Short term fugitive Dust Emissions

Maximum fugitive dust activity occurs in month 1.

1 month of dirt moving
22 construction days per month
10 construction hours per day
60% average load factor for equipment listed (CEQA)

Dirt Piling or Material Handling

$E = k * 0.0032 * (U/5)^{1.3} / (M/2)^{1.4}$ USEPA AP42 Chapter 13.2.4 (Aggregate Handling And Storage Piles)

0.35 k for PM_{10}
0.053 k for $PM_{2.5}$
6.25 U = Mean Wind speed (mph) average for Bakersfield Airport 2000-2004
19 M = Moisture content of surface material (%) (average of soil borings taken onsite at 5 ft)
0.00006 lb/ton of PM_{10}
0.00001 lb/ton of $PM_{2.5}$

Equipment	Quantity	Hours/Day	Material Handled (ton/day)	Material Handled (ton)	Watering Control Efficiency	PM10 Emissions (lb/hr)	PM10 Emissions (lb/day)	PM2.5 Emissions (lb/hr)	PM2.5 Emissions (lb/day)
Scraper	7	6	38,449	845,875	67%	0.1354	0.8124	0.0205	0.1230
Loader	2	6	10,253	225,567	67%	0.0361	0.2166	0.0055	0.0328
Backhoe	2	6	2,563	56,392	67%	0.0090	0.0542	0.0014	0.0082
				1,127,833	**Total**	**0.1805**	**1.0832**	**0.0273**	**0.1640**

Water efficiency from CEQA Table 11-4 watering 3 times daily or using chemical suppressants (South Coast Air Quality Management District, 1993, CEQA Air Quality Handbook, Table 11-4: Mitigation for PM10 Emissions - Construtions.")
assume 75% material handling is done by scrapers, 20% by loaders, and 5% by backhoe

43,445 yd3/day 51,265 ton/day 2,360 density of soil (lb/yd3)
955,791 yd3 1,127,833 tons (USDA NRCS Physical Soil Properties from Kern County for Lockern-Buttonwillow clay)
118.25 acres = 955,791 cubic yds, assume depth of soils moved is 1.67 yd
(assume 25% of entire site in month 1)

Grading Emissions Factor **To be used for all scraping and grading activities**

$E = 0.051(S)^{2.0}$ multiply by 0.60 for PM_{10} USEPA AP42 Chapter 13.2.3 (Heavy Construction Operations), Table 13.2.3-1 - refers to
assumed to be 4 mph S = mean vehicle speed (mph) USEPA AP42 Chapter 11.9 (Western Surface Coal Mining), Table 11.9-1

$E = 0.040(S)^{2.5}$ multiply by 0.031 for $PM_{2.5}$
assumed to be 4 mph S = mean vehicle speed (mph)

S = 4.0 mph
1.28 lb ≤ 30 µm/VMT
0.82 lb ≤ 15 µm/VMT
PM_{10} = 0.49 lb PM_{10}/VMT
$PM_{2.5}$ = 0.04 lb $PM_{2.5}$/VMT

Equipment	Quantity	Hours/Day	Daily VMT	Watering Control Efficiency	PM10 Emissions (lb/hr)	PM10 Emissions (lb/day)	PM2.5 Emissions (lb/hr)	PM2.5 Emissions (lb/day)
Scraper	7	6	1	67%	0.02	0.11	0.00	0.01
Grader	2	6	2	67%	0.05	0.32	0.00	0.03
				Total	**0.07**	**0.44**	**0.01**	**0.04**

Water efficiency from CEQA Table 11-4 watering 3 times daily or using chemical suppressants (South Coast Air Quality Management District, 1993, CEQA Air Quality Handbook, Table 11-4: Mitigation for PM10 Emissions - Construtions.")

