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# Memorandum

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**Date:** June 8, 2005  
**To:** Rob Houghton, Mark Urquhart  
**From:** Andy Wang   
**RE:** Rock Creek Landfill Gas Emission Estimates

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## CLEAN AIR ACT MODELING

EMCON / OWT has updated the preliminary landfill gas (LFG) emission estimates for the Rock Creek Landfill, to better assess the long-term LFG collection and control requirements for the site, to comply with the federal Clean Air Act New Performance Standards and Emission Guidelines (CAA NSPS / EG). The USEPA Landfill Gas Emissions Model (LandGEM) was applied to the assumed waste inflow from site opening through 2035. The input data and results are attached. Two scenarios were modeled:

- The USEPA Clean Air Act Tier 1 model is a preliminary screening scenario and assumes a generic non-methane organic compound (NMOC) concentration of 4,000 parts per million by volume (ppmv).
- The USEPA Clean Air Act Tier 2 model is a refined scenario which uses a site-specific NMOC concentration of 479 ppmv. This NMOC concentration was obtained from representative sampling and analysis performed for the site in 1999.

Both model scenarios assume a design waste capacity of approximately 3,376,000 tons, a methane generation potential of 170 cubic meters per Mg of waste, and a first-order decay rate of  $k=0.02$ , which is the USEPA default assumption for semi-arid areas (receiving less than 25-inches of precipitation per year).

## RESULTS

The results of the two model scenarios are tabulated below, along with the Clean Air Act LFG control action level of 50 Mg/yr.

### USEPA LandGEM Modeling Results

Year	CAA Limit (Mg/yr)	Tier 1 (Mg/yr)	Tier 2 (Mg/yr)
2005	50	36.5	4.4
2009	“	51.8	6.2
2036	“	222.9	26.7

### REGULATORY REQUIREMENTS

In general, the federal NSPS / EG requires:

- Annual reporting of the Tier 1 model result to support that a site remains below 50 Mg/yr NMOC, or
- Submittal of a 5-year Tier 1 or Tier 2 analysis supporting that a site will remain below 50 Mg/yr NMOC for all 5 years, in which time the actual annual waste inflows must not exceed the projected inflows.

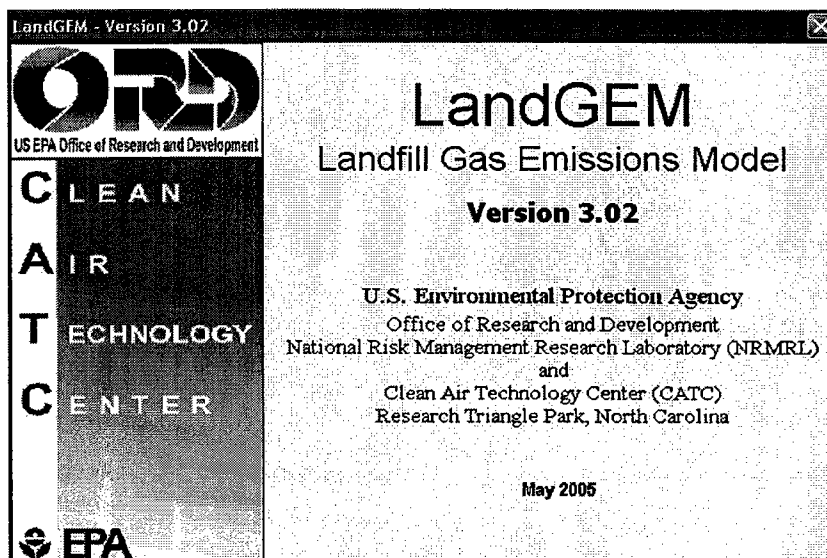
If a future Tier 2 result exceeds 50 Mg/yr, and the site in-place waste quantity exceeds 2,500,000 Mg (2,670,000 tons) the site will be required to either:

- Perform a Tier 3 test (LFG extraction field test) for additional refinement of the model, or
- Install and operate an LFG collection and control system in compliance with all federal CAA regulations.

Local air districts have slightly varying interpretations of these requirements, and actual requirements should be confirmed and verified with the air pollution control officer.

### CONCLUSIONS

Based on the stated modeling assumptions and current regulations, the NMOC results obtained herein indicate that the Rock Creek Landfill will likely not have to install an LFG collection and control system to comply with the current federal CAA NSPS / EG regulations. It should be noted that the concentrations of NMOC and the LFG generation are subject to significant variation with time. Thus, substantial changes in the quantity and / or composition of the accepted waste might warrant re-evaluation of the Tier 2 model results. At a minimum, the site will have to submit an updated Tier 2 test in 2008 to supersede the higher Tier 1 screening-level estimate. Other submittals may also be required in the interim, to fulfill previous NSPS / EG requirements, as enforced by the local air district.



## Summary Report

**Landfill Name or Identifier:** Rock Creek Landfill, Calaveras County

**Date:** Wednesday, June 08, 2005

### Description/Comments:

CAA Tier 1 results: NMOC > 50 Mg in 2009. Peak NMOC = 222.9 Mg in 2036.

CAA Tier 2 results: (assuming [NMOC] = 479 ppmv) Peak NMOC = 26.7 Mg in 2036.

### About LandGEM:

First-Order Decomposition Rate Equation:

$$Q_{CH_4} = \sum_{i=1}^n \sum_{j=0.1}^1 kL_o \left( \frac{M_i}{10} \right) e^{-kt_{ij}}$$

Where,

$Q_{CH_4}$  = annual methane generation in the year of the calculation ( $m^3/year$ )

$i$  = 1-year time increment

$n$  = (year of the calculation) - (initial year of waste acceptance)

$j$  = 0.1-year time increment

$k$  = methane generation rate ( $year^{-1}$ )

$L_o$  = potential methane generation capacity ( $m^3/Mg$ )

$M_i$  = mass of waste accepted in the  $i^{th}$  year ( $Mg$ )

$t_{ij}$  = age of the  $j^{th}$  section of waste mass  $M_i$  accepted in the  $i^{th}$  year  
(decimal years, e.g., 3.2 years)

LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of landfilled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at <http://www.epa.gov/ttnatw01/landfill/landfpg.html>.

