.9E-05	7.2E-05
Green Waste	2.9	7.8E-04	5.5E-03	1.4E-02	1.0E+01	3.9E-04	3.6E-04	1.1E-04	3.8E-05	3.5E-05
Excavation	10.7	2.9E-03	2.0E-02	5.1E-02	3.7E+01	1.4E-03	1.3E-03	4.0E-04	1.4E-04	1.3E-04
SVE Well/Piping	0.8	2.1E-04	1.5E-03	3.6E-03	2.7E+00	1.0E-04	9.5E-05	2.8E-05	1.0E-05	9.2E-06
Subslab Vent	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Backfill/Compact	11.5	3.1E-03	2.2E-02	5.4E-02	4.0E+01	1.5E-03	1.4E-03	4.2E-04	1.5E-04	1.4E-04
Slurry Backfill	3.7	1.0E-03	7.0E-03	1.8E-02	1.3E+01	5.0E-04	4.6E-04	1.4E-04	4.8E-05	4.4E-05
Site Resto.	2.1	5.8E-04	4.1E-03	1.0E-02	7.4E+00	2.9E-04	2.6E-04	7.9E-05	2.8E-05	2.6E-05
Street Trenching										
Demo	0.7	1.9E-04	1.4E-03	3.4E-03	2.5E+00	9.6E-05	8.8E-05	2.6E-05	9.3E-06	8.6E-06
Excavation	2.4	6.5E-04	4.6E-03	1.1E-02	8.3E+00	3.2E-04	3.0E-04	8.9E-05	3.1E-05	2.9E-05
Backfill	2.2	6.0E-04	4.2E-03	1.1E-02	7.7E+00	3.0E-04	2.8E-04	8.2E-05	2.9E-05	2.7E-05
Restoration	0.5	1.2E-04	8.6E-04	2.1E-03	1.6E+00	6.1E-05	5.6E-05	1.7E-05	5.9E-06	5.4E-06
Pipe Delivery	0.7	1.9E-04	1.4E-03	3.4E-03	2.5E+00	9.7E-05	8.9E-05	2.7E-05	9.4E-06	8.7E-06
Well Installation										
Air Vac- Borehole Clearance	0.7	1.9E-04	1.4E-03	3.4E-03	2.5E+00	9.7E-05	8.9E-05	2.7E-05	9.4E-06	8.7E-06
Drilling and SVE Well Installation	0.7	1.9E-04	1.4E-03	3.4E-03	2.5E+00	9.7E-05	8.9E-05	2.7E-05	9.4E-06	8.7E-06
Waste Collection	1.4	3.9E-04	2.7E-03	6.8E-03	5.0E+00	1.9E-04	1.8E-04	5.3E-05	1.9E-05	1.7E-05
Street Paving										
Street Grinding	11.5	3.1E-03	2.2E-02	5.5E-02	4.0E+01	1.6E-03	1.4E-03	4.2E-04	1.5E-04	1.4E-04
Street Paving	5.8	1.6E-03	1.1E-02	2.7E-02	2.0E+01	7.8E-04	7.2E-04	2.1E-04	7.5E-05	6.9E-05
Visitor Trips										
Passenger Vehicle Trips	6.5	9.1E-04	3.6E-02	4.0E-03	9.9E+00	4.3E-05	4.3E-06	1.0E-04	6.4E-04	2.6E-04

Misc Worker Trips

Worker Trip Emission Calculations (SCAB)							lbs/day					
Phase	Worker Round Trips per day	Roundtrip Distance per Worker (mi)	VMT per Day	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
Option 1	32	0.72	23	3.2E-03	1.3E-01	1.4E-02	3.5E+01	1.5E-04	1.5E-05	3.6E-04	2.3E-03	9.1E-04
Street Trenching	42	0.72	30	4.3E-03	1.7E-01	1.9E-02	4.6E+01	2.0E-04	2.0E-05	4.7E-04	3.0E-03	1.2E-03
Well Installation	39	0.72	28	4.0E-03	1.6E-01	1.7E-02	4.3E+01	1.9E-04	1.9E-05	4.3E-04	2.8E-03	1.1E-03
Street Paving												
Street Grinding	16	0.72	12	1.6E-03	6.4E-02	7.1E-03	1.8E+01	7.6E-05	7.6E-06	1.8E-04	1.1E-03	4.6E-04
Street Paving	16	0.72	12	1.6E-03	6.4E-02	7.1E-03	1.8E+01	7.6E-05	7.6E-06	1.8E-04	1.1E-03	4.6E-04

VIIII. On-Site Road - Reentrained Dust

Summary: This section calculates the emissions of re-entrained dust from on-site on road vehicles on paved roads.

$$E = [k(sL)^{0.91} \times (W)^{1.02}] (1 - P/4N)$$

Where:

E = size-specific emission factor (lb/VMT)
k = particle size multiplier
sL = road surface silt loading (g/m^2)
W = mean vehicle weight (tons)
P = averaging period (365 days)
N = number of "wet" days (>0.01 in of precipitation)

Source: AP-42 13.2.1-2, Equation (1). January 2011.

Correction:
P = number of wet days
N = number of days in period

Assumptions			
Parameter	**Value**	**Units**	**Reference**
Heavy Vehicle Weight (tons)	25	tons	Assumed
k (empirical constant) - PM10	0.0022	-	AP-42, Chapter 13.2.1, Table 13.2.1-1. PM10 (lbs/VMT)
k (empirical constant) - PM2.5	0.0005	-	AP-42, Chapter 13.2.1, Table 13.2.1-1. PM2.5 (lbs/VMT)
sL (Haul Trucks)	0.02	g/m2	CARB Entrained Paved Road Dust. (1997) Silt loading for freeways: http://www.arb.ca.gov/ei/areasrc/fullpdf/full7-9.pdf
sL (Worker Vehicles)	0.1	g/m2	CalEEMod Default for Worker trips (Assumes mix of freeway and surface street travel)
P (averaging period)	365	days	Days per year
N (wet days)	40	days	AP-42, Chapter 13.2.1, Figure 13.2.1-2. January 2011.
On-Site Heavy Truck	0.72	miles	Measured distance from the furthest northern and southern homes in the community.
Employee/Worker Trip Distance	0.72	miles	Measured distance from the furthest northern and southern homes in the community.
Paved Road Average	2.4	tons	CalEEMod default average vehicle weight (tons)

Phase	Hourly Round Trips	Daily Round Trips	8 Home Cluster Round Trips	Annual Round Trips	Truck Type	Average Vehicle Weight (tons)	SCAB Round Trip length (SCAB)	Hourly VMT	Daily VMT	8 Home Cluster VMT	Annual VMT
Option 1											
Demo	1.0	8.4	133.8	991.1	Dump Truck	25	0.72	0.8	6.0	96.3	713.3
Green Waste	0.5	4.0	32.0	237.0	Dump Truck	25	0.72	0.4	2.9	23.0	170.6
Excavation	1.9	14.9	1787.5	3530.3	Dump Truck	25	0.72	1.3	10.7	1286.4	2540.7
SVE Well/Piping	0.1	1.1	8.5	63.2	Dump Truck	25	0.72	0.1	0.8	6.1	45.5
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	2.0	15.9	1529.4	3775.8	Dump Truck	25	0.72	1.4	11.5	1100.7	2717.4
Slurry Backfill	0.6	5.1	286.8	1213.8	Concrete Truck	25	0.72	0.5	3.7	206.4	873.6
Site Resto.	0.4	3.0	237.0	702.0	Concrete Truck	25	0.72	0.3	2.1	170.5	505.2
Street Trenching											
Demo	0.1	1.0	0.00	178.0	Dump Truck	25	0.72	0.1	0.7	0.00	128.1
Excavation	0.4	3.3	0.00	600.0	Dump Truck	25	0.72	0.3	2.4	0.00	431.8
Backfill	0.4	3.1	0.00	556.0	Dump Truck	25	0.72	0.3	2.2	0.00	400.2
Restoration	0.1	0.6	0.00	113.0	Concrete Truck	25	0.72	0.1	0.5	0.00	81.3
Pipe Delivery	0.1	1.0	0.00	180.0	Dump Truck	25	0.72	0.1	0.7	0.00	129.5
Well Installation											
Air Vac-Borehole Clearance	0.1	1.0	0.00	63.0	Air-Vac	25	0.72	0.1	0.7	0.00	45.3
Drilling and SVE Well Installation	0.1	1.0	0.00	63.0	Drill Rig	25	0.72	0.1	0.7	0.00	45.3
Waste Collection	0.3	2.0	0.00	126.0	Dump Truck	25	0.72	0.2	1.4	0.00	90.7
Street Paving											
Street Grinding	2.7	16.0	0.00	80.0	Dump Truck	25	0.72	1.9	11.5	0.00	57.6
Street Paving	1.3	8.0	0.00	80.0	Dump Truck	25	0.72	1.0	5.8	0.00	57.6

Emission Calculation

Daily:

Phase	Daily VMT (SCAB)	sL (g/M^2)	W (tons)	k (PM10)	k (PM2.5)	Wet Days	Avg. Period	PM10 EF (lbs/mi.)	PM2.5 EF (lbs/mi.)	SCAB Pm10 Emissions	SCAB PM2.5 Emissions
Option 1											
Demo	6.0	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	3.65E-04	8.96E-05
Green Waste	2.9	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	1.75E-04	4.28E-05
Excavation	10.7	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	6.50E-04	1.60E-04
SVE Well/Piping	0.8	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	4.65E-05	1.14E-05
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	11.5	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	6.95E-04	1.71E-04
Slurry Backfill	3.7	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	2.24E-04	5.49E-05
Site Resto.	2.1	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	1.29E-04	3.17E-05
Street Trenching											
Demo	0.7	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	4.32E-05	1.06E-05
Excavation	2.4	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	1.45E-04	3.57E-05
Backfill	2.2	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	1.35E-04	3.31E-05
Restoration	0.5	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	2.74E-05	6.72E-06
Pipe Delivery	0.7	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	4.36E-05	1.07E-05
Well Installation											
Air Vac-Borehole Clearance	0.7	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	4.36E-05	1.07E-05
Drilling and SVE Well Installation	0.7	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	4.36E-05	1.07E-05
Waste Collection	1.4	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	8.73E-05	2.14E-05
Street Paving											
Street Grinding	11.5	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	6.98E-04	1.71E-04
Street Paving	5.8	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	3.49E-04	8.57E-05

Daily Worker Trip Emissions:

Phase	Worker Trips per Day	Round Trip per Worker (mile)	VMT per Hour	SL (g/m^2)	W (Tons)	k (PM10)	k (PM2.5)	Wet Days	Avg. period	PM10 EF lbs/mi	PM2.5 EF lbs/mi	SCAB PM10 Emissions	SCAB PM2.5 Emissions
Option 1	32	0.72	23	0.02	2.40	0.0022	0.00054	40	365	1.49E-04	3.65E-05	3.42E-03	8.40E-04
Street Trenching	42	0.72	30	0.02	2.40	0.0022	0.00054	40	365	1.49E-04	3.65E-05	4.49E-03	1.10E-03
Well Installation	39	0.72	28	0.02	2.40	0.0022	0.00054	40	365	1.49E-04	3.65E-05	4.17E-03	1.02E-03
Street Paving													
Street Grinding	16	0.72	12	0.02	2.40	0.0022	0.00054	40	365	1.49E-04	3.65E-05	1.71E-03	4.20E-04
Street Paving	16	0.72	12	0.02	2.40	0.0022	0.00054	40	365	1.49E-04	3.65E-05	1.71E-03	4.20E-04

X. Off-Site Road Emissions

Summary: This section calculates the emissions of criteria pollutants from off-site paved roads.

Emissions Factors

Running Emissions							g/mi				
Veh Class	Fuel	MdlYr	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
LDA/LDT	All	All	6.4E-02	2.5E+00	2.8E-01	6.9E+02	3.0E-03	3.0E-04	7.0E-03	4.5E-02	1.8E-02
HHDT	DSL	All	7.8E-01	4.0E+00	1.4E+01	1.6E+03	8.0E-01	7.4E-01	1.7E-02	7.8E-02	3.1E-02
HHDT	DSL	2007	1.2E-01	8.6E-01	2.2E+00	1.6E+03	6.1E-02	5.6E-02	1.7E-02	5.9E-03	5.5E-03

Source: EMFAC 2011

Running Emissions							lbs/mi				
Veh Class	Fuel	MdlYr	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
LDA/LDT	All	All	1.4E-04	5.5E-03	6.1E-04	1.5E+00	6.6E-06	6.6E-07	1.5E-05	9.9E-05	4.0E-05
HHDT	DSL	All	1.7E-03	8.8E-03	3.1E-02	3.6E+00	1.8E-03	1.6E-03	3.7E-05	1.7E-04	6.8E-05
HHDT	DSL	2007	2.7E-04	1.9E-03	4.8E-03	3.5E+00	1.4E-04	1.2E-04	3.7E-05	1.3E-05	1.2E-05

Source: EMFAC 2011

Heavy Truck Trip Data																
Phase	Hourly Round Trips	Daily Round Trips	8 Home Cluster Round Trips	Annual Round Trips	Truck Type	Average Vehicle Weight (tons)	Round Trip length (SCAB)	Hourly VMT	Daily VMT	8 Home Cluster Round Trips	Annual VMT	Trip length (MDAB)	Hourly VMT	Daily VMT	8 Home Cluster Round Trips	Annual VMT
Option 1																
Demo	1.0	8	134	991	Dump Truck	25	60	63	502	8,030	59,469	0	0	0	0	0
Green Waste	0.5	4.0	32.0	237.0	Dump Truck	25.0	10.0	5	40	320	2,370	0	0	0	0	0
Excavation	1.9	15	1,787	3,530	Dump Truck	25	150	279	2,234	268,121	529,539	50	93	745	89,374	176,513
SVE Well/Piping	0.1	1.1	8.5	63.2	Dump Truck	25	100	13	107	853	6,320	0	0	0	0	0
Subslab Vent	0.0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	2.0	16	1,529	3,776	Dump Truck	25	8	16	127	12,236	30,207	0	0	0	0	0
Slurry Backfill	0.6	5.1	286.8	1213.8	Concrete Truck	25	20	13	102	5,736	24,277	0	0	0	0	0
Site Resto.	0.4	3	237	702	Concrete Truck	25	20	7	59	4,739	14,040	0	0	0	0	0
Street Trenching																
Demo	0.1	1.0	0.00	178.0	Dump Truck	25	60	7	59	0	10,680	0	0	0	0.00	0
Excavation	0.4	3.3	0.00	600.0	Dump Truck	25	150	63	500	0	90,000	50	21	167	0.00	30,000
Slurry Backfill	0.4	3.1	0.00	556.0	Dump Truck	25	8	3	25	0	4,448	0	0	0	0.00	0
Restoration	0.1	0.6	0.00	113.0	Concrete Truck	25	20	2	13	0	2,260	0	0	0	0.00	0
Pipe Delivery	0.1	1.0	0.00	180.0	Dump Truck	25	100	13	100	0	18,000	0	0	0	0.00	0
Well Installation																
Air Vac- Borehole Clearance	0.1	1.0	0.00	63.0	Air-Vac	25	10	1	10	0	630	0	0	0	0.00	0
Drilling and SVE Well Installation	0.1	1.0	0.00	63.0	Drill Rig	25	10	1	10	0	630	0	0	0	0.00	0
Waste Collection	0.3	2.0	0.00	126.0	Dump Truck	25	10	3	20	0	1,260	0	0	0	0.00	0
Waste Transport to Offsite Disposal	0.1	1.0	0.00	60.4	Dump Truck	25	150	18	144	0	9,060	50	6	48	0	3,020
Street Paving																
Street Grinding	2.7	8.0	0.00	80.0	Dump Truck	25	60	160	480	0	4,800	0	0	0	0.00	0
Street Paving	1.3	16.0	0.00	80.0	Dump Truck	25	100	133	1,600	0	8,000	0	0	0	0.00	0

Daily Truck Trip Emission Calculations (SCAB)						lbs/day (SCAB)				
Phase	Daily VMT (SCAB)	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
Option 1										
Demo	502	1.4E-01	9.5E-01	2.4E+00	1.7E+03	6.8E-02	6.2E-02	1.9E-02	6.6E-03	6.0E-03
Green Waste	40	1.1E-02	7.6E-02	1.9E-01	1.4E+02	5.4E-03	5.0E-03	1.5E-03	5.2E-04	4.8E-04
Excavation	2,234	6.1E-01	4.3E+00	1.1E+01	7.8E+03	3.0E-01	2.8E-01	8.2E-02	2.9E-02	2.7E-02
SVE Well/Piping	107	2.9E-02	2.0E-01	5.1E-01	3.7E+02	1.4E-02	1.3E-02	3.9E-03	1.4E-03	1.3E-03
Subslab Vent	0.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Backfill/Compact	127	3.5E-02	2.4E-01	6.1E-01	4.4E+02	1.7E-02	1.6E-02	4.7E-03	1.7E-03	1.5E-03
Slurry Backfill	102	2.8E-02	1.9E-01	4.9E-01	3.6E+02	1.4E-02	1.3E-02	3.8E-03	1.3E-03	1.2E-03
Site Resto.	59	1.6E-02	1.1E-01	2.8E-01	2.1E+02	8.0E-03	7.4E-03	2.2E-03	7.7E-04	7.1E-04
Street Trenching										
Demo	59	1.6E-02	1.1E-01	2.8E-01	2.1E+02	8.0E-03	7.4E-03	2.2E-03	7.8E-04	7.1E-04
Excavation	500	1.4E-01	9.5E-01	2.4E+00	1.7E+03	6.8E-02	6.2E-02	1.8E-02	6.5E-03	6.0E-03
Backfill	25	6.7E-03	4.7E-02	1.2E-01	8.6E+01	3.3E-03	3.1E-03	9.1E-04	3.2E-04	3.0E-04
Restoration	13	3.4E-03	2.4E-02	6.0E-02	4.4E+01	1.7E-03	1.6E-03	4.6E-04	1.6E-04	1.5E-04
Pipe Delivery	100	2.7E-02	1.9E-01	4.8E-01	3.5E+02	1.4E-02	1.2E-02	3.7E-03	1.3E-03	1.2E-03
Well Installation										
Air Vac- Borehole Clearance	10	2.7E-03	1.9E-02	4.8E-02	3.5E+01	1.4E-03	1.2E-03	3.7E-04	1.3E-04	1.2E-04
Drilling and SVE Well Installation	10	2.7E-03	1.9E-02	4.8E-02	3.5E+01	1.4E-03	1.2E-03	3.7E-04	1.3E-04	1.2E-04
Waste Collection	20	5.4E-03	3.8E-02	9.5E-02	6.9E+01	2.7E-03	2.5E-03	7.4E-04	2.6E-04	2.4E-04
Waste Transport to Offsite Disposal	144	3.9E-02	2.7E-01	6.8E-01	5.0E+02	1.9E-02	1.8E-02	5.3E-03	1.9E-03	1.7E-03
Street Paving										
Street Grinding	480	1.3E-01	9.1E-01	2.3E+00	1.7E+03	6.5E-02	6.0E-02	1.8E-02	6.3E-03	5.8E-03
Street Paving	1,600	4.3E-01	3.0E+00	7.6E+00	5.6E+03	2.2E-01	2.0E-01	5.9E-02	2.1E-02	1.9E-02

Daily Truck Trip Emission Calculations (MDAB)		lbs/day (MDAB)								
Phase	Daily VMT (MDAB)	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
Option 1										
Demo	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Green Waste	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Excavation	745	2.0E-01	1.4E+00	3.5E+00	2.6E+03	1.0E-01	9.3E-02	2.7E-02	9.7E-03	9.0E-03
SVE Well/Piping	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Subslab Vent	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Backfill/Compact	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Slurry Backfill	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Site Resto.	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Street Trenching										
Demo	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Excavation	167	4.5E-02	3.2E-01	7.9E-01	5.8E+02	2.3E-02	2.1E-02	6.2E-03	2.2E-03	2.0E-03
Backfill	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Restoration	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pipe Delivery	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Well Installation										
Air Vac- Borehole Clearance	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Drilling and SVE Well Installation	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Waste Collection	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Waste Transport to Offsite Disposal	48	1.3E-02	9.1E-02	2.3E-01	1.7E+02	6.5E-03	6.0E-03	1.8E-03	6.3E-04	5.8E-04
Street Paving										
Street Grinding	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Street Paving	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

				lbs/day								
Phase	Worker Round Trips per day	Roundtrip Distance per Worker (mi)	VMT per Day	ROG	CO	NOx	CO2	PM10	PM2.5	Sox	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
Option 1	32	21.6	691	9.8E-02	3.8E+00	4.2E-01	1.1E+03	4.6E-03	4.6E-04	1.1E-02	6.9E-02	2.7E-02
Street Trenching	42	21.6	907	1.3E-01	5.0E+00	5.6E-01	1.4E+03	6.0E-03	6.0E-04	1.4E-02	9.0E-02	3.6E-02
Well Installation	39	21.6	842	1.2E-01	4.7E+00	5.2E-01	1.3E+03	5.6E-03	5.6E-04	1.3E-02	8.4E-02	3.3E-02
Street Paving												
Street Grinding	16	21.6	346	4.9E-02	1.9E+00	2.1E-01	5.3E+02	2.3E-03	2.3E-04	5.3E-03	3.4E-02	1.4E-02
Street Paving	16	21.6	346	4.9E-02	1.9E+00	2.1E-01	5.3E+02	2.3E-03	2.3E-04	5.3E-03	3.4E-02	1.4E-02

*Used worker distances from CalEEMod Assumptions

XI. Off-Site Road - Reentrained Dust

Summary: This section calculates the emissions of re-entrained dust from off-site on road vehicles on paved roads.

$$E = [k(sL)^{0.91} \times (W)^{1.02}] (1 - P/4N)$$

Where:

E = size-specific emission factor (lb/VMT)
k = particle size multiplier
sL = road surface silt loading (g/m^2)
W = mean vehicle weight (tons)
P = averaging period (365 days)
N = number of "wet" days (>0.01 in of precipitation)

Source: AP-42 13.2.1-2, Equation (1). January 2011.

Correction:
P = number of wet days
N = number of days in period

Assumptions				
Parameter	**Value**	**Units**	**Reference**	
Vehicle Weight (tons)		25	tons	Assumed
k (empirical constant) - PM10		0.0022	-	AP-42, Chapter 13.2.1, Table 13.2.1-1. PM10 (lbs/VMT)
k (empirical constant) - PM2.5		0.00054	-	AP-42, Chapter 13.2.1, Table 13.2.1-1. PM2.5 (lbs/VMT)
sL (Haul Trucks)		0.02	g/m2	CARB Entrained Paved Road Dust. (1997) Silt loading for freeways:
sL (Worker Vehicles)		0.1	g/m2	CalEEMod Default for Worker trips (Assumes mix of freeway and
P (averaging period)		365	days	Days per year
N (wet days)		40	days	AP-42, Chapter 13.2.1, Figure 13.2.1-2. January 2011.
South Coast Air Basin Distance		75	miles	google maps
Mojave Desert Distance		25	miles	google maps
Employee/Worker Trip Distance		21.6	miles	CalEEMod Default Construction Worker Trip (Round Trip)
Paved Road Average Vehicle Weight		2.4	tons	CalEEMod default average vehicle weight (tons)

Phase	Hourly Round Trips	Daily Round Trips	8 Home Cluster Round Trips	Annual Round Trips	Truck Type	Average Vehicle Weight (tons)	Round Trip length (SCAB)	SCAB Hourly VMT	SCAB Daily VMT	SCAB 8 Home Cluster VMT	SCAB Annual VMT	Trip length (MDAB)	MDAB Hourly VMT	MDAB Daily VMT	MDAB 8 Home Cluster VMT	MDAB Annual VMT
Option 1																
Demo	1.0	8.4	133.8	991.1	Dump Truck	25	60	63	502	8,030	59,469	0	0	0	0	0
Green Waste	0.5	4.0	32.0	237.0	Dump Truck	25	10	5	40	320	2,370	0	0	0	0	0
Excavation	1.9	14.9	1,787.5	3,530.3	Dump Truck	25	150	279	2,234	268,121	529,539	50	93	745	89,374	176,513
SVE Well/Piping	0.1	1.1	8.5	63.2	Dump Truck	25	100	13	107	853	6,320	0	0	0	0	0
Subslab Vent	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0
Backfill/Compact	2.0	15.9	1,529.4	3,775.8	Dump Truck	25	8	16	127	12,236	30,207	0	0	0	0	0
Slurry Backfill	0.6	5.1	286.8	1,213.8	Concrete Truck	25	20	13	102	5,736	24,277	0	0	0	0	0
Site Resto.	0.4	3.0	237.0	702.0	Concrete Truck	25	20	7	59	4,739	14,040	0	0	0	0	0
Street Trenching																
Demo	0.1	1.0	0.0	178.0	Dump Truck	25	60	7	59	0	10,680	0	0	0	0	0
Excavation	0.4	3.3	0.0	600.0	Dump Truck	25	150	63	500	0	90,000	50	21	167	0	30,000
Backfill	0.4	3.1	0.0	556.0	Dump Truck	25	8	3	25	0	4,448	0	0	0	0	0
Restoration	0.1	0.6	0.0	113.0	Concrete Truck	25	20	2	13	0	2,260	0	0	0	0	0
Pipe Delievery	0.1	1.0	0.0	180.0	Dump Truck	25	100	13	100	0	18,000	0	0	0	0	0
Well Installation																
Air Vac- Borehole Clearance	0.1	1.0	0.0	63.0	Air-Vac	25	10.0	1	10	0	630	0	0	0	0	0
Drilling and SVE Well Installation	0.1	1.0	0.0	63.0	Drill Rig	25	10.0	1	10	0	630	0	0	0	0	0
Waste Collection	0.3	2.0	0.0	126.0	Dump Truck	25.0	10.0	2.5	20.0	0.0	1,260.0	0.0	0.0	0.0	0.0	0.0
Waste Transport to Offsite Disposal	0.1	1.0	0.0	60.4	Dump Truck	25.0	150.0	18.0	143.8	0.0	9,060.0	50.0	6.0	47.9	0.0	3,020.0
Street Paving																
Street Grinding	2.7	16.0	0.0	80.0	Dump Truck	25	60	160	960	0	4,800	0	0	0	0	0
Street Paving	2.7	16.0	0.0	160.0	Dump Truck	25	100	267	1,600	0	16,000	0	0	0	0	0

Emission Calculation

Daily:

Phase	Daily VMT (SCAB)	Daily VMT (MDAB)	sL (g/M^2)	W (tons)	k (PM10)	k (PM2.5)	Wet Days	Avg. Period	PM10 EF (lbs/mi.)	PM2.5 EF (lbs/mi.)	SCAB Pm10 Emissions	SCAB PM2.5 Emissions	MDAB Pm10 Emissions	MDAB PM2.5 Emissions
Option 1														
Demo	501.8	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	8.1E-01	2.0E-01	0.0E+00	0.0E+00
Green Waste	40.0	0.0	0.02	25	0.0022	0.00054	40	366	0.0016	0.0004	6.5E-02	1.6E-02	0.0E+00	0.0E+00
Excavation	2,234.3	744.8	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	3.6E+00	8.9E-01	1.2E+00	3.0E-01
SVE Well/Piping	106.7	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	1.7E-01	4.2E-02	0.0E+00	0.0E+00
Subslab Vent	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Backfill/Compact	127.5	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	2.1E-01	5.1E-02	0.0E+00	0.0E+00
Slurry Backfill	102.4	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	1.7E-01	4.1E-02	0.0E+00	0.0E+00
Site Resto.	59.2	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	9.6E-02	2.4E-02	0.0E+00	0.0E+00
Street Trenching														
Demo	59.3	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	9.6E-02	2.4E-02	0.0E+00	0.0E+00
Excavation	500.0	166.7	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	8.1E-01	2.0E-01	2.7E-01	6.6E-02
Backfill	24.7	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	4.0E-02	9.8E-03	0.0E+00	0.0E+00
Restoration	12.6	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	2.0E-02	5.0E-03	0.0E+00	0.0E+00
Pipe Delievery	100.0	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	1.6E-01	4.0E-02	0.0E+00	0.0E+00
Well Installation														
Air Vac- Borehole Clearance	10.0	0.0	0.02	25	0.0022	0.00054	40	367	0.0016	0.0004	1.6E-02	4.0E-03	0.0E+00	0.0E+00
Drilling and SVE Well Installation	10.0	0.0	0.02	25	0.0022	0.00054	40	368	0.0016	0.0004	1.6E-02	4.0E-03	0.0E+00	0.0E+00
Waste Collection	20.0	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	3.2E-02	8.0E-03	0.0E+00	0.0E+00
Waste Transport to Offsite Disposal	143.8	47.9	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	2.3E-01	5.7E-02	7.8E-02	1.9E-02
Street Paving														
Street Grinding	960.0	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	1.6E+00	3.8E-01	0.0E+00	0.0E+00
Street Paving	1,600.0	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	2.6E+00	6.4E-01	0.0E+00	0.0E+00

Daily Worker Trip Emissions:

Phase	Worker Trips per Day	Round Trip per Worker (mile)	VMT per Hour	SL (g/m^2)	W (Tons)	k (PM10)	k (PM2.5)	Wet Days	Avg. period	PM10 EF lbs/mi	PM2.5 EF lbs/mi	SCAB PM10 Emissions	SCAB PM2.5 Emissions
Option 1	32	21.6	691	0.02	2.4	0.0022	0.00054	40	365	0.0001	0.0000	1.0E-01	2.5E-02
Street Trenching	42	21.6	907	0.02	2.4	0.0022	0.00054	40	365	0.0001	0.0000	1.3E-01	3.3E-02
Well Installation	39	21.6	842	0.02	2.4	0.0022	0.00054	40	365	0.0001	0.0000	1.3E-01	3.1E-02
Street Paving													
Street Grinding	16	21.6	346	0.02	2.4	0.0022	0.00054	40	365	0.0001	0.0000	5.1E-02	1.3E-02
Street Paving	16	21.6	346	0.02	2.4	0.0022	0.00054	40	365	0.0001	0.0000	5.1E-02	1.3E-02

Calculation Delivery Cover Sheet

URS Santa Ana Air Quality Group

Date:	*10/29/2014*
Project:	Kast Remediation Project - VOC Emissions Option 1 (Hard and Softscape Excavation) **5 foot with *10 foot Excavation, 4 Houses at a Time, Phase Overlap***
Project number:	*49194119*
Requestor:	*PCR Consulting*
Project manager:	*Roy Patterson*
Air Quality originator:	*Irma Buenrostro*
Air Quality project lead:	*Shirley Pearson*
Air Quality internal reviewer:	*Shirley Pearson*
Date review completed:	*29-Oct-14*
Detail check internal reviewer:	*Irma Buenrostro*
Date review completed:	*29-Oct-14*
Brief description of analysis:	*Calculating emission rates of VOC from contaminated soil.*
Reference MXD:	S:\Shirley Pearson\!Kast\29 Oct 2014 Updates
Model used:	*EMSOFT, 2002*

Version 10-29-14

Kast VOC Emissions Calculations

I. List of VOC's Listed in the HHRA

COC	CAS #	Organic Carbon partition Coefficient (Koc) (cm^3/g)	Diffusivity in Air (Dair) (cm^2/s)	Diffusivity in Water (Dwater) (cm^2/s)	Henry's Law Constant (H') (unit less)	Soil-water Partition coefficient (Ksw) (cm^3/g)	Soil-Water Partition Coefficient (kd) (cm^3/g)	Apparent Diffusivity (Da) (cm^2/s)	Effective Diffusion Coefficient (Deff) (cm^2/s)
1,1,2,2-Tetrachloroethane	79-34-5	9.30E+01	7.10E-02	7.90E-06	1.40E-02	6.60E-01	5.60E-01	7.80E-05	5.50E-03
1,2,3-Trichloropropane	96-18-4	2.20E+01	7.10E-02	7.90E-06	1.70E-02	2.40E-01	1.30E-01	2.60E-04	5.50E-03
1,2,4-Trimethylbenzene	95-63-6	1.40E+03	6.10E-02	7.90E-06	2.50E-01	8.30E+00	8.10E+00	9.60E-05	4.70E-03
1,2-Dichloropropane	78-87-5	4.40E+01	7.80E-02	8.70E-06	1.10E-01	3.80E-01	2.60E-01	1.20E-03	6.10E-03
1,3,5-Trimethylbenzene	108-67-8	1.40E+03	6.00E-02	8.70E-06	2.40E-01	8.30E+00	8.10E+00	9.10E-05	4.70E-03
1,4-Dichlorobenzene	106-46-7	6.20E+02	6.90E-02	7.90E-06	9.80E-02	3.80E+00	3.70E+00	9.20E-05	5.40E-03
Benzene	71-43-2	5.90E+01	8.80E-02	9.80E-06	2.30E-01	5.00E-01	3.50E-01	2.10E-03	6.90E-03
Bromodichloromethane	75-27-4	5.50E+01	3.00E-02	1.10E-05	6.50E-02	4.40E-01	3.30E-01	2.30E-04	2.30E-03
Bromomethane	74-83-9	1.10E+01	7.30E-02	1.20E-05	2.60E-01	2.10E-01	6.30E-02	4.60E-03	5.70E-03
Ethylbenzene	100-41-4	3.60E+02	7.50E-02	7.80E-06	3.20E-01	2.30E+00	2.20E+00	5.30E-04	5.90E-03
Methylene chloride	75-09-2	1.20E+01	1.00E-01	1.20E-05	9.00E-02	1.90E-01	7.00E-02	2.50E-03	7.90E-03
Tetrachloroethene	127-18-4	1.60E+02	7.20E-02	8.20E-06	7.50E-01	1.20E+00	9.30E-01	2.40E-03	5.60E-03
Toluene	108-88-3	1.80E+02	8.70E-02	8.60E-06	2.70E-01	1.20E+00	1.10E+00	9.80E-04	6.80E-03
Trichloroethene	79-01-6	1.70E+02	7.90E-02	9.10E-06	4.20E-01	1.20E+00	1.00E+00	1.50E-03	6.20E-03
Vinyl chloride	75-01-4	1.90E+01	1.10E-01	1.20E-05	1.10E+00	4.20E-01	1.10E-01	1.50E-02	8.30E-03
Xylenes, total	1330-20-7	3.90E+02	7.70E-02	8.40E-06	3.10E-01	2.50E+00	2.30E+00	5.00E-04	6.00E-03
1-Methylnaphthalene	90-12-0	3.00E+03	5.30E-02	7.90E-06	2.10E-02	1.80E+01	1.80E+01	3.10E-06	4.10E-03
2-Methylnaphthalene	91-57-6	2.80E+03	5.20E-02	7.80E-06	2.10E-02	1.70E+01	1.70E+01	3.40E-06	4.10E-03
Naphthalene	91-20-3	2.00E+03	5.90E-02	7.50E-06	2.00E-02	1.20E+01	1.20E+01	5.00E-06	4.60E-03

Kast VOC Emissions Calculations

COC	CAS #	Organic Carbon partition Coefficient (Koc) (cm^3/g)	Diffusivity in Air (Dair) (cm^2/s)	Diffusivity in Water (Dwater) (cm^2/s)	Henry's Law Constant (H') (unit less)	Soil-water Partition coefficient (Ksw) (cm^3/g)	Soil-Water Partition Coefficient (kd) (cm^3/g)	Apparent Diffusivity (Da) (cm^2/s)	Effective Diffusion Coefficient (Deff) (cm^2/s)
Pyrene	129-00-0	1.10E+05	2.70E-02	7.20E-06	4.50E-04	6.30E+02	6.30E+02	1.10E-09	2.30E-03
1,1,2,2-Tetrachloroethane	79-34-5	9.30E+01	7.10E-02	7.90E-06	1.40E-02	6.60E-01	5.60E-01	7.80E-05	5.50E-03
1,1,2-Trichloroethane	79-00-5	5.00E+01	7.80E-02	8.80E-06	3.70E-02	4.10E-01	3.00E-01	3.70E-04	6.10E-03
1,1-Dichloroethane	75-34-3	3.20E+01	7.40E-02	1.10E-05	2.30E-01	3.30E-01	1.90E-01	2.70E-03	5.80E-03
1,2,3-Trichloropropane	96-18-4	2.20E+01	7.10E-02	7.90E-06	1.70E-02	2.40E-01	1.30E-01	2.60E-04	5.50E-03
1,2,4-Trichlorobenzene	120-82-1	1.80E+03	3.00E-02	8.20E-06	5.80E-02	1.10E+01	1.10E+01	8.40E-06	2.30E-03
1,2,4-Trimethylbenzene	95-63-6	1.40E+03	6.10E-02	7.90E-06	2.50E-01	8.30E+00	8.10E+00	9.60E-05	4.70E-03
1,2-Dichloroethane	107-06-2	1.70E+01	1.00E-01	9.90E-06	4.00E-02	2.10E-01	1.00E-01	1.00E-03	8.10E-03
1,2-Dichloropropane	78-87-5	4.40E+01	7.80E-02	8.70E-06	1.10E-01	3.80E-01	2.60E-01	1.20E-03	6.10E-03
1,3,5-Trimethylbenzene	108-67-8	1.40E+03	6.00E-02	8.70E-06	2.40E-01	8.30E+00	8.10E+00	9.10E-05	4.70E-03
1,3-Butadiene	106-99-0	1.90E+01	2.50E-01	1.10E-05	3.00E+00	7.80E-01	1.10E-01	5.00E-02	1.90E-02
1,4-Dichlorobenzene	106-46-7	6.20E+02	6.90E-02	7.90E-06	9.80E-02	3.80E+00	3.70E+00	9.20E-05	5.40E-03
1,4-Dioxane	123-91-1	1.00E+00	2.30E-01	1.00E-05	2.30E-04	1.10E-01	6.00E-03	2.60E-05	1.80E-02
2,2,4-Trimethylpentane	540-84-1	1.50E+05	1.00E-01	1.00E-05	1.80E+02	9.30E+02	9.00E+02	1.00E-03	7.80E-03
2-Hexanone	591-78-6	9.40E+00	7.50E-02	8.40E-06	3.80E-03	1.60E-01	5.70E-02	9.40E-05	5.80E-03
4-Ethyltoluene	622-96-8	1.80E+03	6.80E-02	7.30E-06	2.10E-01	1.10E+01	1.10E+01	6.70E-05	5.30E-03
Benzene	71-43-2	5.90E+01	8.80E-02	9.80E-06	2.30E-01	5.00E-01	3.50E-01	2.10E-03	6.90E-03
Bromodichloromethane	75-27-4	5.50E+01	3.00E-02	1.10E-05	6.50E-02	4.40E-01	3.30E-01	2.30E-04	2.30E-03
Bromomethane	74-83-9	1.10E+01	7.30E-02	1.20E-05	2.60E-01	2.10E-01	6.30E-02	4.60E-03	5.70E-03
Carbon disulfide	75-15-0	4.60E+01	1.00E-01	1.00E-05	1.20E+00	6.10E-01	2.70E-01	1.10E-02	8.10E-03
Carbon tetrachloride tetrachloride	56-23-5	1.70E+02	7.80E-02	8.80E-06	1.20E+00	1.40E+00	1.00E+00	3.60E-03	6.10E-03
Chloroform	67-66-3	4.00E+01	1.00E-01	1.00E-05	1.50E-01	3.70E-01	2.40E-01	2.20E-03	8.10E-03
Cyclohexane	110-82-7	1.70E+02	7.40E-02	8.50E-06	7.90E+00	2.60E+00	9.90E-01	1.20E-02	5.70E-03
Dibromochloromethane	124-48-1	6.30E+01	2.00E-02	1.10E-05	3.20E-02	4.80E-01	3.80E-01	6.70E-05	1.50E-03
cis-1,2-Dichloroethene	156-59-2	3.60E+01	7.40E-02	1.10E-05	1.70E-01	3.40E-01	2.10E-01	1.80E-03	5.70E-03
trans-1,2-Dichloroethene	156-60-5	5.30E+01	7.10E-02	1.20E-05	3.80E-01	4.90E-01	3.20E-01	2.90E-03	5.50E-03
trans-1,3-Dichloropropene	10061-02-6	4.60E+01	6.30E-02	1.00E-05	7.20E-01	5.10E-01	2.70E-01	4.60E-03	4.90E-03
Ethanol	64-17-5	1.00E+00	1.50E-01	1.60E-05	1.90E-04	1.10E-01	6.00E-03	1.50E-05	1.30E-02
Ethylbenzene	100-41-4	3.60E+02	7.50E-02	7.80E-06	3.20E-01	2.30E+00	2.20E+00	5.40E-04	5.90E-03
Heptane	142-82-5	2.70E+02	9.30E-02	7.60E-06	8.20E+01	1.70E+01	1.60E+00	2.30E-02	7.20E-03
Hexachloro-1,3-butadiene	87-68-3	5.40E+04	5.60E-02	6.20E-06	3.30E-01	3.20E+02	3.20E+02	3.00E-06	4.40E-03
Hexane	110-54-3	4.30E+01	2.00E-01	7.80E-06	6.80E+01	1.30E+01	2.60E-01	5.40E-02	1.60E-02

Kast VOC Emissions Calculations

COC	CAS #	Organic Carbon partition Coefficient (Koc) (cm^3/g)	Diffusivity in Air (Dair) (cm^2/s)	Diffusivity in Water (Dwater) (cm^2/s)	Henry's Law Constant (H') (unit less)	Soil-water Partition coefficient (Ksw) (cm^3/g)	Soil-Water Partition Coefficient (kd) (cm^3/g)	Apparent Diffusivity (Da) (cm^2/s)	Effective Diffusion Coefficient (Deff) (cm^2/s)
Isopropanol	67-63-0	6.90E+00	8.00E-02	9.30E-06	3.60E-04	1.40E-01	4.20E-02	1.10E-05	6.50E-03
Isopropyl benzene (cumene)	98-82-8	4.90E+02	6.50E-02	7.10E-06	4.70E+01	1.20E+01	2.90E+00	1.30E-02	5.10E-03
Methyl ethyl ketone (2-butanone)	78-93-3	2.30E+00	8.10E-02	9.80E-06	2.30E-03	1.10E-01	1.40E-02	8.40E-05	6.30E-03
Methylene chloride	75-09-2	1.20E+01	1.00E-01	1.20E-05	9.00E-02	1.90E-01	7.00E-02	2.50E-03	7.90E-03
Methyl-tert-butyl ether	1634-04-4	7.30E+00	1.00E-01	1.10E-05	2.60E-02	1.50E-01	4.40E-02	9.10E-04	8.00E-03
Propyl benzene	103-65-1	5.60E+02	6.00E-02	7.80E-06	4.40E-01	3.60E+00	3.40E+00	3.80E-04	4.70E-03
tert-Butyl Alcohol (TBA)	75-65-0	4.20E+00	8.50E-02	9.10E-06	3.00E-03	1.30E-01	2.50E-02	1.10E-04	6.70E-03
Tetrachloroethene	127-18-4	1.60E+02	7.20E-02	8.20E-06	7.50E-01	1.20E+00	9.30E-01	2.40E-03	5.60E-03
Tetrahydrofuran	109-99-9	9.50E-01	9.80E-02	1.10E-05	2.90E-03	1.10E-01	5.70E-03	1.40E-04	7.70E-03
Toluene	108-88-3	1.80E+02	8.70E-02	8.60E-06	2.70E-01	1.20E+00	1.10E+00	9.80E-04	6.80E-03
Trichloroethene	79-01-6	1.70E+02	7.90E-02	9.10E-06	4.20E-01	1.20E+00	1.00E+00	1.50E-03	6.20E-03
Vinyl chloride	75-01-4	1.90E+01	1.10E-01	1.20E-05	1.10E+00	4.20E-01	1.10E-01	1.50E-02	8.30E-03
Xylenes, total	1330-20-7	3.90E+02	7.70E-02	8.40E-06	3.10E-01	2.50E+00	2.30E+00	5.00E-04	6.00E-03
1-Methylnaphthalene	90-12-0	3.00E+03	5.30E-02	7.90E-06	2.10E-02	1.80E+01	1.80E+01	3.10E-06	4.10E-03
2-Methylnaphthalene	91-57-6	2.80E+03	5.20E-02	7.80E-06	2.10E-02	1.70E+01	1.70E+01	3.40E-06	4.10E-03
Naphthalene	91-20-3	2.00E+03	5.90E-02	7.50E-06	2.00E-02	1.20E+01	1.20E+01	5.00E-06	4.60E-03
Pyrene	129-00-0	1.10E+05	2.70E-02	7.20E-06	4.50E-04	6.30E+02	6.30E+02	1.10E-09	2.30E-03

Data Source: Geosyntec Consultants, Human Health Risk Assessment Report Former Kast Property Carson, California, March 10, 2014

Kast VOC Emissions Calculations

II. Chemical Inputs for EMSOFT Model run

CAS #	Chemical	Organic Carbon Partition Coefficient Koc (cm^3/g)	Air Diffusion Coefficient D'a (cm^2/s)	Air Diffusion Coefficient D'a (cm^2/day)	Aqueous Diffusion Coefficient D'w (cm^2/s)	Aqueous Diffusion Coefficient D'w (cm^2/day)	Henry's Law Constant (unit less)	COC Concentrations (0-10 feet)		COC Concentrations (0-10 feet)	
								Units	Sitewide UCL	Units	Sitewide UCL
100-41-4	Ethylbenzene	360	7.50E-02	6.48E+03	7.80E-06	6.74E-01	3.20E-01	mg/kg	5.00E-01	ug/kg	5.00E+02
106-46-7	1,4-Dichlorobenzene	620	6.90E-02	5.96E+03	7.90E-06	6.83E-01	9.80E-02	mg/kg	5.90E-04	ug/kg	5.90E-01
107-06-2	1,2-Dichloroethane	17	1.00E-01	8.64E+03	9.90E-06	8.55E-01	4.00E-02	mg/kg	4.70E-04	ug/kg	4.70E-01
108-67-8	1,3,5-Trimethylbenzene	1400	6.00E-02	5.18E+03	8.70E-06	7.52E-01	2.40E-01	mg/kg	1.90E-01	ug/kg	1.90E+02
108-88-3	Toluene	180	8.70E-02	7.52E+03	8.60E-06	7.43E-01	2.70E-01	mg/kg	1.20E-01	ug/kg	1.20E+02
127-18-4	Tetrachloroethene	160	7.20E-02	6.22E+03	8.20E-06	7.08E-01	7.50E-01	mg/kg	1.30E-02	ug/kg	1.30E+01
129-00-0	Pyrene	110000	2.70E-02	2.33E+03	7.20E-06	6.22E-01	4.50E-04	mg/kg	1.00E+00	mg/kg	1.00E+00
1330-20-7	Xylenes, Total	390	7.70E-02	6.65E+03	8.40E-06	7.26E-01	3.10E-01	mg/kg	7.69E-01	ug/kg	7.69E+02
156-59-2	cis-1,2-Dichloroethene	36	7.40E-02	6.39E+03	1.10E-05	9.50E-01	1.70E-01	mg/kg	5.60E-04	ug/kg	5.60E-01
71-43-2	Benzene	59	8.80E-02	7.60E+03	9.80E-06	8.47E-01	2.30E-01	mg/kg	1.70E-01	ug/kg	1.70E+02
74-83-9	Bromomethane	11	7.30E-02	6.31E+03	1.20E-05	1.04E+00	2.60E-01	mg/kg	5.80E-03	ug/kg	5.80E+00
75-01-4	Vinyl Chloride	19	1.10E-01	9.50E+03	1.20E-05	1.04E+00	1.10E+00	mg/kg	2.41E-04	ug/kg	2.41E-01
75-09-2	Methylene Chloride	12	1.00E-01	8.64E+03	1.20E-05	1.04E+00	9.00E-02	mg/kg	3.20E-03	ug/kg	3.20E+00
75-27-4	Bromodichloromethane	55	3.00E-02	2.59E+03	1.10E-05	9.50E-01	6.50E-02	mg/kg	2.40E-04	ug/kg	2.40E-01
75-65-0	tert-Butyl Alcohol (TBA)	4.2	8.50E-02	7.34E+03	9.10E-06	7.86E-01	3.00E-03	mg/kg	4.80E-03	ug/kg	4.80E+00
78-87-5	1,2-Dichloropropane	44	7.80E-02	6.74E+03	8.70E-06	7.52E-01	1.10E-01	mg/kg	3.60E-04	ug/kg	3.60E-01
79-01-6	Trichloroethene	170	7.90E-02	6.83E+03	9.10E-06	7.86E-01	4.20E-01	mg/kg	7.40E-04	ug/kg	7.40E-01
79-34-5	1,1,2,2-Tetrachloroethane	93	7.10E-02	6.13E+03	7.90E-06	6.83E-01	1.40E-02	mg/kg	4.80E-04	ug/kg	4.80E-01
90-12-0	1-Methylnaphthalene	3000	5.30E-02	4.58E+03	7.90E-06	6.83E-01	2.10E-02	mg/kg	2.60E+00	mg/kg	2.60E+00
91-20-3	Naphthalene	2000	5.90E-02	5.10E+03	7.50E-06	6.48E-01	2.00E-02	mg/kg	1.50E+00	mg/kg	1.50E+00
91-57-6	2-Methylnaphthalene	2800	5.20E-02	4.49E+03	7.80E-06	6.74E-01	2.10E-02	mg/kg	3.90E+00	mg/kg	3.90E+00
95-63-6	1,2,4-Trimethylbenzene	1400	6.10E-02	5.27E+03	7.90E-06	6.83E-01	2.50E-01	mg/kg	7.80E-01	ug/kg	7.80E+02

Kast VOC Emissions Calculations

CAS #	Chemical	Organic Carbon Partition Coefficient Koc (cm^3/g)	Air Diffusion Coefficient D'a (cm^2/s)	Air Diffusion Coefficient D'a (cm^2/day)	Aqueous Diffusion Coefficient D'w (cm^2/s)	Aqueous Diffusion Coefficient D'w (cm^2/day)	Henry's Law Constant (unit less)	Units	Sitewide UCL	Units	Sitewide UCL
96-18-4	1,2,3-Trichloropropane	22	7.10E-02	6.13E+03	7.90E-06	6.83E-01	1.70E-02	mg/kg	6.40E-04	ug/kg	6.40E-01
#N/A	2,4-Dinitrotoluene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	6.30E-02	mg/kg	6.30E-02
#N/A	Antimony	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	2.90E-01	mg/kg	2.90E-01
#N/A	Arsenic	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	4.90E+00	mg/kg	4.90E+00
#N/A	BaP TEQ	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.70E-01	mg/kg	1.70E-01
#N/A	Benzo (a) Anthracene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	2.10E-01	mg/kg	2.10E-01
#N/A	Benzo (a) Pyrene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.20E-01	mg/kg	1.20E-01
#N/A	Benzo (b) Fluoranthene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	5.80E-02	mg/kg	5.80E-02
#N/A	Benzo (k) Fluoranthene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.30E-02	mg/kg	1.30E-02
#N/A	Bis(2-Ethylhexyl) Phthalate	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.50E-01	mg/kg	1.50E-01
#N/A	Cadmium	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	9.90E-02	mg/kg	9.90E-02
#N/A	Chromium, Hexavalent	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.30E-01	mg/kg	1.30E-01
#N/A	Chrysene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	5.60E-01	mg/kg	5.60E-01
#N/A	Cobalt	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	8.10E+00	mg/kg	8.10E+00
#N/A	Copper	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.40E+01	mg/kg	1.40E+01
#N/A	Dibenz (a,h) Anthracene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	8.90E-03	mg/kg	8.90E-03
#N/A	Indeno (1,2,3-c,d) Pyrene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.70E-02	mg/kg	1.70E-02
#N/A	Lead	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.10E+01	mg/kg	1.10E+01
#N/A	Thallium	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	2.20E-01	mg/kg	2.20E-01
#N/A	TPH as Diesel	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	2.20E+03	mg/kg	2.20E+03
#N/A	TPH as Gasoline	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.30E+02	mg/kg	1.30E+02
#N/A	TPH as Motor Oil	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	3.00E+03	mg/kg	3.00E+03
#N/A	Vanadium	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	3.00E+01	mg/kg	3.00E+01
#N/A	Zinc	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	4.20E+01	mg/kg	4.20E+01

Data Source: Geosyntec Consultants, Human Health Risk Assessment Report Former Kast Property Carson, California, March 10, 2014

*Chemicals with values as "#N/A" were not listed in the HHRA.

III. Soil and Layer Inputs for EMSOFT Model Run

	Calculation Options			Soil Properties				Physical Constants		Layer Properties	
	Time Period for Averaging and Printing Flux and Soil Concentration Results* (days)	Depth (D1) for Averaging Soil Concentration Results (cm)	Depth (D2) for Printing Soil Concentration Results (cm)	Fraction Organic Carbon[A,B] (unit less)	Fraction Porosity[A,B] (unit less)	Fraction Water Content[A,B] (unit less)	Bulk Density[A,B] (g/cm^3)	Porewater Flux (-=up, +=down)^c (cm/day)	Boundary Layer Thickness[D] (cm)	Cover Thickness[E] (cm)	Layer Thickness[F] (cm)
Site Wide (USEPA Screening Values for Loam)	[0.1/1]*	1	1	0.002	0.399	0.148	1.59	0	0.5	0	304.8

* 0.1 days: Shortest duration supported by EMSOFT model and used the represent the maximum hourly flux.

1 day: Used to represent the maximum daily flux

Data Sources: A. USPEA, User's Guide for Evaluation subsurface Vapor intrusion into Buildings, Table 11 - Guidance for Selection of Soil Type, (2004) 37. The soil parameters are based on soil texture classification of "lam."

B. USPEA, Johnson and Ettinger (1991) Model for Subsurface Vapor Intrusion into Buildings, Version 3.1, Soil Properties Lookup Table, (2004).

C. USEPA, EMSOFT User's Guide, Page 38, September 2002. "If no data are available, it would be conservative for the purpose of calculating long-term volatilization rates and soil concentrations to assume a porewater flux of zero."

D. USEPA, EMSOFT User's Guide, Page 43, September 2002. "A default boundary layer thickness that may be used in EMSOFT when no other data are available is 0.5 cm.

