Air Quality Technical Appendix
Bradley Landfill
Operational Emissions

Bradley Landfill
Change in Operational Emissions
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Bradley Landfill
Change in Operational Emissions
Summary

Change in Daily Operational Emissions

	Max. Daily Emissions (lb/day)					Max. Daily Emissions (lb/day)				
Description	*ROG*	*CO*	*NOx*	*SOx*	*PM10*	*ROG*	*CO*	*NOx*	*SOx*	*PM10*
Phase 1	74	314	954	4	186	74	314	954	4	101
Phase 2 - Interim (c. 2008)	71	284	947	3	176	71	284	947	3	91
Phase 2 - Complete (c. 2012)	35	153	556	3	101	35	153	556	3	59
Max. Daily Change	*74*	*314*	*954*	*4*	*186*	*74*	*314*	*954*	*4*	*101*
SCAQMD Significance Threshold	55	550	55	150	150	55	550	55	150	150
Project Exceeds SCAQMD Threshold?	Yes	No	Yes	No	Yes	Yes	No	Yes	No	No

Notes:
SCAQMD = South Coast Air Quality Management District

Change in Quarterly Operational Emissions

	Max. Quarterly Emissions (tons/Q)					Max. Quarterly Emissions (tons/Q)				
Description	*ROG*	*CO*	*NOx*	*SOx*	*PM10*	*ROG*	*CO*	*NOx*	*SOx*	*PM10*
Phase 1	2.9	12.3	37.2	0.1	7.3	2.9	12.3	37.2	0.1	3.9
Phase 2 - Interim (c. 2008)	2.8	11.1	36.9	0.1	6.9	2.8	11.1	36.9	0.1	3.6
Phase 2 - Complete (c. 2012)	1.4	6.0	21.7	0.1	3.9	1.4	6.0	21.7	0.1	2.3
Max. Quarterly Change (1)	*2.9*	*12.3*	*37.2*	*0.1*	*7.3*	*2.9*	*12.3*	*37.2*	*0.1*	*3.9*

Notes:
(1) Quarterly emissions = worst case daily emissions x 6 days/week x 13 weeks/quarter

Bradley Landfill
Change in Operational Emissions
Phase 1

Equipment/Activity Descriptions

Equipment/Activity	*Hp Rating*	*Load Factor*	*Number Active*	*Equip-Hrs Day*	*Miles/ Day*	*Idling Min. Day*	Equipment Type
Front-End Loader	230	0.465	2	12.0	-	-	Off-Road
Bulldozer	352	0.59	4	12.0	-	-	Off-Road
Compactor	79	0.575	3	12.0	-	-	Off-Road
Trash Truck (WM)	-	-	-	-	2,400	800	Trash
Trash Truck (non-WM)	-	-	-	-	3,585	1,195	Trash
Transfer trucks (HHDT trucks)	-	-	-	-	3,105	1,035	On-Road
Water Truck, Peterbilt (4,000 gal) [HHDT]	-	-	1	12.0	60	72	On-Road
Worker commute vehicle [LDT1-ALL]	-	-	28	-	60	-	On-Road

Notes:
Load factors and horsepower ratings from 1993 SCAQMD CEQA Handbook (Tables A9-8-C and A9-8-D), project team, Caterpillar Handbook.

Baseline:	1,219	RT/day
Phase 1:	1,825	RT/day
Net change:	606	RT/day
Increase in trash truck RTs:	399	RT/day
WM Trash Truck RTs:	40%	of total RT/day
RT/day:	160	RT/day
Avg RT length:	15	miles/RT
Non-WM Trash Truck RTs:	60%	of total RT/day
RT/day:	239	RT/day
Avg RT length:	15	miles/RT
Increase in transfer truck RTs:	207	RT/day
Avg RT length:	15	miles/RT

RT = roundtrip
Trips estimates based on WM's Bradley Landfill and Recycling Center Master Plan, "Trip Gen 1-19-05.xls".

Trash trucks assumed to idle 5 minutes total per roundtrip.

Bradley Landfill
Change in Operational Emissions
Phase 1

Emission Factors for Off-Road Equipment

	Emission Factors						
Equipment/Activity	*ROG*	*CO*	*NOx*	*SOx*	*PM10*	*Units*	*Reference*
Front-End Loader	0.72	3.08	9.06	0.01	0.42	g/hp-hr	(1)
Bulldozer	0.63	2.78	8.54	0.01	0.37	g/hp-hr	(1)
Compactor	0.63	2.78	8.54	0.01	0.37	g/hp-hr	(1)

(1) Composite based on CARB OFFROAD Emissions Model (1999). SOx emission factor assumes fuel has maximum sulfur content of 15 ppmw (SCAQMD Rule 431.2 requirement effective as early as 1 January 2005).

Emission Factors for On-Road Heavy Duty Trucks and Refuse Trucks

	Emission Factors						
Project Year/Mode	*ROG*	*CO*	*NOx*	*SOx*	*PM10*	*Units*	*Reference*
On-road Truck - Idle	4.41	26.30	80.70	0.34	1.84	grams/hr	(1)
On-road Truck - 5 mph	1.85	10.53	20.27	0.18	0.83	grams/mile	(1)
On-road Truck - 10 mph	1.45	7.26	16.81	0.18	0.79	grams/mile	(1)
On-road Truck - 25 mph	0.80	3.13	11.88	0.18	0.44	grams/mile	(1)
On-road Truck - 55 mph	0.44	1.98	15.47	0.18	0.24	grams/mile	(1)
On-road Trucks - Composite (Water Truck)	1.85	10.53	20.27	0.18	0.83	grams/mile	(2)
On-road Trucks - Composite (Heavy Duty Tr	0.69	2.97	14.17	0.18	0.38	grams/mile	(3)
Trash Trucks - Local	7.51	22.79	86.57	0.18	3.13	grams/mile	(4)
Trash Trucks - Highway	0.44	1.98	15.47	0.18	0.24	grams/mile	(4)

(1) From CARB's EMFAC2002 (v2.2). Assumes: Heavy duty diesel truck (HHDT), Location: SCAQMD, Temp.: 70 F, Relative Humidity: 60%.
PM10 factors include PM10 from combustion only (tire wear and brake wear included with fugitive dust).
Based on EMFAC emission factors for Year 2006.
(2) Assumes water truck travel at 5 miles per hour (mph) maximum. Although not included in this composite emission factor, daily emissions estimates (see below) include idling emissions.
(3) Based on 10% at 10 miles per hour (mph), 40% at 25 mph, and 50% at 55 mph. Although not included in this composite emission factor, daily emissions estimates (see below) include idling emissions.
(4) Based on NYGTC refuse collection vehicle emission factors (CARB, June 6, 2003) and Bradley fleet mix as of October 2004.
Trash truck highway emission factors conservatively assume EMFAC emission factors for Year 2006 (heavy duty diesel truck).