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate. Defaults for estimating emissions for this type of operation are being developed to include in LandGEM along with defaults for conventional landfills (no leachate or liquid additions) for developing emission inventories and determining CAA applicability. Refer to the Web site identified above for future updates.

**Input Review****LANDFILL CHARACTERISTICS**

Landfill Open Year	<b>1990</b>	
Landfill Closure Year (with 80-year limit)	<b>2035</b>	
Actual Closure Year (without limit)	<b>2035</b>	
Have Model Calculate Closure Year?	<b>Yes</b>	
Waste Design Capacity	<b>3,375,946</b>	<i>short tons</i>

**MODEL PARAMETERS**

Methane Generation Rate, k	<b>0.020</b>	<i>year<sup>-1</sup></i>
Potential Methane Generation Capacity, L <sub>0</sub>	<b>170</b>	<i>m<sup>3</sup>/Mg</i>
NMOC Concentration	<b>4,000</b>	<i>ppmv as hexane</i>
Methane Content	<b>50</b>	<i>% by volume</i>

**GASES / POLLUTANTS SELECTED**

Gas / Pollutant #1:	<b>Total landfill gas</b>
Gas / Pollutant #2:	<b>Methane</b>
Gas / Pollutant #3:	<b>Carbon dioxide</b>
Gas / Pollutant #4:	<b>NMOC</b>

**WASTE ACCEPTANCE RATES**

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	(short tons/year)	(Mg)	(short tons)
1990	5,310	5,841	0	0
1991	36,975	40,673	5,310	5,841
1992	23,802	26,182	42,285	46,514
1993	23,209	25,530	66,087	72,696
1994	22,750	25,025	89,296	98,226
1995	24,950	27,445	112,046	123,251
1996	26,111	28,722	136,996	150,696
1997	23,849	26,234	163,107	179,418
1998	25,128	27,641	186,956	205,652
1999	27,878	30,666	212,085	233,293
2000	31,318	34,450	239,963	263,959
2001	32,949	36,244	271,281	298,409
2002	35,996	39,596	304,230	334,653
2003	40,217	44,239	340,226	374,249
2004	43,624	47,986	380,444	418,488
2005	45,369	49,905	424,067	466,474
2006	47,183	51,902	469,436	516,379
2007	49,071	53,978	516,619	568,281
2008	51,033	56,137	565,690	622,259
2009	53,075	58,382	616,723	678,396
2010	55,198	60,718	669,798	736,778
2011	57,406	63,146	724,996	797,496
2012	59,702	65,672	782,402	860,642
2013	62,090	68,299	842,104	926,314
2014	64,574	71,031	904,194	994,613
2015	67,157	73,872	968,767	1,065,644
2016	69,843	76,827	1,035,924	1,139,516
2017	72,637	79,900	1,105,767	1,216,343
2018	75,542	83,096	1,178,403	1,296,244
2019	78,564	86,420	1,253,945	1,379,340
2020	81,706	89,877	1,332,509	1,465,760
2021	84,975	93,472	1,414,215	1,555,637
2022	88,373	97,211	1,499,190	1,649,109
2023	91,908	101,099	1,587,563	1,746,320
2024	95,585	105,143	1,679,472	1,847,419
2025	99,408	109,349	1,775,056	1,952,562
2026	103,384	113,723	1,874,465	2,061,911
2027	107,520	118,272	1,977,849	2,175,634
2028	111,821	123,003	2,085,369	2,293,906
2029	116,293	127,923	2,197,190	2,416,909

## WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	(short tons/year)	(Mg)	(short tons)
2030	120,945	133,040	2,313,483	2,544,831
2031	125,783	138,361	2,434,428	2,677,871
2032	130,814	143,896	2,560,211	2,816,232
2033	136,047	149,652	2,691,026	2,960,128
2034	141,489	155,638	2,827,073	3,109,780
2035	100,480	110,529	2,968,561	3,265,417
2036	0	0	3,069,042	3,375,946
2037	0	0	3,069,042	3,375,946
2038	0	0	3,069,042	3,375,946
2039	0	0	3,069,042	3,375,946
2040	0	0	3,069,042	3,375,946
2041	0	0	3,069,042	3,375,946
2042	0	0	3,069,042	3,375,946
2043	0	0	3,069,042	3,375,946
2044	0	0	3,069,042	3,375,946
2045	0	0	3,069,042	3,375,946
2046	0	0	3,069,042	3,375,946
2047	0	0	3,069,042	3,375,946
2048	0	0	3,069,042	3,375,946
2049	0	0	3,069,042	3,375,946
2050	0	0	3,069,042	3,375,946
2051	0	0	3,069,042	3,375,946
2052	0	0	3,069,042	3,375,946
2053	0	0	3,069,042	3,375,946
2054	0	0	3,069,042	3,375,946
2055	0	0	3,069,042	3,375,946
2056	0	0	3,069,042	3,375,946
2057	0	0	3,069,042	3,375,946
2058	0	0	3,069,042	3,375,946
2059	0	0	3,069,042	3,375,946
2060	0	0	3,069,042	3,375,946
2061	0	0	3,069,042	3,375,946
2062	0	0	3,069,042	3,375,946
2063	0	0	3,069,042	3,375,946
2064	0	0	3,069,042	3,375,946
2065	0	0	3,069,042	3,375,946
2066	0	0	3,069,042	3,375,946
2067	0	0	3,069,042	3,375,946
2068	0	0	3,069,042	3,375,946
2069	0	0	3,069,042	3,375,946

