ENVIRONMENTAL INFORMATION LOGISTICS, LLC

April 11, 2017

Illinois Environmental Protection Agency
Division of Air Quality Control
Air Quality Planning Section (#39)
1021 North Grand Avenue East
Springfield, IL 62794-9276

RE: Cottonwood Hills Recycling and Disposal Facility
Facility ID No. 163075AAL
CAAPP Permit No. 01040051
2016 Annual Emission Report

Dear Sir or Madam:

Please find attached the 2016 Annual Emission Report for Cottonwood Hills Recycling & Disposal Facility located in Marissa, Illinois. The report covers the time period from January 1, 2016 through December 31, 2016. The report is signed by the responsible official.

The calculated emissions during 2016 indicate there were no exceedences of air emission limits.

If you have any questions regarding this report, please contact CR at (630) 254-9392 or Laura Niemann at (616) 891-2592.

Sincerely,

Environmental Information Logistics, LLC

Laura J. Niemann

Laura Niemann, P.E.
Senior Engineer

Chirag (CR) Nanavati
Project Engineer

Cc: Ernest H. Dennison – WMII, Inc.

Report: APCA0530

Illinois Environmental Protection Agency
Division of Air Pollution Control
DAPC - ANNUAL EMISSIONS REPORT - 2016

Page: 1
Date: 11-17-2016

163075AAL - Cottonwood Hills Recycling & Disposal

- SOURCE DATA -

SOURCE IDS AND LOCATION

AIRS:	17-163-00305	IEPA USE ONLY	SIC 1:	4953	NAICS 1:	562212	
FINDS:		IEPA USE ONLY	SIC 2:		NAICS 2:		
FEIN:	362660859		SIC 3:		NAICS 3:		
D&B:			SIC 4:		NAICS 4:		
LATITUDE:	38:15:16.0488		SIC 5:		NAICS 5:		
LONGITUDE:	89:46:34.3200		SIC 6:		NAICS 6:		

SOURCE ADDRESS

Cottonwood Hills Recycling & Disposal

10400 Hillstown Rd
Marissa, IL 62257-1034

CONTACT: Ernest Dennison
PHONE: ~~618-857-7160~~ 314-568-2025 EXT:
FAX:
ALT PHONE:
E-MAIL: ddenniso@wm.com

ANNUAL EMISSION REPORT MAILING ADDRESS

Waste Management Of Illinois Inc

601 Madison Rd
East St. Louis, IL 62201-1642

CONTACT: Ernest Dennison
PHONE: ~~618-271-6700~~ 314-568-2025 EXT: ~~2122~~
FAX:
ALT PHONE:
E-MAIL: ddenniso@wm.com

Any person who knowingly makes a false, fictitious, or fraudulent material statement, orally or in writing, to the Illinois EPA commits a Class 4 felony. A second or subsequent offense after conviction is a Class 3 felony. (415 ILCS 5/44(h))

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete.

Joe Durako

AUTHORIZED SIGNATURE

4/11/17
DATE

Joe Durako, Senior District Manager
TYPED OR PRINTED NAME AND TITLE

618-857-7159
TELEPHONE NUMBER

The Illinois EPA is authorized to require, and you must disclose, the information on this form pursuant to 35 Ill. Adm. Code 201.302(a, b) and 254. It is not necessary to use this form in providing the information. Failure to disclose the information may result in penalties as provided for in the Environmental Protection Act, 415 ILCS 5/24-45.

WM02661

Illinois Environmental Protection Agency
Division of Air Pollution Control
DAPC - ANNUAL EMISSIONS REPORT - 2016

163075AAL - Cottonwood Hills Recycling & Disposal

- ANNUAL SOURCE EMISSIONS -

POLLUTANT CODE	SOURCES REPORTED EMISSIONS FOR 2016 (TONS/YEAR)	EMISSIONS REPORTED FOR 2015 (TONS/YEAR)	IEPA 2016 ESTIMATED EMISSIONS (TONS/YEAR)
CO	148.42	141.860000	153.344360
CO2	26537.22	26,910.970000	29,099.694000
H2S	3.95	3.690000	3.669120
MC	0.076	0.070000	0.061152
METHANE	504.66	461.740000	460.474560
NOX	27.49	26.160000	28.301000
PART	21.46	10.750000	12.842860
PM10	11.27	8.130000	12.842860
PM2.5	1.15	7.310000	7.740730
SO2	18.77	24.320000	26.251763
VOM	6.75	5.330000	5.557550
HAPs	0.73		

163075AAL - Cottonwood Hills Recycling & Disposal

- PERMIT LISTING -

PERMIT NUMBER	TYPE OF PERMIT	OPERATION NAME	STATUS	STATUS DATE	EXPIRES
00060110	CONSTRUCTION	Portable crushing operation	GRANTED	05-25-2012	
01040051	TITLE V	Sanitary landfill	GRANTED	04-25-2016	12-23-2019
02080021	CONSTRUCTION	Landscape and Liquid Waste Processing Facilities	GRANTED	11-22-2011	
05120002	CONSTRUCTION	Overburden loading grate system	GRANTED	02-22-2006	
06070067	CONSTRUCTION	Landfill Airspace	GRANTED	12-23-2008	
06100058	CONSTRUCTION	Landfill Gas Collection System with Flare	GRANTED	02-27-2013	
11070012	CONSTRUCTION	Pug Mill Facility	GRANTED	10-28-2011	

163075AAL - Cottonwood Hills Recycling & Disposal

- FUEL COMBUSTION DATA -

POINT 0001 - Engine (158 HP)

PERMIT: 01040051

BEGAN OPERATION: 03 / 2000

CEASED OPERATION: /

SCC: 20200102

MODE 01 -

DESCRIPTION CORRECTION:

BEGAN OPERATION: / 1999

CEASED OPERATION: /

PERCENT THROUGHPUTS:

DEC - FEB:	0.00	%44.9	MAR - MAY:	100.00 %11.2
JUN - AUG:	0.00	%31.8	SEP - NOV:	0.00 %12.1

FUEL TYPE: 21 DISTILLATE OIL #2

INPUT (MMBTU/HR): .4

HEAT CONTENT: 140000 Btu/gal

SULFUR CONTENT (%): 0.280000

ASH CONTENT (%):