Emission Factors for On-Road Vehicles

	Emission Factors						
Project Year/Mode	*ROG*	*CO*	*NOx*	*SOx*	*PM10*	*Units*	*Reference*
Worker Trips - 10 mph	0.92	11.15	0.79	0.01	0.04	grams/mile	(1)
Worker Trips - 25 mph	0.50	7.25	0.59	0.01	0.02	grams/mile	(1)
Worker Trips - 55 mph	0.40	5.71	0.59	0.00	0.01	grams/mile	(1)
Worker Trips - Composite	0.49	6.87	0.61	0.00	0.02	grams/mile	(2)

(1) From CARB's EMFAC2002 (v2.2). Units in grams/mile. Assumptions: Location: SCAQMD, Temperature: 70 F, Relative Humidity: 60%.
PM10 factors include PM10 from combustion only (tire and brake wear included with fugitive dust). Conservatively assumes light-duty trucks, composite (LDT1-ALL).
ROG emission factors includes evaporative running loss of 0.2017 grams/mile.
Based on EMFAC emission factors for Year 2006.
Starting emisions (grams/trip, after 600 minutes): ROG (1.52), CO (17.59), Nox (0.66), SOx (0.003), PM10 (0.015).
Starting emisions (grams/trip, after 60 minutes): ROG (0.862), CO (10.647), Nox (0.726), SOx (0.001), PM10 (0.008).
Hot soak emissions (grams/trip): ROG (0.326).
Partial day diurnal emissions (grams/hr): ROG (0.013).
Resting losses (grams/hr): ROG (0.077).
(2) Based on 10% at 10 miles per hour (mph), 40% at 25 mph, and 50% at 55 mph. Composite emission factor is used for worker commute vehicles.

Bradley Landfill
Change in Operational Emissions
Phase 1

Fugitive Dust

	Emissions (lb/day) - Unmitigated					Emissions (lb/day) - Mitigated				
Equipment/Activity	*ROG*	*CO*	*NOx*	*SOx*	*PM10*	*ROG*	*CO*	*NOx*	*SOx*	*PM10*
Electric grinder	-	-	-	-	100.0	-	-	-	-	15.0
Front-End Loader	-	-	-	-	-	-	-	-	-	-
Bulldozer	-	-	-	-	-	-	-	-	-	-
Compactor	-	-	-	-	-	-	-	-	-	-
Trash Truck (WM)	-	-	-	-	12.7	-	-	-	-	12.7
Trash Truck (non-WM)	-	-	-	-	19.0	-	-	-	-	19.0
Transfer trucks (HHDT trucks)	-	-	-	-	16.4	-	-	-	-	16.4
Water Truck, Peterbilt (4,000 gal) [HHDT]	-	-	-	-	3.9	-	-	-	-	3.9
Worker commute vehicle [LDT1-ALL]	-	-	-	-	2.6	-	-	-	-	2.6
Total	-	-	-	-	154.6	-	-	-	-	69.6

Notes:
Grinder mitigated fugitive PM10 emissions estimates assume watering control efficiency 85% (based on Table A11-9-A, CEQA Handbook, and grinder-specific enclosure/water c
Water truck fugitive PM10 emissions estimates assumes watering control efficiency of: 50% (Table A11-9-A, CEQA Handbook)
Road watering required per SCAQMD Rule 403, so watering and resulting reduction in fugitive dust is not considered mitigation.
No reduction assumed for off-site travel on paved roads (eg., worker commute vehicles) because watering only occurs on site.
Fugitive PM10 emissions for on-road vehicles also include break and tire wear.
Fugitive dust from equipment with "-" assumed to be negligible relative to other equipment.

Grinder:

Description	Value	References/Notes
PM10 Emission factor:	0.25 lb/ton	Estimate, based on 2003-2004 AER
Greenwaste throughput:	400 ton/day	WM Estimate
PM10 emissions:	100.0 lb/day	Uncontrolled

Passenger vehicle travel on PAVED roads:

Description	PM10 Emissions	References/Notes
Freeway:	0.0008 lb/mile	AP-42 Section 13.2.1, CARB Section 7.9
Major/Collector Roads:	0.0012 lb/mile	AP-42 Section 13.2.1, CARB Section 7.9
Local roads:	0.0040 lb/mile	AP-42 Section 13.2.1, CARB Section 7.9
PM10 Emission factor (composite)	0.00152 lb/mile	Assumption (20% Local, 20% Collector, 60% Freeway)

Truck travel on PAVED roads:

Description	PM10 Emissions	References/Notes
Freeway:	0.0036 lb/mile	AP-42 Section 13.2.1, CARB Section 7.9
Major/Collector Roads:	0.0053 lb/mile	AP-42 Section 13.2.1, CARB Section 7.9
Local roads:	0.0180 lb/mile	AP-42 Section 13.2.1, CARB Section 7.9
Composite	0.00530 lb/mile	Assumption (10% Local, 15% Collector, 75% Highway)

Reference:
EPA AP-42 Section 13.2.1 (Paved Roads, 12/2003) and CARB Section 7.9 (Entrained Paved Road Dust, Paved Road Travel, July 1997)
PM10 Emissions (lb/VMT) = $k(sL/2)^{0.65} \times (W/3)^{1.5}$
Where: k = 0.016 (particle size multiplier for PM10), sL = road silt loading (grams per square meter) from CARB Methodology 7.9 for paved roads, W = vehicle weight (tons)
For Los Angeles County, sL = 0.02 g/m2 for freeways, 0.037 g/m2 for major/collector roads, 0.24 g/m2 for local roads.
For haul trucks, assume W = 30 tons; for commute vehicle, assume W = 3 tons.

