

**BIOGAS RENEWABLE GENERATION PROJECT  
FINAL INITIAL STUDY / MITIGATED NEGATIVE DECLARATION**

Appendix E Greenhouse (GHG) Emission Inventory  
March 9, 2018

**Appendix E GREENHOUSE (GHG) EMISSION INVENTORY**



**APPENDIX E**  
**GREENHOUSE GASES (GHG) EMISSION INVENTORY**



**APPENDIX E  
GREENHOUSE GASES EMISSION INVENTORY  
SCHOLL CANYON LANDFILL GAS FACILITY**

Greenhouse Gases	GWP <sup>1</sup>	Landfill gas emission factor <sup>2</sup> , kg/mmBtu	Diesel gas emission factor <sup>2</sup> , kg/gal
CO <sub>2</sub>	1	52.07	10.21
CH <sub>4</sub>	25	0.0032	0.41
N <sub>2</sub> O	298	0.00063	0.08

**NOTES:**

<sup>1</sup>GWP = Global Warming Potential. [Source: IPCC, 4th Assessment Report, 2007]

<sup>2</sup>Source: USEPA website: <http://www.epa.gov/climateleadership/documents/emission-factors.pdf> for CH<sub>4</sub> and N<sub>2</sub>O

**GHG Emissions Project**

Device/Activity	LFG Available, MMBtu/hr	Annual Op. hours	CO <sub>2</sub> , MT/year	CH <sub>4</sub> , MT/year	N <sub>2</sub> O, MT/year	Total CO <sub>2</sub> e, MT/year
Operating the Proposed Equipment	124.806	8760	56928.16	3.498562	0.68877935	57,221
Operating the Emergency Fire Pump <sup>1</sup>	4.9	50	2.50	0.10	0.02	11
Construction <sup>2</sup>			204.0199	0.0432	0	205
Facility Occupants <sup>2</sup>			232.3566	0.566	5.93E-03	246
Total Project GHG Emissions:						57,683

**NOTES:**

<sup>1</sup>GHG emissions are estimated based on 50 hours per year (T&M) and fuel rate of 4.9 gal/hr

<sup>2</sup>GHG emissions are estimated by using CalEEmod.

**Baseline GHG Emissions**

Existing Equipment Type	LFG Flow, mmscf/yr	LFG Flow, mmbtu/yr	CO <sub>2</sub> , MT/year	CH <sub>4</sub> , MT/year	N <sub>2</sub> O, MT/year	CO <sub>2</sub> e, MT/year
Boiler 3,4,5	3200.33	1073710.715	55,908	3	1	56,196
Flare	145.272	48738.756	2,538	0.156	0.031	2,551
Total Baseline GHG Emissions:						58,746



## Emission Factors for Greenhouse Gas Inventories

Last Modified: 4 April 2014

Red text indicates an update from the 2011 version of this document.

Typically, greenhouse gas emissions are reported in units of carbon dioxide equivalent (CO<sub>2</sub>e). Gases are converted to CO<sub>2</sub>e by multiplying by their global warming potential (GWP). The emission factors listed in this document have not been converted to CO<sub>2</sub>e. To do so, multiply the emissions by the corresponding GWP listed in the table below.

Gas	100-year GWP
CH <sub>4</sub>	25
N <sub>2</sub> O	298

Source: Intergovernmental Panel on Climate Change (IPCC), Fourth Assessment Report (AR4), 2007. See the source note to Table 9 for further explanation.

