Tier 2 Landfill Gas Sampling Report Cinder Lake Landfill

December 2013

Prepared for:
City of Flagstaff

211 West Aspen Avenue
Flagstaff, AZ 86001

CORNERSTONE Environmental Group, LLC

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TIER 2 LANDFILL GAS SAMPLING REPORT

CINDER LAKE LANDFILL

FLAGSTAFF, ARIZONA

Prepared for

The City of Flagstaff – Cinder Lake Landfill
Attn: Matt Morales, Project Manager
211 West Aspen Avenue
Flagstaff, AZ 86001

December 2013

Prepared by

CORNERSTONE
Environmental Group, LLC
17 West Wetmore Road, Suite 310
Tucson, Arizona 85705

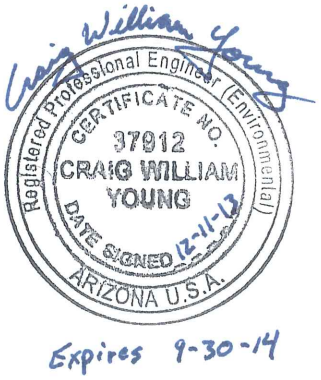
Project 130674
City of Flagstaff File # 20-700-16

Tier 2 Landfill Gas Sampling Report
Cinder Lake Landfill
Flagstaff, Arizona

The material and data in this report were prepared under the supervision and direction of the undersigned.

Cornerstone Environmental Group, LLC

Scott Johnson
Client Manager



Expires 9-30-14

Craig Young, P.E.
Project Engineer

Garth R. Bowers, P.E.
Arizona Area Manager

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1 INTRODUCTION

Cornerstone Environmental Group, LLC (Cornerstone) conducted a Tier 2 landfill gas (LFG) sampling event at the Cinder Lake Landfill (CLL) located in Flagstaff, Arizona from October 21, 2013 through October 23, 2013

This report summarizes the field sampling, analytical results, and emissions estimates in support of a Tier 2 evaluation of non-methane organic carbon (NMOC) emissions at the CLL, a municipal solid waste landfill (MSWLF) located approximately eight (8) miles northeast of Flagstaff, Arizona, as shown in Figure 1.

The CLL is a MSWLF owned and operated by the City of Flagstaff. The CLL has been in operation since 1965, accepting non-hazardous solid waste materials, including domestic wastes, commercial and institutional wastes, and construction/demolition wastes. Operations are conducted according to an approved solid waste facility plan, which includes compaction and daily cover of landfilled wastes with soil. To date, approximately 81.3 acres (32.9 hectares) of permitted disposal area have received wastes that are more than two (2) years old. Approximately 14.2 acres have been filled only with construction/demolition debris and were not a subject of the work performed in this report. Soil cover has been installed over the landfill wastes, and can be as thick as 8 feet in places.

The CLL operates under Title V Stationary Source Permit Number 53332, issued by the Arizona Department of Environmental Quality (ADEQ) on June 20, 2012. The Title V permit requires the CLL to periodically submit an NMOC emissions estimate report and retest NMOC concentrations every five years in accordance with 40 Code of Federal Regulations (CFR) §60.754(a)(3) of the New Source Performance Standards (NSPS). This report is intended to satisfy Title V permit reporting requirements in addition to NSPS requirements.

The CLL has not been classified as an NSPS source and is conducting this Tier 2 assessment in order to meet the compliance schedule set forth in the Federal NSPS requirements. The CLL previously conducted a Tier 2 LFG sampling event in October 2008. The previous Tier 2 Sampling Report was submitted in December 2008 and indicated the NMOC emission rate to be 5.62 megagrams per year (Mg/yr) of NMOC in 2008, and was not projected to exceed the regulatory threshold limit of 50 Mg/yr during the succeeding five year period.

This NMOC emission rate calculation was updated based on site-specific NMOC concentrations determined during field testing in October 2013 to yield an updated estimate of NMOC emissions from CLL. The results of this calculation were then used to project the annual NMOC emissions and determine if or when the facility will exceed 50 Mg/yr, and therefore, subject the CLL to the LFG collection and control system (GCCS) requirements of the NSPS.