Bulldozing/Earth clearing

$E = 1.0(s)^{1.5}/(M)^{1.4}$ multiply by 0.75 for PM_{10} USEPA AP42 Chapter 13.2.3 (Heavy Construction Operations), Table 13.2.3-1 - refers to
$E = 5.7(s)^{1.2}/(M)^{1.3}$ multiply by 0.105 for $PM_{2.5}$ USEPA AP42 Chapter 11.9 (Western Surface Coal Mining), Table 11.9-1, 11.9-3

50 s = Silt content (%) (from soil boring B-4)
19 M = Moisture content of surface material (%) (average of soil borings taken onsite at 5 ft)
4.30 lb/hr of PM10
1.42 lb/hr of PM2.5

Equipment	Quantity	Hours/Day	Watering Control Efficiency	PM10 Emissions (lb/hr)	PM10 Emissions (lb/day)	PM2.5 Emissions (lb/hr)	PM2.5 Emissions (lb/day)
Dozer	6	6	67%	8.51	51.06	2.82	16.91
			Total	**8.51**	**51.06**	**2.82**	**16.91**

22 construction days per month
1 Total months of soil movement

Water efficiency from CEQA Table 11-4 watering 3 times daily or using chemical suppressants (South Coast Air Quality Management District, 1993, CEQA Air Quality Handbook, Table 11-4: Mitigation for PM10 Emissions - Construtions.")

Cover Storage Pile

SCAQMD Table A9-9-E
$E = 1.7 * G/1.5 * (365-H)/235 * I/15 * J$
PM10 Emission factor from wind erosion of storage piles per day per acre

50 G = Silt content (%) (from soil boring B-4)
37 H = Mean number of days per year with at least 0.01 inches of precipitation (from WRCC for Bakersfield Airport Station)
0.3 I = Percentage of time that the unobstructed wind speed exceeds 12 mph at mean pile height
0.5 J = Fraction of TSP that is PM10 = 0.5
0.791 lb/acre/day

wind speed percentage and average based on 2000-04 (5 yrs) of wind speed data as recorded at Bakersfield Airport station

Source	Quantity	Size of Pile (acre)	Hours/Day	Watering Control Efficiency	PM10 Emissions (lb/hr)	PM10 Emissions (lb/day)	PM2.5 Emissions (lb/hr)	PM2.5 Emissions (lb/day)

Cover Storage Pile	25	0.25	24	67%	0.07	1.63	0.014	0.339

Water efficiency from CEQA Table 11-4 watering 3 times daily or using chemical suppressants (South Coast Air Quality Management District, 1993, CEQA Air Quality Handbook, Table 11-4: Mitigation for PM10 Emissions - Constrution.")
pile size and number are assumed

Travel on unpaved road

$F = 2.1 * G/12 * H/30 * (J/3)^{0.7} * (I/4)^{0.5} * (365-K)/365$ SCAQMD Table A9-9-D

Emission factor for vehicle travel on unpaved roads (lb/VMT)

4 G = Surface silt loading (%) (value for gravel road)

4 H = Mean vehicle speed (mph)

value listed in table I = Mean number of wheels on vehicle

value listed in table J = Mean vehicle weight (ton)

37 K = Mean number of days per year with at least 0.01 inches of precipitation (from WRCC for Bakersfield Airport Station)