E. Assumes contamination begins at the surface.

F. This analysis uses 10 feet (304.8 cm) throughout site.

IV. EMSOFT Volatilization Factor Out Put

CAS #	Chemical	Volatilization Factors	
		0.1 Day Average (mg/cm^2)	1 Day Average (mg/cm^2-day)
100-41-4	Ethylbenzene	2.74E-02	8.72E-03
106-46-7	1,4-Dichlorobenzene	1.36E-05	4.35E-06
107-06-2	1,2-Dichloroethane	2.68E-05	8.52E-06
108-67-8	1,3,5-Trimethylbenzene	4.32E-03	1.39E-03
108-88-3	Toluene	8.61E-03	2.74E-03
127-18-4	Tetrachloroethene	1.37E-03	4.34E-04
129-00-0	Pyrene	8.66E-06	7.21E-06
1330-20-7	Xylenes, Total	4.07E-02	1.29E-02
156-59-2	cis-1,2-Dichloroethene	4.73E-05	1.50E-05
71-43-2	Benzene	1.60E-02	5.09E-03
74-83-9	Bromomethane	6.68E-04	2.12E-04
75-01-4	Vinyl Chloride	5.03E-05	1.59E-05
75-09-2	Methylene Chloride	2.76E-04	8.78E-05
75-27-4	Bromodichloromethane	7.50E-06	2.40E-06
75-65-0	tert-Butyl Alcohol (TBA)	7.75E-05	2.50E-05
78-87-5	1,2-Dichloropropane	2.47E-05	7.84E-06
79-01-6	Trichloroethene	6.29E-05	2.00E-05
79-34-5	1,1,2,2-Tetrachloroethane	9.23E-06	2.97E-06
90-12-0	1-Methylnaphthalene	1.05E-02	5.48E-03
91-20-3	Naphthalene	8.22E-02	2.60E-03
91-57-6	2-Methylnaphthalene	1.61E-02	5.48E-03
95-63-6	1,2,4-Trimethylbenzene	1.83E-02	5.86E-03
96-18-4	1,2,3-Trichloropropane	1.94E-05	6.21E-06

V. VOC Emission Calculations

General Assumptions

Parameter	Value	Units	References
Hours per Day	8	hours	Hours of work 8am-4pm

Excavated Surface Volatilization Assumptions

Parameter	Value	Units	References
Layer Thickness	304.8	cm	10 feet of excavation
Stabilizer	91%	%	Apply stabilizer on inactive areas. Source: USEPA, Control of Air Emissions from Superfund Sites, (1992). Long-term VOC control efficiency ranges from 91 to 100%.
Work Days in year	251	days	

Excavated Surfaces VOC Emissions

Equation:

Active Area Emissions (lb/time) = tXVFXAs

None-Active Area Emissions (lb/time) = (1-MR)xtXVFXAs

Where:

MR = stabilized mitigation

t = time conversion factor (e.g. Hours/day, days/year)

VF = volatility factor output from EMSOFT model (mg/cm^2-day)

As = surface area of volatilization (cm^2)

Phase	Duration (days)	Hourly QTY Excavated (CY)	Daily QTY Excavated (CY)	Yearly QTY Excavated (CY)	Hourly Excavated/Disturbed Surface Area (cm^2)	Daily Previously Excavated/Disturbed Surface Area (cm^2)	Yearly Excavated/Disturbed Surface Area (cm^2)	Stabilized Mitigation (% Reduction)
Option 1 - Excavati	889	7	209	49,423	1.76E+04	5.23E+05	1.24E+08	91%
Street Trenching	180	6	45	8,100	1.41E+04	1.13E+05	2.03E+07	91%

Kast VOC Emissions Calculations

Volatilization Factor Calculations:

CAS #	Chemical	Chemical UCL Concentration (mg/kg)	Volatilization Factors					
			VF1day [1 day avg.] (mg/cm^2-day)	VF1day [workday] (lbs/cm^2-day)	VF1day [off-workday] (lbs/cm^2-day)	VF1hr [0.1 day avg.] (mg/cm^2-day)	VF1hr [workday] (lbs/cm^2-day)	VF1hr [off-workday] (lbs/cm^2-day)
Option 1 - Excavation								
100-41-4	Ethylbenzene	5.00E-01	8.72E-03	6.41E-09	2.88E-08	2.74E-02	2.01E-08	4.03E-08
106-46-7	1,4-Dichlorobenzene	5.90E-04	4.35E-06	3.20E-12	1.44E-11	1.36E-05	9.97E-12	1.99E-11
107-06-2	1,2-Dichloroethane	4.70E-04	8.52E-06	6.26E-12	2.82E-11	2.68E-05	1.97E-11	3.94E-11
108-67-8	1,3,5-Trimethylbenzene	1.90E-01	1.39E-03	1.02E-09	4.59E-09	4.32E-03	3.18E-09	6.35E-09
108-88-3	Toluene	1.20E-01	2.74E-03	2.01E-09	9.05E-09	8.61E-03	6.33E-09	1.27E-08
127-18-4	Tetrachloroethene	1.30E-02	4.34E-04	3.19E-10	1.44E-09	1.37E-03	1.01E-09	2.01E-09
129-00-0	Pyrene	1.00E+00	7.21E-06	5.29E-12	2.38E-11	8.66E-06	6.37E-12	1.27E-11
1330-20-7	Xylenes, Total	7.69E-01	1.29E-02	9.51E-09	4.28E-08	4.07E-02	2.99E-08	5.98E-08
156-59-2	cis-1,2-Dichloroethene	5.60E-04	1.50E-05	1.10E-11	4.96E-11	4.73E-05	3.47E-11	6.95E-11
71-43-2	Benzene	1.70E-01	5.09E-03	3.74E-09	1.68E-08	1.60E-02	1.18E-08	2.36E-08
74-83-9	Bromomethane	5.80E-03	2.12E-04	1.56E-10	7.01E-10	6.68E-04	4.91E-10	9.82E-10
75-01-4	Vinyl Chloride	2.41E-04	1.59E-05	1.17E-11	5.26E-11	5.03E-05	3.69E-11	7.39E-11
75-09-2	Methylene Chloride	3.20E-03	8.78E-05	6.45E-11	2.90E-10	2.76E-04	2.03E-10	4.06E-10
75-27-4	Bromodichloromethane	2.40E-04	2.40E-06	1.76E-12	7.92E-12	7.50E-06	5.51E-12	1.10E-11
75-65-0	tert-Butyl Alcohol (TBA)	4.80E-03	2.50E-05	1.84E-11	8.27E-11	7.75E-05	5.70E-11	1.14E-10
78-87-5	1,2-Dichloropropane	3.60E-04	7.84E-06	5.76E-12	2.59E-11	2.47E-05	1.81E-11	3.62E-11
79-01-6	Trichloroethene	7.40E-04	2.00E-05	1.47E-11	6.61E-11	6.29E-05	4.63E-11	9.25E-11
79-34-5	1,1,2,2-Tetrachloroethane	4.80E-04	2.97E-06	2.18E-12	9.83E-12	9.23E-06	6.79E-12	1.36E-11
90-12-0	1-Methylnaphthalene	2.60E+00	5.48E-03	4.02E-09	1.81E-08	1.05E-02	7.68E-09	1.54E-08
91-20-3	Naphthalene	1.50E+00	2.60E-03	1.91E-09	8.60E-09	8.22E-02	6.04E-08	1.21E-07
91-57-6	2-Methylnaphthalene	3.90E+00	5.48E-03	4.02E-09	1.81E-08	1.61E-02	1.18E-08	2.37E-08
95-63-6	1,2,4-Trimethylbenzene	7.80E-01	5.86E-03	4.31E-09	1.94E-08	1.83E-02	1.34E-08	2.69E-08
96-18-4	1,2,3-Trichloropropane	6.40E-04	6.21E-06	4.56E-12	2.05E-11	1.94E-05	1.43E-11	2.85E-11

Kast VOC Emissions Calculations

Street Trenching - Excavation

CAS #	Chemical	Chemical UCL Concentration (mg/kg)	Volatilization Factors					
			VF1day [1 day avg.] (mg/cm^2-day)	VF1day [workday] (lbs/cm^2-day)	VF1day [off-workday] (lbs/cm^2-day)	VF1hr [0.1 day avg.] (mg/cm^2-day)	VF1hr [workday] (lbs/cm^2-day)	VF1hr [off-workday] (lbs/cm^2-day)
100-41-4	Ethylbenzene	5.00E-01	8.72E-03	6.41E-09	2.88E-08	2.74E-02	2.01E-08	4.03E-08
106-46-7	1,4-Dichlorobenzene	5.90E-04	4.35E-06	3.20E-12	1.44E-11	1.36E-05	9.97E-12	1.99E-11
107-06-2	1,2-Dichloroethane	4.70E-04	8.52E-06	6.26E-12	2.82E-11	2.68E-05	1.97E-11	3.94E-11
108-67-8	1,3,5-Trimethylbenzene	1.90E-01	1.39E-03	1.02E-09	4.59E-09	4.32E-03	3.18E-09	6.35E-09
108-88-3	Toluene	1.20E-01	2.74E-03	2.01E-09	9.05E-09	8.61E-03	6.33E-09	1.27E-08
127-18-4	Tetrachloroethene	1.30E-02	4.34E-04	3.19E-10	1.44E-09	1.37E-03	1.01E-09	2.01E-09
129-00-0	Pyrene	1.00E+00	7.21E-06	5.29E-12	2.38E-11	8.66E-06	6.37E-12	1.27E-11
1330-20-7	Xylenes, Total	7.69E-01	1.29E-02	9.51E-09	4.28E-08	4.07E-02	2.99E-08	5.98E-08
156-59-2	cis-1,2-Dichloroethene	5.60E-04	1.50E-05	1.10E-11	4.96E-11	4.73E-05	3.47E-11	6.95E-11
71-43-2	Benzene	1.70E-01	5.09E-03	3.74E-09	1.68E-08	1.60E-02	1.18E-08	2.36E-08
74-83-9	Bromomethane	5.80E-03	2.12E-04	1.56E-10	7.01E-10	6.68E-04	4.91E-10	9.82E-10
75-01-4	Vinyl Chloride	2.41E-04	1.59E-05	1.17E-11	5.26E-11	5.03E-05	3.69E-11	7.39E-11
75-09-2	Methylene Chloride	3.20E-03	8.78E-05	6.45E-11	2.90E-10	2.76E-04	2.03E-10	4.06E-10
75-27-4	Bromodichloromethane	2.40E-04	2.40E-06	1.76E-12	7.92E-12	7.50E-06	5.51E-12	1.10E-11
75-65-0	tert-Butyl Alcohol (TBA)	4.80E-03	2.50E-05	1.84E-11	8.27E-11	7.75E-05	5.70E-11	1.14E-10
78-87-5	1,2-Dichloropropane	3.60E-04	7.84E-06	5.76E-12	2.59E-11	2.47E-05	1.81E-11	3.62E-11
79-01-6	Trichloroethene	7.40E-04	2.00E-05	1.47E-11	6.61E-11	6.29E-05	4.63E-11	9.25E-11
79-34-5	1,1,2,2-Tetrachloroethane	4.80E-04	2.97E-06	2.18E-12	9.83E-12	9.23E-06	6.79E-12	1.36E-11
90-12-0	1-Methylnaphthalene	2.60E+00	5.48E-03	4.02E-09	1.81E-08	1.05E-02	7.68E-09	1.54E-08
91-20-3	Naphthalene	1.50E+00	2.60E-03	1.91E-09	8.60E-09	8.22E-02	6.04E-08	1.21E-07
91-57-6	2-Methylnaphthalene	3.90E+00	5.48E-03	4.02E-09	1.81E-08	1.61E-02	1.18E-08	2.37E-08
95-63-6	1,2,4-Trimethylbenzene	7.80E-01	5.86E-03	4.31E-09	1.94E-08	1.83E-02	1.34E-08	2.69E-08
96-18-4	1,2,3-Trichloropropane	6.40E-04	6.21E-06	4.56E-12	2.05E-11	1.94E-05	1.43E-11	2.85E-11

Kast VOC Emissions Calculations

VOC Emission Calculations:

CAS #	Chemical	VOC Emission Rates								
		Active Area Emissions (lbs/hour)	Non-Active Area Emissions (lbs/hour)	Total Area Emissions (lbs/hour)	Active Area Emissions (lbs/day)	Non-Active Area Emissions (lbs/day)	Total Area Emissions (lbs/day)	Active Area Emissions (lbs/year)	Non-Active Area Emissions (lbs/year)	Total Area Emissions (lbs/year)
Option 1 - Excavation										
100-41-4	Ethylbenzene	3.54E-04	6.37E-05	4.17E-04	3.35E-03	1.36E-03	4.71E-03	1.99E+02	1.79E+01	2.17E+02
106-46-7	1,4-Dichlorobenzene	1.75E-07	3.15E-08	2.07E-07	1.67E-06	6.78E-07	2.35E-06	9.96E-02	8.96E-03	1.09E-01
107-06-2	1,2-Dichloroethane	3.46E-07	6.22E-08	4.08E-07	3.27E-06	1.33E-06	4.60E-06	1.95E-01	1.75E-02	2.12E-01
108-67-8	1,3,5-Trimethylbenzene	5.58E-05	1.00E-05	6.58E-05	5.33E-04	2.16E-04	7.49E-04	3.17E+01	2.86E+00	3.46E+01
108-88-3	Toluene	1.11E-04	2.00E-05	1.31E-04	1.05E-03	4.26E-04	1.48E-03	6.26E+01	5.63E+00	6.82E+01
127-18-4	Tetrachloroethene	1.77E-05	3.18E-06	2.08E-05	1.67E-04	6.76E-05	2.34E-04	9.93E+00	8.93E-01	1.08E+01
129-00-0	Pyrene	1.12E-07	2.01E-08	1.32E-07	2.77E-06	1.12E-06	3.89E-06	1.65E-01	1.48E-02	1.80E-01
1330-20-7	Xylenes, Total	5.25E-04	9.45E-05	6.19E-04	4.97E-03	2.01E-03	6.99E-03	2.96E+02	2.66E+01	3.23E+02
156-59-2	cis-1,2-Dichloroethene	6.10E-07	1.10E-07	7.20E-07	5.77E-06	2.34E-06	8.11E-06	3.43E-01	3.09E-02	3.74E-01
71-43-2	Benzene	2.07E-04	3.73E-05	2.44E-04	1.96E-03	7.93E-04	2.75E-03	1.16E+02	1.05E+01	1.27E+02
74-83-9	Bromomethane	8.62E-06	1.55E-06	1.02E-05	8.15E-05	3.30E-05	1.14E-04	4.85E+00	4.36E-01	5.28E+00
75-01-4	Vinyl Chloride	6.49E-07	1.17E-07	7.65E-07	6.12E-06	2.48E-06	8.60E-06	3.64E-01	3.28E-02	3.97E-01
75-09-2	Methylene Chloride	3.57E-06	6.42E-07	4.21E-06	3.37E-05	1.37E-05	4.74E-05	2.01E+00	1.81E-01	2.19E+00
75-27-4	Bromodichloromethane	9.67E-08	1.74E-08	1.14E-07	9.21E-07	3.73E-07	1.29E-06	5.48E-02	4.93E-03	5.97E-02
75-65-0	tert-Butyl Alcohol (TBA)	1.00E-06	1.80E-07	1.18E-06	9.62E-06	3.90E-06	1.35E-05	5.72E-01	5.15E-02	6.24E-01
78-87-5	1,2-Dichloropropane	3.18E-07	5.73E-08	3.76E-07	3.01E-06	1.22E-06	4.23E-06	1.79E-01	1.61E-02	1.95E-01
79-01-6	Trichloroethene	8.12E-07	1.46E-07	9.58E-07	7.68E-06	3.11E-06	1.08E-05	4.57E-01	4.11E-02	4.98E-01
79-34-5	1,1,2,2-Tetrachloroethane	1.19E-07	2.14E-08	1.41E-07	1.14E-06	4.63E-07	1.60E-06	6.79E-02	6.11E-03	7.41E-02
90-12-0	1-Methylnaphthalene	1.35E-04	2.43E-05	1.59E-04	2.11E-03	8.53E-04	2.96E-03	1.25E+02	1.13E+01	1.37E+02
91-20-3	Naphthalene	1.06E-03	1.91E-04	1.25E-03	9.99E-04	4.05E-04	1.40E-03	5.94E+01	5.35E+00	6.48E+01
91-57-6	2-Methylnaphthalene	2.08E-04	3.74E-05	2.45E-04	2.11E-03	8.53E-04	2.96E-03	1.25E+02	1.13E+01	1.37E+02
95-63-6	1,2,4-Trimethylbenzene	2.36E-04	4.25E-05	2.78E-04	2.25E-03	9.13E-04	3.17E-03	1.34E+02	1.21E+01	1.46E+02
96-18-4	1,2,3-Trichloropropane	2.50E-07	4.51E-08	2.96E-07	2.39E-06	9.66E-07	3.35E-06	1.42E-01	1.28E-02	1.55E-01

Kast VOC Emissions Calculations

Street Trenching - Excavation

CAS #	Chemical	VOC Emission Rates								
		Active Area Emissions (lbs/hour)	Non-Active Area Emissions (lbs/hour)	Total Area Emissions (lbs/hour)	Active Area Emissions (lbs/day)	Non-Active Area Emissions (lbs/day)	Total Area Emissions (lbs/day)	Active Area Emissions (lbs/year)	Non-Active Area Emissions (lbs/year)	Total Area Emissions (lbs/year)
100-41-4	Ethylbenzene	2.84E-04	5.12E-05	3.35E-04	7.23E-04	2.93E-04	1.02E-03	3.27E+01	2.94E+00	3.56E+01
106-46-7	1,4-Dichlorobenzene	1.41E-07	2.53E-08	1.66E-07	3.61E-07	1.46E-07	5.07E-07	1.63E-02	1.47E-03	1.78E-02
107-06-2	1,2-Dichloroethane	2.78E-07	5.00E-08	3.28E-07	7.07E-07	2.86E-07	9.93E-07	3.19E-02	2.87E-03	3.48E-02
108-67-8	1,3,5-Trimethylbenzene	4.48E-05	8.07E-06	5.29E-05	1.15E-04	4.66E-05	1.62E-04	5.20E+00	4.68E-01	5.67E+00
108-88-3	Toluene	8.93E-05	1.61E-05	1.05E-04	2.27E-04	9.19E-05	3.19E-04	1.03E+01	9.23E-01	1.12E+01
127-18-4	Tetrachloroethene	1.42E-05	2.55E-06	1.67E-05	3.60E-05	1.46E-05	5.06E-05	1.63E+00	1.46E-01	1.77E+00
129-00-0	Pyrene	8.98E-08	1.62E-08	1.06E-07	5.98E-07	2.42E-07	8.40E-07	2.70E-02	2.43E-03	2.94E-02
1330-20-7	Xylenes, Total	4.22E-04	7.59E-05	4.98E-04	1.07E-03	4.35E-04	1.51E-03	4.85E+01	4.37E+00	5.29E+01
156-59-2	cis-1,2-Dichloroethene	4.90E-07	8.83E-08	5.79E-07	1.25E-06	5.04E-07	1.75E-06	5.63E-02	5.06E-03	6.13E-02
71-43-2	Benzene	1.66E-04	2.99E-05	1.96E-04	4.22E-04	1.71E-04	5.94E-04	1.91E+01	1.72E+00	2.08E+01
74-83-9	Bromomethane	6.93E-06	1.25E-06	8.18E-06	1.76E-05	7.12E-06	2.47E-05	7.94E-01	7.15E-02	8.66E-01
75-01-4	Vinyl Chloride	5.21E-07	9.38E-08	6.15E-07	1.32E-06	5.35E-07	1.86E-06	5.97E-02	5.37E-03	6.50E-02
75-09-2	Methylene Chloride	2.87E-06	5.16E-07	3.38E-06	7.28E-06	2.95E-06	1.02E-05	3.29E-01	2.96E-02	3.59E-01
75-27-4	Bromodichloromethane	7.77E-08	1.40E-08	9.17E-08	1.99E-07	8.05E-08	2.79E-07	8.98E-03	8.08E-04	9.79E-03
75-65-0	tert-Butyl Alcohol (TBA)	8.04E-07	1.45E-07	9.48E-07	2.08E-06	8.41E-07	2.92E-06	9.38E-02	8.44E-03	1.02E-01
78-87-5	1,2-Dichloropropane	2.56E-07	4.60E-08	3.02E-07	6.50E-07	2.63E-07	9.13E-07	2.94E-02	2.64E-03	3.20E-02
79-01-6	Trichloroethene	6.53E-07	1.17E-07	7.70E-07	1.66E-06	6.71E-07	2.33E-06	7.49E-02	6.74E-03	8.16E-02
79-34-5	1,1,2,2-Tetrachloroethane	9.57E-08	1.72E-08	1.13E-07	2.46E-07	9.98E-08	3.46E-07	1.11E-02	1.00E-03	1.21E-02
90-12-0	1-Methylnaphthalene	1.08E-04	1.95E-05	1.28E-04	4.54E-04	1.84E-04	6.38E-04	2.05E+01	1.85E+00	2.24E+01
91-20-3	Naphthalene	8.53E-04	1.53E-04	1.01E-03	2.16E-04	8.73E-05	3.03E-04	9.74E+00	8.77E-01	1.06E+01
91-57-6	2-Methylnaphthalene	1.67E-04	3.01E-05	1.97E-04	4.54E-04	1.84E-04	6.38E-04	2.05E+01	1.85E+00	2.24E+01
95-63-6	1,2,4-Trimethylbenzene	1.90E-04	3.41E-05	2.24E-04	4.86E-04	1.97E-04	6.83E-04	2.20E+01	1.98E+00	2.40E+01
96-18-4	1,2,3-Trichloropropane	2.01E-07	3.62E-08	2.38E-07	5.15E-07	2.09E-07	7.23E-07	2.33E-02	2.09E-03	2.54E-02

Summary of VOC Emissions (Base Case)

Sum of Value Row Labels	Column Labels lbs/day
1,1,2,2-Tetrachloroethane	1.95E-06
1,2,3-Trichloropropane	4.08E-06
1,2,4-Trimethylbenzene	3.85E-03
1,2-Dichloroethane	5.59E-06
1,2-Dichloropropane	5.15E-06
1,3,5-Trimethylbenzene	9.11E-04
1,4-Dichlorobenzene	2.86E-06
1-Methylnaphthalene	3.60E-03
2-Methylnaphthalene	3.60E-03
Benzene	3.34E-03
Bromodichloromethane	1.57E-06
Bromomethane	1.39E-04
cis-1,2-Dichloroethene	9.86E-06
Ethylbenzene	5.73E-03
Methylene Chloride	5.76E-05
Naphthalene	1.71E-03
Pyrene	4.73E-06
tert-Butyl Alcohol (TBA)	1.64E-05
Tetrachloroethene	2.85E-04
Toluene	1.80E-03
Trichloroethene	1.31E-05
Vinyl Chloride	1.05E-05
Xylenes, Total	8.50E-03
Grand Total	**3.36E-02**

Applicant's Proposed Remedy Calculation Files – Peak Day

- Calculation Cover Sheet and Assumptions
- On-Site Haul Roads – Re-entrained Dust
- Fugitive Dust Emissions During Soil and Excavation and Handling
- Dust Emissions during Concrete Breaking
- On-Site Construction Equipment Emissions
- On-Site Road Emissions
- On-Site Road – Re-entrained Dust
- Off-Site Road Emissions
- Off-Site Road – Re-entrained Dust
- VOC Emissions

Calculation Delivery Cover Sheet

URS Santa Ana Air Quality Group

Date:	*10/10/2014*
Project:	Kast Remediation Project - Option 1 (Hard and Softscape Excavation) ***5 foot with 10 foot Excavation, 4 Houses at a Time, Phase Overlap***
Project number:	*49194119*
Requestor:	*PCR Consulting*
Project manager:	*Roy Patterson*
Air Quality originator:	*Irma Buenrostro*
Air Quality project lead:	*Shirley Pearson*
Air Quality internal reviewer:	*Shirley Pearson*
Date review completed:	*19-Sep-14*
Detail check internal reviewer:	*Irma Buenrostro*
Date review completed:	*10-Oct-14*
Brief description of analysis:	*Calculating emission rates of criteria pollutants and toxic air contaminates during excavating activities at the former Kast property. Calculations will be used to assess air quality impacts in the form of an Environmental Impact Report.*
Reference MXD:	S:\Shirley Pearson\!Kast\10 Oct 2014 Updates
Model used:	*AP-42 equations and assumptions were used.*

Version 10-10-14

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Kast Air Emissions Calculations

I. Project Phasing

				Hours/Task per House									
#	Equipment	Engine Type	HP	Demo	Excavation	SVE Well/Piping Instal	Subslab Vent Install	Backfill/Comp.	Slurry Backfill	Site Resto.	Total Hrs./ House	Houses	Total Hrs.
2	15,000 lbs Excavator	D	60	0	87	0	0	0		0	87	237	20,619
1	Dump Truck	D	450	4	45	0	0	69		0	118	237	27,966
2	Bobcat	D	22	12	87	4	4	69		0	176	237	41,712
1	Bucket Auger	D	65	0	30	0	0	0		0	30	237	7,110
1	6000 Watt Generato	G	10	2	45	1	1	0		2	51	237	12,087
1	Water Pump	G	5	6	45	0	0	69		0	120	237	28,440
1	Chain Saw	G	0.5	2	0	0	0	0		0	2	237	474
1	Small Compactor (W	G	3	0	0	0	0	69		0	69	237	16,353
1	Concrete Mix Truck	D	450	0	0	0	0	0	20	6	26	237	6,162
1	Concrete Pump	D	80	0	0	0	0	0	20	6	26	237	6,162
2	Pickup Truck	G	200										
1	Flatbed Truck	D	350										

				Street Work (Hours/day)		
#	Equipment	Engine Type	HP	Trenching/Pipe Installation	Street Grinding	Street Paving
1	Backhoe	D	350	1		
1	Compressor	G	49	1		
1	Generator	G	10	1		
1	Concrete Saw	D	13	1		
1	Vacuum Excavator	D	155	6		
1	Drill Rig	D	250	6		
1	Cold Plane Grinding	D	600		6	
1	Dump Truck	D	450		6	
1	Street Sweeper	G	200		6	
1	Paving Machine	D	150			6
1	Super 10 Dump Truc	D	450			6
1	Steam Roller	D	50			6
1	Street Sweeper	G	200			6
1	Steam Roller	D	50			6
1	Street Sweeper	G	200			6

II. General Assumptions

General Assumptions			
Parameter	**Value**	**Units**	**Reference**
Number of Homes Yards Excavated at a Time	4	Yards	Information provided by project staff
Number of Homes	237	Homes	Information provided by project staff
Hours of Operation	8	Hours	working hours 8AM - 3PM, from project description
Duration (phase overlap)	253	weeks	Information provided by project staff
Days of Operation per Week	5	days	Monday - Friday
Number of Holidays per Year	9	days	Based on URS' holiday schedule
Number of people at houses	15	people	Information provided
Trenching/pipe installation	10	people	Information provided
Air-vac borehole clearance	3	people	Information provided
Drilling and SVE well install	4	people	Information provided
Number of people during street grinding	10	people	Information provided
Number of people during street paving	12	people	Information provided
Worker trips for various reasons	32	trips	Assumed value (e.g., shuttling workers to site, workers going to lunch, mgt. going to and from site)
Mitigation (% Reduction)	84%	%	WARP Fugitive Dust Handbook, September 2006, Table 3-7. Apply water every 1 hour: 74% control per MRI, April 2001, test series 701. Apply dust suppressant: 84% control per CARB April 2002; for actively disturbed areas
U (mean wind speed)	1.88	m/s	Based on mean wind speed met data from the SCAQMD Long Beach Station from 2006 to 2011.
U (mean wind speed)	4.21	mph	Based on mean wind speed met data from the SCAQMD Long Beach Station from 2006 to 2011.
s (silt content) - Overburden	6.9	%	AP-42, Chapter 11.9, Table 11.9-3. Bulldozer Overburden Silt Content.
s (silt content) - Paved road	3.4	%	AP-42, Chapter 13.2.1.1, Table 13.2.1-3
M (material moisture content)	7.9	%	AP-42 Chapter 11.9-9. Table 11.9-3. Overburden default value.
Silt Content Range	0.44-19	%	AP-42, Chapter 13.2.4, Page 4. Assumed range. No adjustments required.

Kast Air Emissions Calculations

Soil Density	3,400	lbs/cy	Information provided by project staff
Density of Asphalt	3,915	lbs/cy	Information provided by project staff
Density of Asphalt	1.95	Tons/cy	Information provided by project staff
Typical Density of Concrete	150	lbs/cf	Information provided by project staff
Typical Density of Concrete	2.01	ton/cy	Information provided by project staff
Max Depth of Excavation at Residential Homes	10	ft	Information provided by project staff
Concrete Removed per House	35	cy	Information provided by project staff. 1,675 SF and 6 inches thick concrete slab.
Concrete Removed per Day during Street Trenching	810	cy	Information provided by project staff. Assumed 100 feet of trench per day, trench would be 5 feet in width and asphalt is 6 inches thick.
Debris Disposal Haul Route Total Length, One Way	30	miles	Google maps, address destination 12017 Greenstone, Santa Fe Springs, CA 90670
Offsite Disposal Route total Length, One Way	100	miles	Google maps, address destination 12328 Hibiscus Rd, Adelanto
Backfill Import Route Total Length, One Way	4	miles	Google maps, address destination 26311 Palos Verdes Dr. East, Rolling Hilles Estates, CA 90274
Concrete Batch Plant Route Total Length, One Way	10	miles	Google maps, address destination 2521 E. Artesia Blvd., Long Beach, CA 90805
Plastic Pipe Company, Chino, CA, One Way	50	miles	Google maps, destination Chino, CA
All American Asphalt, Corona, CA, One Way	50	miles	Google maps, destination Corona, CA
Green Waste Disposal, One Way	5	Miles	Google maps, 321 Francisco Street, Carson, CA
Distance of project within South Coast Air Basin	75	miles	Based on informational maps obtained from CARB and distance estimate from Google maps.
Distance of project activities within Mojave Desert Distance	25	miles	Based on furthest trip outside of SCAB/within MDAB, informational maps obtained from CARB, and distance estimate from Google maps.

Kast Air Emissions Calculations

Average On-Site Haul Route Distance	1,900	feet	Measured distance from the furthest northern and southern homes in the community.
Employee/Worker Trip Distance	21.6	miles	CalEEMod Default Construction Worker Trip (Round Trip)
Passenger Vehicle Trips	9	trips	Visitor trips/traffic adjustment provided by project staff
Street Grinding and Paving Worker trips for various reasons	16	trips	Assumed value (e.g., shuttling workers to site, workers going to lunch, mgt. going to and from site)

III. Cubic Yard and Trip Estimates

Cubic Yard and Trip Estimates during Yard Excavation

Parameter	Option 1 - Hard&Softscape Value	Units
Duration	253	weeks (Phase Overlap)
Work Hours	8	hours
Total Work Days - 8 Homes	42	days
Total Work Days - 237 Homes	1,256	days
Total Work Days in Year	251	days
Total Houses	237	homes
Number of Homes at a time	4	homes
Total Volume Soil - 237 Homes	177,000	cy
Passenger Vehicle Trips	9	trips/day
Demo	11,599	cy
Excavation	177,000	cy
Subslab Vent	0	cy
Backfill/Compact	148,700	cy
Slurry Backfill	28,300	cy
Site Resto.	8,295	cy
Concrete Removed per Home	35	CY
Total Loads -Debris Disposal	971	loads
Total Loads -Debris Disposal (green waste only)	237	loads
Total Loads -Offsite Disposal	12,643	loads
Total Loads -Backfill Import	12,763	loads
Total Loads -Concrete Batch Plant	4,057	loads
Slurry Backfill	1,556	loads
Site Resto.	884	loads
Total Loads -Flatbed Truck	474	loads
Total Loads -Pipe Delivery	40	loads
Demo	12	cy/load
Excavation	14	cy/load
SVE Well/Piping	0	cy/load
Subslab Vent	0	cy/load
Backfill/Compact	12	cy/load
Slurry Backfill	18	cy/load
Site Resto.	0	cy/load

Kast Air Emissions Calculations

Option 1 Phase	Duration to Complete One Home (days)	Phase Duration (days)	Round Trips Hourly	Daily	8 Home Clusters	Annually	Project
Demo - Truck Trips	2	119	1.67	13	214	1,584	1,584
Green Waste - Truck Trips	1	59	0.50	4	32	237	237
Excavation - Truck Trips	15	889	2.67	21	2,567	5,071	19,015
SVE Well/Piping - Truck Trips	1	59	0.39	3	25	186	186
Subslab Vent - Truck Trips	1	59	0.00	0	0	0	0
Backfill/Compact - Truck Trips	12	711	2.82	23	2,163	5,340	16,019
Slurry Backfill - Truck Trips	7	415	1.02	8	455	1,925	3,368
Site Resto. - Truck Trips	10	593	0.68	5	437	1,294	3,236
Worker Trips	49	1,256	4.00	32	12,544	8,032	40,192
Passenger Vehicle Trips	1	1,256	1.13	9	0	2,259	11,304

Note: PEAK Day case was described as having 30 additional trips, which were added based on the porportion from base-case trips.

Option 1 Phase	Cubic Yard (CY) of Soil/Material Moved Hourly	Daily	8 Home Clusters	Annually	Project
Demo	20	160	2,554	18,917	18,917
Excavation	7	300	35,944	70,990	266,212
SVE Well/Piping[1]	0	0	0	0	0
Subslab Vent[1]	0	0	0	0	0
Backfill/Compact	33	263	25,200	62,213	186,638
Slurry Backfill	18	148	8,272	35,008	61,264
Site Resto.[1]	0	0	0	0	0

Note: 1 - No soil excavation associated with SVE Well/Piping, Subslab Vent or Site Restoration phases

Kast Air Emissions Calculations

Cubic Yard and Trip Estimates during Street Trenching/Pipe Installation

Parameter	Street Trenching Value	Units
Duration	36	weeks
Work Hours	8	hours
Total Work Days	180	days
Total Work Days in Year	251	days
Trenching per day	100	feet
Linear feet of trenching	8,715	feet
Total Volume Soil	8,100	cy
Total Volume of Asphalt	810	cy
Demo	810	cy
Excavation	8,100	cy
Slurry Backfill	5,000	cy
Restoration	1,100	cy
Total Loads -Debris Disposal	70	loads
Total Loads -Offsite Disposal	600	loads
Total Loads -Backfill Import	0	loads
Total Loads -Concrete Batch Plant	556	loads
Pipe Delivery	180	loads
Total Loads - Restoration	95	loads
Demo - Asphalt	12	cy/load
Excavation	14	cy/load
Slurry Backfill	9	cy/load
Restoration - Asphalt	12	cy/load

Street Trenching	Round Trips			
Phase	Hourly	Daily	Annually	Project
Demo - Truck Trips	0.19	1.5	268	268
Excavation - Truck Trips	0.6	4.5	816	816
Slurry Backfill - Truck Trips	0.6	4.5	808	808
Restoration - Truck Trips	0.2	1.5	275	275
Pipe Delivery - Truck Trips	0.2	1.5	270	270
Worker Trips	5.3	42	7,560	7,560

Street Trenching	Cubic Yard (CY) of Soil/Material			
Phase	Hourly	Daily	Annually	Project
Demo	2	17	3,101	3,101
Excavation	8	61	11,016	11,016
Slurry Backfill	5	40	7,266	7,266
Restoration	2	18	3,184	3,184

Kast Air Emissions Calculations

Cubic Yard and Trip Estimates during Well Installation

Parameter	Street Trenching Value	Units
Work Hours	8	hours
Total Work Days	63	days
Total Work Days in Year	63	days
Total round trips to Wilmington soil storage area	126	Trips
Total trips from Wilmington soil storage area to	10	Trips
Waste Collection	12	cy/load

Well Installation Phase	Round Trips Hourly	Daily	Annually	Project
Air Vac- Borehole Clearance - Truck Trips	0.19	1.5	95	95
Drilling and SVE Well Installation - Truck Trips	0.19	1.5	95	95
Waste Collection - Truck Trips	0.38	3.0	189	189
Waste Transport to Offsite Disposal - Truck Trips	0.18	1.5	92	92
Worker Trips	4.88	39	2,457	2,457

Well Installation Phase	Cubic Yard (CY) of Soil/Material Hourly	Daily	Annually	Project
Air Vac- Borehole Clearance	0	0	0	0
Drilling and SVE Well Installation	0	0	0	0
Waste Collection	5	36	2,268	2,268
Waste Transport to Offsite Disposal	2.2	18	1,103	1,103

Cubic Yard and Trip Estimates during Street Paving

Parameter	Street Grinding Value	Units	Street Paving Value	Units
Duration	5	days	10	days
Work Hours	6	hours	6	hours
Trucks per day	14	Dump Trucks	7	Dump Trucks
Total Mass of Asphalt	2,000	tons	2,000	tons
Total Volume of Asphalt	1,025	cy	1,025	cy
Total Loads -Debris Disposal	80	loads	0	loads
Total Loads - Asphalt Delivery	0	loads	80	loads
Cubic Yard per Load	12	cy/load	12	cy/load

Street Paving	Round Trips			
Phase	Hourly	Daily	Annually	Project
Street Grinding - Truck Trips	3	16	80	80
Street Paving - Truck Trips	1	8	80	80
Worker Trips - Grinding	3	16	80	80
Worker Trips - Paving	3	16	160	160

Street Paving	Cubic Yard (CY) of Soil/Material			
Phase	Hourly	Daily	Annually	Project
Street Grinding	32	192	960	960
Street Paving	16	96	960	960

Note: It is assumed that the scenario (including the amount of associated workers and trips) for Street Grinding and Paving will not change from Base case.

IV. On-Site Haul Roads - Re-entrained Dust

Summary: This section calculates the dust emissions (PM2.5, PM10) from the on-site haul roads at the residential homes. The on-site haul roads consist of off-road equipment transporting soil to-and-from the dump truck.

$$E = k(s/12)^a(W/3)^b$$

Where:
E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
M = surface material moisture content (%)
S = mean vehicle speed (mph)
a = empirical constant
b = empirical constant
k = empirical constant
Source: AP-42 13.2.2-4, Equation (1a)

Assumptions Parameters	Value	Unites	Notes
s (silt content)	6.4	%	Western Governors' Association, Western Regional Air Partnership (WRAP) Fugitive Dust Handbook, Table 6-2. Average silt content for gravel/crushed limestone road surface material.
W (vehicle weight)	18,000	lbs	Weight of excavator
a (empirical constant)	0.9	-	AP-42, Chapter 13.2.2, Table 13.2.2-2. Industrial Roads (PM10 and PM2.5)
b (empirical constant)	0.45	-	AP-42, Chapter 13.2.2, Table 13.2.2-2. Industrial Roads (PM10 and PM2.5)
k (empirical constant) - PM10	1.5	-	AP-42, Chapter 13.2.2, Table 13.2.2-2. Industrial Roads (PM10)
k (empirical constant) - PM2.5	0.15	-	AP-42, Chapter 13.2.2, Table 13.2.2-2. Industrial Roads (PM2.5)
Shovel Load (soil) Bobcat	1.25	cy	volume of soil a bucket can hold, http://www.bobcat.com/attachments/bucket_loader_general
Shovel Load (soil) Excavator	1.75	cy	volume of soil a bucket can hold
Weight of a bobcat	3.11	tons	Based on spec information from a S185 Skide-Steer Loader, http://www.bobcat.com/loaders/models/skidsteer/s185
Mitigation (% Reduction)	84%	%	Apply dust suppressants on inactive areas. SCAQMD mitigation measures examples. Table X1-A.
Haul Route length	200	ft	Assumed distance soil would have to be hauled on each property

Option 1 Phases	Hourly Round Trips	Daily Round Trips	8 Home Clusters	Annual Round Trips	Equipment Type	Average Vehicle Weight (tons)	Round Trip length (SCAB)	Hourly VMT	Daily VMT	8 Home Clusters VMT	Annual VMT
Demo	1.7	13	214	1,584	Bobcat	3.11	0.08	0.13	4.05	16	120
Excavation	2.7	21	20,540	40,566	Excavator	9	0.08	0.20	6.48	1,556	3,073
SVE Well/Piping	0.4	3	0	0	0	0	0	0	0.00	0	0
Subslab Vent	0.0	0	0	0	0	0	0	0	0.00	0	0
Backfill/Compact	2.8	23	14,400	35,550	Excavator	9	0.08	0.21	6.83	1,091	2,693
Site Resto.	0.0	5	0	0	0	0	0	0	0.00	0	0

Emission Calculation

Daily:

Option 1 Phases	Daily VMT (SCAB)	W (tons)	k (PM10)	k (PM2.5)	Mitigation %	PM10 EF (lbs/mi.)	PM2.5 EF (lbs/mi.)	PM10 Emissions (lbs/day)	PM2.5 Emissions (lbs/day)
Demo	4.0	3.11	1.5	0.15	84%	0.87	0.09	0.56	0.06
Excavation	6.5	9	1.5	0.15	84%	1.40	0.14	1.45	0.14
SVE Well/Piping	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	6.8	9	1.5	0.15	84%	1.40	0.14	1.53	0.15
Site Resto.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

V. Fugitive Dust Emissions During Soil Excavation and Handling

Summary: This section calculates the dust emissions (PM2.5, PM10) from the on-site soil handling and excavation at the residential homes and during street trenching. The on-site soil handing and excavation consists of two parts: 1) Excavating soil 2)Dropping soil

$$E = k(0.0032)\frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \text{ (pound [lb]/ton)}$$

Where:

E = emission factor
k = particle size multiplier (dimensionless)
U = mean wind speed, meters per second (m/s) (miles per hour [mph])
M = material moisture content (%)

Source: AP-42 13.2.4-3, Equation (1)

Assumptions Equation parameters	Value	Units	Notes
k - PM10	0.35	-	AP-42, Chapter 13.2.4, Page 4. Nov 2006
k - PM2.5	0.053	-	AP-42, Chapter 13.2.4, Page 4. Nov 2006
U	4.21	mph	Average wind speed
M	7.9	%	AP-42 Chapter 11.9-9. Table 11.9-3. Overburden default value.
Soil Density	3,400	lbs/CY	Information provided by project staff
Mitigation (% Reduction) - Watering	84%	%	WARP Fugitive Dust Handbook, September 2006, Table 3-7. Apply water every 1 hour: 74% control per MRI, April 2001, test series 701. Apply dust suppressant: 84% control per CARB April 2002; for actively disturbed areas
Times Soil is Handled	2	time	1) Excavating soil 2) Dropping soil

Emission Calculation (PM10)

Daily Dust Emissions During Soil Excavation and Handling								
Phase	Daily CY	Daily (tons)	k (PM10)	U (mph)	M%	EF (lbs/ton)	Mitigation (%)	PM10 Emissions (lbs/day)
Option 1								
Demo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavation	300	509.2	0.35	4.20556	7.9	1.31E-04	84%	2.13E-02
SVE Well/Piping	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	263	446.3	0.35	4.20556	7.9	1.31E-04	84%	1.87E-02
Slurry Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Site Resto.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Trenching								
Demo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavation	61	104.0	0.35	4.20556	7.9	1.31E-04	84%	4.35E-03
Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Restoration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Emission Calculation (PM2.5)

Daily Dust Emissions During Soil Excavation and Handling								
Phase	**Daily CY**	**Hourly (tons)**	**k (PM2.5)**	**U (mph)**	**M%**	**EF (lbs/ton)**	**Mitigation (%)**	**PM2.5 Emissions (lbs/day)**
Option 1								
Demo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavation	300	509.2	0.053	4.21	7.9	1.98E-05	84%	3.23E-03
SVE Well/Piping	0	0	0.00	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	263	446.3	0.053	4.21	7.9	1.98E-05	84%	2.83E-03
Slurry Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Site Resto.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Trenching								
Demo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavation	61	104.0	0.053	4.21	7.9	1.98E-05	84%	6.59E-04
Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Restoration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

VI. Dust Emissions during Concrete Breaking

Summary: This section calculates the dust emissions (PM2.5, PM10) during on-site concrete breaking at residential homes, street trenching and street paving. The on-site dust emissions from concrete breaking consists of two parts: 1) Mechanical dismemberment and 2) Debris loading

Mechanical Dismemberment Equations

$$EF_D = k \times (0.0032) \times \frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

U = Mean wind speed

M = material moisture content (%). The moisture contents of different materials are listed in Table 13.2.4-1 of AP 42. The program uses the moisture content of cover (12%) as default.

Where:

EF_D = emission factor (lb PM/ton of debris)

$EF_{D\text{-}PM10}$ = 0.0011 lb PM_{10}/ton of debris

$EF_{D\text{-}PM2.5}$ = 0.00017 lb $PM_{2.5}$/ton of debris

k = particle size multiplier. The AP-42 default value for PM_{10} is 0.35 and that for $PM_{2.5}$ is 0.053.

Source: CalEEMod, Appendix A, Page 11

$$E_D = EF_D \times W$$

Where:

E_D = emissions (lb of PM)

EF_D = emission factor (lb of PM/ton of debris)

W = building waste (ton of debris)

Source: CalEEMod, Appendix A, Page 12

Assumptions Equation parameters	Value	Units	Notes
Mean wind speed (U)	4.21	mph	Based on mean wind speed met data from the SCAQMD Long Beach Station from 2006 to 2011.
M (material moisture content)	7.9	%	AP-42 Chapter 11.9-9. Table 11.9-3. Overburden default value.
Typical Density of Concrete	150	lbs/ft^3	Information provided by project staff
Mitigation (% Reduction) - Watering	84%	%	WARP Fugitive Dust Handbook, September 2006, Table 3-7. Apply water every 1 hour: 74% control per MRI, April 2001, test

Phase	Hourly Weight of Concrete (tons)	Daily Weight of Concrete (tons)	Weight of Concrete per 8 Home Cluster (tons)	Annual Weight of Concrete (tons)	Total Weight of Concrete (tons)
Option 1					
Demo	40	321	5,134	38,024	38,024
Excavation	0.00	0.00	0.00	0.00	0.00
SVE Well/Piping	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	0.00	0.00	0.00	0.00	0.00
Slurry Backfill	0.00	0.00	0.00	0.00	0.00
Site Resto.	0.00	0.00	0.00	0.00	0.00
Street Trenching					
Demo	4	34	0.00	6,047	6,047
Excavation	0.00	0.00	0.00	0.00	0.00
Backfill	0.00	0.00	0.00	0.00	0.00
Restoration	0.00	0.00	0.00	0.00	0.00
Street Paving					
Street Grinding	62	374	0.00	1,872	1,872

Mechanical Dismemberment Emissions Calculations

Concrete Breaking Emissions - Daily

Phase	Particle Size Multiplier for PM10 (k)	Particle Size Multiplier for PM2.5 (k)	Emission Factor PM10 (lb PM/Ton of Concrete)	Emission Factor for PM2.5 (lb PM/Ton of Concrete)	Mitigation (%)	Concrete Breaking Emissions for PM10 (lbs of PM10)	Concrete Breaking Emissions PM2.5 (lbs of PM2.5)
Option 1							
Demo	0.35	0.053	1.31E-04	1.98E-05	84%	6.71E-03	1.02E-03
Excavation	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SVE Well/Piping	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Slurry Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Site Resto.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Trenching							
Demo	0.35	0.053	1.31E-04	1.98E-05	84%	7.03E-04	1.06E-04
Excavation	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Restoration	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Paving							
Street Grinding	0.35	0.053	1.31E-04	1.98E-05	84%	7.83E-03	1.19E-03

Debris Loading Equations

$$EF_L = k \times EF_{L\text{-}TSP}$$

Where:

EF_L = emission factor (lb/ton)

k = particle size multiplier. The AP-42 default value for PM_{10} is 0.35 and that for $PM_{2.5}$ is 0.053.

Source: CalEEMod, Appendix A, Page 12

The default value for $EF_{L\text{-}TSP}$ is 0.058 lb/ton, the average of the two TSP factor (i.e. 0.053 and 0.063 lb/ton) measured from two tests of the filling of trucks with crushed limestone using a front-end loader.

Source: CalEEMod, Appendix A, Page 13

$$E_D = EF_D \times W$$

Where:

E_D = emissions (lb of PM)

EF_D = emission factor (lb of PM/ton of debris)

W = building waste (ton of debris)

Source: CalEEMod, Appendix A, Page 12

Assumptions Equation parameters	Value	Units	Notes
Emission Factor for Total Suspended Particulates (TSP)	0.058	lb/ton	CalEEMod, Appendix A, Page 13

Debris Loading Emissions Calculations

Concrete Debris Loading - Daily Phase	Particle Size Multiplier for PM10 (k)	Particle Size Multiplier for PM2.5 (k)	Emission Factor PM10 (lb PM/Ton of Concrete)	Emission Factor for PM2.5 (lb PM/Ton of Concrete)	Mitigation (%)	Concrete Breaking Emissions for PM10 (lbs of PM10)	Concrete Breaking Emissions PM2.5 (lbs of PM2.5)
Option 1							
Demo	0.35	0.053	0.0203	0.003074	84%	1.04E+00	1.58E-01
Excavation	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SVE Well/Piping	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Slurry Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Site Resto.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Trenching							
Demo	0.35	0.053	0.0203	0.003074	84%	1.09E-01	1.65E-02
Excavation	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Restoration	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Paving							
Street Grinding	0.35	0.053	0.0203	0.003074	84%	1.22E+00	1.84E-01

Total Concrete Breaking Emissions (Mechanical Dismemberment + Debris Loading)

Total Concrete Breaking Emissions - Daily		
Phase	**Concrete Breaking Emissions for PM10 (lbs of PM10)**	**Concrete Breaking Emissions PM2.5 (lbs of PM2.5)**
Option 1		
Demo	1.05E+00	1.59E-01
Excavation	0.00	0.00
SVE Well/Piping	0.00	0.00
Subslab Vent	0.00	0.00
Backfill/Compact	0.00	0.00
Slurry Backfill	0.00	0.00
Site Resto.	0.00	0.00
Street Trenching		
Demo	1.10E-01	1.66E-02
Excavation	0.00	0.00
Backfill	0.00	0.00
Restoration	0.00	0.00
Street Paving		
Street Grinding	1.22E+00	1.85E-01
Total	2.38E+00	3.61E-01

VII. On-Site Construction Equipment Emissions

Summary: This section calculates the emissions of criteria pollutants from off-road equipment.

Emission Equation

Emission (Off-road Construction Equipment) = E x bhp-hr

Where:

E = size-specific emission factor (g/bhp-hr)

Source:

EMFAC2011

Assumptions	Value	Value	Units	Notes
Equipment Engine Tier		3	-	Refers to EPA emission standards (Tier 1-4) for Off-road equipment

Off-road Engine Emission Ratings

USEPA TABLE I - EPA Tier 1-3 Nonroad Diesel Engine Emission Standards (g/bhp-hr)

Engine Power		Tier	CO
(25 ≤ hp < 50)	50	1	4.9
(25 ≤ hp < 50)	50	2	4.9
(50 ≤ hp < 100)	100	1	-
(50 ≤ hp < 100)	100	2	3.7
(50 ≤ hp < 100)	100	3	3.7
(100 ≤ hp < 175)	175	1	-
(100 ≤ hp < 175)	175	2	3.7
(100 ≤ hp < 175)	175	3	3.7
(175 ≤ hp < 300)	300	1	8.5
(175 ≤ hp < 300)	300	2	2.6
(175 ≤ hp < 300)	300	3	2.6
(300 ≤ hp < 600)	600	1	8.5
(300 ≤ hp < 600)	600	2	2.6
(300 ≤ hp < 600)	600	3	2.6

Tiers 1, 2,3 &4 Off-Road Engine Emission Standards

HP Range	Tier	Nox	ROG	PM
75 - 99	1	6.9	1.19	0.552
100 - 174	1	6.9	0.82	0.304
175 - 299	1	6.9	1	0.4
300 - 600	1	6.9	1	0.4
75 - 99	2	5.32	0.28	0.3
100 - 174	2	4.655	0.245	0.22
175 - 299	2	4.655	0.245	0.15
300 - 600	2	4.56	0.24	0.15
75 - 99	3	3.325	0.175	0.3
100 - 174	3	2.85	0.15	0.22
175 - 299	3	2.85	0.15	0.15
300 - 600	3	2.85	0.15	0.15
75 - 99	4	2.5	0.14	0.015
100 - 174	4	2.5	0.14	0.015
175 - 299	4	1.5	0.14	0.015
300 - 600	4	1.5	0.14	0.015

Note: Based on SCAQMD Table II-B Tiers 1, 2,3 &4 Off-Road Engine Emission Standards

Table 3.3 OFFROAD Default Horsepower and Load Factors

OFFROAD Equipment Type	Horsepower	Load Factor
Aerial Lifts	63	0.31
Air Compressors	78	0.48
Bore/Drill Rigs	206	0.50
Cement and Mortar Mixers	9	0.56
Concrete/Industrial Saws	81	0.73
Cranes	226	0.29
Crawler Tractors	208	0.43
Crushing/Proc. Equipment	85	0.78
Dumpers/Tenders	16	0.38
Excavators	163	0.38
Forklifts	89	0.20
Generator Sets	84	0.74
Graders	175	0.41
Off-Highway Tractors	123	0.44
Off-Highway Trucks	400	0.38
Other Construction Equipment	172	0.42
Other General Industrial Equipment	88	0.34
Other Material Handling Equipment	167	0.40
Pavers	126	0.42
Paving Equipment	131	0.36
Plate Compactors	8	0.43
Pressure Washers	13	0.30
Pumps	84	0.74
Rollers	81	0.38
Rough Terrain Forklifts	100	0.40
Rubber Tired Dozers	255	0.40
Rubber Tired Loaders	200	0.36
Scrapers	362	0.48
Signal Boards	6	0.82
Skid Steer Loaders	65	0.37
Surfacing Equipment	254	0.30
Sweepers/Scrubbers	64	0.46
Tractors/Loaders/Backhoes	98	0.37
Trenchers	81	0.50
Welders	46	0.45

Notes:

1. Based on the weighted average horsepower (by equipment population) and load factors for the mode of the engine groupings in 2011 OFFROAD

Equipment List by Phase															Emissions Factors (g/bhp-hr)			
Phase	Phase Duration (days)	Hours per Day	Equipment	HP/Size	CalEEMod Category	Load Factor[1]	Output (bhp-hour)	Output (bhp-day)	Engine Size Class	Engine Size Class (CO)	Engine Tier	ROG	CO	NOx	CO2 [2]	PM10	PM2.5	SOx [2]
Option 1																		
Demolition	119	8	Bobcat (Bobcat S510)	22	Tractors/Loaders /Backhoes	0.57	12.54	100.32	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Demolition	119	2	6000 Watt Generator	10	Generator Sets	0.74	7.4	14.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Demolition	119	2	Chain Saw	0.5	Concrete/Industrial Saws	0.73	0.365	0.73	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Demolition	119	8	Water Pump	5	Pumps	0.74	3.7	29.6	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Excavation	889	8	18,000 lbs Excavator (Kubota KX80-4)	70	Excavator	0.38	26.6	212.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Excavation	889	8	Bobcat (Bobcat S510)	22	Tractors/Loaders /Backhoes	0.37	8.14	65.12	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Excavation	889	2	6000 Watt Generator	10	Generator Sets	0.74	7.4	14.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Excavation	889	8	Water Pump	5	Pumps	0.74	3.7	29.6	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
SVE Well Installation	59	4	Bobcat with Auger (Bobcat S510)	22	Tractors/Loaders /Backhoes	0.37	8.14	32.56	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
SVE Well Installation	59	1	6000 Watt Generator	10	Generator Sets	0.74	7.4	7.4	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Subslab Vent Installation	59	4	Bobcat with Auger (Bobcat S510)	22	Tractors/Loaders /Backhoes	0.37	8.14	32.56	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Subslab Vent Installation	59	1	6000 Watt Generator	10	Generator Sets	0.38	3.8	3.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Backfill and Compaction	415	8	Bobcat (Bobcat S510)	22	Tractors/Loaders /Backhoes	0.37	8.14	65.12	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Backfill and Compaction	593	4	Small Compactor (Wacker)	3	Plate compactors	0.43	1.29	5.16	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Backfill and Compaction	1256	4	Water Pump	5	Pumps	0.74	3.7	14.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Slurry Backfill	415	8	Concrete Pump	2	Pumps	0.74	1.48	11.84	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Site Restoration	593	1	6000 Watt Generator	10	Generator Sets	0.74	7.4	7.4	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Site Restoration	593	2	Concrete Pump	2	Pumps	0.74	1.48	2.96	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Street Trenching																		
Street Trenching/Pipe installation	180	8	Backhoe	100	Tractors/Loaders /Backhoes	0.57	57	456	100-174	100<hp<175	3	0.15	3.7	2.85	568.3	0.3	0.3	0.0050
Street Trenching/Pipe installation	180	8	Compressor	49	Generator Sets	0.74	36.26	290.08	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Street Trenching/Pipe installation	180	2	Generator	10	Generator Sets	0.74	7.4	14.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Street Trenching/Pipe installation	180	1	Concrete Saw	48	Concrete/Industrial Saws	0.73	35.04	35.04	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Well Installation																		
Drilling and SVE Well Installation	63	8	Drill Rig	155	Bore/Drill Rigs	0.5	77.5	620	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Street Paving																		
Street - Grinding	5	8	Cold Plane Grinding Machine	600	Scrapers	0.48	288	2304	300-600	300<hp<600	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Street - Grinding	5	8	Street Sweeper	200	Crawler Tractors	0.5	100	800	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Street - Paving	10	8	Paving Machine	150	Other Construction Equipment	0.42	63	504	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Street - Paving	10	8	Steam Roller	50	Rollers	0.38	19	152	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Street - Paving	10	8	Street Sweeper	200	Crawler Tractors	0.5	100	800	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050

1 - Load Factor obtained from CalEEMod Appendix D Defaults

2- Emission factors for CO2 and Sox were obtained from Table 3.4, Off-road Equipment Emission Factors, CalEEMod Appendix D Default Data Tables.