Vehicle travel on UNPAVED roads:

Description	PM10 Emissions	References/Notes
Water truck:	0.13 lb/mile	Vehicle weighs 20 tons, has 10 wheels, travels at 1 mph on site.

Reference: Table A9-9-D, CEQA Handbook; Caterpillar Equipment Handbook. Assumes silt loading of 4% (Gravel Road, Table A9-9-D-1).

Bradley Landfill
Change in Operational Emissions
Phase 1

Daily Emissions

	Emissions (lb/day) - Unmitigated					Emissions (lb/day) - Mitigated				
Equipment/Activity	*ROG*	*CO*	*NOx*	*SOx*	*PM10*	*ROG*	*CO*	*NOx*	*SOx*	*PM10*
Front-End Loader	4.1	17.4	51.3	-	2.4	4.1	17.4	51.3	-	2.4
Bulldozer	13.8	61.1	187.7	0.1	8.1	13.8	61.1	187.7	0.1	8.1
Compactor	2.3	10.0	30.8	-	1.3	2.3	10.0	30.8	-	1.3
Trash Truck (WM)	15.6	49.8	215.9	1.0	4.8	15.6	49.8	215.9	1.0	4.8
Trash Truck (non-WM)	23.2	74.4	322.5	1.4	8.5	23.2	74.4	322.5	1.4	8.5
Transfer trucks (HHDT trucks)	12.8	73.0	141.8	1.2	5.7	12.8	73.0	141.8	1.2	5.7
Water Truck, Peterbilt (4,000 gal) [HHDT]	0.1	0.5	2.1	-	0.1	0.1	0.5	2.1	-	0.1
Worker commute vehicle [LDT1-ALL]	2.1	27.6	2.3	-	0.1	2.1	27.6	2.3	-	0.1
Fugitive Dust	-	-	-	-	154.6	-	-	-	-	69.6
Total	*74.0*	*313.8*	*954.4*	*3.7*	*185.6*	*74.0*	*313.8*	*954.4*	*3.7*	*100.6*

Notes:
Trash truck daily emissions based on following ratio of local/highway travel:

Local:	35%
Highway:	65%

Mitigation assumptions:

Fraction of WM trash trucks meeting each BACT level:

CARB Level 3 (85% PM Reduction)	25%
CARB Level 2 (25% PM reduction):	25%
No CARB level:	50%

Fraction of non-WM trash trucks meeting each BACT level:

CARB Level 3 (85% PM Reduction)	10%
CARB Level 2 (25% PM reduction):	25%
No CARB level:	65%

Daily Emissions - Grouped by Equipment/Activity Type

	Emissions (lb/day) - Unmitigated					Emissions (lb/day) - Mitigated				
Equipment/Activity	*ROG*	*CO*	*NOx*	*SOx*	*PM10*	*ROG*	*CO*	*NOx*	*SOx*	*PM10*
Off-Road and Heavy Duty Equipment	20.3	89.0	271.9	0.1	11.9	20.3	89.0	271.9	0.1	11.9
Trash Trucks (WM)	15.6	49.8	215.9	1.0	4.8	15.6	49.8	215.9	1.0	4.8
Trash Trucks (non-WM)	23.2	74.4	322.5	1.4	8.5	23.2	74.4	322.5	1.4	8.5
Transfer Trucks	12.8	73.0	141.8	1.2	5.7	12.8	73.0	141.8	1.2	5.7
Commute Vehicles	2.1	27.6	2.3	-	0.1	2.1	27.6	2.3	-	0.1
Fugitive Dust	-	-	-	-	154.6	-	-	-	-	69.6
Total	*74.0*	*313.8*	*954.4*	*3.7*	*185.6*	*74.0*	*313.8*	*954.4*	*3.7*	*100.6*

Bradley Landfill
Change in Operational Emissions
Phase 2 - Interim (c. 2008)

Equipment/Activity Descriptions

Equipment/Activity	*Hp Rating*	*Load Factor*	*Number Active*	*Equip-Hrs Day*	*Miles/ Day*	*Idling Min. Day*	Equipment Type
Front-End Loader	230	0.465	2	12.0	-	-	Off-Road
Bulldozer	352	0.59	4	12.0	-	-	Off-Road
Compactor	79	0.575	3	12.0	-	-	Off-Road
Trash Truck (WM)	-	-	-	-	2,130	710	Trash
Trash Truck (non-WM)	-	-	-	-	3,210	1,070	Trash
Transfer trucks (HHDT trucks)	-	-	-	-	3,270	1,090	On-Road
Water Truck, Peterbilt (4,000 gal) [HHDT]	-	-	1	12.0	60	72	On-Road
Worker commute vehicle [LDT1-ALL]	-	-	9	-	60	-	On-Road

Notes:
Load factors and horsepower ratings from 1993 SCAQMD CEQA Handbook (Tables A9-8-C and A9-8-D), project team, Caterpillar Handbook.

Baseline:	1,219	RT/day
Phase 2 - Interim (c. 2008):	1,793	RT/day
Net change:	574	RT/day
Increase in trash truck RTs:	356	RT/day
WM Trash Truck RTs:	40%	of total RT/day
RT/day:	142	RT/day
Avg RT length:	15	miles/RT
Non-WM Trash Truck RTs:	60%	of total RT/day
RT/day:	214	RT/day
Avg RT length:	15	miles/RT
Increase in transfer truck RTs:	218	RT/day
Avg RT length:	15	miles/RT
% of RTs using LNG/CNG transfer trucks:	34%	

RT = roundtrip
Trips estimates based on WM's Bradley Landfill and Recycling Center Master Plan, "Trip Gen 1-19-05.xls".

Trash trucks assumed to idle 5 minutes total per roundtrip.