**Table 1 Stationary Combustion Emission Factors**

Fuel Type	Heating Value mmBtu per short ton	CO <sub>2</sub> Factor kg CO <sub>2</sub> per mmBtu	CH <sub>4</sub> Factor g CH <sub>4</sub> per mmBtu	N <sub>2</sub> O Factor g N <sub>2</sub> O per mmBtu	CO <sub>2</sub> Factor kg CO <sub>2</sub> per short ton	CH <sub>4</sub> Factor g CH <sub>4</sub> per short ton	N <sub>2</sub> O Factor g N <sub>2</sub> O per short ton	Unit
<b>Coal and Coke</b>								
Anthracite Coal	25.09	103.69	11	1.6	2,602	276	40	short tons
Bituminous Coal	24.93	93.28	11	1.6	2,325	274	40	short tons
Sub-bituminous Coal	17.25	97.17	11	1.6	1,676	190	28	short tons
Lignite Coal	14.21	97.72	11	1.6	1,389	156	23	short tons
Mixed (Commercial Sector)	21.39	94.27	11	1.6	2,016	235	34	short tons
Mixed (Electric Power Sector)	19.73	95.52	11	1.6	1,885	217	32	short tons
Mixed (Industrial Coking)	26.28	93.90	11	1.6	2,468	289	42	short tons
Mixed (Industrial Sector)	22.35	94.67	11	1.6	2,116	246	36	short tons
Coal Coke	24.80	113.67	11	1.6	2,819	273	40	short tons
<b>Fossil Fuel-derived Fuels (Solid)</b>								
Municipal Solid Waste	9.95	90.70	32	4.2	902	318	42	short tons
Petroleum Coke (Solid)	30.00	102.41	32	4.2	3,072	960	126	short tons
Plastics	38.00	75.00	32	4.2	2,850	1,216	160	short tons
Tires	28.00	85.97	32	4.2	2,407	896	118	short tons
<b>Biomass Fuels (Solid)</b>								
Agricultural Byproducts	8.25	118.17	32	4.2	975	264	35	short tons
Peat	8.00	111.84	32	4.2	895	256	34	short tons
Solid Byproducts	10.39	105.51	32	4.2	1,096	332	44	short tons
Wood and Wood Residuals	17.48	93.80	7.2	3.6	1,640	126	63	short tons
	mmBtu per scf	kg CO <sub>2</sub> per mmBtu	g CH <sub>4</sub> per mmBtu	g N <sub>2</sub> O per mmBtu	kg CO <sub>2</sub> per scf	g CH <sub>4</sub> per scf	g N <sub>2</sub> O per scf	
<b>Natural Gas</b>								
Natural Gas (per scf)	0.001026	53.06	1.0	0.10	0.05444	0.00103	0.00010	scf
<b>Fossil-derived Fuels (Gaseous)</b>								
Blast Furnace Gas	0.000092	274.32	0.022	0.10	0.02524	0.000002	0.000009	scf
Coke Oven Gas	0.000599	46.85	0.48	0.10	0.02806	0.000288	0.000060	scf
Fuel Gas	0.001388	59.00	3.0	0.60	0.08189	0.004164	0.000833	scf
Propane Gas	0.002516	61.46	0.022	0.10	0.15463	0.000055	0.000252	scf
<b>Biomass Fuels (Gaseous)</b>								
Landfill Gas	0.000485	52.07	3.2	0.63	0.025254	0.001552	0.000306	scf
Other Biomass Gases	0.000655	52.07	3.2	0.63	0.034106	0.002096	0.000413	scf
	mmBtu per gallon	kg CO <sub>2</sub> per mmBtu	g CH <sub>4</sub> per mmBtu	g N <sub>2</sub> O per mmBtu	kg CO <sub>2</sub> per gallon	g CH <sub>4</sub> per gallon	g N <sub>2</sub> O per gallon	
<b>Petroleum Products</b>								
Asphalt and Road Oil	0.158	75.36	3.0	0.60	11.91	0.47	0.09	gallon
Aviation Gasoline	0.120	69.25	3.0	0.60	8.31	0.36	0.07	gallon
Butane	0.103	64.77	3.0	0.60	6.67	0.31	0.06	gallon
Butylene	0.105	68.72	3.0	0.60	7.22	0.32	0.06	gallon
Crude Oil	0.138	74.54	3.0	0.60	10.29	0.41	0.08	gallon
Distillate Fuel Oil No. 1	0.139	73.25	3.0	0.60	10.18	0.42	0.08	gallon
Distillate Fuel Oil No. 2	0.138	73.96	3.0	0.60	10.21	0.41	0.08	gallon
Distillate Fuel Oil No. 4	0.146	75.04	3.0	0.60	10.96	0.44	0.09	gallon
Ethane	0.068	59.60	3.0	0.60	4.05	0.20	0.04	gallon
Ethylene	0.058	65.96	3.0	0.60	3.83	0.17	0.03	gallon
Heavy Gas Oils	0.148	74.92	3.0	0.60	11.09	0.44	0.09	gallon
Isobutane	0.099	64.94	3.0	0.60	6.43	0.30	0.06	gallon
Isobutylene	0.103	68.86	3.0	0.60	7.09	0.31	0.06	gallon
Kerosene	0.135	75.20	3.0	0.60	10.15	0.41	0.08	gallon
Kerosene-type Jet Fuel	0.135	72.22	3.0	0.60	9.75	0.41	0.08	gallon
Liquefied Petroleum Gases (LPG)	0.092	61.71	3.0	0.60	5.68	0.28	0.06	gallon
Lubricants	0.144	74.27	3.0	0.60	10.69	0.43	0.09	gallon
Motor Gasoline	0.125	70.22	3.0	0.60	8.78	0.38	0.08	gallon
Naphtha (<401 deg F)	0.125	68.02	3.0	0.60	8.50	0.38	0.08	gallon
Natural Gasoline	0.110	66.88	3.0	0.60	7.36	0.33	0.07	gallon
Other Oil (>401 deg F)	0.139	76.22	3.0	0.60	10.59	0.42	0.08	gallon
Pentanes Plus	0.110	70.02	3.0	0.60	7.70	0.33	0.07	gallon
Petrochemical Feedstocks	0.125	71.02	3.0	0.60	8.88	0.38	0.08	gallon
Petroleum Coke	0.143	102.41	3.0	0.60	14.64	0.43	0.09	gallon
Propane	0.091	62.87	3.0	0.60	5.72	0.27	0.05	gallon
Propylene	0.091	65.95	3.0	0.60	6.00	0.27	0.05	gallon
Residual Fuel Oil No. 5	0.140	72.93	3.0	0.60	10.21	0.42	0.08	gallon
Residual Fuel Oil No. 6	0.150	75.10	3.0	0.60	11.27	0.45	0.09	gallon
Special Naphtha	0.125	72.34	3.0	0.60	9.04	0.38	0.08	gallon
Still Gas	0.143	66.72	3.0	0.60	9.54	0.43	0.09	gallon
Unfinished Oils	0.139	74.54	3.0	0.60	10.36	0.42	0.08	gallon
Used Oil	0.138	74.00	3.0	0.60	10.21	0.41	0.08	gallon
<b>Biomass Fuels (Liquid)</b>								
Biodiesel (100%)	0.128	73.84	1.1	0.11	9.45	0.14	0.01	gallon
Ethanol (100%)	0.084	68.44	1.1	0.11	5.75	0.09	0.01	gallon
Rendered Animal Fat	0.125	71.06	1.1	0.11	8.88	0.14	0.01	gallon
Vegetable Oil	0.120	81.55	1.1	0.11	9.79	0.13	0.01	gallon
	mmBtu per gallon	kg CO <sub>2</sub> per mmBtu	g CH <sub>4</sub> per mmBtu	g N <sub>2</sub> O per mmBtu				
<b>Steam and Hot Water</b>								
Steam and Hot Water		66.33	1,250	0.125				mmBtu