Off-Road Emissions Calculations		Daily Emissions (lb)						
Phase	Equipment	ROG	CO	NOx	CO2	PM10	PM2.5	SOx
Option 1								
Demolition	Bobcat (Bobcat S510)	3.9E-02	1.1E+00	7.4E-01	1.3E+02	6.6E-02	6.6E-02	1.1E-03
Demolition	6000 Watt Generator	5.7E-03	1.6E-01	1.1E-01	1.9E+01	9.8E-03	9.8E-03	1.6E-04
Demolition	Chain Saw	2.8E-04	7.9E-03	5.4E-03	9.1E-01	4.8E-04	4.8E-04	8.0E-06
Demolition	Water Pump	1.1E-02	3.2E-01	2.2E-01	3.7E+01	2.0E-02	2.0E-02	3.3E-04
Excavation	18,000 lbs Excavator (Kubota KX80-4)	8.2E-02	2.3E+00	1.6E+00	2.7E+02	1.4E-01	1.4E-01	2.3E-03
Excavation	Bobcat (Bobcat S510)	2.5E-02	7.0E-01	4.8E-01	8.2E+01	4.3E-02	4.3E-02	7.2E-04
Excavation	6000 Watt Generator	5.7E-03	1.6E-01	1.1E-01	1.9E+01	9.8E-03	9.8E-03	1.6E-04
Excavation	Water Pump	1.1E-02	3.2E-01	2.2E-01	3.7E+01	2.0E-02	2.0E-02	3.3E-04
SVE Well Installation	Bobcat with Auger (Bobcat S510)	1.3E-02	3.5E-01	2.4E-01	4.1E+01	2.2E-02	2.2E-02	3.6E-04
SVE Well Installation	6000 Watt Generator	2.9E-03	8.0E-02	5.4E-02	9.3E+00	4.9E-03	4.9E-03	8.2E-05
Subslab Vent Installation	Bobcat with Auger (Bobcat S510)	1.3E-02	3.5E-01	2.4E-01	4.1E+01	2.2E-02	2.2E-02	3.6E-04
Subslab Vent Installation	6000 Watt Generator	1.5E-03	4.1E-02	2.8E-02	4.8E+00	2.5E-03	2.5E-03	4.2E-05
Backfill and Compaction	Bobcat (Bobcat S510)	2.5E-02	7.0E-01	4.8E-01	8.2E+01	4.3E-02	4.3E-02	7.2E-04
Backfill and Compaction	Small Compactor (Wacker)	2.0E-03	5.6E-02	3.8E-02	6.5E+00	3.4E-03	3.4E-03	5.7E-05
Backfill and Compaction	Water Pump	5.7E-03	1.6E-01	1.1E-01	1.9E+01	9.8E-03	9.8E-03	1.6E-04
Slurry Backfill	Concrete Pump	4.6E-03	1.3E-01	8.7E-02	1.5E+01	7.8E-03	7.8E-03	1.3E-04
Site Restoration	6000 Watt Generator	2.9E-03	8.0E-02	5.4E-02	9.3E+00	4.9E-03	4.9E-03	8.2E-05
Site Restoration	Concrete Pump	1.1E-03	3.2E-02	2.2E-02	3.7E+00	2.0E-03	2.0E-03	3.3E-05
Street Trenching								
Street Trenching/Pipe installation	Backhoe	1.5E-01	3.7E+00	2.9E+00	5.7E+02	3.0E-01	3.0E-01	5.0E-03
Street Trenching/Pipe installation	Compressor	1.1E-01	3.1E+00	2.1E+00	3.6E+02	1.9E-01	1.9E-01	3.2E-03
Street Trenching/Pipe installation	Generator	5.7E-03	1.6E-01	1.1E-01	1.9E+01	9.8E-03	9.8E-03	1.6E-04
Street Trenching/Pipe installation	Concrete Saw	1.2E-02	2.0E-01	2.2E-01	4.4E+01	2.3E-02	2.3E-02	3.9E-04
Well Installation								
Drilling and SVE Well Installation	Drill Rig	2.1E-01	3.6E+00	3.9E+00	7.8E+02	4.1E-01	4.1E-01	6.8E-03
Street Paving								
Street - Grinding	Cold Plane Grinding Machine	7.6E-01	1.3E+01	1.4E+01	2.9E+03	1.5E+00	1.5E+00	2.5E-02
Street - Grinding	Street Sweeper	2.6E-01	4.6E+00	5.0E+00	1.0E+03	5.3E-01	5.3E-01	8.8E-03
Street - Paving	Paving Machine	1.7E-01	2.9E+00	3.2E+00	6.3E+02	3.3E-01	3.3E-01	5.6E-03
Street - Paving	Steam Roller	5.0E-02	8.7E-01	9.6E-01	1.9E+02	1.0E-01	1.0E-01	1.7E-03
Street - Paving	Street Sweeper	2.6E-01	4.6E+00	5.0E+00	1.0E+03	5.3E-01	5.3E-01	8.8E-03

Off-Road Emissions Calculations	Daily Emissions (lb)						
Phase	ROG	CO	NOx	CO2	PM10	PM2.5	SOx
Option 1							
Demolition	5.6E-02	1.6E+00	1.1E+00	1.8E+02	9.6E-02	9.6E-02	1.6E-03
Excavation	1.2E-01	3.5E+00	2.4E+00	4.0E+02	2.1E-01	2.1E-01	3.6E-03
SVE Well/Piping	1.5E-02	4.3E-01	2.9E-01	5.0E+01	2.6E-02	2.6E-02	4.4E-04
Subslab Vent Installation	1.4E-02	3.9E-01	2.7E-01	4.6E+01	2.4E-02	2.4E-02	4.0E-04
Backfill and Compaction	3.3E-02	9.2E-01	6.2E-01	1.1E+02	5.6E-02	5.6E-02	9.4E-04
Slurry Backfill	4.6E-03	1.3E-01	8.7E-02	1.5E+01	7.8E-03	7.8E-03	1.3E-04
Site Restoration	4.0E-03	1.1E-01	7.6E-02	1.3E+01	6.9E-03	6.9E-03	1.1E-04
Well Installation							
Drilling and SVE Well Installation	2.1E-01	3.6E+00	3.9E+00	7.8E+02	4.1E-01	4.1E-01	6.8E-03
Street Trenching							
Street Trenching/Pipe installation	2.8E-01	7.2E+00	5.3E+00	1.0E+03	5.3E-01	5.3E-01	8.8E-03
Street Paving							
Street - Grinding	1.0E+00	1.8E+01	2.0E+01	3.9E+03	2.1E+00	2.1E+00	3.4E-02
Street - Paving	4.8E-01	8.3E+00	9.1E+00	1.8E+03	9.6E-01	9.6E-01	1.6E-02

VIII. On-Site Road Emissions

Summary: This section calculates the emissions of criteria pollutants from on-site paved roads.

Emissions Factors

Running Emissions							g/mi				
Veh Class	Fuel	MdlYr	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
LDA/LDT	All	All	6.4E-02	2.5E+00	2.8E-01	6.9E+02	3.0E-03	3.0E-04	7.0E-03	4.5E-02	1.8E-02
HHDT	DSL	All	7.8E-01	4.0E+00	1.4E+01	1.6E+03	8.0E-01	7.4E-01	1.7E-02	7.8E-02	3.1E-02
HHDT	DSL	2007	1.2E-01	8.6E-01	2.2E+00	1.6E+03	6.1E-02	5.6E-02	1.7E-02	5.9E-03	5.5E-03

Source: EMFAC 2011

Running Emissions							lbs/mi				
Veh Class	Fuel	MdlYr	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
LDA/LDT	All	All	1.4E-04	5.5E-03	6.1E-04	1.5E+00	6.6E-06	6.6E-07	1.5E-05	9.9E-05	4.0E-05
HHDT	DSL	All	1.7E-03	8.8E-03	3.1E-02	3.6E+00	1.8E-03	1.6E-03	3.7E-05	1.7E-04	6.8E-05
HHDT	DSL	2007	2.7E-04	1.9E-03	4.8E-03	3.5E+00	1.4E-04	1.2E-04	3.7E-05	1.3E-05	1.2E-05

Source: EMFAC 2011

Heavy Truck Trip Data									SCAB		
Phase	Hourly Round Trips	Daily Round Trips	8 Home Cluster Round Trips	Annual Round Trips	Truck Type	Average Vehicle Weight (tons)	Trip length (SCAB)	Hourly VMT	Daily VMT	8 Home Cluster VMT	Annual VMT
Option 1											
Demo	1.67	13	214	1,584	Dump Truck	25	0.72	1.20	10	154	1140
Green Waste	0.50	4	32	237	Dump Truck	25	0.72	0.36	3	23	171
Excavation	2.67	21	2,567	5,071	Dump Truck	25	0.72	1.92	15	1848	3649
SVE Well/Piping	0.4	3.1	25.1	185.8	Dump Truck	25	0.72	0.28	2.3	18	134
Subslab Vent	0.00	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	2.82	23	2,163	5,340	Dump Truck	25	0.72	2.03	16	1557	3843
Slurry Backfill	1.02	8	455	1,925	Concrete Truck	25	0.72	0.73	6	327	1385
Site Resto.	0.68	5	437	1,294	Concrete Truck	25	0.72	0.49	4	314	932
Street Trenching											
Demo	0.19	1	0	268	Dump Truck	25	0.72	0.13	1.1	0.00	193
Excavation	0.57	5	0	816	Dump Truck	25	0.72	0.41	3	0.00	587
Backfill	0.56	4	0	808	Dump Truck	25	0.72	0.40	3	0.00	582
Restoration	0.19	2	0	275	Concrete Truck	25	0.72	0.14	1.1	0.00	198
Pipe Delivery	0.19	2	0	270	Dump Truck	25	0.72	0.13	1	0.00	194
Well Installation											
Air Vac- Borehole Clearance	0.19	2	0	95	Air-Vac	25	0.72	0.13	1	0.00	68
Drilling and SVE Well Installation	0.19	2	0	95	Drill Rig	25	0.72	0.13	1	0.00	68
Waste Collection	0.38	3	0	189	Dump Truck	25	0.72	0.27	2	0.00	136
Street Paving											
Street Grinding	3	16	0	80	Dump Truck	25	0.72	1.92	12	0.00	58
Street Paving	1	8	0	80	Dump Truck	25	0.72	0.96	6	0.00	58
Visitor Trips											
Passenger Vehicle Trips	1.13	9	0	2,259	Passenger Vehicle	25	0.72	0.81	6	0	1626

Emissions Calculations

Daily Truck Trip Emission Calculations (SCAB)						lbs/day				
Phase	Daily VMT (SCAB)	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
Option 1										
Demo	9.6	2.6E-03	1.8E-02	4.6E-02	3.3E+01	1.3E-03	1.2E-03	3.5E-04	1.3E-04	1.2E-04
Green Waste	2.9	7.8E-04	5.5E-03	1.4E-02	1.0E+01	3.9E-04	3.6E-04	1.1E-04	3.8E-05	3.5E-05
Excavation	15.4	4.2E-03	2.9E-02	7.3E-02	5.3E+01	2.1E-03	1.9E-03	5.7E-04	2.0E-04	1.9E-04
SVE Well/Piping	2.3	6.1E-04	4.3E-03	1.1E-02	7.8E+00	3.0E-04	2.8E-04	8.3E-05	2.9E-05	2.7E-05
Subslab Vent	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Backfill/Compact	16.2	4.4E-03	3.1E-02	7.7E-02	5.6E+01	2.2E-03	2.0E-03	6.0E-04	2.1E-04	1.9E-04
Slurry Backfill	5.8	1.6E-03	1.1E-02	2.8E-02	2.0E+01	7.9E-04	7.3E-04	2.2E-04	7.6E-05	7.0E-05
Site Resto.	3.9	1.1E-03	7.5E-03	1.9E-02	1.4E+01	5.3E-04	4.9E-04	1.5E-04	5.1E-05	4.7E-05
Street Trenching										
Demo	1.1	2.9E-04	2.0E-03	5.1E-03	3.7E+00	1.4E-04	1.3E-04	4.0E-05	1.4E-05	1.3E-05
Excavation	3.3	8.8E-04	6.2E-03	1.6E-02	1.1E+01	4.4E-04	4.1E-04	1.2E-04	4.3E-05	3.9E-05
Backfill	3.2	8.8E-04	6.1E-03	1.5E-02	1.1E+01	4.4E-04	4.0E-04	1.2E-04	4.2E-05	3.9E-05
Restoration	1.1	3.0E-04	2.1E-03	5.2E-03	3.8E+00	1.5E-04	1.4E-04	4.1E-05	1.4E-05	1.3E-05
Pipe Delivery	1.1	2.9E-04	2.1E-03	5.1E-03	3.8E+00	1.5E-04	1.3E-04	4.0E-05	1.4E-05	1.3E-05
Well Installation										
Air Vac- Borehole Clearance	1.1	2.9E-04	2.1E-03	5.1E-03	3.8E+00	1.5E-04	1.3E-04	4.0E-05	1.4E-05	1.3E-05
Drilling and SVE Well Installation	1.1	2.9E-04	2.1E-03	5.1E-03	3.8E+00	1.5E-04	1.3E-04	4.0E-05	1.4E-05	1.3E-05
Waste Collection	2.2	5.8E-04	4.1E-03	1.0E-02	7.5E+00	2.9E-04	2.7E-04	8.0E-05	2.8E-05	2.6E-05
Street Paving										
Street Grinding	11.5	3.1E-03	2.2E-02	5.5E-02	4.0E+01	1.6E-03	1.4E-03	4.2E-04	1.5E-04	1.4E-04
Street Paving	5.8	1.6E-03	1.1E-02	2.7E-02	2.0E+01	7.8E-04	7.2E-04	2.1E-04	7.5E-05	6.9E-05
Visitor Trips										
Passenger Vehicle Trips	6.5	9.1E-04	3.6E-02	4.0E-03	9.9E+00	4.3E-05	4.3E-06	1.0E-04	6.4E-04	2.6E-04

Misc. Worker Trips

Worker Trip Emission Calculations (SCAB)							lbs/day					
Phase	Worker Round Trips per day	Roundtrip Distance per Worker (mi)	VMT per Day	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
Option 1	32	0.72	23	3.2E-03	1.3E-01	1.4E-02	3.5E+01	1.5E-04	1.5E-05	3.6E-04	2.3E-03	9.1E-04
Street Trenching	42	0.72	30	4.3E-03	1.7E-01	1.9E-02	4.6E+01	2.0E-04	2.0E-05	4.7E-04	3.0E-03	1.2E-03
Well Installation	39	0.72	28	4.0E-03	1.6E-01	1.7E-02	4.3E+01	1.9E-04	1.9E-05	4.3E-04	2.8E-03	1.1E-03
Street Paving												
Street Grinding	16	0.72	12	1.6E-03	6.4E-02	7.1E-03	1.8E+01	7.6E-05	7.6E-06	1.8E-04	1.1E-03	4.6E-04
Street Paving	16	0.72	12	1.6E-03	6.4E-02	7.1E-03	1.8E+01	7.6E-05	7.6E-06	1.8E-04	1.1E-03	4.6E-04

VIIII. On-Site Road - Reentrained Dust

Summary: This section calculates the emissions of re-entrained dust from on-site on road vehicles on paved roads.

$$E = [k(sL)^{0.91} \times (W)^{1.02}] (1 - P/4N)$$

Where:

E = size-specific emission factor (lb/VMT)

k = particle size multiplier

sL = road surface silt loading (g/m^2)

W = mean vehicle weight (tons)

P = averaging period (365 days)

N = number of "wet" days (>0.01 in of precipitation)

Source: AP-42 13.2.1-2, Equation (1). January 2011.

Correction:

P = number of wet days

N = number of days in period

Assumptions			
Parameter	**Value**	**Units**	**Reference**
Heavy Vehicle Weight (tons)	25	tons	Assumed
k (empirical constant) - PM10	0.0022	-	AP-42, Chapter 13.2.1, Table 13.2.1-1. PM10 (lbs/VMT)
k (empirical constant) - PM2.5	0.0005	-	AP-42, Chapter 13.2.1, Table 13.2.1-1. PM2.5 (lbs/VMT)
sL (Haul Trucks)	0.02	g/m2	CARB Entrained Paved Road Dust. (1997) Silt loading for freeways: http://www.arb.ca.gov/ei/areasrc/fullpdf/full7-9.pdf
sL (Worker Vehicles)	0.1	g/m2	CalEEMod Default for Worker trips (Assumes mix of freeway and surface street travel)
P (averaging period)	365	days	Days per year
N (wet days)	40	days	AP-42, Chapter 13.2.1, Figure 13.2.1-2. January 2011.
On-Site Heavy Truck Haul	0.72	miles	Measured distance from the furthest northern and southern homes in the community.
Employee/Worker Trip Distance	0.72	miles	Measured distance from the furthest northern and southern homes in the community.
Paved Road Average Vehicle	2.4	tons	CalEEMod default average vehicle weight (tons)

Phase	Hourly Round Trips	Daily Round Trips	8 Home Cluster Round Trips	Annual Round Trips	Truck Type	Average Vehicle Weight (tons)	SCAB Round Trip length (SCAB)	Hourly VMT	Daily VMT	8 Home Cluster VMT	Annual VMT
Option 1											
Demo	1.7	13.4	213.8	1583.6	Dump Truck	25	0.72	1.2	9.6	153.9	1139.7
Green Waste	0.5	4.0	32.0	237.0	Dump Truck	25	0.72	0.4	2.9	23.0	170.6
Excavation	2.7	21.4	2567.5	5070.8	Dump Truck	25	0.72	1.9	15.4	1847.8	3649.4
SVE Well/Piping	0.4	3.1	25.1	185.8	Dump Truck	25	0.72	0.3	2.3	18.1	133.8
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	2.8	22.5	2162.9	5339.8	Dump Truck	25	0.72	2.0	16.2	1556.7	3843.0
Slurry Backfill	1.0	8.1	454.8	1924.8	Concrete Truck	25	0.72	0.7	5.8	327.3	1385.3
Site Resto.	0.7	5.5	437.0	1294.5	Concrete Truck	25	0.72	0.5	3.9	314.5	931.6
Street Trenching											
Demo	0.2	1.5	0.00	268.0	Dump Truck	25	0.72	0.1	1.1	0.00	192.9
Excavation	0.6	4.5	0.00	816.0	Dump Truck	25	0.72	0.4	3.3	0.00	587.3
Backfill	0.6	4.5	0.00	808.0	Dump Truck	25	0.72	0.4	3.2	0.00	581.5
Restoration	0.2	1.5	0.00	275.0	Concrete Truck	25	0.72	0.1	1.1	0.00	197.9
Pipe Delivery	0.2	1.5	0.00	270.0	Dump Truck	25	0.72	0.1	1.1	0.00	194.3
Well Installation											
Air Vac- Borehole Clearance	0.2	1.5	0.00	94.5	Air-Vac	25	0.72	0.1	1.1	0.00	68.0
Drilling and SVE Well Installation	0.2	1.5	0.00	94.5	Drill Rig	25	0.72	0.1	1.1	0.00	68.0
Waste Collection	0.4	3.0	0.00	189.0	Dump Truck	25	0.72	0.3	2.2	0.00	136.0
Street Paving											
Street Grinding	2.7	16.0	0.00	80.0	Dump Truck	25	0.72	1.9	11.5	0.00	57.6
Street Paving	1.3	8.0	0.00	80.0	Dump Truck	25	0.72	1.0	5.8	0.00	57.6

Emission Calculation

Daily:

Phase	Daily VMT (SCAB)	sL (g/M^2)	W (tons)	k (PM10)	k (PM2.5)	Wet Days	Avg. Period	PM10 EF (lbs/mi.)	PM2.5 EF (lbs/mi.)	SCAB Pm10 Emissions	SCAB PM2.5 Emissions
Option 1											
Demo	9.6	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	5.83E-04	1.43E-04
Green Waste	2.9	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	1.75E-04	4.28E-05
Excavation	15.4	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	9.34E-04	2.29E-04
SVE Well/Piping	2.3	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	1.37E-04	3.36E-05
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	16.2	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	9.83E-04	2.41E-04
Slurry Backfill	5.8	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	3.54E-04	8.70E-05
Site Resto.	3.9	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	2.38E-04	5.85E-05
Street Trenching											
Demo	1.1	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	6.50E-05	1.59E-05
Excavation	3.3	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	1.98E-04	4.86E-05
Backfill	3.2	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	1.96E-04	4.81E-05
Restoration	1.1	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	6.67E-05	1.64E-05
Pipe Delivery	1.1	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	6.55E-05	1.61E-05
Well Installation											
Air Vac- Borehole Clearance	1.1	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	6.55E-05	1.61E-05
Drilling and SVE Well Installation	1.1	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	6.55E-05	1.61E-05
Waste Collection	2.2	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	1.31E-04	3.21E-05
Street Paving											
Street Grinding	11.5	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	6.98E-04	1.71E-04
Street Paving	5.8	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	3.49E-04	8.57E-05

Daily Worker Trip Emissions:

Phase	Worker Trips per Day	Round Trip per Worker (mile)	VMT per Hour	SL (g/m^2)	W (Tons)	k (PM10)	k (PM2.5)	Wet Days	Avg. period	PM10 EF lbs/mi	PM2.5 EF lbs/mi	SCAB PM10 Emissions	SCAB PM2.5 Emissions
Option 1	32	0.72	23	0.02	2.40	0.0022	0.00054	40	365	1.49E-04	3.65E-05	3.42E-03	8.40E-04
Street Trenching	42	0.72	30	0.02	2.40	0.0022	0.00054	40	365	1.49E-04	3.65E-05	4.49E-03	1.10E-03
Well Installation	39	0.72	28	0.02	2.40	0.0022	0.00054	40	365	1.49E-04	3.65E-05	4.17E-03	1.02E-03
Street Paving													
Street Grinding	16	0.72	12	0.02	2.40	0.0022	0.00054	40	365	1.49E-04	3.65E-05	1.71E-03	4.20E-04
Street Paving	16	0.72	12	0.02	2.40	0.0022	0.00054	40	365	1.49E-04	3.65E-05	1.71E-03	4.20E-04

X. Off-Site Road Emissions

Summary: This section calculates the emissions of criteria pollutants from off-site paved roads.

Emissions Factors

Running Emissions						g/mi					
Veh Class	Fuel	MdlYr	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
LDA/LDT	All	All	6.4E-02	2.5E+00	2.8E-01	6.9E+02	3.0E-03	3.0E-04	7.0E-03	4.5E-02	1.8E-02
HHDT	DSL	All	7.8E-01	4.0E+00	1.4E+01	1.6E+03	8.0E-01	7.4E-01	1.7E-02	7.8E-02	3.1E-02
HHDT	DSL	2007	1.2E-01	8.6E-01	2.2E+00	1.6E+03	6.1E-02	5.6E-02	1.7E-02	5.9E-03	5.5E-03

Source: EMFAC 2011

Running Emissions						lbs/mi					
Veh Class	Fuel	MdlYr	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
LDA/LDT	All	All	1.4E-04	5.5E-03	6.1E-04	1.5E+00	6.6E-06	6.6E-07	1.5E-05	9.9E-05	4.0E-05
HHDT	DSL	All	1.7E-03	8.8E-03	3.1E-02	3.6E+00	1.8E-03	1.6E-03	3.7E-05	1.7E-04	6.8E-05
HHDT	DSL	2007	2.7E-04	1.9E-03	4.8E-03	3.5E+00	1.4E-04	1.2E-04	3.7E-05	1.3E-05	1.2E-05

Source: EMFAC 2011

Heavy Truck Trip Data																
Phase	Hourly Round Trips	Daily Round Trips	8 Home Cluster Round Trips	Annual Round Trips	Truck Type	Average Vehicle Weight (tons)	Round Trip length (SCAB)	Hourly VMT	Daily VMT	8 Home Cluster Round Trips	Annual VMT	Trip length (MDAB)	Hourly VMT	Daily VMT	8 Home Cluster Round Trips	Annual VMT
Option 1																
Demo	1.7	13	214	1,584	Dump Truck	25	60	100	802	12,830	95,019	0	0	0	0	0
Green Waste	0.5	4.0	32.0	237.0	Dump Truck	25.0	10.0	5	40	320	2,370	0	0	0	0	0
Excavation	2.7	21	2,567	5,071	Dump Truck	25	150	401	3,209	385,121	760,614	50	134	1,070	128,374	253,538
SVE Well/Piping	0.4	3.1	25.1	185.8	Dump Truck	25	100	39	314	2,509	18,585	0	0	0	0	0
Subslab Vent	0.0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	2.8	23	2,163	5,340	Dump Truck	25	8	23	180	17,304	42,718	0	0	0	0	0
Slurry Backfill	1.0	8.1	454.8	1924.8	Concrete Truck	25	20	20	162	9,096	38,497	0	0	0	0	0
Site Resto.	0.7	5	437	1,294	Concrete Truck	25	20	14	109	8,739	25,890	0	0	0	0	0
Street Trenching																
Demo	0.2	1.5	0.00	268.0	Dump Truck	25	60	11	89	0	16,080	0	0	0	0.00	0
Excavation	0.6	4.5	0.00	816.0	Dump Truck	25	150	85	680	0	122,400	50	28	227	0.00	40,800
Slurry Backfill	0.6	4.5	0.00	808.0	Dump Truck	25	8	4	36	0	6,464	0	0	0	0.00	0
Restoration	0.2	1.5	0.00	275.0	Concrete Truck	25	20	4	31	0	5,500	0	0	0	0.00	0
Pipe Delivery	0.2	1.5	0.00	270.0	Dump Truck	25	100	19	150	0	27,000	0	0	0	0.00	0
Well Installation																
Air Vac- Borehole Clearance	0.2	1.5	0.00	94.5	Air-Vac	25	10	2	15	0	945	0	0	0	0.00	0
Drilling and SVE Well Installation	0.2	1.5	0.00	94.5	Drill Rig	25	10	2	15	0	945	0	0	0	0.00	0
Waste Collection	0.4	3.0	0.00	189.0	Dump Truck	25	10	4	30	0	1,890	0	0	0	0.00	0
Waste Transport to Offsite Disposal	0.2	1.5	0.00	91.9	Dump Truck	25	150	27	219	0	13,785	50	9	73	0	4,595
Street Paving																
Street Grinding	2.7	8.0	0.00	80.0	Dump Truck	25	60	160	480	0	4,800	0	0	0	0.00	0
Street Paving	1.3	16.0	0.00	80.0	Dump Truck	25	100	133	1,600	0	8,000	0	0	0	0.00	0

Emissions Calculations

Daily Truck Trip Emission Calculations (SCAB)		lbs/day (SCAB)								
Phase	Daily VMT (SCAB)	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
Option 1										
Demo	802	2.2E-01	1.5E+00	3.8E+00	2.8E+03	1.1E-01	1.0E-01	3.0E-02	1.0E-02	9.6E-03
Green Waste	40	1.1E-02	7.6E-02	1.9E-01	1.4E+02	5.4E-03	5.0E-03	1.5E-03	5.2E-04	4.8E-04
Excavation	3,209	8.7E-01	6.1E+00	1.5E+01	1.1E+04	4.3E-01	4.0E-01	1.2E-01	4.2E-02	3.9E-02
SVE Well/Piping	314	8.5E-02	6.0E-01	1.5E+00	1.1E+03	4.2E-02	3.9E-02	1.2E-02	4.1E-03	3.8E-03
Subslab Vent	0.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Backfill/Compact	180	4.9E-02	3.4E-01	8.6E-01	6.3E+02	2.4E-02	2.2E-02	6.7E-03	2.4E-03	2.2E-03
Slurry Backfill	162	4.4E-02	3.1E-01	7.7E-01	5.6E+02	2.2E-02	2.0E-02	6.0E-03	2.1E-03	2.0E-03
Site Resto.	109	3.0E-02	2.1E-01	5.2E-01	3.8E+02	1.5E-02	1.4E-02	4.0E-03	1.4E-03	1.3E-03
Street Trenching										
Demo	89	2.4E-02	1.7E-01	4.2E-01	3.1E+02	1.2E-02	1.1E-02	3.3E-03	1.2E-03	1.1E-03
Excavation	680	1.8E-01	1.3E+00	3.2E+00	2.4E+03	9.2E-02	8.5E-02	2.5E-02	8.9E-03	8.2E-03
Backfill	36	9.7E-03	6.8E-02	1.7E-01	1.2E+02	4.9E-03	4.5E-03	1.3E-03	4.7E-04	4.3E-04
Restoration	31	8.3E-03	5.8E-02	1.5E-01	1.1E+02	4.1E-03	3.8E-03	1.1E-03	4.0E-04	3.7E-04
Pipe Delivery	150	4.1E-02	2.9E-01	7.1E-01	5.2E+02	2.0E-02	1.9E-02	5.5E-03	2.0E-03	1.8E-03
Well Installation										
Air Vac- Borehole Clearance	15	4.1E-03	2.9E-02	7.1E-02	5.2E+01	2.0E-03	1.9E-03	5.5E-04	2.0E-04	1.8E-04
Drilling and SVE Well Installation	15	4.1E-03	2.9E-02	7.1E-02	5.2E+01	2.0E-03	1.9E-03	5.5E-04	2.0E-04	1.8E-04
Waste Collection	30	8.1E-03	5.7E-02	1.4E-01	1.0E+02	4.1E-03	3.7E-03	1.1E-03	3.9E-04	3.6E-04
Waste Transport to Offsite Disposal	219	5.9E-02	4.2E-01	1.0E+00	7.6E+02	3.0E-02	2.7E-02	8.1E-03	2.9E-03	2.6E-03
Street Paving										
Street Grinding	480	1.3E-01	9.1E-01	2.3E+00	1.7E+03	6.5E-02	6.0E-02	1.8E-02	6.3E-03	5.8E-03
Street Paving	1,600	4.3E-01	3.0E+00	7.6E+00	5.6E+03	2.2E-01	2.0E-01	5.9E-02	2.1E-02	1.9E-02

Daily Truck Trip Emission Calculations (MDAB)		lbs/day (MDAB)								
Phase	Daily VMT (MDAB)	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
Option 1										
Demo	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Green Waste	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Excavation	1070	2.9E-01	2.0E+00	5.1E+00	3.7E+03	1.4E-01	1.3E-01	3.9E-02	1.4E-02	1.3E-02
SVE Well/Piping	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Subslab Vent	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Backfill/Compact	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Slurry Backfill	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Site Resto.	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Street Trenching										
Demo	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Excavation	227	6.1E-02	4.3E-01	1.1E+00	7.9E+02	3.1E-02	2.8E-02	8.4E-03	3.0E-03	2.7E-03
Backfill	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Restoration	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pipe Delivery	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Well Installation										
Air Vac- Borehole Clearance	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Drilling and SVE Well Installation	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Waste Collection	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Waste Transport to Offsite Disposal	73	2.0E-02	1.4E-01	3.5E-01	2.5E+02	9.9E-03	9.1E-03	2.7E-03	9.5E-04	8.8E-04
Street Paving										
Street Grinding	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Street Paving	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

				lbs/day								
Phase	Worker Round Trips per day	Roundtrip Distance per Worker (mi)	VMT per Day	ROG	CO	NOx	CO2	PM10	PM2.5	Sox	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
Option 1	32	21.6	691	9.8E-02	3.8E+00	4.2E-01	1.1E+03	4.6E-03	4.6E-04	1.1E-02	6.9E-02	2.7E-02
Street Trenching	42	21.6	907	1.3E-01	5.0E+00	5.6E-01	1.4E+03	6.0E-03	6.0E-04	1.4E-02	9.0E-02	3.6E-02
Well Installation	39	21.6	842	1.2E-01	4.7E+00	5.2E-01	1.3E+03	5.6E-03	5.6E-04	1.3E-02	8.4E-02	3.3E-02
Street Paving												
Street Grinding	16	21.6	346	4.9E-02	1.9E+00	2.1E-01	5.3E+02	2.3E-03	2.3E-04	5.3E-03	3.4E-02	1.4E-02
Street Paving	16	21.6	346	4.9E-02	1.9E+00	2.1E-01	5.3E+02	2.3E-03	2.3E-04	5.3E-03	3.4E-02	1.4E-02

*Used worker distances from CalEEMod Assumptions

XI. Off-Site Road - Reentrained Dust

Summary: This section calculates the emissions of re-entrained dust from off-site on road vehicles on paved roads.

$$E = [k(sL)^{0.91} \times (W)^{1.02}] (1 - P/4N)$$

Where:

E = size-specific emission factor (lb/VMT)
k = particle size multiplier
sL = road surface silt loading (g/m^2)
W = mean vehicle weight (tons)
P = averaging period (365 days)
N = number of "wet" days (>0.01 in of precipitation)

Source: AP-42 13.2.1-2, Equation (1). January 2011.

Correction:
P = number of wet days
N = number of days in period

Assumptions			
Parameter	**Value**	**Units**	**Reference**
Vehicle Weight (tons)	25	tons	Assumed
k (empirical constant) - PM10	0.0022	-	AP-42, Chapter 13.2.1, Table 13.2.1-1. PM10 (lbs/VMT)
k (empirical constant) - PM2.5	0.00054	-	AP-42, Chapter 13.2.1, Table 13.2.1-1. PM2.5 (lbs/VMT)
sL (Haul Trucks)	0.02	g/m2	CARB Entrained Paved Road Dust. (1997) Silt loading for freeways:
sL (Worker Vehicles)	0.1	g/m2	CalEEMod Default for Worker trips (Assumes mix of freeway and
P (averaging period)	365	days	Days per year
N (wet days)	40	days	AP-42, Chapter 13.2.1, Figure 13.2.1-2. January 2011.
South Coast Air Basin Distance	75	miles	google maps
Mojave Desert Distance	25	miles	google maps
Employee/Worker Trip Distance	21.6	miles	CalEEMod Default Construction Worker Trip (Round Trip)
Paved Road Average Vehicle Weight	2.4	tons	CalEEMod default average vehicle weight (tons)

Phase	Hourly Round Trips	Daily Round Trips	8 Home Cluster Round Trips	Annual Round Trips	Truck Type	Average Vehicle Weight (tons)	Round Trip length (SCAB)	SCAB Hourly VMT	SCAB Daily VMT	SCAB 8 Home Cluster VMT	SCAB Annual VMT	Trip length (MDAB)	MDAB Hourly VMT	MDAB Daily VMT	MDAB 8 Home Cluster VMT	MDAB Annual VMT
Option 1																
Demo	1.7	13.4	213.8	1,583.6	Dump Truck	25	60	100	802	12,830	95,019	0	0	0	0	0
Green Waste	0.5	4.0	32.0	237.0	Dump Truck	25	10	5	40	320	2,370	0	0	0	0	0
Excavation	2.7	21.4	2,567.5	5,070.8	Dump Truck	25	150	401	3,209	385,121	760,614	50	134	1,070	128,374	253,538
SVE Well/Piping	0.4	3.1	25.1	185.8	Dump Truck	25	100	39	314	2,509	18,585	0	0	0	0	0
Subslab Vent	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0
Backfill/Compact	2.8	22.5	2,162.9	5,339.8	Dump Truck	25	8	23	180	17,304	42,718	0	0	0	0	0
Slurry Backfill	1.0	8.1	454.8	1,924.8	Concrete Truck	25	20	20	162	9,096	38,497	0	0	0	0	0
Site Resto.	0.7	5.5	437.0	1,294.5	Concrete Truck	25	20	14	109	8,739	25,890	0	0	0	0	0
Street Trenching																
Demo	0.2	1.5	0.0	268.0	Dump Truck	25	60	11	89	0	16,080	0	0	0	0	0
Excavation	0.6	4.5	0.0	816.0	Dump Truck	25	150	85	680	0	122,400	50	28	227	0	40,800
Backfill	0.6	4.5	0.0	808.0	Dump Truck	25	8	4	36	0	6,464	0	0	0	0	0
Restoration	0.2	1.5	0.0	275.0	Concrete Truck	25	20	4	31	0	5,500	0	0	0	0	0
Pipe Delievery	0.2	1.5	0.0	270.0	Dump Truck	25	100	19	150	0	27,000	0	0	0	0	0
Well Installation																
Air Vac- Borehole Clearance	0.2	1.5	0.0	94.5	Air-Vac	25	10.0	2	15	0	945	0	0	0	0	0
Drilling and SVE Well Installation	0.2	1.5	0.0	94.5	Drill Rig	25	10.0	2	15	0	945	0	0	0	0	0
Waste Collection	0.4	3.0	0.0	189.0	Dump Truck	25.0	10.0	3.8	30.0	0.0	1,890.0	0.0	0.0	0.0	0.0	0.0
Waste Transport to Offsite Disposal	0.2	1.5	0.0	91.9	Dump Truck	25.0	150.0	27.4	218.8	0.0	13,785.0	50.0	9.1	72.9	0.0	4,595.0
Street Paving																
Street Grinding	2.7	16.0	0.0	80.0	Dump Truck	25	60	160	960	0	4,800	0	0	0	0	0
Street Paving	2.7	16.0	0.0	160.0	Dump Truck	25	100	267	1,600	0	16,000	0	0	0	0	0

Emission Calculation

Daily:

Phase	Daily VMT (SCAB)	Daily VMT (MDAB)	sL (g/M^2)	W (tons)	k (PM10)	k (PM2.5)	Wet Days	Avg. Period	PM10 EF (lbs/mi.)	PM2.5 EF (lbs/mi.)	SCAB Pm10 Emissions	SCAB PM2.5 Emissions	MDAB Pm10 Emissions	MDAB PM2.5 Emissions
Option 1														
Demo	801.8	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	1.3E+00	3.2E-01	0.0E+00	0.0E+00
Green Waste	40.0	0.0	0.02	25	0.0022	0.00054	40	366	0.0016	0.0004	6.5E-02	1.6E-02	0.0E+00	0.0E+00
Excavation	3,209.3	1,069.8	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	5.2E+00	1.3E+00	1.7E+00	4.3E-01
SVE Well/Piping	313.7	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	5.1E-01	1.2E-01	0.0E+00	0.0E+00
Subslab Vent	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Backfill/Compact	180.2	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	2.9E-01	7.2E-02	0.0E+00	0.0E+00
Slurry Backfill	162.4	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	2.6E-01	6.5E-02	0.0E+00	0.0E+00
Site Resto.	109.2	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	1.8E-01	4.4E-02	0.0E+00	0.0E+00
Street Trenching														
Demo	89.3	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	1.4E-01	3.6E-02	0.0E+00	0.0E+00
Excavation	680.0	226.7	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	1.1E+00	2.7E-01	3.7E-01	9.0E-02
Backfill	35.9	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	5.8E-02	1.4E-02	0.0E+00	0.0E+00
Restoration	30.6	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	5.0E-02	1.2E-02	0.0E+00	0.0E+00
Pipe Delievery	150.0	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	2.4E-01	6.0E-02	0.0E+00	0.0E+00
Well Installation														
Air Vac- Borehole Clearance	15.0	0.0	0.02	25	0.0022	0.00054	40	367	0.0016	0.0004	2.4E-02	6.0E-03	0.0E+00	0.0E+00
Drilling and SVE Well Installation	15.0	0.0	0.02	25	0.0022	0.00054	40	368	0.0016	0.0004	2.4E-02	6.0E-03	0.0E+00	0.0E+00
Waste Collection	30.0	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	4.9E-02	1.2E-02	0.0E+00	0.0E+00
Waste Transport to Offsite Disposal	218.8	72.9	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	3.6E-01	8.7E-02	1.2E-01	2.9E-02
Street Paving														
Street Grinding	960.0	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	1.6E+00	3.8E-01	0.0E+00	0.0E+00
Street Paving	1,600.0	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	2.6E+00	6.4E-01	0.0E+00	0.0E+00

Daily Worker Trip Emissions:

Phase	Worker Trips per Day	Round Trip per Worker (mile)	VMT per Hour	SL (g/m^2)	W (Tons)	k (PM10)	k (PM2.5)	Wet Days	Avg. period	PM10 EF lbs/mi	PM2.5 EF lbs/mi	SCAB PM10 Emissions	SCAB PM2.5 Emissions
Option 1	32	21.6	691	0.02	2.4	0.0022	0.00054	40	365	0.0001	0.0000	1.0E-01	2.5E-02
Street Trenching	42	21.6	907	0.02	2.4	0.0022	0.00054	40	365	0.0001	0.0000	1.3E-01	3.3E-02
Well Installation	39	21.6	842	0.02	2.4	0.0022	0.00054	40	365	0.0001	0.0000	1.3E-01	3.1E-02
Street Paving													
Street Grinding	16	21.6	346	0.02	2.4	0.0022	0.00054	40	365	0.0001	0.0000	5.1E-02	1.3E-02
Street Paving	16	21.6	346	0.02	2.4	0.0022	0.00054	40	365	0.0001	0.0000	5.1E-02	1.3E-02

Calculation Delivery Cover Sheet

URS Santa Ana Air Quality Group

Date:	*10/29/2014*
Project:	Kast Remediation Project - VOC Emissions Option 1 (Hard and Softscape Excavation) **5 foot with *10 foot Excavation, 4 Houses at a Time, Phase Overlap***
Project number:	*49194119*
Requestor:	*PCR Consulting*
Project manager:	*Roy Patterson*
Air Quality originator:	*Irma Buenrostro*
Air Quality project lead:	*Shirley Pearson*
Air Quality internal reviewer:	*Shirley Pearson*
Date review completed:	*29-Oct-14*
Detail check internal reviewer:	*Irma Buenrostro*
Date review completed:	*29-Oct-14*
Brief description of analysis:	*Calculating emission rates of VOC from contaminated soil.*
Reference MXD:	S:\Shirley Pearson\!Kast\29 Oct 2014 Update
Model used:	*EMSOFT, 2002*

Version 10-29-14

Kast VOC Emissions Calculations

I. List of VOC's Listed in the HHRA

COC	CAS #	Organic Carbon partition Coefficient (Koc) (cm^3/g)	Diffusivity in Air (Dair) (cm^2/s)	Diffusivity in Water (Dwater) (cm^2/s)	Henry's Law Constant (H') (unit less)	Soil-water Partition coefficient (Ksw) (cm^3/g)	Soil-Water Partition Coefficient (kd) (cm^3/g)	Apparent Diffusivity (Da) (cm^2/s)	Effective Diffusion Coefficient (Deff) (cm^2/s)
1,1,2,2-Tetrachloroethane	79-34-5	9.30E+01	7.10E-02	7.90E-06	1.40E-02	6.60E-01	5.60E-01	7.80E-05	5.50E-03
1,2,3-Trichloropropane	96-18-4	2.20E+01	7.10E-02	7.90E-06	1.70E-02	2.40E-01	1.30E-01	2.60E-04	5.50E-03
1,2,4-Trimethylbenzene	95-63-6	1.40E+03	6.10E-02	7.90E-06	2.50E-01	8.30E+00	8.10E+00	9.60E-05	4.70E-03
1,2-Dichloropropane	78-87-5	4.40E+01	7.80E-02	8.70E-06	1.10E-01	3.80E-01	2.60E-01	1.20E-03	6.10E-03
1,3,5-Trimethylbenzene	108-67-8	1.40E+03	6.00E-02	8.70E-06	2.40E-01	8.30E+00	8.10E+00	9.10E-05	4.70E-03
1,4-Dichlorobenzene	106-46-7	6.20E+02	6.90E-02	7.90E-06	9.80E-02	3.80E+00	3.70E+00	9.20E-05	5.40E-03
Benzene	71-43-2	5.90E+01	8.80E-02	9.80E-06	2.30E-01	5.00E-01	3.50E-01	2.10E-03	6.90E-03
Bromodichloromethane	75-27-4	5.50E+01	3.00E-02	1.10E-05	6.50E-02	4.40E-01	3.30E-01	2.30E-04	2.30E-03
Bromomethane	74-83-9	1.10E+01	7.30E-02	1.20E-05	2.60E-01	2.10E-01	6.30E-02	4.60E-03	5.70E-03
Ethylbenzene	100-41-4	3.60E+02	7.50E-02	7.80E-06	3.20E-01	2.30E+00	2.20E+00	5.30E-04	5.90E-03
Methylene chloride	75-09-2	1.20E+01	1.00E-01	1.20E-05	9.00E-02	1.90E-01	7.00E-02	2.50E-03	7.90E-03
Tetrachloroethene	127-18-4	1.60E+02	7.20E-02	8.20E-06	7.50E-01	1.20E+00	9.30E-01	2.40E-03	5.60E-03
Toluene	108-88-3	1.80E+02	8.70E-02	8.60E-06	2.70E-01	1.20E+00	1.10E+00	9.80E-04	6.80E-03
Trichloroethene	79-01-6	1.70E+02	7.90E-02	9.10E-06	4.20E-01	1.20E+00	1.00E+00	1.50E-03	6.20E-03
Vinyl chloride	75-01-4	1.90E+01	1.10E-01	1.20E-05	1.10E+00	4.20E-01	1.10E-01	1.50E-02	8.30E-03
Xylenes, total	1330-20-7	3.90E+02	7.70E-02	8.40E-06	3.10E-01	2.50E+00	2.30E+00	5.00E-04	6.00E-03
1-Methylnaphthalene	90-12-0	3.00E+03	5.30E-02	7.90E-06	2.10E-02	1.80E+01	1.80E+01	3.10E-06	4.10E-03
2-Methylnaphthalene	91-57-6	2.80E+03	5.20E-02	7.80E-06	2.10E-02	1.70E+01	1.70E+01	3.40E-06	4.10E-03
Naphthalene	91-20-3	2.00E+03	5.90E-02	7.50E-06	2.00E-02	1.20E+01	1.20E+01	5.00E-06	4.60E-03
Pyrene	129-00-0	1.10E+05	2.70E-02	7.20E-06	4.50E-04	6.30E+02	6.30E+02	1.10E-09	2.30E-03
1,1,2,2-Tetrachloroethane	79-34-5	9.30E+01	7.10E-02	7.90E-06	1.40E-02	6.60E-01	5.60E-01	7.80E-05	5.50E-03
1,1,2-Trichloroethane	79-00-5	5.00E+01	7.80E-02	8.80E-06	3.70E-02	4.10E-01	3.00E-01	3.70E-04	6.10E-03
1,1-Dichloroethane	75-34-3	3.20E+01	7.40E-02	1.10E-05	2.30E-01	3.30E-01	1.90E-01	2.70E-03	5.80E-03
1,2,3-Trichloropropane	96-18-4	2.20E+01	7.10E-02	7.90E-06	1.70E-02	2.40E-01	1.30E-01	2.60E-04	5.50E-03
1,2,4-Trichlorobenzene	120-82-1	1.80E+03	3.00E-02	8.20E-06	5.80E-02	1.10E+01	1.10E+01	8.40E-06	2.30E-03
1,2,4-Trimethylbenzene	95-63-6	1.40E+03	6.10E-02	7.90E-06	2.50E-01	8.30E+00	8.10E+00	9.60E-05	4.70E-03
1,2-Dichloroethane	107-06-2	1.70E+01	1.00E-01	9.90E-06	4.00E-02	2.10E-01	1.00E-01	1.00E-03	8.10E-03
1,2-Dichloropropane	78-87-5	4.40E+01	7.80E-02	8.70E-06	1.10E-01	3.80E-01	2.60E-01	1.20E-03	6.10E-03

Kast VOC Emissions Calculations

COC	CAS #	Organic Carbon partition Coefficient (Koc) (cm^3/g)	Diffusivity in Air (Dair) (cm^2/s)	Diffusivity in Water (Dwater) (cm^2/s)	Henry's Law Constant (H') (unit less)	Soil-water Partition coefficient (Ksw) (cm^3/g)	Soil-Water Partition Coefficient (kd) (cm^3/g)	Apparent Diffusivity (Da) (cm^2/s)	Effective Diffusion Coefficient (Deff) (cm^2/s)
1,3,5-Trimethylbenzene	108-67-8	1.40E+03	6.00E-02	8.70E-06	2.40E-01	8.30E+00	8.10E+00	9.10E-05	4.70E-03
1,3-Butadiene	106-99-0	1.90E+01	2.50E-01	1.10E-05	3.00E+00	7.80E-01	1.10E-01	5.00E-02	1.90E-02
1,4-Dichlorobenzene	106-46-7	6.20E+02	6.90E-02	7.90E-06	9.80E-02	3.80E+00	3.70E+00	9.20E-05	5.40E-03
1,4-Dioxane	123-91-1	1.00E+00	2.30E-01	1.00E-05	2.30E-04	1.10E-01	6.00E-03	2.60E-05	1.80E-02
2,2,4-Trimethylpentane	540-84-1	1.50E+05	1.00E-01	1.00E-05	1.80E+02	9.30E+02	9.00E+02	1.00E-03	7.80E-03
2-Hexanone	591-78-6	9.40E+00	7.50E-02	8.40E-06	3.80E-03	1.60E-01	5.70E-02	9.40E-05	5.80E-03
4-Ethyltoluene	622-96-8	1.80E+03	6.80E-02	7.30E-06	2.10E-01	1.10E+01	1.10E+01	6.70E-05	5.30E-03
Benzene	71-43-2	5.90E+01	8.80E-02	9.80E-06	2.30E-01	5.00E-01	3.50E-01	2.10E-03	6.90E-03
Bromodichloromethane	75-27-4	5.50E+01	3.00E-02	1.10E-05	6.50E-02	4.40E-01	3.30E-01	2.30E-04	2.30E-03
Bromomethane	74-83-9	1.10E+01	7.30E-02	1.20E-05	2.60E-01	2.10E-01	6.30E-02	4.60E-03	5.70E-03
Carbon disulfide	75-15-0	4.60E+01	1.00E-01	1.00E-05	1.20E+00	6.10E-01	2.70E-01	1.10E-02	8.10E-03
Carbon tetrachloride tetrachloride	56-23-5	1.70E+02	7.80E-02	8.80E-06	1.20E+00	1.40E+00	1.00E+00	3.60E-03	6.10E-03
Chloroform	67-66-3	4.00E+01	1.00E-01	1.00E-05	1.50E-01	3.70E-01	2.40E-01	2.20E-03	8.10E-03
Cyclohexane	110-82-7	1.70E+02	7.40E-02	8.50E-06	7.90E+00	2.60E+00	9.90E-01	1.20E-02	5.70E-03
Dibromochloromethane	124-48-1	6.30E+01	2.00E-02	1.10E-05	3.20E-02	4.80E-01	3.80E-01	6.70E-05	1.50E-03
cis-1,2-Dichloroethene	156-59-2	3.60E+01	7.40E-02	1.10E-05	1.70E-01	3.40E-01	2.10E-01	1.80E-03	5.70E-03
trans-1,2-Dichloroethene	156-60-5	5.30E+01	7.10E-02	1.20E-05	3.80E-01	4.90E-01	3.20E-01	2.90E-03	5.50E-03
trans-1,3-Dichloropropene	10061-02-6	4.60E+01	6.30E-02	1.00E-05	7.20E-01	5.10E-01	2.70E-01	4.60E-03	4.90E-03
Ethanol	64-17-5	1.00E+00	1.50E-01	1.60E-05	1.90E-04	1.10E-01	6.00E-03	1.50E-05	1.30E-02
Ethylbenzene	100-41-4	3.60E+02	7.50E-02	7.80E-06	3.20E-01	2.30E+00	2.20E+00	5.40E-04	5.90E-03
Heptane	142-82-5	2.70E+02	9.30E-02	7.60E-06	8.20E+01	1.70E+01	1.60E+00	2.30E-02	7.20E-03
Hexachloro-1,3-butadiene	87-68-3	5.40E+04	5.60E-02	6.20E-06	3.30E-01	3.20E+02	3.20E+02	3.00E-06	4.40E-03
Hexane	110-54-3	4.30E+01	2.00E-01	7.80E-06	6.80E+01	1.30E+01	2.60E-01	5.40E-02	1.60E-02
Isopropanol	67-63-0	6.90E+00	8.00E-02	9.30E-06	3.60E-04	1.40E-01	4.20E-02	1.10E-05	6.50E-03
Isopropyl benzene (cumene)	98-82-8	4.90E+02	6.50E-02	7.10E-06	4.70E+01	1.20E+01	2.90E+00	1.30E-02	5.10E-03
Methyl ethyl ketone (2-butanone)	78-93-3	2.30E+00	8.10E-02	9.80E-06	2.30E-03	1.10E-01	1.40E-02	8.40E-05	6.30E-03
Methylene chloride	75-09-2	1.20E+01	1.00E-01	1.20E-05	9.00E-02	1.90E-01	7.00E-02	2.50E-03	7.90E-03
Methyl-tert-butyl ether	1634-04-4	7.30E+00	1.00E-01	1.10E-05	2.60E-02	1.50E-01	4.40E-02	9.10E-04	8.00E-03
Propyl benzene	103-65-1	5.60E+02	6.00E-02	7.80E-06	4.40E-01	3.60E+00	3.40E+00	3.80E-04	4.70E-03
tert-Butyl Alcohol (TBA)	75-65-0	4.20E+00	8.50E-02	9.10E-06	3.00E-03	1.30E-01	2.50E-02	1.10E-04	6.70E-03
Tetrachloroethene	127-18-4	1.60E+02	7.20E-02	8.20E-06	7.50E-01	1.20E+00	9.30E-01	2.40E-03	5.60E-03
Tetrahydrofuran	109-99-9	9.50E-01	9.80E-02	1.10E-05	2.90E-03	1.10E-01	5.70E-03	1.40E-04	7.70E-03

Kast VOC Emissions Calculations

COC	CAS #	Organic Carbon partition Coefficient (Koc) (cm^3/g)	Diffusivity in Air (Dair) (cm^2/s)	Diffusivity in Water (Dwater) (cm^2/s)	Henry's Law Constant (H') (unit less)	Soil-water Partition coefficient (Ksw) (cm^3/g)	Soil-Water Partition Coefficient (kd) (cm^3/g)	Apparent Diffusivity (Da) (cm^2/s)	Effective Diffusion Coefficient (Deff) (cm^2/s)
Toluene	108-88-3	1.80E+02	8.70E-02	8.60E-06	2.70E-01	1.20E+00	1.10E+00	9.80E-04	6.80E-03
Trichloroethene	79-01-6	1.70E+02	7.90E-02	9.10E-06	4.20E-01	1.20E+00	1.00E+00	1.50E-03	6.20E-03
Vinyl chloride	75-01-4	1.90E+01	1.10E-01	1.20E-05	1.10E+00	4.20E-01	1.10E-01	1.50E-02	8.30E-03
Xylenes, total	1330-20-7	3.90E+02	7.70E-02	8.40E-06	3.10E-01	2.50E+00	2.30E+00	5.00E-04	6.00E-03
1-Methylnaphthalene	90-12-0	3.00E+03	5.30E-02	7.90E-06	2.10E-02	1.80E+01	1.80E+01	3.10E-06	4.10E-03
2-Methylnaphthalene	91-57-6	2.80E+03	5.20E-02	7.80E-06	2.10E-02	1.70E+01	1.70E+01	3.40E-06	4.10E-03
Naphthalene	91-20-3	2.00E+03	5.90E-02	7.50E-06	2.00E-02	1.20E+01	1.20E+01	5.00E-06	4.60E-03
Pyrene	129-00-0	1.10E+05	2.70E-02	7.20E-06	4.50E-04	6.30E+02	6.30E+02	1.10E-09	2.30E-03

Data Source: Geosyntec Consultants, Human Health Risk Assessment Report Former Kast Property Carson, California, March 10, 2014

Kast VOC Emissions Calculations

II. Chemical Inputs for EMSOFT Model run

CAS #	Chemical	Organic Carbon Partition Coefficient Koc (cm^3/g)	Air Diffusion Coefficient D'a (cm^2/s)	Air Diffusion Coefficient D'a (cm^2/day)	Aqueous Diffusion Coefficient D'w (cm^2/s)	Aqueous Diffusion Coefficient D'w (cm^2/day)	Henry's Law Constant (unit less)	COC Concentrations (0-10 feet)		COC Concentrations (0-10 feet)	
								Units	Sitewide UCL	Units	Sitewide UCL
100-41-4	Ethylbenzene	360	7.50E-02	6.48E+03	7.80E-06	6.74E-01	3.20E-01	mg/kg	5.00E-01	ug/kg	5.00E+02
106-46-7	1,4-Dichlorobenzene	620	6.90E-02	5.96E+03	7.90E-06	6.83E-01	9.80E-02	mg/kg	5.90E-04	ug/kg	5.90E-01
107-06-2	1,2-Dichloroethane	17	1.00E-01	8.64E+03	9.90E-06	8.55E-01	4.00E-02	mg/kg	4.70E-04	ug/kg	4.70E-01
108-67-8	1,3,5-Trimethylbenzene	1400	6.00E-02	5.18E+03	8.70E-06	7.52E-01	2.40E-01	mg/kg	1.90E-01	ug/kg	1.90E+02
108-88-3	Toluene	180	8.70E-02	7.52E+03	8.60E-06	7.43E-01	2.70E-01	mg/kg	1.20E-01	ug/kg	1.20E+02
127-18-4	Tetrachloroethene	160	7.20E-02	6.22E+03	8.20E-06	7.08E-01	7.50E-01	mg/kg	1.30E-02	ug/kg	1.30E+01
129-00-0	Pyrene	110000	2.70E-02	2.33E+03	7.20E-06	6.22E-01	4.50E-04	mg/kg	1.00E+00	mg/kg	1.00E+00
1330-20-7	Xylenes, Total	390	7.70E-02	6.65E+03	8.40E-06	7.26E-01	3.10E-01	mg/kg	7.69E-01	ug/kg	7.69E+02
156-59-2	cis-1,2-Dichloroethene	36	7.40E-02	6.39E+03	1.10E-05	9.50E-01	1.70E-01	mg/kg	5.60E-04	ug/kg	5.60E-01
71-43-2	Benzene	59	8.80E-02	7.60E+03	9.80E-06	8.47E-01	2.30E-01	mg/kg	1.70E-01	ug/kg	1.70E+02
74-83-9	Bromomethane	11	7.30E-02	6.31E+03	1.20E-05	1.04E+00	2.60E-01	mg/kg	5.80E-03	ug/kg	5.80E+00
75-01-4	Vinyl Chloride	19	1.10E-01	9.50E+03	1.20E-05	1.04E+00	1.10E+00	mg/kg	2.41E-04	ug/kg	2.41E-01
75-09-2	Methylene Chloride	12	1.00E-01	8.64E+03	1.20E-05	1.04E+00	9.00E-02	mg/kg	3.20E-03	ug/kg	3.20E+00
75-27-4	Bromodichloromethane	55	3.00E-02	2.59E+03	1.10E-05	9.50E-01	6.50E-02	mg/kg	2.40E-04	ug/kg	2.40E-01
75-65-0	tert-Butyl Alcohol (TBA)	4.2	8.50E-02	7.34E+03	9.10E-06	7.86E-01	3.00E-03	mg/kg	4.80E-03	ug/kg	4.80E+00
78-87-5	1,2-Dichloropropane	44	7.80E-02	6.74E+03	8.70E-06	7.52E-01	1.10E-01	mg/kg	3.60E-04	ug/kg	3.60E-01
79-01-6	Trichloroethene	170	7.90E-02	6.83E+03	9.10E-06	7.86E-01	4.20E-01	mg/kg	7.40E-04	ug/kg	7.40E-01
79-34-5	1,1,2,2-Tetrachloroethane	93	7.10E-02	6.13E+03	7.90E-06	6.83E-01	1.40E-02	mg/kg	4.80E-04	ug/kg	4.80E-01
90-12-0	1-Methylnaphthalene	3000	5.30E-02	4.58E+03	7.90E-06	6.83E-01	2.10E-02	mg/kg	2.60E+00	mg/kg	2.60E+00
91-20-3	Naphthalene	2000	5.90E-02	5.10E+03	7.50E-06	6.48E-01	2.00E-02	mg/kg	1.50E+00	mg/kg	1.50E+00
91-57-6	2-Methylnaphthalene	2800	5.20E-02	4.49E+03	7.80E-06	6.74E-01	2.10E-02	mg/kg	3.90E+00	mg/kg	3.90E+00
95-63-6	1,2,4-Trimethylbenzene	1400	6.10E-02	5.27E+03	7.90E-06	6.83E-01	2.50E-01	mg/kg	7.80E-01	ug/kg	7.80E+02
96-18-4	1,2,3-Trichloropropane	22	7.10E-02	6.13E+03	7.90E-06	6.83E-01	1.70E-02	mg/kg	6.40E-04	ug/kg	6.40E-01
#N/A	2,4-Dinitrotoluene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	6.30E-02	mg/kg	6.30E-02

Kast VOC Emissions Calculations

CAS #	Chemical	Organic Carbon Partition Coefficient Koc (cm^3/g)	Air Diffusion Coefficient D'a (cm^2/s)	Air Diffusion Coefficient D'a (cm^2/day)	Aqueous Diffusion Coefficient D'w (cm^2/s)	Aqueous Diffusion Coefficient D'w (cm^2/day)	Henry's Law Constant (unit less)	Units	Sitewide UCL	Units	Sitewide UCL
#N/A	Antimony	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	2.90E-01	mg/kg	2.90E-01
#N/A	Arsenic	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	4.90E+00	mg/kg	4.90E+00
#N/A	BaP TEQ	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.70E-01	mg/kg	1.70E-01
#N/A	Benzo (a) Anthracene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	2.10E-01	mg/kg	2.10E-01
#N/A	Benzo (a) Pyrene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.20E-01	mg/kg	1.20E-01
#N/A	Benzo (b) Fluoranthene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	5.80E-02	mg/kg	5.80E-02
#N/A	Benzo (k) Fluoranthene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.30E-02	mg/kg	1.30E-02
#N/A	Bis(2-Ethylhexyl) Phthalate	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.50E-01	mg/kg	1.50E-01
#N/A	Cadmium	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	9.90E-02	mg/kg	9.90E-02
#N/A	Chromium, Hexavalent	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.30E-01	mg/kg	1.30E-01
#N/A	Chrysene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	5.60E-01	mg/kg	5.60E-01
#N/A	Cobalt	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	8.10E+00	mg/kg	8.10E+00
#N/A	Copper	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.40E+01	mg/kg	1.40E+01
#N/A	Dibenz (a,h) Anthracene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	8.90E-03	mg/kg	8.90E-03
#N/A	Indeno (1,2,3-c,d) Pyrene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.70E-02	mg/kg	1.70E-02
#N/A	Lead	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.10E+01	mg/kg	1.10E+01
#N/A	Thallium	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	2.20E-01	mg/kg	2.20E-01
#N/A	TPH as Diesel	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	2.20E+03	mg/kg	2.20E+03
#N/A	TPH as Gasoline	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.30E+02	mg/kg	1.30E+02
#N/A	TPH as Motor Oil	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	3.00E+03	mg/kg	3.00E+03
#N/A	Vanadium	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	3.00E+01	mg/kg	3.00E+01
#N/A	Zinc	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	4.20E+01	mg/kg	4.20E+01

Data Source: Geosyntec Consultants, Human Health Risk Assessment Report Former Kast Property Carson, California, March 10, 2014

*Chemicals with values as "#N/A" were not listed in the HHRA.