Bradley Landfill
Change in Operational Emissions
Phase 2 - Interim (c. 2008)

Emission Factors for Off-Road Equipment

	Emission Factors						
Equipment/Activity	*ROG*	*CO*	*NOx*	*SOx*	*PM10*	*Units*	*Reference*
Front-End Loader	0.72	3.08	9.06	0.01	0.42	g/hp-hr	(1)
Bulldozer	0.63	2.78	8.54	0.01	0.37	g/hp-hr	(1)
Compactor	0.63	2.78	8.54	0.01	0.37	g/hp-hr	(1)

(1) Composite based on CARB OFFROAD Emissions Model (1999). SOx emission factor assumes fuel has maximum sulfur content of 15 ppmw (SCAQMD Rule 431.2 requirement effective as early as 1 January 2005).

Emission Factors for On-Road Heavy Duty Trucks

	Emission Factors						
Project Year/Mode	*ROG*	*CO*	*NOx*	*SOx*	*PM10*	*Units*	*Reference*
On-road Truck - Idle	4.41	26.30	80.70	0.34	1.84	grams/hr	(1)
On-road Truck - 5 mph	1.85	10.53	20.27	0.18	0.83	grams/mile	(1)
On-road Truck - 10 mph	1.45	7.26	16.81	0.18	0.79	grams/mile	(1)
On-road Truck - 25 mph	0.80	3.13	11.88	0.18	0.44	grams/mile	(1)
On-road Truck - 55 mph	0.44	1.98	15.47	0.18	0.24	grams/mile	(1)
On-road Trucks - Composite (Water Truck)	1.85	10.53	20.27	0.18	0.83	grams/mile	(2)
On-road Trucks - Composite (Heavy Duty Tr	0.69	2.97	14.17	0.18	0.38	grams/mile	(3)
Trash Trucks - Local	6.83	20.94	83.14	0.18	2.92	grams/mile	(4)
Trash Trucks - Highway	0.44	1.98	15.47	0.18	0.24	grams/mile	(4)
On-road Trucks - CNG/LNG	0.12	2.30	5.74	0.09	0.08	grams/mile	(5)
On-road Trucks - CNG/LNG - Idle	1.10	6.58	20.18	0.09	0.46	grams/hr	(5)

(1) From CARB's EMFAC2002 (v2.2). Assumes: Heavy duty diesel truck (HHDT), Location: SCAQMD, Temp.: 70 F, Relative Humidity: 60%.
PM10 factors include PM10 from combustion only (tire wear and brake wear included with fugitive dust).
Based on EMFAC emission factors for Year 2006.
(2) Assumes water truck travel at 5 miles per hour (mph) maximum. Although not included in this composite emission factor, daily emissions estimates (see below) include idling emissions.
(3) Based on 10% at 10 miles per hour (mph), 40% at 25 mph, and 50% at 55 mph. Although not included in this composite emission factor, daily emissions estimates (see below) include idling emissions.
(4) Local emission factors based on NYGTC refuse collection vehicle emission factors (CARB, June 6, 2003) and estimated Bradley fleet mix in 2008, Trash truck highway emission factors conservatively assume EMFAC emission factors for Year 2006 (heavy duty diesel truck).
(5) Data for 300 horsepower Cummins L10-300G CNG engine (Ref: http://www.nrdc.org/). "g/mile" calculated from certified emissions data using CARB conversion factors of 4.1 bhp-hr/mi for CNG (CARB 1996). The average CO emissions value over the engine's useful life is 2.3 g/bhp-hr. LNG/CNG idling emissions assumed to be 25% of diesel idling emissions.

Emission Factors for On-Road Vehicles

	Emission Factors						
Project Year/Mode	*ROG*	*CO*	*NOx*	*SOx*	*PM10*	*Units*	*Reference*
Worker Trips - 10 mph	0.92	11.15	0.79	0.01	0.04	grams/mile	(1)
Worker Trips - 25 mph	0.50	7.25	0.59	0.01	0.02	grams/mile	(1)
Worker Trips - 55 mph	0.40	5.71	0.59	0.00	0.01	grams/mile	(1)
Worker Trips - Composite	0.49	6.87	0.61	0.00	0.02	grams/mile	(2)

(1) From CARB's EMFAC2002 (v2.2). Units in grams/mile. Assumptions: Location: SCAQMD, Temperature: 70 F, Relative Humidity: 60%.
PM10 factors include PM10 from combustion only (tire and brake wear included with fugitive dust). Conservatively assumes light-duty trucks, composite (LDT1-ALL).
ROG emission factors includes evaporative running loss of 0.2017 grams/mile.
Based on EMFAC emission factors for Year 2006.
Starting emisions (grams/trip, after 600 minutes): ROG (1.52), CO (17.59), Nox (0.66), SOx (0.003), PM10 (0.015).
Starting emisions (grams/trip, after 60 minutes): ROG (0.862), CO (10.647), Nox (0.726), SOx (0.001), PM10 (0.008).
Hot soak emissions (grams/trip): ROG (0.326).
Partial day diurnal emissions (grams/hr): ROG (0.013).
Resting losses (grams/hr): ROG (0.077).
(2) Based on 10% at 10 miles per hour (mph), 40% at 25 mph, and 50% at 55 mph. Composite emission factor is used for worker commute vehicles.

Bradley Landfill
Change in Operational Emissions
Phase 2 - Interim (c. 2008)

Fugitive Dust

	Emissions (lb/day) - Unmitigated					Emissions (lb/day) - Mitigated				
Equipment/Activity	*ROG*	*CO*	*NOx*	*SOx*	*PM10*	*ROG*	*CO*	*NOx*	*SOx*	*PM10*
Electric grinder	-	-	-	-	100.0	-	-	-	-	15.0
Front-End Loader	-	-	-	-	-	-	-	-	-	-
Bulldozer	-	-	-	-	-	-	-	-	-	-
Compactor	-	-	-	-	-	-	-	-	-	-
Trash Truck (WM)	-	-	-	-	11.3	-	-	-	-	11.3
Trash Truck (non-WM)	-	-	-	-	17.0	-	-	-	-	17.0
Transfer trucks (HHDT trucks)	-	-	-	-	17.3	-	-	-	-	17.3
Water Truck, Peterbilt (4,000 gal) [HHDT]	-	-	-	-	3.9	-	-	-	-	3.9
Worker commute vehicle [LDT1-ALL]	-	-	-	-	0.8	-	-	-	-	0.8
Total	-	-	-	-	150.3	-	-	-	-	65.3

Notes:
Grinder mitigated fugitive PM10 emissions estimates assume watering control efficiency 85% (based on Table A11-9-A, CEQA Handbook, and grinder-specific enclosure/water c
Water truck fugitive PM10 emissions estimates assumes watering control efficiency of: 50% (Table A11-9-A, CEQA Handbook)
Road watering required per SCAQMD Rule 403, so watering and resulting reduction in fugitive dust is not considered mitigation.
No reduction assumed for off-site travel on paved roads (eg., worker commute vehicles) because watering only occurs on site.
Fugitive PM10 emissions for on-road vehicles also include break and tire wear.
Fugitive dust from equipment with "-" assumed to be negligible relative to other equipment.