NITROGEN CONTENT (%):

UNITS: 1000 GALLONS BURNED

UNITS: 1000 GALLONS BURNED

ANNUAL OPERATION			PEAK OZONE SEASON OPERATION		
HOURS/DAY:	0.2	0.4	HOURS/DAY:	0.0	0.52
DAYS/WEEK:	5.0	5	DAYS/WEEK:	0.0	5
WEEKS/YEAR:	52	52	WEEKS/SEASON:	0	13
HOURS/YEAR:	42	93	HOURS/SEASON:	0	34
			START TIME:		
			END TIME:		
RATE/HR:	0.0066	0.0066	RATE/HR:	0.0000	

WM02664

163075AAL - Cottonwood Hills Recycling & Disposal

- FUEL COMBUSTION DATA -

POINT 0001 - Engine (158 HP)

PERMIT: 01040051

BEGAN OPERATION: 03 / 2000

CEASED OPERATION: /

SCC: 20200102

MODE 01 -

POLLUTANT CODE	METHOD IEPA	METHOD REP	EMISSION FACTOR IEPA	EMISSION FACTOR REPORTED	EMISSION RATE (LB/HR) IEPA	EMISSION RATE (LB/HR) REPORTED	
CO	3	3			1.06	1.06	1.06
CO2	3	3	22600		149.16	149.16	65.43
NOX	3	3			4.9	4.9	4.9
PART	3	3			.35	.35	0.35
PM10	3	3			.35	.35	0.35
PM2.5	3	3			.35	.35	0.35
SO2	3	3			.0032	.32	0.32
VOM	3	3			.39	.39	0.39

POLLUTANT CODE	METHOD IEPA	METHOD REP	EMISSION FACTOR IEPA	EMISSION FACTOR REPORTED	OZONE SEASON EMISSION RATE (LB/HR) IEPA	OZONE SEASON EMISSION RATE (LB/HR) REPORTED	
NOX	3	3			0	0	4.9
VOM	3	3			0	0	0.39

CAPTURING CONTROLS:

CAPTURING STACKS:

STACK 0004 CAPTURE EFFICIENCY: 100.00 %

WM02665

163075AAL - Cottonwood Hills Recycling & Disposal

- FUEL COMBUSTION DATA -

POINT 0007 - Open flare

PERMIT: 01040051

BEGAN OPERATION: / 2005

CEASED OPERATION: /

SCC: 50300601

MODE 01 -

DESCRIPTION CORRECTION:

PERCENT THROUGHPUTS:

DEC - FEB:	26.50	%23.9	MAR - MAY:	26.40	%25.7
JUN - AUG:	26.30	%25.1	SEP - NOV:	20.80	%25.2

BEGAN OPERATION: / 2005

CEASED OPERATION: /

FUEL TYPE: 6 LANDFILL GAS

INPUT (MMBTU/HR): 75

HEAT CONTENT: 500 Btu/ft3

SULFUR CONTENT (%):

ASH CONTENT (%):

NITROGEN CONTENT (%):

UNITS: MILLION CUBIC FEET BURNED

UNITS: MILLION CUBIC FEET BURNED

ANNUAL OPERATION			PEAK OZONE SEASON OPERATION		
HOURS/DAY:	22.2	23.09	HOURS/DAY:	24.0	23.1
DAYS/WEEK:	7.0	7	DAYS/WEEK:	7.0	7
WEEKS/YEAR:	52	52	WEEKS/SEASON:	12	12
HOURS/YEAR:	8,080	8,451.8	HOURS/SEASON:	2,207	2,125.7
			START TIME:		
			END TIME:		
RATE/HR:	0.0718	0.067	RATE/HR:	0.0681	0.065

WM02666

163075AAL - Cottonwood Hills Recycling & Disposal

- FUEL COMBUSTION DATA -

POINT 0007 - Open flare

PERMIT: 01040051

BEGAN OPERATION: / 2005

CEASED OPERATION: /

SCC: 50300601

MODE 01 -

POLLUTANT CODE	METHOD IEPA	METHOD REP		EMISSION FACTOR IEPA	EMISSION FACTOR REPORTED	EMISSION RATE (LB/HR) IEPA	EMISSION RATE (LB/HR) REPORTED	
CO	3	3				35.1	35.1	35.1
CO2	3	3		110000		6661.13	6661.13	7365.19
NOX	3	3				6.45	6.45	6.45
PART	3	3				1.77	1.77	1.77
PM10	3	3				1.77	1.77	1.77
PM2.5	3	3				1.77	1.77	1.77
SO2	3	3				6.01	6.01	4.43
VOM	3	3				.64	.64	0.64

POLLUTANT CODE	METHOD IEPA	METHOD REP		EMISSION FACTOR IEPA	EMISSION FACTOR REPORTED	OZONE SEASON EMISSION RATE (LB/HR) IEPA	OZONE SEASON EMISSION RATE (LB/HR) REPORTED	
NOX	3	3				6.45	6.45	6.45
VOM	3	3				.64	.64	0.64

CAPTURING CONTROLS:

CAPTURING STACKS:

STACK 0002 CAPTURE EFFICIENCY: 100.00 %

WM02967

163075AAL - Cottonwood Hills Recycling & Disposal

- PROCESS DATA -

POINT 0008 - Portable rock crushing unit

PERMIT: 01040051

BEGAN OPERATION: 03 / 2000

CEASED OPERATION: /

SCC: 30502001

MODE 01 -

DESCRIPTION CORRECTION:

BEGAN OPERATION: 11 / 2000

CEASED OPERATION: /

PERCENT THROUGHPUTS:

DEC - FEB:	0.00 %	MAR - MAY:	100.00 %
JUN - AUG:	0.00 %	SEP - NOV:	0.00 %

UNITS: TONS PROCESSED

UNITS: TONS PROCESSED

ANNUAL OPERATION			PEAK OZONE SEASON OPERATION	
HOURS/DAY:	0.2	0.4	HOURS/DAY:	0.52
DAYS/WEEK:	5.0	5	DAYS/WEEK:	5
WEEKS/YEAR:	52	52	WEEKS/SEASON:	13
HOURS/YEAR:	49	93	HOURS/SEASON:	34
			START TIME:	
PWR (LB/HR):	40,000.0000	19,800	END TIME:	
RATE/HR:	20.0000	19.8	PWR (LB/HR):	40,000
			RATE/HR:	20