This report is intended to serve as a presentation of the Tier 2 sampling results and a five-year NMOC emission rate report for years 2013 through 2018. Included in this report is a description of the field procedures used to collect LFG field samples for laboratory analysis, the laboratory analytical results and data interpretation, a revised NMOC emission rate calculation, and a discussion of the Tier 2 sampling results.

2 FIELD PROCEDURES

In accordance with the NSPS [40 CFR §60.754(a)(3)], the Tier 2 sampling protocol requires sampling at a frequency of two samples for every hectare of landfill that has retained waste for at least two years, up to a maximum of 50 samples. The standard Tier 2 method requires penetrating the landfill surface and the interim cover.

A total of 50 sampling points were selected on an evenly spaced pattern across the CLL, which has more than 50 acres of landfill surface that have retained waste for at least 2 years. Sampling locations included areas where waste younger than 2 years had been placed over older wastes, but did not include areas which are known to be landfilled with non-degradable construction debris wastes. Areas with steep side slopes (greater than 3 horizontal: 1 vertical) were also avoided in selecting sampling locations due the potential for unsafe conditions with the direct push rig (Geoprobe™). All sampling points where marked on the landfill by the City of Flagstaff site personnel using a global positioning system. Figure 2 illustrates the location of each sampling point.

All samples were collected between October 21 and October 23, 2013. Field sampling was conducted in a manner consistent with EPA Air Quality Test Method 25C, Determination of NMOC in Landfill Gas (Method 25C). Soil gas samples were collected through the use of a direct push rig (Geoprobe™) operated by Cascade Drilling, Inc. The direct push rig was equipped with a soil gas sampling probe that was driven into the subsurface using a pneumatic hammer. A 1.25-inch diameter vapor sampling probe sampler with 3-foot extensions was driven to an appropriate depth below the ground surface for sample collection to ensure a minimum depth of 3 feet below the bottom of the landfill cover in conformance with Method 25C sampling requirements. Sampling locations included areas where waste younger than 2 years had been placed over older wastes, and required the sampling probe to be placed at a depth to reach LFG samples from the older waste mass. The depth of samples ranged from 10 feet to 25 feet below the landfill surface in some locations.

Prior to collecting the LFG samples, a Landtec GEM-2000® portable monitoring unit, was used to measure methane, carbon dioxide, and balance gas (assumed to be nitrogen) concentrations as a check for any indication of air intrusion in the landfill and potentially in the LFG sample collected. The concentrations were observed to be within the limits allowed under EPA Method 25C for NSPS Tier 2 testing.

A total of 18, six-liter Summa® canisters were used to collect 50 LFG samples from within the waste mass. All samples were collected in stainless steel Summa canisters partially filled with helium by the analytical laboratory. All steel canisters were leak-tested by the analytical laboratory to verify that the valve and collection port on each tank was not leaking. Each canister was used to collect composite samples of two to three samples per

canister. The canisters were filled at a rate of approximately 500 milliliters per minute (ml/min) or less at each sample location. Equal volumes of LFG were collected at each location and included in a composite sample by evenly dividing the vacuum used in collecting samples. Each canister was documented in a field log with the laboratory canister number and sampling point. Date, time, depth of sampling point and initial sampling vacuum were also recorded in field logs. A copy of the field log is provided in Appendix A.

3 LABORATORY RESULTS

LFG samples were packaged by the sampler (Craig Young, P.E.) and shipped by Federal Express to Air Technology Laboratories, Inc. (ATL) in City of Industry, California, for analysis by Method 25C and Method 3C (CFR, 2007 Appendix A). All samples were processed in the laboratory with a gas chromatographic column to separate NMOCs from fixed gases. Consistent with Method 25C quality control requirements, each sample were first tested according to Method 3C (CFR 2007, Appendix A) protocols for nitrogen and oxygen concentration using a thermal conductivity detector. The laboratory report for the Method 25C and 3C results is provided in Appendix B. A summary of Method 25C and Method 3C results is provided in Table 1.

