Cottonwood Hills Recycling & Disposal Facility
Emission Totals for 2011 Air Emissions Report (in tons per year) Using Title V Permit Values - Revised

														Anthropogenic		Biogenic
	SO2	NOx	NMOC	CO	Ammonia **	PM	PM10	PM2.5	HAPs *	Methylene Chloride	1,1,1-TCA	H2S	Methane	CH4	N2O	Total CO2
Landfill	-	-	2.16	-	-	-	-	-	0.447	0.051	0.0027	1.73	364.05	-	-	-
Open Flare	6.02	25.80	2.06	140.59	-	1.118	1.118	1.118	0.074	0.004	0.002	-	-	0.47	0.09	13504.90
Roads	-	-	-	-	-	3.48	0.94	0.14	-	-	-	-	-	-	-	-
Solidification			0.168			0.915	0.915	0.915						-	-	-
Stockpile/ Cover					-	0.041	0.020	0.006						-	-	-
Rock Crushing Engine	0.05	0.72	0.06	0.155	-	0.05	0.05	0.05	-	-	-	-	-	-	-	-
Rock Crushing Process	-	-	-	-	-	0.013	0.013	0.013	-	-	-	-	-	-	-	-
Tub Grinder	0.000	0.000	0.000	0.000	-	0.000	0.000	0.000	0.000	-	-	-	-	-	-	-
Totals	6.07	26.51	4.45	140.74		5.61	3.06	1.130	0.522	0.055	0.005	1.73	364.05	0.47	0.09	13504.90

NOTES:
** Methylene Chloride, 1,1,1-TCA and methane are reported separately*
*** Ammonia assumed to be insignificant since leachate is insignificant.*

Cottonwood Hills RDF
2011 Annual Air Emissions Report - Revised
Open Flare Data

						SO2 Emissions		NOX Emissions		VOM Emissions		CO Emissions		PM Emissions	
						SO2 (lb/hr) for 3000 scfm flare = 1.4		NOX (lb/hr) for 3000 scfm flare = 6.0		VOM (lb/hr) for 3000 scfm flare = 0.48		CO (lb/hr) for 3000 scfm flare = 32.7		PM (lb/hr) for 3000 scfm flare = 0.26	
Month	D	Run Hours	mscf	% Methane	mmBtu/hr	lbs/hr	tpy	lbs/hr	tpy	lbs/hr	tpy	lbs/hr	tpy	lbs/hr	tpy
December 10		723.2													
January	31	744.0	35.308	54.1%	17.375	1.40	0.52	6.00	2.23	0.48	0.18	32.7	12.16	0.26	0.097
February	28	670.4	25.455	54.2%	12.549	1.40	0.47	6.00	2.01	0.48	0.16	32.7	10.96	0.26	0.087
March	31	742.9	24.696	56.5%	12.692	1.40	0.52	6.00	2.23	0.48	0.18	32.7	12.15	0.26	0.097
April	30	710.9	31.122	54.9%	15.541	1.40	0.50	6.00	2.13	0.48	0.17	32.7	11.62	0.26	0.092
May	31	726.8	32.627	54.0%	16.026	1.40	0.51	6.00	2.18	0.48	0.17	32.7	11.88	0.26	0.094
June	30	701.2	33.083	54.1%	16.280	1.40	0.49	6.00	2.10	0.48	0.17	32.7	11.46	0.26	0.091
July	31	744.0	35.217	55.0%	17.618	1.40	0.52	6.00	2.23	0.48	0.18	32.7	12.16	0.26	0.097
August	31	744.0	34.777	55.3%	17.493	1.40	0.52	6.00	2.23	0.48	0.18	32.7	12.16	0.26	0.097
September	30	720.0	33.036	53.5%	16.077	1.40	0.50	6.00	2.16	0.48	0.17	32.7	11.77	0.26	0.094
October	31	743.2	31.569	50.6%	14.530	1.40	0.52	6.00	2.23	0.48	0.18	32.7	12.15	0.26	0.097
November	30	624.7	24.292	53.4%	11.799	1.40	0.44	6.00	1.87	0.48	0.15	32.7	10.21	0.26	0.081
December	31	726.6	37.393	55.8%	18.979	1.40	0.51	6.00	2.18	0.48	0.17	32.7	11.88	0.26	0.094
TOTALS	365	8598.7	378.575	54.30%	186.983	1.40	6.02	6.00	25.80	0.48	2.06	32.7	140.59	0.26	1.118