III. Soil and Layer Inputs for EMSOFT Model Run

	Calculation Options			Soil Properties				Physical Constants		Layer Properties	
	Time Period for Averaging and Printing Flux and Soil Concentration Results* (days)	Depth (D1) for Averaging Soil Concentration Results (cm)	Depth (D2) for Printing Soil Concentration Results (cm)	Fraction Organic Carbon[A,B] (unit less)	Fraction Porosity[A,B] (unit less)	Fraction Water Content[A,B] (unit less)	Bulk Density[A,B] (g/cm^3)	Porewater Flux (-=up, +=down)^c (cm/day)	Boundary Layer Thickness[D] (cm)	Cover Thickness[E] (cm)	Layer Thickness[F] (cm)
Site Wide (USEPA Screening Values for Loam)	[0.1/1]*	1	1	0.002	0.399	0.148	1.59	0	0.5	0	304.8

* 0.1 days: Shortest duration supported by EMSOFT model and used the represent the maximum hourly flux.

1 day: Used to represent the maximum daily flux

Data Sources: A. USPEA, User's Guide for Evaluation subsurface Vapor intrusion into Buildings, Table 11 - Guidance for Selection of Soil Type, (2004) 37. The soil parameters are based on soil texture classification of "lam."

B. USPEA, Johnson and Ettinger (1991) Model for Subsurface Vapor Intrusion into Buildings, Version 3.1, Soil Properties Lookup Table, (2004).

C. USEPA, EMSOFT User's Guide, Page 38, September 2002. "If no data are available, it would be conservative for the purpose of calculating long-term volatilization rates and soil concentrations to assume a porewater flux of zero."

D. USEPA, EMSOFT User's Guide, Page 43, September 2002. "A default boundary layer thickness that may be used in EMSOFT when no other data are available is 0.5 cm.

E. Assumes contamination begins at the surface.

F. This analysis uses 10 feet (304.8 cm) throughout site.

IV. EMSOFT Volatilization Factor Out Put

CAS #	Chemical	Volatilization Factors	
		0.1 Day Average (mg/cm^2)	1 Day Average (mg/cm^2-day)
100-41-4	Ethylbenzene	2.74E-02	8.72E-03
106-46-7	1,4-Dichlorobenzene	1.36E-05	4.35E-06
107-06-2	1,2-Dichloroethane	2.68E-05	8.52E-06
108-67-8	1,3,5-Trimethylbenzene	4.32E-03	1.39E-03
108-88-3	Toluene	8.61E-03	2.74E-03
127-18-4	Tetrachloroethene	1.37E-03	4.34E-04
129-00-0	Pyrene	8.66E-06	7.21E-06
1330-20-7	Xylenes, Total	4.07E-02	1.29E-02
156-59-2	cis-1,2-Dichloroethene	4.73E-05	1.50E-05
71-43-2	Benzene	1.60E-02	5.09E-03
74-83-9	Bromomethane	6.68E-04	2.12E-04
75-01-4	Vinyl Chloride	5.03E-05	1.59E-05
75-09-2	Methylene Chloride	2.76E-04	8.78E-05
75-27-4	Bromodichloromethane	7.50E-06	2.40E-06
75-65-0	tert-Butyl Alcohol (TBA)	7.75E-05	2.50E-05
78-87-5	1,2-Dichloropropane	2.47E-05	7.84E-06
79-01-6	Trichloroethene	6.29E-05	2.00E-05
79-34-5	1,1,2,2-Tetrachloroethane	9.23E-06	2.97E-06
90-12-0	1-Methylnaphthalene	1.05E-02	5.48E-03
91-20-3	Naphthalene	8.22E-02	2.60E-03
91-57-6	2-Methylnaphthalene	1.61E-02	5.48E-03
95-63-6	1,2,4-Trimethylbenzene	1.83E-02	5.86E-03
96-18-4	1,2,3-Trichloropropane	1.94E-05	6.21E-06

V. VOC Emission Calculations

General Assumptions

Parameter	Value	Units	References
Hours per Day	8	hours	Hours of work 8am-4pm

Excavated Surface Volatilization Assumptions

Parameter	Value	Units	References
Layer Thickness	304.8	cm	10 feet of excavation
Stabilizer	91%	%	Apply stabilizer on inactive areas. Source: USEPA, Control of Air Emissions from Superfund Sites, (1992). Long-term VOC control efficiency ranges from 91 to 100%.
Work Days in year	251	days	

Excavated Surfaces VOC Emissions

Equation:

Active Area Emissions (lb/time) = tXVFXAs

None-Active Area Emissions (lb/time) = (1-MR)xtXVFXAs

Where:

MR = stabilized mitigation

t = time conversion factor (e.g. Hours/day, days/year)

VF = volatility factor output from EMSOFT model (mg/cm^2-day)

As = surface area of volatilization (cm^2)

Phase	Duration (days)	Hourly QTY Excavated (CY)	Daily QTY Excavated (CY)	Yearly QTY Excavated (CY)	Hourly Excavated/Disturbed Surface Area (cm^2)	Daily Previously Excavated/Disturbed Surface Area (cm^2)	Yearly Excavated/Disturbed Surface Area (cm^2)	Stabilized Mitigation (% Reduction)
Option 1 - Excavati	889	7	300	70,990	1.76E+04	7.51E+05	1.78E+08	91%
Street Trenching	180	8	61	11,016	1.92E+04	1.54E+05	2.76E+07	91%

Kast VOC Emissions Calculations

Volatilization Factor Calculations:

CAS #	Chemical	Chemical UCL Concentration (mg/kg)	Volatilization Factors					
			VF1day [1 day avg.] (mg/cm^2-day)	VF1day [workday] (lbs/cm^2-day)	VF1day [off-workday] (lbs/cm^2-day)	VF1hr [0.1 day avg.] (mg/cm^2-day)	VF1hr [workday] (lbs/cm^2-day)	VF1hr [off-workday] (lbs/cm^2-day)
Option 1 - Excavation								
100-41-4	Ethylbenzene	5.00E-01	8.72E-03	6.41E-09	2.88E-08	2.74E-02	2.01E-08	4.03E-08
106-46-7	1,4-Dichlorobenzene	5.90E-04	4.35E-06	3.20E-12	1.44E-11	1.36E-05	9.99E-12	2.00E-11
107-06-2	1,2-Dichloroethane	4.70E-04	8.52E-06	6.26E-12	2.82E-11	2.68E-05	1.97E-11	3.94E-11
108-67-8	1,3,5-Trimethylbenzene	1.90E-01	1.39E-03	1.02E-09	4.60E-09	4.32E-03	3.17E-09	6.35E-09
108-88-3	Toluene	1.20E-01	2.74E-03	2.01E-09	9.06E-09	8.61E-03	6.33E-09	1.27E-08
127-18-4	Tetrachloroethene	1.30E-02	4.34E-04	3.19E-10	1.44E-09	1.37E-03	1.01E-09	2.01E-09
129-00-0	Pyrene	1.00E+00	7.21E-06	5.30E-12	2.38E-11	8.66E-06	6.36E-12	1.27E-11
1330-20-7	Xylenes, Total	7.69E-01	1.29E-02	9.48E-09	4.27E-08	4.07E-02	2.99E-08	5.98E-08
156-59-2	cis-1,2-Dichloroethene	5.60E-04	1.50E-05	1.10E-11	4.96E-11	4.73E-05	3.48E-11	6.95E-11
71-43-2	Benzene	1.70E-01	5.09E-03	3.74E-09	1.68E-08	1.60E-02	1.18E-08	2.35E-08
74-83-9	Bromomethane	5.80E-03	2.12E-04	1.56E-10	7.01E-10	6.68E-04	4.91E-10	9.82E-10
75-01-4	Vinyl Chloride	2.41E-04	1.59E-05	1.17E-11	5.26E-11	5.03E-05	3.70E-11	7.39E-11
75-09-2	Methylene Chloride	3.20E-03	8.78E-05	6.45E-11	2.90E-10	2.76E-04	2.03E-10	4.06E-10
75-27-4	Bromodichloromethane	2.40E-04	2.40E-06	1.76E-12	7.94E-12	7.50E-06	5.51E-12	1.10E-11
75-65-0	tert-Butyl Alcohol (TBA)	4.80E-03	2.50E-05	1.84E-11	8.27E-11	7.75E-05	5.70E-11	1.14E-10
78-87-5	1,2-Dichloropropane	3.60E-04	7.84E-06	5.76E-12	2.59E-11	2.47E-05	1.82E-11	3.63E-11
79-01-6	Trichloroethene	7.40E-04	2.00E-05	1.47E-11	6.61E-11	6.29E-05	4.62E-11	9.24E-11
79-34-5	1,1,2,2-Tetrachloroethane	4.80E-04	2.97E-06	2.18E-12	9.82E-12	9.23E-06	6.78E-12	1.36E-11
90-12-0	1-Methylnaphthalene	2.60E+00	5.48E-03	4.03E-09	1.81E-08	1.05E-02	7.72E-09	1.54E-08
91-20-3	Naphthalene	1.50E+00	2.60E-03	1.91E-09	8.60E-09	8.22E-02	6.04E-08	1.21E-07
91-57-6	2-Methylnaphthalene	3.90E+00	5.48E-03	4.03E-09	1.81E-08	1.61E-02	1.18E-08	2.37E-08
95-63-6	1,2,4-Trimethylbenzene	7.80E-01	5.86E-03	4.31E-09	1.94E-08	1.83E-02	1.34E-08	2.69E-08
96-18-4	1,2,3-Trichloropropane	6.40E-04	6.21E-06	4.56E-12	2.05E-11	1.94E-05	1.43E-11	2.85E-11

Kast VOC Emissions Calculations

Street Trenching - Excavation

CAS #	Chemical	Chemical UCL Concentration (mg/kg)	Volatilization Factors					
			VF1day [1 day avg.] (mg/cm^2-day)	VF1day [workday] (lbs/cm^2-day)	VF1day [off-workday] (lbs/cm^2-day)	VF1hr [0.1 day avg.] (mg/cm^2-day)	VF1hr [workday] (lbs/cm^2-day)	VF1hr [off-workday] (lbs/cm^2-day)
100-41-4	Ethylbenzene	5.00E-01	8.72E-03	6.41E-09	2.88E-08	2.74E-02	2.01E-08	4.03E-08
106-46-7	1,4-Dichlorobenzene	5.90E-04	4.35E-06	3.20E-12	1.44E-11	1.36E-05	9.99E-12	2.00E-11
107-06-2	1,2-Dichloroethane	4.70E-04	8.52E-06	6.26E-12	2.82E-11	2.68E-05	1.97E-11	3.94E-11
108-67-8	1,3,5-Trimethylbenzene	1.90E-01	1.39E-03	1.02E-09	4.60E-09	4.32E-03	3.17E-09	6.35E-09
108-88-3	Toluene	1.20E-01	2.74E-03	2.01E-09	9.06E-09	8.61E-03	6.33E-09	1.27E-08
127-18-4	Tetrachloroethene	1.30E-02	4.34E-04	3.19E-10	1.44E-09	1.37E-03	1.01E-09	2.01E-09
129-00-0	Pyrene	1.00E+00	7.21E-06	5.30E-12	2.38E-11	8.66E-06	6.36E-12	1.27E-11
1330-20-7	Xylenes, Total	7.69E-01	1.29E-02	9.48E-09	4.27E-08	4.07E-02	2.99E-08	5.98E-08
156-59-2	cis-1,2-Dichloroethene	5.60E-04	1.50E-05	1.10E-11	4.96E-11	4.73E-05	3.48E-11	6.95E-11
71-43-2	Benzene	1.70E-01	5.09E-03	3.74E-09	1.68E-08	1.60E-02	1.18E-08	2.35E-08
74-83-9	Bromomethane	5.80E-03	2.12E-04	1.56E-10	7.01E-10	6.68E-04	4.91E-10	9.82E-10
75-01-4	Vinyl Chloride	2.41E-04	1.59E-05	1.17E-11	5.26E-11	5.03E-05	3.70E-11	7.39E-11
75-09-2	Methylene Chloride	3.20E-03	8.78E-05	6.45E-11	2.90E-10	2.76E-04	2.03E-10	4.06E-10
75-27-4	Bromodichloromethane	2.40E-04	2.40E-06	1.76E-12	7.94E-12	7.50E-06	5.51E-12	1.10E-11
75-65-0	tert-Butyl Alcohol (TBA)	4.80E-03	2.50E-05	1.84E-11	8.27E-11	7.75E-05	5.70E-11	1.14E-10
78-87-5	1,2-Dichloropropane	3.60E-04	7.84E-06	5.76E-12	2.59E-11	2.47E-05	1.82E-11	3.63E-11
79-01-6	Trichloroethene	7.40E-04	2.00E-05	1.47E-11	6.61E-11	6.29E-05	4.62E-11	9.24E-11
79-34-5	1,1,2,2-Tetrachloroethane	4.80E-04	2.97E-06	2.18E-12	9.82E-12	9.23E-06	6.78E-12	1.36E-11
90-12-0	1-Methylnaphthalene	2.60E+00	5.48E-03	4.03E-09	1.81E-08	1.05E-02	7.72E-09	1.54E-08
91-20-3	Naphthalene	1.50E+00	2.60E-03	1.91E-09	8.60E-09	8.22E-02	6.04E-08	1.21E-07
91-57-6	2-Methylnaphthalene	3.90E+00	5.48E-03	4.03E-09	1.81E-08	1.61E-02	1.18E-08	2.37E-08
95-63-6	1,2,4-Trimethylbenzene	7.80E-01	5.86E-03	4.31E-09	1.94E-08	1.83E-02	1.34E-08	2.69E-08
96-18-4	1,2,3-Trichloropropane	6.40E-04	6.21E-06	4.56E-12	2.05E-11	1.94E-05	1.43E-11	2.85E-11

Kast VOC Emissions Calculations

VOC Emission Calculations:

CAS #	Chemical	VOC Emission Rates								
		Active Area Emissions (lbs/hour)	Non-Active Area Emissions (lbs/hour)	Total Area Emissions (lbs/hour)	Active Area Emissions (lbs/day)	Non-Active Area Emissions (lbs/day)	Total Area Emissions (lbs/day)	Active Area Emissions (lbs/year)	Non-Active Area Emissions (lbs/year)	Total Area Emissions (lbs/year)
Option 1 - Excavation										
100-41-4	Ethylbenzene	3.54E-04	6.36E-05	4.17E-04	4.81E-03	1.95E-03	6.76E-03	2.86E+02	2.58E+01	3.12E+02
106-46-7	1,4-Dichlorobenzene	1.75E-07	3.16E-08	2.07E-07	2.40E-06	9.73E-07	3.37E-06	1.43E-01	1.29E-02	1.56E-01
107-06-2	1,2-Dichloroethane	3.46E-07	6.22E-08	4.08E-07	4.70E-06	1.91E-06	6.61E-06	2.80E-01	2.52E-02	3.05E-01
108-67-8	1,3,5-Trimethylbenzene	5.57E-05	1.00E-05	6.58E-05	7.67E-04	3.11E-04	1.08E-03	4.57E+01	4.11E+00	4.98E+01
108-88-3	Toluene	1.11E-04	2.00E-05	1.31E-04	1.51E-03	6.13E-04	2.13E-03	9.00E+01	8.10E+00	9.81E+01
127-18-4	Tetrachloroethene	1.77E-05	3.18E-06	2.09E-05	2.40E-04	9.71E-05	3.37E-04	1.43E+01	1.28E+00	1.55E+01
129-00-0	Pyrene	1.12E-07	2.01E-08	1.32E-07	3.98E-06	1.61E-06	5.59E-06	2.37E-01	2.13E-02	2.58E-01
1330-20-7	Xylenes, Total	5.25E-04	9.45E-05	6.20E-04	7.12E-03	2.88E-03	1.00E-02	4.24E+02	3.81E+01	4.62E+02
156-59-2	cis-1,2-Dichloroethene	6.10E-07	1.10E-07	7.20E-07	8.28E-06	3.35E-06	1.16E-05	4.93E-01	4.43E-02	5.37E-01
71-43-2	Benzene	2.06E-04	3.72E-05	2.44E-04	2.81E-03	1.14E-03	3.95E-03	1.67E+02	1.50E+01	1.82E+02
74-83-9	Bromomethane	8.62E-06	1.55E-06	1.02E-05	1.17E-04	4.74E-05	1.64E-04	6.96E+00	6.27E-01	7.59E+00
75-01-4	Vinyl Chloride	6.49E-07	1.17E-07	7.66E-07	8.78E-06	3.56E-06	1.23E-05	5.22E-01	4.70E-02	5.69E-01
75-09-2	Methylene Chloride	3.56E-06	6.41E-07	4.20E-06	4.85E-05	1.96E-05	6.81E-05	2.88E+00	2.60E-01	3.14E+00
75-27-4	Bromodichloromethane	9.68E-08	1.74E-08	1.14E-07	1.33E-06	5.37E-07	1.86E-06	7.88E-02	7.09E-03	8.59E-02
75-65-0	tert-Butyl Alcohol (TBA)	1.00E-06	1.80E-07	1.18E-06	1.38E-05	5.59E-06	1.94E-05	8.21E-01	7.39E-02	8.95E-01
78-87-5	1,2-Dichloropropane	3.19E-07	5.74E-08	3.76E-07	4.33E-06	1.75E-06	6.08E-06	2.58E-01	2.32E-02	2.81E-01
79-01-6	Trichloroethene	8.12E-07	1.46E-07	9.58E-07	1.10E-05	4.47E-06	1.55E-05	6.57E-01	5.91E-02	7.16E-01
79-34-5	1,1,2,2-Tetrachloroethane	1.19E-07	2.14E-08	1.41E-07	1.64E-06	6.64E-07	2.30E-06	9.76E-02	8.78E-03	1.06E-01
90-12-0	1-Methylnaphthalene	1.35E-04	2.44E-05	1.60E-04	3.03E-03	1.23E-03	4.25E-03	1.80E+02	1.62E+01	1.96E+02
91-20-3	Naphthalene	1.06E-03	1.91E-04	1.25E-03	1.44E-03	5.81E-04	2.02E-03	8.54E+01	7.69E+00	9.31E+01
91-57-6	2-Methylnaphthalene	2.08E-04	3.74E-05	2.45E-04	3.03E-03	1.23E-03	4.25E-03	1.80E+02	1.62E+01	1.96E+02
95-63-6	1,2,4-Trimethylbenzene	2.36E-04	4.25E-05	2.79E-04	3.24E-03	1.31E-03	4.55E-03	1.92E+02	1.73E+01	2.10E+02
96-18-4	1,2,3-Trichloropropane	2.50E-07	4.51E-08	2.95E-07	3.43E-06	1.39E-06	4.82E-06	2.04E-01	1.84E-02	2.22E-01

Kast VOC Emissions Calculations

Street Trenching - Excavation

CAS #	Chemical	VOC Emission Rates								
		Active Area Emissions (lbs/hour)	Non-Active Area Emissions (lbs/hour)	Total Area Emissions (lbs/hour)	Active Area Emissions (lbs/day)	Non-Active Area Emissions (lbs/day)	Total Area Emissions (lbs/day)	Active Area Emissions (lbs/year)	Non-Active Area Emissions (lbs/year)	Total Area Emissions (lbs/year)
100-41-4	Ethylbenzene	3.86E-04	6.95E-05	4.56E-04	9.84E-04	3.98E-04	1.38E-03	4.44E+01	4.00E+00	4.84E+01
106-46-7	1,4-Dichlorobenzene	1.92E-07	3.45E-08	2.26E-07	4.91E-07	1.99E-07	6.89E-07	2.22E-02	2.00E-03	2.42E-02
107-06-2	1,2-Dichloroethane	3.78E-07	6.80E-08	4.46E-07	9.61E-07	3.89E-07	1.35E-06	4.34E-02	3.91E-03	4.73E-02
108-67-8	1,3,5-Trimethylbenzene	6.09E-05	1.10E-05	7.19E-05	1.57E-04	6.35E-05	2.20E-04	7.08E+00	6.38E-01	7.72E+00
108-88-3	Toluene	1.21E-04	2.19E-05	1.43E-04	3.09E-04	1.25E-04	4.34E-04	1.40E+01	1.26E+00	1.52E+01
127-18-4	Tetrachloroethene	1.93E-05	3.48E-06	2.28E-05	4.90E-05	1.98E-05	6.88E-05	2.21E+00	1.99E-01	2.41E+00
129-00-0	Pyrene	1.22E-07	2.20E-08	1.44E-07	8.13E-07	3.29E-07	1.14E-06	3.67E-02	3.31E-03	4.01E-02
1330-20-7	Xylenes, Total	5.74E-04	1.03E-04	6.77E-04	1.46E-03	5.89E-04	2.04E-03	6.57E+01	5.92E+00	7.17E+01
156-59-2	cis-1,2-Dichloroethene	6.67E-07	1.20E-07	7.87E-07	1.69E-06	6.85E-07	2.38E-06	7.65E-02	6.88E-03	8.33E-02
71-43-2	Benzene	2.26E-04	4.06E-05	2.66E-04	5.74E-04	2.33E-04	8.07E-04	2.59E+01	2.33E+00	2.83E+01
74-83-9	Bromomethane	9.42E-06	1.70E-06	1.11E-05	2.39E-05	9.69E-06	3.36E-05	1.08E+00	9.72E-02	1.18E+00
75-01-4	Vinyl Chloride	7.09E-07	1.28E-07	8.37E-07	1.79E-06	7.26E-07	2.52E-06	8.10E-02	7.29E-03	8.83E-02
75-09-2	Methylene Chloride	3.89E-06	7.01E-07	4.59E-06	9.90E-06	4.01E-06	1.39E-05	4.48E-01	4.03E-02	4.88E-01
75-27-4	Bromodichloromethane	1.06E-07	1.90E-08	1.25E-07	2.71E-07	1.10E-07	3.80E-07	1.22E-02	1.10E-03	1.33E-02
75-65-0	tert-Butyl Alcohol (TBA)	1.09E-06	1.97E-07	1.29E-06	2.82E-06	1.14E-06	3.96E-06	1.27E-01	1.15E-02	1.39E-01
78-87-5	1,2-Dichloropropane	3.48E-07	6.27E-08	4.11E-07	8.84E-07	3.58E-07	1.24E-06	4.00E-02	3.60E-03	4.36E-02
79-01-6	Trichloroethene	8.87E-07	1.60E-07	1.05E-06	2.26E-06	9.14E-07	3.17E-06	1.02E-01	9.17E-03	1.11E-01
79-34-5	1,1,2,2-Tetrachloroethane	1.30E-07	2.34E-08	1.54E-07	3.35E-07	1.36E-07	4.71E-07	1.51E-02	1.36E-03	1.65E-02
90-12-0	1-Methylnaphthalene	1.48E-04	2.67E-05	1.75E-04	6.18E-04	2.50E-04	8.69E-04	2.79E+01	2.51E+00	3.04E+01
91-20-3	Naphthalene	1.16E-03	2.09E-04	1.37E-03	2.93E-04	1.19E-04	4.12E-04	1.33E+01	1.19E+00	1.44E+01
91-57-6	2-Methylnaphthalene	2.27E-04	4.09E-05	2.68E-04	6.18E-04	2.50E-04	8.69E-04	2.79E+01	2.51E+00	3.04E+01
95-63-6	1,2,4-Trimethylbenzene	2.58E-04	4.65E-05	3.05E-04	6.61E-04	2.68E-04	9.29E-04	2.99E+01	2.69E+00	3.26E+01
96-18-4	1,2,3-Trichloropropane	2.74E-07	4.92E-08	3.23E-07	7.01E-07	2.84E-07	9.84E-07	3.17E-02	2.85E-03	3.45E-02

Summary of VOC Emissions (Base Case- Peak)

VOC/NonVOC	VOC

Sum of Value **Row Labels**	**Column Labels** **lbs/day**
1,1,2,2-Tetrachloroethane	2.77E-06
1,2,3-Trichloropropane	5.80E-06
1,2,4-Trimethylbenzene	5.47E-03
1,2-Dichloroethane	7.96E-06
1,2-Dichloropropane	7.32E-06
1,3,5-Trimethylbenzene	1.30E-03
1,4-Dichlorobenzene	4.06E-06
1-Methylnaphthalene	5.12E-03
2-Methylnaphthalene	5.12E-03
Benzene	4.76E-03
Bromodichloromethane	2.24E-06
Bromomethane	1.98E-04
cis-1,2-Dichloroethene	1.40E-05
Ethylbenzene	8.15E-03
Methylene Chloride	8.20E-05
Naphthalene	2.43E-03
Pyrene	6.74E-06
tert-Butyl Alcohol (TBA)	2.34E-05
Tetrachloroethene	4.05E-04
Toluene	2.56E-03
Trichloroethene	1.87E-05
Vinyl Chloride	1.49E-05
Xylenes, Total	1.21E-02
Grand Total	**4.77E-02**

Expedited Implementation Option Calculation Files – Average Day

- Calculation Cover Sheet and Assumptions
- On-Site Haul Roads – Re-entrained Dust
- Fugitive Dust Emissions During Soil and Excavation and Handling
- Dust Emissions during Concrete Breaking
- On-Site Construction Equipment Emissions
- On-Site Road Emissions
- On-Site Road – Re-entrained Dust
- Off-Site Road Emissions
- Off-Site Road – Re-entrained Dust
- VOC Emissions

Calculation Delivery Cover Sheet

URS Santa Ana Air Quality Group

Date:	*10/10/2014*
Project:	Kast Remediation Project - Option 1 (Hard and Softscape Excavation) ***5 foot with 10 foot Excavation, 4 Houses at a Time, Phase Overlap***
Project number:	*49194119*
Requestor:	*PCR Consulting*
Project manager:	*Roy Patterson*
Air Quality originator:	*Irma Buenrostro*
Air Quality project lead:	*Shirley Pearson*
Air Quality internal reviewer:	*Shirley Pearson*
Date review completed:	*19-Sep-14*
Detail check internal reviewer:	*Irma Buenrostro*
Date review completed:	*10-Oct-14*
Brief description of analysis:	*Calculating emission rates of criteria pollutants and toxic air contaminates during excavating activities at the former Kast property. Calculations will be used to assess air quality impacts in the form of an Environmental Impact Report.*
Reference MXD:	S:\Shirley Pearson\!Kast\10 Oct 2014 Updates
Model used:	*AP-42 equations and assumptions were used.*

Version 10-10-14

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Kast Air Emissions Calculations

I. Project Phasing

				Hours/Task per House									
#	Equipment	Engine Type	HP	Demo	Excavation	SVE Well/Piping Instal	Subslab Vent Install	Backfill/Comp.	Slurry Backfill	Site Resto.	Total Hrs./ House	Houses	Total Hrs.
2	15,000 lbs Excavator	D	60	0	87	0	0	0		0	87	237	20,619
1	Dump Truck	D	450	4	45	0	0	69		0	118	237	27,966
2	Bobcat	D	22	12	87	4	4	69		0	176	237	41,712
1	Bucket Auger	D	65	0	30	0	0	0		0	30	237	7,110
1	6000 Watt Generato	G	10	2	45	1	1	0		2	51	237	12,087
1	Water Pump	G	5	6	45	0	0	69		0	120	237	28,440
1	Chain Saw	G	0.5	2	0	0	0	0		0	2	237	474
1	Small Compactor (W	G	3	0	0	0	0	69		0	69	237	16,353
1	Concrete Mix Truck	D	450	0	0	0	0	0	20	6	26	237	6,162
1	Concrete Pump	D	80	0	0	0	0	0	20	6	26	237	6,162
2	Pickup Truck	G	200										
1	Flatbed Truck	D	350										

				Street Work (Hours/day)		
#	Equipment	Engine Type	HP	Trenching/Pipe Installation	Street Grinding	Street Paving
1	Backhoe	D	350	1		
1	Compressor	G	49	1		
1	Generator	G	10	1		
1	Concrete Saw	D	13	1		
1	Vacuum Excavator	D	155	6		
1	Drill Rig	D	250	6		
1	Cold Plane Grinding	D	600		6	
1	Dump Truck	D	450		6	
1	Street Sweeper	G	200		6	
1	Paving Machine	D	150			6
1	Super 10 Dump Truc	D	450			6
1	Steam Roller	D	50			6
1	Street Sweeper	G	200			6
1	Steam Roller	D	50			6
1	Street Sweeper	G	200			6

II. General Assumptions

General Assumptions			
Parameter	**Value**	**Units**	**Reference**
Number of Homes Yards Excavated at a Time	4	Yards	Information provided by project staff
Number of Homes	237	Homes	Information provided by project staff
Hours of Operation	8	Hours	working hours 8AM - 3PM, from project description
Duration (phase overlap)	253	weeks	Information provided by project staff
Days of Operation per Week	5	days	Monday - Friday
Number of Holidays per Year	9	days	Based on URS' holiday schedule
Number of people at houses	15	people	Information provided
Trenching/pipe installation	15	people	Information provided
Air-vac borehole clearance	7	people	Information provided
Drilling and SVE well install	10	people	Information provided
Number of people during street grinding	10	people	Information provided
Number of people during street paving	12	people	Information provided
Worker trips for various reasons	56	trips	Assumed value (e.g., shuttling workers to site, workers going to lunch, mgt. going to and from site)
Mitigation (% Reduction)	84%	%	WARP Fugitive Dust Handbook, September 2006, Table 3-7. Apply water every 1 hour: 74% control per MRI, April 2001, test series 701. Apply dust suppressant: 84% control per CARB April 2002; for actively disturbed areas
U (mean wind speed)	1.88	m/s	Based on mean wind speed met data from the SCAQMD Long Beach Station from 2006 to 2011.
U (mean wind speed)	4.21	mph	Based on mean wind speed met data from the SCAQMD Long Beach Station from 2006 to 2011.
s (silt content) - Overburden	6.9	%	AP-42, Chapter 11.9, Table 11.9-3. Bulldozer Overburden Silt Content.
s (silt content) - Paved road	3.4	%	AP-42, Chapter 13.2.1.1, Table 13.2.1-3
M (material moisture content)	7.9	%	AP-42 Chapter 11.9-9. Table 11.9-3. Overburden default value.
Silt Content Range	0.44-19	%	AP-42, Chapter 13.2.4, Page 4. Assumed range. No adjustments required.
Soil Density	3,400	lbs/cy	Information provided by project staff
Density of Asphalt	3,915	lbs/cy	Information provided by project staff
Density of Asphalt	1.95	Tons/cy	Information provided by project staff
Typical Density of Concrete	150	lbs/cf	Information provided by project staff
Typical Density of Concrete	2.01	ton/cy	Information provided by project staff

Kast Air Emissions Calculations

Max Depth of Excavation at Residential Homes	10	ft	Information provided by project staff
Concrete Removed per House	35	cy	Information provided by project staff. 1,675 SF and 6 inches thick concrete slab.
Concrete Removed per Day during Street Trenching	810	cy	Information provided by project staff. Assumed 100 feet of trench per day, trench would be 5 feet in width and asphalt is 6 inches thick.
Debris Disposal Haul Route Total Length, One Way	30	miles	Google maps, address destination 12017 Greenstone, Santa Fe Springs, CA 90670
Offsite Disposal Route total Length, One Way	100	miles	Google maps, address destination 12328 Hibiscus Rd, Adelanto
Backfill Import Route Total Length, One Way	4	miles	Google maps, address destination 26311 Palos Verdes Dr. East, Rolling Hilles Estates, CA 90274
Concrete Batch Plant Route Total Length, One Way	10	miles	Google maps, address destination 2521 E. Artesia Blvd., Long Beach, CA 90805
Plastic Pipe Company, Chino, CA, One Way	50	miles	Google maps, destination Chino, CA
All American Asphalt, Corona, CA, One Way	50	miles	Google maps, destination Corona, CA
Green Waste Disposal, One Way	5	Miles	Google maps, 321 Francisco Street, Carson, CA
Distance of project within South Coast Air Basin	75	miles	Based on informational maps obtained from CARB and distance estimate from Google maps.
Distance of project activities within Mojave Desert Distance	25	miles	Based on furthest trip outside of SCAB/within MDAB, informational maps obtained from CARB, and distance estimate from Google maps.
Average On-Site Haul Route Distance	1,900	feet	Measured distance from the furthest northern and southern homes in the community.
Employee/Worker Trip Distance	21.6	miles	CalEEMod Default Construction Worker Trip (Round Trip)
Passenger Vehicle Trips	9	trips	Visitor trips/traffic adjustment provided by project staff
Street Grinding and Paving Worker trips for various reasons	16	trips	Assumed value (e.g., shuttling workers to site, workers going to lunch, mgt. going to and from site)

III. Cubic Yard and Trip Estimates

Cubic Yard and Trip Estimates during Yard Excavation

Parameter	Option 1 - Hard&Softscape Value	Units
Duration	253	weeks (Phase Overlap)
Work Hours	8	hours
Total Work Days - 8 Homes	42	days
Total Work Days - 237 Homes	1,256	days
Total Work Days in Year	251	days
Total Houses	237	homes
Number of Homes at a time	4	homes
Total Volume Soil - 202 Homes	177,000	cy
Passenger Vehicle Trips	9	trips/day
Demo	11,599	cy
Excavation	177,000	cy
Subslab Vent	0	cy
Backfill/Compact	148,700	cy
Slurry Backfill	28,300	cy
Site Resto.	8,295	cy
Concrete Removed per Home	35	CY
Total Loads -Debris Disposal	971	loads
Total Loads -Debris Disposal (green waste only)	237	loads
Total Loads -Offsite Disposal	12,643	loads
Total Loads -Backfill Import	12,764	loads
Total Loads -Concrete Batch Plant	4,057	loads
Slurry Backfill	1,556	loads
Site Resto.	884	loads
Total Loads -Flatbed Truck	474	loads
Total Loads -Pipe Delivery	40	loads
Demo	12	cy/load
Excavation	14	cy/load
SVE Well/Piping	0	cy/load
Subslab Vent	0	cy/load
Backfill/Compact	12	cy/load
Slurry Backfill	18	cy/load
Site Resto.	0	cy/load

Note: All loads and CY are assumed to remain the same as Base case, only the trips are expedited.

Kast Air Emissions Calculations

Option 1 Phase	Duration to Complete One Home (days)	Phase Duration (days)	Round Trips Hourly	Daily	8 Home Clusters	Annually	Project
Demo - Truck Trips	2	119	1.81	14	231	1,712	1,712
Green Waste - Truck Trips	1	59	0.50	4	32	237	237
Excavation - Truck Trips	15	889	3.28	26	3,153	6,227	23,352
SVE Well/Piping - Truck Trips	1	59	0.33	3	21	155	155
Subslab Vent - Truck Trips	1	59	0.00	0	0	0	0
Backfill/Compact - Truck Trips	12	711	3.51	28	2,699	6,662	19,987
Slurry Backfill - Truck Trips	7	415	1.06	9	476	2,015	3,526
Site Resto. - Truck Trips	10	593	0.82	7	523	1,550	3,876
Worker Trips	49	1,256	7.00	56	21,952	14,056	70,336
Passenger Vehicle Trips	1	1,256	1.13	9	0	2,259	11,304

Option 1 Phase	Cubic Yard (CY) of Soil/Material Moved Hourly	Daily	8 Home Clusters	Annually	Project
Demo	22	173	2,761	20,446	20,446
Excavation	7	368	44,143	87,181	326,930
SVE Well/Piping[1]	0	0	0	0	0
Subslab Vent[1]	0	0	0	0	0
Backfill/Compact	41	328	31,440	77,618	232,853
Slurry Backfill	19	155	8,659	36,646	64,131
Site Resto.[1]	0	0	0	0	0

Note: 1 - No soil excavation associated with SVE Well/Piping, Subslab Vent or Site Restoration phases

Cubic Yard and Trip Estimates during Street Trenching/Pipe Installation

Parameter	Street Trenching Value	Units
Duration	36	weeks
Work Hours	8	hours
Total Work Days	180	days
Total Work Days in Year	251	days
Trenching per day	100	feet
Linear feet of trenching	8,715	feet
Total Volume Soil	8,100	cy
Total Volume of Asphalt	810	cy
Demo	810	cy
Excavation	8,100	cy
Slurry Backfill	5,000	cy
Restoration	1,100	cy
Total Loads -Debris Disposal	70	loads
Total Loads -Offsite Disposal	600	loads
Total Loads -Backfill Import	0	loads
Total Loads -Concrete Batch Plant	556	loads
Pipe Delivery	180	loads
Total Loads - Restoration	95	loads
Demo - Asphalt	12	cy/load
Excavation	14	cy/load
Slurry Backfill	9	cy/load
Restoration - Asphalt	12	cy/load

Note: All loads and CY (highlighted yellow) are assumed to remain the same as Base case, only the trips are expedited.

Street Trenching	Round Trips			
Phase	Hourly	Daily	Annually	Project
Demo - Truck Trips	0.25	2.0	358	358
Excavation - Truck Trips	0.7	5.9	1,068	1,068
Slurry Backfill - Truck Trips	0.7	5.9	1,060	1,060
Restoration - Truck Trips	0.2	2.0	358	358
Pipe Delivery - Truck Trips	0.2	2.0	351	351
Worker Trips	8.9	71	12,780	12,780

Street Trenching	Cubic Yard (CY) of Soil/Material			
Phase	Hourly	Daily	Annually	Project
Demo	3	23	4,143	4,143
Excavation	10	80	14,418	14,418
Slurry Backfill	7	53	9,532	9,532
Restoration	3	23	4,143	4,143

Cubic Yard and Trip Estimates during Well Installation

Parameter	Street Trenching Value	Units
Work Hours	8	hours
Total Work Days	63	days
Total Work Days in Year	63	days
Total round trips to Wilmington soil storage area	126	Trips
Total trips from Wilmington soil storage area to	10	Trips
Waste Collection	12	cy/load

Note: All loads and CY (highlighted yellow) are assumed to remain the same as Base case, only the trips are expedited.

Well Installation Phase	Round Trips Hourly	Daily	Annually	Project
Air Vac- Borehole Clearance - Truck Trips	0.25	2	126	126
Drilling and SVE Well Installation - Truck Trips	0.25	2	126	126
Waste Collection - Truck Trips	0.50	4	252	252
Waste Transport to Offsite Disposal - Truck Trips	0.22	2	111	111
Worker Trips	9.13	73	4,599	4,599

Well Installation Phase	Cubic Yard (CY) of Soil/Material Hourly	Daily	Annually	Project
Air Vac- Borehole Clearance	0	0	0	0
Drilling and SVE Well Installation	0	0	0	0
Waste Collection	6	48	3,024	3,024
Waste Transport to Offsite Disposal	2.6	21	1,330	1,330

Note: All loads and CY are assumed to remain the same as Base case, only the trips are expedited.

Cubic Yard and Trip Estimates during Street Paving

Parameter	Street Grinding Value	Units	Street Paving Value	Units
Duration	5	days	10	days
Work Hours	6	hours	6	hours
Trucks per day	14	Dump Trucks	7	Dump Trucks
Total Mass of Asphalt	2,000	tons	2,000	tons
Total Volume of Asphalt	1,025	cy	1,025	cy
Total Loads -Debris Disposal	80	loads	0	loads
Total Loads - Asphalt Delivery	0	loads	80	loads
Cubic Yard per Load	12	cy/load	12	cy/load

Street Paving	Round Trips			
Phase	Hourly	Daily	Annually	Project
Street Grinding - Truck Trips	3	16	80	80
Street Paving - Truck Trips	1	8	80	80
Worker Trips - Grinding	3	16	80	80
Worker Trips - Paving	3	16	160	160

Street Paving	Cubic Yard (CY) of Soil/Material			
Phase	Hourly	Daily	Annually	Project
Street Grinding	32	192	960	960
Street Paving	16	96	960	960

Note: It is assumed that the scenario (including the amount of associated workers and trips) for Street Grinding and Paving will not change from Base case.

IV. On-Site Haul Roads - Re-entrained Dust

Summary: This section calculates the dust emissions (PM2.5, PM10) from the on-site haul roads at the residential homes. The on-site haul roads consist of off-road equipment transporting soil to-and-from the dump truck.

$$E = k(s/12)^a(W/3)^b$$

Where:
E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
M = surface material moisture content (%)
S = mean vehicle speed (mph)
a = empirical constant
b = empirical constant
k = empirical constant
Source: AP-42 13.2.2-4, Equation (1a)

Assumptions Parameters	Value	Unites	Notes
s (silt content)	6.4	%	Western Governors' Association, Western Regional Air Partnership (WRAP) Fugitive Dust Handbook, Table 6-2. Average silt content for gravel/crushed limestone road surface material.
W (vehicle weight)	18,000	lbs	Weight of excavator
a (empirical constant)	0.9	-	AP-42, Chapter 13.2.2, Table 13.2.2-2. Industrial Roads (PM10 and PM2.5)
b (empirical constant)	0.45	-	AP-42, Chapter 13.2.2, Table 13.2.2-2. Industrial Roads (PM10 and PM2.5)
k (empirical constant) - PM10	1.5	-	AP-42, Chapter 13.2.2, Table 13.2.2-2. Industrial Roads (PM10)
k (empirical constant) - PM2.5	0.15	-	AP-42, Chapter 13.2.2, Table 13.2.2-2. Industrial Roads (PM2.5)
Shovel Load (soil) Bobcat	1.25	cy	volume of soil a bucket can hold, http://www.bobcat.com/attachments/bucket_loader_general
Shovel Load (soil) Excavator	1.75	cy	volume of soil a bucket can hold
Weight of a bobcat	3.11	tons	Based on spec information from a S185 Skide-Steer Loader, http://www.bobcat.com/loaders/models/skidsteer/s185
Mitigation (% Reduction)	84%	%	Apply dust suppressants on inactive areas. SCAQMD mitigation measures examples. Table X1-A.
Haul Route length	200	ft	Assumed distance soil would have to be hauled on each property

Option 1 Phases	Hourly Round Trips	Daily Round Trips	8 Home Clusters	Annual Round Trips	Equipment Type	Average Vehicle Weight (tons)	Round Trip length (SCAB)	Hourly VMT	Daily VMT	8 Home Clusters VMT	Annual VMT
Demo	1.8	14	231	1,712	Bobcat	3.11	0.08	0.14	4.38	18	130
Excavation	3.3	26	25,224	49,818	Excavator	9	0.08	0.25	7.96	1,911	3,774
SVE Well/Piping	0.3	3	0	0	0	0	0	0	0.00	0	0
Subslab Vent	0.0	0	0	0	0	0	0	0	0.00	0	0
Backfill/Compact	3.5	28	17,966	44,353	Excavator	9	0.08	0.27	8.52	1,361	3,360
Site Resto.	0.0	7	0	0	0	0	0	0	0.00	0	0

Emission Calculation

Daily:

Option 1 Phases	Daily VMT (SCAB)	W (tons)	k (PM10)	k (PM2.5)	Mitigation %	PM10 EF (lbs/mi.)	PM2.5 EF (lbs/mi.)	PM10 Emissions (lbs/day)	PM2.5 Emissions (lbs/day)
Demo	4.4	3.11	1.5	0.15	84%	0.87	0.09	0.61	0.06
Excavation	8.0	9	1.5	0.15	84%	1.40	0.14	1.78	0.18
SVE Well/Piping	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	8.5	9	1.5	0.15	84%	1.40	0.14	1.90	0.19
Site Resto.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

V. Fugitive Dust Emissions During Soil Excavation and Handling

Summary: This section calculates the dust emissions (PM2.5, PM10) from the on-site soil handling and excavation at the residential homes and during street trenching. The on-site soil handing and excavation consists of two parts: 1) Excavating soil 2)Dropping soil

$$E = k(0.0032) \frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \text{ (pound [lb]/ton)}$$

Where:

E = emission factor
k = particle size multiplier (dimensionless)
U = mean wind speed, meters per second (m/s) (miles per hour [mph])
M = material moisture content (%)

Source: AP-42 13.2.4-3, Equation (1)

Assumptions Equation parameters	Value	Units	Notes
k - PM10	0.35	-	AP-42, Chapter 13.2.4, Page 4. Nov 2006
k - PM2.5	0.053	-	AP-42, Chapter 13.2.4, Page 4. Nov 2006
U	4.21	mph	Average wind speed
M	7.9	%	AP-42 Chapter 11.9-9. Table 11.9-3. Overburden default value.
Soil Density	3,400	lbs/CY	Information provided by project staff
Mitigation (% Reduction) - Watering	84%	%	WARP Fugitive Dust Handbook, September 2006, Table 3-7. Apply water every 1 hour: 74% control per MRI, April 2001, test series 701. Apply dust suppressant: 84% control per CARB April 2002; for actively disturbed areas
Times Soil is Handled	2	time	1) Excavating soil 2) Dropping soil

Emission Calculation (PM10)

Daily Dust Emissions During Soil Excavation and Handling Phase	Daily CY	Daily (tons)	k (PM10)	U (mph)	M%	EF (lbs/ton)	Mitigation (%)	PM10 Emissions (lbs/day)
Option 1								
Demo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavation	368	625.4	0.35	4.20556	7.9	1.31E-04	84%	2.62E-02
SVE Well/Piping	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	328	556.8	0.35	4.20556	7.9	1.31E-04	84%	2.33E-02
Slurry Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Site Resto.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Trenching								
Demo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavation	80	136.2	0.35	4.20556	7.9	1.31E-04	84%	5.70E-03
Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Restoration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Emission Calculation (PM2.5)

Daily Dust Emissions During Soil Excavation and Handling								
Phase	**Daily CY**	**Hourly (tons)**	**k (PM2.5)**	**U (mph)**	**M%**	**EF (lbs/ton)**	**Mitigation (%)**	**PM2.5 Emissions (lbs/day)**
Option 1								
Demo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavation	368	625.4	0.053	4.21	7.9	1.98E-05	84%	3.96E-03
SVE Well/Piping	0	0	0.00	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	328	556.8	0.053	4.21	7.9	1.98E-05	84%	3.53E-03
Slurry Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Site Resto.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Trenching								
Demo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavation	80	136.2	0.053	4.21	7.9	1.98E-05	84%	8.62E-04
Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Restoration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

VI. Dust Emissions during Concrete Breaking

Summary: This section calculates the dust emissions (PM2.5, PM10) during on-site concrete breaking at residential homes, street trenching and street paving. The on-site dust emissions from concrete breaking consists of two parts: 1) Mechanical dismemberment and 2) Debris loading

Mechanical Dismemberment Equations

$$EF_D = k \times (0.0032) \times \frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

U = Mean wind speed

M = material moisture content (%). The moisture contents of different materials are listed in Table 13.2.4-1 of AP 42. The program uses the moisture content of cover (12%) as default.

Where:

EF_D = emission factor (lb PM/ton of debris)

$EF_{D\text{-}PM10}$ = 0.0011 lb PM_{10}/ton of debris

$EF_{D\text{-}PM2.5}$ = 0.00017 lb $PM_{2.5}$/ton of debris

k = particle size multiplier. The AP-42 default value for PM_{10} is 0.35 and that for $PM_{2.5}$ is 0.053.