Grinder:

Description	Value	References/Notes
PM10 Emission factor:	0.25 lb/ton	Estimate, based on 2003-2004 AER
Greenwaste throughput:	400 ton/day	WM Estimate
PM10 emissions:	100.0 lb/day	Uncontrolled

Passenger vehicle travel on PAVED roads:

Description	PM10 Emissions	References/Notes
Freeway:	0.0008 lb/mile	AP-42 Section 13.2.1, CARB Section 7.9
Major/Collector Roads:	0.0012 lb/mile	AP-42 Section 13.2.1, CARB Section 7.9
Local roads:	0.0040 lb/mile	AP-42 Section 13.2.1, CARB Section 7.9
PM10 Emission factor (composite)	0.00152 lb/mile	Assumption (20% Local, 20% Collector, 60% Freeway)

Truck travel on PAVED roads:

Description	PM10 Emissions	References/Notes
Freeway:	0.0036 lb/mile	AP-42 Section 13.2.1, CARB Section 7.9
Major/Collector Roads:	0.0053 lb/mile	AP-42 Section 13.2.1, CARB Section 7.9
Local roads:	0.0180 lb/mile	AP-42 Section 13.2.1, CARB Section 7.9
Composite	0.00530 lb/mile	Assumption (10% Local, 15% Collector, 75% Highway)

Reference:
EPA AP-42 Section 13.2.1 (Paved Roads, 12/2003) and CARB Section 7.9 (Entrained Paved Road Dust, Paved Road Travel, July 1997)
PM10 Emissions (lb/VMT) = $k(sL/2)^{0.65} \times (W/3)^{1.5}$
Where: k = 0.016 (particle size multiplier for PM10), sL = road silt loading (grams per square meter) from CARB Methodology 7.9 for paved roads, W = vehicle weight (tons)
For Los Angeles County, sL = 0.02 g/m2 for freeways, 0.037 g/m2 for major/collector roads, 0.24 g/m2 for local roads.
For haul truck, assume W = 30 tons; for commute vehicle, assume W = 3 tons.

Vehicle travel on UNPAVED roads:

Description	PM10 Emissions	References/Notes
Water truck:	0.13 lb/mile	Vehicle weighs 20 tons, has 10 wheels, travels at 1 mph on site.

Reference: Table A9-9-D, CEQA Handbook; Caterpillar Equipment Handbook. Assumes silt loading of 8% (Mining Haul Road, Table A9-9-D-1).

Bradley Landfill
Change in Operational Emissions
Phase 2 - Interim (c. 2008)

Daily Emissions

	Emissions (lb/day) - Unmitigated					Emissions (lb/day) - Mitigated				
Equipment/Activity	*ROG*	*CO*	*NOx*	*SOx*	*PM10*	*ROG*	*CO*	*NOx*	*SOx*	*PM10*
Front-End Loader	4.1	17.4	51.3	-	2.4	4.1	17.4	51.3	-	2.4
Bulldozer	13.8	61.1	187.7	0.1	8.1	13.8	61.1	187.7	0.1	8.1
Compactor	2.3	10.0	30.8	-	1.3	2.3	10.0	30.8	-	1.3
Trash Truck (WM)	16.3	51.8	224.1	0.9	2.9	16.3	51.8	224.1	0.9	2.9
Trash Truck (non-WM)	24.5	78.1	337.7	1.3	6.6	24.5	78.1	337.7	1.3	6.6
Transfer trucks (HHDT trucks)	9.2	56.5	112.9	1.1	4.2	9.2	56.5	112.9	1.1	4.2
Water Truck, Peterbilt (4,000 gal) [HHDT]	0.1	0.5	2.1	-	0.1	0.1	0.5	2.1	-	0.1
Worker commute vehicle [LDT1-ALL]	0.7	8.9	0.8	-	-	0.7	8.9	0.8	-	-
Fugitive Dust	-	-	-	-	150.3	-	-	-	-	65.3
Total	*71.0*	*284.3*	*947.4*	*3.4*	*175.9*	*71.0*	*284.3*	*947.4*	*3.4*	*90.9*

Notes:
Trash truck daily emissions based on following ratio of local/highway travel:

Local:	47%
Highway:	53%

Mitigation assumptions:
Fraction of WM trash trucks meeting each BACT level:

CARB Level 3 BACT (85% PM Reduction):	60%
CARB Level 2 BACT (25% PM reduction):	30%
No CARB level:	10%

Fraction of non-WM trash trucks meeting each BACT level:

CARB Level 3 (85% PM Reduction):	30%
CARB Level 2 (25% PM reduction):	50%
No CARB level:	20%

Daily Emissions - Grouped by Equipment/Activity Type

	Emissions (lb/day) - Unmitigated					Emissions (lb/day) - Mitigated				
Equipment/Activity	*ROG*	*CO*	*NOx*	*SOx*	*PM10*	*ROG*	*CO*	*NOx*	*SOx*	*PM10*
Off-Road and Heavy Duty Equipment	20.3	89.0	271.9	0.1	11.9	20.3	89.0	271.9	0.1	11.9
Trash Trucks (WM)	16.3	51.8	224.1	0.9	2.9	16.3	51.8	224.1	0.9	2.9
Trash Trucks (non-WM)	24.5	78.1	337.7	1.3	6.6	24.5	78.1	337.7	1.3	6.6
Transfer Trucks	9.2	56.5	112.9	1.1	4.2	9.2	56.5	112.9	1.1	4.2
Commute Vehicles	0.7	8.9	0.8	-	-	0.7	8.9	0.8	-	-
Fugitive Dust	-	-	-	-	150.3	-	-	-	-	65.3
Total	**71.0**	**284.3**	**947.4**	**3.4**	**175.9**	**71.0**	**284.3**	**947.4**	**3.4**	**90.9**