Vehicle Type	No. Of Unit	Round Trips /Day/ Unit	Round Trip Distance (mile)	Daily VMT (all units)	Mean Vehicle Weight (tons)	Number of Wheels on Vehicle	PM10 EF (lbs/VMT)	Watering Control Efficiency	PM10 Emissions (lb/hr)	PM10 Emissions (lb/day)	PM2.5 Emissions (lb/hr)	PM2.5 Emissions (lb/day)
Concrete Pumper Truck	0			0.0	30	10	0.66	67%	0.00	0.00	0.00	0.00
Dump Truck	3	8	0.75	18.0	15	10	0.41	67%	0.24	2.43	0.05	0.52
Service Truck - 1 ton	0			0.0	15	10	0.41	67%	0.00	0.00	0.00	0.00
Pile Driver Truck	0			0.0	15	10	0.41	67%	0.00	0.00	0.00	0.00
Truck - Fuel/Lube	0			0.0	15	10	0.41	67%	0.00	0.00	0.00	0.00
Tractor Truck 5th Wheel	0			0.0	11	10	0.33	67%	0.00	0.00	0.00	0.00
Trucks - Pickup 3/4 ton	5	10	0.5	25.0	3	4	0.08	67%	0.07	0.69	0.01	0.15
Trucks - 3 ton	0			0.0	11	10	0.33	67%	0.00	0.00	0.00	0.00
Truck - Water	3	4	1	12.0	25	10	0.59	67%	0.23	2.32	0.05	0.49
Air Compressor 185 CFM	0			0.0	0.5	2	0.02	67%	0.00	0.00	0.00	0.00
Air Compressor 750 CFM	1	1	0.01	0.0	0.5	2	0.02	67%	0.00	0.00	0.00	0.00
Articulating Boom Platform	0			0.0	5	10	0.19	67%	0.00	0.00	0.00	0.00
Bulldozer D10R	3	1	0.1	0.3	35	2	0.33	67%	0.00	0.03	0.00	0.01
Bulldozer D4C	3	1	0.1	0.3	15	2	0.18	67%	0.00	0.02	0.00	0.00
Concrete Trowel Machine	0			0.0	15	8	0.37	67%	0.00	0.00	0.00	0.00
Concrete Vibrators	0			0.0	0.25	0	0.00	67%	0.00	0.00	0.00	0.00
Cranes - Mobile 35 ton	0			0.0	25	12	0.64	67%	0.00	0.00	0.00	0.00
Cranes - Mobile 45 ton	0			0.0	35	2	0.33	67%	0.00	0.00	0.00	0.00
Crane - Mobile 65 ton	0			0.0	45	2	0.39	67%	0.00	0.00	0.00	0.00
Cranes 100 / 150 ton cap	0			0.0	50	12	1.04	67%	0.00	0.00	0.00	0.00
Diesel Powered Welder	0			0.0	0.5	2	0.02	67%	0.00	0.00	0.00	0.00
Backhoe/loader	2	4	0.25	2.0	11	4	0.21	67%	0.01	0.14	0.00	0.03
Earth Scraper	7	1	0.1	0.7	40	4	0.51	67%	0.01	0.12	0.00	0.03
Loader	2	2	0.5	2.0	25	4	0.37	67%	0.02	0.24	0.01	0.05
Motor Grader	2	2	0.5	2.0	20	6	0.39	67%	0.03	0.26	0.01	0.05
Excavator - Trencher	0			0.0	17	4	0.28	67%	0.00	0.00	0.00	0.00
Fired Heaters	0			0.0	0.25	0	0.00	67%	0.00	0.00	0.00	0.00
Forklift	0			0.0	10	4	0.19	67%	0.00	0.00	0.00	0.00
Fusion Welder	0			0.0	0.25	2	0.01	67%	0.00	0.00	0.00	0.00
Heavy Haul / Cranes	0			0.0	75	2	0.56	67%	0.00	0.00	0.00	0.00
Light Plants	0			0.0	0.5	4	0.02	67%	0.00	0.00	0.00	0.00
Portable Compaction Roller	0			0.0	3	3	0.07	67%	0.00	0.00	0.00	0.00
Portable Compaction - Plate	0			0.0	0.1	0	0.00	67%	0.00	0.00	0.00	0.00
Portable Compaction - Ram	0			0.0	0.25	0	0.00	67%	0.00	0.00	0.00	0.00
Pumps	3	0	0	0.0	0.1	0	0.00	67%	0.00	0.00	0.00	0.00
Portable Power Generators	0			0.0	0.5	4	0.02	67%	0.00	0.00	0.00	0.00
Truck Crane - Greater than 200 ton	0			0.0	50	12	1.04	67%	0.00	0.00	0.00	0.00
Truck Crane - Greater than 300 ton	0			0.0	60	12	1.18	67%	0.00	0.00	0.00	0.00
Vibratory Roller 20 ton	3	1	0.25	0.8	20	3	0.27	67%	0.01	0.07	0.00	0.01
								Total	**0.65**	**6.54**	**0.14**	**1.39**

worker personal vehicles	35	1	0.5	17.6	3	4	0.08	85%	0.02	0.22	0.00	0.05

Assumed maximum travel speed is 4 mph
Equipment weight from SCAQMD Table A9-9-D-3 and various websites
Water efficiency from CEQA Table 11-4 watering 3 times daily or using chemical suppressants (South Coast Air Quality Management District, 1993, CEQA Air Quality Handbook, Table 11-4: Mitigation for PM10 Emissions - Constrution.")
PM2.5 emission factors from updated CEIDARS List with PM2.5 fractions.
PM2.5 numbers obtained by multiplying the PM10 values by fraction in CEIDARS list for appropriate fugitive dust sources.
Water trucks operate at least 4 times per day.

