## Cottonwood Hills Recycling & Disposal Facility
## Emission Totals for 2015 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 | - | - | 2.74 | - | - | - | - | - | 0.567 | 0.065 | 0.0034 | 3.69 | 461.74 | - | - | - |
| Open Flare | 24.31 | 26.06 | 2.59 | 141.84 | - | 7.150 | 7.150 | 7.150 | 0.114 | 0.005 | 0.003 | - | - | 0.67 | 0.13 | 26910.97 |
| Roads | - | - | - | - | - | 3.55 | 0.96 | 0.15 | - | - | - | - | - | - | - | - |
| Solidification | | | 0.000 | | | 0.000 | 0.000 | 0.000 | | | | | | - | - | - |
| Stockpile/ Cover | | | | | - | 0.034 | 0.016 | 0.005 | | | | | | - | - | - |
| Rock Crushing Engine | 0.01 | 0.10 | 0.01 | 0.022 | - | 0.01 | 0.01 | 0.01 | - | - | - | - | - | - | - | - |
| Rock Crushing Process | - | - | - | - | - | 0.002 | 0.002 | 0.002 | - | - | - | - | - | - | - | - |
| Totals | 24.32 | 26.16 | 5.33 | 141.86 | | 10.75 | 8.13 | 0.161 | 0.681 | 0.070 | 0.007 | 3.69 | 461.74 | 0.67 | 0.13 | 26910.97 |

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

# Cottonwood Hills RDF
# 2015 Annual Air Emissions Report
# Open Flare Data

| | | | | | | SO2 Emissions | | NOX Emissions | | VOM Emissions | | CO Emissions | | PM Emissions | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | SO2 (lb/hr) per 1000 scfm = 5.032 | | 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 | mscf | % Methane | mmBtu/hr | lbs/hr | tpy | lbs/hr | tpy | lbs/hr | tpy | lbs/hr | tpy | lbs/hr | tpy |
| December 14 | | 744.0 | | | | | | | | | | | | | |
| January | 31 | 728.0 | 56.040 | 55.0% | 28.036 | 6.46 | 2.35 | 6.45 | 2.35 | 0.64 | 0.23 | 35.1 | 12.78 | 1.77 | 0.644 |
| February | 28 | 672.0 | 42.863 | 52.7% | 20.547 | 5.35 | 1.80 | 6.45 | 2.17 | 0.64 | 0.22 | 35.1 | 11.80 | 1.77 | 0.595 |
| March | 31 | 741.2 | 52.592 | 48.6% | 23.249 | 5.95 | 2.21 | 6.45 | 2.39 | 0.64 | 0.24 | 35.1 | 13.01 | 1.77 | 0.656 |
| April | 30 | 652.7 | 51.915 | 54.3% | 25.641 | 6.67 | 2.18 | 6.45 | 2.11 | 0.64 | 0.21 | 35.1 | 11.46 | 1.77 | 0.578 |
| May | 31 | 744.0 | 55.948 | 48.1% | 24.478 | 6.31 | 2.35 | 6.45 | 2.40 | 0.64 | 0.24 | 35.1 | 13.06 | 1.77 | 0.658 |
| June | 30 | 679.5 | 50.954 | 55.6% | 25.769 | 6.29 | 2.14 | 6.45 | 2.19 | 0.64 | 0.22 | 35.1 | 11.93 | 1.77 | 0.601 |
| July | 31 | 706.8 | 39.334 | 55.3% | 19.785 | 4.67 | 1.65 | 6.45 | 2.28 | 0.64 | 0.23 | 35.1 | 12.41 | 1.77 | 0.626 |
| August | 31 | 741.9 | 54.706 | 49.9% | 24.831 | 6.18 | 2.29 | 6.45 | 2.39 | 0.64 | 0.24 | 35.1 | 13.02 | 1.77 | 0.657 |
| September | 30 | 582.3 | 43.705 | 50.6% | 20.116 | 6.29 | 1.83 | 6.45 | 1.88 | 0.64 | 0.19 | 35.1 | 10.22 | 1.77 | 0.515 |
| October | 31 | 387.0 | 29.047 | 52.6% | 13.897 | 6.29 | 1.22 | 6.45 | 1.25 | 0.64 | 0.12 | 35.1 | 6.79 | 1.77 | 0.342 |
| November | 30 | 714.1 | 53.590 | 52.0% | 25.348 | 6.29 | 2.25 | 6.45 | 2.30 | 0.64 | 0.23 | 35.1 | 12.54 | 1.77 | 0.632 |
| December | 31 | 730.0 | 49.089 | 52.3% | 23.353 | 5.64 | 2.06 | 6.45 | 2.35 | 0.64 | 0.23 | 35.1 | 12.82 | 1.77 | 0.646 |
| TOTALS | 365 | 8079.6 | 579.783 | 52.3% | 34.105 | 6.03 | 24.31 | 6.45 | 26.06 | 0.64 | 2.59 | 35.1 | 141.84 | 1.77 | 7.150 |