Pressurization of the Summa® canisters with helium was performed in the laboratory prior to analysis. The laboratory results are reported as total NMOC by volume as carbon and have been corrected for temperature and pressure as indicated by the dilution factor incorporated within the laboratory results.

The laboratory results were also corrected for the moisture content and measured nitrogen content present in the samples as discussed in EPA Method 25C. The moisture content of the LFG was determined based upon default EPA Method 25C specifications. Oxygen and nitrogen content for each sample was obtained from the EPA Method 3C test results.

Three samples out of the eighteen analyzed were identified to contain Nitrogen and Oxygen concentrations. Sample CLLF 2-5416 was identified to have a Nitrogen and Oxygen concentration of 14 percent by volume and 4 percent by volume, respectively. This sample (CLLF 2-5416) did not exceed the 20 percent Nitrogen and 5 percent Oxygen limit by volume and, therefore, was deemed to be an acceptable sample. Two additional samples, identified as CLLF 12-3105, and CLLF 17-1358, were identified to have exceeded the 20 percent Nitrogen and 5 percent Oxygen limit by volume and were therefore considered to be unacceptable samples. See Figure 1 for sample NMOC concentrations.

Samples collected at locations, 20, 21 and 22 which corresponds to laboratory sample CLLF 8-3624 was identified to have an NMOC concentration of 25,000 part per million by volume (ppmv) as carbon. The reason for the high reading was unknown. However, as a conservative assumption, the NMOC concentration from these sample locations was still used in the calculation of the weighted average NMOC concentration for the site as discussed below.

A weighted average of the NMOC concentration (ppmv as carbon) for each sample was calculated. Results were within the acceptable range of data collected at landfills. This value was then divided by six to convert from ppmv NMOC as carbon to ppmv NMOC as hexane and used as the site-specific NMOC concentration for CLL.

The Method 25C results revealed that the average NMOC concentration at the CLL ranged from 65 to 4,166 parts per million-hexane (ppmh) for all samples analyzed. The weighted average NMOC concentration was identified to be 458.3 ppmh for all samples, and 432.7 ppmh for samples with acceptable levels of nitrogen. The average NMOC concentration of 433 ppmh for acceptable samples was used to evaluate NMOC emissions consistent with Tier 2 protocols.

TABLE 1 – SAMPLE NMOC CONCENTRATIONS

Sample	Sample ID	Weighting Factor (1)	Method 3C Results		Acceptable Sample by 25C	Method 25 C Results		Weighted NMOC Ave, as Hexane
			Nitrogen (%)	Oxygen (%)		NMOC (ppm as C) (2)	NMOC (ppm as C_6) (3)	
1, 2, 3	CLLF 1-5413	3/45	<1.0	<0.5	Yes	600	100.0	6.7
4, 5	CLLF 2-5416	2/45	<1.0	<0.5	Yes	480	80.0	3.6
6, 7	CLLF 3-1305	2/45	14	4	Yes	390	65.0	2.9
8, 9, 10	CLLF 4-3143	3/45	<1.0	<0.5	Yes	1,500	250.0	16.7
11, 12, 13	CLLF 5-1370	3/45	<1.0	<0.5	Yes	810	135.0	9
14, 15, 16	CLLF 6-GLO167	3/45	<1.0	<0.5	Yes	410	68.3	4.6
17, 18, 19	CLLF 7-3619	3/45	<1.0	<0.5	Yes	550	91.7	6.1
20, 21, 22	CLLF 8-3624	3/45	<1.0	<0.5	Yes	25,000	4166.7	277.8
23, 24, 25	CLLF 9-1383	3/45	<1.0	<0.5	Yes	1,500	250.0	16.7
26, 27, 28	CLLF 10-1416	3/45	<1.0	<0.5	Yes	400	66.7	4.4
29, 30, 31	CLLF 11-1447	3/45	<1.0	<0.5	Yes	1,600	266.7	17.8
32, 33	CLLF 12-3105	2/45	20	5.6	No	1,200	200.0	8.9
34, 35, 36	CLLF 13-1168	3/45	<1.0	<0.5	Yes	1,400	233.3	15.6
37, 38, 39	CLLF 14-6459	3/45	<1.0	<0.5	Yes	2,400	400.0	26.7
40, 41, 46	CLLF 15-1374	3/45	<1.0	<0.5	Yes	740	123.3	8.2
42, 43, 44	CLLF 16-3720	3/45	<1.0	<0.5	Yes	980	163.3	10.9
45, 49, 50	CLLF 17-1358	3/45	26	7.4	No	1,500	250.0	16.7
47, 48	CLLF 18-3582	2/45	<1.0	<0.5	Yes	710	118.3	5.3
Total (acceptable samples)								432.7