10 Maximum number of construction work hours per day

CEQA Load Factors (Table A9-8-D)						average equipment load factor
generator	74	crane	43	roller	57.5	58
welder	45	pumps	74	loader	54	
compressors	48	light plant	62	backhoe	46.5	
crawler dozer	59	trucks	57	grader	57.5	
drill rig	75	forklift	47.5	scraper	66	

Total Annual Fugitive Dust from Onsite Equipment - Month 1

	PM_{10} Emissions (lbs/day)	$PM_{2.5}$ Emissions (lbs/day)
Grading	0.4362	0.0354
Bulldozing	51.0596	16.9147
Dirt Piling	1.0832	0.1640
Storage Piles	1.6313	0.3393
Travel on Unpaved Roads	6.7567	1.4324
TOTAL	**60.97**	**18.89**

Annual Fugitive Dust Emissions

Maximum annual fugitive dust activity occurs in months 1-12.

7 months of soil disturbance
10 total construction hours per work day
22 construction days per month
60% average load factor for equipment listed (CEQA)

Grading Emissions Factor **To be used for all scraping and grading activities (except material handling)**

$E = 0.051(S)^{2.0}$ multiply by 0.60 for PM_{10} USEPA AP42 Chapter 13.2.3 (Heavy Construction Operations), Table 13.2.3-1 - refers to
assumed to be 4 mph S = mean vehicle speed (mph) USEPA AP42 Chapter 11.9 (Western Surface Coal Mining), Table 11.9-1

$E = 0.040(S)^{2.5}$ multiply by 0.031 for $PM_{2.5}$
assumed to be 4 mph S = mean vehicle speed (mph)

S = 4.0 mph
1.28 lb ≤ 30 µm/VMT
0.82 lb ≤ 15 µm/VMT
PM_{10} = 0.49 lb PM_{10}/VMT
$PM_{2.5}$ = 0.04 lb $PM_{2.5}$/VMT

Equipment	Quantity	Hours/Day	Annual VMT	Watering Control Efficiency	PM10 Emissions (lb/yr)	PM10 Emissions (ton/yr)	PM2.5 Emissions (lb/yr)	PM2.5 Emissions (ton/yr)
Scraper	24	6	634	67%	102	0.05	8.3	0.00
Grader	24	6	3,696	67%	597	0.30	48.4	0.02
				Total	**700**	**0.35**	**56.7**	**0.03**

Bulldozing/Earth clearing

$E = 1.0(s)^{1.5}/(M)^{1.4}$ multiply by 0.75 for PM_{10} USEPA AP42 Chapter 13.2.3 (Heavy Construction Operations), Table 13.2.3-1 - refers to
$E = 5.7(s)^{1.2}/(M)^{1.3}$ multiply by 0.105 for $PM_{2.5}$ USEPA AP42 Chapter 11.9 (Western Surface Coal Mining), Table 11.9-1, 11.9-3

50 s = Silt content (%) (from soil boring B-4)
19 M = Moisture content of surface material (%) (average of soil borings taken onsite at 5 ft)
4.30 lb/hr of PM_{10}
1.42 lb/hr of $PM_{2.5}$

Equipment	Quantity	Hours/Day	Watering Control Efficiency	PM10 Emissions (ton/yr)	PM2.5 Emissions (ton/yr)
Dozer	50	6	67%	4.68	1.55
			Total	**4.68**	**1.55**

Water efficiency from CEQA Table 11-4 watering 3 times daily or using chemical suppressants (South Coast Air Quality Management District, 1993, CEQA Air Quality Handbook, Table 11-4: Mitigation for PM10 Emissions - Construtions.")

Dirt Piling or Material Handling

$E = k * 0.0032 * (U/5)^{1.3} / (M/2)^{1.4}$ USEPA AP42 Chapter 13.2.4 (Aggregate Handling And Storage Piles)

0.35 k for PM_{10}
0.053 k for $PM_{2.5}$
6.25 U = Mean Wind speed (mph) average for Bakersfield Airport 2000-2004
19 M = Moisture content of surface material (%) (average of soil borings taken onsite at 5 ft)
0.00006 lb/ton of PM_{10}
0.00001 lb/ton of $PM_{2.5}$