*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* | *26.5%* | *Mar-May* | *26.4%* |
| *Jun-Aug* | *26.3%* | *Sep-Nov* | *20.8%* |

| | | | |
|---|---|---|---|
| PM10 | 7.150 tpy | 1.770 lbs/hr | *Assumed to be same as* |
| PM2.5 | 7.150 tpy | 1.770 lbs/hr | *TSP per AP-42, Table 2.4.4* |

*Sulfur: Average Cs for reporting year was* **505** ppm

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 505 / 1,000,000 | ·pm H2S | 64 / 385.4 | mol. Wt. SO2 x / scf/lb-mole | 60,000 | scfh x | 1 T x / 2000 lbs | = | **5.032** lbs/hour per 1000 scfm |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Annual* | *Rate/hr =* | *579.783 mscf /* | *8079.6 hrs =* | *0.0717589 MCF/hr or* | *1.5884474 MCF/day* |
| *Peak Ozone* | *Rate/hr =* | *144.994 mscf /* | *2128.2 hrs =* | *0.0681299 MCF/hr or* | *1.5760231 MCF/day* |

Please note that the flow for September, October and November 2015 is estimated due to flow meter probe reading erroneously low.

WM01237

## Cottonwood Hills RDF Open Flare Data
## 2015 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 |
| 0.198 | 0.07 | 0.039 | 0.01 | 3,218.29 | 1,171.51 | 4,017.89 | 1,462.58 | 7,236.18 | 2,634.09 |
| 0.145 | 0.05 | 0.029 | 0.01 | 2,358.65 | 792.51 | 3,499.60 | 1,175.86 | 5,858.24 | 1,968.37 |
| 0.164 | 0.06 | 0.032 | 0.01 | 2,668.83 | 989.11 | 4,230.25 | 1,567.80 | 6,899.07 | 2,556.91 |
| 0.181 | 0.06 | 0.036 | 0.01 | 2,943.47 | 960.65 | 4,216.12 | 1,376.00 | 7,159.59 | 2,336.65 |
| 0.173 | 0.06 | 0.034 | 0.01 | 2,809.97 | 1,045.31 | 4,527.14 | 1,684.10 | 7,337.11 | 2,729.40 |
| 0.182 | 0.06 | 0.036 | 0.01 | 2,958.17 | 1,004.99 | 3,862.22 | 1,312.12 | 6,820.38 | 2,317.11 |
| 0.140 | 0.05 | 0.027 | 0.01 | 2,271.22 | 802.69 | 2,885.35 | 1,019.73 | 5,156.57 | 1,822.42 |
| 0.175 | 0.06 | 0.034 | 0.01 | 2,850.39 | 1,057.35 | 4,285.18 | 1,589.59 | 7,135.57 | 2,646.94 |
| 0.142 | 0.04 | 0.028 | 0.01 | 2,309.16 | 672.31 | 4,300.88 | 1,252.20 | 6,610.03 | 1,924.51 |
| 0.098 | 0.02 | 0.019 | 0.00 | 1,595.34 | 308.70 | 4,126.76 | 798.53 | 5,722.10 | 1,107.23 |
| 0.179 | 0.06 | 0.035 | 0.01 | 2,909.77 | 1,038.88 | 4,178.60 | 1,491.90 | 7,088.37 | 2,530.78 |
| 0.165 | 0.06 | 0.032 | 0.01 | 2,680.72 | 978.51 | 3,720.48 | 1,358.04 | 6,401.20 | 2,336.55 |
| 0.241 | 0.67 | 0.047 | 0.13 | 3,914.98 | 10,822.51 | 3,974.58 | 16,088.45 | 7,889.56 | 26,910.97 |