EXAMPLE CALCULATIONS

mmBtu = Flow (scfm) x 60 min/hr x % methane x 909.6 btu/cft (@ 14.7 psia and 60F) / 1000000Btu/mmBtu
lbs/hr = mmBtu/hr x Permitted Pollutant Factor (lb/mmBtu) x Run Hours / (Days/mo x 24hrs/day)
tpy = lbs/hr / 2000 lbs/ton x 8760 hrs/yr

Percent Throughputs

Dec-Feb	*24.9%*	*Mar-May*	*25.4%*
Jun-Aug	*25.5%*	*Sep-Nov*	*24.3%*

PM10	1.118 tpy	0.260 lbs/hr	*Assumed to be same as*
PM2.5	1.118 tpy	0.260 lbs/hr	*TSP per AP-42, Table 2.4.4*

Annual	*Rate/hr =*	*378.575 mscf /*	*8598.7 hrs =*	*0.044027 MCF/hr or*	*1.0371918*	*MCF/day*
Peak Ozone	*Rate/hr =*	*103.077 mscf /*	*2189.2 hrs =*	*0.0470843 MCF/hr or*	*1.1204022*	*MCF/day*

Please Note Flare Emissions Factors were modified by REVISED Construction Permit 06100058 dated December 9, 2011 and the 2012 Annual Emissions Report will reflect the new factors

Anthropogenic GHG				Biogenic GHG					
CH4 Emissions		N2O Emissions		Combustion CO2		Pass-Through CO2		Total CO2	
CH4 (lb/mmBtu)=	7.05E-03	N2O (lb/mmBtu)=	1.39E-03	CO2 (lb/mmBtu)=	114.79	Based on % CO2		Combustion+Pass-Through	
lbs/hr	tpy	lbs/hr	tpy	lbs/hr	tpy	lbs/hr	tpy	lbs/hr	tpy
0.123	0.05	0.024	0.01	1,994.52	741.96	2,526.70	939.93	4,521.22	1,681.90
0.089	0.03	0.017	0.01	1,440.59	482.89	2,017.19	676.16	3,457.78	1,159.05
0.090	0.03	0.018	0.01	1,456.94	541.18	1,677.36	623.06	3,134.31	1,164.24
0.110	0.04	0.022	0.01	1,784.05	634.14	0.00	0.00	1,784.05	634.14
0.113	0.04	0.022	0.01	1,839.66	668.53	2,395.31	870.46	4,234.97	1,538.99
0.115	0.04	0.023	0.01	1,868.83	655.21	2,511.99	880.70	4,380.82	1,535.91
0.124	0.05	0.024	0.01	2,022.47	752.36	0.00	0.00	2,022.47	752.36
0.123	0.05	0.024	0.01	2,008.10	747.01	2,423.64	901.59	4,431.74	1,648.61
0.113	0.04	0.022	0.01	1,845.48	664.37	2,474.85	890.95	4,320.33	1,555.32
0.103	0.04	0.020	0.01	1,667.94	619.80	0.00	0.00	1,667.94	619.80
0.083	0.03	0.016	0.01	1,354.48	423.07	0.00	0.00	1,354.48	423.07
0.134	0.05	0.026	0.01	2,178.67	791.51	0.00	0.00	2,178.67	791.51
1.319	0.47	0.260	0.09	21,464.44	7,722.05	2,333.87	5,782.85	23,798.31	13,504.90