Source: CalEEMod, Appendix A, Page 11

$$E_D = EF_D \times W$$

Where:

E_D = emissions (lb of PM)

EF_D = emission factor (lb of PM/ton of debris)

W = building waste (ton of debris)

Source: CalEEMod, Appendix A, Page 12

Assumptions Equation parameters	Value	Units	Notes
Mean wind speed (U)	4.21	mph	Based on mean wind speed met data from the SCAQMD Long Beach Station from 2006 to 2011.
M (material moisture content)	7.9	%	AP-42 Chapter 11.9-9. Table 11.9-3. Overburden default value.
Typical Density of Concrete	150	lbs/ft^3	Information provided by project staff
Mitigation (% Reduction) - Watering	84%	%	WARP Fugitive Dust Handbook, September 2006, Table 3-7. Apply water every 1 hour: 74% control per MRI, April 2001, test

Phase	Hourly Weight of Concrete (tons)	Daily Weight of Concrete (tons)	Weight of Concrete per 8 Home Cluster (tons)	Annual Weight of Concrete (tons)	Total Weight of Concrete (tons)
Option 1					
Demo	43	347	5,549	41,097	41,097
Excavation	0.00	0.00	0.00	0.00	0.00
SVE Well/Piping	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	0.00	0.00	0.00	0.00	0.00
Slurry Backfill	0.00	0.00	0.00	0.00	0.00
Site Resto.	0.00	0.00	0.00	0.00	0.00
Street Trenching					
Demo	6	45	0.00	8,078	8,078
Excavation	0.00	0.00	0.00	0.00	0.00
Backfill	0.00	0.00	0.00	0.00	0.00
Restoration	0.00	0.00	0.00	0.00	0.00
Street Paving					
Street Grinding	62	374	0.00	1,872	1,872

Mechanical Dismemberment Emissions Calculations

Concrete Breaking Emissions - Daily

Phase	Particle Size Multiplier for PM10 (k)	Particle Size Multiplier for PM2.5 (k)	Emission Factor PM10 (lb PM/Ton of Concrete)	Emission Factor for PM2.5 (lb PM/Ton of Concrete)	Mitigation (%)	Concrete Breaking Emissions for PM10 (lbs of PM10)	Concrete Breaking Emissions PM2.5 (lbs of PM2.5)
Option 1							
Demo	0.35	0.053	1.31E-04	1.98E-05	84%	7.25E-03	1.10E-03
Excavation	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SVE Well/Piping	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Slurry Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Site Resto.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Trenching							
Demo	0.35	0.053	1.31E-04	1.98E-05	84%	9.39E-04	1.42E-04
Excavation	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Restoration	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Paving							
Street Grinding	0.35	0.053	1.31E-04	1.98E-05	84%	7.83E-03	1.19E-03

Debris Loading Equations

$$EF_L = k \times EF_{L\text{-}TSP}$$

Where:

EF_L = emission factor (lb/ton)

k = particle size multiplier. The AP-42 default value for PM_{10} is 0.35 and that for $PM_{2.5}$ is 0.053.

Source: CalEEMod, Appendix A, Page 12

The default value for $EF_{L\text{-}TSP}$ is 0.058 lb/ton, the average of the two TSP factor (i.e. 0.053 and 0.063 lb/ton) measured from two tests of the filling of trucks with crushed limestone using a front-end loader.

Source: CalEEMod, Appendix A, Page 13

$$E_D = EF_D \times W$$

Where:

E_D = emissions (lb of PM)

EF_D = emission factor (lb of PM/ton of debris)

W = building waste (ton of debris)

Source: CalEEMod, Appendix A, Page 12

Assumptions Equation parameters	Value	Units	Notes
Emission Factor for Total Suspended Particulates (TSP)	0.058	lb/ton	CalEEMod, Appendix A, Page 13

Debris Loading Emissions Calculations

Concrete Debris Loading - Daily Phase	Particle Size Multiplier for PM10 (k)	Particle Size Multiplier for PM2.5 (k)	Emission Factor PM10 (lb PM/Ton of Concrete)	Emission Factor for PM2.5 (lb PM/Ton of Concrete)	Mitigation (%)	Concrete Breaking Emissions for PM10 (lbs of PM10)	Concrete Breaking Emissions PM2.5 (lbs of PM2.5)
Option 1							
Demo	0.35	0.053	0.0203	0.003074	84%	1.13E+00	1.71E-01
Excavation	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SVE Well/Piping	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Slurry Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Site Resto.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Trenching							
Demo	0.35	0.053	0.0203	0.003074	84%	1.46E-01	2.21E-02
Excavation	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Restoration	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Paving							
Street Grinding	0.35	0.053	0.0203	0.003074	84%	1.22E+00	1.84E-01

Total Concrete Breaking Emissions (Mechanical Dismemberment + Debris Loading)

Total Concrete Breaking Emissions - Daily		
Phase	**Concrete Breaking Emissions for PM10 (lbs of PM10)**	**Concrete Breaking Emissions PM2.5 (lbs of PM2.5)**
Option 1		
Demo	1.13E+00	1.72E-01
Excavation	0.00	0.00
SVE Well/Piping	0.00	0.00
Subslab Vent	0.00	0.00
Backfill/Compact	0.00	0.00
Slurry Backfill	0.00	0.00
Site Resto.	0.00	0.00
Street Trenching		
Demo	1.47E-01	2.22E-02
Excavation	0.00	0.00
Backfill	0.00	0.00
Restoration	0.00	0.00
Street Paving		
Street Grinding	1.22E+00	1.85E-01
Total	2.50E+00	3.79E-01

VII. On-Site Construction Equipment Emissions

Summary: This section calculates the emissions of criteria pollutants from off-road equipment.

Emission Equation

Emission (Off-road Construction Equipment) = E x bhp-hr

Where:

E = size-specific emission factor (g/bhp-hr)

Source:

EMFAC2011

Assumptions	Value	Value	Units	Notes
Equipment Engine Tier		3	-	Refers to EPA emission standards (Tier 1-4) for Off-road equipment

Off-road Engine Emission Ratings

USEPA TABLE I - EPA Tier 1-3 Nonroad Diesel Engine Emission Standards (g/bhp-hr)

Engine Power		Tier	CO
(25 ≤ hp < 50)	50	1	4.9
(25 ≤ hp < 50)	50	2	4.9
(50 ≤ hp < 100)	100	1	-
(50 ≤ hp < 100)	100	2	3.7
(50 ≤ hp < 100)	100	3	3.7
(100 ≤ hp < 175)	175	1	-
(100 ≤ hp < 175)	175	2	3.7
(100 ≤ hp < 175)	175	3	3.7
(175 ≤ hp < 300)	300	1	8.5
(175 ≤ hp < 300)	300	2	2.6
(175 ≤ hp < 300)	300	3	2.6
(300 ≤ hp < 600)	600	1	8.5
(300 ≤ hp < 600)	600	2	2.6
(300 ≤ hp < 600)	600	3	2.6

Tiers 1, 2,3 &4 Off-Road Engine Emission Standards

HP Range	Tier	Nox	ROG	PM
75 - 99	1	6.9	1.19	0.552
100 - 174	1	6.9	0.82	0.304
175 - 299	1	6.9	1	0.4
300 - 600	1	6.9	1	0.4
75 - 99	2	5.32	0.28	0.3
100 - 174	2	4.655	0.245	0.22
175 - 299	2	4.655	0.245	0.15
300 - 600	2	4.56	0.24	0.15
75 - 99	3	3.325	0.175	0.3
100 - 174	3	2.85	0.15	0.22
175 - 299	3	2.85	0.15	0.15
300 - 600	3	2.85	0.15	0.15
75 - 99	4	2.5	0.14	0.015
100 - 174	4	2.5	0.14	0.015
175 - 299	4	1.5	0.14	0.015
300 - 600	4	1.5	0.14	0.015

Note: Based on SCAQMD Table II-B Tiers 1, 2,3 &4 Off-Road Engine Emission Standards

Table 3.3 OFFROAD Default Horsepower and Load Factors

OFFROAD Equipment Type	Horsepower	Load Factor
Aerial Lifts	63	0.31
Air Compressors	78	0.48
Bore/Drill Rigs	206	0.50
Cement and Mortar Mixers	9	0.56
Concrete/Industrial Saws	81	0.73
Cranes	226	0.29
Crawler Tractors	208	0.43
Crushing/Proc. Equipment	85	0.78
Dumpers/Tenders	16	0.38
Excavators	163	0.38
Forklifts	89	0.20
Generator Sets	84	0.74
Graders	175	0.41
Off-Highway Tractors	123	0.44
Off-Highway Trucks	400	0.38
Other Construction Equipment	172	0.42
Other General Industrial Equipment	88	0.34
Other Material Handling Equipment	167	0.40
Pavers	126	0.42
Paving Equipment	131	0.36
Plate Compactors	8	0.43
Pressure Washers	13	0.30
Pumps	84	0.74
Rollers	81	0.38
Rough Terrain Forklifts	100	0.40
Rubber Tired Dozers	255	0.40
Rubber Tired Loaders	200	0.36
Scrapers	362	0.48
Signal Boards	6	0.82
Skid Steer Loaders	65	0.37
Surfacing Equipment	254	0.30
Sweepers/Scrubbers	64	0.46
Tractors/Loaders/Backhoes	98	0.37
Trenchers	81	0.50
Welders	46	0.45

Notes:

1. Based on the weighted average horsepower (by equipment population) and load factors for the mode of the engine groupings in 2011 OFFROAD

Equipment List by Phase																Emissions Factors (g/bhp-hr)		
Phase	Phase Duration (days)	Hours per Day	Equipment	HP/Size	CalEEMod Category	Load Factor[1]	Output (bhp-hour)	Output (bhp-day)	Engine Size Class	Engine Size Class (CO)	Engine Tier	ROG	CO	NOx	CO2[2]	PM10	PM2.5	SOx[2]
Option 1																		
Demolition	119	8	Bobcat (Bobcat S510)	22	Tractors/Loaders/Backhoes	0.57	12.54	100.32	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Demolition	119	2	6000 Watt Generator	10	Generator Sets	0.74	7.4	14.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Demolition	119	2	Chain Saw	0.5	Concrete/Industrial Saws	0.73	0.365	0.73	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Demolition	119	8	Water Pump	5	Pumps	0.74	3.7	29.6	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Excavation	889	8	18,000 lbs Excavator (Kubota KX80-4)	70	Excavator	0.38	26.6	212.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Excavation	889	8	Bobcat (Bobcat S510)	22	Tractors/Loaders/Backhoes	0.37	8.14	65.12	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Excavation	889	2	6000 Watt Generator	10	Generator Sets	0.74	7.4	14.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Excavation	889	8	Water Pump	5	Pumps	0.74	3.7	29.6	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
SVE Well Installation	59	4	Bobcat with Auger (Bobcat S510)	22	Tractors/Loaders/Backhoes	0.37	8.14	32.56	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
SVE Well Installation	59	1	6000 Watt Generator	10	Generator Sets	0.74	7.4	7.4	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Subslab Vent Installation	59	4	Bobcat with Auger (Bobcat S510)	22	Tractors/Loaders/Backhoes	0.37	8.14	32.56	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Subslab Vent Installation	59	1	6000 Watt Generator	10	Generator Sets	0.38	3.8	3.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Backfill and Compaction	415	8	Bobcat (Bobcat S510)	22	Tractors/Loaders/Backhoes	0.37	8.14	65.12	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Backfill and Compaction	593	4	Small Compactor (Wacker)	3	Plate compactors	0.43	1.29	5.16	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Backfill and Compaction	1256	4	Water Pump	5	Pumps	0.74	3.7	14.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Slurry Backfill	415	8	Concrete Pump	2	Pumps	0.74	1.48	11.84	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Site Restoration	593	1	6000 Watt Generator	10	Generator Sets	0.74	7.4	7.4	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Site Restoration	593	2	Concrete Pump	2	Pumps	0.74	1.48	2.96	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Street Trenching																		
Street Trenching/Pipe installation	180	8	Backhoe	100	Tractors/Loaders/Backhoes	0.57	57	456	100-174	100<hp<175	3	0.15	3.7	2.85	568.3	0.3	0.3	0.0050
Street Trenching/Pipe installation	180	8	Compressor	49	Generator Sets	0.74	36.26	290.08	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Street Trenching/Pipe installation	180	2	Generator	10	Generator Sets	0.74	7.4	14.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Street Trenching/Pipe installation	180	1	Concrete Saw	48	Concrete/Industrial Saws	0.73	35.04	35.04	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Well Installation																		
Drilling and SVE Well Installation	63	8	Drill Rig	155	Bore/Drill Rigs	0.5	77.5	620	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Street Paving																		
Street - Grinding	5	8	Cold Plane Grinding Machine	600	Scrapers	0.48	288	2304	300-600	300<hp<600	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Street - Grinding	5	8	Street Sweeper	200	Crawler Tractors	0.5	100	800	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Street - Paving	10	8	Paving Machine	150	Other Construction Equipment	0.42	63	504	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Street - Paving	10	8	Steam Roller	50	Rollers	0.38	19	152	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Street - Paving	10	8	Street Sweeper	200	Crawler Tractors	0.5	100	800	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050

1 - Load Factor obtained from CalEEMod Appendix D Defaults

2- Emission factors for CO2 and Sox were obtained from Table 3.4, Off-road Equipment Emission Factors, CalEEMod Appendix D Default Data Tables.

Off-Road Emissions Calculations		Daily Emissions (lb)						
Phase	Equipment	ROG	CO	NOx	CO2	PM10	PM2.5	SOx
Option 1								
Demolition	Bobcat (Bobcat S510)	3.9E-02	1.1E+00	7.4E-01	1.3E+02	6.6E-02	6.6E-02	1.1E-03
Demolition	6000 Watt Generator	5.7E-03	1.6E-01	1.1E-01	1.9E+01	9.8E-03	9.8E-03	1.6E-04
Demolition	Chain Saw	2.8E-04	7.9E-03	5.4E-03	9.1E-01	4.8E-04	4.8E-04	8.0E-06
Demolition	Water Pump	1.1E-02	3.2E-01	2.2E-01	3.7E+01	2.0E-02	2.0E-02	3.3E-04
Excavation	18,000 lbs Excavator (Kubota KX80-4)	8.2E-02	2.3E+00	1.6E+00	2.7E+02	1.4E-01	1.4E-01	2.3E-03
Excavation	Bobcat (Bobcat S510)	2.5E-02	7.0E-01	4.8E-01	8.2E+01	4.3E-02	4.3E-02	7.2E-04
Excavation	6000 Watt Generator	5.7E-03	1.6E-01	1.1E-01	1.9E+01	9.8E-03	9.8E-03	1.6E-04
Excavation	Water Pump	1.1E-02	3.2E-01	2.2E-01	3.7E+01	2.0E-02	2.0E-02	3.3E-04
SVE Well Installation	Bobcat with Auger (Bobcat S510)	1.3E-02	3.5E-01	2.4E-01	4.1E+01	2.2E-02	2.2E-02	3.6E-04
SVE Well Installation	6000 Watt Generator	2.9E-03	8.0E-02	5.4E-02	9.3E+00	4.9E-03	4.9E-03	8.2E-05
Subslab Vent Installation	Bobcat with Auger (Bobcat S510)	1.3E-02	3.5E-01	2.4E-01	4.1E+01	2.2E-02	2.2E-02	3.6E-04
Subslab Vent Installation	6000 Watt Generator	1.5E-03	4.1E-02	2.8E-02	4.8E+00	2.5E-03	2.5E-03	4.2E-05
Backfill and Compaction	Bobcat (Bobcat S510)	2.5E-02	7.0E-01	4.8E-01	8.2E+01	4.3E-02	4.3E-02	7.2E-04
Backfill and Compaction	Small Compactor (Wacker)	2.0E-03	5.6E-02	3.8E-02	6.5E+00	3.4E-03	3.4E-03	5.7E-05
Backfill and Compaction	Water Pump	5.7E-03	1.6E-01	1.1E-01	1.9E+01	9.8E-03	9.8E-03	1.6E-04
Slurry Backfill	Concrete Pump	4.6E-03	1.3E-01	8.7E-02	1.5E+01	7.8E-03	7.8E-03	1.3E-04
Site Restoration	6000 Watt Generator	2.9E-03	8.0E-02	5.4E-02	9.3E+00	4.9E-03	4.9E-03	8.2E-05
Site Restoration	Concrete Pump	1.1E-03	3.2E-02	2.2E-02	3.7E+00	2.0E-03	2.0E-03	3.3E-05
Street Trenching								
Street Trenching/Pipe installation	Backhoe	1.5E-01	3.7E+00	2.9E+00	5.7E+02	3.0E-01	3.0E-01	5.0E-03
Street Trenching/Pipe installation	Compressor	1.1E-01	3.1E+00	2.1E+00	3.6E+02	1.9E-01	1.9E-01	3.2E-03
Street Trenching/Pipe installation	Generator	5.7E-03	1.6E-01	1.1E-01	1.9E+01	9.8E-03	9.8E-03	1.6E-04
Street Trenching/Pipe installation	Concrete Saw	1.2E-02	2.0E-01	2.2E-01	4.4E+01	2.3E-02	2.3E-02	3.9E-04
Well Installation								
Drilling and SVE Well Installation	Drill Rig	2.1E-01	3.6E+00	3.9E+00	7.8E+02	4.1E-01	4.1E-01	6.8E-03
Street Paving								
Street - Grinding	Cold Plane Grinding Machine	7.6E-01	1.3E+01	1.4E+01	2.9E+03	1.5E+00	1.5E+00	2.5E-02
Street - Grinding	Street Sweeper	2.6E-01	4.6E+00	5.0E+00	1.0E+03	5.3E-01	5.3E-01	8.8E-03
Street - Paving	Paving Machine	1.7E-01	2.9E+00	3.2E+00	6.3E+02	3.3E-01	3.3E-01	5.6E-03
Street - Paving	Steam Roller	5.0E-02	8.7E-01	9.6E-01	1.9E+02	1.0E-01	1.0E-01	1.7E-03
Street - Paving	Street Sweeper	2.6E-01	4.6E+00	5.0E+00	1.0E+03	5.3E-01	5.3E-01	8.8E-03

Off-Road Emissions Calculations	Daily Emissions (lb)						
Phase	ROG	CO	NOx	CO2	PM10	PM2.5	SOx
Option 1							
Demolition	5.6E-02	1.6E+00	1.1E+00	1.8E+02	9.6E-02	9.6E-02	1.6E-03
Excavation	1.2E-01	3.5E+00	2.4E+00	4.0E+02	2.1E-01	2.1E-01	3.6E-03
SVE Well/Piping	1.5E-02	4.3E-01	2.9E-01	5.0E+01	2.6E-02	2.6E-02	4.4E-04
Subslab Vent Installation	1.4E-02	3.9E-01	2.7E-01	4.6E+01	2.4E-02	2.4E-02	4.0E-04
Backfill and Compaction	3.3E-02	9.2E-01	6.2E-01	1.1E+02	5.6E-02	5.6E-02	9.4E-04
Slurry Backfill	4.6E-03	1.3E-01	8.7E-02	1.5E+01	7.8E-03	7.8E-03	1.3E-04
Site Restoration	4.0E-03	1.1E-01	7.6E-02	1.3E+01	6.9E-03	6.9E-03	1.1E-04
Well Installation							
Drilling and SVE Well Installation	2.1E-01	3.6E+00	3.9E+00	7.8E+02	4.1E-01	4.1E-01	6.8E-03
Street Trenching							
Street Trenching/Pipe installation	2.8E-01	7.2E+00	5.3E+00	1.0E+03	5.3E-01	5.3E-01	8.8E-03
Street Paving							
Street - Grinding	1.0E+00	1.8E+01	2.0E+01	3.9E+03	2.1E+00	2.1E+00	3.4E-02
Street - Paving	4.8E-01	8.3E+00	9.1E+00	1.8E+03	9.6E-01	9.6E-01	1.6E-02

VIII. On-Site Road Emissions

Summary: This section calculates the emissions of criteria pollutants from on-site paved roads.

Emissions Factors

Running Emissions							g/mi				
Veh Class	Fuel	MdlYr	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
LDA/LDT	All	All	6.4E-02	2.5E+00	2.8E-01	6.9E+02	3.0E-03	3.0E-04	7.0E-03	4.5E-02	1.8E-02
HHDT	DSL	All	7.8E-01	4.0E+00	1.4E+01	1.6E+03	8.0E-01	7.4E-01	1.7E-02	7.8E-02	3.1E-02
HHDT	DSL	2007	1.2E-01	8.6E-01	2.2E+00	1.6E+03	6.1E-02	5.6E-02	1.7E-02	5.9E-03	5.5E-03

Source: EMFAC 2011

Running Emissions							lbs/mi				
Veh Class	Fuel	MdlYr	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
LDA/LDT	All	All	1.4E-04	5.5E-03	6.1E-04	1.5E+00	6.6E-06	6.6E-07	1.5E-05	9.9E-05	4.0E-05
HHDT	DSL	All	1.7E-03	8.8E-03	3.1E-02	3.6E+00	1.8E-03	1.6E-03	3.7E-05	1.7E-04	6.8E-05
HHDT	DSL	2007	2.7E-04	1.9E-03	4.8E-03	3.5E+00	1.4E-04	1.2E-04	3.7E-05	1.3E-05	1.2E-05

Source: EMFAC 2011

Heavy Truck Trip Data									SCAB		
Phase	Hourly Round Trips	Daily Round Trips	8 Home Cluster Round Trips	Annual Round Trips	Truck Type	Average Vehicle Weight (tons)	Trip length (SCAB)	Hourly VMT	Daily VMT	8 Home Cluster VMT	Annual VMT
Option 1											
Demo	1.81	14	231	1,712	Dump Truck	25	0.72	1.30	10	166	1232
Green Waste	0.50	4	32	237	Dump Truck	25	0.72	0.36	3	23	171
Excavation	3.28	26	3,153	6,227	Dump Truck	25	0.72	2.36	19	2269	4482
SVE Well/Piping	0.3	2.6	20.9	155.0	Dump Truck	25	0.72	0.24	1.9	15	112
Subslab Vent	0.00	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	3.51	28	2,699	6,662	Dump Truck	25	0.72	2.53	20	1942	4795
Slurry Backfill	1.06	9	476	2,015	Concrete Truck	25	0.72	0.76	6	343	1450
Site Resto.	0.82	7	523	1,550	Concrete Truck	25	0.72	0.59	5	377	1116
Street Trenching											
Demo	0.25	2	0	358	Dump Truck	25	0.72	0.18	1.4	0.00	258
Excavation	0.74	6	0	1,068	Dump Truck	25	0.72	0.53	4	0.00	769
Backfill	0.74	6	0	1,060	Dump Truck	25	0.72	0.53	4	0.00	763
Restoration	0.25	2	0	358	Concrete Truck	25	0.72	0.18	1.4	0.00	258
Pipe Delivery	0.24	2	0	351	Dump Truck	25	0.72	0.18	1	0.00	253
Well Installation											
Air Vac- Borehole Clearance	0.25	2	0	126	Air-Vac	25	0.72	0.18	1	0.00	91
Drilling and SVE Well Installation	0.25	2	0	126	Drill Rig	25	0.72	0.18	1	0.00	91
Waste Collection	0.50	4	0	252	Dump Truck	25	0.72	0.36	3	0.00	181
Street Paving											
Street Grinding	3	16	0	80	Dump Truck	25	0.72	1.92	12	0.00	58
Street Paving	1	8	0	80	Dump Truck	25	0.72	0.96	6	0.00	58
Visitor Trips											
Passenger Vehicle Trips	1.13	9	0	2,259	Passenger Vehicle	25	0.72	0.81	6	0	1626

Emissions Calculations

Daily Truck Trip Emission Calculations (SCAB)						lbs/day				
Phase	Daily VMT (SCAB)	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
Option 1										
Demo	10.4	2.8E-03	2.0E-02	4.9E-02	3.6E+01	1.4E-03	1.3E-03	3.8E-04	1.4E-04	1.2E-04
Green Waste	2.9	7.8E-04	5.5E-03	1.4E-02	1.0E+01	3.9E-04	3.6E-04	1.1E-04	3.8E-05	3.5E-05
Excavation	18.9	5.1E-03	3.6E-02	9.0E-02	6.6E+01	2.6E-03	2.4E-03	7.0E-04	2.5E-04	2.3E-04
SVE Well/Piping	1.9	5.1E-04	3.6E-03	8.9E-03	6.5E+00	2.5E-04	2.3E-04	6.9E-05	2.5E-05	2.3E-05
Subslab Vent	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Backfill/Compact	20.2	5.5E-03	3.8E-02	9.6E-02	7.0E+01	2.7E-03	2.5E-03	7.5E-04	2.6E-04	2.4E-04
Slurry Backfill	6.1	1.7E-03	1.2E-02	2.9E-02	2.1E+01	8.3E-04	7.6E-04	2.3E-04	8.0E-05	7.4E-05
Site Resto.	4.7	1.3E-03	9.0E-03	2.2E-02	1.6E+01	6.4E-04	5.9E-04	1.7E-04	6.2E-05	5.7E-05
Street Trenching										
Demo	1.4	3.9E-04	2.7E-03	6.8E-03	5.0E+00	1.9E-04	1.8E-04	5.3E-05	1.9E-05	1.7E-05
Excavation	4.3	1.2E-03	8.1E-03	2.0E-02	1.5E+01	5.8E-04	5.3E-04	1.6E-04	5.6E-05	5.1E-05
Backfill	4.2	1.1E-03	8.1E-03	2.0E-02	1.5E+01	5.7E-04	5.3E-04	1.6E-04	5.5E-05	5.1E-05
Restoration	1.4	3.9E-04	2.7E-03	6.8E-03	5.0E+00	1.9E-04	1.8E-04	5.3E-05	1.9E-05	1.7E-05
Pipe Delivery	1.4	3.8E-04	2.7E-03	6.7E-03	4.9E+00	1.9E-04	1.7E-04	5.2E-05	1.8E-05	1.7E-05
Well Installation										
Air Vac- Borehole Clearance	1.4	3.9E-04	2.7E-03	6.8E-03	5.0E+00	1.9E-04	1.8E-04	5.3E-05	1.9E-05	1.7E-05
Drilling and SVE Well Installation	1.4	3.9E-04	2.7E-03	6.8E-03	5.0E+00	1.9E-04	1.8E-04	5.3E-05	1.9E-05	1.7E-05
Waste Collection	2.9	7.8E-04	5.5E-03	1.4E-02	1.0E+01	3.9E-04	3.6E-04	1.1E-04	3.8E-05	3.5E-05
Street Paving										
Street Grinding	11.5	3.1E-03	2.2E-02	5.5E-02	4.0E+01	1.6E-03	1.4E-03	4.2E-04	1.5E-04	1.4E-04
Street Paving	5.8	1.6E-03	1.1E-02	2.7E-02	2.0E+01	7.8E-04	7.2E-04	2.1E-04	7.5E-05	6.9E-05
Visitor Trips										
Passenger Vehicle Trips	6.5	9.1E-04	3.6E-02	4.0E-03	9.9E+00	4.3E-05	4.3E-06	1.0E-04	6.4E-04	2.6E-04

Worker Trip Emission Calculations (SCAB)							lbs/day					
Phase	Worker Round Trips per day	Roundtrip Distance per Worker (mi)	VMT per Day	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
Option 1	56	0.72	40	5.7E-03	2.2E-01	2.5E-02	6.1E+01	2.7E-04	2.7E-05	6.2E-04	4.0E-03	1.6E-03
Street Trenching	71	0.72	51	7.2E-03	2.8E-01	3.1E-02	7.8E+01	3.4E-04	3.4E-05	7.9E-04	5.1E-03	2.0E-03
Well Installation	73	0.72	53	7.4E-03	2.9E-01	3.2E-02	8.0E+01	3.5E-04	3.5E-05	8.1E-04	5.2E-03	2.1E-03
Street Paving												
Street Grinding	16	0.72	12	1.6E-03	6.4E-02	7.1E-03	1.8E+01	7.6E-05	7.6E-06	1.8E-04	1.1E-03	4.6E-04
Street Paving	16	0.72	12	1.6E-03	6.4E-02	7.1E-03	1.8E+01	7.6E-05	7.6E-06	1.8E-04	1.1E-03	4.6E-04

VIIII. On-Site Road - Reentrained Dust

Summary: This section calculates the emissions of re-entrained dust from on-site on road vehicles on paved roads.

$$E = [k(sL)^{0.91} \times (W)^{1.02}] (1 - P/4N)$$

Where:

E = size-specific emission factor (lb/VMT)
k = particle size multiplier
sL = road surface silt loading (g/m^2)
W = mean vehicle weight (tons)
P = averaging period (365 days)
N = number of "wet" days (>0.01 in of precipitation)

Source: AP-42 13.2.1-2, Equation (1). January 2011.

Correction:
P = number of wet days
N = number of days in period

Assumptions			
Parameter	**Value**	**Units**	**Reference**
Heavy Vehicle Weight (tons)	25	tons	Assumed
k (empirical constant) - PM10	0.0022	-	AP-42, Chapter 13.2.1, Table 13.2.1-1. PM10 (lbs/VMT)
k (empirical constant) - PM2.5	0.0005	-	AP-42, Chapter 13.2.1, Table 13.2.1-1. PM2.5 (lbs/VMT)
sL (Haul Trucks)	0.02	g/m2	CARB Entrained Paved Road Dust. (1997) Silt loading for freeways: http://www.arb.ca.gov/ei/areasrc/fullpdf/full7-9.pdf
sL (Worker Vehicles)	0.1	g/m2	CalEEMod Default for Worker trips (Assumes mix of freeway and surface street travel)
P (averaging period)	365	days	Days per year
N (wet days)	40	days	AP-42, Chapter 13.2.1, Figure 13.2.1-2. January 2011.
On-Site Heavy Truck Haul	0.72	miles	Measured distance from the furthest northern and southern homes in the community.
Employee/Worker Trip Distance	0.72	miles	Measured distance from the furthest northern and southern homes in the community.
Paved Road Average Vehicle	2.4	tons	CalEEMod default average vehicle weight (tons)

							SCAB				
Phase	**Hourly Round Trips**	**Daily Round Trips**	**8 Home Cluster Round Trips**	**Annual Round Trips**	**Truck Type**	**Average Vehicle Weight (tons)**	**Round Trip length (SCAB)**	**Hourly VMT**	**Daily VMT**	**8 Home Cluster VMT**	**Annual VMT**
Option 1											
Demo	1.8	14.4	231.1	1711.6	Dump Truck	25	0.72	1.3	10.4	166.3	1231.9
Green Waste	0.5	4.0	32.0	237.0	Dump Truck	25	0.72	0.4	2.9	23.0	170.6
Excavation	3.3	26.3	3153.1	6227.3	Dump Truck	25	0.72	2.4	18.9	2269.3	4481.8
SVE Well/Piping	0.3	2.6	20.9	155.0	Dump Truck	25	0.72	0.2	1.9	15.1	111.6
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	3.5	28.1	2698.7	6662.5	Dump Truck	25	0.72	2.5	20.2	1942.3	4795.0
Slurry Backfill	1.1	8.5	476.1	2014.9	Concrete Truck	25	0.72	0.8	6.1	342.6	1450.1
Site Resto.	0.8	6.5	523.4	1550.5	Concrete Truck	25	0.72	0.6	4.7	376.7	1115.9
Street Trenching											
Demo	0.2	2.0	0.00	358.0	Dump Truck	25	0.72	0.2	1.4	0.00	257.7
Excavation	0.7	5.9	0.00	1068.0	Dump Truck	25	0.72	0.5	4.3	0.00	768.6
Backfill	0.7	5.9	0.00	1060.0	Dump Truck	25	0.72	0.5	4.2	0.00	762.9
Restoration	0.2	2.0	0.00	357.8	Concrete Truck	25	0.72	0.2	1.4	0.00	257.5
Pipe Delivery	0.2	2.0	0.00	351.0	Dump Truck	25	0.72	0.2	1.4	0.00	252.6
Well Installation											
Air Vac- Borehole Clearance	0.3	2.0	0.00	126.0	Air-Vac	25	0.72	0.2	1.4	0.00	90.7
Drilling and SVE Well Installation	0.3	2.0	0.00	126.0	Drill Rig	25	0.72	0.2	1.4	0.00	90.7
Waste Collection	0.5	4.0	0.00	252.0	Dump Truck	25	0.72	0.4	2.9	0.00	181.4
Street Paving											
Street Grinding	2.7	16.0	0.00	80.0	Dump Truck	25	0.72	1.9	11.5	0.00	57.6
Street Paving	1.3	8.0	0.00	80.0	Dump Truck	25	0.72	1.0	5.8	0.00	57.6

Emission Calculation

Daily:

Phase	Daily VMT (SCAB)	sL (g/M^2)	W (tons)	k (PM10)	k (PM2.5)	Wet Days	Avg. Period	PM10 EF (lbs/mi.)	PM2.5 EF (lbs/mi.)	SCAB Pm10 Emissions	SCAB PM2.5 Emissions
Option 1											
Demo	10.4	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	6.30E-04	1.55E-04
Green Waste	2.9	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	1.75E-04	4.28E-05
Excavation	18.9	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	1.15E-03	2.81E-04
SVE Well/Piping	1.9	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	1.14E-04	2.80E-05
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	20.2	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	1.23E-03	3.01E-04
Slurry Backfill	6.1	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	3.71E-04	9.11E-05
Site Resto.	4.7	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	2.85E-04	7.01E-05
Street Trenching											
Demo	1.4	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	8.68E-05	2.13E-05
Excavation	4.3	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	2.59E-04	6.36E-05
Backfill	4.2	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	2.57E-04	6.31E-05
Restoration	1.4	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	8.67E-05	2.13E-05
Pipe Delivery	1.4	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	8.51E-05	2.09E-05
Well Installation											
Air Vac- Borehole Clearance	1.4	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	8.73E-05	2.14E-05
Drilling and SVE Well Installation	1.4	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	8.73E-05	2.14E-05
Waste Collection	2.9	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	1.75E-04	4.28E-05
Street Paving											
Street Grinding	11.5	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	6.98E-04	1.71E-04
Street Paving	5.8	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	3.49E-04	8.57E-05

Daily Worker Trip Emissions:

Phase	Worker Trips per Day	Round Trip per Worker (mile)	VMT per Hour	SL (g/m^2)	W (Tons)	k (PM10)	k (PM2.5)	Wet Days	Avg. period	PM10 EF lbs/mi	PM2.5 EF lbs/mi	SCAB PM10 Emissions	SCAB PM2.5 Emissions
Option 1	56	0.72	40	0.02	2.40	0.0022	0.00054	40	365	1.49E-04	3.65E-05	5.99E-03	1.47E-03
Street Trenching	71	0.72	51	0.02	2.40	0.0022	0.00054	40	365	1.49E-04	3.65E-05	7.59E-03	1.86E-03
Well Installation	73	0.72	53	0.02	2.40	0.0022	0.00054	40	365	1.49E-04	3.65E-05	7.81E-03	1.92E-03
Street Paving													
Street Grinding	16	0.72	12	0.02	2.40	0.0022	0.00054	40	365	1.49E-04	3.65E-05	1.71E-03	4.20E-04
Street Paving	16	0.72	12	0.02	2.40	0.0022	0.00054	40	365	1.49E-04	3.65E-05	1.71E-03	4.20E-04

X. Off-Site Road Emissions

Summary: This section calculates the emissions of criteria pollutants from off-site paved roads.

Emissions Factors

Running Emissions											g/mi
Veh Class	Fuel	MdlYr	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
LDA/LDT	All	All	6.4E-02	2.5E+00	2.8E-01	6.9E+02	3.0E-03	3.0E-04	7.0E-03	4.5E-02	1.8E-02
HHDT	DSL	All	7.8E-01	4.0E+00	1.4E+01	1.6E+03	8.0E-01	7.4E-01	1.7E-02	7.8E-02	3.1E-02
HHDT	DSL	2007	1.2E-01	8.6E-01	2.2E+00	1.6E+03	6.1E-02	5.6E-02	1.7E-02	5.9E-03	5.5E-03

Source: EMFAC 2011

Running Emissions											lbs/mi
Veh Class	Fuel	MdlYr	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
LDA/LDT	All	All	1.4E-04	5.5E-03	6.1E-04	1.5E+00	6.6E-06	6.6E-07	1.5E-05	9.9E-05	4.0E-05
HHDT	DSL	All	1.7E-03	8.8E-03	3.1E-02	3.6E+00	1.8E-03	1.6E-03	3.7E-05	1.7E-04	6.8E-05
HHDT	DSL	2007	2.7E-04	1.9E-03	4.8E-03	3.5E+00	1.4E-04	1.2E-04	3.7E-05	1.3E-05	1.2E-05

Source: EMFAC 2011

Heavy Truck Trip Data																
Phase	Hourly Round Trips	Daily Round Trips	8 Home Cluster Round Trips	Annual Round Trips	Truck Type	Average Vehicle Weight (tons)	Round Trip length (SCAB)	Hourly VMT	Daily VMT	8 Home Cluster Round Trips	Annual VMT	Trip length (MDAB)	Hourly VMT	Daily VMT	8 Home Cluster Round Trips	Annual VMT
Option 1																
Demo	1.8	14	231	1,712	Dump Truck	25	60	108	867	13,866	102,698	0	0	0	0	0
Green Waste	0.5	4.0	32.0	237.0	Dump Truck	25.0	10.0	5	40	320	2,370	0	0	0	0	0
Excavation	3.3	26	3,153	6,227	Dump Truck	25	150	493	3,941	472,961	934,098	50	164	1,314	157,654	311,366
SVE Well/Piping	0.3	2.6	20.9	155.0	Dump Truck	25	100	33	262	2,093	15,504	0	0	0	0	0
Subslab Vent	0.0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	3.5	28	2,699	6,662	Dump Truck	25	8	28	225	21,590	53,300	0	0	0	0	0
Slurry Backfill	1.1	8.5	476.1	2014.9	Concrete Truck	25	20	21	170	9,522	40,298	0	0	0	0	0
Site Resto.	0.8	7	523	1,550	Concrete Truck	25	20	16	131	10,467	31,009	0	0	0	0	0
Street Trenching																
Demo	0.2	2.0	0.00	358.0	Dump Truck	25	60	15	119	0	21,480	0	0	0	0.00	0
Excavation	0.7	5.9	0.00	1068.0	Dump Truck	25	150	111	890	0	160,200	50	37	297	0.00	53,400
Slurry Backfill	0.7	5.9	0.00	1060.0	Dump Truck	25	8	6	47	0	8,480	0	0	0	0.00	0
Restoration	0.2	2.0	0.00	357.8	Concrete Truck	25	20	5	40	0	7,156	0	0	0	0.00	0
Pipe Delivery	0.2	2.0	0.00	351.0	Dump Truck	25	100	24	195	0	35,100	0	0	0	0.00	0
Well Installation																
Air Vac- Borehole Clearance	0.3	2.0	0.00	126.0	Air-Vac	25	10	3	20	0	1,260	0	0	0	0.00	0
Drilling and SVE Well Installation	0.3	2.0	0.00	126.0	Drill Rig	25	10	3	20	0	1,260	0	0	0	0.00	0
Waste Collection	0.5	4.0	0.00	252.0	Dump Truck	25	10	5	40	0	2,520	0	0	0	0.00	0
Waste Transport to Offsite Disposal	0.2	1.8	0.00	110.8	Dump Truck	25	150	33	264	0	16,620	50	11	88	0	5,540
Street Paving																
Street Grinding	2.7	8.0	0.00	80.0	Dump Truck	25	60	160	480	0	4,800	0	0	0	0.00	0
Street Paving	1.3	16.0	0.00	80.0	Dump Truck	25	100	133	1,600	0	8,000	0	0	0	0.00	0

Emissions Calculations

Daily Truck Trip Emission Calculations (SCAB)		lbs/day (SCAB)								
Phase	Daily VMT (SCAB)	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
Option 1										
Demo	867	2.3E-01	1.6E+00	4.1E+00	3.0E+03	1.2E-01	1.1E-01	3.2E-02	1.1E-02	1.0E-02
Green Waste	40	1.1E-02	7.6E-02	1.9E-01	1.4E+02	5.4E-03	5.0E-03	1.5E-03	5.2E-04	4.8E-04
Excavation	3,941	1.1E+00	7.5E+00	1.9E+01	1.4E+04	5.3E-01	4.9E-01	1.5E-01	5.2E-02	4.7E-02
SVE Well/Piping	262	7.1E-02	5.0E-01	1.2E+00	9.1E+02	3.5E-02	3.3E-02	9.7E-03	3.4E-03	3.1E-03
Subslab Vent	0.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Backfill/Compact	225	6.1E-02	4.3E-01	1.1E+00	7.8E+02	3.0E-02	2.8E-02	8.3E-03	2.9E-03	2.7E-03
Slurry Backfill	170	4.6E-02	3.2E-01	8.1E-01	5.9E+02	2.3E-02	2.1E-02	6.3E-03	2.2E-03	2.0E-03
Site Resto.	131	3.5E-02	2.5E-01	6.2E-01	4.5E+02	1.8E-02	1.6E-02	4.8E-03	1.7E-03	1.6E-03
Street Trenching										
Demo	119	3.2E-02	2.3E-01	5.7E-01	4.1E+02	1.6E-02	1.5E-02	4.4E-03	1.6E-03	1.4E-03
Excavation	890	2.4E-01	1.7E+00	4.2E+00	3.1E+03	1.2E-01	1.1E-01	3.3E-02	1.2E-02	1.1E-02
Backfill	47	1.3E-02	9.0E-02	2.2E-01	1.6E+02	6.4E-03	5.9E-03	1.7E-03	6.2E-04	5.7E-04
Restoration	40	1.1E-02	7.6E-02	1.9E-01	1.4E+02	5.4E-03	4.9E-03	1.5E-03	5.2E-04	4.8E-04
Pipe Delivery	195	5.3E-02	3.7E-01	9.3E-01	6.8E+02	2.6E-02	2.4E-02	7.2E-03	2.5E-03	2.3E-03
Well Installation										
Air Vac- Borehole Clearance	20	5.4E-03	3.8E-02	9.5E-02	6.9E+01	2.7E-03	2.5E-03	7.4E-04	2.6E-04	2.4E-04
Drilling and SVE Well Installation	20	5.4E-03	3.8E-02	9.5E-02	6.9E+01	2.7E-03	2.5E-03	7.4E-04	2.6E-04	2.4E-04
Waste Collection	40	1.1E-02	7.6E-02	1.9E-01	1.4E+02	5.4E-03	5.0E-03	1.5E-03	5.2E-04	4.8E-04
Waste Transport to Offsite Disposal	264	7.1E-02	5.0E-01	1.3E+00	9.2E+02	3.6E-02	3.3E-02	9.7E-03	3.4E-03	3.2E-03
Street Paving										
Street Grinding	480	1.3E-01	9.1E-01	2.3E+00	1.7E+03	6.5E-02	6.0E-02	1.8E-02	6.3E-03	5.8E-03
Street Paving	1,600	4.3E-01	3.0E+00	7.6E+00	5.6E+03	2.2E-01	2.0E-01	5.9E-02	2.1E-02	1.9E-02

Daily Truck Trip Emission Calculations (MDAB)		lbs/day (MDAB)								
Phase	Daily VMT (MDAB)	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
Option 1										
Demo	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Green Waste	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Excavation	1314	3.6E-01	2.5E+00	6.2E+00	4.6E+03	1.8E-01	1.6E-01	4.8E-02	1.7E-02	1.6E-02
SVE Well/Piping	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Subslab Vent	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Backfill/Compact	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Slurry Backfill	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Site Resto.	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Street Trenching										
Demo	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Excavation	297	8.0E-02	5.6E-01	1.4E+00	1.0E+03	4.0E-02	3.7E-02	1.1E-02	3.9E-03	3.6E-03
Backfill	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Restoration	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pipe Delivery	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Well Installation										
Air Vac- Borehole Clearance	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Drilling and SVE Well Installation	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Waste Collection	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Waste Transport to Offsite Disposal	88	2.4E-02	1.7E-01	4.2E-01	3.1E+02	1.2E-02	1.1E-02	3.2E-03	1.1E-03	1.1E-03
Street Paving										
Street Grinding	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Street Paving	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

				lbs/day								
Phase	Worker Round Trips per day	Roundtrip Distance per Worker (mi)	VMT per Day	ROG	CO	NOx	CO2	PM10	PM2.5	Sox	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
Option 1	56	21.6	1210	1.7E-01	6.7E+00	7.4E-01	1.8E+03	8.0E-03	8.0E-04	1.9E-02	1.2E-01	4.8E-02
Street Trenching	71	21.6	1534	2.2E-01	8.5E+00	9.4E-01	2.3E+03	1.0E-02	1.0E-03	2.4E-02	1.5E-01	6.1E-02
Well Installation	73	21.6	1577	2.2E-01	8.7E+00	9.7E-01	2.4E+03	1.0E-02	1.0E-03	2.4E-02	1.6E-01	6.3E-02
Street Paving												
Street Grinding	16	21.6	346	4.9E-02	1.9E+00	2.1E-01	5.3E+02	2.3E-03	2.3E-04	5.3E-03	3.4E-02	1.4E-02
Street Paving	16	21.6	346	4.9E-02	1.9E+00	2.1E-01	5.3E+02	2.3E-03	2.3E-04	5.3E-03	3.4E-02	1.4E-02

*Used worker distances from CalEEMod Assumptions

XI. Off-Site Road - Reentrained Dust

Summary: This section calculates the emissions of re-entrained dust from off-site on road vehicles on paved roads.

$$E = [k(sL)^{0.91} \times (W)^{1.02}] (1 - P/4N)$$

Where:

E = size-specific emission factor (lb/VMT)
k = particle size multiplier
sL = road surface silt loading (g/m^2)
W = mean vehicle weight (tons)
P = averaging period (365 days)
N = number of "wet" days (>0.01 in of precipitation)

Source: AP-42 13.2.1-2, Equation (1). January 2011.

Correction:
P = number of wet days
N = number of days in period

Assumptions			
Parameter	**Value**	**Units**	**Reference**
Vehicle Weight (tons)	25	tons	Assumed
k (empirical constant) - PM10	0.0022	-	AP-42, Chapter 13.2.1, Table 13.2.1-1. PM10 (lbs/VMT)
k (empirical constant) - PM2.5	0.00054	-	AP-42, Chapter 13.2.1, Table 13.2.1-1. PM2.5 (lbs/VMT)
sL (Haul Trucks)	0.02	g/m2	CARB Entrained Paved Road Dust. (1997) Silt loading for freeways:
sL (Worker Vehicles)	0.1	g/m2	CalEEMod Default for Worker trips (Assumes mix of freeway and
P (averaging period)	365	days	Days per year
N (wet days)	40	days	AP-42, Chapter 13.2.1, Figure 13.2.1-2. January 2011.
South Coast Air Basin Distance	75	miles	google maps
Mojave Desert Distance	25	miles	google maps
Employee/Worker Trip Distance	21.6	miles	CalEEMod Default Construction Worker Trip (Round Trip)
Paved Road Average Vehicle Weight	2.4	tons	CalEEMod default average vehicle weight (tons)

Phase	Hourly Round Trips	Daily Round Trips	8 Home Cluster Round Trips	Annual Round Trips	Truck Type	Average Vehicle Weight (tons)	Round Trip length (SCAB)	SCAB Hourly VMT	SCAB Daily VMT	SCAB 8 Home Cluster VMT	SCAB Annual VMT	Trip length (MDAB)	MDAB Hourly VMT	MDAB Daily VMT	MDAB 8 Home Cluster VMT	MDAB Annual VMT
Option 1																
Demo	1.8	14.4	231.1	1,711.6	Dump Truck	25	60	108	867	13,866	102,698	0	0	0	0	0
Green Waste	0.5	4.0	32.0	237.0	Dump Truck	25	10	5	40	320	2,370	0	0	0	0	0
Excavation	3.3	26.3	3,153.1	6,227.3	Dump Truck	25	150	493	3,941	472,961	934,098	50	164	1,314	157,654	311,366
SVE Well/Piping	0.3	2.6	20.9	155.0	Dump Truck	25	100	33	262	2,093	15,504	0	0	0	0	0
Subslab Vent	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0
Backfill/Compact	3.5	28.1	2,698.7	6,662.5	Dump Truck	25	8	28	225	21,590	53,300	0	0	0	0	0
Slurry Backfill	1.1	8.5	476.1	2,014.9	Concrete Truck	25	20	21	170	9,522	40,298	0	0	0	0	0
Site Resto.	0.8	6.5	523.4	1,550.5	Concrete Truck	25	20	16	131	10,467	31,009	0	0	0	0	0
Street Trenching																
Demo	0.2	2.0	0.0	358.0	Dump Truck	25	60	15	119	0	21,480	0	0	0	0	0
Excavation	0.7	5.9	0.0	1,068.0	Dump Truck	25	150	111	890	0	160,200	50	37	297	0	53,400
Backfill	0.7	5.9	0.0	1,060.0	Dump Truck	25	8	6	47	0	8,480	0	0	0	0	0
Restoration	0.2	2.0	0.0	357.8	Concrete Truck	25	20	5	40	0	7,156	0	0	0	0	0
Pipe Delievery	0.2	2.0	0.0	351.0	Dump Truck	25	100	24	195	0	35,100	0	0	0	0	0
Well Installation																
Air Vac- Borehole Clearance	0.3	2.0	0.0	126.0	Air-Vac	25	10.0	3	20	0	1,260	0	0	0	0	0
Drilling and SVE Well Installation	0.3	2.0	0.0	126.0	Drill Rig	25	10.0	3	20	0	1,260	0	0	0	0	0
Waste Collection	0.5	4.0	0.0	252.0	Dump Truck	25.0	10.0	5.0	40.0	0.0	2,520.0	0.0	0.0	0.0	0.0	0.0
Waste Transport to Offsite Disposal	0.2	1.8	0.0	110.8	Dump Truck	25.0	150.0	33.0	263.8	0.0	16,620.0	50.0	11.0	87.9	0.0	5,540.0
Street Paving																
Street Grinding	2.7	16.0	0.0	80.0	Dump Truck	25	60	160	960	0	4,800	0	0	0	0	0
Street Paving	2.7	16.0	0.0	160.0	Dump Truck	25	100	267	1,600	0	16,000	0	0	0	0	0

Emission Calculation

Daily:

Phase	Daily VMT (SCAB)	Daily VMT (MDAB)	sL (g/M^2)	W (tons)	k (PM10)	k (PM2.5)	Wet Days	Avg. Period	PM10 EF (lbs/mi.)	PM2.5 EF (lbs/mi.)	SCAB Pm10 Emissions	SCAB PM2.5 Emissions	MDAB Pm10 Emissions	MDAB PM2.5 Emissions
Option 1														
Demo	866.6	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	1.4E+00	3.5E-01	0.0E+00	0.0E+00
Green Waste	40.0	0.0	0.02	25	0.0022	0.00054	40	366	0.0016	0.0004	6.5E-02	1.6E-02	0.0E+00	0.0E+00
Excavation	3,941.3	1,313.8	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	6.4E+00	1.6E+00	2.1E+00	5.2E-01
SVE Well/Piping	261.7	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	4.2E-01	1.0E-01	0.0E+00	0.0E+00
Subslab Vent	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Backfill/Compact	224.9	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	3.6E-01	9.0E-02	0.0E+00	0.0E+00
Slurry Backfill	170.0	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	2.8E-01	6.8E-02	0.0E+00	0.0E+00
Site Resto.	130.8	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	2.1E-01	5.2E-02	0.0E+00	0.0E+00
Street Trenching														
Demo	119.3	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	1.9E-01	4.8E-02	0.0E+00	0.0E+00
Excavation	890.0	296.7	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	1.4E+00	3.5E-01	4.8E-01	1.2E-01
Backfill	47.1	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	7.6E-02	1.9E-02	0.0E+00	0.0E+00
Restoration	39.8	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	6.5E-02	1.6E-02	0.0E+00	0.0E+00
Pipe Delievery	195.0	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	3.2E-01	7.8E-02	0.0E+00	0.0E+00
Well Installation														
Air Vac- Borehole Clearance	20.0	0.0	0.02	25	0.0022	0.00054	40	367	0.0016	0.0004	3.2E-02	8.0E-03	0.0E+00	0.0E+00
Drilling and SVE Well Installation	20.0	0.0	0.02	25	0.0022	0.00054	40	368	0.0016	0.0004	3.2E-02	8.0E-03	0.0E+00	0.0E+00
Waste Collection	40.0	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	6.5E-02	1.6E-02	0.0E+00	0.0E+00
Waste Transport to Offsite Disposal	263.8	87.9	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	4.3E-01	1.1E-01	1.4E-01	3.5E-02
Street Paving														
Street Grinding	960.0	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	1.6E+00	3.8E-01	0.0E+00	0.0E+00
Street Paving	1,600.0	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	2.6E+00	6.4E-01	0.0E+00	0.0E+00

Daily Worker Trip Emissions:

Phase	Worker Trips per Day	Round Trip per Worker (mile)	VMT per Hour	SL (g/m^2)	W (Tons)	k (PM10)	k (PM2.5)	Wet Days	Avg. period	PM10 EF lbs/mi	PM2.5 EF lbs/mi	SCAB PM10 Emissions	SCAB PM2.5 Emissions
Option 1	56	21.6	1,210	0.02	2.4	0.0022	0.00054	40	365	0.0001	0.0000	1.8E-01	4.4E-02
Street Trenching	71	21.6	1,534	0.02	2.4	0.0022	0.00054	40	365	0.0001	0.0000	2.3E-01	5.6E-02
Well Installation	73	21.6	1,577	0.02	2.4	0.0022	0.00054	40	365	0.0001	0.0000	2.3E-01	5.8E-02
Street Paving													
Street Grinding	16	21.6	346	0.02	2.4	0.0022	0.00054	40	365	0.0001	0.0000	5.1E-02	1.3E-02
Street Paving	16	21.6	346	0.02	2.4	0.0022	0.00054	40	365	0.0001	0.0000	5.1E-02	1.3E-02

Calculation Delivery Cover Sheet

URS Santa Ana Air Quality Group

Date:	*10/29/2014*
Project:	Kast Remediation Project - VOC Emissions Option 1 (Hard and Softscape Excavation) ***5 foot with 10 foot Excavation, 4 Houses at a Time, Phase Overlap***
Project number:	*49194119*
Requestor:	*PCR Consulting*
Project manager:	*Roy Patterson*
Air Quality originator:	*Irma Buenrostro*
Air Quality project lead:	*Shirley Pearson*
Air Quality internal reviewer:	*Shirley Pearson*
Date review completed:	*29-Oct-14*
Detail check internal reviewer:	*Irma Buenrostro*
Date review completed:	*29-Oct-14*
Brief description of analysis:	*Calculating emission rates of VOC from contaminated soil.*
Reference MXD:	S:\Shirley Pearson\!Kast\29 Oct 2014 Updates
Model used:	*EMSOFT, 2002*