163075AAL - Cottonwood Hills Recycling & Disposal

- PROCESS DATA -

POINT 0008 - Portable rock crushing unit

PERMIT: 01040051

BEGAN OPERATION: 03 / 2000

CEASED OPERATION: /

SCC: 30502001

MODE 01 -

POLLUTANT CODE	METHOD IEPA	METHOD REP		EMISSION FACTOR IEPA	EMISSION FACTOR REPORTED	EMISSION RATE (LB/HR) IEPA	EMISSION RATE (LB/HR)	REPORTED
PART	3	3		.04522		5.1	.09	0.09
PM10	3	3		.04522		5.1	.09	0.09
PM2.5	3	3		.04522		.00027	.09	0.09

POLLUTANT CODE	METHOD IEPA	METHOD REP	EMISSION FACTOR IEPA	EMISSION FACTOR REPORTED	OZONE SEASON EMISSION RATE (LB/HR) IEPA	OZONE SEASON EMISSION RATE (LB/HR) REPORTED

CAPTURING CONTROLS:

CONTROL 0001 CAPTURE EFFICIENCY: 100.00 %

CAPTURING STACKS:

163075AAL - Cottonwood Hills Recycling & Disposal

- PROCESS DATA -

POINT 0009 - Liquid waste solidification

PERMIT: 01040051

BEGAN OPERATION: /

CEASED OPERATION: /

SCC: 30599999

MODE 01 -

DESCRIPTION CORRECTION:

LIQUID WASTE SOLIDIFICATION DID NOT OCCUR IN 2016

BEGAN OPERATION: /

CEASED OPERATION: /

PERCENT THROUGHPUTS:

DEC - FEB:	25.00 %	0	MAR - MAY:	25.00 %	0
JUN - AUG:	25.00 %	0	SEP - NOV:	25.00 %	0

UNITS: TONS PRODUCED

UNITS: TONS PRODUCED

ANNUAL OPERATION			PEAK OZONE SEASON OPERATION		
HOURS/DAY:	0.0	0	HOURS/DAY:	0.0	0
DAYS/WEEK:	0.0	0	DAYS/WEEK:	0.0	0
WEEKS/YEAR:	0	0	WEEKS/SEASON:	0	0
HOURS/YEAR:	0	0	HOURS/SEASON:	0	0
			START TIME:		
PWR (LB/HR):	0.0000	0	END TIME:		
RATE/HR:	0.0000	0	PWR (LB/HR):	0.0000	0
			RATE/HR:	0.0000	0

163075AAL - Cottonwood Hills Recycling & Disposal

- PROCESS DATA -

POINT 0009 - Liquid waste solidification

PERMIT: 01040051

BEGAN OPERATION: /

CEASED OPERATION: /

SCC: 30599999

MODE 01 -

LIQUID WASTE SOLIDIFICATION DID NOT OCCUR IN 2016

POLLUTANT CODE	METHOD IEPA	METHOD REP	EMISSION FACTOR IEPA	EMISSION FACTOR REPORTED	EMISSION RATE (LB/HR) IEPA	EMISSION RATE (LB/HR) REPORTED
PART	3	3			4.8	0
PM10	3	3			4.8	0
VOM	3	3			.1	0

POLLUTANT CODE	METHOD IEPA	METHOD REP	EMISSION FACTOR IEPA	EMISSION FACTOR REPORTED	OZONE SEASON EMISSION RATE (LB/HR) IEPA	OZONE SEASON EMISSION RATE (LB/HR) REPORTED
VOM	3	3			0	0 0

CAPTURING CONTROLS:

CAPTURING STACKS:

STACK 0005 CAPTURE EFFICIENCY: 100.00 %

WM02671

163075AAL - Cottonwood Hills Recycling & Disposal

- OTHER SOURCE DATA -

POINT 0002 - Municipal solid waste landfill

PERMIT: 01040051

BEGAN OPERATION: 03 / 2000

CEASED OPERATION: /

SCC: 50100403

MODE 01 -

DESCRIPTION CORRECTION:

BEGAN OPERATION: 11 / 2000

CEASED OPERATION: /

PERCENT THROUGHPUTS: DEC - FEB: 25.00 % 25 MAR - MAY: 25.00 % 25
JUN - AUG: 25.00 % 25 SEP - NOV: 25.00 % 25

UNITS: MILLION CUBIC FEET PRODUCED

ANNUAL OPERATION		
HOURS/DAY:	24.0	24.0
DAYS/WEEK:	7.0	7.0
WEEKS/YEAR:	52	52
HOURS/YEAR:	8,760	8784
RATE/HR:	0.1295	0.1382

UNITS: MILLION CUBIC FEET PRODUCED

PEAK OZONE SEASON OPERATION		
HOURS/DAY:	24.0	24
DAYS/WEEK:	7.0	7.0
WEEKS/SEASON:	13	13
HOURS/SEASON:	2184	2208
START TIME:		
END TIME:		
RATE/HR:	0.1295	0.1382

163075AAL - Cottonwood Hills Recycling & Disposal

- OTHER SOURCE DATA -

POINT 0002 - Municipal solid waste landfill

PERMIT: 01040051

BEGAN OPERATION: 03 / 2000

CEASED OPERATION: /

SCC: 50100403

MODE 01 -

POLLUTANT CODE	METHOD IEPA	METHOD REP	EMISSION FACTOR IEPA	EMISSION FACTOR REPORTED	EMISSION RATE (LB/HR) IEPA	EMISSION RATE (LB/HR) REPORTED	
H2S	3	3			.84	.84	0.90
MC	3	3			.014	.0148	0.016
METHANE	4	3			105.42	105.42	115.22
VOM	3	3			.63	.63	0.92