Equipment	Annual Material Handled (ton)	Watering Control Efficiency	PM10 Emissions (tons/yr)	PM2.5 Emissions (tons/yr)
Scraper	1,691,750	67%	0.0179	0.0027
Loader	1,522,575	67%	0.0161	0.0024
Backhoe	169,175	67%	0.0018	0.0003
	3,383,500	**Total**	**0.0357**	**0.0054**

Water efficiency from CEQA Table 11-4 watering 3 times daily or using chemical suppressants (South Coast Air Quality Management District, 1993, CEQA Air Quality Handbook, Table 11-4: Mitigation for PM10 Emissions - Construtions.")
assume scraper handles 50% of dirt, loader 45%, and backhoe 5%

18,619 yd3/day 21,971 ton/day 2360 density of soil (lb/yd3)
2,867,373 yd3 3,383,500 tons (USDA NRCS Physical Soil Properties from Kern County Lockern-Buttonwillow clay soil)
354.75 acres = 2,867,373 cubic yds, assume depth of soils moved is 1.67 yd
(assume 75% of entire site disturbed in 12 month period)

Cover Storage Pile

SCAQMD Table A9-9-E
$E = 1.7 * G/1.5 * (365-H)/235 * I/15 * J$
PM10 Emission factor from wind erosion of storage piles per day per acre

50 G = Silt content (%) (from soil boring B-4)
37 H = Mean number of days per year with at least 0.01 inches of precipitation (from WRCC for Bakersfield Airport Station)
0.3 I = Percentage of time that the unobstructed wind speed exceeds 12 mph at mean pile height
0.5 J = Fraction of TSP that is PM10 = 0.5
0.791 lb/acre/day

wind speed percentage and average based on 2000-04 (5 yrs) of wind speed data as recorded at Bakersfield Airport station

Source	Quantity	Size of Pile (acre)	Days / year	Watering Control Efficiency	PM10 Emissions (tons/yr)	PM2.5 Emissions (tons/yr)
Cover Storage Pile	40	0.25	365	67%	0.48	0.099

Water efficiency from CEQA Table 11-4 watering 3 times daily or using chemical suppressants (South Coast Air Quality Management District, 1993, CEQA Air Quality Handbook, Table 11-4: Mitigation for PM10 Emissions - Construtions.")
pile size and number are assumed
Days per year accounts for weekend days also, not just work days

Travel on unpaved road

$F = 2.1 * G/12 * H/30 * (J/3)^{0.7} * (I/4)^{0.5} * (365-K)/365$ SCAQMD Table A9-9-D

Emission factor for vehicle travel on unpaved roads (lb/VMT)

4 G = Surface silt loading (%) (value for gravel road)
4 H = Mean vehicle speed (mph)
value listed in table I = Mean number of wheels on vehicle
value listed in table J = Mean vehicle weight (ton)
37 K = Mean number of days per year with at least 0.01 inches of precipitation (from WRCC for Bakersfield Airport Station)