Bradley Landfill
Change in Operational Emissions
Phase 2 - Complete (c. 2012)

Equipment/Activity Descriptions

Equipment/Activity	*Hp Rating*	*Load Factor*	*Number Active*	*Equip-Hrs Day*	*Miles/ Day*	*Idling Min. Day*	Equipment Type
Front-End Loader	230	0.465	2	12.0	-	-	Off-Road
Bulldozer	352	0.59	4	12.0	-	-	Off-Road
Compactor	79	0.575	3	12.0	-	-	Off-Road
Trash Truck (WM)	-	-	-	-	1,410	470	Trash
Trash Truck (non-WM)	-	-	-	-	2,130	710	Trash
Transfer trucks (HHDT trucks)	-	-	-	-	2,520	840	On-Road
Water Truck, Peterbilt (4,000 gal) [HHDT]	-	-	1	12.0	60	72	On-Road
Worker commute vehicle [LDT1-ALL]	-	-	(21)	-	60	-	On-Road

Notes:
Load factors and horsepower ratings from 1993 SCAQMD CEQA Handbook (Tables A9-8-C and A9-8-D), project team, Caterpillar Handbook.

Baseline:	1,219	RT/day
Phase 2 - Complete (c. 2012):	1,623	RT/day
Net change:	404	RT/day
Increase in trash truck RTs:	236	RT/day
WM Trash Truck RTs:	40%	of total RT/day
RT/day:	94	RT/day
Avg RT length:	15	miles/RT
Non-WM Trash Truck RTs:	60%	of total RT/day
RT/day:	142	RT/day
Avg RT length:	15	miles/RT
Increase in transfer truck RTs:	168	RT/day
Avg RT length:	15	miles/RT

RT = roundtrip
Trips estimates based on WM's Bradley Landfill and Recycling Center Master Plan, "Trip Gen 1-19-05.xls".
(#) = Negative number (ie., project phase has less employees/commute trips than baseline/existing operation)
Trash trucks assumed to idle 5 minutes total per roundtrip.

Bradley Landfill
Change in Operational Emissions
Phase 2 - Complete (c. 2012)

Emission Factors for Off-Road Equipment

	Emission Factors						
Equipment/Activity	*ROG*	*CO*	*NOx*	*SOx*	*PM10*	*Units*	*Reference*
Front-End Loader	0.72	3.08	9.06	0.01	0.42	g/hp-hr	(1)
Bulldozer	0.63	2.78	8.54	0.01	0.37	g/hp-hr	(1)
Compactor	0.63	2.78	8.54	0.01	0.37	g/hp-hr	(1)

(1) Composite based on CARB OFFROAD Emissions Model (1999). SOx emission factor assumes fuel has maximum sulfur content of 15 ppmw (SCAQMD Rule 431.2 requirement effective as early as 1 January 2005).

Emission Factors for On-Road Heavy Duty Trucks

	Emission Factors						
Project Year/Mode	*ROG*	*CO*	*NOx*	*SOx*	*PM10*	*Units*	*Reference*
On-road Truck - Idle	4.41	26.30	80.70	0.34	1.84	grams/hr	(1)
On-road Truck - 5 mph	1.85	10.53	20.27	0.18	0.83	grams/mile	(1)
On-road Truck - 10 mph	1.45	7.26	16.81	0.18	0.79	grams/mile	(1)
On-road Truck - 25 mph	0.80	3.13	11.88	0.18	0.44	grams/mile	(1)
On-road Truck - 55 mph	0.44	1.98	15.47	0.18	0.24	grams/mile	(1)
On-road Trucks - Composite (Water Truck)	1.85	10.53	20.27	0.18	0.83	grams/mile	(2)
On-road Trucks - Composite (Heavy Duty	0.69	2.97	14.17	0.18	0.38	grams/mile	(3)
Trash Trucks - Local	1.11	4.27	28.13	0.18	0.34	grams/mile	(4)
Trash Trucks - Highway	0.44	1.98	15.47	0.18	0.24	grams/mile	(4)

(1) From CARB's EMFAC2002 (v2.2). Assumes: Heavy duty diesel truck (HHDT), Location: SCAQMD, Temp.: 70 F, Relative Humidity: 60%.
PM10 factors include PM10 from combustion only (tire wear and brake wear included with fugitive dust).
Based on EMFAC emission factors for Year 2006.
(2) Assumes water truck travel at 5 miles per hour (mph) maximum. Although not included in this composite emission factor, daily emissions estimates (see below) include idling emissions.
(3) Based on 10% at 10 miles per hour (mph), 40% at 25 mph, and 50% at 55 mph. Although not included in this composite emission factor, daily emissions estimates (see below) include idling emissions.
(4) Local emission factors based on NYGTC refuse collection vehicle emission factors (CARB, June 6, 2003) and estimated Bradley fleet mix in 2012, Trash truck highway emission factors conservatively assume EMFAC emission factors for Year 2006 (heavy duty diesel truck).

Emission Factors for On-Road Vehicles

	Emission Factors						
Project Year/Mode	*ROG*	*CO*	*NOx*	*SOx*	*PM10*	*Units*	*Reference*
Worker Trips - 10 mph	0.92	11.15	0.79	0.01	0.04	grams/mile	(1)
Worker Trips - 25 mph	0.50	7.25	0.59	0.01	0.02	grams/mile	(1)
Worker Trips - 55 mph	0.40	5.71	0.59	0.00	0.01	grams/mile	(1)
Worker Trips - Composite	0.49	6.87	0.61	0.00	0.02	grams/mile	(2)

(1) From CARB's EMFAC2002 (v2.2). Units in grams/mile. Assumptions: Location: SCAQMD, Temperature: 70 F, Relative Humidity: 60%.
PM10 factors include PM10 from combustion only (tire and brake wear included with fugitive dust). Conservatively assumes light-duty trucks, composite (LDT1-ALL).
ROG emission factors includes evaporative running loss of 0.2017 grams/mile.
Based on EMFAC emission factors for Year 2006.
Starting emisions (grams/trip, after 600 minutes): ROG (1.52), CO (17.59), Nox (0.66), SOx (0.003), PM10 (0.015).
Starting emisions (grams/trip, after 60 minutes): ROG (0.862), CO (10.647), Nox (0.726), SOx (0.001), PM10 (0.008).
Hot soak emissions (grams/trip): ROG (0.326).
Partial day diurnal emissions (grams/hr): ROG (0.013).
Resting losses (grams/hr): ROG (0.077).
(2) Based on 10% at 10 miles per hour (mph), 40% at 25 mph, and 50% at 55 mph. Composite emission factor is used for worker commute vehicles.