POLLUTANT CODE	METHOD IEPA	METHOD REP	EMISSION FACTOR IEPA	EMISSION FACTOR REPORTED	OZONE SEASON EMISSION RATE (LB/HR) IEPA	OZONE SEASON EMISSION RATE (LB/HR) REPORTED	
VOM	3	3			.63	.63	

CAPTURING CONTROLS:

CAPTURING STACKS:

STACK 0010 CAPTURE EFFICIENCY: 100.00 %

163075AAL - Cottonwood Hills Recycling & Disposal

- CONTROL DEVICE DATA -

CONTROL 0001 - Water spray

PERMIT: 01040051

BEGAN OPERATION: /

CEASED OPERATION: /

CONTROL CODE: 217

DESCRIPTION CORRECTION:

REMOVAL EFFICIENCY

POLLUTANT	ANNUAL OPERATION EFFICIENCY IEPA	ANNUAL OPERATION EFFICIENCY REPORTED	ANNUAL OPERATION METHOD IEPA	ANNUAL OPERATION METHOD REPORTED	PEAK OZONE SEASON OPERATION EFFICIENCY IEPA	PEAK OZONE SEASON OPERATION EFFICIENCY REPORTED	PEAK OZONE SEASON OPERATION METHOD IEPA	PEAK OZONE SEASON OPERATION METHOD REPORTED
PART	90.000	80		AP-42		80		AP-42
PM10	90.000	80		AP-42		80		AP-42

CAPTURING CONTROLS:

CAPTURING STACKS:

STACK 0001 CAPTURE EFFICIENCY: 100.00 %

163075AAL - Cottonwood Hills Recycling & Disposal

- STACK DATA -

STACK	DIAMETER (FT)	HEIGHT (FT)	FLOW RATE (ACFM)	TEMPERATURE (F)
0001 - Water spray	3.40	10	28585	86
0002 - Flare	3.20	43	72	1400
0004 - Rock crusher engine	1.50	20	6687	429
0005 - Liquid waste solidification	2.30	20	320	179
0010 - Landfill		1	2	69

163075AAL - Cottonwood Hills Recycling & Disposal

WM02676

2016 AER Supporting Calculations

Cottonwood Hills Recycling & Disposal Facility
Emission Totals for 2016 Air Emissions Report (in tons per year) Using Title V Permit Values

														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	-	-	4.03	-	-	-	-	-	0.620	0.071	0.0037	3.95	504.66	-	-	-
Open Flare	18.76	27.26	2.70	148.37	-	7.480	7.480	7.480	0.111	0.005	0.003	-	-	0.68	0.13	26534.18
Roads	-	-	-	-	-	13.93	3.76	1.13	-	-	-	-	-	-	-	-
Solidification			0.000			0.000	0.000	0.000						-	-	-
Stockpile/ Cover					-	0.028	0.013	0.002						-	-	-
Rock Crushing Engine	0.01	0.23	0.02	0.049	-	0.02	0.02	0.02	-	-	-	-	-	-	-	3.04
Rock Crushing Process	-	-	-	-	-	0.004	0.004	0.004	-	-	-	-	-	-	-	-
Totals	18.77	27.49	6.75	148.42		21.46	11.27	1.151	0.731	0.076	0.007	3.95	504.66	0.68	0.13	26537.22

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

Cottonwood Hills RDF
2016 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	1,696,343	848,171	508,903	461,674
2013	1,514,265	757,132	454,279	412,120
2014	1,269,442	634,721	380,833	345,489
2015	1,415,289	707,644	424,587	385,183
2016	1,141,454	570,727	342,436	310,656
2017	0	0		0
2018	0	0		0
2019	0	0		0
2020	0	0		0
Total			6,886,145	6,247,070

Note: 1 Mg = 1.1023 ton

Cottonwood Hills RDF
2016 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:

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

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 =	800 ppmv as hexane NMOC concentration (site specific 2016 testing, 5/10 & 9/23 sample results max.)

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

Year for emission calculation = **2016**

NMOC emissions for 2016 = 96.96 Mg/yr = 106.88 ton/yr

Conversion of NMOC emission rate to Landfill Gas Rate

Maximum Annual Landfill Gas Rate:

96.96 Mg NMOC/yr * 10^6 g/Mg * g-mole/86.17 g * 24.45 l/g-mole * 1 m^3/1000 l* 10^6 m³/800 m³ NMOC = 34,389,940 m³/yr

Daily Gas Rate:

34,389,940 m³/yr * 35.31 ft³/m³ * 1 yr/365 days = 3,326,870 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 = 800 ppm$_v$

800 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

= 2819.47 mg/m^3 NMOC as hexane

NMOC Emissions Calculation

NMOC emissions = 2,819.47 mg/m^3 LFG * 34,389,940 m^3 LFG/yr * 1 Mg/10^9 mg * 1.1023 ton/Mg

NMOC emissions = 106.88 tons/yr NMOC as hexane

Collection Efficiency= 0.75 %

Cover Factor= 0.15

Controlled NMOC Emissions = 4.027 tons/yr NMOC as hexane

Cottonwood Hills RDF
2016 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	73.2	Enter the footprint acreage.

COVER TYPE	COVER FACTOR	ACREAGE		
Active area	0.6265	10	0.0856	Enter the average size of the active face. The cover factor is based on 50% air and 50% daily cover.
Intermediate	0.1110	40.2	0.0610	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	23	0.0041	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.
		73.2	Total Liner Acreage Constructed	
COVER ATTENUATION FACTOR (CAF) =			0.1507	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