# Cottonwood Hills RDF
# 2015 Annual Air Emissions Report
# Open Flare HAPs

| | | | |
|---|---|---|---|
| Gas Flow Rate: | 580 mscf | 16,430,250 | m^3/yr |
| Operating Hours: | 8079.6 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 | 0.1425 | 0.1586 | **0.0032** |
| 79345 | 1,1,2,2-Tetrachloroethane | 1.11 | AP-42 | 167.86 | 7.62 | 0.1252 | 0.1394 | 0.0028 |
| 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 | 0.0130 | 0.0145 | 0.0003 |
| 107062 | 1,2-Dichloroethane (ethylene dichloride) | 7.84 | Site Specific | 98.96 | 31.71 | 0.5210 | 0.5801 | 0.0116 |
| 78875 | 1,2-Dichloropropane (propylene dichloride) | 0.16 | AP-42 | 112.99 | 0.83 | 0.0137 | 0.0152 | 0.0003 |
| 107131 | Acrylonitrile | 6.33 | AP-42 | 53.06 | 13.74 | 0.2257 | 0.2513 | 0.0050 |
| 75150 | Carbon disulfide | 0.58 | AP-42 | 76.14 | 1.81 | 0.0297 | 0.0330 | 0.0007 |
| 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 | 0.0198 | 0.0220 | 0.0004 |
| 108907 | Chlorobenzene | 4.30 | Site Specific | 112.56 | 19.81 | 0.3254 | 0.3623 | 0.0072 |
| 75003 | Chloroethane (ethyl chloride) | 1.25 | AP-42 | 64.52 | 3.30 | 0.0542 | 0.0603 | 0.0012 |
| 67663 | Chloroform | 0.03 | AP-42 | 119.39 | 0.15 | 0.0024 | 0.0027 | 0.0001 |
| 75092 | Dichloromethane (methylene chloride) | 4.28 | Site Specific | 84.94 | 14.85 | 0.2441 | 0.2717 | **0.0054** |
| 100414 | Ethylbenzene | 4.42 | Site Specific | 106.16 | 19.20 | 0.3155 | 0.3512 | 0.0070 |
| 110543 | n-Hexane | 3.49 | Site Specific | 86.17 | 12.28 | 0.2018 | 0.2247 | 0.0045 |
| 78933 | Methyl ethyl ketone | 7.09 | AP-42 | 72.10 | 20.91 | 0.3435 | 0.3824 | 0.0076 |
| 108101 | Methyl isobutyl ketone | 1.87 | AP-42 | 100.07 | 7.65 | 0.1258 | 0.1400 | 0.0028 |
| 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 | 0.5723 | 0.6372 | 0.0127 |
| 75014 | Vinyl chloride | 0.42 | Site Specific | 62.50 | 1.07 | 0.0175 | 0.0195 | 0.0004 |
| 71432 | Benzene | 1.56 | Site Specific | 78.11 | 4.99 | 0.0820 | 0.0913 | 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 | 76.52 | 1.2901 | 1.4363 | 0.0287 |
| 95476 | o-Xylenes | 0.73 | Site Specific | 106.16 | 3.15 | 0.0517 | 0.0576 | 0.0012 |
| 108383 | m-Xylenes | 5.49 | Site Specific | 106.16 | 23.82 | 0.3914 | 0.4358 | 0.0087 |
| | | | | | | | | |
| | **Total HAPS** | | | | | | 5.69 | **0.1137** |

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
# 2015 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 $i^{th}$ section, Mg |
| Cnmoc = | concentration of NMOC, parts per million by volume as hexane |
| $3.6 \times 10^{-9}$= | 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 = **2015**

NMOC emissions for 2015 = 67.39 Mg/yr = 74.28 ton/yr

**Conversion of NMOC emission rate to Landfill Gas Rate**

Maximum Annual Landfill Gas Rate:

67.39 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 = 32,135,720 m³/yr

Daily Gas Rate:

32,135,720 m³/yr * 35.31 ft³/m³ * 1 yr/365 days = 3,108,800 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 * 32,135,720 m^3 LFG/yr * 1 Mg/10^9 mg * 1.1023 ton/Mg