**Results (Continued)**

Year	Carbon dioxide			NMOC		
	(Mg/year)	(m <sup>3</sup> /year)	(av ft <sup>3</sup> /min)	(Mg/year)	(m <sup>3</sup> /year)	(av ft <sup>3</sup> /min)
1990	0	0	0	0	0	0
1991	3.275E+01	1.789E+04	1.202E+00	5.131E-01	1.431E+02	9.618E-03
1992	2.602E+02	1.421E+05	9.550E+00	4.076E+00	1.137E+03	7.640E-02
1993	4.018E+02	2.195E+05	1.475E+01	6.295E+00	1.756E+03	1.180E-01
1994	5.370E+02	2.934E+05	1.971E+01	8.413E+00	2.347E+03	1.577E-01
1995	6.667E+02	3.642E+05	2.447E+01	1.044E+01	2.914E+03	1.958E-01
1996	8.074E+02	4.411E+05	2.964E+01	1.265E+01	3.529E+03	2.371E-01
1997	9.525E+02	5.203E+05	3.496E+01	1.492E+01	4.163E+03	2.797E-01
1998	1.081E+03	5.904E+05	3.967E+01	1.693E+01	4.723E+03	3.173E-01
1999	1.214E+03	6.634E+05	4.457E+01	1.902E+01	5.307E+03	3.566E-01
2000	1.362E+03	7.442E+05	5.000E+01	2.134E+01	5.953E+03	4.000E-01
2001	1.528E+03	8.350E+05	5.610E+01	2.394E+01	6.680E+03	4.488E-01
2002	1.701E+03	9.295E+05	6.245E+01	2.665E+01	7.436E+03	4.996E-01
2003	1.890E+03	1.032E+06	6.936E+01	2.960E+01	8.259E+03	5.549E-01
2004	2.100E+03	1.147E+06	7.710E+01	3.290E+01	9.179E+03	6.168E-01
2005	2.328E+03	1.272E+06	8.545E+01	3.647E+01	1.017E+04	6.836E-01
2006	2.562E+03	1.399E+06	9.402E+01	4.013E+01	1.120E+04	7.522E-01
2007	2.802E+03	1.531E+06	1.028E+02	4.389E+01	1.225E+04	8.228E-01
2008	3.049E+03	1.666E+06	1.119E+02	4.777E+01	1.333E+04	8.953E-01
* 2009	3.303E+03	1.805E+06	1.213E+02	* 5.175E+01	1.444E+04	9.701E-01
2010	3.565E+03	1.948E+06	1.309E+02	5.585E+01	1.558E+04	1.047E+00
2011	3.835E+03	2.095E+06	1.408E+02	6.008E+01	1.676E+04	1.126E+00
2012	4.113E+03	2.247E+06	1.510E+02	6.444E+01	1.798E+04	1.208E+00
2013	4.400E+03	2.404E+06	1.615E+02	6.893E+01	1.923E+04	1.292E+00
2014	4.696E+03	2.565E+06	1.724E+02	7.357E+01	2.052E+04	1.379E+00
2015	5.001E+03	2.732E+06	1.836E+02	7.835E+01	2.186E+04	1.469E+00
2016	5.317E+03	2.904E+06	1.951E+02	8.329E+01	2.324E+04	1.561E+00
2017	5.642E+03	3.082E+06	2.071E+02	8.839E+01	2.466E+04	1.657E+00
2018	5.978E+03	3.266E+06	2.194E+02	9.365E+01	2.613E+04	1.756E+00
2019	6.326E+03	3.456E+06	2.322E+02	9.910E+01	2.765E+04	1.858E+00
2020	6.685E+03	3.652E+06	2.454E+02	1.047E+02	2.922E+04	1.963E+00
2021	7.057E+03	3.855E+06	2.590E+02	1.105E+02	3.084E+04	2.072E+00
2022	7.441E+03	4.065E+06	2.731E+02	1.166E+02	3.252E+04	2.185E+00
2023	7.839E+03	4.282E+06	2.877E+02	1.228E+02	3.426E+04	2.302E+00
2024	8.251E+03	4.507E+06	3.028E+02	1.293E+02	3.606E+04	2.423E+00
2025	8.677E+03	4.740E+06	3.185E+02	1.359E+02	3.792E+04	2.548E+00
2026	9.118E+03	4.981E+06	3.347E+02	1.428E+02	3.985E+04	2.678E+00
2027	9.575E+03	5.231E+06	3.515E+02	1.500E+02	4.185E+04	2.812E+00
2028	1.005E+04	5.490E+06	3.689E+02	1.574E+02	4.392E+04	2.951E+00
2029	1.054E+04	5.758E+06	3.869E+02	1.651E+02	4.606E+04	3.095E+00
2030	1.105E+04	6.036E+06	4.055E+02	1.731E+02	4.829E+04	3.244E+00
2031	1.158E+04	6.324E+06	4.249E+02	1.813E+02	5.059E+04	3.399E+00
2032	1.212E+04	6.622E+06	4.450E+02	1.899E+02	5.298E+04	3.560E+00
2033	1.269E+04	6.932E+06	4.658E+02	1.988E+02	5.546E+04	3.726E+00
2034	1.328E+04	7.253E+06	4.873E+02	2.080E+02	5.802E+04	3.899E+00
2035	1.389E+04	7.586E+06	5.097E+02	2.175E+02	6.069E+04	4.078E+00
* * 2036	1.423E+04	7.775E+06	5.224E+02	* * 2.229E+02	6.220E+04	4.179E+00
2037	1.395E+04	7.621E+06	5.120E+02	2.185E+02	6.097E+04	4.096E+00
2038	1.367E+04	7.470E+06	5.019E+02	2.142E+02	5.976E+04	4.015E+00
2039	1.340E+04	7.322E+06	4.920E+02	2.100E+02	5.857E+04	3.936E+00

\* NMOC EMISSION &gt; 50 Mg./yr.