Version 10-29-14

Kast VOC Emissions Calculations

I. List of VOC's Listed in the HHRA

COC	CAS #	Organic Carbon partition Coefficient (Koc) (cm^3/g)	Diffusivity in Air (Dair) (cm^2/s)	Diffusivity in Water (Dwater) (cm^2/s)	Henry's Law Constant (H') (unit less)	Soil-water Partition coefficient (Ksw) (cm^3/g)	Soil-Water Partition Coefficient (kd) (cm^3/g)	Apparent Diffusivity (Da) (cm^2/s)	Effective Diffusion Coefficient (Deff) (cm^2/s)
1,1,2,2-Tetrachloroethane	79-34-5	9.30E+01	7.10E-02	7.90E-06	1.40E-02	6.60E-01	5.60E-01	7.80E-05	5.50E-03
1,2,3-Trichloropropane	96-18-4	2.20E+01	7.10E-02	7.90E-06	1.70E-02	2.40E-01	1.30E-01	2.60E-04	5.50E-03
1,2,4-Trimethylbenzene	95-63-6	1.40E+03	6.10E-02	7.90E-06	2.50E-01	8.30E+00	8.10E+00	9.60E-05	4.70E-03
1,2-Dichloropropane	78-87-5	4.40E+01	7.80E-02	8.70E-06	1.10E-01	3.80E-01	2.60E-01	1.20E-03	6.10E-03
1,3,5-Trimethylbenzene	108-67-8	1.40E+03	6.00E-02	8.70E-06	2.40E-01	8.30E+00	8.10E+00	9.10E-05	4.70E-03
1,4-Dichlorobenzene	106-46-7	6.20E+02	6.90E-02	7.90E-06	9.80E-02	3.80E+00	3.70E+00	9.20E-05	5.40E-03
Benzene	71-43-2	5.90E+01	8.80E-02	9.80E-06	2.30E-01	5.00E-01	3.50E-01	2.10E-03	6.90E-03
Bromodichloromethane	75-27-4	5.50E+01	3.00E-02	1.10E-05	6.50E-02	4.40E-01	3.30E-01	2.30E-04	2.30E-03
Bromomethane	74-83-9	1.10E+01	7.30E-02	1.20E-05	2.60E-01	2.10E-01	6.30E-02	4.60E-03	5.70E-03
Ethylbenzene	100-41-4	3.60E+02	7.50E-02	7.80E-06	3.20E-01	2.30E+00	2.20E+00	5.30E-04	5.90E-03
Methylene chloride	75-09-2	1.20E+01	1.00E-01	1.20E-05	9.00E-02	1.90E-01	7.00E-02	2.50E-03	7.90E-03
Tetrachloroethene	127-18-4	1.60E+02	7.20E-02	8.20E-06	7.50E-01	1.20E+00	9.30E-01	2.40E-03	5.60E-03
Toluene	108-88-3	1.80E+02	8.70E-02	8.60E-06	2.70E-01	1.20E+00	1.10E+00	9.80E-04	6.80E-03
Trichloroethene	79-01-6	1.70E+02	7.90E-02	9.10E-06	4.20E-01	1.20E+00	1.00E+00	1.50E-03	6.20E-03
Vinyl chloride	75-01-4	1.90E+01	1.10E-01	1.20E-05	1.10E+00	4.20E-01	1.10E-01	1.50E-02	8.30E-03
Xylenes, total	1330-20-7	3.90E+02	7.70E-02	8.40E-06	3.10E-01	2.50E+00	2.30E+00	5.00E-04	6.00E-03
1-Methylnaphthalene	90-12-0	3.00E+03	5.30E-02	7.90E-06	2.10E-02	1.80E+01	1.80E+01	3.10E-06	4.10E-03
2-Methylnaphthalene	91-57-6	2.80E+03	5.20E-02	7.80E-06	2.10E-02	1.70E+01	1.70E+01	3.40E-06	4.10E-03
Naphthalene	91-20-3	2.00E+03	5.90E-02	7.50E-06	2.00E-02	1.20E+01	1.20E+01	5.00E-06	4.60E-03
Pyrene	129-00-0	1.10E+05	2.70E-02	7.20E-06	4.50E-04	6.30E+02	6.30E+02	1.10E-09	2.30E-03
1,1,2,2-Tetrachloroethane	79-34-5	9.30E+01	7.10E-02	7.90E-06	1.40E-02	6.60E-01	5.60E-01	7.80E-05	5.50E-03
1,1,2-Trichloroethane	79-00-5	5.00E+01	7.80E-02	8.80E-06	3.70E-02	4.10E-01	3.00E-01	3.70E-04	6.10E-03
1,1-Dichloroethane	75-34-3	3.20E+01	7.40E-02	1.10E-05	2.30E-01	3.30E-01	1.90E-01	2.70E-03	5.80E-03
1,2,3-Trichloropropane	96-18-4	2.20E+01	7.10E-02	7.90E-06	1.70E-02	2.40E-01	1.30E-01	2.60E-04	5.50E-03
1,2,4-Trichlorobenzene	120-82-1	1.80E+03	3.00E-02	8.20E-06	5.80E-02	1.10E+01	1.10E+01	8.40E-06	2.30E-03
1,2,4-Trimethylbenzene	95-63-6	1.40E+03	6.10E-02	7.90E-06	2.50E-01	8.30E+00	8.10E+00	9.60E-05	4.70E-03
1,2-Dichloroethane	107-06-2	1.70E+01	1.00E-01	9.90E-06	4.00E-02	2.10E-01	1.00E-01	1.00E-03	8.10E-03
1,2-Dichloropropane	78-87-5	4.40E+01	7.80E-02	8.70E-06	1.10E-01	3.80E-01	2.60E-01	1.20E-03	6.10E-03

Kast VOC Emissions Calculations

COC	CAS #	Organic Carbon partition Coefficient (Koc) (cm^3/g)	Diffusivity in Air (Dair) (cm^2/s)	Diffusivity in Water (Dwater) (cm^2/s)	Henry's Law Constant (H') (unit less)	Soil-water Partition coefficient (Ksw) (cm^3/g)	Soil-Water Partition Coefficient (kd) (cm^3/g)	Apparent Diffusivity (Da) (cm^2/s)	Effective Diffusion Coefficient (Deff) (cm^2/s)
1,3,5-Trimethylbenzene	108-67-8	1.40E+03	6.00E-02	8.70E-06	2.40E-01	8.30E+00	8.10E+00	9.10E-05	4.70E-03
1,3-Butadiene	106-99-0	1.90E+01	2.50E-01	1.10E-05	3.00E+00	7.80E-01	1.10E-01	5.00E-02	1.90E-02
1,4-Dichlorobenzene	106-46-7	6.20E+02	6.90E-02	7.90E-06	9.80E-02	3.80E+00	3.70E+00	9.20E-05	5.40E-03
1,4-Dioxane	123-91-1	1.00E+00	2.30E-01	1.00E-05	2.30E-04	1.10E-01	6.00E-03	2.60E-05	1.80E-02
2,2,4-Trimethylpentane	540-84-1	1.50E+05	1.00E-01	1.00E-05	1.80E+02	9.30E+02	9.00E+02	1.00E-03	7.80E-03
2-Hexanone	591-78-6	9.40E+00	7.50E-02	8.40E-06	3.80E-03	1.60E-01	5.70E-02	9.40E-05	5.80E-03
4-Ethyltoluene	622-96-8	1.80E+03	6.80E-02	7.30E-06	2.10E-01	1.10E+01	1.10E+01	6.70E-05	5.30E-03
Benzene	71-43-2	5.90E+01	8.80E-02	9.80E-06	2.30E-01	5.00E-01	3.50E-01	2.10E-03	6.90E-03
Bromodichloromethane	75-27-4	5.50E+01	3.00E-02	1.10E-05	6.50E-02	4.40E-01	3.30E-01	2.30E-04	2.30E-03
Bromomethane	74-83-9	1.10E+01	7.30E-02	1.20E-05	2.60E-01	2.10E-01	6.30E-02	4.60E-03	5.70E-03
Carbon disulfide	75-15-0	4.60E+01	1.00E-01	1.00E-05	1.20E+00	6.10E-01	2.70E-01	1.10E-02	8.10E-03
Carbon tetrachloride tetrachloride	56-23-5	1.70E+02	7.80E-02	8.80E-06	1.20E+00	1.40E+00	1.00E+00	3.60E-03	6.10E-03
Chloroform	67-66-3	4.00E+01	1.00E-01	1.00E-05	1.50E-01	3.70E-01	2.40E-01	2.20E-03	8.10E-03
Cyclohexane	110-82-7	1.70E+02	7.40E-02	8.50E-06	7.90E+00	2.60E+00	9.90E-01	1.20E-02	5.70E-03
Dibromochloromethane	124-48-1	6.30E+01	2.00E-02	1.10E-05	3.20E-02	4.80E-01	3.80E-01	6.70E-05	1.50E-03
cis-1,2-Dichloroethene	156-59-2	3.60E+01	7.40E-02	1.10E-05	1.70E-01	3.40E-01	2.10E-01	1.80E-03	5.70E-03
trans-1,2-Dichloroethene	156-60-5	5.30E+01	7.10E-02	1.20E-05	3.80E-01	4.90E-01	3.20E-01	2.90E-03	5.50E-03
trans-1,3-Dichloropropene	10061-02-6	4.60E+01	6.30E-02	1.00E-05	7.20E-01	5.10E-01	2.70E-01	4.60E-03	4.90E-03
Ethanol	64-17-5	1.00E+00	1.50E-01	1.60E-05	1.90E-04	1.10E-01	6.00E-03	1.50E-05	1.30E-02
Ethylbenzene	100-41-4	3.60E+02	7.50E-02	7.80E-06	3.20E-01	2.30E+00	2.20E+00	5.40E-04	5.90E-03
Heptane	142-82-5	2.70E+02	9.30E-02	7.60E-06	8.20E+01	1.70E+01	1.60E+00	2.30E-02	7.20E-03
Hexachloro-1,3-butadiene	87-68-3	5.40E+04	5.60E-02	6.20E-06	3.30E-01	3.20E+02	3.20E+02	3.00E-06	4.40E-03
Hexane	110-54-3	4.30E+01	2.00E-01	7.80E-06	6.80E+01	1.30E+01	2.60E-01	5.40E-02	1.60E-02
Isopropanol	67-63-0	6.90E+00	8.00E-02	9.30E-06	3.60E-04	1.40E-01	4.20E-02	1.10E-05	6.50E-03
Isopropyl benzene (cumene)	98-82-8	4.90E+02	6.50E-02	7.10E-06	4.70E+01	1.20E+01	2.90E+00	1.30E-02	5.10E-03
Methyl ethyl ketone (2-butanone)	78-93-3	2.30E+00	8.10E-02	9.80E-06	2.30E-03	1.10E-01	1.40E-02	8.40E-05	6.30E-03
Methylene chloride	75-09-2	1.20E+01	1.00E-01	1.20E-05	9.00E-02	1.90E-01	7.00E-02	2.50E-03	7.90E-03
Methyl-tert-butyl ether	1634-04-4	7.30E+00	1.00E-01	1.10E-05	2.60E-02	1.50E-01	4.40E-02	9.10E-04	8.00E-03
Propyl benzene	103-65-1	5.60E+02	6.00E-02	7.80E-06	4.40E-01	3.60E+00	3.40E+00	3.80E-04	4.70E-03
tert-Butyl Alcohol (TBA)	75-65-0	4.20E+00	8.50E-02	9.10E-06	3.00E-03	1.30E-01	2.50E-02	1.10E-04	6.70E-03
Tetrachloroethene	127-18-4	1.60E+02	7.20E-02	8.20E-06	7.50E-01	1.20E+00	9.30E-01	2.40E-03	5.60E-03
Tetrahydrofuran	109-99-9	9.50E-01	9.80E-02	1.10E-05	2.90E-03	1.10E-01	5.70E-03	1.40E-04	7.70E-03

Kast VOC Emissions Calculations

COC	CAS #	Organic Carbon partition Coefficient (Koc) (cm^3/g)	Diffusivity in Air (Dair) (cm^2/s)	Diffusivity in Water (Dwater) (cm^2/s)	Henry's Law Constant (H') (unit less)	Soil-water Partition coefficient (Ksw) (cm^3/g)	Soil-Water Partition Coefficient (kd) (cm^3/g)	Apparent Diffusivity (Da) (cm^2/s)	Effective Diffusion Coefficient (Deff) (cm^2/s)
Toluene	108-88-3	1.80E+02	8.70E-02	8.60E-06	2.70E-01	1.20E+00	1.10E+00	9.80E-04	6.80E-03
Trichloroethene	79-01-6	1.70E+02	7.90E-02	9.10E-06	4.20E-01	1.20E+00	1.00E+00	1.50E-03	6.20E-03
Vinyl chloride	75-01-4	1.90E+01	1.10E-01	1.20E-05	1.10E+00	4.20E-01	1.10E-01	1.50E-02	8.30E-03
Xylenes, total	1330-20-7	3.90E+02	7.70E-02	8.40E-06	3.10E-01	2.50E+00	2.30E+00	5.00E-04	6.00E-03
1-Methylnaphthalene	90-12-0	3.00E+03	5.30E-02	7.90E-06	2.10E-02	1.80E+01	1.80E+01	3.10E-06	4.10E-03
2-Methylnaphthalene	91-57-6	2.80E+03	5.20E-02	7.80E-06	2.10E-02	1.70E+01	1.70E+01	3.40E-06	4.10E-03
Naphthalene	91-20-3	2.00E+03	5.90E-02	7.50E-06	2.00E-02	1.20E+01	1.20E+01	5.00E-06	4.60E-03
Pyrene	129-00-0	1.10E+05	2.70E-02	7.20E-06	4.50E-04	6.30E+02	6.30E+02	1.10E-09	2.30E-03

Data Source: Geosyntec Consultants, Human Health Risk Assessment Report Former Kast Property Carson, California, March 10, 2014

II. Chemical Inputs for EMSOFT Model run

CAS #	Chemical	Organic Carbon Partition Coefficient Koc (cm^3/g)	Air Diffusion Coefficient D'a (cm^2/s)	Air Diffusion Coefficient D'a (cm^2/day)	Aqueous Diffusion Coefficient D'w (cm^2/s)	Aqueous Diffusion Coefficient D'w (cm^2/day)	Henry's Law Constant (unit less)	COC Concentrations (0-10 feet)		COC Concentrations (0-10 feet)	
								Units	Sitewide UCL	Units	Sitewide UCL
100-41-4	Ethylbenzene	360	7.50E-02	6.48E+03	7.80E-06	6.74E-01	3.20E-01	mg/kg	5.00E-01	ug/kg	5.00E+02
106-46-7	1,4-Dichlorobenzene	620	6.90E-02	5.96E+03	7.90E-06	6.83E-01	9.80E-02	mg/kg	5.90E-04	ug/kg	5.90E-01
107-06-2	1,2-Dichloroethane	17	1.00E-01	8.64E+03	9.90E-06	8.55E-01	4.00E-02	mg/kg	4.70E-04	ug/kg	4.70E-01
108-67-8	1,3,5-Trimethylbenzene	1400	6.00E-02	5.18E+03	8.70E-06	7.52E-01	2.40E-01	mg/kg	1.90E-01	ug/kg	1.90E+02
108-88-3	Toluene	180	8.70E-02	7.52E+03	8.60E-06	7.43E-01	2.70E-01	mg/kg	1.20E-01	ug/kg	1.20E+02
127-18-4	Tetrachloroethene	160	7.20E-02	6.22E+03	8.20E-06	7.08E-01	7.50E-01	mg/kg	1.30E-02	ug/kg	1.30E+01
129-00-0	Pyrene	110000	2.70E-02	2.33E+03	7.20E-06	6.22E-01	4.50E-04	mg/kg	1.00E+00	mg/kg	1.00E+00
1330-20-7	Xylenes, Total	390	7.70E-02	6.65E+03	8.40E-06	7.26E-01	3.10E-01	mg/kg	7.69E-01	ug/kg	7.69E+02
156-59-2	cis-1,2-Dichloroethene	36	7.40E-02	6.39E+03	1.10E-05	9.50E-01	1.70E-01	mg/kg	5.60E-04	ug/kg	5.60E-01
71-43-2	Benzene	59	8.80E-02	7.60E+03	9.80E-06	8.47E-01	2.30E-01	mg/kg	1.70E-01	ug/kg	1.70E+02
74-83-9	Bromomethane	11	7.30E-02	6.31E+03	1.20E-05	1.04E+00	2.60E-01	mg/kg	5.80E-03	ug/kg	5.80E+00
75-01-4	Vinyl Chloride	19	1.10E-01	9.50E+03	1.20E-05	1.04E+00	1.10E+00	mg/kg	2.41E-04	ug/kg	2.41E-01
75-09-2	Methylene Chloride	12	1.00E-01	8.64E+03	1.20E-05	1.04E+00	9.00E-02	mg/kg	3.20E-03	ug/kg	3.20E+00
75-27-4	Bromodichloromethane	55	3.00E-02	2.59E+03	1.10E-05	9.50E-01	6.50E-02	mg/kg	2.40E-04	ug/kg	2.40E-01
75-65-0	tert-Butyl Alcohol (TBA)	4.2	8.50E-02	7.34E+03	9.10E-06	7.86E-01	3.00E-03	mg/kg	4.80E-03	ug/kg	4.80E+00
78-87-5	1,2-Dichloropropane	44	7.80E-02	6.74E+03	8.70E-06	7.52E-01	1.10E-01	mg/kg	3.60E-04	ug/kg	3.60E-01
79-01-6	Trichloroethene	170	7.90E-02	6.83E+03	9.10E-06	7.86E-01	4.20E-01	mg/kg	7.40E-04	ug/kg	7.40E-01
79-34-5	1,1,2,2-Tetrachloroethane	93	7.10E-02	6.13E+03	7.90E-06	6.83E-01	1.40E-02	mg/kg	4.80E-04	ug/kg	4.80E-01
90-12-0	1-Methylnaphthalene	3000	5.30E-02	4.58E+03	7.90E-06	6.83E-01	2.10E-02	mg/kg	2.60E+00	mg/kg	2.60E+00
91-20-3	Naphthalene	2000	5.90E-02	5.10E+03	7.50E-06	6.48E-01	2.00E-02	mg/kg	1.50E+00	mg/kg	1.50E+00
91-57-6	2-Methylnaphthalene	2800	5.20E-02	4.49E+03	7.80E-06	6.74E-01	2.10E-02	mg/kg	3.90E+00	mg/kg	3.90E+00
95-63-6	1,2,4-Trimethylbenzene	1400	6.10E-02	5.27E+03	7.90E-06	6.83E-01	2.50E-01	mg/kg	7.80E-01	ug/kg	7.80E+02
96-18-4	1,2,3-Trichloropropane	22	7.10E-02	6.13E+03	7.90E-06	6.83E-01	1.70E-02	mg/kg	6.40E-04	ug/kg	6.40E-01
#N/A	2,4-Dinitrotoluene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	6.30E-02	mg/kg	6.30E-02
#N/A	Antimony	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	2.90E-01	mg/kg	2.90E-01
#N/A	Arsenic	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	4.90E+00	mg/kg	4.90E+00
#N/A	BaP TEQ	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.70E-01	mg/kg	1.70E-01
#N/A	Benzo (a) Anthracene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	2.10E-01	mg/kg	2.10E-01
#N/A	Benzo (a) Pyrene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.20E-01	mg/kg	1.20E-01
#N/A	Benzo (b) Fluoranthene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	5.80E-02	mg/kg	5.80E-02
#N/A	Benzo (k) Fluoranthene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.30E-02	mg/kg	1.30E-02
#N/A	Bis(2-Ethylhexyl) Phthalate	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.50E-01	mg/kg	1.50E-01

Kast VOC Emissions Calculations

CAS #	Chemical	Organic Carbon Partition Coefficient Koc (cm^3/g)	Air Diffusion Coefficient D'a (cm^2/s)	Air Diffusion Coefficient D'a (cm^2/day)	Aqueous Diffusion Coefficient D'w (cm^2/s)	Aqueous Diffusion Coefficient D'w (cm^2/day)	Henry's Law Constant (unit less)	Units	Sitewide UCL	Units	Sitewide UCL
#N/A	Cadmium	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	9.90E-02	mg/kg	9.90E-02
#N/A	Chromium, Hexavalent	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.30E-01	mg/kg	1.30E-01
#N/A	Chrysene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	5.60E-01	mg/kg	5.60E-01
#N/A	Cobalt	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	8.10E+00	mg/kg	8.10E+00
#N/A	Copper	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.40E+01	mg/kg	1.40E+01
#N/A	Dibenz (a,h) Anthracene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	8.90E-03	mg/kg	8.90E-03
#N/A	Indeno (1,2,3-c,d) Pyrene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.70E-02	mg/kg	1.70E-02
#N/A	Lead	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.10E+01	mg/kg	1.10E+01
#N/A	Thallium	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	2.20E-01	mg/kg	2.20E-01
#N/A	TPH as Diesel	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	2.20E+03	mg/kg	2.20E+03
#N/A	TPH as Gasoline	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.30E+02	mg/kg	1.30E+02
#N/A	TPH as Motor Oil	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	3.00E+03	mg/kg	3.00E+03
#N/A	Vanadium	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	3.00E+01	mg/kg	3.00E+01
#N/A	Zinc	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	4.20E+01	mg/kg	4.20E+01

Data Source: Geosyntec Consultants, Human Health Risk Assessment Report Former Kast Property Carson, California, March 10, 2014

*Chemicals with values listed as "#N/A" were not listed in the HHRA.

III. Soil and Layer Inputs for EMSOFT Model Run

	Calculation Options			Soil Properties				Physical Constants		Layer Properties	
	Time Period for Averaging and Printing Flux and Soil Concentration Results* (days)	Depth (D1) for Averaging Soil Concentration Results (cm)	Depth (D2) for Printing Soil Concentration Results (cm)	Fraction Organic Carbon[A,B] (unit less)	Fraction Porosity[A,B] (unit less)	Fraction Water Content[A,B] (unit less)	Bulk Density[A,B] (g/cm^3)	Porewater Flux (-=up, +=down)^c (cm/day)	Boundary Layer Thickness[D] (cm)	Cover Thickness[E] (cm)	Layer Thickness[F] (cm)
Site Wide (USEPA Screening Values for Loam)	[0.1/1]*	1	1	0.002	0.399	0.148	1.59	0	0.5	0	304.8

* 0.1 days: Shortest duration supported by EMSOFT model and used the represent the maximum hourly flux.

1 day: Used to represent the maximum daily flux

Data Sources: A. USPEA, User's Guide for Evaluation subsurface Vapor intrusion into Buildings, Table 11 - Guidance for Selection of Soil Type, (2004) 37. The soil parameters are based on soil texture classification of "lam."

B. USPEA, Johnson and Ettinger (1991) Model for Subsurface Vapor Intrusion into Buildings, Version 3.1, Soil Properties Lookup Table, (2004).

C. USEPA, EMSOFT User's Guide, Page 38, September 2002. "If no data are available, it would be conservative for the purpose of calculating long-term volatilization rates and soil concentrations to assume a porewater flux of zero."

D. USEPA, EMSOFT User's Guide, Page 43, September 2002. "A default boundary layer thickness that may be used in EMSOFT when no other data are available is 0.5 cm.

E. Assumes contamination begins at the surface.

F. This analysis uses 10 feet (304.8 cm) throughout site.

IV. EMSOFT Volatilization Factor Out Put

CAS #	Chemical	Volatilization Factors	
		0.1 Day Average (mg/cm^2)	1 Day Average (mg/cm^2-day)
100-41-4	Ethylbenzene	2.74E-02	8.72E-03
106-46-7	1,4-Dichlorobenzene	1.36E-05	4.35E-06
107-06-2	1,2-Dichloroethane	2.68E-05	8.52E-06
108-67-8	1,3,5-Trimethylbenzene	4.32E-03	1.39E-03
108-88-3	Toluene	8.61E-03	2.74E-03
127-18-4	Tetrachloroethene	1.37E-03	4.34E-04
129-00-0	Pyrene	8.66E-06	7.21E-06
1330-20-7	Xylenes, Total	4.07E-02	1.29E-02
156-59-2	cis-1,2-Dichloroethene	4.73E-05	1.50E-05
71-43-2	Benzene	1.60E-02	5.09E-03
74-83-9	Bromomethane	6.68E-04	2.12E-04
75-01-4	Vinyl Chloride	5.03E-05	1.59E-05
75-09-2	Methylene Chloride	2.76E-04	8.78E-05
75-27-4	Bromodichloromethane	7.50E-06	2.40E-06
75-65-0	tert-Butyl Alcohol (TBA)	7.75E-05	2.50E-05
78-87-5	1,2-Dichloropropane	2.47E-05	7.84E-06
79-01-6	Trichloroethene	6.29E-05	2.00E-05
79-34-5	1,1,2,2-Tetrachloroethane	9.23E-06	2.97E-06
90-12-0	1-Methylnaphthalene	1.05E-02	5.48E-03
91-20-3	Naphthalene	8.22E-02	2.60E-03
91-57-6	2-Methylnaphthalene	1.61E-02	5.48E-03
95-63-6	1,2,4-Trimethylbenzene	1.83E-02	5.86E-03
96-18-4	1,2,3-Trichloropropane	1.94E-05	6.21E-06

V. VOC Emission Calculations

General Assumptions

Parameter	Value	Units	References
Hours per Day	8	hours	Hours of work 8am-4pm

Excavated Surface Volatilization Assumptions

Parameter	Value	Units	References
Layer Thickness	304.8	cm	10 feet of excavation
Stabilizer	91%	%	Apply stabilizer on inactive areas. Source: USEPA, Control of Air Emissions from Superfund Sites, (1992). Long-term VOC control efficiency ranges from 91 to 100%.
Work Days in year	251	days	

Excavated Surfaces VOC Emissions

Equation:

Active Area Emissions (lb/time) = tXVFXAs

None-Active Area Emissions (lb/time) = (1-MR)xtXVFXAs

Where:

MR = stabilized mitigation

t = time conversion factor (e.g. Hours/day, days/year)

VF = volatility factor output from EMSOFT model (mg/cm^2-day)

As = surface area of volatilization (cm^2)

Phase	Duration (days)	Hourly QTY Excavated (CY)	Daily QTY Excavated (CY)	Yearly QTY Excavated (CY)	Hourly Excavated/Disturbed Surface Area (cm^2)	Daily Previously Excavated/Disturbed Surface Area (cm^2)	Yearly Excavated/Disturbed Surface Area (cm^2)	Stabilized Mitigation (% Reduction)
Option 1 - Excavati	889	7	368	87,181	1.76E+04	9.23E+05	2.19E+08	91%
Street Trenching	180	10	80	14,418	2.51E+04	2.01E+05	3.62E+07	91%

Kast VOC Emissions Calculations

Volatilization Factor Calculations:

CAS #	Chemical	Chemical UCL Concentration (mg/kg)	Volatilization Factors					
			VF1day [1 day avg.] (mg/cm^2-day)	VF1day [workday] (lbs/cm^2-day)	VF1day [off-workday] (lbs/cm^2-day)	VF1hr [0.1 day avg.] (mg/cm^2-day)	VF1hr [workday] (lbs/cm^2-day)	VF1hr [off-workday] (lbs/cm^2-day)
Option 1 - Excavation								
100-41-4	Ethylbenzene	5.00E-01	8.72E-03	6.41E-09	2.88E-08	2.74E-02	2.01E-08	4.03E-08
106-46-7	1,4-Dichlorobenzene	5.90E-04	4.35E-06	3.20E-12	1.44E-11	1.36E-05	9.99E-12	2.00E-11
107-06-2	1,2-Dichloroethane	4.70E-04	8.52E-06	6.26E-12	2.82E-11	2.68E-05	1.97E-11	3.94E-11
108-67-8	1,3,5-Trimethylbenzene	1.90E-01	1.39E-03	1.02E-09	4.60E-09	4.32E-03	3.17E-09	6.35E-09
108-88-3	Toluene	1.20E-01	2.74E-03	2.01E-09	9.06E-09	8.61E-03	6.33E-09	1.27E-08
127-18-4	Tetrachloroethene	1.30E-02	4.34E-04	3.19E-10	1.44E-09	1.37E-03	1.01E-09	2.01E-09
129-00-0	Pyrene	1.00E+00	7.21E-06	5.30E-12	2.38E-11	8.66E-06	6.36E-12	1.27E-11
1330-20-7	Xylenes, Total	7.69E-01	1.29E-02	9.48E-09	4.27E-08	4.07E-02	2.99E-08	5.98E-08
156-59-2	cis-1,2-Dichloroethene	5.60E-04	1.50E-05	1.10E-11	4.96E-11	4.73E-05	3.48E-11	6.95E-11
71-43-2	Benzene	1.70E-01	5.09E-03	3.74E-09	1.68E-08	1.60E-02	1.18E-08	2.35E-08
74-83-9	Bromomethane	5.80E-03	2.12E-04	1.56E-10	7.01E-10	6.68E-04	4.91E-10	9.82E-10
75-01-4	Vinyl Chloride	2.41E-04	1.59E-05	1.17E-11	5.26E-11	5.03E-05	3.70E-11	7.39E-11
75-09-2	Methylene Chloride	3.20E-03	8.78E-05	6.45E-11	2.90E-10	2.76E-04	2.03E-10	4.06E-10
75-27-4	Bromodichloromethane	2.40E-04	2.40E-06	1.76E-12	7.94E-12	7.50E-06	5.51E-12	1.10E-11
75-65-0	tert-Butyl Alcohol (TBA)	4.80E-03	2.50E-05	1.84E-11	8.27E-11	7.75E-05	5.70E-11	1.14E-10
78-87-5	1,2-Dichloropropane	3.60E-04	7.84E-06	5.76E-12	2.59E-11	2.47E-05	1.82E-11	3.63E-11
79-01-6	Trichloroethene	7.40E-04	2.00E-05	1.47E-11	6.61E-11	6.29E-05	4.62E-11	9.24E-11
79-34-5	1,1,2,2-Tetrachloroethane	4.80E-04	2.97E-06	2.18E-12	9.82E-12	9.23E-06	6.78E-12	1.36E-11
90-12-0	1-Methylnaphthalene	2.60E+00	5.48E-03	4.03E-09	1.81E-08	1.05E-02	7.72E-09	1.54E-08
91-20-3	Naphthalene	1.50E+00	2.60E-03	1.91E-09	8.60E-09	8.22E-02	6.04E-08	1.21E-07
91-57-6	2-Methylnaphthalene	3.90E+00	5.48E-03	4.03E-09	1.81E-08	1.61E-02	1.18E-08	2.37E-08
95-63-6	1,2,4-Trimethylbenzene	7.80E-01	5.86E-03	4.31E-09	1.94E-08	1.83E-02	1.34E-08	2.69E-08
96-18-4	1,2,3-Trichloropropane	6.40E-04	6.21E-06	4.56E-12	2.05E-11	1.94E-05	1.43E-11	2.85E-11

Kast VOC Emissions Calculations

Street Trenching - Excavation

CAS #	Chemical	Chemical UCL Concentration (mg/kg)	Volatilization Factors					
			VF1day [1 day avg.] (mg/cm^2-day)	VF1day [workday] (lbs/cm^2-day)	VF1day [off-workday] (lbs/cm^2-day)	VF1hr [0.1 day avg.] (mg/cm^2-day)	VF1hr [workday] (lbs/cm^2-day)	VF1hr [off-workday] (lbs/cm^2-day)
100-41-4	Ethylbenzene	5.00E-01	8.72E-03	6.41E-09	2.88E-08	2.74E-02	2.01E-08	4.03E-08
106-46-7	1,4-Dichlorobenzene	5.90E-04	4.35E-06	3.20E-12	1.44E-11	1.36E-05	9.99E-12	2.00E-11
107-06-2	1,2-Dichloroethane	4.70E-04	8.52E-06	6.26E-12	2.82E-11	2.68E-05	1.97E-11	3.94E-11
108-67-8	1,3,5-Trimethylbenzene	1.90E-01	1.39E-03	1.02E-09	4.60E-09	4.32E-03	3.17E-09	6.35E-09
108-88-3	Toluene	1.20E-01	2.74E-03	2.01E-09	9.06E-09	8.61E-03	6.33E-09	1.27E-08
127-18-4	Tetrachloroethene	1.30E-02	4.34E-04	3.19E-10	1.44E-09	1.37E-03	1.01E-09	2.01E-09
129-00-0	Pyrene	1.00E+00	7.21E-06	5.30E-12	2.38E-11	8.66E-06	6.36E-12	1.27E-11
1330-20-7	Xylenes, Total	7.69E-01	1.29E-02	9.48E-09	4.27E-08	4.07E-02	2.99E-08	5.98E-08
156-59-2	cis-1,2-Dichloroethene	5.60E-04	1.50E-05	1.10E-11	4.96E-11	4.73E-05	3.48E-11	6.95E-11
71-43-2	Benzene	1.70E-01	5.09E-03	3.74E-09	1.68E-08	1.60E-02	1.18E-08	2.35E-08
74-83-9	Bromomethane	5.80E-03	2.12E-04	1.56E-10	7.01E-10	6.68E-04	4.91E-10	9.82E-10
75-01-4	Vinyl Chloride	2.41E-04	1.59E-05	1.17E-11	5.26E-11	5.03E-05	3.70E-11	7.39E-11
75-09-2	Methylene Chloride	3.20E-03	8.78E-05	6.45E-11	2.90E-10	2.76E-04	2.03E-10	4.06E-10
75-27-4	Bromodichloromethane	2.40E-04	2.40E-06	1.76E-12	7.94E-12	7.50E-06	5.51E-12	1.10E-11
75-65-0	tert-Butyl Alcohol (TBA)	4.80E-03	2.50E-05	1.84E-11	8.27E-11	7.75E-05	5.70E-11	1.14E-10
78-87-5	1,2-Dichloropropane	3.60E-04	7.84E-06	5.76E-12	2.59E-11	2.47E-05	1.82E-11	3.63E-11
79-01-6	Trichloroethene	7.40E-04	2.00E-05	1.47E-11	6.61E-11	6.29E-05	4.62E-11	9.24E-11
79-34-5	1,1,2,2-Tetrachloroethane	4.80E-04	2.97E-06	2.18E-12	9.82E-12	9.23E-06	6.78E-12	1.36E-11
90-12-0	1-Methylnaphthalene	2.60E+00	5.48E-03	4.03E-09	1.81E-08	1.05E-02	7.72E-09	1.54E-08
91-20-3	Naphthalene	1.50E+00	2.60E-03	1.91E-09	8.60E-09	8.22E-02	6.04E-08	1.21E-07
91-57-6	2-Methylnaphthalene	3.90E+00	5.48E-03	4.03E-09	1.81E-08	1.61E-02	1.18E-08	2.37E-08
95-63-6	1,2,4-Trimethylbenzene	7.80E-01	5.86E-03	4.31E-09	1.94E-08	1.83E-02	1.34E-08	2.69E-08
96-18-4	1,2,3-Trichloropropane	6.40E-04	6.21E-06	4.56E-12	2.05E-11	1.94E-05	1.43E-11	2.85E-11

Kast VOC Emissions Calculations

VOC Emission Calculations:

CAS #	Chemical	VOC Emission Rates								
		Active Area Emissions (lbs/hour)	Non-Active Area Emissions (lbs/hour)	Total Area Emissions (lbs/hour)	Active Area Emissions (lbs/day)	Non-Active Area Emissions (lbs/day)	Total Area Emissions (lbs/day)	Active Area Emissions (lbs/year)	Non-Active Area Emissions (lbs/year)	Total Area Emissions (lbs/year)
Option 1 - Excavation										
100-41-4	Ethylbenzene	3.54E-04	6.36E-05	4.17E-04	5.91E-03	2.39E-03	8.31E-03	3.52E+02	3.17E+01	3.83E+02
106-46-7	1,4-Dichlorobenzene	1.75E-07	3.16E-08	2.07E-07	2.95E-06	1.19E-06	4.14E-06	1.75E-01	1.58E-02	1.91E-01
107-06-2	1,2-Dichloroethane	3.46E-07	6.22E-08	4.08E-07	5.78E-06	2.34E-06	8.12E-06	3.44E-01	3.09E-02	3.75E-01
108-67-8	1,3,5-Trimethylbenzene	5.57E-05	1.00E-05	6.58E-05	9.43E-04	3.82E-04	1.32E-03	5.61E+01	5.05E+00	6.11E+01
108-88-3	Toluene	1.11E-04	2.00E-05	1.31E-04	1.86E-03	7.52E-04	2.61E-03	1.11E+02	9.95E+00	1.20E+02
127-18-4	Tetrachloroethene	1.77E-05	3.18E-06	2.09E-05	2.94E-04	1.19E-04	4.13E-04	1.75E+01	1.58E+00	1.91E+01
129-00-0	Pyrene	1.12E-07	2.01E-08	1.32E-07	4.89E-06	1.98E-06	6.87E-06	2.91E-01	2.62E-02	3.17E-01
1330-20-7	Xylenes, Total	5.25E-04	9.45E-05	6.20E-04	8.75E-03	3.54E-03	1.23E-02	5.20E+02	4.68E+01	5.67E+02
156-59-2	cis-1,2-Dichloroethene	6.10E-07	1.10E-07	7.20E-07	1.02E-05	4.12E-06	1.43E-05	6.05E-01	5.45E-02	6.60E-01
71-43-2	Benzene	2.06E-04	3.72E-05	2.44E-04	3.45E-03	1.40E-03	4.85E-03	2.05E+02	1.85E+01	2.24E+02
74-83-9	Bromomethane	8.62E-06	1.55E-06	1.02E-05	1.44E-04	5.82E-05	2.02E-04	8.55E+00	7.70E-01	9.32E+00
75-01-4	Vinyl Chloride	6.49E-07	1.17E-07	7.66E-07	1.08E-05	4.37E-06	1.51E-05	6.41E-01	5.77E-02	6.99E-01
75-09-2	Methylene Chloride	3.56E-06	6.41E-07	4.20E-06	5.95E-05	2.41E-05	8.36E-05	3.54E+00	3.19E-01	3.86E+00
75-27-4	Bromodichloromethane	9.68E-08	1.74E-08	1.14E-07	1.63E-06	6.59E-07	2.29E-06	9.68E-02	8.71E-03	1.06E-01
75-65-0	tert-Butyl Alcohol (TBA)	1.00E-06	1.80E-07	1.18E-06	1.70E-05	6.87E-06	2.38E-05	1.01E+00	9.08E-02	1.10E+00
78-87-5	1,2-Dichloropropane	3.19E-07	5.74E-08	3.76E-07	5.32E-06	2.15E-06	7.47E-06	3.16E-01	2.85E-02	3.45E-01
79-01-6	Trichloroethene	8.12E-07	1.46E-07	9.58E-07	1.36E-05	5.49E-06	1.91E-05	8.07E-01	7.26E-02	8.79E-01
79-34-5	1,1,2,2-Tetrachloroethane	1.19E-07	2.14E-08	1.41E-07	2.01E-06	8.16E-07	2.83E-06	1.20E-01	1.08E-02	1.31E-01
90-12-0	1-Methylnaphthalene	1.35E-04	2.44E-05	1.60E-04	3.72E-03	1.50E-03	5.22E-03	2.21E+02	1.99E+01	2.41E+02
91-20-3	Naphthalene	1.06E-03	1.91E-04	1.25E-03	1.76E-03	7.14E-04	2.48E-03	1.05E+02	9.44E+00	1.14E+02
91-57-6	2-Methylnaphthalene	2.08E-04	3.74E-05	2.45E-04	3.72E-03	1.50E-03	5.22E-03	2.21E+02	1.99E+01	2.41E+02
95-63-6	1,2,4-Trimethylbenzene	2.36E-04	4.25E-05	2.79E-04	3.97E-03	1.61E-03	5.58E-03	2.36E+02	2.13E+01	2.58E+02
96-18-4	1,2,3-Trichloropropane	2.50E-07	4.51E-08	2.95E-07	4.21E-06	1.71E-06	5.92E-06	2.50E-01	2.25E-02	2.73E-01

Kast VOC Emissions Calculations

Street Trenching - Excavation

CAS #	Chemical	VOC Emission Rates								
		Active Area Emissions (lbs/hour)	Non-Active Area Emissions (lbs/hour)	Total Area Emissions (lbs/hour)	Active Area Emissions (lbs/day)	Non-Active Area Emissions (lbs/day)	Total Area Emissions (lbs/day)	Active Area Emissions (lbs/year)	Non-Active Area Emissions (lbs/year)	Total Area Emissions (lbs/year)
100-41-4	Ethylbenzene	5.06E-04	9.10E-05	5.97E-04	1.29E-03	5.21E-04	1.81E-03	5.82E+01	5.24E+00	6.34E+01
106-46-7	1,4-Dichlorobenzene	2.51E-07	4.52E-08	2.96E-07	6.42E-07	2.60E-07	9.02E-07	2.90E-02	2.61E-03	3.16E-02
107-06-2	1,2-Dichloroethane	4.95E-07	8.90E-08	5.84E-07	1.26E-06	5.09E-07	1.77E-06	5.68E-02	5.12E-03	6.20E-02
108-67-8	1,3,5-Trimethylbenzene	7.97E-05	1.44E-05	9.41E-05	2.05E-04	8.31E-05	2.88E-04	9.27E+00	8.35E-01	1.01E+01
108-88-3	Toluene	1.59E-04	2.86E-05	1.88E-04	4.05E-04	1.64E-04	5.68E-04	1.83E+01	1.65E+00	1.99E+01
127-18-4	Tetrachloroethene	2.53E-05	4.55E-06	2.98E-05	6.41E-05	2.60E-05	9.00E-05	2.90E+00	2.61E-01	3.16E+00
129-00-0	Pyrene	1.60E-07	2.88E-08	1.89E-07	1.06E-06	4.31E-07	1.50E-06	4.81E-02	4.33E-03	5.24E-02
1330-20-7	Xylenes, Total	7.51E-04	1.35E-04	8.86E-04	1.90E-03	7.71E-04	2.68E-03	8.61E+01	7.74E+00	9.38E+01
156-59-2	cis-1,2-Dichloroethene	8.73E-07	1.57E-07	1.03E-06	2.21E-06	8.97E-07	3.11E-06	1.00E-01	9.01E-03	1.09E-01
71-43-2	Benzene	2.95E-04	5.32E-05	3.48E-04	7.52E-04	3.04E-04	1.06E-03	3.40E+01	3.06E+00	3.70E+01
74-83-9	Bromomethane	1.23E-05	2.22E-06	1.45E-05	3.13E-05	1.27E-05	4.40E-05	1.41E+00	1.27E-01	1.54E+00
75-01-4	Vinyl Chloride	9.28E-07	1.67E-07	1.10E-06	2.35E-06	9.51E-07	3.30E-06	1.06E-01	9.55E-03	1.16E-01
75-09-2	Methylene Chloride	5.09E-06	9.17E-07	6.01E-06	1.30E-05	5.25E-06	1.82E-05	5.86E-01	5.27E-02	6.38E-01
75-27-4	Bromodichloromethane	1.38E-07	2.49E-08	1.63E-07	3.54E-07	1.44E-07	4.98E-07	1.60E-02	1.44E-03	1.75E-02
75-65-0	tert-Butyl Alcohol (TBA)	1.43E-06	2.57E-07	1.69E-06	3.69E-06	1.49E-06	5.19E-06	1.67E-01	1.50E-02	1.82E-01
78-87-5	1,2-Dichloropropane	4.56E-07	8.21E-08	5.38E-07	1.16E-06	4.69E-07	1.63E-06	5.23E-02	4.71E-03	5.70E-02
79-01-6	Trichloroethene	1.16E-06	2.09E-07	1.37E-06	2.95E-06	1.20E-06	4.15E-06	1.33E-01	1.20E-02	1.45E-01
79-34-5	1,1,2,2-Tetrachloroethane	1.70E-07	3.07E-08	2.01E-07	4.39E-07	1.78E-07	6.16E-07	1.98E-02	1.78E-03	2.16E-02
90-12-0	1-Methylnaphthalene	1.94E-04	3.49E-05	2.29E-04	8.09E-04	3.28E-04	1.14E-03	3.66E+01	3.29E+00	3.98E+01
91-20-3	Naphthalene	1.52E-03	2.73E-04	1.79E-03	3.84E-04	1.55E-04	5.39E-04	1.73E+01	1.56E+00	1.89E+01
91-57-6	2-Methylnaphthalene	2.97E-04	5.35E-05	3.51E-04	8.09E-04	3.28E-04	1.14E-03	3.66E+01	3.29E+00	3.98E+01
95-63-6	1,2,4-Trimethylbenzene	3.38E-04	6.08E-05	3.99E-04	8.65E-04	3.50E-04	1.22E-03	3.91E+01	3.52E+00	4.26E+01
96-18-4	1,2,3-Trichloropropane	3.58E-07	6.45E-08	4.23E-07	9.17E-07	3.71E-07	1.29E-06	4.14E-02	3.73E-03	4.52E-02

Summary of VOC Emissions (Expedited Case)

Sum of Value Row Labels	Column Labels lbs/day
1,1,2,2-Tetrachloroethane	1.94E-06
1,2,3-Trichloropropane	4.06E-06
1,2,4-Trimethylbenzene	3.83E-03
1,2-Dichloroethane	5.57E-06
1,2-Dichloropropane	5.13E-06
1,3,5-Trimethylbenzene	9.09E-04
1,4-Dichlorobenzene	2.85E-06
1-Methylnaphthalene	3.59E-03
2-Methylnaphthalene	3.59E-03
Benzene	3.33E-03
Bromodichloromethane	1.57E-06
Bromomethane	1.39E-04
cis-1,2-Dichloroethene	9.81E-06
Ethylbenzene	5.71E-03
Methylene Chloride	5.74E-05
Naphthalene	1.70E-03
Pyrene	4.72E-06
tert-Butyl Alcohol (TBA)	1.64E-05
Tetrachloroethene	2.84E-04
Toluene	1.79E-03
Trichloroethene	1.31E-05
Vinyl Chloride	1.04E-05
Xylenes, Total	8.44E-03
Grand Total	**3.34E-02**

Expedited Implementation Option Calculation Files – Peak Day

- Calculation Cover Sheet and Assumptions
- On-Site Haul Roads – Re-entrained Dust
- Fugitive Dust Emissions During Soil and Excavation and Handling
- Dust Emissions during Concrete Breaking
- On-Site Construction Equipment Emissions
- On-Site Road Emissions
- On-Site Road – Re-entrained Dust
- Off-Site Road Emissions
- Off-Site Road – Re-entrained Dust
- VOC Emissions

Calculation Delivery Cover Sheet

URS Santa Ana Air Quality Group

Date:	*10/10/2014*
Project:	Kast Remediation Project - Option 1 (Hard and Softscape Excavation) ***5 foot with 10 foot Excavation, 4 Houses at a Time, Phase Overlap***
Project number:	*49194119*
Requestor:	*PCR Consulting*
Project manager:	*Roy Patterson*
Air Quality originator:	*Irma Buenrostro*
Air Quality project lead:	*Shirley Pearson*
Air Quality internal reviewer:	*Shirley Pearson*
Date review completed:	*19-Sep-14*
Detail check internal reviewer:	*Irma Buenrostro*
Date review completed:	*10-Oct-14*
Brief description of analysis:	*Calculating emission rates of criteria pollutants and toxic air contaminates during excavating activities at the former Kast property. Calculations will be used to assess air quality impacts in the form of an Environmental Impact Report.*
Reference MXD:	S:\Shirley Pearson\!Kast\10 Oct 2014 Updates
Model used:	*AP-42 equations and assumptions were used.*

Version 10-10-14

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Kast Air Emissions Calculations

I. Project Phasing

				Hours/Task per House									
#	Equipment	Engine Type	HP	Demo	Excavation	SVE Well/Piping Instal	Subslab Vent Install	Backfill/Comp.	Slurry Backfill	Site Resto.	Total Hrs./ House	Houses	Total Hrs.
2	15,000 lbs Excavator	D	60	0	87	0	0	0		0	87	237	20,619
1	Dump Truck	D	450	4	45	0	0	69		0	118	237	27,966
2	Bobcat	D	22	12	87	4	4	69		0	176	237	41,712
1	Bucket Auger	D	65	0	30	0	0	0		0	30	237	7,110
1	6000 Watt Generato	G	10	2	45	1	1	0		2	51	237	12,087
1	Water Pump	G	5	6	45	0	0	69		0	120	237	28,440
1	Chain Saw	G	0.5	2	0	0	0	0		0	2	237	474
1	Small Compactor (W	G	3	0	0	0	0	69		0	69	237	16,353
1	Concrete Mix Truck	D	450	0	0	0	0	0	20	6	26	237	6,162
1	Concrete Pump	D	80	0	0	0	0	0	20	6	26	237	6,162
2	Pickup Truck	G	200										
1	Flatbed Truck	D	350										

				Street Work (Hours/day)		
#	Equipment	Engine Type	HP	Trenching/Pipe Installation	Street Grinding	Street Paving
1	Backhoe	D	350	1		
1	Compressor	G	49	1		
1	Generator	G	10	1		
1	Concrete Saw	D	13	1		
1	Vacuum Excavator	D	155	6		
1	Drill Rig	D	250	6		
1	Cold Plane Grinding	D	600		6	
1	Dump Truck	D	450		6	
1	Street Sweeper	G	200		6	
1	Paving Machine	D	150			6
1	Super 10 Dump Truc	D	450			6
1	Steam Roller	D	50			6
1	Street Sweeper	G	200			6
1	Steam Roller	D	50			6
1	Street Sweeper	G	200			6

II. General Assumptions

General Assumptions			
Parameter	**Value**	**Units**	**Reference**
Number of Homes Yards Excavated at a Time	4	Yards	Information provided by project staff
Number of Homes	237	Homes	Information provided by project staff
Hours of Operation	8	Hours	working hours 8AM - 3PM, from project description
Duration (phase overlap)	253	weeks	Information provided by project staff
Days of Operation per Week	5	days	Monday - Friday
Number of Holidays per Year	9	days	Based on URS' holiday schedule
Number of people at houses	15	people	Information provided.
Trenching/pipe installation	15	people	Information provided.
Air-vac borehole clearance	7	people	Information provided.
Drilling and SVE well install	10	people	Information provided.
Number of people during street grinding	10	people	Information provided
Number of people during street paving	12	people	Information provided
Worker trips for various reasons	42	trips	Assumed value (e.g., shuttling workers to site, workers going to lunch, mgt. going to and from site)
Mitigation (% Reduction)	84%	%	WARP Fugitive Dust Handbook, September 2006, Table 3-7. Apply water every 1 hour: 74% control per MRI, April 2001, test series 701. Apply dust suppressant: 84% control per CARB April 2002; for actively disturbed areas
U (mean wind speed)	1.88	m/s	Based on mean wind speed met data from the SCAQMD Long Beach Station from 2006 to 2011.
U (mean wind speed)	4.21	mph	Based on mean wind speed met data from the SCAQMD Long Beach Station from 2006 to 2011.
s (silt content) - Overburden	6.9	%	AP-42, Chapter 11.9, Table 11.9-3. Bulldozer Overburden Silt Content.
s (silt content) - Paved road	3.4	%	AP-42, Chapter 13.2.1.1, Table 13.2.1-3
M (material moisture content)	7.9	%	AP-42 Chapter 11.9-9. Table 11.9-3. Overburden default value.
Silt Content Range	0.44-19	%	AP-42, Chapter 13.2.4, Page 4. Assumed range. No adjustments required.
Soil Density	3,400	lbs/cy	Information provided by project staff
Density of Asphalt	3,915	lbs/cy	Information provided by project staff
Density of Asphalt	1.95	Tons/cy	Information provided by project staff
Typical Density of Concrete	150	lbs/cf	Information provided by project staff
Typical Density of Concrete	2.01	ton/cy	Information provided by project staff

Kast Air Emissions Calculations

Max Depth of Excavation at Residential Homes	10	ft	Information provided by project staff
Concrete Removed per House	35	cy	Information provided by project staff. 1,675 SF and 6 inches thick concrete slab.
Concrete Removed per Day during Street Trenching	810	cy	Information provided by project staff. Assumed 100 feet of trench per day, trench would be 5 feet in width and asphalt is 6 inches thick.
Debris Disposal Haul Route Total Length, One Way	30	miles	Google maps, address destination 12017 Greenstone, Santa Fe Springs, CA 90670
Offsite Disposal Route total Length, One Way	100	miles	Google maps, address destination 12328 Hibiscus Rd, Adelanto
Backfill Import Route Total Length, One Way	4	miles	Google maps, address destination 26311 Palos Verdes Dr. East, Rolling Hilles Estates, CA 90274
Concrete Batch Plant Route Total Length, One Way	10	miles	Google maps, address destination 2521 E. Artesia Blvd., Long Beach, CA 90805
Plastic Pipe Company, Chino, CA, One Way	50	miles	Google maps, destination Chino, CA
All American Asphalt, Corona, CA, One Way	50	miles	Google maps, destination Corona, CA
Green Waste Disposal, One Way	5	Miles	Google maps, 321 Francisco Street, Carson, CA
Distance of project within South Coast Air Basin	75	miles	Based on informational maps obtained from CARB and distance estimate from Google maps.
Distance of project activities within Mojave Desert Distance	25	miles	Based on furthest trip outside of SCAB/within MDAB, informational maps obtained from CARB, and distance estimate from Google maps.
Average On-Site Haul Route Distance	1,900	feet	Measured distance from the furthest northern and southern homes in the community.
Employee/Worker Trip Distance	21.6	miles	CalEEMod Default Construction Worker Trip (Round Trip)
Passenger Vehicle Trips	9	trips	Visitor trips/traffic adjustment provided by project staff
Street Grinding and Paving Worker trips for various reasons	16	trips	Assumed value (e.g., shuttling workers to site, workers going to lunch, mgt. going to and from site)

III. Cubic Yard and Trip Estimates

Cubic Yard and Trip Estimates during Yard Excavation

Parameter	Option 1 - Hard&Softscape Value	Units
Duration	253	weeks (Phase Overlap)
Work Hours	8	hours
Total Work Days - 8 Homes	42	days
Total Work Days - 202 Homes	1,256	days
Total Work Days in Year	251	days
Total Houses	237	homes
Number of Homes at a time	4	homes
Total Volume Soil - 202 Homes	177,000	cy
Passenger Vehicle Trips	9	trips/day
Demo	11,599	cy
Excavation	177,000	cy
Subslab Vent	0	cy
Backfill/Compact	148,700	cy
Slurry Backfill	28,300	cy
Site Resto.	8,295	cy
Concrete Removed per Home	35	CY
Total Loads -Debris Disposal	971	loads
Total Loads -Debris Disposal (green waste only)	237	loads
Total Loads -Offsite Disposal	12,643	loads
Total Loads -Backfill Import	12,764	loads
Total Loads -Concrete Batch Plant	4,057	loads
Slurry Backfill	1,556	loads
Site Resto.	884	loads
Total Loads -Flatbed Truck	474	loads
Total Loads -Pipe Delivery	40	loads
Demo	12	cy/load
Excavation	14	cy/load
SVE Well/Piping	0	cy/load
Subslab Vent	0	cy/load
Backfill/Compact	12	cy/load
Slurry Backfill	18	cy/load
Site Resto.	0	cy/load

Note: All loads and CY loads are assumed to remain the same as Base case, only the trips are expedited.

Kast Air Emissions Calculations

Option 1 Phase	Duration to Complete One Home (days)	Phase Duration (days)	Round Trips Hourly	Daily	8 Home Clusters	Annually	Project
Demo - Truck Trips	2	119	2.40	19	307	2,275	2,275
Green Waste - Truck Trips	1	59	0.50	4	32	237	237
Excavation - Truck Trips	15	889	4.34	35	4,167	8,230	30,862
SVE Well/Piping - Truck Trips	1	59	0.33	3	21	158	158
Subslab Vent - Truck Trips	1	59	0.00	0	0	0	0
Backfill/Compact - Truck Trips	12	711	4.52	36	3,472	8,570	25,711
Slurry Backfill - Truck Trips	7	415	1.34	11	602	2,548	4,459
Site Resto. - Truck Trips	10	593	1.04	8	663	1,965	4,913
Worker Trips	49	1,256	5.25	42	16,464	10,542	52,752
Passenger Vehicle Trips	1	1,256	1.13	9	0	2,259	11,304

Option 1 Phase	Cubic Yard (CY) of Soil/Material Moved Hourly	Daily	8 Home Clusters	Annually	Project
Demo	29	229	3,669	27,170	27,170
Excavation	7	486	58,338	115,218	432,068
SVE Well/Piping[1]	0	0	0	0	0
Subslab Vent[1]	0	0	0	0	0
Backfill/Compact	53	421	40,443	99,844	299,532
Slurry Backfill	24	196	10,951	46,345	81,103
Site Resto.[1]	0	0	0	0	0

Note: 1 - No soil excavation associated with SVE Well/Piping, Subslab Vent or Site Restoration phases

Cubic Yard and Trip Estimates during Street Trenching/Pipe Installation

Parameter	Street Trenching Value	Units
Duration	36	weeks
Work Hours	8	hours
Total Work Days	180	days
Total Work Days in Year	251	days
Trenching per day	100	feet
Linear feet of trenching	8,715	feet
Total Volume Soil	8,100	cy
Total Volume of Asphalt	810	cy
Demo	810	cy
Excavation	8,100	cy
Slurry Backfill	5,000	cy
Restoration	1,100	cy
Total Loads -Debris Disposal	70	loads
Total Loads -Offsite Disposal	600	loads
Total Loads -Backfill Import	0	loads
Total Loads -Concrete Batch Plant	556	loads
Pipe Delivery	180	loads
Total Loads - Restoration	95	loads
Demo - Asphalt	12	cy/load
Excavation	14	cy/load
Slurry Backfill	9	cy/load
Restoration - Asphalt	12	cy/load

Note: All loads and CY (highlighted yellow) are assumed to remain the same as Base case, only the trips are expedited.