NMOC emissions = 74.28 tons/yr NMOC as hexane

Collection Efficiency= 0.75 %

Cover Factor= 0.15

**Controlled NMOC Emissions = 2.740 tons/yr NMOC as hexane**

# Cottonwood Hills RDF
# 2015 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 | 0 | 0 | | 0 |
| 2017 | 0 | 0 | | 0 |
| 2018 | 0 | 0 | | 0 |
| 2019 | 0 | 0 | | 0 |
| 2020 | 0 | 0 | | 0 |
| Total | | | 6,543,709 | 5,936,414 |

Note: 1 Mg = 1.1023 ton

# Cottonwood Hills RDF
# 2015 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 | 9.8 | 0.0839 | Enter the average size of the active face. The cover factor is based on 50% air and 50% daily cover. |
| Intermediate | 0.1110 | 39.1 | 0.0593 | 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 | 24.3 | 0.0044 | 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) =** | | | 0.1475 | 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
## 2015 Annual Air Emissions Report
## TOTAL HAP EMISSION ESTIMATES Using Title V Permit Values

| | |
|---|---|
| Modeled Landfill Gas Rate | 32,135,720 m³/yr |
| Gas Collection Efficiency: | 75% |
| Cover Factor: | 0.15 |

Hourly Rate
0.1295 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 | 0.08 | 0.09 | **0.0034** | 0.0008 |
| 1,1,2,2-Tetrachloroethane* | 1.11 | 167.85 | 7.62 | 0.24 | 0.27 | 0.0100 | 0.0023 |
| 1,1-Dichloroethane (ethylidene dichloride)* | 2.35 | 98.95 | 9.51 | 0.31 | 0.34 | 0.0124 | 0.0028 |
| 1,1-Dichloroethene (vinylidene chloride)* | 0.20 | 96.94 | 0.79 | 0.03 | 0.03 | 0.0010 | 0.0002 |
| 1,2-Dichloroethane (ethylene dichloride)* | 0.41 | 98.96 | 1.66 | 0.05 | 0.06 | 0.0022 | 0.0005 |
| 1,2-Dichloropropane (propylene dichloride)* | 0.18 | 112.98 | 0.83 | 0.03 | 0.03 | 0.0011 | 0.0002 |
| Acrylonitrile* | 6.33 | 53.06 | 13.74 | 0.44 | 0.49 | 0.0179 | 0.0041 |
| Benzene* (AP-42 no co-disposal default) | 1.91 | 78.11 | 6.10 | 0.20 | 0.22 | 0.0080 | 0.0018 |
| Carbon disulfide* | 0.58 | 76.13 | 1.81 | 0.06 | 0.06 | 0.0024 | 0.0005 |
| 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 | 0.04 | 0.0016 | 0.0004 |
| Chlorobenzene* | 0.25 | 112.56 | 1.15 | 0.04 | 0.04 | 0.0015 | 0.0003 |
| Chloroethane (ethyl chloride)* | 1.25 | 64.52 | 3.30 | 0.11 | 0.12 | 0.0043 | 0.0010 |
| Chloroform* | 0.03 | 119.39 | 0.15 | 0.005 | 0.005 | 0.0002 | 0.0000 |
| Chloromethane (methyl chloride)* | 1.21 | 50.49 | 2.50 | 0.08 | 0.09 | 0.0033 | 0.0007 |
| Dichloromethane **(methylene chloride)* | 14.3 | 84.94 | 49.68 | 1.60 | 1.76 | **0.0649** | 0.0148 |
| Ethylbenzene* | 4.61 | 106.16 | 20.02 | 0.64 | 0.71 | 0.0262 | 0.0060 |
| Hexane* | 6.57 | 86.18 | 23.16 | 0.74 | 0.82 | 0.0303 | 0.0069 |
| 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 | 0.67 | 0.74 | 0.0273 | 0.0062 |
| Methyl isobutyl ketone* | 1.87 | 100.16 | 7.66 | 0.25 | 0.27 | 0.0100 | 0.0023 |
| Perchloroethylene **(tetrachloroethene)* | 3.73 | 165.83 | 25.30 | 0.81 | 0.90 | 0.0331 | 0.0075 |
| Toluene* (AP-42 no co-disposal default) | 39.30 | 92.13 | 148.09 | 4.76 | 5.25 | 0.1935 | 0.0442 |
| Trichloroethene* | 2.82 | 131.38 | 15.15 | 0.49 | 0.54 | 0.0198 | 0.0045 |
| Vinyl chloride* | 7.34 | 62.50 | 18.76 | 0.60 | 0.66 | 0.0245 | 0.0056 |
| Xylene* | 12.1 | 106.16 | 52.54 | 1.69 | 1.86 | 0.0686 | 0.0157 |
| **Total HAPs** | | | | | **15.383** | **0.567** | **0.130** |
| **Total Non-VOM Haps (1,1,1 TCA + dichloromethane + PCE)** | | | | | **12.634** | **0.466** | **0.106** |