\* \* PEAK NMOC EMISSION

**Results (Continued)**

Year	Carbon dioxide			NMOC		
	(Mg/year)	(m <sup>3</sup> /year)	(av ft <sup>3</sup> /min)	(Mg/year)	(m <sup>3</sup> /year)	(av ft <sup>3</sup> /min)
2040	1.314E+04	7.177E+06	4.822E+02	2.058E+02	5.741E+04	3.858E+00
2041	1.288E+04	7.035E+06	4.727E+02	2.017E+02	5.628E+04	3.781E+00
2042	1.262E+04	6.895E+06	4.633E+02	1.977E+02	5.516E+04	3.706E+00
2043	1.237E+04	6.759E+06	4.541E+02	1.938E+02	5.407E+04	3.633E+00
2044	1.213E+04	6.625E+06	4.451E+02	1.900E+02	5.300E+04	3.561E+00
2045	1.189E+04	6.494E+06	4.363E+02	1.862E+02	5.195E+04	3.491E+00
2046	1.165E+04	6.365E+06	4.277E+02	1.825E+02	5.092E+04	3.421E+00
2047	1.142E+04	6.239E+06	4.192E+02	1.789E+02	4.991E+04	3.354E+00
2048	1.119E+04	6.116E+06	4.109E+02	1.754E+02	4.893E+04	3.287E+00
2049	1.097E+04	5.995E+06	4.028E+02	1.719E+02	4.796E+04	3.222E+00
2050	1.076E+04	5.876E+06	3.948E+02	1.685E+02	4.701E+04	3.158E+00
2051	1.054E+04	5.760E+06	3.870E+02	1.652E+02	4.608E+04	3.096E+00
2052	1.033E+04	5.646E+06	3.793E+02	1.619E+02	4.516E+04	3.035E+00
2053	1.013E+04	5.534E+06	3.718E+02	1.587E+02	4.427E+04	2.974E+00
2054	9.929E+03	5.424E+06	3.644E+02	1.555E+02	4.339E+04	2.916E+00
2055	9.732E+03	5.317E+06	3.572E+02	1.525E+02	4.253E+04	2.858E+00
2056	9.540E+03	5.211E+06	3.502E+02	1.494E+02	4.169E+04	2.801E+00
2057	9.351E+03	5.108E+06	3.432E+02	1.465E+02	4.087E+04	2.746E+00
2058	9.166E+03	5.007E+06	3.364E+02	1.436E+02	4.006E+04	2.691E+00
2059	8.984E+03	4.908E+06	3.298E+02	1.407E+02	3.926E+04	2.638E+00
2060	8.806E+03	4.811E+06	3.232E+02	1.380E+02	3.849E+04	2.586E+00
2061	8.632E+03	4.716E+06	3.168E+02	1.352E+02	3.772E+04	2.535E+00
2062	8.461E+03	4.622E+06	3.106E+02	1.325E+02	3.698E+04	2.485E+00
2063	8.293E+03	4.531E+06	3.044E+02	1.299E+02	3.625E+04	2.435E+00
2064	8.129E+03	4.441E+06	2.984E+02	1.273E+02	3.553E+04	2.387E+00
2065	7.968E+03	4.353E+06	2.925E+02	1.248E+02	3.482E+04	2.340E+00
2066	7.810E+03	4.267E+06	2.867E+02	1.224E+02	3.413E+04	2.293E+00
2067	7.656E+03	4.182E+06	2.810E+02	1.199E+02	3.346E+04	2.248E+00
2068	7.504E+03	4.099E+06	2.754E+02	1.176E+02	3.280E+04	2.204E+00
2069	7.356E+03	4.018E+06	2.700E+02	1.152E+02	3.215E+04	2.160E+00
2070	7.210E+03	3.939E+06	2.646E+02	1.129E+02	3.151E+04	2.117E+00
2071	7.067E+03	3.861E+06	2.594E+02	1.107E+02	3.089E+04	2.075E+00
2072	6.927E+03	3.784E+06	2.543E+02	1.085E+02	3.027E+04	2.034E+00
2073	6.790E+03	3.709E+06	2.492E+02	1.064E+02	2.968E+04	1.994E+00
2074	6.656E+03	3.636E+06	2.443E+02	1.043E+02	2.909E+04	1.954E+00
2075	6.524E+03	3.564E+06	2.395E+02	1.022E+02	2.851E+04	1.916E+00
2076	6.395E+03	3.493E+06	2.347E+02	1.002E+02	2.795E+04	1.878E+00
2077	6.268E+03	3.424E+06	2.301E+02	9.819E+01	2.739E+04	1.841E+00
2078	6.144E+03	3.356E+06	2.255E+02	9.625E+01	2.685E+04	1.804E+00
2079	6.022E+03	3.290E+06	2.210E+02	9.434E+01	2.632E+04	1.768E+00
2080	5.903E+03	3.225E+06	2.167E+02	9.247E+01	2.580E+04	1.733E+00
2081	5.786E+03	3.161E+06	2.124E+02	9.064E+01	2.529E+04	1.699E+00
2082	5.671E+03	3.098E+06	2.082E+02	8.885E+01	2.479E+04	1.665E+00
2083	5.559E+03	3.037E+06	2.041E+02	8.709E+01	2.430E+04	1.632E+00
2084	5.449E+03	2.977E+06	2.000E+02	8.536E+01	2.381E+04	1.600E+00
2085	5.341E+03	2.918E+06	1.961E+02	8.367E+01	2.334E+04	1.568E+00
2086	5.235E+03	2.860E+06	1.922E+02	8.202E+01	2.288E+04	1.537E+00
2087	5.132E+03	2.803E+06	1.884E+02	8.039E+01	2.243E+04	1.507E+00
2088	5.030E+03	2.748E+06	1.846E+02	7.880E+01	2.198E+04	1.477E+00
2089	4.931E+03	2.694E+06	1.810E+02	7.724E+01	2.155E+04	1.448E+00
2090	4.833E+03	2.640E+06	1.774E+02	7.571E+01	2.112E+04	1.419E+00