Cottonwood Hills RDF
2011 Annual Air Emissions Report
Open Flare HAPs

Gas Flow Rate:	379 mscf	10,728,287	m^3/yr
Operating Hours:	8598.7 hours		

CAS Number	COMPOUND (2)	MEDIAN ppmv	DATA SOURCE (3	MOLECULAR WEIGHT	GRAVIMETRIC CONCENTRATION (mg/M^3)	Uncontrolled (1) POTENTIAL TO EMIT INMOC (Mg/yr)	Uncontrolled (1) POTENTIAL TO EMIT INMOC (tons/yr)	Controlled Destruction 98% (tons/yr)
71556	1,1,1-Trichloroethane (methyl chloroform)	1.59	Site Specific	133.42	8.67	0.0930	0.1036	**0.0021**
79345	1,1,2,2-Tetrachloroethane	1.11	AP-42	167.86	7.62	0.0818	0.0910	0.0018
75343	1,1-Dichloroethane (ethylidene dichloride)	0.00	Site Specific	98.96	0.00	0.0000	0.0000	0.0000
75354	1,1-Dichloroethene (vinylidene chloride)	0.20	AP-42	96.95	0.79	0.0085	0.0095	0.0002
107062	1,2-Dichloroethane (ethylene dichloride)	7.84	Site Specific	98.96	31.71	0.3402	0.3788	0.0076
78875	1,2-Dichloropropane (propylene dichloride)	0.18	AP-42	112.99	0.83	0.0089	0.0099	0.0002
107131	Acrylonitrile	6.33	AP-42	53.06	13.74	0.1474	0.1641	0.0033
75150	Carbon disulfide	0.58	AP-42	76.14	1.81	0.0194	0.0216	0.0004
56235	Carbon tetrachloride	0.00	AP-42	153.84	0.00	0.0000	0.0000	0.0000
463581	Carbonyl sulfide	0.49	AP-42	60.07	1.20	0.0129	0.0144	0.0003
108907	Chlorobenzene	4.30	Site Specific	112.56	19.81	0.2125	0.2365	0.0047
75003	Chloroethane (ethyl chloride)	1.25	AP-42	64.52	3.30	0.0354	0.0394	0.0008
67663	Chloroform	0.03	AP-42	119.39	0.15	0.0016	0.0017	0.0000
75092	Dichloromethane (methylene chloride)	4.28	Site Specific	84.94	14.85	0.1594	0.1774	**0.0035**
100414	Ethylbenzene	4.42	Site Specific	106.16	19.20	0.2060	0.2293	0.0046
110543	n-Hexane	3.49	Site Specific	86.17	12.28	0.1318	0.1467	0.0029
78933	Methyl ethyl ketone	7.09	AP-42	72.10	20.91	0.2243	0.2497	0.0050
108101	Methyl isobutyl ketone	1.87	AP-42	100.07	7.65	0.0821	0.0914	0.0018
127184	Perchloroethylene (tetrachloroethene)	0.00	Site Specific	165.85	0.00	0.0000	0.0000	0.0000
79016	Trichloroethlyene	6.48	Site Specific	131.39	34.83	0.3737	0.4160	0.0083
75014	Vinyl chloride	0.42	Site Specific	62.50	1.07	0.0114	0.0127	0.0003
71432	Benzene	1.56	Site Specific	78.11	4.99	0.0536	0.0596	0.0012
106467	1,4-Dichlorobenzene(p)	0.00	Site Specific	147.01	0.00	0.0000	0.0000	0.0000
108883	Toluene	20.84	Site Specific	92.13	78.52	0.8424	0.9378	0.0188
95476	o-Xylenes	0.73	Site Specific	106.16	3.15	0.0338	0.0376	0.0008
108383	m-Xylenes	5.49	Site Specific	106.16	23.82	0.2556	0.2846	0.0057
	Total HAPS						3.71	**0.0743**

NOTES: (1) UNCONTROLLED LANDFILL GAS CONCENTRATIONS (a) - (SCC 50200602) where a = Reference 9-35. SCC = Source Classification Code

(2) Hazardous Air Pollutants listed in Title I of the 1990 Clean Air Act Amendments.

(3) HAPs information obtained from EPA AP-42 Section 2.4, 5th edition, 11/98.

Cottonwood Hills RDF
2011 Annual Air Emissions Report
Waste Acceptance

Year	Waste Receipts gcy	Waste Receipts bcy	Waste Receipts (ton)	Waste Receipts (Mg)
2000	11,253	5,627	4,220	3,828
2001	759,749	379,875	284,906	258,465
2002	837,003	418,501	313,876	284,746
2003	1,282,080	641,040	384,624	348,929
2004	1,443,807	721,904	433,142	392,944
2005	1,497,231	748,616	449,169	407,484
2006	1,850,556	925,278	555,167	503,644
2007	1,600,248	800,124	480,074	435,521
2008	1,327,855	663,928	398,357	361,387
2009	1,651,631	825,816	495,489	449,505
2010	1,542,690	771,345	462,807	419,856
2011	1,710,919	855,460	513,276	465,641
2012			0	0
Total			3,799,025	3,446,453

Note: 1 Mg = 1.1023 ton

Cottonwood Hills RDF
2011 Annual Air Emissions Report
LANDFILL GAS EMISSION RATE CALCULATIONS Using Title V Permit Values

The equation below was used to create Table 2 on the following page.