| 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 | 11355.94 | 12517.65 | **461.74** | 105.42 |
| NMOC (VOM) | | | | 67.39 | 74.28 | **2.74** | 0.63 |
| Hydrogen Sulfide *** | 300.0 | 34.00 | 417.18 | 13.41 | 14.78 | **3.69** | 0.84 |

** = 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
# 2015 Annual Air Emissions Report
# Crusher Engine Data - REVISED

| | | 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 14 | 0 | | | | | | | | | | |
| January | 0 | 0.320 | 0.000 | 4.900 | 0.000 | 0.390 | 0.000 | 1.060 | 0.000 | 0.350 | 0.000 |
| February | 0 | 0.320 | 0.000 | 4.900 | 0.000 | 0.390 | 0.000 | 1.060 | 0.000 | 0.350 | 0.000 |
| March | 26 | 0.320 | 0.004 | 4.900 | 0.064 | 0.390 | 0.005 | 1.060 | 0.014 | 0.350 | 0.005 |
| April | 0 | 0.320 | 0.000 | 4.900 | 0.000 | 0.390 | 0.000 | 1.060 | 0.000 | 0.350 | 0.000 |
| May | 8 | 0.320 | 0.001 | 4.900 | 0.020 | 0.390 | 0.002 | 1.060 | 0.004 | 0.350 | 0.001 |
| June | 0 | 0.320 | 0.000 | 4.900 | 0.000 | 0.390 | 0.000 | 1.060 | 0.000 | 0.350 | 0.000 |
| July | 0 | 0.320 | 0.000 | 4.900 | 0.000 | 0.390 | 0.000 | 1.060 | 0.000 | 0.350 | 0.000 |
| 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 | 0 | 0.320 | 0.000 | 4.900 | 0.000 | 0.390 | 0.000 | 1.060 | 0.000 | 0.350 | 0.000 |
| November | 0 | 0.320 | 0.000 | 4.900 | 0.000 | 0.390 | 0.000 | 1.060 | 0.000 | 0.350 | 0.000 |
| December | 15 | 0.320 | 0.002 | 4.900 | 0.037 | 0.390 | 0.003 | 1.060 | 0.008 | 0.350 | 0.003 |
| TOTALS | 49 | 0.320 | 0.008 | 4.900 | 0.120 | 0.390 | 0.010 | 1.060 | 0.026 | 0.350 | 0.009 |

*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* | *0.0%* | *Mar-May* | *100.0%* |
| *Jun-Aug* | *0.0%* | *Sep-Nov* | *0.0%* |

| | | hrs/day |
|---|---|---|
| Annual Hours | 49 | 0.19 |
| Peak Ozone Hours | 0 | 0.00 |

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# Cottonwood Hills RDF
# 2015 Annual Air Emissions Report
# Crusher Unit Throughput Data - REVISED

| | | Uncontrolled | | Controlled | 90% |
|---|---|---|---|---|---|
| Month | Throughput tons | PM Emissions * tpy | PM Emissions * lbs/hr | PM Emissions * tpy | PM Emissions * lbs/hr |
| December 14 | 0 | | | | |
| January | - | 0.00 | #DIV/0! | 0.000 | #DIV/0! |
| February | - | 0.00 | #DIV/0! | 0.000 | #DIV/0! |
| March | 520 | 0.01 | 0.90 | 0.001 | 0.09 |
| April | - | 0.00 | #DIV/0! | 0.000 | #DIV/0! |
| May | 160 | 0.00 | 0.90 | 0.000 | 0.09 |
| June | - | 0.00 | #DIV/0! | 0.000 | #DIV/0! |
| July | - | 0.00 | 0.00 | 0.000 | 0.00 |
| August | - | 0.00 | #DIV/0! | 0.000 | #DIV/0! |
| September | 0 | 0.00 | #DIV/0! | 0.000 | #DIV/0! |
| October | - | 0.00 | #DIV/0! | 0.000 | #DIV/0! |
| November | - | 0.00 | #DIV/0! | 0.000 | #DIV/0! |
| December | 300 | 0.01 | 0.90 | 0.001 | 0.09 |
| TOTALS | 980 | 0.02 | 0.90 | 0.002 | 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* | *0.0%* | *Mar-May* | *100.0%* |
| *Jun-Aug* | *0.0%* | *Sep-Nov* | *0.0%* |