Vehicle Type	Quantity per year	Round Trips /Day/ Unit	Round Trip Distance (mile)	Annual VMT (all units)	Mean Vehicle Weight (tons)	Number of Wheels on Vehicle	PM10 EF (lbs/VMT)	Watering Control Efficiency	PM10 Emissions (tons/yr)	PM2.5 Emissions (tons/yr)
Concrete Pumper Truck	6	2	0.75	792.0	30	10	0.66	67%	0.087	0.018
Dump Truck	32	8	0.75	50688.0	15	10	0.41	67%	3.422	0.725
Service Truck - 1 ton	0			0.0	15	10	0.41	67%	0.000	0.000
Pile Driver Truck	12	2	0.1	633.6	15	10	0.41	67%	0.043	0.009
Truck - Fuel/Lube	0			0.0	15	10	0.41	67%	0.000	0.000
Tractor Truck 5th Wheel	0			0.0	11	10	0.33	67%	0.000	0.000
Trucks - Pickup 3/4 ton	60	10	0.5	79200.0	3	4	0.08	67%	1.096	0.232
Trucks - 3 ton	15	2	0.5	3960.0	11	10	0.33	67%	0.215	0.046
Truck - Water	28	4	1	29568.0	25	10	0.59	67%	2.854	0.605
Air Compressor 185 CFM	0			0.0	0.5	2	0.02	67%	0.000	0.000
Air Compressor 750 CFM	16	1	0.01	42.2	0.5	2	0.02	67%	0.000	0.000
Articulating Boom Platform	0			0.0	5	10	0.19	67%	0.000	0.000
Bulldozer D10R	24	1	0.1	633.6	35	2	0.33	67%	0.035	0.007
Bulldozer D4C	26	1	0.1	686.4	15	2	0.18	67%	0.021	0.004
Concrete Trowel Machine	8	1	0.25	528.0	15	8	0.37	67%	0.032	0.007
Concrete Vibrators	0			0.0	0.25	0	0.00	67%	0.000	0.000
Cranes - Mobile 35 ton	15	1	0.1	396.0	25	12	0.64	67%	0.042	0.009
Cranes - Mobile 45 ton	0			0.0	35	2	0.33	67%	0.000	0.000
Crane - Mobile 65 ton	0			0.0	45	2	0.39	67%	0.000	0.000
Cranes 100 / 150 ton cap	2	0	0	0.0	50	12	1.04	67%	0.000	0.000
Diesel Powered Welder	8	0	0	0.0	0.5	2	0.02	67%	0.000	0.000
Backhoe/loader	40	4	0.25	10560.0	11	4	0.21	67%	0.363	0.077
Earth Scraper	24	1	0.1	633.6	40	4	0.51	67%	0.054	0.011
Loader	24	2	0.5	6336.0	25	4	0.37	67%	0.387	0.082
Motor Grader	14	2	0.5	3696.0	20	6	0.39	67%	0.236	0.050
Excavator - Trencher	0			0.0	17	4	0.28	67%	0.000	0.000
Fired Heaters	24	0	0	0.0	0.25	0	0.00	67%	0.000	0.000
Forklift	7	5	0.5	4620.0	10	4	0.19	67%	0.149	0.031
Fusion Welder	0			0.0	0.25	2	0.01	67%	0.000	0.000
Heavy Haul / Cranes	0			0.0	75	2	0.56	67%	0.000	0.000
Light Plants	18	0	0	0.0	0.5	4	0.02	67%	0.000	0.000
Portable Compaction Roller	19	0	0	0.0	3	3	0.07	67%	0.000	0.000
Portable Compaction - Plate	15	0	0	0.0	0.1	0	0.00	67%	0.000	0.000
Portable Compaction - Ram	0			0.0	0.25	0	0.00	67%	0.000	0.000
Pumps	35	0	0	0.0	0.1	0	0.00	67%	0.000	0.000
Portable Power Generators	19	0	0	0.0	0.5	4	0.02	67%	0.000	0.000
Truck Crane - Greater than 200 ton	1	1	0.1	26.4	50	12	1.04	67%	0.005	0.001
Truck Crane - Greater than 300 ton	0			0.0	60	12	1.18	67%	0.000	0.000
Vibratory Roller 20 ton	27	2	0.25	3564.0	20	3	0.27	67%	0.161	0.034
								Total	**9.201**	**1.951**
worker personal vehicles	176	1	0.5	87.9	3	4	0.08	85%	0.001	0.000

worker personal vehicle data from Table 2-26, Estimated Monthly Construction Workforce from AFC, average for months 1-12 divided by 1.25 employees per vehicle

Assumed maximum travel speed is 4 mph
Equipment weight from SCAQMD Table A9-9-D-3 and various websites
Water efficiency from CEQA Table 11-4 watering 3 times daily or using chemical suppressants (South Coast Air Quality Management District, 1993, CEQA Air Quality Handbook, Table 11-4: Mitigation for PM10 Emissions - Construtions.")
except for worker vehicles - parking area will be graveled and main road onsite will be paved
PM2.5 emission factors from updated CEIDARS List with PM2.5 fractions.
PM2.5 numbers obtained by multiplying the PM10 values by fraction in CEIDARS list for appropriate fugitive dust sources.
Water trucks operate at least 4 times per day.

Total Annual Fugitive Dust from Onsite Equipment - Months 1 - 12

	PM_{10} Emissions (tons/yr)	$PM_{2.5}$ Emissions (tons/yr)
Grading	0.3498	0.0283
Bulldozing	4.6805	1.5505
Dirt Piling	0.0357	0.0054
Storage Piles	0.4763	0.0991
Travel on Unpaved Roads	9.2005	1.9505
TOTAL	**14.74**	**3.63**