NMOC equation from 40 CFR 60.754 (a)(1)(i) used to estimate Annual NMOC Emission Rate:

$$Mnmoc\ (Mg/yr) = \sum_{i=1}^{n} 2\ k\ Lo\ M_i\ [e^{(-kti)}\ (Cnmoc)\ (3.6 \times 10^{-9})]$$

Where

Mnmoc =	total NMOC emission rate from the landfill in megagrams per year (Mg/yr)
k =	methane generation rate constant, year $^{-1}$
Lo =	methane generation potential, cubic meters per megagram solid waste (m^3/Mg)
M_i =	mass of solid waste in the ith section, Mg
Cnmoc =	concentration of NMOC, parts per million by volume as hexane
3.6×10^{-9}=	conversion factor

NMOC Equation Constants

k =	0.023 yr^{-1}
Lo =	139.6 m^3/Mg solid waste
Cnmoc =	595 ppmv as hexane NMOC concentration (from NSPS Subpart WWW, 40 CFR 60.754(a)(1))

NMOC emission rate from RATE TABLE on following page...

Year for emission calculation = **2011**

NMOC emissions for 2011 = 47.35 Mg/yr = 52.20 ton/yr

Conversion of NMOC emission rate to Landfill Gas Rate

Maximum Annual Landfill Gas Rate:

47.35 Mg NMOC/yr * 10^6 g/Mg * g-mole/86.17 g * 24.45 l/g-mole * 1 m^3/1000 l* 10^6 m³/595 m³ NMOC = 22,582,010 m³/yr

Daily Gas Rate:

22,582,010 m³/yr * 35.31 ft³/m³ * 1 yr/365 days = 2,184,580 ft³/day

Gas Constant for 25 C and 760 mmHg

62.36 l-mmHg/g-mole-K x 298 K ÷ 760 mmHg = 24.45 l/g-mole

Example Emission Calculation for NMOC

Conversion from ppm_v to mg/m^3

NMOC concentration as hexane = 595 ppm_v

595 m^3 NMOC (as hexane)/10^6 m^3 LFG *1000 liters/m^3 * mole/24.45 liters * 86.17 g/mole *1000 mg/g

= 2096.98 mg/m^3 NMOC as hexane

NMOC Emissions Calculation

NMOC emissions = 2,096.98 mg/m^3 LFG * 22,582,010 m^3 LFG/yr * 1 Mg/10^9 mg * 1.1023 ton/Mg

NMOC emissions =	52.2 tons/yr NMOC as hexane
Collection Efficiency=	0.75 %
Cover Factor=	0.17

Controlled NMOC Emissions = 2.160 tons/yr NMOC as hexane

Cottonwood Hills RDF
2011 Annual Air Emissions Report
Cover Factor/ NMOC Emissions Calculations

LANDFILL:	Cottonwood	Enter the name of the landfill.
UNIT:	Active Units	Enter the name of the unit (if any)
CURRENT ACRE	59.9	Enter the footprint acreage.

COVER TYPE	COVER FACTOR	ACREAGE		
Active area	0.6265	10	0.1046	Enter the average size of the active face. The cover factor is based on 50% air and 50% daily cover.
Intermediate	0.1110	30.6	0.0567	Enter the acreage with 12" soil (or other like material).
Final Cover A	0.0305	0	0.0000	Enter the acreage with 2 feet clay and 6 inches top soil.
Final Cover B	0.0295	0	0.0000	Enter the acreage with 3 feet clay and 6 inches top soil.
Final Cover C	0.0132	19.3	0.0043	Enter the acreage with 3 feet clay, 2.5 feet protective soil and 6 inches top soil.
Final Cover D	0.0000	0	0.0000	Enter the acreage with 3 feet clay, 40 ml HDPE, 2.5 feet protective soil and 6 inches top soil.

COVER ATTENUATION FACTOR (CAF) = 0.1655 This is the cover attenuation factor for the specified unit.