*Processing Rates:*

| | | |
|---|---|---|
| *Annual* | *20.0* | *tons/hr* |
| *Jun-Aug* | *#DIV/0!* | *tons/hr* |

# Cottonwood Hills RDF
# 2015 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% | 16,420 | 361,240 | 13.75 |
| Front End Loader | 19.3 | 28.8 | 24.05 | 13% | 4,269 | 40,557 | 3.13 |
| Rear End Loader | 15.5 | 23 | 19.25 | 13% | 4,269 | 32,019 | 2.50 |
| Roll-Off Container | 17.8 | 26.8 | 22.3 | 5% | 1,642 | 14,778 | 1.12 |
| Other | 14 | 30.9 | 22.45 | 3% | 985 | 16,650 | 0.67 |
| T-Plate | 3.8 | 5 | 4.4 | 0% | - | - | - |
| Private Truck | 2.6 | 3.1 | 2.85 | 1% | 328 | 164 | 0.03 |
| Tractor Trailer | 15.6 | 35.2 | 25.4 | 0% | - | - | - |
| Dump Trucks | 12 | 17 | 14.5 | 0% | - | - | - |
| Volvo | 26 | 38 | 32 | 15% | 4,926 | 59,112 | 4.80 |
| | | | | 100% | 32,840 | 524,520 | 26.00 |
| | | | | actual tons in 2015 >> | | 424,587 | |
| | | | | 100,00 tons of soil cover | | 100,000 | |

**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 | 32,840 | 0.38 | 0.2364 | 1.5418 | 5.7114 |
| Paved Roads | 32,840 | 0.00 | 0.2200 | 0.8800 | 4.5102 |
| Total (tons/yr) - Uncontrolled | | | 1.47 | 9.59 | 35.52 |
| Control Efficiency | | | 90% | 90% | 90% |
| Total (tons/yr) - Controlled | | | 0.15 | 0.96 | 3.55 |
| Total (lb/hr) - Controlled | | | **0.113** | **0.738** | **2.733** |

*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, break wear and tire wear are not subtracted out, since EPA MOBILE 6.2 is*

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

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

# Cottonwood Hills RDF
# 2015 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 | 33,886 | 1,540 | 2,600 | 1,100 | 15% | 546 | 0.000 | 0.001 | 0.003 |
| February | 20 | 28,627 | 1,431 | 2,600 | 1,100 | 15% | 507 | 0.000 | 0.001 | 0.002 |
| March | 21 | 34,094 | 1,624 | 2,600 | 1,100 | 15% | 576 | 0.000 | 0.001 | 0.003 |
| April | 22 | 44,047 | 2,002 | 2,600 | 1,100 | 15% | 710 | 0.001 | 0.002 | 0.004 |
| May | 22 | 35,721 | 1,624 | 2,600 | 1,100 | 15% | 576 | 0.000 | 0.001 | 0.003 |
| June | 20 | 37,782 | 1,889 | 2,600 | 1,100 | 15% | 670 | 0.000 | 0.001 | 0.003 |
| July | 22 | 37,283 | 1,695 | 2,600 | 1,100 | 15% | 601 | 0.000 | 0.001 | 0.003 |
| August | 22 | 39,104 | 1,777 | 2,600 | 1,100 | 15% | 630 | 0.000 | 0.001 | 0.003 |
| September | 20 | 34,579 | 1,729 | 2,600 | 1,100 | 15% | 613 | 0.000 | 0.001 | 0.003 |
| October | 23 | 32,500 | 1,413 | 2,600 | 1,100 | 15% | 501 | 0.000 | 0.001 | 0.003 |
| November | 20 | 31,480 | 1,574 | 2,600 | 1,100 | 15% | 558 | 0.000 | 0.001 | 0.003 |
| December | 21 | 35,483 | 1,690 | 2,600 | 1,100 | 15% | 599 | 0.000 | 0.001 | 0.003 |
| TOTALS | 255 | 424,587 | 1,665 | 2,600 | 1,100 | 15% | 590 | **0.005** | **0.016** | **0.034** |

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** | |

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