2016 Annual Air Emissions Report

ANNUAL NMOC EMISSION RATE Using Title V Permit Values

See NMOC equation on previous page

Time for "i" th section	i	Mi (Mg)	Mnmoc (Mg/yr) 2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
2000	1	3,828	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04
(ti =)			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2001	2	258,465		4.67	4.57	4.46	4.36	4.26	4.16	4.07	3.98	3.89	3.80	3.71	3.63	3.54	3.46	3.39	3.31	3.23	3.16	3.09
(ti =)				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2002	3	284,746			5.15	5.03	4.92	4.80	4.69	4.59	4.48	4.38	4.28	4.18	4.09	4.00	3.91	3.82	3.73	3.64	3.56	3.48
(ti =)					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
2003	4	348,929				6.31	6.16	6.02	5.89	5.75	5.62	5.49	5.37	5.25	5.13	5.01	4.90	4.79	4.68	4.57	4.47	4.36
(ti =)						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
2004	5	392,944					7.10	6.94	6.78	6.63	6.48	6.33	6.19	6.05	5.91	5.77	5.64	5.51	5.39	5.27	5.15	5.03
(ti =)							1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2005	6	407,484						7.36	7.20	7.03	6.87	6.72	6.56	6.42	6.27	6.13	5.99	5.85	5.72	5.59	5.46	5.34
(ti =)								1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2006	7	503,644							9.10	8.90	8.69	8.50	8.30	8.11	7.93	7.75	7.57	7.40	7.23	7.07	6.91	6.75
(ti =)									1	2	3	4	5	6	7	8	9	10	11	12	13	14
2007	8	435,521								7.87	7.69	7.52	7.35	7.18	7.02	6.86	6.70	6.55	6.40	6.25	6.11	5.97
(ti =)										1	2	3	4	5	6	7	8	9	10	11	12	13
2008	9	361,387									6.53	6.38	6.24	6.10	5.96	5.82	5.69	5.56	5.43	5.31	5.19	5.07
(ti =)											1	2	3	4	5	6	7	8	9	10	11	12
2009	10	449,505										8.12	7.94	7.76	7.58	7.41	7.24	7.08	6.92	6.76	6.61	6.45
(ti =)												1	2	3	4	5	6	7	8	9	10	11
2010	11	419,856											7.59	7.42	7.25	7.08	6.92	6.76	6.61	6.46	6.31	6.17
(ti =)													1	2	3	4	5	6	7	8	9	10
2011	12	465,641												8.42	8.22	8.04	7.85	7.68	7.50	7.33	7.16	7.00
(ti =)														1	2	3	4	5	6	7	8	9
2012	13	461,674													8.42	8.22	8.04	7.85	7.68	7.50	7.33	7.16
(ti =)															1	2	3	4	5	6	7	8
2013	14	412,120														8.42	8.22	8.04	7.85	7.68	7.50	7.33
(ti =)																1	2	3	4	5	6	7
2014	15	345,489															8.42	8.22	8.04	7.85	7.68	7.50
(ti =)																	1	2	3	4	5	6
2015	16	385,183																8.42	8.22	8.04	7.85	7.68
(ti =)																		1	2	3	4	5
2016	17	310,656																	8.42	8.22	8.04	7.85
(ti =)																			1	2	3	4
2017	18	0																		8.42	8.22	8.04
(ti =)																				1	2	3
2018	19	0																			8.42	8.22
(ti =)																					1	2
2019	20	0																				8.42
(ti =)																						1
2020	21	0																				
(ti =)																						
Total (Mg/year) =			0.07	4.74	9.78	15.86	22.60	29.45	37.89	44.90	50.41	57.39	63.67	70.64	77.45	84.10	90.61	96.96	103.17	109.24	115.17	120.97

C:\Users\Chirag\Documents\All folders\Cottonwood\2017\AER\Files from Danny\[Landfill 2016 - Cottonwood.xls]NMOC Table

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Cottonwood Hills RDF
2016 Annual Air Emissions Report
TOTAL HAP EMISSION ESTIMATES Using Title V Permit Values

Modeled Landfill Gas Rate	34,389,940 m³/yr
Gas Collection Efficiency:	75%
Cover Factor:	0.15

Hourly Rate
0.13815 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	0.09	0.10	**0.0037**	0.0009
1,1,2,2-Tetrachloroethane*	1.11	167.85	7.62	0.26	0.29	0.0109	0.0025
1,1-Dichloroethane (ethylidene dichloride)*	2.35	98.95	9.51	0.33	0.36	0.0136	0.0031
1,1-Dichloroethene (vinylidene chloride)*	0.20	96.94	0.79	0.03	0.03	0.0011	0.0003
1,2-Dichloroethane (ethylene dichloride)*	0.41	98.96	1.66	0.06	0.06	0.0024	0.0005
1,2-Dichloropropane (propylene dichloride)*	0.18	112.98	0.83	0.03	0.03	0.0012	0.0003
Acrylonitrile*	6.33	53.06	13.74	0.47	0.52	0.0196	0.0045
Benzene* (AP-42 no co-disposal default)	1.91	78.11	6.10	0.21	0.23	0.0087	0.0020
Carbon disulfide*	0.58	76.13	1.81	0.06	0.07	0.0026	0.0006
Carbon tetrachloride*	0.004	153.84	0.03	0.001	0.001	0.0000	0.0000
Carbonyl sulfide*	0.49	60.07	1.20	0.04	0.05	0.0017	0.0004
Chlorobenzene*	0.25	112.56	1.15	0.04	0.04	0.0016	0.0004
Chloroethane (ethyl chloride)*	1.25	64.52	3.30	0.11	0.13	0.0047	0.0011
Chloroform*	0.03	119.39	0.15	0.005	0.006	0.0002	0.0000
Chloromethane (methyl chloride)*	1.21	50.49	2.50	0.09	0.09	0.0036	0.0008
Dichloromethane **(methylene chloride)*	14.3	84.94	49.68	1.71	1.88	**0.0709**	0.0162
Ethylbenzene*	4.61	106.16	20.02	0.69	0.76	0.0286	0.0065
Hexane*	6.57	86.18	23.16	0.80	0.88	0.0331	0.0076
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	0.72	0.79	0.0299	0.0068
Methyl isobutyl ketone*	1.87	100.16	7.66	0.26	0.29	0.0109	0.0025
Perchloroethylene **(tetrachloroethene)*	3.73	165.83	25.30	0.87	0.96	0.0361	0.0082
Toluene* (AP-42 no co-disposal default)	39.30	92.13	148.09	5.09	5.61	0.2115	0.0483
Trichloroethene*	2.82	131.38	15.15	0.52	0.57	0.0216	0.0049
Vinyl chloride*	7.34	62.50	18.76	0.65	0.71	0.0268	0.0061
Xylene*	12.1	106.16	52.54	1.81	1.99	0.0750	0.0171
Total HAPs					**16.462**	**0.620**	**0.142**
Total Non-VOM Haps (1,1,1 TCA + dichloromethane + PCE)					**13.521**	**0.509**	**0.116**