LANDFILL GAS COLLECTION SYSTEM

CAPTURE EFFICIENCY (CE): 0.75 Gas Collection System and Open Flare began operating in Feb 2008

CONTROL EQUIPMENT EFFICIENCY (CEE): 0.98 Gas Collection System and Open Flare began operating in Feb 2008

Cottonwood Hills RDF
2011 Annual Air Emissions Report
TOTAL HAP EMISSION ESTIMATES Using Title V Permit Values

Modeled Landfill Gas Rate	22,582,010	m³/yr
Gas Collection Efficiency:	75%	
Cover Factor:	0.17	

Hourly Rate
0.091 mcf/hr

HAP/ VOC Compounds	Median ppmv	Molecular Weight	Mass Concentration (mg/m³)	Uncontrolled Potential Emissions (Mg/yr)	Uncontrolled Potential Emissions (tons/yr)	After Controls ton/yr	After Controls lb/hr
1,1,1-Trichloroethane **(methyl chloroform)*	0.48	133.42	2.62	0.06	0.07	**0.0027**	0.0006
1,1,2,2-Tetrachloroethane*	1.11	167.85	7.62	0.17	0.19	0.0079	0.0018
1,1-Dichloroethane (ethylidene dichloride)*	2.35	98.95	9.51	0.21	0.24	0.0098	0.0022
1,1-Dichloroethene (vinylidene chloride)*	0.20	96.94	0.79	0.02	0.02	0.0008	0.0002
1,2-Dichloroethane (ethylene dichloride)*	0.41	98.96	1.66	0.04	0.04	0.0017	0.0004
1,2-Dichloropropane (propylene dichloride)*	0.18	112.98	0.83	0.02	0.02	0.0009	0.0002
Acrylonitrile*	6.33	53.06	13.74	0.31	0.34	0.0142	0.0032
Benzene* (AP-42 no co-disposal default)	1.91	78.11	6.10	0.14	0.15	0.0063	0.0014
Carbon disulfide*	0.58	76.13	1.81	0.04	0.04	0.0019	0.0004
Carbon tetrachloride*	0.004	153.84	0.03	0.001	0.001	0.0000	0.0000
Carbonyl sulfide*	0.49	60.07	1.20	0.03	0.03	0.0012	0.0003
Chlorobenzene*	0.25	112.56	1.15	0.03	0.03	0.0012	0.0003
Chloroethane (ethyl chloride)*	1.25	64.52	3.30	0.07	0.08	0.0034	0.0008
Chloroform*	0.03	119.39	0.15	0.003	0.004	0.0002	0.0000
Chloromethane (methyl chloride)*	1.21	50.49	2.50	0.06	0.06	0.0026	0.0006
Dichloromethane **(methylene chloride)*	14.3	84.94	49.68	1.12	1.24	**0.0512**	0.0117
Ethylbenzene*	4.61	106.16	20.02	0.45	0.50	0.0206	0.0047
Hexane*	6.57	86.18	23.16	0.52	0.58	0.0239	0.0054
Mercury (total)*	2.92E-04	200.61	0.002	0.0001	0.0001	0.0000	0.0000
Methyl ethyl ketone*	7.09	72.11	20.91	0.47	0.52	0.0215	0.0049
Methyl isobutyl ketone*	1.87	100.16	7.66	0.17	0.19	0.0079	0.0018
Perchloroethylene **(tetrachloroethene)*	3.73	165.83	25.30	0.57	0.63	0.0261	0.0060
Toluene* (AP-42 no co-disposal default)	39.30	92.13	148.09	3.34	3.69	0.1526	0.0348
Trichloroethene*	2.82	131.38	15.15	0.34	0.38	0.0156	0.0036
Vinyl chloride*	7.34	62.50	18.76	0.42	0.47	0.0193	0.0044
Xylene*	12.1	106.16	52.54	1.19	1.31	0.0541	0.0124
Total HAPs					**10.810**	**0.447**	**0.102**
Total Non-VOM Haps (1,1,1 TCA + dichloromethane + PCE)					**8.878**	**0.367**	**0.084**