Street Trenching	Round Trips			
Phase	Hourly	Daily	Annually	Project
Demo - Truck Trips	0.31	2.5	448	448
Excavation - Truck Trips	1.0	7.6	1,374	1,374
Slurry Backfill - Truck Trips	0.9	7.6	1,366	1,366
Restoration - Truck Trips	0.3	2.5	455	455
Pipe Delivery - Truck Trips	0.3	2.5	450	450
Worker Trips	7.1	57	10,260	10,260

Street Trenching	Cubic Yard (CY) of Soil/Material			
Phase	Hourly	Daily	Annually	Project
Demo	4	29	5,184	5,184
Excavation	13	103	18,549	18,549
Slurry Backfill	9	68	12,284	12,284
Restoration	4	29	5,268	5,268

Cubic Yard and Trip Estimates during Well Installation

Parameter	Street Trenching Value	Units
Work Hours	8	hours
Total Work Days	63	days
Total Work Days in Year	63	days
Total round trips to Wilmington soil storage area	126	Trips
Total trips from Wilmington soil storage area to	10	Trips
Waste Collection	12	cy/load

Note: All loads and CY (highlighted yellow) are assumed to remain the same as Base case, only the trips are expedited.

Well Installation Phase	Round Trips Hourly	Daily	Annually	Project
Air Vac- Borehole Clearance - Truck Trips	0.31	2.5	158	158
Drilling and SVE Well Installation - Truck Trips	0.31	2.5	158	158
Waste Collection - Truck Trips	0.63	5	315	315
Waste Transport to Offsite Disposal - Truck Trips	0.31	2.5	155	155
Worker Trips	7.38	59	3,717	3,717

Well Installation Phase	Cubic Yard (CY) of Soil/Material Hourly	Daily	Annually	Project
Air Vac- Borehole Clearance	0	0	0	0
Drilling and SVE Well Installation	0	0	0	0
Waste Collection	8	60	3,780	3,780
Waste Transport to Offsite Disposal	3.7	30	1,859	1,859

Note: All loads and CY are assumed to remain the same as Base case, only the trips are expedited.

Cubic Yard and Trip Estimates during Street Paving

Parameter	Street Grinding Value	Units	Street Paving Value	Units
Duration	5	days	10	days
Work Hours	6	hours	6	hours
Trucks per day	14	Dump Trucks	7	Dump Trucks
Total Mass of Asphalt	2,000	tons	2,000	tons
Total Volume of Asphalt	1,025	cy	1,025	cy
Total Loads -Debris Disposal	80	loads	0	loads
Total Loads - Asphalt Delivery	0	loads	80	loads
Cubic Yard per Load	12	cy/load	12	cy/load

Street Paving	Round Trips			
Phase	Hourly	Daily	Annually	Project
Street Grinding - Truck Trips	3	16	80	80
Street Paving - Truck Trips	1	8	80	80
Worker Trips - Grinding	3	16	80	80
Worker Trips - Paving	3	16	160	160

Street Paving	Cubic Yard (CY) of Soil/Material			
Phase	Hourly	Daily	Annually	Project
Street Grinding	32	192	960	960
Street Paving	16	96	960	960

Note: *It is assumed that the Peak emissions will occur during the Excavation/Street Trenching, and Well installation due to higher base case emissions.*

IV. On-Site Haul Roads - Re-entrained Dust

Summary: This section calculates the dust emissions (PM2.5, PM10) from the on-site haul roads at the residential homes. The on-site haul roads consist of off-road equipment transporting soil to-and-from the dump truck.

$$E = k(s/12)^a(W/3)^b$$

Where:
E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
M = surface material moisture content (%)
S = mean vehicle speed (mph)
a = empirical constant
b = empirical constant
k = empirical constant
Source: AP-42 13.2.2-4, Equation (1a)

Assumptions Parameters	Value	Unites	Notes
s (silt content)	6.4	%	Western Governors' Association, Western Regional Air Partnership (WRAP) Fugitive Dust Handbook, Table 6-2. Average silt content for gravel/crushed limestone road surface material.
W (vehicle weight)	18,000	lbs	Weight of excavator
a (empirical constant)	0.9	-	AP-42, Chapter 13.2.2, Table 13.2.2-2. Industrial Roads (PM10 and PM2.5)
b (empirical constant)	0.45	-	AP-42, Chapter 13.2.2, Table 13.2.2-2. Industrial Roads (PM10 and PM2.5)
k (empirical constant) - PM10	1.5	-	AP-42, Chapter 13.2.2, Table 13.2.2-2. Industrial Roads (PM10)
k (empirical constant) - PM2.5	0.15	-	AP-42, Chapter 13.2.2, Table 13.2.2-2. Industrial Roads (PM2.5)
Shovel Load (soil) Bobcat	1.25	cy	volume of soil a bucket can hold, http://www.bobcat.com/attachments/bucket_loader_general
Shovel Load (soil) Excavator	1.75	cy	volume of soil a bucket can hold
Weight of a bobcat	3.11	tons	Based on spec information from a S185 Skide-Steer Loader, http://www.bobcat.com/loaders/models/skidsteer/s185
Mitigation (% Reduction)	84%	%	Apply dust suppressants on inactive areas. SCAQMD mitigation measures examples. Table X1-A.
Haul Route length	200	ft	Assumed distance soil would have to be hauled on each property

Option 1 Phases	Hourly Round Trips	Daily Round Trips	8 Home Clusters	Annual Round Trips	Equipment Type	Average Vehicle Weight (tons)	Round Trip length (SCAB)	Hourly VMT	Daily VMT	8 Home Clusters VMT	Annual VMT
Demo	2.4	19	307	2,275	Bobcat	3.11	0.08	0.18	5.82	23	172
Excavation	4.3	35	33,336	65,839	Excavator	9	0.08	0.33	10.52	2,525	4,988
SVE Well/Piping	0.3	3	0	0	0	0	0	0	0.00	0	0
Subslab Vent	0.0	0	0	0	0	0	0	0	0.00	0	0
Backfill/Compact	4.5	36	23,110	57,054	Excavator	9	0.08	0.34	10.96	1,751	4,322
Site Resto.	0.0	8	0	0	0	0	0	0	0.00	0	0

Emission Calculation

Daily:

Option 1 Phases	Daily VMT (SCAB)	W (tons)	k (PM10)	k (PM2.5)	Mitigation %	PM10 EF (lbs/mi.)	PM2.5 EF (lbs/mi.)	PM10 Emissions (lbs/day)	PM2.5 Emissions (lbs/day)
Demo	5.8	3.11	1.5	0.15	84%	0.87	0.09	0.81	0.08
Excavation	10.5	9	1.5	0.15	84%	1.40	0.14	2.35	0.24
SVE Well/Piping	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	11.0	9	1.5	0.15	84%	1.40	0.14	2.45	0.24
Site Resto.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

V. Fugitive Dust Emissions During Soil Excavation and Handling

Summary: This section calculates the dust emissions (PM2.5, PM10) from the on-site soil handling and excavation at the residential homes and during street trenching. The on-site soil handing and excavation consists of two parts: 1) Excavating soil 2)Dropping soil

$$E = k(0.0032)\frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \text{ (pound [lb]/ton)}$$

Where:

E = emission factor
k = particle size multiplier (dimensionless)
U = mean wind speed, meters per second (m/s) (miles per hour [mph])
M = material moisture content (%)

Source: AP-42 13.2.4-3, Equation (1)

Assumptions Equation parameters	Value	Units	Notes
k - PM10	0.35	-	AP-42, Chapter 13.2.4, Page 4. Nov 2006
k - PM2.5	0.053	-	AP-42, Chapter 13.2.4, Page 4. Nov 2006
U	4.21	mph	Average wind speed
M	7.9	%	AP-42 Chapter 11.9-9. Table 11.9-3. Overburden default value.
Soil Density	3,400	lbs/CY	Information provided by project staff
Mitigation (% Reduction) - Watering	84%	%	WARP Fugitive Dust Handbook, September 2006, Table 3-7. Apply water every 1 hour: 74% control per MRI, April 2001, test series 701.
Times Soil is Handled	2	time	Apply dust suppressant: 84% control per CARB April 2002: for 1) Excavating soil 2) Dropping soil

Emission Calculation (PM10)

Daily Dust Emissions During Soil Excavation and Handling Phase	Daily CY	Daily (tons)	k (PM10)	U (mph)	M%	EF (lbs/ton)	Mitigation (%)	PM10 Emissions (lbs/day)
Option 1								
Demo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavation	486	826.5	0.35	4.20556	7.9	1.31E-04	84%	3.46E-02
SVE Well/Piping	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	421	716.2	0.35	4.20556	7.9	1.31E-04	84%	3.00E-02
Slurry Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Site Resto.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Trenching								
Demo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavation	103	175.2	0.35	4.20556	7.9	1.31E-04	84%	7.33E-03
Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Restoration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Emission Calculation (PM2.5)

Daily Dust Emissions During Soil Excavation and Handling								
Phase	**Daily CY**	**Hourly (tons)**	**k (PM2.5)**	**U (mph)**	**M%**	**EF (lbs/ton)**	**Mitigation (%)**	**PM2.5 Emissions (lbs/day)**
Option 1								
Demo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavation	486	826.5	0.053	4.21	7.9	1.98E-05	84%	5.23E-03
SVE Well/Piping	0	0	0.00	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	421	716.2	0.053	4.21	7.9	1.98E-05	84%	4.54E-03
Slurry Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Site Resto.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Trenching								
Demo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavation	103	175.2	0.053	4.21	7.9	1.98E-05	84%	1.11E-03
Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Restoration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

VI. Dust Emissions during Concrete Breaking

Summary: This section calculates the dust emissions (PM2.5, PM10) during on-site concrete breaking at residential homes, street trenching and street paving. The on-site dust emissions from concrete breaking consists of two parts: 1) Mechanical dismemberment and 2) Debris loading

Mechanical Dismemberment Equations

$$EF_D = k \times (0.0032) \times \frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

U = Mean wind speed

M = material moisture content (%). The moisture contents of different materials are listed in Table 13.2.4-1 of AP 42. The program uses the moisture content of cover (12%) as default.

Where:

EF_D = emission factor (lb PM/ton of debris)

$EF_{D\text{-}PM10}$ = 0.0011 lb PM_{10}/ton of debris

$EF_{D\text{-}PM2.5}$ = 0.00017 lb $PM_{2.5}$/ton of debris

k = particle size multiplier. The AP-42 default value for PM_{10} is 0.35 and that for $PM_{2.5}$ is 0.053.

Source: CalEEMod, Appendix A, Page 11

$$E_D = EF_D \times W$$

Where:

E_D = emissions (lb of PM)

EF_D = emission factor (lb of PM/ton of debris)

W = building waste (ton of debris)

Source: CalEEMod, Appendix A, Page 12

Assumptions Equation parameters	Value	Units	Notes
Mean wind speed (U)	4.21	mph	Based on mean wind speed met data from the SCAQMD Long Beach Station from 2006 to 2011.
M (material moisture content)	7.9	%	AP-42 Chapter 11.9-9. Table 11.9-3. Overburden default value.
Typical Density of Concrete	150	lbs/ft^3	Information provided by project staff
Mitigation (% Reduction) - Watering	84%	%	WARP Fugitive Dust Handbook, September 2006, Table 3-7. Apply water every 1 hour: 74% control per MRI, April 2001, test

Phase	Hourly Weight of Concrete (tons)	Daily Weight of Concrete (tons)	Weight of Concrete per 8 Home Cluster (tons)	Annual Weight of Concrete (tons)	Total Weight of Concrete (tons)
Option 1					
Demo	58	461	7,374	54,611	54,611
Excavation	0.00	0.00	0.00	0.00	0.00
SVE Well/Piping	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	0.00	0.00	0.00	0.00	0.00
Slurry Backfill	0.00	0.00	0.00	0.00	0.00
Site Resto.	0.00	0.00	0.00	0.00	0.00
Street Trenching					
Demo	7	56	0.00	10,109	10,109
Excavation	0.00	0.00	0.00	0.00	0.00
Backfill	0.00	0.00	0.00	0.00	0.00
Restoration	0.00	0.00	0.00	0.00	0.00
Street Paving					
Street Grinding	62	374	0.00	1,872	1,872

Mechanical Dismemberment Emissions Calculations

Concrete Breaking Emissions - Daily

Phase	Particle Size Multiplier for PM10 (k)	Particle Size Multiplier for PM2.5 (k)	Emission Factor PM10 (lb PM/Ton of Concrete)	Emission Factor for PM2.5 (lb PM/Ton of Concrete)	Mitigation (%)	Concrete Breaking Emissions for PM10 (lbs of PM10)	Concrete Breaking Emissions PM2.5 (lbs of PM2.5)
Option 1							
Demo	0.35	0.053	1.31E-04	1.98E-05	84%	9.64E-03	1.46E-03
Excavation	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SVE Well/Piping	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Slurry Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Site Resto.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Trenching							
Demo	0.35	0.053	1.31E-04	1.98E-05	84%	1.17E-03	1.78E-04
Excavation	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Restoration	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Paving							
Street Grinding	0.35	0.053	1.31E-04	1.98E-05	84%	7.83E-03	1.19E-03

Debris Loading Equations

$$EF_L = k \times EF_{L\text{-}TSP}$$

Where:

EF_L = emission factor (lb/ton)

k = particle size multiplier. The AP-42 default value for PM_{10} is 0.35 and that for $PM_{2.5}$ is 0.053.

Source: CalEEMod, Appendix A, Page 12

The default value for $EF_{L\text{-}TSP}$ is 0.058 lb/ton, the average of the two TSP factor (i.e. 0.053 and 0.063 lb/ton) measured from two tests of the filling of trucks with crushed limestone using a front-end loader.

Source: CalEEMod, Appendix A, Page 13

$$E_D = EF_D \times W$$

Where:

E_D = emissions (lb of PM)

EF_D = emission factor (lb of PM/ton of debris)

W = building waste (ton of debris)

Source: CalEEMod, Appendix A, Page 12

Assumptions Equation parameters	Value	Units	Notes
Emission Factor for Total Suspended Particulates (TSP)	0.058	lb/ton	CalEEMod, Appendix A, Page 13

Debris Loading Emissions Calculations

Concrete Debris Loading - Daily Phase	Particle Size Multiplier for PM10 (k)	Particle Size Multiplier for PM2.5 (k)	Emission Factor PM10 (lb PM/Ton of Concrete)	Emission Factor for PM2.5 (lb PM/Ton of Concrete)	Mitigation (%)	Concrete Breaking Emissions for PM10 (lbs of PM10)	Concrete Breaking Emissions PM2.5 (lbs of PM2.5)
Option 1							
Demo	0.35	0.053	0.0203	0.003074	84%	1.50E+00	2.27E-01
Excavation	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SVE Well/Piping	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Slurry Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Site Resto.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Trenching							
Demo	0.35	0.053	0.0203	0.003074	84%	1.82E-01	2.76E-02
Excavation	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Restoration	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street Paving							
Street Grinding	0.35	0.053	0.0203	0.003074	84%	1.22E+00	1.84E-01

Total Concrete Breaking Emissions (Mechanical Dismemberment + Debris Loading)

Total Concrete Breaking Emissions - Daily		
Phase	**Concrete Breaking Emissions for PM10 (lbs of PM10)**	**Concrete Breaking Emissions PM2.5 (lbs of PM2.5)**
Option 1		
Demo	1.51E+00	2.28E-01
Excavation	0.00	0.00
SVE Well/Piping	0.00	0.00
Subslab Vent	0.00	0.00
Backfill/Compact	0.00	0.00
Slurry Backfill	0.00	0.00
Site Resto.	0.00	0.00
Street Trenching		
Demo	1.84E-01	2.78E-02
Excavation	0.00	0.00
Backfill	0.00	0.00
Restoration	0.00	0.00
Street Paving		
Street Grinding	1.22E+00	1.85E-01
Total	2.91E+00	4.41E-01

VII. On-Site Construction Equipment Emissions

Summary: This section calculates the emissions of criteria pollutants from off-road equipment.

Emission Equation

Emission (Off-road Construction Equipment) = E x bhp-hr

Where:

E = size-specific emission factor (g/bhp-hr)

Source:

EMFAC2011

Assumptions	Value	Value	Units	Notes
Equipment Engine Tier		3	-	Refers to EPA emission standards (Tier 1-4) for Off-road equipment

Off-road Engine Emission Ratings

USEPA TABLE I - EPA Tier 1-3 Nonroad Diesel Engine Emission Standards (g/bhp-hr)

Engine Power		Tier	CO
(25 ≤ hp < 50)	50	1	4.9
(25 ≤ hp < 50)	50	2	4.9
(50 ≤ hp < 100)	100	1	-
(50 ≤ hp < 100)	100	2	3.7
(50 ≤ hp < 100)	100	3	3.7
(100 ≤ hp < 175)	175	1	-
(100 ≤ hp < 175)	175	2	3.7
(100 ≤ hp < 175)	175	3	3.7
(175 ≤ hp < 300)	300	1	8.5
(175 ≤ hp < 300)	300	2	2.6
(175 ≤ hp < 300)	300	3	2.6
(300 ≤ hp < 600)	600	1	8.5
(300 ≤ hp < 600)	600	2	2.6
(300 ≤ hp < 600)	600	3	2.6

Tiers 1, 2,3 &4 Off-Road Engine Emission Standards

HP Range	Tier	Nox	ROG	PM
75 - 99	1	6.9	1.19	0.552
100 - 174	1	6.9	0.82	0.304
175 - 299	1	6.9	1	0.4
300 - 600	1	6.9	1	0.4
75 - 99	2	5.32	0.28	0.3
100 - 174	2	4.655	0.245	0.22
175 - 299	2	4.655	0.245	0.15
300 - 600	2	4.56	0.24	0.15
75 - 99	3	3.325	0.175	0.3
100 - 174	3	2.85	0.15	0.22
175 - 299	3	2.85	0.15	0.15
300 - 600	3	2.85	0.15	0.15
75 - 99	4	2.5	0.14	0.015
100 - 174	4	2.5	0.14	0.015
175 - 299	4	1.5	0.14	0.015
300 - 600	4	1.5	0.14	0.015

Note: Based on SCAQMD Table II-B Tiers 1, 2,3 &4 Off-Road Engine Emission Standards

Table 3.3 OFFROAD Default Horsepower and Load Factors

OFFROAD Equipment Type	Horsepower	Load Factor
Aerial Lifts	63	0.31
Air Compressors	78	0.48
Bore/Drill Rigs	206	0.50
Cement and Mortar Mixers	9	0.56
Concrete/Industrial Saws	81	0.73
Cranes	226	0.29
Crawler Tractors	208	0.43
Crushing/Proc. Equipment	85	0.78
Dumpers/Tenders	16	0.38
Excavators	163	0.38
Forklifts	89	0.20
Generator Sets	84	0.74
Graders	175	0.41
Off-Highway Tractors	123	0.44
Off-Highway Trucks	400	0.38
Other Construction Equipment	172	0.42
Other General Industrial Equipment	88	0.34
Other Material Handling Equipment	167	0.40
Pavers	126	0.42
Paving Equipment	131	0.36
Plate Compactors	8	0.43
Pressure Washers	13	0.30
Pumps	84	0.74
Rollers	81	0.38
Rough Terrain Forklifts	100	0.40
Rubber Tired Dozers	255	0.40
Rubber Tired Loaders	200	0.36
Scrapers	362	0.48
Signal Boards	6	0.82
Skid Steer Loaders	65	0.37
Surfacing Equipment	254	0.30
Sweepers/Scrubbers	64	0.46
Tractors/Loaders/Backhoes	98	0.37
Trenchers	81	0.50
Welders	46	0.45

Notes:

1. Based on the weighted average horsepower (by equipment population) and load factors for the mode of the engine groupings in 2011 OFFROAD

Equipment List by Phase																			Emissions Factors (g/bhp-hr)
Phase	Phase Duration (days)	Hours per Day	Equipment	HP/Size	CalEEMod Category	Load Factor[1]	Output (bhp-hour)	Output (bhp-day)	Engine Size Class	Engine Size Class (CO)	Engine Tier	ROG	CO	NOx	CO2 [2]	PM10	PM2.5	SOx [2]
Option 1																			
Demolition	119	8	Bobcat (Bobcat S510)	22	Tractors/Loaders/ Backhoes	0.57	12.54	100.32	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Demolition	119	2	6000 Watt Generator	10	Generator Sets	0.74	7.4	14.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Demolition	119	2	Chain Saw	0.5	Concrete/Industrial Saws	0.73	0.365	0.73	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Demolition	119	8	Water Pump	5	Pumps	0.74	3.7	29.6	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Excavation	889	8	18,000 lbs Excavator (Kubota KX80-4)	70	Excavator	0.38	26.6	212.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Excavation	889	8	Bobcat (Bobcat S510)	22	Tractors/Loaders/ Backhoes	0.37	8.14	65.12	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Excavation	889	2	6000 Watt Generator	10	Generator Sets	0.74	7.4	14.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Excavation	889	8	Water Pump	5	Pumps	0.74	3.7	29.6	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
SVE Well Installation	59	4	Bobcat with Auger (Bobcat S510)	22	Tractors/Loaders/ Backhoes	0.37	8.14	32.56	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
SVE Well Installation	59	1	6000 Watt Generator	10	Generator Sets	0.74	7.4	7.4	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Subslab Vent Installation	59	4	Bobcat with Auger (Bobcat S510)	22	Tractors/Loaders/ Backhoes	0.37	8.14	32.56	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Subslab Vent Installation	59	1	6000 Watt Generator	10	Generator Sets	0.38	3.8	3.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Backfill and Compaction	415	8	Bobcat (Bobcat S510)	22	Tractors/Loaders/ Backhoes	0.37	8.14	65.12	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Backfill and Compaction	593	4	Small Compactor (Wacker)	3	Plate compactors	0.43	1.29	5.16	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Backfill and Compaction	1256	4	Water Pump	5	Pumps	0.74	3.7	14.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Slurry Backfill	415	8	Concrete Pump	2	Pumps	0.74	1.48	11.84	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Site Restoration	593	1	6000 Watt Generator	10	Generator Sets	0.74	7.4	7.4	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Site Restoration	593	2	Concrete Pump	2	Pumps	0.74	1.48	2.96	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Street Trenching																			
Street Trenching/Pipe installation	180	8	Backhoe	100	Tractors/Loaders/ Backhoes	0.57	57	456	100-174	100<hp<175	3	0.15	3.7	2.85	568.3	0.3	0.3	0.0050
Street Trenching/Pipe installation	180	8	Compressor	49	Generator Sets	0.74	36.26	290.08	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Street Trenching/Pipe installation	180	2	Generator	10	Generator Sets	0.74	7.4	14.8	75-99	50<hp<100	3	0.175	4.9	3.325	568.3	0.3	0.3	0.0050
Street Trenching/Pipe installation	180	1	Concrete Saw	48	Concrete/Industrial Saws	0.73	35.04	35.04	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Well Installation																			
Drilling and SVE Well Installation	63	8	Drill Rig	155	Bore/Drill Rigs	0.5	77.5	620	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Street Paving																			
Street - Grinding	5	8	Cold Plane Grinding Machine	600	Scrapers	0.48	288	2304	300-600	300<hp<600	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Street - Grinding	5	8	Street Sweeper	200	Crawler Tractors	0.5	100	800	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Street - Paving	10	8	Paving Machine	150	Other Construction Equipment	0.42	63	504	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Street - Paving	10	8	Steam Roller	50	Rollers	0.38	19	152	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050
Street - Paving	10	8	Street Sweeper	200	Crawler Tractors	0.5	100	800	175-299	175<hp<300	3	0.15	2.6	2.85	568.3	0.3	0.3	0.0050

1 - Load Factor obtained from CalEEMod Appendix D Defaults

2- Emission factors for CO2 and Sox were obtained from Table 3.4, Off-road Equipment Emission Factors, CalEEMod Appendix D Default Data Tables.

Off-Road Emissions Calculations		Daily Emissions (lb)						
Phase	Equipment	ROG	CO	NOx	CO2	PM10	PM2.5	SOx
Option 1								
Demolition	Bobcat (Bobcat S510)	3.9E-02	1.1E+00	7.4E-01	1.3E+02	6.6E-02	6.6E-02	1.1E-03
Demolition	6000 Watt Generator	5.7E-03	1.6E-01	1.1E-01	1.9E+01	9.8E-03	9.8E-03	1.6E-04
Demolition	Chain Saw	2.8E-04	7.9E-03	5.4E-03	9.1E-01	4.8E-04	4.8E-04	8.0E-06
Demolition	Water Pump	1.1E-02	3.2E-01	2.2E-01	3.7E+01	2.0E-02	2.0E-02	3.3E-04
Excavation	18,000 lbs Excavator (Kubota KX80-4)	8.2E-02	2.3E+00	1.6E+00	2.7E+02	1.4E-01	1.4E-01	2.3E-03
Excavation	Bobcat (Bobcat S510)	2.5E-02	7.0E-01	4.8E-01	8.2E+01	4.3E-02	4.3E-02	7.2E-04
Excavation	6000 Watt Generator	5.7E-03	1.6E-01	1.1E-01	1.9E+01	9.8E-03	9.8E-03	1.6E-04
Excavation	Water Pump	1.1E-02	3.2E-01	2.2E-01	3.7E+01	2.0E-02	2.0E-02	3.3E-04
SVE Well Installation	Bobcat with Auger (Bobcat S510)	1.3E-02	3.5E-01	2.4E-01	4.1E+01	2.2E-02	2.2E-02	3.6E-04
SVE Well Installation	6000 Watt Generator	2.9E-03	8.0E-02	5.4E-02	9.3E+00	4.9E-03	4.9E-03	8.2E-05
Subslab Vent Installation	Bobcat with Auger (Bobcat S510)	1.3E-02	3.5E-01	2.4E-01	4.1E+01	2.2E-02	2.2E-02	3.6E-04
Subslab Vent Installation	6000 Watt Generator	1.5E-03	4.1E-02	2.8E-02	4.8E+00	2.5E-03	2.5E-03	4.2E-05
Backfill and Compaction	Bobcat (Bobcat S510)	2.5E-02	7.0E-01	4.8E-01	8.2E+01	4.3E-02	4.3E-02	7.2E-04
Backfill and Compaction	Small Compactor (Wacker)	2.0E-03	5.6E-02	3.8E-02	6.5E+00	3.4E-03	3.4E-03	5.7E-05
Backfill and Compaction	Water Pump	5.7E-03	1.6E-01	1.1E-01	1.9E+01	9.8E-03	9.8E-03	1.6E-04
Slurry Backfill	Concrete Pump	4.6E-03	1.3E-01	8.7E-02	1.5E+01	7.8E-03	7.8E-03	1.3E-04
Site Restoration	6000 Watt Generator	2.9E-03	8.0E-02	5.4E-02	9.3E+00	4.9E-03	4.9E-03	8.2E-05
Site Restoration	Concrete Pump	1.1E-03	3.2E-02	2.2E-02	3.7E+00	2.0E-03	2.0E-03	3.3E-05
Street Trenching								
Street Trenching/Pipe installation	Backhoe	1.5E-01	3.7E+00	2.9E+00	5.7E+02	3.0E-01	3.0E-01	5.0E-03
Street Trenching/Pipe installation	Compressor	1.1E-01	3.1E+00	2.1E+00	3.6E+02	1.9E-01	1.9E-01	3.2E-03
Street Trenching/Pipe installation	Generator	5.7E-03	1.6E-01	1.1E-01	1.9E+01	9.8E-03	9.8E-03	1.6E-04
Street Trenching/Pipe installation	Concrete Saw	1.2E-02	2.0E-01	2.2E-01	4.4E+01	2.3E-02	2.3E-02	3.9E-04
Well Installation								
Drilling and SVE Well Installation	Drill Rig	2.1E-01	3.6E+00	3.9E+00	7.8E+02	4.1E-01	4.1E-01	6.8E-03
Street Paving								
Street - Grinding	Cold Plane Grinding Machine	7.6E-01	1.3E+01	1.4E+01	2.9E+03	1.5E+00	1.5E+00	2.5E-02
Street - Grinding	Street Sweeper	2.6E-01	4.6E+00	5.0E+00	1.0E+03	5.3E-01	5.3E-01	8.8E-03
Street - Paving	Paving Machine	1.7E-01	2.9E+00	3.2E+00	6.3E+02	3.3E-01	3.3E-01	5.6E-03
Street - Paving	Steam Roller	5.0E-02	8.7E-01	9.6E-01	1.9E+02	1.0E-01	1.0E-01	1.7E-03
Street - Paving	Street Sweeper	2.6E-01	4.6E+00	5.0E+00	1.0E+03	5.3E-01	5.3E-01	8.8E-03

Off-Road Emissions Calculations	Daily Emissions (lb)						
Phase	ROG	CO	NOx	CO2	PM10	PM2.5	SOx
Option 1							
Demolition	5.6E-02	1.6E+00	1.1E+00	1.8E+02	9.6E-02	9.6E-02	1.6E-03
Excavation	1.2E-01	3.5E+00	2.4E+00	4.0E+02	2.1E-01	2.1E-01	3.6E-03
SVE Well/Piping	1.5E-02	4.3E-01	2.9E-01	5.0E+01	2.6E-02	2.6E-02	4.4E-04
Subslab Vent Installation	1.4E-02	3.9E-01	2.7E-01	4.6E+01	2.4E-02	2.4E-02	4.0E-04
Backfill and Compaction	3.3E-02	9.2E-01	6.2E-01	1.1E+02	5.6E-02	5.6E-02	9.4E-04
Slurry Backfill	4.6E-03	1.3E-01	8.7E-02	1.5E+01	7.8E-03	7.8E-03	1.3E-04
Site Restoration	4.0E-03	1.1E-01	7.6E-02	1.3E+01	6.9E-03	6.9E-03	1.1E-04
Well Installation							
Drilling and SVE Well Installation	2.1E-01	3.6E+00	3.9E+00	7.8E+02	4.1E-01	4.1E-01	6.8E-03
Street Trenching							
Street Trenching/Pipe installation	2.8E-01	7.2E+00	5.3E+00	1.0E+03	5.3E-01	5.3E-01	8.8E-03
Street Paving							
Street - Grinding	1.0E+00	1.8E+01	2.0E+01	3.9E+03	2.1E+00	2.1E+00	3.4E-02
Street - Paving	4.8E-01	8.3E+00	9.1E+00	1.8E+03	9.6E-01	9.6E-01	1.6E-02

VIII. On-Site Road Emissions

Summary: This section calculates the emissions of criteria pollutants from on-site paved roads.

Emissions Factors

Running Emissions										g/mi	
Veh Class	Fuel	MdlYr	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
LDA/LDT	All	All	6.4E-02	2.5E+00	2.8E-01	6.9E+02	3.0E-03	3.0E-04	7.0E-03	4.5E-02	1.8E-02
HHDT	DSL	All	7.8E-01	4.0E+00	1.4E+01	1.6E+03	8.0E-01	7.4E-01	1.7E-02	7.8E-02	3.1E-02
HHDT	DSL	2007	1.2E-01	8.6E-01	2.2E+00	1.6E+03	6.1E-02	5.6E-02	1.7E-02	5.9E-03	5.5E-03

Source: EMFAC 2011

Running Emissions										lbs/mi	
Veh Class	Fuel	MdlYr	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
LDA/LDT	All	All	1.4E-04	5.5E-03	6.1E-04	1.5E+00	6.6E-06	6.6E-07	1.5E-05	9.9E-05	4.0E-05
HHDT	DSL	All	1.7E-03	8.8E-03	3.1E-02	3.6E+00	1.8E-03	1.6E-03	3.7E-05	1.7E-04	6.8E-05
HHDT	DSL	2007	2.7E-04	1.9E-03	4.8E-03	3.5E+00	1.4E-04	1.2E-04	3.7E-05	1.3E-05	1.2E-05

Source: EMFAC 2011

Heavy Truck Trip Data									SCAB		
Phase	Hourly Round Trips	Daily Round Trips	8 Home Cluster Round Trips	Annual Round Trips	Truck Type	Average Vehicle Weight (tons)	Trip length (SCAB)	Hourly VMT	Daily VMT	8 Home Cluster VMT	Annual VMT
Option 1											
Demo	2.40	19	307	2,275	Dump Truck	25	0.72	1.73	14	221	1637
Green Waste	0.50	4	32	237	Dump Truck	25	0.72	0.36	3	23	171
Excavation	4.34	35	4,167	8,230	Dump Truck	25	0.72	3.12	25	2999	5923
SVE Well/Piping	0.3	2.7	21.3	158.0	Dump Truck	25	0.72	0.24	1.9	15	114
Subslab Vent	0.00	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	4.52	36	3,472	8,570	Dump Truck	25	0.72	3.25	26	2498	6168
Slurry Backfill	1.34	11	602	2,548	Concrete Truck	25	0.72	0.97	8	433	1834
Site Resto.	1.04	8	663	1,965	Concrete Truck	25	0.72	0.75	6	477	1414
Street Trenching											
Demo	0.31	2	0	448	Dump Truck	25	0.72	0.22	1.8	0.00	322
Excavation	0.95	8	0	1,374	Dump Truck	25	0.72	0.69	5	0.00	989
Backfill	0.95	8	0	1,366	Dump Truck	25	0.72	0.68	5	0.00	983
Restoration	0.32	3	0	455	Concrete Truck	25	0.72	0.23	1.8	0.00	327
Pipe Delivery	0.31	3	0	450	Dump Truck	25	0.72	0.22	2	0.00	324
Well Installation											
Air Vac- Borehole Clearance	0.31	3	0	158	Air-Vac	25	0.72	0.22	2	0.00	113
Drilling and SVE Well Installation	0.31	3	0	158	Drill Rig	25	0.72	0.22	2	0.00	113
Waste Collection	0.63	5	0	315	Dump Truck	25	0.72	0.45	4	0.00	227
Street Paving											
Street Grinding	3	16	0	80	Dump Truck	25	0.72	1.92	12	0.00	58
Street Paving	1	8	0	80	Dump Truck	25	0.72	0.96	6	0.00	58
Visitor Trips											
Passenger Vehicle Trips	1.13	9	0	2,259	Passenger Vehicle	25	0.72	0.81	6	0	1626

Emissions Calculations

Daily Truck Trip Emission Calculations (SCAB)						lbs/day				
Phase	Daily VMT (SCAB)	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
Option 1										
Demo	13.8	3.7E-03	2.6E-02	6.6E-02	4.8E+01	1.9E-03	1.7E-03	5.1E-04	1.8E-04	1.7E-04
Green Waste	2.9	7.8E-04	5.5E-03	1.4E-02	1.0E+01	3.9E-04	3.6E-04	1.1E-04	3.8E-05	3.5E-05
Excavation	25.0	6.8E-03	4.8E-02	1.2E-01	8.7E+01	3.4E-03	3.1E-03	9.2E-04	3.3E-04	3.0E-04
SVE Well/Piping	1.9	5.2E-04	3.7E-03	9.1E-03	6.7E+00	2.6E-04	2.4E-04	7.1E-05	2.5E-05	2.3E-05
Subslab Vent	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Backfill/Compact	26.0	7.1E-03	5.0E-02	1.2E-01	9.0E+01	3.5E-03	3.2E-03	9.6E-04	3.4E-04	3.1E-04
Slurry Backfill	7.7	2.1E-03	1.5E-02	3.7E-02	2.7E+01	1.0E-03	9.6E-04	2.9E-04	1.0E-04	9.3E-05
Site Resto.	6.0	1.6E-03	1.1E-02	2.8E-02	2.1E+01	8.1E-04	7.4E-04	2.2E-04	7.8E-05	7.2E-05
Street Trenching										
Demo	1.8	4.9E-04	3.4E-03	8.5E-03	6.2E+00	2.4E-04	2.2E-04	6.6E-05	2.3E-05	2.2E-05
Excavation	5.5	1.5E-03	1.0E-02	2.6E-02	1.9E+01	7.4E-04	6.8E-04	2.0E-04	7.2E-05	6.6E-05
Backfill	5.5	1.5E-03	1.0E-02	2.6E-02	1.9E+01	7.4E-04	6.8E-04	2.0E-04	7.1E-05	6.6E-05
Restoration	1.8	4.9E-04	3.5E-03	8.6E-03	6.3E+00	2.5E-04	2.3E-04	6.7E-05	2.4E-05	2.2E-05
Pipe Delivery	1.8	4.9E-04	3.4E-03	8.5E-03	6.3E+00	2.4E-04	2.2E-04	6.6E-05	2.4E-05	2.2E-05
Well Installation										
Air Vac- Borehole Clearance	1.8	4.9E-04	3.4E-03	8.5E-03	6.3E+00	2.4E-04	2.2E-04	6.6E-05	2.4E-05	2.2E-05
Drilling and SVE Well Installation	1.8	4.9E-04	3.4E-03	8.5E-03	6.3E+00	2.4E-04	2.2E-04	6.6E-05	2.4E-05	2.2E-05
Waste Collection	3.6	9.7E-04	6.8E-03	1.7E-02	1.3E+01	4.9E-04	4.5E-04	1.3E-04	4.7E-05	4.3E-05
Street Paving										
Street Grinding	11.5	3.1E-03	2.2E-02	5.5E-02	4.0E+01	1.6E-03	1.4E-03	4.2E-04	1.5E-04	1.4E-04
Street Paving	5.8	1.6E-03	1.1E-02	2.7E-02	2.0E+01	7.8E-04	7.2E-04	2.1E-04	7.5E-05	6.9E-05
Visitor Trips										
Passenger Vehicle Trips	6.5	9.1E-04	3.6E-02	4.0E-03	9.9E+00	4.3E-05	4.3E-06	1.0E-04	6.4E-04	2.6E-04

Worker Trip Emission Calculations (SCAB)							lbs/day					
Phase	Worker Round Trips per day	Roundtrip Distance per Worker (mi)	VMT per Day	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
Option 1	42	0.72	30	4.3E-03	1.7E-01	1.9E-02	4.6E+01	2.0E-04	2.0E-05	4.7E-04	3.0E-03	1.2E-03
Street Trenching	57	0.72	41	5.8E-03	2.3E-01	2.5E-02	6.3E+01	2.7E-04	2.7E-05	6.3E-04	4.1E-03	1.6E-03
Well Installation	59	0.72	42	6.0E-03	2.3E-01	2.6E-02	6.5E+01	2.8E-04	2.8E-05	6.6E-04	4.2E-03	1.7E-03
Street Paving												
Street Grinding	16	0.72	12	1.6E-03	6.4E-02	7.1E-03	1.8E+01	7.6E-05	7.6E-06	1.8E-04	1.1E-03	4.6E-04
Street Paving	16	0.72	12	1.6E-03	6.4E-02	7.1E-03	1.8E+01	7.6E-05	7.6E-06	1.8E-04	1.1E-03	4.6E-04

VIIII. On-Site Road - Reentrained Dust

Summary: This section calculates the emissions of re-entrained dust from on-site on road vehicles on paved roads.

$$E = [k(sL)^{0.91} \times (W)^{1.02}] (1 - P/4N)$$

Where:

E = size-specific emission factor (lb/VMT)

k = particle size multiplier

sL = road surface silt loading (g/m^2)

W = mean vehicle weight (tons)

P = averaging period (365 days)

N = number of "wet" days (>0.01 in of precipitation)

Source: AP-42 13.2.1-2, Equation (1). January 2011.

Correction:

P = number of wet days

N = number of days in period

Assumptions			
Parameter	**Value**	**Units**	**Reference**
Heavy Vehicle Weight (tons)	25	tons	Assumed
k (empirical constant) - PM10	0.0022	-	AP-42, Chapter 13.2.1, Table 13.2.1-1. PM10 (lbs/VMT)
k (empirical constant) - PM2.5	0.0005	-	AP-42, Chapter 13.2.1, Table 13.2.1-1. PM2.5 (lbs/VMT)
sL (Haul Trucks)	0.02	g/m2	CARB Entrained Paved Road Dust. (1997) Silt loading for freeways: http://www.arb.ca.gov/ei/areasrc/fullpdf/full7-9.pdf
sL (Worker Vehicles)	0.1	g/m2	CalEEMod Default for Worker trips (Assumes mix of freeway and surface street travel)
P (averaging period)	365	days	Days per year
N (wet days)	40	days	AP-42, Chapter 13.2.1, Figure 13.2.1-2. January 2011.
On-Site Heavy Truck Haul	0.72	miles	Measured distance from the furthest northern and southern homes in the community.
Employee/Worker Trip Distance	0.72	miles	Measured distance from the furthest northern and southern homes in the community.
Paved Road Average Vehicle	2.4	tons	CalEEMod default average vehicle weight (tons)

Phase	Hourly Round Trips	Daily Round Trips	8 Home Cluster Round Trips	Annual Round Trips	Truck Type	Average Vehicle Weight (tons)	SCAB Round Trip length (SCAB)	Hourly VMT	Daily VMT	8 Home Cluster VMT	Annual VMT
Option 1											
Demo	2.4	19.2	307.1	2274.5	Dump Truck	25	0.72	1.7	13.8	221.0	1637.0
Green Waste	0.5	4.0	32.0	237.0	Dump Truck	25	0.72	0.4	2.9	23.0	170.6
Excavation	4.3	34.7	4167.1	8230.0	Dump Truck	25	0.72	3.1	25.0	2999.0	5923.1
SVE Well/Piping	0.3	2.7	21.3	158.0	Dump Truck	25	0.72	0.2	1.9	15.4	113.7
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	4.5	36.2	3471.5	8570.3	Dump Truck	25	0.72	3.3	26.0	2498.4	6168.0
Slurry Backfill	1.3	10.8	602.1	2548.1	Concrete Truck	25	0.72	1.0	7.7	433.3	1833.9
Site Resto.	1.0	8.3	663.4	1965.2	Concrete Truck	25	0.72	0.7	6.0	477.4	1414.3
Street Trenching											
Demo	0.3	2.5	0.00	448.0	Dump Truck	25	0.72	0.2	1.8	0.00	322.4
Excavation	1.0	7.6	0.00	1374.0	Dump Truck	25	0.72	0.7	5.5	0.00	988.9
Backfill	0.9	7.6	0.00	1366.0	Dump Truck	25	0.72	0.7	5.5	0.00	983.1
Restoration	0.3	2.5	0.00	455.0	Concrete Truck	25	0.72	0.2	1.8	0.00	327.5
Pipe Delivery	0.3	2.5	0.00	450.0	Dump Truck	25	0.72	0.2	1.8	0.00	323.9
Well Installation											
Air Vac- Borehole Clearance	0.3	2.5	0.00	157.5	Air-Vac	25	0.72	0.2	1.8	0.00	113.4
Drilling and SVE Well Installation	0.3	2.5	0.00	157.5	Drill Rig	25	0.72	0.2	1.8	0.00	113.4
Waste Collection	0.6	5.0	0.00	315.0	Dump Truck	25	0.72	0.4	3.6	0.00	226.7
Street Paving											
Street Grinding	2.7	16.0	0.00	80.0	Dump Truck	25	0.72	1.9	11.5	0.00	57.6
Street Paving	1.3	8.0	0.00	80.0	Dump Truck	25	0.72	1.0	5.8	0.00	57.6

Emission Calculation

Daily:

Phase	Daily VMT (SCAB)	sL (g/M^2)	W (tons)	k (PM10)	k (PM2.5)	Wet Days	Avg. Period	PM10 EF (lbs/mi.)	PM2.5 EF (lbs/mi.)	SCAB Pm10 Emissions	SCAB PM2.5 Emissions
Option 1											
Demo	13.8	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	8.38E-04	2.06E-04
Green Waste	2.9	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	1.75E-04	4.28E-05
Excavation	25.0	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	1.52E-03	3.72E-04
SVE Well/Piping	1.9	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	1.16E-04	2.86E-05
Subslab Vent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	26.0	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	1.58E-03	3.87E-04
Slurry Backfill	7.7	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	4.69E-04	1.15E-04
Site Resto.	6.0	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	3.62E-04	8.88E-05
Street Trenching											
Demo	1.8	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	1.09E-04	2.67E-05
Excavation	5.5	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	3.33E-04	8.18E-05
Backfill	5.5	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	3.31E-04	8.13E-05
Restoration	1.8	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	1.10E-04	2.71E-05
Pipe Delivery	1.8	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	1.09E-04	2.68E-05
Well Installation											
Air Vac- Borehole Clearance	1.8	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	1.09E-04	2.68E-05
Drilling and SVE Well Installation	1.8	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	1.09E-04	2.68E-05
Waste Collection	3.6	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	2.18E-04	5.36E-05
Street Paving											
Street Grinding	11.5	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	6.98E-04	1.71E-04
Street Paving	5.8	0.00054	25	0.0022	0.00054	40	365	6.06E-05	1.49E-05	3.49E-04	8.57E-05

Daily Worker Trip Emissions:

Phase	Worker Trips per Day	Round Trip per Worker (mile)	VMT per Hour	SL (g/m^2)	W (Tons)	k (PM10)	k (PM2.5)	Wet Days	Avg. period	PM10 EF lbs/mi	PM2.5 EF lbs/mi	SCAB PM10 Emissions	SCAB PM2.5 Emissions
Option 1	42	0.72	30	0.02	2.40	0.0022	0.00054	40	365	1.49E-04	3.65E-05	4.49E-03	1.10E-03
Street Trenching	57	0.72	41	0.02	2.40	0.0022	0.00054	40	365	1.49E-04	3.65E-05	6.10E-03	1.50E-03
Well Installation	59	0.72	42	0.02	2.40	0.0022	0.00054	40	365	1.49E-04	3.65E-05	6.31E-03	1.55E-03
Street Paving													
Street Grinding	16	0.72	12	0.02	2.40	0.0022	0.00054	40	365	1.49E-04	3.65E-05	1.71E-03	4.20E-04
Street Paving	16	0.72	12	0.02	2.40	0.0022	0.00054	40	365	1.49E-04	3.65E-05	1.71E-03	4.20E-04

X. Off-Site Road Emissions

Summary: This section calculates the emissions of criteria pollutants from off-site paved roads.

Emissions Factors

Running Emissions							g/mi				
Veh Class	Fuel	MdlYr	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
LDA/LDT	All	All	6.4E-02	2.5E+00	2.8E-01	6.9E+02	3.0E-03	3.0E-04	7.0E-03	4.5E-02	1.8E-02
HHDT	DSL	All	7.8E-01	4.0E+00	1.4E+01	1.6E+03	8.0E-01	7.4E-01	1.7E-02	7.8E-02	3.1E-02
HHDT	DSL	2007	1.2E-01	8.6E-01	2.2E+00	1.6E+03	6.1E-02	5.6E-02	1.7E-02	5.9E-03	5.5E-03

Source: EMFAC 2011

Running Emissions							lbs/mi				
Veh Class	Fuel	MdlYr	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
LDA/LDT	All	All	1.4E-04	5.5E-03	6.1E-04	1.5E+00	6.6E-06	6.6E-07	1.5E-05	9.9E-05	4.0E-05
HHDT	DSL	All	1.7E-03	8.8E-03	3.1E-02	3.6E+00	1.8E-03	1.6E-03	3.7E-05	1.7E-04	6.8E-05
HHDT	DSL	2007	2.7E-04	1.9E-03	4.8E-03	3.5E+00	1.4E-04	1.2E-04	3.7E-05	1.3E-05	1.2E-05

Source: EMFAC 2011

Heavy Truck Trip Data																
Phase	Hourly Round Trips	Daily Round Trips	8 Home Cluster Round Trips	Annual Round Trips	Truck Type	Average Vehicle Weight (tons)	Round Trip length (SCAB)	Hourly VMT	Daily VMT	8 Home Cluster Round Trips	Annual VMT	Trip length (MDAB)	Hourly VMT	Daily VMT	8 Home Cluster Round Trips	Annual VMT
Option 1																
Demo	2.4	19	307	2,275	Dump Truck	25	60	144	1,152	18,426	136,470	0	0	0	0	0
Green Waste	0.5	4.0	32.0	237.0	Dump Truck	25.0	10.0	5	40	320	2,370	0	0	0	0	0
Excavation	4.3	35	4,167	8,230	Dump Truck	25	150	651	5,209	625,061	1,234,495	50	217	1,736	208,354	411,498
SVE Well/Piping	0.3	2.7	21.3	158.0	Dump Truck	25	100	33	267	2,133	15,800	0	0	0	0	0
Subslab Vent	0.0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backfill/Compact	4.5	36	3,472	8,570	Dump Truck	25	8	36	289	27,772	68,563	0	0	0	0	0
Slurry Backfill	1.3	10.8	602.1	2548.1	Concrete Truck	25	20	27	215	12,042	50,963	0	0	0	0	0
Site Resto.	1.0	8	663	1,965	Concrete Truck	25	20	21	166	13,267	39,304	0	0	0	0	0
Street Trenching																
Demo	0.3	2.5	0.00	448.0	Dump Truck	25	60	19	149	0	26,880	0	0	0	0.00	0
Excavation	1.0	7.6	0.00	1374.0	Dump Truck	25	150	143	1,145	0	206,100	50	48	382	0.00	68,700
Slurry Backfill	0.9	7.6	0.00	1366.0	Dump Truck	25	8	8	61	0	10,928	0	0	0	0.00	0
Restoration	0.3	2.5	0.00	455.0	Concrete Truck	25	20	6	51	0	9,100	0	0	0	0.00	0
Pipe Delivery	0.3	2.5	0.00	450.0	Dump Truck	25	100	31	250	0	45,000	0	0	0	0.00	0
Well Installation																
Air Vac- Borehole Clearance	0.3	2.5	0.00	157.5	Air-Vac	25	10	3	25	0	1,575	0	0	0	0.00	0
Drilling and SVE Well Installation	0.3	2.5	0.00	157.5	Drill Rig	25	10	3	25	0	1,575	0	0	0	0.00	0
Waste Collection	0.6	5.0	0.00	315.0	Dump Truck	25	10	6	50	0	3,150	0	0	0	0.00	0
Waste Transport to Offsite Disposal	0.3	2.5	0.00	154.9	Dump Truck	25	150	46	369	0	23,235	50	15	123	0	7,745
Street Paving																
Street Grinding	2.7	8.0	0.00	80.0	Dump Truck	25	60	160	480	0	4,800	0	0	0	0.00	0
Street Paving	1.3	16.0	0.00	80.0	Dump Truck	25	100	133	1,600	0	8,000	0	0	0	0.00	0

Emissions Calculations

Daily Truck Trip Emission Calculations (SCAB)						lbs/day (SCAB)				
Phase	Daily VMT (SCAB)	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
Option 1										
Demo	1,152	3.1E-01	2.2E+00	5.5E+00	4.0E+03	1.6E-01	1.4E-01	4.2E-02	1.5E-02	1.4E-02
Green Waste	40	1.1E-02	7.6E-02	1.9E-01	1.4E+02	5.4E-03	5.0E-03	1.5E-03	5.2E-04	4.8E-04
Excavation	5,209	1.4E+00	9.9E+00	2.5E+01	1.8E+04	7.0E-01	6.5E-01	1.9E-01	6.8E-02	6.3E-02
SVE Well/Piping	267	7.2E-02	5.1E-01	1.3E+00	9.3E+02	3.6E-02	3.3E-02	9.8E-03	3.5E-03	3.2E-03
Subslab Vent	0.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Backfill/Compact	289	7.8E-02	5.5E-01	1.4E+00	1.0E+03	3.9E-02	3.6E-02	1.1E-02	3.8E-03	3.5E-03
Slurry Backfill	215	5.8E-02	4.1E-01	1.0E+00	7.5E+02	2.9E-02	2.7E-02	7.9E-03	2.8E-03	2.6E-03
Site Resto.	166	4.5E-02	3.2E-01	7.9E-01	5.8E+02	2.2E-02	2.1E-02	6.1E-03	2.2E-03	2.0E-03
Street Trenching										
Demo	149	4.0E-02	2.8E-01	7.1E-01	5.2E+02	2.0E-02	1.9E-02	5.5E-03	2.0E-03	1.8E-03
Excavation	1,145	3.1E-01	2.2E+00	5.4E+00	4.0E+03	1.5E-01	1.4E-01	4.2E-02	1.5E-02	1.4E-02
Backfill	61	1.6E-02	1.2E-01	2.9E-01	2.1E+02	8.2E-03	7.5E-03	2.2E-03	7.9E-04	7.3E-04
Restoration	51	1.4E-02	9.6E-02	2.4E-01	1.8E+02	6.8E-03	6.3E-03	1.9E-03	6.6E-04	6.1E-04
Pipe Delivery	250	6.8E-02	4.8E-01	1.2E+00	8.7E+02	3.4E-02	3.1E-02	9.2E-03	3.3E-03	3.0E-03
Well Installation										
Air Vac- Borehole Clearance	25	6.8E-03	4.8E-02	1.2E-01	8.7E+01	3.4E-03	3.1E-03	9.2E-04	3.3E-04	3.0E-04
Drilling and SVE Well Installation	25	6.8E-03	4.8E-02	1.2E-01	8.7E+01	3.4E-03	3.1E-03	9.2E-04	3.3E-04	3.0E-04
Waste Collection	50	1.4E-02	9.5E-02	2.4E-01	1.7E+02	6.8E-03	6.2E-03	1.8E-03	6.5E-04	6.0E-04
Waste Transport to Offsite Disposal	369	1.0E-01	7.0E-01	1.8E+00	1.3E+03	5.0E-02	4.6E-02	1.4E-02	4.8E-03	4.4E-03
Street Paving										
Street Grinding	480	1.3E-01	9.1E-01	2.3E+00	1.7E+03	6.5E-02	6.0E-02	1.8E-02	6.3E-03	5.8E-03
Street Paving	1,600	4.3E-01	3.0E+00	7.6E+00	5.6E+03	2.2E-01	2.0E-01	5.9E-02	2.1E-02	1.9E-02

Daily Truck Trip Emission Calculations (MDAB)						lbs/day (MDAB)				
Phase	Daily VMT (MDAB)	ROG	CO	NOx	CO2	PM10	PM2.5	SOx	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
Option 1										
Demo	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Green Waste	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Excavation	1736	4.7E-01	3.3E+00	8.2E+00	6.0E+03	2.3E-01	2.2E-01	6.4E-02	2.3E-02	2.1E-02
SVE Well/Piping	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Subslab Vent	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Backfill/Compact	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Slurry Backfill	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Site Resto.	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Street Trenching										
Demo	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Excavation	382	1.0E-01	7.3E-01	1.8E+00	1.3E+03	5.2E-02	4.7E-02	1.4E-02	5.0E-03	4.6E-03
Backfill	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Restoration	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pipe Delivery	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Well Installation										
Air Vac- Borehole Clearance	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Drilling and SVE Well Installation	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Waste Collection	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Waste Transport to Offsite Disposal	123	3.3E-02	2.3E-01	5.8E-01	4.3E+02	1.7E-02	1.5E-02	4.5E-03	1.6E-03	1.5E-03
Street Paving										
Street Grinding	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Street Paving	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

Phase	Worker Round Trips per day	Roundtrip Distance per Worker (mi)	VMT per Day	ROG	CO	NOx	CO2	PM10	PM2.5	Sox	Tire & Brake Wear PM10	Tire & Brake Wear PM2.5
				lbs/day								
Option 1	42	21.6	907	1.3E-01	5.0E+00	5.6E-01	1.4E+03	6.0E-03	6.0E-04	1.4E-02	9.0E-02	3.6E-02
Street Trenching	57	21.6	1231	1.7E-01	6.8E+00	7.5E-01	1.9E+03	8.1E-03	8.1E-04	1.9E-02	1.2E-01	4.9E-02
Well Installation	59	21.6	1274	1.8E-01	7.0E+00	7.8E-01	1.9E+03	8.4E-03	8.4E-04	2.0E-02	1.3E-01	5.1E-02
Street Paving												
Street Grinding	16	21.6	346	4.9E-02	1.9E+00	2.1E-01	5.3E+02	2.3E-03	2.3E-04	5.3E-03	3.4E-02	1.4E-02
Street Paving	16	21.6	346	4.9E-02	1.9E+00	2.1E-01	5.3E+02	2.3E-03	2.3E-04	5.3E-03	3.4E-02	1.4E-02

*Used worker distances from CalEEMod Assumptions

XI. Off-Site Road - Reentrained Dust

Summary: This section calculates the emissions of re-entrained dust from off-site on road vehicles on paved roads.

$$E = [k(sL)^{0.91} \times (W)^{1.02}] (1 - P/4N)$$

Where:

E = size-specific emission factor (lb/VMT)
k = particle size multiplier
sL = road surface silt loading (g/m^2)
W = mean vehicle weight (tons)
P = averaging period (365 days)
N = number of "wet" days (>0.01 in of precipitation)

Source: AP-42 13.2.1-2, Equation (1). January 2011.