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	12152.52	13395.72	**504.66**	115.22
NMOC (VOM)				96.96	106.88	**4.03**	0.92
Hydrogen Sulfide ***	300.0	34.00	417.18	14.35	15.81	**3.95**	0.90

** = 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
2016 Annual Air Emissions Report
Open Flare Data

						SO2 Emissions		NOX Emissions		VOM Emissions		CO Emissions		PM Emissions	
						SO2 (lb/hr) per 1000 scfm = 3.973		NOX (lb/hr) for 3000 scfm flare = 6.45		VOM (lb/hr) for 3000 scfm flare = 0.64		CO (lb/hr) for 3000 scfm flare = 35.11		PM (lb/hr) for 3000 scfm flare = 1.77	
Month	D	Run Hours	mmscf	% Methane	mmBtu/hr	lbs/hr	tpy	lbs/hr	tpy	lbs/hr	tpy	lbs/hr	tpy	lbs/hr	tpy
December 15		730.0													
January	31	620.8	37.641	55.1%	18.865	4.01	1.25	6.45	2.00	0.64	0.20	35.1	10.90	1.77	0.549
February	29	673.8	43.096	53.5%	20.972	4.23	1.43	6.45	2.17	0.64	0.22	35.1	11.83	1.77	0.596
March	31	735.2	45.506	54.1%	22.393	4.10	1.51	6.45	2.37	0.64	0.24	35.1	12.91	1.77	0.651
April	30	709.3	45.609	54.0%	22.402	4.26	1.51	6.45	2.29	0.64	0.23	35.1	12.45	1.77	0.628
May	31	732.4	45.423	54.4%	22.476	4.11	1.50	6.45	2.36	0.64	0.23	35.1	12.86	1.77	0.648
June	30	705.8	43.393	53.2%	20.998	4.07	1.44	6.45	2.28	0.64	0.23	35.1	12.39	1.77	0.625
July	31	708.0	48.002	52.1%	22.748	4.49	1.59	6.45	2.28	0.64	0.23	35.1	12.43	1.77	0.627
August	31	711.9	47.390	53.2%	22.932	4.41	1.57	6.45	2.30	0.64	0.23	35.1	12.50	1.77	0.630
September	30	719.7	52.483	52.2%	24.920	4.83	1.74	6.45	2.32	0.64	0.23	35.1	12.63	1.77	0.637
October	31	696.5	52.493	52.0%	24.829	4.99	1.74	6.45	2.25	0.64	0.22	35.1	12.23	1.77	0.616
November	30	714.8	54.388	52.3%	25.873	5.04	1.80	6.45	2.31	0.64	0.23	35.1	12.55	1.77	0.633
December	31	723.7	51.148	48.7%	22.657	4.68	1.69	6.45	2.33	0.64	0.23	35.1	12.71	1.77	0.641
TOTALS	366	8451.8	566.572	52.9%	32.256	4.43	18.76	6.45	27.26	0.64	2.70	35.1	148.37	1.77	7.480

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	*23.9%*	*Mar-May*	*25.7%*
Jun-Aug	*25.1%*	*Sep-Nov*	*25.2%*

PM10	7.480 tpy	1.770 lbs/hr	*Assumed to be same as*
PM2.5	7.480 tpy	1.770 lbs/hr	*TSP per AP-42, Table 2.4.4*

Sulfur: Average Cs for reporting year was **398.7** ppm

398.7 / 1,000,000	ppm H2S	64 / 385.4	mol. Wt. SO2 x / scf/lb-mole	60,000	scfh x	1 T x / 2000 lbs	=	**3.973**	lbs/hr per 1000 scfm

Annual	*Rate/hr =*	*566.572*	*mscf /*	*8451.8*	*hrs =*	*0.0670354*	*MCF/hr or*	*1.5480116* *MCF/day*
Peak Ozone	*Rate/hr =*	*138.785*	*mscf /*	*2125.7*	*hrs =*	*0.0652902*	*MCF/hr or*	*1.508534* *MCF/day*

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Cottonwood Hills RDF Open Flare Data
2016 Annual Air Emissions Report

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
0.133	0.04	0.026	0.01	2,165.63	672.18	3,158.09	980.22	5,323.72	1,652.39
0.148	0.05	0.029	0.01	2,407.47	811.12	3,449.70	1,162.26	5,857.17	1,973.38
0.158	0.06	0.031	0.01	2,570.61	944.96	3,295.49	1,211.42	5,866.11	2,156.38
0.158	0.06	0.031	0.01	2,571.65	911.99	3,431.15	1,216.80	6,002.80	2,128.79
0.159	0.06	0.031	0.01	2,580.13	944.80	3,280.59	1,201.30	5,860.72	2,146.10
0.148	0.05	0.029	0.01	2,410.47	850.65	3,337.55	1,177.82	5,748.01	2,028.47
0.160	0.06	0.032	0.01	2,611.36	924.42	3,767.08	1,333.55	6,378.45	2,257.97
0.162	0.06	0.032	0.01	2,632.47	936.98	3,613.87	1,286.30	6,246.34	2,223.28
0.176	0.06	0.035	0.01	2,860.60	1,029.43	4,043.12	1,454.98	6,903.72	2,484.42
0.175	0.06	0.034	0.01	2,850.16	992.57	4,196.23	1,461.34	7,046.38	2,453.90
0.183	0.07	0.036	0.01	2,970.11	1,061.47	4,210.16	1,504.64	7,180.26	2,566.11
0.160	0.06	0.031	0.01	2,600.90	941.18	4,205.41	1,521.80	6,806.31	2,462.98
0.228	0.68	0.045	0.13	3,702.78	11,021.75	3,662.41	15,512.43	7,365.19	26,534.18