Other Compounds	Median ppmv	Molecular Weight	Mass Concentration (mg/m³)	Uncontrolled Potential Emissions (Mg/yr)	Uncontrolled Potential Emissions (tons/yr)	After Controls ton/yr	After Controls lb/hr
Methane	540000.0	16.00	353374.23	7979.90	8796.24	**364.05**	83.12
NMOC (VOM)				47.36	52.20	**2.16**	0.49
Hydrogen Sulfide ***	200.0	34.00	278.12	6.28	6.92	**1.73**	0.40

** = Hazardous Air Pollutants listed in Title III of the 1990 Clean Air Act Amendments*
*** = Exempt VOC*
Information obtained from EPA AP-42 5th Edition Section 2.4 (11/98) on individual NMOC and HAP concentrations in Tables 2.4-1 and 2.4-2 and footnote c of table 2.4-2.
The control efficiency is based on an average 0% area coverage of gas extraction wells at the facility. There is no collection system in place
See cover_02.xls for cover factor determination.

Cottonwood Hills RDF
2011 Annual Air Emissions Report
Solidification Process

Process Data		
Liquid Processed	305091	gal/yr
Density of Liquid	8.0	lb/gal
Dust Requirement	1	lb dust/lb liquid sludge
PM Emission Factor*	1.5	lb PM/ton dust

Emission Calculations:

Dust required = 305091 gallon/year x 8 lbs/gallon x 1 lb dust/lb liquid x 1 ton/2000 lb = **1220 ton/yr**

PM Emissions = 1220.36 ton/yr x 1.5 lb PM/lb dust x 1 ton/2000 lb = **0.9153 ton/yr**

PM10 Emissions = 1220.36 ton/yr x 1.5 lb PM/lb dust x 1 ton/2000 lb = **0.9153 ton/yr**

PM2.5 Emissions = 1220.36 ton/yr x 1.5 lb PM/lb dust x 1 ton/2000 lb = **0.9153 ton/yr**

Month	Gallons
January	0
February	0
March	0
April	0
May	0
June	0
July	0
August	0
September	0
October	0
November	109962
December	195129
TOTAL	305,091

Calculate emissions rate lbs/hour:

PM = 7.04 lbs/hr

Based on 1 hr/day 260 days per year

*Emission factor source: EPA's AP-42; 5th Edition; Chapter 11.17; Table 11.17-4. No data was available for PM-10 or PM-2.5 so the same emission factor as PM was assumed.

Limit of 3,500,000 gal/yr / 2080 hrs/yr = 1682.7 gal/hr process rate

VOM = 0.168 tons/yr

Cottonwood Hills RDF
2011 Annual Air Emissions Report
Fugitive Roadway Emissions

Vehicle Type	AP-42 Data: Vehicle Wt. Unloaded (ton)	AP-42 Data: Vehicle Wt. Loaded (ton)	AP-42 Data: Mean Vehicle Weight (tons)	% of all Trucks	* Trucks/ Yr	Net Vehicle Weight (tons)	W: Mean Vehicle Weight (tons)
Transfer Trailer	16.5	38.5	27.5	50%	16,068	353,496	13.75
Front End Loader	19.3	28.8	24.05	13%	4,178	39,688	3.13
Rear End Loader	15.5	23	19.25	13%	4,178	31,333	2.50
Roll-Off Container	17.8	26.8	22.3	5%	1,607	14,461	1.12
Other	14	30.9	22.45	3%	964	16,293	0.67
T-Plate	3.8	5	4.4	0%	-	-	-
Private Truck	2.6	3.1	2.85	1%	321	161	0.03
Tractor Trailer	15.6	35.2	25.4	0%	-	-	-
Dump Trucks	12	17	14.5	0%	-	-	-
Volvo	26	38	32	15%	4,820	57,845	4.80
				100%	32,136	513,276	26.00
				actual tons in 2011 >>		513,276	

Spreadsheet Inputs:

s = surf. mat. silt content (unpaved) =	6.4	% (from Table 13.2.2-1)		
sL=paved road surface silt load (g/m2) =	7.4	g/m2 (Table 13.2.1-3)		
M = surface material moist. cont. =	0.2	% (default value)		
P = # of day/yr with precip. =	115	days		
UPR = Total length of unpaved roads =	2000	ft	0.38	miles
PR = Total length of paved roads =	0	ft	0.00	miles
VMT = Vehicle mile traveled				
W = fleet mean vehicle weight (tons)				
N = Number of days in the averaging period	365			
Control Efficiency	90%	*(Per Title V Application 01040051 dated April 2001)*		