Correction:
P = number of wet days
N = number of days in period

Assumptions				
Parameter	**Value**	**Units**	**Reference**	
Vehicle Weight (tons)		25	tons	Assumed
k (empirical constant) - PM10		0.0022	-	AP-42, Chapter 13.2.1, Table 13.2.1-1. PM10 (lbs/VMT)
k (empirical constant) - PM2.5		0.00054	-	AP-42, Chapter 13.2.1, Table 13.2.1-1. PM2.5 (lbs/VMT)
sL (Haul Trucks)		0.02	g/m2	CARB Entrained Paved Road Dust. (1997) Silt loading for freeways:
sL (Worker Vehicles)		0.1	g/m2	CalEEMod Default for Worker trips (Assumes mix of freeway and surface street
P (averaging period)		365	days	Days per year
N (wet days)		40	days	AP-42, Chapter 13.2.1, Figure 13.2.1-2. January 2011.
South Coast Air Basin Distance		75	miles	google maps
Mojave Desert Distance		25	miles	google maps
Employee/Worker Trip Distance		21.6	miles	CalEEMod Default Construction Worker Trip (Round Trip)
Paved Road Average Vehicle Weight		2.4	tons	CalEEMod default average vehicle weight (tons)

Phase	Hourly Round Trips	Daily Round Trips	8 Home Cluster Round Trips	Annual Round Trips	Truck Type	Average Vehicle Weight (tons)	Round Trip length (SCAB)	SCAB Hourly VMT	SCAB Daily VMT	SCAB 8 Home Cluster VMT	SCAB Annual VMT	Trip length (MDAB)	MDAB Hourly VMT	MDAB Daily VMT	MDAB 8 Home Cluster VMT	MDAB Annual VMT
Option 1																
Demo	2.4	19.2	307.1	2,274.5	Dump Truck	25	60	144	1,152	18,426	136,470	0	0	0	0	0
Green Waste	0.5	4.0	32.0	237.0	Dump Truck	25	10	5	40	320	2,370	0	0	0	0	0
Excavation	4.3	34.7	4,167.1	8,230.0	Dump Truck	25	150	651	5,209	625,061	1,234,495	50	217	1,736	208,354	411,498
SVE Well/Piping	0.3	2.7	21.3	158.0	Dump Truck	25	100	33	267	2,133	15,800	0	0	0	0	0
Subslab Vent	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0
Backfill/Compact	4.5	36.2	3,471.5	8,570.3	Dump Truck	25	8	36	289	27,772	68,563	0	0	0	0	0
Slurry Backfill	1.3	10.8	602.1	2,548.1	Concrete Truck	25	20	27	215	12,042	50,963	0	0	0	0	0
Site Resto.	1.0	8.3	663.4	1,965.2	Concrete Truck	25	20	21	166	13,267	39,304	0	0	0	0	0
Street Trenching																
Demo	0.3	2.5	0.0	448.0	Dump Truck	25	60	19	149	0	26,880	0	0	0	0	0
Excavation	1.0	7.6	0.0	1,374.0	Dump Truck	25	150	143	1,145	0	206,100	50	48	382	0	68,700
Backfill	0.9	7.6	0.0	1,366.0	Dump Truck	25	8	8	61	0	10,928	0	0	0	0	0
Restoration	0.3	2.5	0.0	455.0	Concrete Truck	25	20	6	51	0	9,100	0	0	0	0	0
Pipe Delievery	0.3	2.5	0.0	450.0	Dump Truck	25	100	31	250	0	45,000	0	0	0	0	0
Well Installation																
Air Vac- Borehole Clearance	0.3	2.5	0.0	157.5	Air-Vac	25	10.0	3	25	0	1,575	0	0	0	0	0
Drilling and SVE Well Installation	0.3	2.5	0.0	157.5	Drill Rig	25	10.0	3	25	0	1,575	0	0	0	0	0
Waste Collection	0.6	5.0	0.0	315.0	Dump Truck	25.0	10.0	6.3	50.0	0.0	3,150.0	0.0	0.0	0.0	0.0	0.0
Waste Transport to Offsite Disposal	0.3	2.5	0.0	154.9	Dump Truck	25.0	150.0	46.1	368.8	0.0	23,235.0	50.0	15.4	122.9	0.0	7,745.0
Street Paving																
Street Grinding	2.7	16.0	0.0	80.0	Dump Truck	25	60	160	960	0	4,800	0	0	0	0	0
Street Paving	2.7	16.0	0.0	160.0	Dump Truck	25	100	267	1,600	0	16,000	0	0	0	0	0

Emission Calculation

Daily:

Phase	Daily VMT (SCAB)	Daily VMT (MDAB)	sL (g/M^2)	W (tons)	k (PM10)	k (PM2.5)	Wet Days	Avg. Period	PM10 EF (lbs/mi.)	PM2.5 EF (lbs/mi.)	SCAB Pm10 Emissions	SCAB PM2.5 Emissions	MDAB Pm10 Emissions	MDAB PM2.5 Emissions
Option 1														
Demo	1,151.6	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	1.9E+00	4.6E-01	0.0E+00	0.0E+00
Green Waste	40.0	0.0	0.02	25	0.0022	0.00054	40	366	0.0016	0.0004	6.5E-02	1.6E-02	0.0E+00	0.0E+00
Excavation	5,208.8	1,736.3	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	8.5E+00	2.1E+00	2.8E+00	6.9E-01
SVE Well/Piping	266.7	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	4.3E-01	1.1E-01	0.0E+00	0.0E+00
Subslab Vent	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Backfill/Compact	289.3	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	4.7E-01	1.2E-01	0.0E+00	0.0E+00
Slurry Backfill	215.0	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	3.5E-01	8.6E-02	0.0E+00	0.0E+00
Site Resto.	165.8	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	2.7E-01	6.6E-02	0.0E+00	0.0E+00
Street Trenching														
Demo	149.3	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	2.4E-01	5.9E-02	0.0E+00	0.0E+00
Excavation	1,145.0	381.7	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	1.9E+00	4.6E-01	6.2E-01	1.5E-01
Backfill	60.7	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	9.9E-02	2.4E-02	0.0E+00	0.0E+00
Restoration	50.6	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	8.2E-02	2.0E-02	0.0E+00	0.0E+00
Pipe Delievery	250.0	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	4.1E-01	1.0E-01	0.0E+00	0.0E+00
Well Installation														
Air Vac- Borehole Clearance	25.0	0.0	0.02	25	0.0022	0.00054	40	367	0.0016	0.0004	4.1E-02	1.0E-02	0.0E+00	0.0E+00
Drilling and SVE Well Installation	25.0	0.0	0.02	25	0.0022	0.00054	40	368	0.0016	0.0004	4.1E-02	1.0E-02	0.0E+00	0.0E+00
Waste Collection	50.0	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	8.1E-02	2.0E-02	0.0E+00	0.0E+00
Waste Transport to Offsite Disposal	368.8	122.9	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	6.0E-01	1.5E-01	2.0E-01	4.9E-02
Street Paving														
Street Grinding	960.0	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	1.6E+00	3.8E-01	0.0E+00	0.0E+00
Street Paving	1,600.0	0.0	0.02	25	0.0022	0.00054	40	365	0.0016	0.0004	2.6E+00	6.4E-01	0.0E+00	0.0E+00

Daily Worker Trip Emissions:

Phase	Worker Trips per Day	Round Trip per Worker (mile)	VMT per Hour	SL (g/m^2)	W (Tons)	k (PM10)	k (PM2.5)	Wet Days	Avg. period	PM10 EF lbs/mi	PM2.5 EF lbs/mi	SCAB PM10 Emissions	SCAB PM2.5 Emissions
Option 1	42	21.6	907	0.02	2.4	0.0022	0.00054	40	365	0.0001	0.0000	1.3E-01	3.3E-02
Street Trenching	57	21.6	1,231	0.02	2.4	0.0022	0.00054	40	365	0.0001	0.0000	1.8E-01	4.5E-02
Well Installation	59	21.6	1,274	0.02	2.4	0.0022	0.00054	40	365	0.0001	0.0000	1.9E-01	4.6E-02
Street Paving													
Street Grinding	16	21.6	346	0.02	2.4	0.0022	0.00054	40	365	0.0001	0.0000	5.1E-02	1.3E-02
Street Paving	16	21.6	346	0.02	2.4	0.0022	0.00054	40	365	0.0001	0.0000	5.1E-02	1.3E-02

Calculation Delivery Cover Sheet

URS Santa Ana Air Quality Group

Date:	*10/29/2014*
Project:	Kast Remediation Project - VOC Emissions Option 1 (Hard and Softscape Excavation) ***5 foot with 10 foot Excavation, 4 Houses at a Time, Phase Overlap***
Project number:	*49194119*
Requestor:	*PCR Consulting*
Project manager:	*Roy Patterson*
Air Quality originator:	*Irma Buenrostro*
Air Quality project lead:	*Shirley Pearson*
Air Quality internal reviewer:	*Shirley Pearson*
Date review completed:	*29-Oct-14*
Detail check internal reviewer:	*Irma Buenrostro*
Date review completed:	*29-Oct-14*
Brief description of analysis:	*Calculating emission rates of VOC from contaminated soil.*
Reference MXD:	S:\Shirley Pearson\!Kast\29 Oct 2014 Updates
Model used:	*EMSOFT, 2002*

Version 10-29-14

Kast VOC Emissions Calculations

I. List of VOC's Listed in the HHRA

COC	CAS #	Organic Carbon partition Coefficient (Koc) (cm^3/g)	Diffusivity in Air (Dair) (cm^2/s)	Diffusivity in Water (Dwater) (cm^2/s)	Henry's Law Constant (H') (unit less)	Soil-water Partition coefficient (Ksw) (cm^3/g)	Soil-Water Partition Coefficient (kd) (cm^3/g)	Apparent Diffusivity (Da) (cm^2/s)	Effective Diffusion Coefficient (Deff) (cm^2/s)
1,1,2,2-Tetrachloroethane	79-34-5	9.30E+01	7.10E-02	7.90E-06	1.40E-02	6.60E-01	5.60E-01	7.80E-05	5.50E-03
1,2,3-Trichloropropane	96-18-4	2.20E+01	7.10E-02	7.90E-06	1.70E-02	2.40E-01	1.30E-01	2.60E-04	5.50E-03
1,2,4-Trimethylbenzene	95-63-6	1.40E+03	6.10E-02	7.90E-06	2.50E-01	8.30E+00	8.10E+00	9.60E-05	4.70E-03
1,2-Dichloropropane	78-87-5	4.40E+01	7.80E-02	8.70E-06	1.10E-01	3.80E-01	2.60E-01	1.20E-03	6.10E-03
1,3,5-Trimethylbenzene	108-67-8	1.40E+03	6.00E-02	8.70E-06	2.40E-01	8.30E+00	8.10E+00	9.10E-05	4.70E-03
1,4-Dichlorobenzene	106-46-7	6.20E+02	6.90E-02	7.90E-06	9.80E-02	3.80E+00	3.70E+00	9.20E-05	5.40E-03
Benzene	71-43-2	5.90E+01	8.80E-02	9.80E-06	2.30E-01	5.00E-01	3.50E-01	2.10E-03	6.90E-03
Bromodichloromethane	75-27-4	5.50E+01	3.00E-02	1.10E-05	6.50E-02	4.40E-01	3.30E-01	2.30E-04	2.30E-03
Bromomethane	74-83-9	1.10E+01	7.30E-02	1.20E-05	2.60E-01	2.10E-01	6.30E-02	4.60E-03	5.70E-03
Ethylbenzene	100-41-4	3.60E+02	7.50E-02	7.80E-06	3.20E-01	2.30E+00	2.20E+00	5.30E-04	5.90E-03
Methylene chloride	75-09-2	1.20E+01	1.00E-01	1.20E-05	9.00E-02	1.90E-01	7.00E-02	2.50E-03	7.90E-03
Tetrachloroethene	127-18-4	1.60E+02	7.20E-02	8.20E-06	7.50E-01	1.20E+00	9.30E-01	2.40E-03	5.60E-03
Toluene	108-88-3	1.80E+02	8.70E-02	8.60E-06	2.70E-01	1.20E+00	1.10E+00	9.80E-04	6.80E-03
Trichloroethene	79-01-6	1.70E+02	7.90E-02	9.10E-06	4.20E-01	1.20E+00	1.00E+00	1.50E-03	6.20E-03
Vinyl chloride	75-01-4	1.90E+01	1.10E-01	1.20E-05	1.10E+00	4.20E-01	1.10E-01	1.50E-02	8.30E-03
Xylenes, total	1330-20-7	3.90E+02	7.70E-02	8.40E-06	3.10E-01	2.50E+00	2.30E+00	5.00E-04	6.00E-03
1-Methylnaphthalene	90-12-0	3.00E+03	5.30E-02	7.90E-06	2.10E-02	1.80E+01	1.80E+01	3.10E-06	4.10E-03
2-Methylnaphthalene	91-57-6	2.80E+03	5.20E-02	7.80E-06	2.10E-02	1.70E+01	1.70E+01	3.40E-06	4.10E-03
Naphthalene	91-20-3	2.00E+03	5.90E-02	7.50E-06	2.00E-02	1.20E+01	1.20E+01	5.00E-06	4.60E-03
Pyrene	129-00-0	1.10E+05	2.70E-02	7.20E-06	4.50E-04	6.30E+02	6.30E+02	1.10E-09	2.30E-03
1,1,2,2-Tetrachloroethane	79-34-5	9.30E+01	7.10E-02	7.90E-06	1.40E-02	6.60E-01	5.60E-01	7.80E-05	5.50E-03
1,1,2-Trichloroethane	79-00-5	5.00E+01	7.80E-02	8.80E-06	3.70E-02	4.10E-01	3.00E-01	3.70E-04	6.10E-03
1,1-Dichloroethane	75-34-3	3.20E+01	7.40E-02	1.10E-05	2.30E-01	3.30E-01	1.90E-01	2.70E-03	5.80E-03
1,2,3-Trichloropropane	96-18-4	2.20E+01	7.10E-02	7.90E-06	1.70E-02	2.40E-01	1.30E-01	2.60E-04	5.50E-03
1,2,4-Trichlorobenzene	120-82-1	1.80E+03	3.00E-02	8.20E-06	5.80E-02	1.10E+01	1.10E+01	8.40E-06	2.30E-03
1,2,4-Trimethylbenzene	95-63-6	1.40E+03	6.10E-02	7.90E-06	2.50E-01	8.30E+00	8.10E+00	9.60E-05	4.70E-03
1,2-Dichloroethane	107-06-2	1.70E+01	1.00E-01	9.90E-06	4.00E-02	2.10E-01	1.00E-01	1.00E-03	8.10E-03
1,2-Dichloropropane	78-87-5	4.40E+01	7.80E-02	8.70E-06	1.10E-01	3.80E-01	2.60E-01	1.20E-03	6.10E-03

Kast VOC Emissions Calculations

COC	CAS #	Organic Carbon partition Coefficient (Koc) (cm^3/g)	Diffusivity in Air (Dair) (cm^2/s)	Diffusivity in Water (Dwater) (cm^2/s)	Henry's Law Constant (H') (unit less)	Soil-water Partition coefficient (Ksw) (cm^3/g)	Soil-Water Partition Coefficient (kd) (cm^3/g)	Apparent Diffusivity (Da) (cm^2/s)	Effective Diffusion Coefficient (Deff) (cm^2/s)
1,3,5-Trimethylbenzene	108-67-8	1.40E+03	6.00E-02	8.70E-06	2.40E-01	8.30E+00	8.10E+00	9.10E-05	4.70E-03
1,3-Butadiene	106-99-0	1.90E+01	2.50E-01	1.10E-05	3.00E+00	7.80E-01	1.10E-01	5.00E-02	1.90E-02
1,4-Dichlorobenzene	106-46-7	6.20E+02	6.90E-02	7.90E-06	9.80E-02	3.80E+00	3.70E+00	9.20E-05	5.40E-03
1,4-Dioxane	123-91-1	1.00E+00	2.30E-01	1.00E-05	2.30E-04	1.10E-01	6.00E-03	2.60E-05	1.80E-02
2,2,4-Trimethylpentane	540-84-1	1.50E+05	1.00E-01	1.00E-05	1.80E+02	9.30E+02	9.00E+02	1.00E-03	7.80E-03
2-Hexanone	591-78-6	9.40E+00	7.50E-02	8.40E-06	3.80E-03	1.60E-01	5.70E-02	9.40E-05	5.80E-03
4-Ethyltoluene	622-96-8	1.80E+03	6.80E-02	7.30E-06	2.10E-01	1.10E+01	1.10E+01	6.70E-05	5.30E-03
Benzene	71-43-2	5.90E+01	8.80E-02	9.80E-06	2.30E-01	5.00E-01	3.50E-01	2.10E-03	6.90E-03
Bromodichloromethane	75-27-4	5.50E+01	3.00E-02	1.10E-05	6.50E-02	4.40E-01	3.30E-01	2.30E-04	2.30E-03
Bromomethane	74-83-9	1.10E+01	7.30E-02	1.20E-05	2.60E-01	2.10E-01	6.30E-02	4.60E-03	5.70E-03
Carbon disulfide	75-15-0	4.60E+01	1.00E-01	1.00E-05	1.20E+00	6.10E-01	2.70E-01	1.10E-02	8.10E-03
Carbon tetrachloride tetrachloride	56-23-5	1.70E+02	7.80E-02	8.80E-06	1.20E+00	1.40E+00	1.00E+00	3.60E-03	6.10E-03
Chloroform	67-66-3	4.00E+01	1.00E-01	1.00E-05	1.50E-01	3.70E-01	2.40E-01	2.20E-03	8.10E-03
Cyclohexane	110-82-7	1.70E+02	7.40E-02	8.50E-06	7.90E+00	2.60E+00	9.90E-01	1.20E-02	5.70E-03
Dibromochloromethane	124-48-1	6.30E+01	2.00E-02	1.10E-05	3.20E-02	4.80E-01	3.80E-01	6.70E-05	1.50E-03
cis-1,2-Dichloroethene	156-59-2	3.60E+01	7.40E-02	1.10E-05	1.70E-01	3.40E-01	2.10E-01	1.80E-03	5.70E-03
trans-1,2-Dichloroethene	156-60-5	5.30E+01	7.10E-02	1.20E-05	3.80E-01	4.90E-01	3.20E-01	2.90E-03	5.50E-03
trans-1,3-Dichloropropene	10061-02-6	4.60E+01	6.30E-02	1.00E-05	7.20E-01	5.10E-01	2.70E-01	4.60E-03	4.90E-03
Ethanol	64-17-5	1.00E+00	1.50E-01	1.60E-05	1.90E-04	1.10E-01	6.00E-03	1.50E-05	1.30E-02
Ethylbenzene	100-41-4	3.60E+02	7.50E-02	7.80E-06	3.20E-01	2.30E+00	2.20E+00	5.40E-04	5.90E-03
Heptane	142-82-5	2.70E+02	9.30E-02	7.60E-06	8.20E+01	1.70E+01	1.60E+00	2.30E-02	7.20E-03
Hexachloro-1,3-butadiene	87-68-3	5.40E+04	5.60E-02	6.20E-06	3.30E-01	3.20E+02	3.20E+02	3.00E-06	4.40E-03
Hexane	110-54-3	4.30E+01	2.00E-01	7.80E-06	6.80E+01	1.30E+01	2.60E-01	5.40E-02	1.60E-02
Isopropanol	67-63-0	6.90E+00	8.00E-02	9.30E-06	3.60E-04	1.40E-01	4.20E-02	1.10E-05	6.50E-03
Isopropyl benzene (cumene)	98-82-8	4.90E+02	6.50E-02	7.10E-06	4.70E+01	1.20E+01	2.90E+00	1.30E-02	5.10E-03
Methyl ethyl ketone (2-butanone)	78-93-3	2.30E+00	8.10E-02	9.80E-06	2.30E-03	1.10E-01	1.40E-02	8.40E-05	6.30E-03
Methylene chloride	75-09-2	1.20E+01	1.00E-01	1.20E-05	9.00E-02	1.90E-01	7.00E-02	2.50E-03	7.90E-03
Methyl-tert-butyl ether	1634-04-4	7.30E+00	1.00E-01	1.10E-05	2.60E-02	1.50E-01	4.40E-02	9.10E-04	8.00E-03
Propyl benzene	103-65-1	5.60E+02	6.00E-02	7.80E-06	4.40E-01	3.60E+00	3.40E+00	3.80E-04	4.70E-03
tert-Butyl Alcohol (TBA)	75-65-0	4.20E+00	8.50E-02	9.10E-06	3.00E-03	1.30E-01	2.50E-02	1.10E-04	6.70E-03
Tetrachloroethene	127-18-4	1.60E+02	7.20E-02	8.20E-06	7.50E-01	1.20E+00	9.30E-01	2.40E-03	5.60E-03
Tetrahydrofuran	109-99-9	9.50E-01	9.80E-02	1.10E-05	2.90E-03	1.10E-01	5.70E-03	1.40E-04	7.70E-03

Kast VOC Emissions Calculations

COC	CAS #	Organic Carbon partition Coefficient (Koc) (cm^3/g)	Diffusivity in Air (Dair) (cm^2/s)	Diffusivity in Water (Dwater) (cm^2/s)	Henry's Law Constant (H') (unit less)	Soil-water Partition coefficient (Ksw) (cm^3/g)	Soil-Water Partition Coefficient (kd) (cm^3/g)	Apparent Diffusivity (Da) (cm^2/s)	Effective Diffusion Coefficient (Deff) (cm^2/s)
Toluene	108-88-3	1.80E+02	8.70E-02	8.60E-06	2.70E-01	1.20E+00	1.10E+00	9.80E-04	6.80E-03
Trichloroethene	79-01-6	1.70E+02	7.90E-02	9.10E-06	4.20E-01	1.20E+00	1.00E+00	1.50E-03	6.20E-03
Vinyl chloride	75-01-4	1.90E+01	1.10E-01	1.20E-05	1.10E+00	4.20E-01	1.10E-01	1.50E-02	8.30E-03
Xylenes, total	1330-20-7	3.90E+02	7.70E-02	8.40E-06	3.10E-01	2.50E+00	2.30E+00	5.00E-04	6.00E-03
1-Methylnaphthalene	90-12-0	3.00E+03	5.30E-02	7.90E-06	2.10E-02	1.80E+01	1.80E+01	3.10E-06	4.10E-03
2-Methylnaphthalene	91-57-6	2.80E+03	5.20E-02	7.80E-06	2.10E-02	1.70E+01	1.70E+01	3.40E-06	4.10E-03
Naphthalene	91-20-3	2.00E+03	5.90E-02	7.50E-06	2.00E-02	1.20E+01	1.20E+01	5.00E-06	4.60E-03
Pyrene	129-00-0	1.10E+05	2.70E-02	7.20E-06	4.50E-04	6.30E+02	6.30E+02	1.10E-09	2.30E-03

Data Source: Geosyntec Consultants, Human Health Risk Assessment Report Former Kast Property Carson, California, March 10, 2014

Kast VOC Emissions Calculations

II. Chemical Inputs for EMSOFT Model run

CAS #	Chemical	Organic Carbon Partition Coefficient Koc (cm^3/g)	Air Diffusion Coefficient D'a (cm^2/s)	Air Diffusion Coefficient D'a (cm^2/day)	Aqueous Diffusion Coefficient D'w (cm^2/s)	Aqueous Diffusion Coefficient D'w (cm^2/day)	Henry's Law Constant (unit less)	COC Concentrations (0-10 feet)		COC Concentrations (0-10 feet)	
								Units	Sitewide UCL	Units	Sitewide UCL
100-41-4	Ethylbenzene	360	7.50E-02	6.48E+03	7.80E-06	6.74E-01	3.20E-01	mg/kg	5.00E-01	ug/kg	5.00E+02
106-46-7	1,4-Dichlorobenzene	620	6.90E-02	5.96E+03	7.90E-06	6.83E-01	9.80E-02	mg/kg	5.90E-04	ug/kg	5.90E-01
107-06-2	1,2-Dichloroethane	17	1.00E-01	8.64E+03	9.90E-06	8.55E-01	4.00E-02	mg/kg	4.70E-04	ug/kg	4.70E-01
108-67-8	1,3,5-Trimethylbenzene	1400	6.00E-02	5.18E+03	8.70E-06	7.52E-01	2.40E-01	mg/kg	1.90E-01	ug/kg	1.90E+02
108-88-3	Toluene	180	8.70E-02	7.52E+03	8.60E-06	7.43E-01	2.70E-01	mg/kg	1.20E-01	ug/kg	1.20E+02
127-18-4	Tetrachloroethene	160	7.20E-02	6.22E+03	8.20E-06	7.08E-01	7.50E-01	mg/kg	1.30E-02	ug/kg	1.30E+01
129-00-0	Pyrene	110000	2.70E-02	2.33E+03	7.20E-06	6.22E-01	4.50E-04	mg/kg	1.00E+00	mg/kg	1.00E+00
1330-20-7	Xylenes, Total	390	7.70E-02	6.65E+03	8.40E-06	7.26E-01	3.10E-01	mg/kg	7.69E-01	ug/kg	7.69E+02
156-59-2	cis-1,2-Dichloroethene	36	7.40E-02	6.39E+03	1.10E-05	9.50E-01	1.70E-01	mg/kg	5.60E-04	ug/kg	5.60E-01
71-43-2	Benzene	59	8.80E-02	7.60E+03	9.80E-06	8.47E-01	2.30E-01	mg/kg	1.70E-01	ug/kg	1.70E+02
74-83-9	Bromomethane	11	7.30E-02	6.31E+03	1.20E-05	1.04E+00	2.60E-01	mg/kg	5.80E-03	ug/kg	5.80E+00
75-01-4	Vinyl Chloride	19	1.10E-01	9.50E+03	1.20E-05	1.04E+00	1.10E+00	mg/kg	2.41E-04	ug/kg	2.41E-01
75-09-2	Methylene Chloride	12	1.00E-01	8.64E+03	1.20E-05	1.04E+00	9.00E-02	mg/kg	3.20E-03	ug/kg	3.20E+00
75-27-4	Bromodichloromethane	55	3.00E-02	2.59E+03	1.10E-05	9.50E-01	6.50E-02	mg/kg	2.40E-04	ug/kg	2.40E-01
75-65-0	tert-Butyl Alcohol (TBA)	4.2	8.50E-02	7.34E+03	9.10E-06	7.86E-01	3.00E-03	mg/kg	4.80E-03	ug/kg	4.80E+00
78-87-5	1,2-Dichloropropane	44	7.80E-02	6.74E+03	8.70E-06	7.52E-01	1.10E-01	mg/kg	3.60E-04	ug/kg	3.60E-01
79-01-6	Trichloroethene	170	7.90E-02	6.83E+03	9.10E-06	7.86E-01	4.20E-01	mg/kg	7.40E-04	ug/kg	7.40E-01
79-34-5	1,1,2,2-Tetrachloroethane	93	7.10E-02	6.13E+03	7.90E-06	6.83E-01	1.40E-02	mg/kg	4.80E-04	ug/kg	4.80E-01
90-12-0	1-Methylnaphthalene	3000	5.30E-02	4.58E+03	7.90E-06	6.83E-01	2.10E-02	mg/kg	2.60E+00	mg/kg	2.60E+00
91-20-3	Naphthalene	2000	5.90E-02	5.10E+03	7.50E-06	6.48E-01	2.00E-02	mg/kg	1.50E+00	mg/kg	1.50E+00
91-57-6	2-Methylnaphthalene	2800	5.20E-02	4.49E+03	7.80E-06	6.74E-01	2.10E-02	mg/kg	3.90E+00	mg/kg	3.90E+00
95-63-6	1,2,4-Trimethylbenzene	1400	6.10E-02	5.27E+03	7.90E-06	6.83E-01	2.50E-01	mg/kg	7.80E-01	ug/kg	7.80E+02
96-18-4	1,2,3-Trichloropropane	22	7.10E-02	6.13E+03	7.90E-06	6.83E-01	1.70E-02	mg/kg	6.40E-04	ug/kg	6.40E-01

Kast VOC Emissions Calculations

CAS #	Chemical	Organic Carbon Partition Coefficient Koc (cm^3/g)	Air Diffusion Coefficient D'a (cm^2/s)	Air Diffusion Coefficient D'a (cm^2/day)	Aqueous Diffusion Coefficient D'w (cm^2/s)	Aqueous Diffusion Coefficient D'w (cm^2/day)	Henry's Law Constant (unit less)	Units	Sitewide UCL	Units	Sitewide UCL
#N/A	2,4-Dinitrotoluene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	6.30E-02	mg/kg	6.30E-02
#N/A	Antimony	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	2.90E-01	mg/kg	2.90E-01
#N/A	Arsenic	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	4.90E+00	mg/kg	4.90E+00
#N/A	BaP TEQ	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.70E-01	mg/kg	1.70E-01
#N/A	Benzo (a) Anthracene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	2.10E-01	mg/kg	2.10E-01
#N/A	Benzo (a) Pyrene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.20E-01	mg/kg	1.20E-01
#N/A	Benzo (b) Fluoranthene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	5.80E-02	mg/kg	5.80E-02
#N/A	Benzo (k) Fluoranthene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.30E-02	mg/kg	1.30E-02
#N/A	Bis(2-Ethylhexyl) Phthalate	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.50E-01	mg/kg	1.50E-01
#N/A	Cadmium	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	9.90E-02	mg/kg	9.90E-02
#N/A	Chromium, Hexavalent	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.30E-01	mg/kg	1.30E-01
#N/A	Chrysene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	5.60E-01	mg/kg	5.60E-01
#N/A	Cobalt	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	8.10E+00	mg/kg	8.10E+00
#N/A	Copper	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.40E+01	mg/kg	1.40E+01
#N/A	Dibenz (a,h) Anthracene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	8.90E-03	mg/kg	8.90E-03
#N/A	Indeno (1,2,3-c,d) Pyrene	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.70E-02	mg/kg	1.70E-02
#N/A	Lead	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.10E+01	mg/kg	1.10E+01
#N/A	Thallium	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	2.20E-01	mg/kg	2.20E-01
#N/A	TPH as Diesel	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	2.20E+03	mg/kg	2.20E+03
#N/A	TPH as Gasoline	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	1.30E+02	mg/kg	1.30E+02
#N/A	TPH as Motor Oil	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	3.00E+03	mg/kg	3.00E+03
#N/A	Vanadium	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	3.00E+01	mg/kg	3.00E+01
#N/A	Zinc	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	mg/kg	4.20E+01	mg/kg	4.20E+01

Data Source: Geosyntec Consultants, Human Health Risk Assessment Report Former Kast Property Carson, California, March 10, 2014

*Chemicals with values listed as "#N/A" were not listed in the HHRA.

III. Soil and Layer Inputs for EMSOFT Model Run

	Calculation Options			Soil Properties				Physical Constants		Layer Properties	
	Time Period for Averaging and Printing Flux and Soil Concentration Results* (days)	Depth (D1) for Averaging Soil Concentration Results (cm)	Depth (D2) for Printing Soil Concentration Results (cm)	Fraction Organic Carbon[A,B] (unit less)	Fraction Porosity[A,B] (unit less)	Fraction Water Content[A,B] (unit less)	Bulk Density[A,B] (g/cm^3)	Porewater Flux (-=up, +=down)^c (cm/day)	Boundary Layer Thickness[D] (cm)	Cover Thickness[E] (cm)	Layer Thickness[F] (cm)
Site Wide (USEPA Screening Values for Loam)	[0.1/1]*	1	1	0.002	0.399	0.148	1.59	0	0.5	0	304.8

* 0.1 days: Shortest duration supported by EMSOFT model and used the represent the maximum hourly flux.

1 day: Used to represent the maximum daily flux

Data Sources: A. USPEA, User's Guide for Evaluation subsurface Vapor intrusion into Buildings, Table 11 - Guidance for Selection of Soil Type, (2004) 37. The soil parameters are based on soil texture classification of "lam."

B. USPEA, Johnson and Ettinger (1991) Model for Subsurface Vapor Intrusion into Buildings, Version 3.1, Soil Properties Lookup Table, (2004).

C. USEPA, EMSOFT User's Guide, Page 38, September 2002. "If no data are available, it would be conservative for the purpose of calculating long-term volatilization rates and soil concentrations to assume a porewater flux of zero."

D. USEPA, EMSOFT User's Guide, Page 43, September 2002. "A default boundary layer thickness that may be used in EMSOFT when no other data are available is 0.5 cm.

E. Assumes contamination begins at the surface.

F. This analysis uses 10 feet (304.8 cm) throughout site.

IV. EMSOFT Volatilization Factor Out Put

CAS #	Chemical	Volatilization Factors	
		0.1 Day Average (mg/cm^2)	1 Day Average (mg/cm^2-day)
100-41-4	Ethylbenzene	2.74E-02	8.72E-03
106-46-7	1,4-Dichlorobenzene	1.36E-05	4.35E-06
107-06-2	1,2-Dichloroethane	2.68E-05	8.52E-06
108-67-8	1,3,5-Trimethylbenzene	4.32E-03	1.39E-03
108-88-3	Toluene	8.61E-03	2.74E-03
127-18-4	Tetrachloroethene	1.37E-03	4.34E-04
129-00-0	Pyrene	8.66E-06	7.21E-06
1330-20-7	Xylenes, Total	4.07E-02	1.29E-02
156-59-2	cis-1,2-Dichloroethene	4.73E-05	1.50E-05
71-43-2	Benzene	1.60E-02	5.09E-03
74-83-9	Bromomethane	6.68E-04	2.12E-04
75-01-4	Vinyl Chloride	5.03E-05	1.59E-05
75-09-2	Methylene Chloride	2.76E-04	8.78E-05
75-27-4	Bromodichloromethane	7.50E-06	2.40E-06
75-65-0	tert-Butyl Alcohol (TBA)	7.75E-05	2.50E-05
78-87-5	1,2-Dichloropropane	2.47E-05	7.84E-06
79-01-6	Trichloroethene	6.29E-05	2.00E-05
79-34-5	1,1,2,2-Tetrachloroethane	9.23E-06	2.97E-06
90-12-0	1-Methylnaphthalene	1.05E-02	5.48E-03
91-20-3	Naphthalene	8.22E-02	2.60E-03
91-57-6	2-Methylnaphthalene	1.61E-02	5.48E-03
95-63-6	1,2,4-Trimethylbenzene	1.83E-02	5.86E-03
96-18-4	1,2,3-Trichloropropane	1.94E-05	6.21E-06

V. VOC Emission Calculations

General Assumptions

Parameter	Value	Units	References
Hours per Day	8	hours	Hours of work 8am-4pm

Excavated Surface Volatilization Assumptions

Parameter	Value	Units	References
Layer Thickness	304.8	cm	10 feet of excavation
Stabilizer	91%	%	Apply stabilizer on inactive areas. Source: USEPA, Control of Air Emissions from Superfund Sites, (1992). Long-term VOC control efficiency ranges from 91 to 100%.
Work Days in year	251	days	

Excavated Surfaces VOC Emissions

Equation:

Active Area Emissions (lb/time) = tXVFXAs

None-Active Area Emissions (lb/time) = (1-MR)xtXVFXAs

Where:

MR = stabilized mitigation

t = time conversion factor (e.g. Hours/day, days/year)

VF = volatility factor output from EMSOFT model (mg/cm^2-day)

As = surface area of volatilization (cm^2)

Phase	Duration (days)	Hourly QTY Excavated (CY)	Daily QTY Excavated (CY)	Yearly QTY Excavated (CY)	Hourly Excavated/Disturbed Surface Area (cm^2)	Daily Previously Excavated/Disturbed Surface Area (cm^2)	Yearly Excavated/Disturbed Surface Area (cm^2)	Stabilized Mitigation (% Reduction)
Option 1 - Excavati	889	22	173	20,446	5.41E+04	4.33E+05	5.13E+07	91%
Street Trenching	180	10	80	14,418	2.51E+04	2.01E+05	3.62E+07	91%

Kast VOC Emissions Calculations

Volatilization Factor Calculations:

CAS #	Chemical	Chemical UCL Concentration (mg/kg)	Volatilization Factors					
			VF1day [1 day avg.] (mg/cm^2-day)	VF1day [workday] (lbs/cm^2-day)	VF1day [off-workday] (lbs/cm^2-day)	VF1hr [0.1 day avg.] (mg/cm^2-day)	VF1hr [workday] (lbs/cm^2-day)	VF1hr [off-workday] (lbs/cm^2-day)
Option 1 - Excavation								
100-41-4	Ethylbenzene	5.00E-01	8.72E-03	6.41E-09	2.88E-08	2.74E-02	2.01E-08	4.03E-08
106-46-7	1,4-Dichlorobenzene	5.90E-04	4.35E-06	3.20E-12	1.44E-11	1.36E-05	9.99E-12	2.00E-11
107-06-2	1,2-Dichloroethane	4.70E-04	8.52E-06	6.26E-12	2.82E-11	2.68E-05	1.97E-11	3.94E-11
108-67-8	1,3,5-Trimethylbenzene	1.90E-01	1.39E-03	1.02E-09	4.60E-09	4.32E-03	3.17E-09	6.35E-09
108-88-3	Toluene	1.20E-01	2.74E-03	2.01E-09	9.06E-09	8.61E-03	6.33E-09	1.27E-08
127-18-4	Tetrachloroethene	1.30E-02	4.34E-04	3.19E-10	1.44E-09	1.37E-03	1.01E-09	2.01E-09
129-00-0	Pyrene	1.00E+00	7.21E-06	5.30E-12	2.38E-11	8.66E-06	6.36E-12	1.27E-11
1330-20-7	Xylenes, Total	7.69E-01	1.29E-02	9.48E-09	4.27E-08	4.07E-02	2.99E-08	5.98E-08
156-59-2	cis-1,2-Dichloroethene	5.60E-04	1.50E-05	1.10E-11	4.96E-11	4.73E-05	3.48E-11	6.95E-11
71-43-2	Benzene	1.70E-01	5.09E-03	3.74E-09	1.68E-08	1.60E-02	1.18E-08	2.35E-08
74-83-9	Bromomethane	5.80E-03	2.12E-04	1.56E-10	7.01E-10	6.68E-04	4.91E-10	9.82E-10
75-01-4	Vinyl Chloride	2.41E-04	1.59E-05	1.17E-11	5.26E-11	5.03E-05	3.70E-11	7.39E-11
75-09-2	Methylene Chloride	3.20E-03	8.78E-05	6.45E-11	2.90E-10	2.76E-04	2.03E-10	4.06E-10
75-27-4	Bromodichloromethane	2.40E-04	2.40E-06	1.76E-12	7.94E-12	7.50E-06	5.51E-12	1.10E-11
75-65-0	tert-Butyl Alcohol (TBA)	4.80E-03	2.50E-05	1.84E-11	8.27E-11	7.75E-05	5.70E-11	1.14E-10
78-87-5	1,2-Dichloropropane	3.60E-04	7.84E-06	5.76E-12	2.59E-11	2.47E-05	1.82E-11	3.63E-11
79-01-6	Trichloroethene	7.40E-04	2.00E-05	1.47E-11	6.61E-11	6.29E-05	4.62E-11	9.24E-11
79-34-5	1,1,2,2-Tetrachloroethane	4.80E-04	2.97E-06	2.18E-12	9.82E-12	9.23E-06	6.78E-12	1.36E-11
90-12-0	1-Methylnaphthalene	2.60E+00	5.48E-03	4.03E-09	1.81E-08	1.05E-02	7.72E-09	1.54E-08
91-20-3	Naphthalene	1.50E+00	2.60E-03	1.91E-09	8.60E-09	8.22E-02	6.04E-08	1.21E-07
91-57-6	2-Methylnaphthalene	3.90E+00	5.48E-03	4.03E-09	1.81E-08	1.61E-02	1.18E-08	2.37E-08
95-63-6	1,2,4-Trimethylbenzene	7.80E-01	5.86E-03	4.31E-09	1.94E-08	1.83E-02	1.34E-08	2.69E-08
96-18-4	1,2,3-Trichloropropane	6.40E-04	6.21E-06	4.56E-12	2.05E-11	1.94E-05	1.43E-11	2.85E-11

Kast VOC Emissions Calculations

Street Trenching - Excavation

CAS #	Chemical	Chemical UCL Concentration (mg/kg)	Volatilization Factors					
			VF1day [1 day avg.] (mg/cm^2-day)	VF1day [workday] (lbs/cm^2-day)	VF1day [off-workday] (lbs/cm^2-day)	VF1hr [0.1 day avg.] (mg/cm^2-day)	VF1hr [workday] (lbs/cm^2-day)	VF1hr [off-workday] (lbs/cm^2-day)
100-41-4	Ethylbenzene	5.00E-01	8.72E-03	6.41E-09	2.88E-08	2.74E-02	2.01E-08	4.03E-08
106-46-7	1,4-Dichlorobenzene	5.90E-04	4.35E-06	3.20E-12	1.44E-11	1.36E-05	9.99E-12	2.00E-11
107-06-2	1,2-Dichloroethane	4.70E-04	8.52E-06	6.26E-12	2.82E-11	2.68E-05	1.97E-11	3.94E-11
108-67-8	1,3,5-Trimethylbenzene	1.90E-01	1.39E-03	1.02E-09	4.60E-09	4.32E-03	3.17E-09	6.35E-09
108-88-3	Toluene	1.20E-01	2.74E-03	2.01E-09	9.06E-09	8.61E-03	6.33E-09	1.27E-08
127-18-4	Tetrachloroethene	1.30E-02	4.34E-04	3.19E-10	1.44E-09	1.37E-03	1.01E-09	2.01E-09
129-00-0	Pyrene	1.00E+00	7.21E-06	5.30E-12	2.38E-11	8.66E-06	6.36E-12	1.27E-11
1330-20-7	Xylenes, Total	7.69E-01	1.29E-02	9.48E-09	4.27E-08	4.07E-02	2.99E-08	5.98E-08
156-59-2	cis-1,2-Dichloroethene	5.60E-04	1.50E-05	1.10E-11	4.96E-11	4.73E-05	3.48E-11	6.95E-11
71-43-2	Benzene	1.70E-01	5.09E-03	3.74E-09	1.68E-08	1.60E-02	1.18E-08	2.35E-08
74-83-9	Bromomethane	5.80E-03	2.12E-04	1.56E-10	7.01E-10	6.68E-04	4.91E-10	9.82E-10
75-01-4	Vinyl Chloride	2.41E-04	1.59E-05	1.17E-11	5.26E-11	5.03E-05	3.70E-11	7.39E-11
75-09-2	Methylene Chloride	3.20E-03	8.78E-05	6.45E-11	2.90E-10	2.76E-04	2.03E-10	4.06E-10
75-27-4	Bromodichloromethane	2.40E-04	2.40E-06	1.76E-12	7.94E-12	7.50E-06	5.51E-12	1.10E-11
75-65-0	tert-Butyl Alcohol (TBA)	4.80E-03	2.50E-05	1.84E-11	8.27E-11	7.75E-05	5.70E-11	1.14E-10
78-87-5	1,2-Dichloropropane	3.60E-04	7.84E-06	5.76E-12	2.59E-11	2.47E-05	1.82E-11	3.63E-11
79-01-6	Trichloroethene	7.40E-04	2.00E-05	1.47E-11	6.61E-11	6.29E-05	4.62E-11	9.24E-11
79-34-5	1,1,2,2-Tetrachloroethane	4.80E-04	2.97E-06	2.18E-12	9.82E-12	9.23E-06	6.78E-12	1.36E-11
90-12-0	1-Methylnaphthalene	2.60E+00	5.48E-03	4.03E-09	1.81E-08	1.05E-02	7.72E-09	1.54E-08
91-20-3	Naphthalene	1.50E+00	2.60E-03	1.91E-09	8.60E-09	8.22E-02	6.04E-08	1.21E-07
91-57-6	2-Methylnaphthalene	3.90E+00	5.48E-03	4.03E-09	1.81E-08	1.61E-02	1.18E-08	2.37E-08
95-63-6	1,2,4-Trimethylbenzene	7.80E-01	5.86E-03	4.31E-09	1.94E-08	1.83E-02	1.34E-08	2.69E-08
96-18-4	1,2,3-Trichloropropane	6.40E-04	6.21E-06	4.56E-12	2.05E-11	1.94E-05	1.43E-11	2.85E-11

Kast VOC Emissions Calculations

VOC Emission Calculations:

CAS #	Chemical	VOC Emission Rates								
		Active Area Emissions (lbs/hour)	Non-Active Area Emissions (lbs/hour)	Total Area Emissions (lbs/hour)	Active Area Emissions (lbs/day)	Non-Active Area Emissions (lbs/day)	Total Area Emissions (lbs/day)	Active Area Emissions (lbs/year)	Non-Active Area Emissions (lbs/year)	Total Area Emissions (lbs/year)
Option 1 - Excavation										
100-41-4	Ethylbenzene	1.09E-03	1.96E-04	1.29E-03	2.77E-03	1.12E-03	3.90E-03	8.25E+01	7.42E+00	8.99E+01
106-46-7	1,4-Dichlorobenzene	5.41E-07	9.73E-08	6.38E-07	1.38E-06	5.60E-07	1.94E-06	4.12E-02	3.70E-03	4.49E-02
107-06-2	1,2-Dichloroethane	1.07E-06	1.92E-07	1.26E-06	2.71E-06	1.10E-06	3.81E-06	8.06E-02	7.25E-03	8.79E-02
108-67-8	1,3,5-Trimethylbenzene	1.72E-04	3.09E-05	2.03E-04	4.42E-04	1.79E-04	6.21E-04	1.31E+01	1.18E+00	1.43E+01
108-88-3	Toluene	3.42E-04	6.16E-05	4.04E-04	8.71E-04	3.53E-04	1.22E-03	2.59E+01	2.33E+00	2.83E+01
127-18-4	Tetrachloroethene	5.45E-05	9.80E-06	6.43E-05	1.38E-04	5.59E-05	1.94E-04	4.11E+00	3.70E-01	4.48E+00
129-00-0	Pyrene	3.44E-07	6.20E-08	4.06E-07	2.29E-06	9.29E-07	3.22E-06	6.82E-02	6.14E-03	7.43E-02
1330-20-7	Xylenes, Total	1.62E-03	2.91E-04	1.91E-03	4.10E-03	1.66E-03	5.76E-03	1.22E+02	1.10E+01	1.33E+02
156-59-2	cis-1,2-Dichloroethene	1.88E-06	3.38E-07	2.22E-06	4.77E-06	1.93E-06	6.70E-06	1.42E-01	1.28E-02	1.55E-01
71-43-2	Benzene	6.36E-04	1.14E-04	7.51E-04	1.62E-03	6.56E-04	2.27E-03	4.82E+01	4.33E+00	5.25E+01
74-83-9	Bromomethane	2.66E-05	4.78E-06	3.13E-05	6.74E-05	2.73E-05	9.47E-05	2.01E+00	1.80E-01	2.19E+00
75-01-4	Vinyl Chloride	2.00E-06	3.60E-07	2.36E-06	5.06E-06	2.05E-06	7.11E-06	1.50E-01	1.35E-02	1.64E-01
75-09-2	Methylene Chloride	1.10E-05	1.98E-06	1.29E-05	2.79E-05	1.13E-05	3.92E-05	8.31E-01	7.48E-02	9.05E-01
75-27-4	Bromodichloromethane	2.98E-07	5.37E-08	3.52E-07	7.63E-07	3.09E-07	1.07E-06	2.27E-02	2.04E-03	2.47E-02
75-65-0	tert-Butyl Alcohol (TBA)	3.08E-06	5.55E-07	3.64E-06	7.95E-06	3.22E-06	1.12E-05	2.36E-01	2.13E-02	2.58E-01
78-87-5	1,2-Dichloropropane	9.82E-07	1.77E-07	1.16E-06	2.49E-06	1.01E-06	3.50E-06	7.42E-02	6.67E-03	8.08E-02
79-01-6	Trichloroethene	2.50E-06	4.50E-07	2.95E-06	6.36E-06	2.58E-06	8.94E-06	1.89E-01	1.70E-02	2.06E-01
79-34-5	1,1,2,2-Tetrachloroethane	3.67E-07	6.61E-08	4.33E-07	9.45E-07	3.83E-07	1.33E-06	2.81E-02	2.53E-03	3.06E-02
90-12-0	1-Methylnaphthalene	4.17E-04	7.51E-05	4.93E-04	1.74E-03	7.06E-04	2.45E-03	5.18E+01	4.67E+00	5.65E+01
91-20-3	Naphthalene	3.27E-03	5.88E-04	3.86E-03	8.27E-04	3.35E-04	1.16E-03	2.46E+01	2.21E+00	2.68E+01
91-57-6	2-Methylnaphthalene	6.40E-04	1.15E-04	7.55E-04	1.74E-03	7.06E-04	2.45E-03	5.18E+01	4.67E+00	5.65E+01
95-63-6	1,2,4-Trimethylbenzene	7.28E-04	1.31E-04	8.59E-04	1.86E-03	7.55E-04	2.62E-03	5.54E+01	4.99E+00	6.04E+01
96-18-4	1,2,3-Trichloropropane	7.71E-07	1.39E-07	9.10E-07	1.98E-06	8.00E-07	2.78E-06	5.87E-02	5.29E-03	6.40E-02

Kast VOC Emissions Calculations

Street Trenching - Excavation

CAS #	Chemical	VOC Emission Rates								
		Active Area Emissions (lbs/hour)	Non-Active Area Emissions (lbs/hour)	Total Area Emissions (lbs/hour)	Active Area Emissions (lbs/day)	Non-Active Area Emissions (lbs/day)	Total Area Emissions (lbs/day)	Active Area Emissions (lbs/year)	Non-Active Area Emissions (lbs/year)	Total Area Emissions (lbs/year)
100-41-4	Ethylbenzene	5.06E-04	9.10E-05	5.97E-04	1.29E-03	5.21E-04	1.81E-03	5.82E+01	5.24E+00	6.34E+01
106-46-7	1,4-Dichlorobenzene	2.51E-07	4.52E-08	2.96E-07	6.42E-07	2.60E-07	9.02E-07	2.90E-02	2.61E-03	3.16E-02
107-06-2	1,2-Dichloroethane	4.95E-07	8.90E-08	5.84E-07	1.26E-06	5.09E-07	1.77E-06	5.68E-02	5.12E-03	6.20E-02
108-67-8	1,3,5-Trimethylbenzene	7.97E-05	1.44E-05	9.41E-05	2.05E-04	8.31E-05	2.88E-04	9.27E+00	8.35E-01	1.01E+01
108-88-3	Toluene	1.59E-04	2.86E-05	1.88E-04	4.05E-04	1.64E-04	5.68E-04	1.83E+01	1.65E+00	1.99E+01
127-18-4	Tetrachloroethene	2.53E-05	4.55E-06	2.98E-05	6.41E-05	2.60E-05	9.00E-05	2.90E+00	2.61E-01	3.16E+00
129-00-0	Pyrene	1.60E-07	2.88E-08	1.89E-07	1.06E-06	4.31E-07	1.50E-06	4.81E-02	4.33E-03	5.24E-02
1330-20-7	Xylenes, Total	7.51E-04	1.35E-04	8.86E-04	1.90E-03	7.71E-04	2.68E-03	8.61E+01	7.74E+00	9.38E+01
156-59-2	cis-1,2-Dichloroethene	8.73E-07	1.57E-07	1.03E-06	2.21E-06	8.97E-07	3.11E-06	1.00E-01	9.01E-03	1.09E-01
71-43-2	Benzene	2.95E-04	5.32E-05	3.48E-04	7.52E-04	3.04E-04	1.06E-03	3.40E+01	3.06E+00	3.70E+01
74-83-9	Bromomethane	1.23E-05	2.22E-06	1.45E-05	3.13E-05	1.27E-05	4.40E-05	1.41E+00	1.27E-01	1.54E+00
75-01-4	Vinyl Chloride	9.28E-07	1.67E-07	1.10E-06	2.35E-06	9.51E-07	3.30E-06	1.06E-01	9.55E-03	1.16E-01
75-09-2	Methylene Chloride	5.09E-06	9.17E-07	6.01E-06	1.30E-05	5.25E-06	1.82E-05	5.86E-01	5.27E-02	6.38E-01
75-27-4	Bromodichloromethane	1.38E-07	2.49E-08	1.63E-07	3.54E-07	1.44E-07	4.98E-07	1.60E-02	1.44E-03	1.75E-02
75-65-0	tert-Butyl Alcohol (TBA)	1.43E-06	2.57E-07	1.69E-06	3.69E-06	1.49E-06	5.19E-06	1.67E-01	1.50E-02	1.82E-01
78-87-5	1,2-Dichloropropane	4.56E-07	8.21E-08	5.38E-07	1.16E-06	4.69E-07	1.63E-06	5.23E-02	4.71E-03	5.70E-02
79-01-6	Trichloroethene	1.16E-06	2.09E-07	1.37E-06	2.95E-06	1.20E-06	4.15E-06	1.33E-01	1.20E-02	1.45E-01
79-34-5	1,1,2,2-Tetrachloroethane	1.70E-07	3.07E-08	2.01E-07	4.39E-07	1.78E-07	6.16E-07	1.98E-02	1.78E-03	2.16E-02
90-12-0	1-Methylnaphthalene	1.94E-04	3.49E-05	2.29E-04	8.09E-04	3.28E-04	1.14E-03	3.66E+01	3.29E+00	3.98E+01
91-20-3	Naphthalene	1.52E-03	2.73E-04	1.79E-03	3.84E-04	1.55E-04	5.39E-04	1.73E+01	1.56E+00	1.89E+01
91-57-6	2-Methylnaphthalene	2.97E-04	5.35E-05	3.51E-04	8.09E-04	3.28E-04	1.14E-03	3.66E+01	3.29E+00	3.98E+01
95-63-6	1,2,4-Trimethylbenzene	3.38E-04	6.08E-05	3.99E-04	8.65E-04	3.50E-04	1.22E-03	3.91E+01	3.52E+00	4.26E+01
96-18-4	1,2,3-Trichloropropane	3.58E-07	6.45E-08	4.23E-07	9.17E-07	3.71E-07	1.29E-06	4.14E-02	3.73E-03	4.52E-02

Summary of VOC Emissions (Expedited Case)

Sum of Value Row Labels	Column Labels lbs/day
1,1,2,2-Tetrachloroethane	3.45E-06
1,2,3-Trichloropropane	7.20E-06
1,2,4-Trimethylbenzene	6.80E-03
1,2-Dichloroethane	9.88E-06
1,2-Dichloropropane	9.10E-06
1,3,5-Trimethylbenzene	1.61E-03
1,4-Dichlorobenzene	5.05E-06
1-Methylnaphthalene	6.36E-03
2-Methylnaphthalene	6.36E-03
Benzene	5.91E-03
Bromodichloromethane	2.78E-06
Bromomethane	2.46E-04
cis-1,2-Dichloroethene	1.74E-05
Ethylbenzene	1.01E-02
Methylene Chloride	1.02E-04
Naphthalene	3.02E-03
Pyrene	8.36E-06
tert-Butyl Alcohol (TBA)	2.90E-05
Tetrachloroethene	5.04E-04
Toluene	3.18E-03
Trichloroethene	2.32E-05
Vinyl Chloride	1.84E-05
Xylenes, Total	1.50E-02
Grand Total	**5.93E-02**