Bradley Landfill
Change in Operational Emissions
Phase 2 - Complete (c. 2012)

Fugitive Dust

	Emissions (lb/day) - Unmitigated					*Emissions (lb/day) - Mitigated*				
Equipment/Activity	*ROG*	*CO*	*NOx*	*SOx*	*PM10*	*ROG*	*CO*	*NOx*	*SOx*	*PM10*
Electric grinder	-	-	-	-	50.0	-	-	-	-	7.5
Front-End Loader	-	-	-	-	-	-	-	-	-	-
Bulldozer	-	-	-	-	-	-	-	-	-	-
Compactor	-	-	-	-	-	-	-	-	-	-
Trash Truck (WM)	-	-	-	-	7.5	-	-	-	-	7.5
Trash Truck (non-WM)	-	-	-	-	11.3	-	-	-	-	11.3
Transfer trucks (HHDT trucks)	-	-	-	-	13.3	-	-	-	-	13.3
Water Truck, Peterbilt (4,000 gal) [HHDT]	-	-	-	-	3.9	-	-	-	-	3.9
Worker commute vehicle [LDT1-ALL]	-	-	-	-	(1.9)	-	-	-	-	(1.9)
Total	-	-	-	-	84.1	-	-	-	-	41.6

Notes:
Grinder mitigated fugitive PM10 emissions estimates assume watering control efficien 85% (based on Table A11-9-A, CEQA Handbook, and grinder-specific enclosure/water c
Water truck fugitive PM10 emissions estimates assumes watering control efficiency of 50% (Table A11-9-A, CEQA Handbook)
Road watering required per SCAQMD Rule 403, so watering and resulting reduction in fugitive dust is not considered mitigation.
No reduction assumed for off-site travel on paved roads (eg., worker commute vehicles) because watering only occurs on site.
Fugitive PM10 emissions for on-road vehicles also include break and tire wear.
Fugitive dust from equipment with "-" assumed to be negligible relative to other equipment.

Grinder:

Description	Value	References/Notes
PM10 Emission factor:	0.25 lb/ton	Estimate, based on 2003-2004 AER
Greenwaste throughput:	400 ton/day	WM Estimate
PM10 emissions:	100.0 lb/day	Uncontrolled

Passenger vehicle travel on PAVED roads:

Description	PM10 Emissions	References/Notes
Freeway:	0.0008 lb/mile	AP-42 Section 13.2.1, CARB Section 7.9
Major/Collector Roads:	0.0012 lb/mile	AP-42 Section 13.2.1, CARB Section 7.9
Local roads:	0.0040 lb/mile	AP-42 Section 13.2.1, CARB Section 7.9
PM10 Emission factor (composite)	0.00152 lb/mile	Assumption (20% Local, 20% Collector, 60% Freeway)

Truck travel on PAVED roads:

Description	PM10 Emissions	References/Notes
Freeway:	0.0036 lb/mile	AP-42 Section 13.2.1, CARB Section 7.9
Major/Collector Roads:	0.0053 lb/mile	AP-42 Section 13.2.1, CARB Section 7.9
Local roads:	0.0180 lb/mile	AP-42 Section 13.2.1, CARB Section 7.9
Composite	0.00530 lb/mile	Assumption (10% Local, 15% Collector, 75% Highway)

Reference:
EPA AP-42 Section 13.2.1 (Paved Roads, 12/2003) and CARB Section 7.9 (Entrained Paved Road Dust, Paved Road Travel, July 1997)
PM10 Emissions (lb/VMT) = $k(sL/2)^{0.65} \times (W/3)^{1.5}$
Where: k = 0.016 (particle size multiplier for PM10), sL = road silt loading (grams per square meter) from CARB Methodology 7.9 for paved roads, W = vehicle weight (tons)
For Los Angeles County, sL = 0.02 g/m2 for freeways, 0.037 g/m2 for major/collector roads, 0.24 g/m2 for local roads.
For haul truck, assume W = 30 tons; for commute vehicle, assume W = 3 tons.

Vehicle travel on UNPAVED roads:

Description	PM10 Emissions	References/Notes
Water truck:	0.13 lb/mile	Vehicle weighs 20 tons, has 10 wheels, travels at 1 mph on site.

Reference: Table A9-9-D, CEQA Handbook; Caterpillar Equipment Handbook. Assumes silt loading of 8% (Mining Haul Road, Table A9-9-D-1).

Bradley Landfill
Change in Operational Emissions
Phase 2 - Complete (c. 2012)

Daily Emissions

	Emissions (lb/day) - Unmitigated					Emissions (lb/day) - Mitigated				
Equipment/Activity	*ROG*	*CO*	*NOx*	*SOx*	*PM10*	*ROG*	*CO*	*NOx*	*SOx*	*PM10*
Front-End Loader	4.1	17.4	51.3	-	2.4	4.1	17.4	51.3	-	2.4
Bulldozer	13.8	61.1	187.7	0.1	8.1	13.8	61.1	187.7	0.1	8.1
Compactor	2.3	10.0	30.8	-	1.3	2.3	10.0	30.8	-	1.3
Trash Truck (WM)	2.4	10.0	68.0	0.6	0.3	2.4	10.0	68.0	0.6	0.3
Trash Truck (non-WM)	3.7	15.0	102.7	0.9	0.4	3.7	15.0	102.7	0.9	0.4
Transfer trucks (HHDT trucks)	10.4	59.3	115.1	1.0	4.6	10.4	59.3	115.1	1.0	4.6
Water Truck, Peterbilt (4,000 gal) [HHDT]	0.1	0.5	2.1	-	0.1	0.1	0.5	2.1	-	0.1
Worker commute vehicle [LDT1-ALL]	(1.6)	(20.7)	(1.8)	-	-	(1.6)	(20.7)	(1.8)	-	-
Fugitive Dust	-	-	-	-	84.1	-	-	-	-	41.6
Total	*35.2*	*152.6*	*555.9*	*2.6*	*101.3*	*35.2*	*152.6*	*555.9*	*2.6*	*58.8*