Source:

Solid, gaseous, liquid and biomass fuels: Federal Register (2009) EPA; 40 CFR Parts 86, 87, 89 et al. Mandatory Reporting of Greenhouse Gases; Final Rule, 30Oct09, 261 pp. Tables C-1 and C-2 at FR pp. 56409-56410. Revised emission factors for selected fuels: Federal Register (2010) EPA; 40 CFR Part 98; Mandatory Reporting of Greenhouse Gases; Final Rule, 17Dec10, 81 pp. With Amendments from Memo: Table of Final 2013 Revisions to the Greenhouse Gas Reporting Rule (PDF) to 40 CFR part 98, subpart C; Table C-1 to Subpart C—Default CO<sub>2</sub> Emission Factors and High Heat Values for Various Types of Fuel and Table C-2 to Subpart C—Default CH<sub>4</sub> and N<sub>2</sub>O Emission Factors for Various Types of Fuel.

Steam and Hot Water: EPA (2008) Climate Leaders Greenhouse Gas Inventory Protocol Core Module Guidance - Indirect Emissions from Purchases/Sales of Electricity and Steam. Assumption: 80% boiler efficiency and fuel type assumed natural gas. Factors are per mmBtu of steam or hot water purchased.

<http://www.epa.gov/ghgrreporting/documents/pdf/2013documents/memo-2013-technical-revisions.pdf>  
<http://www.epa.gov/ghgrreporting/reporters/subpart/c.html>