**Input Review****LANDFILL CHARACTERISTICS**

Landfill Open Year	<b>1990</b>	
Landfill Closure Year (with 80-year limit)	<b>2035</b>	
Actual Closure Year (without limit)	<b>2035</b>	
Have Model Calculate Closure Year?	<b>Yes</b>	
Waste Design Capacity	<b>3,375,946</b>	<i>short tons</i>

**MODEL PARAMETERS**

Methane Generation Rate, k	<b>0.020</b>	<i>year<sup>-1</sup></i>
Potential Methane Generation Capacity, L <sub>0</sub>	<b>170</b>	<i>m<sup>3</sup>/Mg</i>
NMOC Concentration	<b>479</b>	<i>ppmv as hexane</i>
Methane Content	<b>50</b>	<i>% by volume</i>

**GASES / POLLUTANTS SELECTED**

Gas / Pollutant #1:	<b>Total landfill gas</b>
Gas / Pollutant #2:	<b>Methane</b>
Gas / Pollutant #3:	<b>Carbon dioxide</b>
Gas / Pollutant #4:	<b>NMOC</b>

**WASTE ACCEPTANCE RATES**

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	(short tons/year)	(Mg)	(short tons)
1990	5,310	5,841	0	0
1991	36,975	40,673	5,310	5,841
1992	23,802	26,182	42,285	46,514
1993	23,209	25,530	66,087	72,696
1994	22,750	25,025	89,296	98,226
1995	24,950	27,445	112,046	123,251
1996	26,111	28,722	136,996	150,696
1997	23,849	26,234	163,107	179,418
1998	25,128	27,641	186,956	205,652
1999	27,878	30,666	212,085	233,293
2000	31,318	34,450	239,963	263,959
2001	32,949	36,244	271,281	298,409
2002	35,996	39,596	304,230	334,653
2003	40,217	44,239	340,226	374,249
2004	43,624	47,986	380,444	418,488
2005	45,369	49,905	424,067	466,474
2006	47,183	51,902	469,436	516,379
2007	49,071	53,978	516,619	568,281
2008	51,033	56,137	565,690	622,259
2009	53,075	58,382	616,723	678,396
2010	55,198	60,718	669,798	736,778
2011	57,406	63,146	724,996	797,496
2012	59,702	65,672	782,402	860,642
2013	62,090	68,299	842,104	926,314
2014	64,574	71,031	904,194	994,613
2015	67,157	73,872	968,767	1,065,644
2016	69,843	76,827	1,035,924	1,139,516
2017	72,637	79,900	1,105,767	1,216,343
2018	75,542	83,096	1,178,403	1,296,244
2019	78,564	86,420	1,253,945	1,379,340
2020	81,706	89,877	1,332,509	1,465,760
2021	84,975	93,472	1,414,215	1,555,637
2022	88,373	97,211	1,499,190	1,649,109
2023	91,908	101,099	1,587,563	1,746,320
2024	95,585	105,143	1,679,472	1,847,419
2025	99,408	109,349	1,775,056	1,952,562
2026	103,384	113,723	1,874,465	2,061,911
2027	107,520	118,272	1,977,849	2,175,634
2028	111,821	123,003	2,085,369	2,293,906
2029	116,293	127,923	2,197,190	2,416,909

## WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	(short tons/year)	(Mg)	(short tons)
2030	120,945	133,040	2,313,483	2,544,831
2031	125,783	138,361	2,434,428	2,677,871
2032	130,814	143,896	2,560,211	2,816,232
2033	136,047	149,652	2,691,026	2,960,128
2034	141,489	155,638	2,827,073	3,109,780
2035	100,480	110,529	2,968,561	3,265,417
2036	0	0	3,069,042	3,375,946
2037	0	0	3,069,042	3,375,946
2038	0	0	3,069,042	3,375,946
2039	0	0	3,069,042	3,375,946
2040	0	0	3,069,042	3,375,946
2041	0	0	3,069,042	3,375,946
2042	0	0	3,069,042	3,375,946
2043	0	0	3,069,042	3,375,946
2044	0	0	3,069,042	3,375,946
2045	0	0	3,069,042	3,375,946
2046	0	0	3,069,042	3,375,946
2047	0	0	3,069,042	3,375,946
2048	0	0	3,069,042	3,375,946
2049	0	0	3,069,042	3,375,946
2050	0	0	3,069,042	3,375,946
2051	0	0	3,069,042	3,375,946
2052	0	0	3,069,042	3,375,946
2053	0	0	3,069,042	3,375,946
2054	0	0	3,069,042	3,375,946
2055	0	0	3,069,042	3,375,946
2056	0	0	3,069,042	3,375,946
2057	0	0	3,069,042	3,375,946
2058	0	0	3,069,042	3,375,946
2059	0	0	3,069,042	3,375,946
2060	0	0	3,069,042	3,375,946
2061	0	0	3,069,042	3,375,946
2062	0	0	3,069,042	3,375,946
2063	0	0	3,069,042	3,375,946
2064	0	0	3,069,042	3,375,946
2065	0	0	3,069,042	3,375,946
2066	0	0	3,069,042	3,375,946
2067	0	0	3,069,042	3,375,946
2068	0	0	3,069,042	3,375,946
2069	0	0	3,069,042	3,375,946