Notes:
(1) Weighting factor is the fraction of the total number of acceptable samples each individual sample represents.
(2) NMOC concentration, as carbon, divided by six to obtain NMOC concentration, as hexane.
(3) NMOC concentration, as hexane, multiplied by the weighting factor.

4 NMOC EMISSION RATE CALCULATION

A revised NMOC emission rate calculation was performed with the site-specific NMOC concentration. The calculation was performed using the USEPA LFG Emission Model Version 3.02 (LandGEM) (Clean Air Act [CAA] default values – k=0.02/year and L_0=170 m^3/Mg), the site-specific NMOC concentration (433 ppmv), historical waste receipts for degradable solid waste, and the projected future waste acceptance rates for CLL. Waste acceptance rates for 2013 and beyond were provided by the City of Flagstaff. Table 2 below details the NMOC emission rate for 2013 through 2018.

The equation specified in 40 CFR 60.754 when the year to year solid waste acceptance rate is known is displayed below:

$$MNMOC = \sum 2\, k\, L_o\, M_i\, (e^{-kti})\, (C_{NMOC})\, (3.6\, x10^{-9})$$

where:

MNMOC = Total emission rate from landfill – (Mg/yr)
k = Methane generation constant = 0.02/yr (representative of an arid climate.)
Lo = Methane generation potential = 170 cubic meters per Megagram (m3/Mg)
M*i* = Mass of waste in the ith section – Mg
t*i* = Age of the ith section of waste - years
CNMOC = Site-specific NMOC concentration of 433 ppmv (as determined from sample analyses)

TABLE 2 – NMOC EMISSION RATE

Year	Refuse in Place (Mg)	(Mg/yr)	(m^3/yr)
2013	4,275,863	32.11	8,959
2014	4,404,095	32.82	9,155
2015	4,536,174	33.55	9,359
2016	4,672,215	34.31	9,571
2017	4,812,338	35.09	9,790
2018	4,956,665	35.90	10,020

Based on the site-specific NMOC concentration, the LandGEM yielded a NMOC emission rate of 32.11 Mg/yr for the year 2013. LandGEM results have been provided in Appendix C of this report**.** The NMOC emission rate calculation indicates that the CLL does not exceed 50 Mg/yr for 2013 and is not expected to exceed the 50 Mg/yr threshold limit value over the next five years.

The results show that the current 2013 NMOC emission rate of 32.11 Mg/yr is much larger when compared to the 2008 Tier II Report results that predicted an estimated NMOC emission in 2013 to be 6.20 Mg/yr (i.e., the 2013 modeled rate represents a 418% increase over the 2008 modeled rate).

The LandGEM model results (Appendix C) for the 2013 Tier II Report indicate that the NMOC result of sample CLLF-8-3624 of 25,000 ppm was a factor in the increase of the total NMOC emission rate. This sample result was significantly higher in concentration than all other sample results collected during the October 2013 sampling event; however the result met the requirements of the Tier II testing protocol and was therefore used as a valid sample result in the LandGEM model. Had the sample result for CLLF-8-3624 been excluded, then the NMOC emission rate result would have been approximately 12 Mg/yr (which would represent a 94% increase over the 2008 modeled emission rate).