Cottonwood Hills RDF
2016 Annual Air Emissions Report
Open Flare HAPs

Gas Flow Rate:	567 mscf	16,055,867	m^3/yr
Operating Hours:	8451.833 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	0.1392	0.1550	**0.0031**
79345	1,1,2,2-Tetrachloroethane	1.11	AP-42	167.86	7.62	0.1224	0.1362	0.0027
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	0.0127	0.0142	0.0003
107062	1,2-Dichloroethane (ethylene dichloride)	7.84	Site Specific	98.96	31.71	0.5092	0.5668	0.0113
78875	1,2-Dichloropropane (propylene dichloride)	0.18	AP-42	112.99	0.83	0.0134	0.0149	0.0003
107131	Acrylonitrile	6.33	AP-42	53.06	13.74	0.2206	0.2455	0.0049
75150	Carbon disulfide	0.58	AP-42	76.14	1.81	0.0290	0.0323	0.0006
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	0.0193	0.0215	0.0004
108907	Chlorobenzene	4.30	Site Specific	112.56	19.81	0.3180	0.3540	0.0071
75003	Chloroethane (ethyl chloride)	1.25	AP-42	64.52	3.30	0.0530	0.0590	0.0012
67663	Chloroform	0.03	AP-42	119.39	0.15	0.0024	0.0026	0.0001
75092	Dichloromethane (methylene chloride)	4.28	Site Specific	84.94	14.85	0.2385	0.2655	**0.0053**
100414	Ethylbenzene	4.42	Site Specific	106.16	19.20	0.3083	0.3432	0.0069
110543	n-Hexane	3.49	Site Specific	86.17	12.28	0.1972	0.2195	0.0044
78933	Methyl ethyl ketone	7.09	AP-42	72.10	20.91	0.3357	0.3737	0.0075
108101	Methyl isobutyl ketone	1.87	AP-42	100.07	7.65	0.1229	0.1368	0.0027
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	0.5593	0.6226	0.0125
75014	Vinyl chloride	0.42	Site Specific	62.50	1.07	0.0171	0.0191	0.0004
71432	Benzene	1.56	Site Specific	78.11	4.99	0.0802	0.0893	0.0018
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	1.2607	1.4035	0.0281
95476	o-Xylenes	0.73	Site Specific	106.16	3.15	0.0505	0.0563	0.0011
108383	m-Xylenes	5.49	Site Specific	106.16	23.82	0.3825	0.4259	0.0085
	Total HAPS						5.56	**0.1111**

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
2016 Annual Emissions Report
Fugitive Roadway Emissions

Vehicle Type	Vehicle Wt. Unloaded (ton)	Vehicle Wt. Loaded (ton)	Mean Vehicle Weight (tons)	% of all Trucks	* Trucks/ Yr	Net Refuse Weight (tons)	W Mean Vehicle Weight (tons)
REFUSE HAULING							
Transfer Trailer	16.5	38.5	27.5	59%	12,088	265,941	16.18
Front End Loader	19.3	28.8	24.05	15%	3,143	29,858	3.68
Rear End Loader	15.5	23	19.25	15%	3,143	23,572	2.94
Roll-Off Container	17.8	26.8	22.3	6%	1,209	10,879	1.31
Other	14	30.9	22.45	4%	725	12,257	0.79
T-Plate	3.8	5	4.4	0%	-	-	-
Private Truck	2.6	3.1	2.85	1%	242	121	0.03
Tractor Trailer	15.6	35.2	25.4	0%	-	-	-
Dump Trucks	12	17	14.5	0%	-	-	-
				100%	20,550	342,629	24.94
				Actual 2016 Waste Tons =		342,436	
SOIL HAULING							
Dump Trailers	18	40	29	0%	-	-	-
Tandems	8	28	18	0%	-	-	-
Volvo/Cat D-400	26	38	32	100%	8,000	96,000	32.00
				100%	8,000	96,000	32.00
					Estimated Soil Truck Trips		

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. = 87 days (Based on 2016 precipitation data for Marissa, IL)

Refuse Truck Haul Roads:
UPR = Total length of unpaved roads = 4000 ft 0.76 miles
PR = Total length of paved roads = 0 ft 0.00 miles

Soil Truck Haul Roads:
UPR = Total length of unpaved roads = 4000 ft 0.76 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 255
Control Efficiency 80% *(Per AP-42, Figure 13.2.2-5, assuming approx. 0.75 gallons/sy application rate)*
40% *(For PM-2.5, the control efficiency is 40% per AP-42)*

Formulas for Emissions Factors:

Unpaved Road: E = k * [s/12]^a * [W/3]^b * [(365 - p)/365] (AP-42 Chapter 13.2.2, 11/06)

Constant	PM2.5	PM10	PM30 (TSP)
k (lb/VMT)	0.15	1.5	4.9
a	0.9	0.9	0.7
b	0.45	0.45	0.45

Paved Road E = [(k * (sL)^0.91 * (W)^1.02)]* [1 - P/(4 * N)] (AP-42 Chapter 13.2.1, 1/11)

Constant	PM2.5	PM10	PM30 (TSP)
k (lb/VMT)	0.00054	0.0022	0.011

Emission Calculations:

W = Fleet Mean Vehicle Weight (Refuse) =	24.94 tons	*Sum of Mean Vehicle Wt x % Vehicles on Site*
W = Fleet Mean Vehicle Weight (Soil) =	32.00 tons	

	Vehicles	Miles	E (2.5)	E (10)	E (TSP)
Unpaved Roads (Refuse)	20,550	0.76	0.1683	1.6827	6.2333
Paved Roads (Refuse)	20,550	0.00	0.0812	0.3307	1.6537
Unpaved Roads (Soil)	8,000	0.76	0.1883	1.8826	6.9736
Paved Roads (Soil)	8,000	0.00	0.1047	0.4265	2.1327
Total (tons/yr) - Uncontrolled			1.88	18.80	69.65
Control Efficiency			40%	80%	80%
Total (tons/yr) - Controlled			1.13	3.76	13.93
Total (lb/hr) - Controlled			**0.885**	**2.950**	**10.926**

NOTES:
** Vehicle count calculated using actual waste volume data (tons) and net vehicle wt. Distribution of vehicles types estimated by site personnel.*
*** Factors for PM emissions from vehicle exhaust, break wear and tire wear are not subtracted out, since EPA MOBILE 6.2 is not being utillized.*