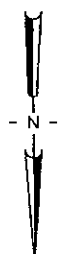
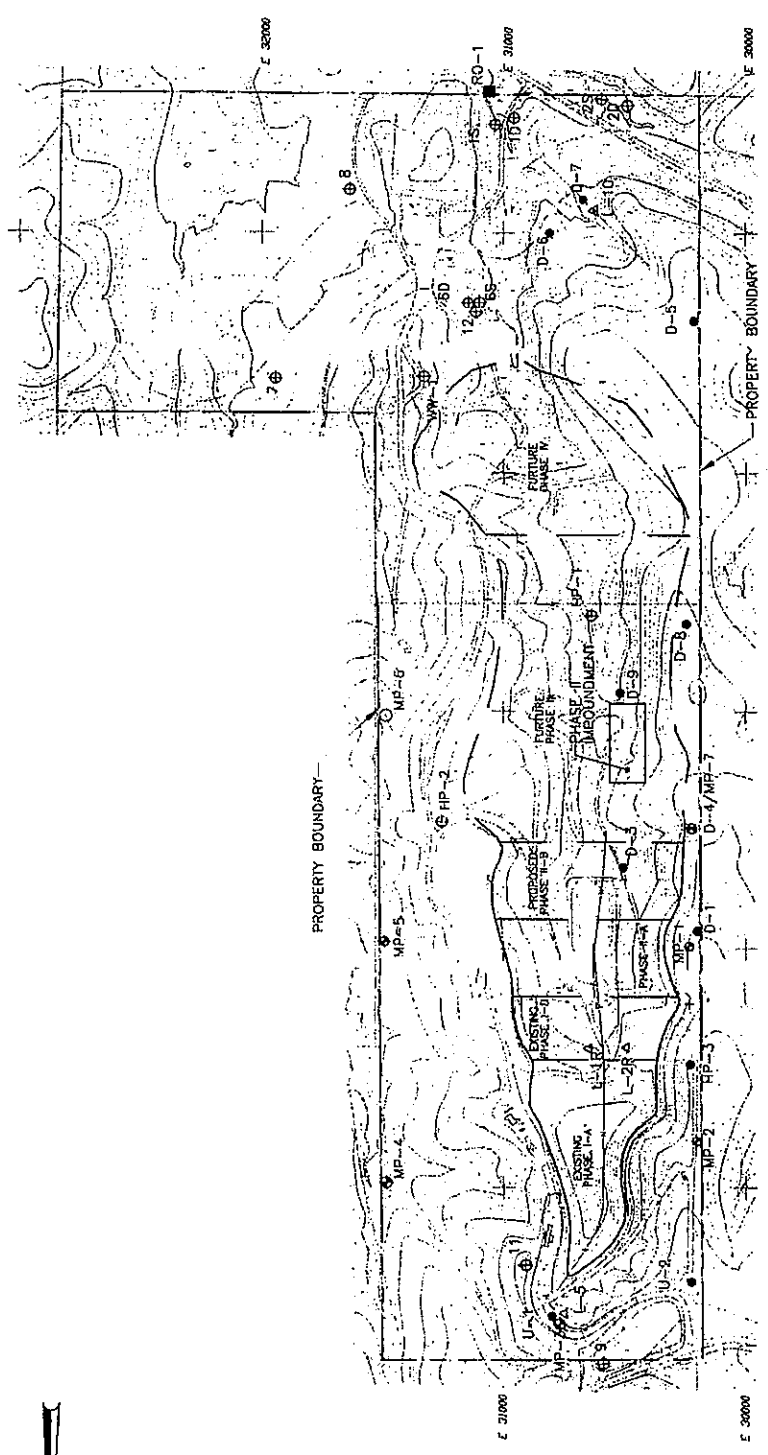
**Results (Continued)**