Formulas for Emissions Factors:

Unpaved Road: E = k * [s/12]^a * [W/3]^b * [(365 - p)/365] (AP-42 Chapter 13.2.2, 12/03)

Constant	PM2.5	PM10	PM30(TSP)
k (lb/VMT)	0.23	1.5	4.9
a	0.9	0.9	0.7
b	0.45	0.45	0.45

Paved Road E = [(k * (sL/2)^0.65 * (W/3)^1.5)]* [1 - P/(4 * N)] (AP-42 Chapter 13.2.1, 12/03)

Constant	PM2.5	PM10	PM30(TSP)
k (lb/VMT)	0.004	0.016	0.082

Emission Calculations:

W = Fleet Mean Vehicle Weight = 26.00 tons *Sum of Mean Vehicle Wt x % Vehicles on Site*

	Vehicles	Miles	E (2.5)	E (10)	E (TSP)
Unpaved Roads	32,136	0.38	0.2364	1.5418	5.7114
Paved Roads	32,136	0.00	0.2200	0.8800	4.5102
Total (tons/yr) - Uncontrolled			1.44	9.38	34.76
Control Efficiency			90%	90%	90%
Total (tons/yr) - Controlled			0.14	0.94	3.48
Total (lb/hr) - Controlled			**0.111**	**0.722**	**2.674**

NOTES:

** Vehicle count calculated using actual waste volume data (tons) and AP-42 net vehicle wt. Distribution of vehicles types*

*** Factors for PM emissions from vehicle exhaust, breek wear and tire wear are not subtracted out, since EPA MOBILE 6.2 is*

**** Hourly emission rate calculated assuming 2600 operating hrs/yr.*

42.17 *ton waste per VMT = waste tonnage / # vehicles / road length (miles)*

Cottonwood Hills RDF
2011 Annual Air Emissions Report
Crusher Engine Data

		SO2 Emissions		NOX Emissions		VOM Emissions		CO Emissions		PM Emissions	
	Engine	SO2(lb/hr)=	0.32	NOX(lb/hr)=	4.9	VOM(lb/hr)=	0.39	CO(lb/hr)=	1.06	PM(lb/hr=)	0.35
Month	Run Hours	lbs/hr	tpy	lbs/hr	tpy	lbs/hr	tpy	lbs/hr	tpy	lbs/hr	tpy
December 10	29										
January	92	0.320	0.015	4.900	0.225	0.390	0.018	1.060	0.049	0.350	0.016
February	48	0.320	0.008	4.900	0.118	0.390	0.009	1.060	0.025	0.350	0.008
March	32	0.320	0.005	4.900	0.078	0.390	0.006	1.060	0.017	0.350	0.006
April	32	0.320	0.005	4.900	0.078	0.390	0.006	1.060	0.017	0.350	0.006
May	9	0.320	0.001	4.900	0.022	0.390	0.002	1.060	0.005	0.350	0.002
June	20	0.320	0.003	4.900	0.049	0.390	0.004	1.060	0.011	0.350	0.004
July	2	0.320	0.000	4.900	0.005	0.390	0.000	1.060	0.001	0.350	0.000
August	12	0.320	0.002	4.900	0.029	0.390	0.002	1.060	0.006	0.350	0.002
September	21	0.320	0.003	4.900	0.051	0.390	0.004	1.060	0.011	0.350	0.004
October	6	0.320	0.001	4.900	0.015	0.390	0.001	1.060	0.003	0.350	0.001
November	6	0.320	0.001	4.900	0.015	0.390	0.001	1.060	0.003	0.350	0.001
December	12	0.320	0.002	4.900	0.029	0.390	0.002	1.060	0.006	0.350	0.002
TOTALS	292	0.320	0.047	4.900	0.715	0.390	0.057	1.060	0.155	0.350	0.051

EXAMPLE CALCULATIONS

Engine Size = 158 hp

tpy = Run Hours x Rate (lb/hr) /2000 lb/ton

lbs/hr = Run Hours / 24 hrs/day / # of days/month x Rate (lb/hr)

Emission Rates for SO2, NOX, VOM, CO and PM were taken from Section 7.3.6 and 7.2.12 of Cottonwood Title V Permit, 11/06/02