Cottonwood Hills RDF
2016 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	28,882	1,313	2,600	1,100	15%	465	0.000	0.001	0.002
February	20	28,690	1,435	2,600	1,100	15%	509	0.000	0.001	0.002
March	21	28,665	1,365	2,600	1,100	15%	484	0.000	0.001	0.002
April	22	30,477	1,385	2,600	1,100	15%	491	0.000	0.001	0.002
May	22	29,691	1,350	2,600	1,100	15%	478	0.000	0.001	0.002
June	20	29,723	1,486	2,600	1,100	15%	527	0.000	0.001	0.002
July	22	28,091	1,277	2,600	1,100	15%	453	0.000	0.001	0.002
August	22	30,844	1,402	2,600	1,100	15%	497	0.000	0.001	0.002
September	20	26,769	1,338	2,600	1,100	15%	475	0.000	0.001	0.002
October	23	27,164	1,181	2,600	1,100	15%	419	0.000	0.001	0.002
November	20	27,150	1,358	2,600	1,100	15%	481	0.000	0.001	0.002
December	21	26,289	1,252	2,600	1,100	15%	444	0.000	0.001	0.002
TOTALS	255	342,436	1,343	2,600	1,100	15%	476	**0.002**	**0.013**	**0.028**

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, 11/06):

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 4.0.9.d Model database
M (%)	12	12	12	Table 13.2.4-1; MSW Cover
k	0.053	0.35	0.74	Revised PM2.5 factor from 0.11 which was AP42 factor from 01/95
E (lb/ton)	**0.0000**	**0.0002**	**0.0005**	

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Cottonwood Hills RDF
2016 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 15	300				
January	-	0.00	0.00	0.000	0.00
February	660	0.01	0.90	0.001	0.09
March	100	0.00	0.90	0.000	0.09
April	140	0.00	0.90	0.000	0.09
May	-	0.00	0.00	0.000	0.00
June	360	0.01	0.90	0.001	0.09
July	320	0.01	0.00	0.001	0.00
August	-	0.00	0.00	0.000	0.00
September	0	0.00	0.00	0.000	0.00
October	260	0.01	0.90	0.001	0.09
November	-	0.00	0.00	0.000	0.00
December	-	0.00	0.00	0.000	0.00
TOTALS	1,840	0.04	0.90	0.004	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	*44.9%*	*Mar-May*	*11.2%*
Jun-Aug	*31.8%*	*Sep-Nov*	*12.1%*

Processing Rates:

Annual	*19.8*	*tons/hr*
Jun-Aug	*20.0*	*tons/hr*

Cottonwood Hills RDF
2016 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 15	15										
January	0	0.320	0.000	4.900	0.000	0.390	0.000	1.060	0.000	0.350	0.000
February	33	0.320	0.005	4.900	0.081	0.390	0.006	1.060	0.017	0.350	0.006
March	5	0.320	0.001	4.900	0.012	0.390	0.001	1.060	0.003	0.350	0.001
April	7	0.320	0.001	4.900	0.017	0.390	0.001	1.060	0.004	0.350	0.001
May	0	0.320	0.000	4.900	0.000	0.390	0.000	1.060	0.000	0.350	0.000
June	18	0.320	0.003	4.900	0.044	0.390	0.004	1.060	0.010	0.350	0.003
July	16	0.320	0.003	4.900	0.039	0.390	0.003	1.060	0.008	0.350	0.003
August	0	0.320	0.000	4.900	0.000	0.390	0.000	1.060	0.000	0.350	0.000
September	0	0.320	0.000	4.900	0.000	0.390	0.000	1.060	0.000	0.350	0.000
October	13	0.320	0.002	4.900	0.032	0.390	0.003	1.060	0.007	0.350	0.002
November	1	0.320	0.000	4.900	0.002	0.390	0.000	1.060	0.001	0.350	0.000
December	0	0.320	0.000	4.900	0.000	0.390	0.000	1.060	0.000	0.350	0.000
TOTALS	93	0.320	0.015	4.900	0.228	0.390	0.018	1.060	0.049	0.350	0.016

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 Original Cottonwood Title V Permit dated 11/06/02

Percent Throughputs

Dec-Feb	*44.9%*	*Mar-May*	*11.2%*
Jun-Aug	*31.8%*	*Sep-Nov*	*12.1%*

		hrs/day
Annual Hours	93	0.36
Peak Ozone Hours	34	0.52

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Cottonwood Hills RDF
2016 GHG Emissions - Crusher Engine

Assumptions:
1. One horsepower is equivalent to 42.4 BTU/minute, or 2545 BTU/hour.

Formula for CO2 Emissions from Combustion:
CO2 = 1x10-3 * Fuel * HHV * EF (From 40 CFR 98 Subpart C)

Where:

CO2 = Annual mass emissions for a specified fuel type
Fuel = Mass or volume of the fuel combusted during the year

HHV = Annual average high heat value of the fuel combusted
EF = Fuel-specific default CO2 Emission Factor, from Table C-1 of the Subpart

Other Information:

Fuel Type	Heating Value (BTU/Unit)	Unit
Diesel Fuel (No. 2)	2,545	BTU/Hp-hour

Global warming potential (GWP) of methane (CH_4) = 21 (Reference 1)
Global warming potential (GWP) of nitrous oxide (N_2O) = 310 (Reference 1)

From 40 CFR 98 Table C-2

Parameter	Petroleum Default Emission Factor (kg/mmbtu)
CO2	73.96
CH4	0.003
N2O	0.0006

References:
1. Table A-1 to Subpart A of 40 CFR Part 98 - Global Warming Potentials

Device/Emissions Unit	Assumptions	Throughput	Units	2016 Operating Hours	CO_2 Emissions Metric Tons/year	CH_4 Emissions Metric Tons/year	Conversion to CO_2e tons/year	N_2O Emissions Metric Tons/year	Conversion to CO_2e tons/year	Total GHG Emissions tons/yr CO_2e
Crusher Engine	See Assumption 1 above	158	Hp	93	2.77	0.0001	0.0024	0.00002	0.01	2.78
				English Units (tons/yr):	3.04	0.0001	0.0026	0.00002	0.01	3.05
				English Units (lbs/hr):	65.43	0.00265	0.0557	0.00053	0.165	65.65

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