Year	Carbon dioxide			NMOC		
	(Mg/year)	(m <sup>3</sup> /year)	(av ft <sup>3</sup> /min)	(Mg/year)	(m <sup>3</sup> /year)	(av ft <sup>3</sup> /min)
1990	0	0	0	0	0	0
1991	3.275E+01	1.789E+04	1.202E+00	6.144E-02	1.714E+01	1.152E-03
1992	2.602E+02	1.421E+05	9.550E+00	4.881E-01	1.362E+02	9.149E-03
1993	4.018E+02	2.195E+05	1.475E+01	7.538E-01	2.103E+02	1.413E-02
1994	5.370E+02	2.934E+05	1.971E+01	1.007E+00	2.811E+02	1.888E-02
1995	6.667E+02	3.642E+05	2.447E+01	1.251E+00	3.489E+02	2.344E-02
1996	8.074E+02	4.411E+05	2.964E+01	1.515E+00	4.226E+02	2.839E-02
1997	9.525E+02	5.203E+05	3.496E+01	1.787E+00	4.985E+02	3.349E-02
1998	1.081E+03	5.904E+05	3.967E+01	2.027E+00	5.656E+02	3.800E-02
1999	1.214E+03	6.634E+05	4.457E+01	2.278E+00	6.355E+02	4.270E-02
2000	1.362E+03	7.442E+05	5.000E+01	2.555E+00	7.129E+02	4.790E-02
2001	1.528E+03	8.350E+05	5.610E+01	2.867E+00	7.999E+02	5.375E-02
2002	1.701E+03	9.295E+05	6.245E+01	3.192E+00	8.904E+02	5.983E-02
2003	1.890E+03	1.032E+06	6.936E+01	3.545E+00	9.890E+02	6.645E-02
2004	2.100E+03	1.147E+06	7.710E+01	3.940E+00	1.099E+03	7.386E-02
2005	2.328E+03	1.272E+06	8.545E+01	4.367E+00	1.218E+03	8.186E-02
2006	2.562E+03	1.399E+06	9.402E+01	4.805E+00	1.341E+03	9.008E-02
2007	2.802E+03	1.531E+06	1.028E+02	5.256E+00	1.466E+03	9.853E-02
2008	3.049E+03	1.666E+06	1.119E+02	5.720E+00	1.596E+03	1.072E-01
2009	3.303E+03	1.805E+06	1.213E+02	6.197E+00	1.729E+03	1.162E-01
2010	3.565E+03	1.948E+06	1.309E+02	6.689E+00	1.866E+03	1.254E-01
2011	3.835E+03	2.095E+06	1.408E+02	7.195E+00	2.007E+03	1.349E-01
2012	4.113E+03	2.247E+06	1.510E+02	7.717E+00	2.153E+03	1.446E-01
2013	4.400E+03	2.404E+06	1.615E+02	8.255E+00	2.303E+03	1.547E-01
2014	4.696E+03	2.565E+06	1.724E+02	8.810E+00	2.458E+03	1.651E-01
2015	5.001E+03	2.732E+06	1.836E+02	9.382E+00	2.617E+03	1.759E-01
2016	5.317E+03	2.904E+06	1.951E+02	9.974E+00	2.782E+03	1.870E-01
2017	5.642E+03	3.082E+06	2.071E+02	1.058E+01	2.953E+03	1.984E-01
2018	5.978E+03	3.266E+06	2.194E+02	1.122E+01	3.129E+03	2.102E-01
2019	6.326E+03	3.456E+06	2.322E+02	1.187E+01	3.311E+03	2.224E-01
2020	6.685E+03	3.652E+06	2.454E+02	1.254E+01	3.499E+03	2.351E-01
2021	7.057E+03	3.855E+06	2.590E+02	1.324E+01	3.693E+03	2.481E-01
2022	7.441E+03	4.065E+06	2.731E+02	1.396E+01	3.894E+03	2.617E-01
2023	7.839E+03	4.282E+06	2.877E+02	1.471E+01	4.103E+03	2.757E-01
2024	8.251E+03	4.507E+06	3.028E+02	1.548E+01	4.318E+03	2.901E-01
2025	8.677E+03	4.740E+06	3.185E+02	1.628E+01	4.541E+03	3.051E-01
2026	9.118E+03	4.981E+06	3.347E+02	1.711E+01	4.772E+03	3.206E-01
2027	9.575E+03	5.231E+06	3.515E+02	1.796E+01	5.011E+03	3.367E-01
2028	1.005E+04	5.490E+06	3.689E+02	1.885E+01	5.259E+03	3.534E-01
2029	1.054E+04	5.758E+06	3.869E+02	1.977E+01	5.516E+03	3.706E-01
2030	1.105E+04	6.036E+06	4.055E+02	2.073E+01	5.782E+03	3.885E-01
2031	1.158E+04	6.324E+06	4.249E+02	2.171E+01	6.058E+03	4.070E-01
2032	1.212E+04	6.622E+06	4.450E+02	2.274E+01	6.344E+03	4.263E-01
2033	1.269E+04	6.932E+06	4.658E+02	2.380E+01	6.641E+03	4.462E-01
2034	1.328E+04	7.253E+06	4.873E+02	2.491E+01	6.948E+03	4.669E-01
2035	1.389E+04	7.586E+06	5.097E+02	2.605E+01	7.268E+03	4.883E-01
* 2036	1.423E+04	7.775E+06	5.224E+02	* 2.670E+01	7.448E+03	5.004E-01
2037	1.395E+04	7.621E+06	5.120E+02	2.617E+01	7.301E+03	4.905E-01
2038	1.367E+04	7.470E+06	5.019E+02	2.565E+01	7.156E+03	4.808E-01
2039	1.340E+04	7.322E+06	4.920E+02	2.514E+01	7.014E+03	4.713E-01

\* PEAK NMOC EMISSION (< 50 Mg/yr.)