There are several potential factors that may have contributed to the large increase in the NMOC emission rate from 2008 to 2013. The first is due to an increase in LFG generation due to the age of the waste. The modeled LFG generation is higher since it is closer to the peak generation in 2013 than it was in 2008 (32.11 MG/yr in 2013 vs. 5.62 MG/yr in 2008) since it is closer to the time of peak generation. Since NMOC emissions are proportional to LFG generation for a given NMOC concentration, the increase in LFG generation alone would account for a 471% increase in NMOC emission rate. A second factor could be due to the waste mass not being heterogeneous and the presence of spacial differences between various waste masses within the landfill. Thirdly, the elevated concentration of the sample CLLF-8-3624 could be an outlier result that is representative of the NMOC in an isolated location in the landfill and not representative of the NMOC concentrations in the entire waste mass, as discussed above. Ultimately, the reason for the large increase in the NMOC emission rate results from 2008 to 2013 cannot be completely determined without additional sampling and investigation.

The number of acceptable samples for this sampling event (45 out of 50) exceeded the 2008 sampling event (35 out of 50), and therefore the results of this Tier II sampling event should be considered statistically more representative.

5 CONCLUSIONS

Based on the site-specific NMOC concentration determined by this Tier 2 LFG sampling event, the results of the Tier 2 calculation indicate that the NMOC emission rate for CLL in 2013 is below the NSPS emission threshold of 50 Mg/yr is not expected to exceed the 50 MG/yr threshold limit value over the next five years. According to the LandGEM model results, the CLL is not expected to exceed the NSPS emission threshold limit of 50 Mg/yr until approximately 2032. In the event that actual waste acceptance rates differ significantly than those estimated in this report, CLL will recalculate the NMOC emission rate using the NMOC concentration determined in this report and actual waste acceptance.

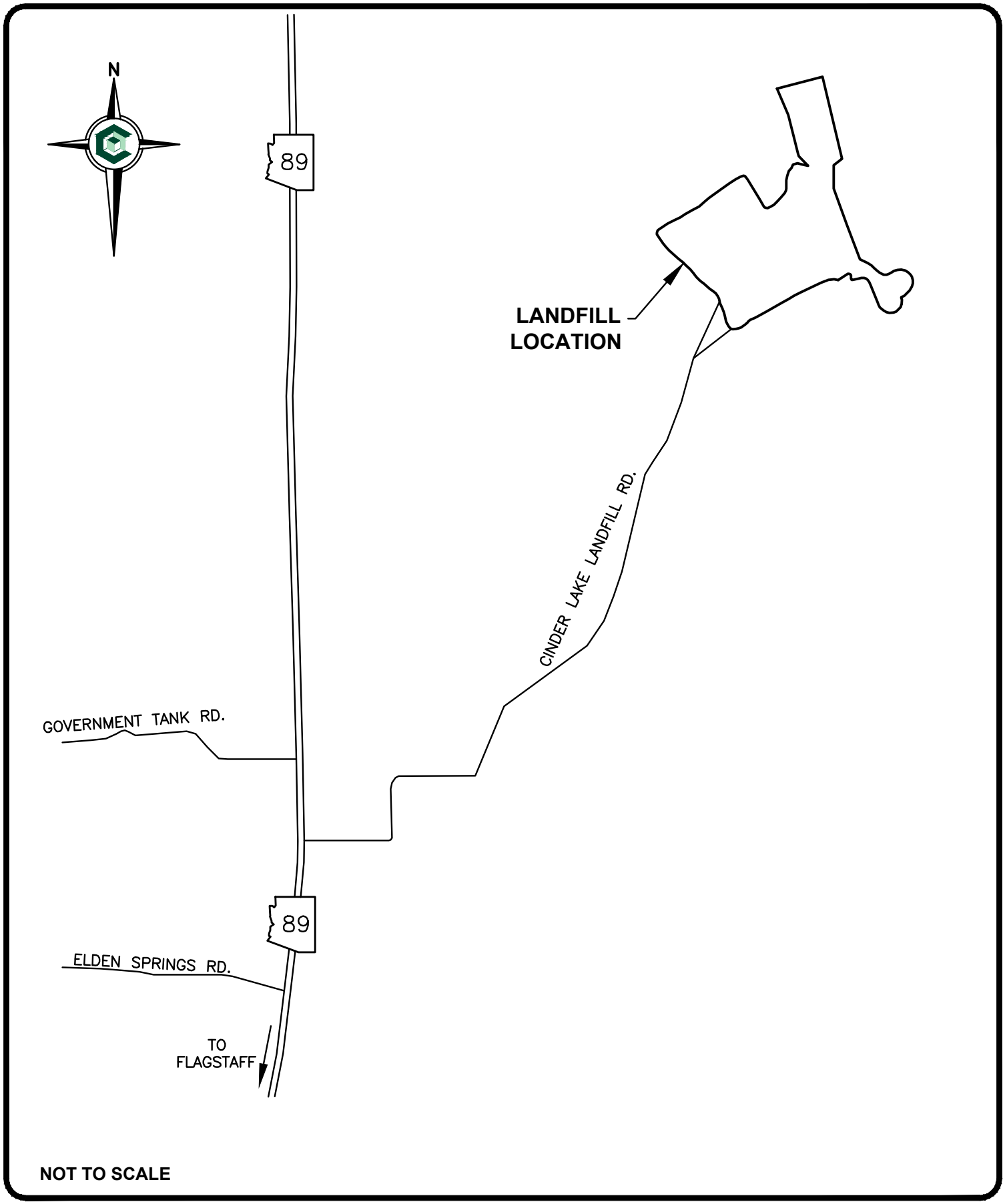
Per this report, as of November 30, 2013, the CLL is not projected to be over the NSPS threshold of 50 Mg/yr for the five year period of 2013 to 2018 and will not be subject to the requirements of NSPS within this timeframe. The CLL will be required to conduct a new Tier II sampling event and report by November 30, 2018.