Notes:
Trash truck daily emissions based on following ratio of local/highway travel:

Local:	47%
Highway:	53%

Mitigation assumptions:
Fraction of WM trash trucks meeting each BACT level:

CARB Level 3 BACT (85% PM Reduction):	80%
CARB Level 2 BACT (25% PM reduction):	20%
No CARB level:	0%

Fraction of non-WM trash trucks meeting each BACT level:

CARB Level 3 BACT (85% PM Reduction):	75%
CARB Level 2 BACT (25% PM reduction):	25%
No CARB level:	0%

Daily Emissions - Grouped by Equipment/Activity Type

	Emissions (lb/day) - Unmitigated					Emissions (lb/day) - Mitigated				
Equipment/Activity	*ROG*	*CO*	*NOx*	*SOx*	*PM10*	*ROG*	*CO*	*NOx*	*SOx*	*PM10*
Off-Road and Heavy Duty Equipment	20.3	89.0	271.9	0.1	11.9	20.3	89.0	271.9	0.1	11.9
Trash Trucks (WM)	2.4	10.0	68.0	0.6	0.3	2.4	10.0	68.0	0.6	0.3
Trash Trucks (non-WM)	3.7	15.0	102.7	0.9	0.4	3.7	15.0	102.7	0.9	0.4
Transfer Trucks	10.4	59.3	115.1	1.0	4.6	10.4	59.3	115.1	1.0	4.6
Commute Vehicles	(1.6)	(20.7)	(1.8)	-	-	(1.6)	(20.7)	(1.8)	-	-
Fugitive Dust	-	-	-	-	84.1	-	-	-	-	41.6
Total	*35.2*	*152.6*	*555.9*	*2.6*	*101.3*	*35.2*	*152.6*	*555.9*	*2.6*	*58.8*

Bradley Landfill
Operational Emissions
References

Table R1 - NYGTC and EMFAC2000 HHD Truck Emission Rates (g/mi):

	Avg. NYGTC Emission Rates				EMFAC2000 HHD Truck Emission Rates								WM Fleet Mix %*		
Model Year	HC	CO	NOx	PM	HC (ZM)	HC (DR)	CO (ZM)	CO (DR)	NOx (ZM)	NOx (DR)	PM (ZM)	PM (DR)	2005	2008	2012
Pre 1975	47.6	104	158	11.66	1.6	0.017	8.36	0.095	28.5	0.013	1.98	0.016	0%	0%	0%
1975-76	43.2	97	150	10.89	1.45	0.017	7.81	0.095	27.2	0.013	1.85	0.016	0%	0%	0%
1977-79	43.2	97	150	10.89	1.45	0.017	7.81	0.095	27.2	0.013	1.85	0.016	0%	0%	0%
1980-83	43.2	97	150	10.89	1.45	0.017	7.81	0.095	27.2	0.013	1.85	0.016	0%	0%	0%
1984-86	22	60.5	112	6.947	0.74	0.017	4.87	0.095	20.2	0.013	1.18	0.016	3%	0%	0%
1987-90	10.1	30.8	92.9	4.945	0.34	0.009	2.48	0.065	16.8	0.015	0.84	0.008	40%	30%	0%
1991-93	8.33	21.6	88.4	3.002	0.28	0.009	1.74	0.056	16	0.03	0.51	0.009	20%	15%	0%
1994-97	3.21	13.2	92.1	1.05	0.19	0.016	0.84	0.068	19.1	0.042	0.32	0.01	12%	10%	0%
1998	3.05	9.86	111	0.853	0.18	0.014	0.63	0.049	23	0.037	0.26	0.007	5%	15%	25%
1999-02	3.05	9.86	64.5	0.853	0.18	0.009	0.63	0.031	13.4	0.013	0.26	0.003	15%	20%	40%
2003-06	2.37	15.8	32.3	0.853	0.14	0.003	1.01	0.023	6.68	0.007	0.26	0.003	4%	10%	30%
2007+	0.663	4.43	3.23	0.0853	0.039	0.003	0.283	0.023	0.668	0.007	0.026	0.003	0%	0%	5%

Notes:

Emission rates from "CARB Staff Report: Proposed Diesel Particulate Matter Control Measure for On-Road Heavy-Duty Residential and Commercial Solid Waste Collection Vehicles (June 6, 2003)", Appendix E (Solid Waste Collection Vehicle Emission Inventory).

ZM = Zero mile emission rate

DR = Deterioration rate per 10,000 miles

* WM Fleet Mix estimate based on Bradley's existing Trash Truck Inventory (see Table R2) and estimated future fleet mix.

Table R2 - Bradley Trash Truck Inventory (2004):

Model Yr	Total	% of Fleet
1984	1	1%
1985	2	2%
1986	0	0%
1987	6	6%
1988	13	13%
1989	17	17%
1990	3	3%
1991	9	9%
1992	2	2%
1993	9	9%
1994	5	5%
1995	2	2%
1996	3	3%
1997	2	2%
1998	5	5%
1999	6	6%
2000	0	0%
2001	6	6%
2002	3	3%
2003	1	1%
2004	3	3%
Total	98	100%

Reference:

Bradley Landfill refuse truck inventory, 2004.

Table R3 - Trash Truck Weighted Emission Factors (g/mile):

Year	HC	CO	NOx	PM
2005	7.51	22.79	86.57	3.13
2008	6.83	20.94	83.14	2.92
2012	1.11	4.27	28.13	0.34

Assumes each model year travels same distance

Based on fleet mix in Tables R1 and R2.