**Results (Continued)**

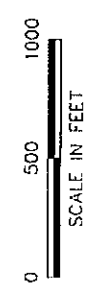
Year	Carbon dioxide			NMOC		
	(Mg/year)	(m <sup>3</sup> /year)	(av ft <sup>3</sup> /min)	(Mg/year)	(m <sup>3</sup> /year)	(av ft <sup>3</sup> /min)
2040	1.314E+04	7.177E+06	4.822E+02	2.464E+01	6.875E+03	4.620E-01
2041	1.288E+04	7.035E+06	4.727E+02	2.416E+01	6.739E+03	4.528E-01
2042	1.262E+04	6.895E+06	4.633E+02	2.368E+01	6.606E+03	4.438E-01
2043	1.237E+04	6.759E+06	4.541E+02	2.321E+01	6.475E+03	4.351E-01
2044	1.213E+04	6.625E+06	4.451E+02	2.275E+01	6.347E+03	4.264E-01
2045	1.189E+04	6.494E+06	4.363E+02	2.230E+01	6.221E+03	4.180E-01
2046	1.165E+04	6.365E+06	4.277E+02	2.186E+01	6.098E+03	4.097E-01
2047	1.142E+04	6.239E+06	4.192E+02	2.143E+01	5.977E+03	4.016E-01
2048	1.119E+04	6.116E+06	4.109E+02	2.100E+01	5.859E+03	3.937E-01
2049	1.097E+04	5.995E+06	4.028E+02	2.059E+01	5.743E+03	3.859E-01
2050	1.076E+04	5.876E+06	3.948E+02	2.018E+01	5.629E+03	3.782E-01
2051	1.054E+04	5.760E+06	3.870E+02	1.978E+01	5.518E+03	3.707E-01
2052	1.033E+04	5.646E+06	3.793E+02	1.939E+01	5.408E+03	3.634E-01
2053	1.013E+04	5.534E+06	3.718E+02	1.900E+01	5.301E+03	3.562E-01
2054	9.929E+03	5.424E+06	3.644E+02	1.863E+01	5.196E+03	3.491E-01
2055	9.732E+03	5.317E+06	3.572E+02	1.826E+01	5.093E+03	3.422E-01
2056	9.540E+03	5.211E+06	3.502E+02	1.790E+01	4.993E+03	3.355E-01
2057	9.351E+03	5.108E+06	3.432E+02	1.754E+01	4.894E+03	3.288E-01
2058	9.166E+03	5.007E+06	3.364E+02	1.719E+01	4.797E+03	3.223E-01
2059	8.984E+03	4.908E+06	3.298E+02	1.685E+01	4.702E+03	3.159E-01
2060	8.806E+03	4.811E+06	3.232E+02	1.652E+01	4.609E+03	3.097E-01
2061	8.632E+03	4.716E+06	3.168E+02	1.619E+01	4.517E+03	3.035E-01
2062	8.461E+03	4.622E+06	3.106E+02	1.587E+01	4.428E+03	2.975E-01
2063	8.293E+03	4.531E+06	3.044E+02	1.556E+01	4.340E+03	2.916E-01
2064	8.129E+03	4.441E+06	2.984E+02	1.525E+01	4.254E+03	2.859E-01
2065	7.968E+03	4.353E+06	2.925E+02	1.495E+01	4.170E+03	2.802E-01
2066	7.810E+03	4.267E+06	2.867E+02	1.465E+01	4.088E+03	2.746E-01
2067	7.656E+03	4.182E+06	2.810E+02	1.436E+01	4.007E+03	2.692E-01
2068	7.504E+03	4.099E+06	2.754E+02	1.408E+01	3.927E+03	2.639E-01
2069	7.356E+03	4.018E+06	2.700E+02	1.380E+01	3.850E+03	2.587E-01
2070	7.210E+03	3.939E+06	2.646E+02	1.353E+01	3.773E+03	2.535E-01
2071	7.067E+03	3.861E+06	2.594E+02	1.326E+01	3.699E+03	2.485E-01
2072	6.927E+03	3.784E+06	2.543E+02	1.300E+01	3.625E+03	2.436E-01
2073	6.790E+03	3.709E+06	2.492E+02	1.274E+01	3.554E+03	2.388E-01
2074	6.656E+03	3.636E+06	2.443E+02	1.249E+01	3.483E+03	2.340E-01
2075	6.524E+03	3.564E+06	2.395E+02	1.224E+01	3.414E+03	2.294E-01
2076	6.395E+03	3.493E+06	2.347E+02	1.200E+01	3.347E+03	2.249E-01
2077	6.268E+03	3.424E+06	2.301E+02	1.176E+01	3.280E+03	2.204E-01
2078	6.144E+03	3.356E+06	2.255E+02	1.153E+01	3.215E+03	2.160E-01
2079	6.022E+03	3.290E+06	2.210E+02	1.130E+01	3.152E+03	2.118E-01
2080	5.903E+03	3.225E+06	2.167E+02	1.107E+01	3.089E+03	2.076E-01
2081	5.786E+03	3.161E+06	2.124E+02	1.085E+01	3.028E+03	2.035E-01
2082	5.671E+03	3.098E+06	2.082E+02	1.064E+01	2.968E+03	1.994E-01
2083	5.559E+03	3.037E+06	2.041E+02	1.043E+01	2.909E+03	1.955E-01
2084	5.449E+03	2.977E+06	2.000E+02	1.022E+01	2.852E+03	1.916E-01
2085	5.341E+03	2.918E+06	1.961E+02	1.002E+01	2.795E+03	1.878E-01
2086	5.235E+03	2.860E+06	1.922E+02	9.821E+00	2.740E+03	1.841E-01
2087	5.132E+03	2.803E+06	1.884E+02	9.627E+00	2.686E+03	1.805E-01
2088	5.030E+03	2.748E+06	1.846E+02	9.436E+00	2.633E+03	1.769E-01
2089	4.931E+03	2.694E+06	1.810E+02	9.249E+00	2.580E+03	1.734E-01
2090	4.833E+03	2.640E+06	1.774E+02	9.066E+00	2.529E+03	1.699E-01



- LEGEND**
- U-1 ● EXISTING GROUNDWATER MONITORING WELL LOCATION
  - L-1R △ EXISTING VADOSE ZONE MONITORING LOCATION
  - MP-1 ◆ EXISTING LANDFILL GAS MONITORING PROBE LOCATION
  - MP-6 ○ PROPOSED LANDFILL GAS MONITORING PROBE LOCATION
  - D-4/ MP-7 □ EXISTING GROUNDWATER MONITORING WELL AND LANDFILL GAS MONITORING PROBE LOCATION
  - U-2 ● EXISTING OBSERVATION WELL
  - L-2R ● EXISTING PIEZOMETER
  - HP-3 ◆ EXISTING WATER SUPPLY WELL
  - MP-2 ◆ EXISTING SURFACE WATER SAMPLING LOCATION
  - MP-3 ◆ EXISTING SURFACE WATER SAMPLING LOCATION
  - MP-4 ◆ EXISTING SURFACE WATER SAMPLING LOCATION
  - MP-5 ◆ EXISTING SURFACE WATER SAMPLING LOCATION
  - MP-6 ◆ EXISTING SURFACE WATER SAMPLING LOCATION
  - HP-2 ◆ EXISTING SURFACE WATER SAMPLING LOCATION



CONTOUR INTERVAL: 4'  
DATE OF PHOTOGRAPHY: 4-25-86



DATE	_____
DWN	_____
APP	_____
REV	_____
PROJECT NO.	20539-C-006

**FIGURE 2**  
CALAVERAS COUNTY DEPT. OF PUBLIC WORKS  
ROCK CREEK SOLID WASTE FACILITY  
CALAVERAS COUNTY, CALIFORNIA  
**MONITORING POINT LOCATIONS**

DATE PLOT: 01/11/88  
SCALE: 1" = 500 FEET  
PROJECT: 20539-C-006  
DRAWN BY: J. W. BROWN  
CHECKED BY: J. W. BROWN  
DATE: 01/11/88