Percent Throughputs

Dec-Feb	*54.7%*	*Mar-May*	*23.6%*
Jun-Aug	*11.0%*	*Sep-Nov*	*10.7%*

		hrs/day
Annual Hours	292	1.12
Peak Ozone Hours	34	0.52

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Cottonwood Hills RDF
2011 Annual Air Emissions Report
Crusher Unit Throughput Data

		Uncontrolled		Controlled	90%
Month	Throughput tons	PM Emissions * tpy	PM Emissions * lbs/hr	PM Emissions * tpy	PM Emissions * lbs/hr
December 10	580				
January	1,840	0.04	0.90	0.004	0.09
February	960	0.02	0.90	0.002	0.09
March	640	0.01	0.90	0.001	0.09
April	640	0.01	0.90	0.001	0.09
May	180	0.00	0.90	0.000	0.09
June	400	0.01	0.90	0.001	0.09
July	40	0.00	0.00	0.000	0.00
August	240	0.01	0.90	0.001	0.09
September	420	0.01	0.90	0.001	0.09
October	120	0.00	0.90	0.000	0.09
November	120	0.00	0.90	0.000	0.09
December	240	0.01	0.90	0.001	0.09
TOTALS	5,840	0.13	0.90	0.013	0.09

EXAMPLE CALCULATIONS
** PM Emissions assumed to be the same for TSP, PM10 & PM2.5*
tpy = PM Emissions Factor x Throughput (tons)/2000 lb/ton
PM Emissions Factor: 0.04522 lbs/Ton processed
Emission Factors for PM were taken from Condition 7.2.6 of Cottonwood Title V Permit, 11/06/02

Percent Throughputs

Dec-Feb	*54.7%*	*Mar-May*	*23.6%*
Jun-Aug	*11.0%*	*Sep-Nov*	*10.7%*

Processing Rates:

Annual	*20.0*	*tons/hr*
Jun-Aug	*20.0*	*tons/hr*

Cottonwood Hills RDF
2011 Annual Air Emissions Report
Fugitive Stockpile/Cover Emissions

Month	Operating Days	Waste Intake	Intake Rate (tons/day)	Soil Cover Density (lb/cy)	Refuse Density (lb/cy)	Percent Soil Volume	Cover Used (tons/day)	Fugitive Dust Emissions (tons) PM2.5	PM10	TSP
January	22	34,697	1,577	2,600	1,100	15%	559	0.000	0.001	0.003
February	20	34,298	1,715	2,600	1,100	15%	608	0.000	0.001	0.003
March	21	45,807	2,181	2,600	1,100	15%	773	0.001	0.002	0.004
April	22	43,123	1,960	2,600	1,100	15%	695	0.001	0.002	0.003
May	22	46,438	2,111	2,600	1,100	15%	748	0.001	0.002	0.004
June	20	46,853	2,343	2,600	1,100	15%	831	0.001	0.002	0.004
July	22	44,054	2,002	2,600	1,100	15%	710	0.001	0.002	0.004
August	22	47,527	2,160	2,600	1,100	15%	766	0.001	0.002	0.004
September	20	42,473	2,124	2,600	1,100	15%	753	0.001	0.002	0.003
October	23	40,356	1,755	2,600	1,100	15%	622	0.000	0.002	0.003
November	20	43,160	2,158	2,600	1,100	15%	765	0.001	0.002	0.003
December	21	44,491	2,119	2,600	1,100	15%	751	0.001	0.002	0.004
TOTALS	255	513,276	2,013	2,600	1,100	15%	714	**0.006**	**0.020**	**0.041**

Cover Used (tons/day) = Waste Disposal rate (tpd) x Soil Cover Density (lb/cy) / Refuse Density (lb/cy) x % Soil Volume

Formulas for Emissions Factors:
Aggregate Handling/Storage Piles (from AP-42 Chapter 13.2.4, 1/95):

E (lb/ton of material) = k x (0.0032) x [(U/5)^1.3 / (M/2)^1.4]

Constant	PM2.5	PM10	TSP	Comment
U (mph)	9.66	9.66	9.66	Wind speed for St. Louis, Mo. from Tanks 4.0 Model database
M (%)	12	12	12	Table 13.2.4-1; MSW Cover
k	0.11	0.35	0.74	
E (lb/ton)	**0.0001**	**0.0002**	**0.0005**	