LIMITATIONS

The work product included in the attached was undertaken in full conformity with generally accepted professional consulting principles and practices and to the fullest extent as allowed by law we expressly disclaim all warranties, express or implied, including warranties of merchantability or fitness for a particular purpose. The work product was completed in full conformity with the contract with our client and this document is solely for the use and reliance of our client (unless previously agreed upon that a third party could rely on the work product) and any reliance on this work product by an unapproved outside party is at such party's risk.

The work product herein (including opinions, conclusions, suggestions, etc.) was prepared based on the situations and circumstances as found at the time, location, scope and goal of our performance and thus should be relied upon and used by our client recognizing these considerations and limitations. Cornerstone shall not be liable for the consequences of any change in environmental standards, practices, or regulations following the completion of our work and there is no warrant to the veracity of information provided by third parties, or the partial utilization of this work product.

FIGURES



NOT TO SCALE

CORNERSTONE
Environmental Group, LLC

CITY OF FLAGSTAFF
CINDER LAKE LANDFILL
FLAGSTAFF, ARIZONA

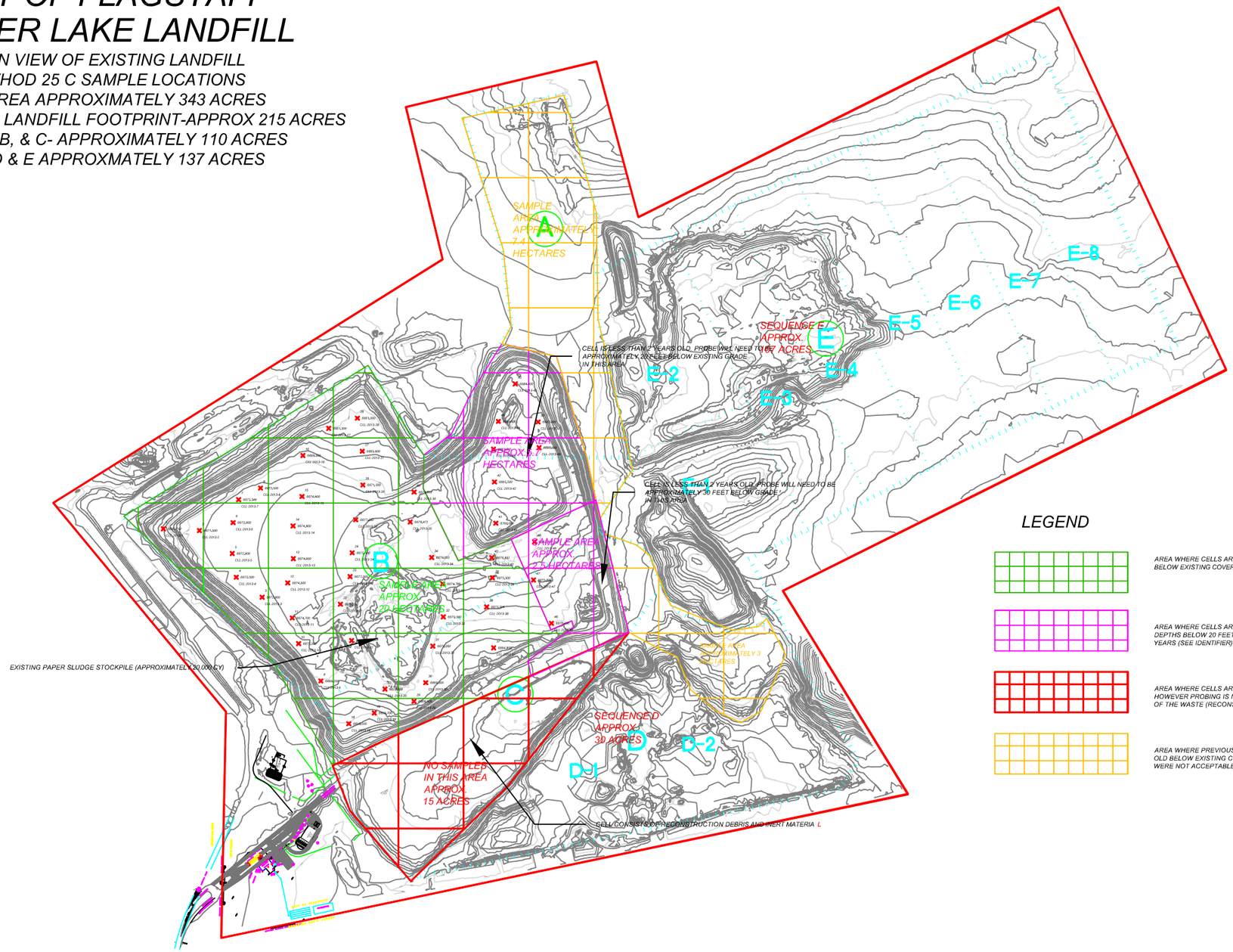
VICINITY MAP

FIGURE NO.
1

PROJECT NO.
130674

CITY OF FLAGSTAFF
CINDER LAKE LANDFILL

PLAN VIEW OF EXISTING LANDFILL
METHOD 25 C SAMPLE LOCATIONS
SITE AREA APPROXIMATELY 343 ACRES
LANDFILL TOTAL LANDFILL FOOTPRINT-APPROX 215 ACRES
CELLS A, B, & C- APPROXIMATELY 110 ACRES
CELL D & E APPROXMATELY 137 ACRES



LEGEND

- AREA WHERE CELLS ARE GREATER THAN 2 YEARS OLD BELOW EXISTING COVER
- AREA WHERE CELLS ARE LESS THAN 2 YEARS OLD HOWEVER DEPTHS BELOW 20 FEET AND 30 FEET ARE OLDER THAN 2 YEARS (SEE IDENTIFIER)
- AREA WHERE CELLS ARE GREATER THAN 2 YEARS OLD HOWEVER PROBING IS NOT SUGGESTED DUE TO THE NATURE OF THE WASTE (RECONSTRUCTION DEBRIS)
- AREA WHERE PREVIOUS CELLS ARE GREATER THAN 2 YEARS OLD BELOW EXISTING COVER BUT PREVIOUS SAMPLINGS WERE NOT ACCEPTABLE BY METHOD 25C

FILE NO:

CITY OF FLAGSTAFF
6770 E LANDFILL ROAD FLAGSTAFF, AZ 86004 PHONE: 928-527-9843

DATE SUBMITTED: 11/22/13

CALL TWO WORKING DAYS BEFORE YOU DIG
1-800-STAKE-IT
1-800-782-5348
(OUTSIDE MARICOPA COUNTY)

REVISIONS:

REVISION I-UPDATED LEGEND 6-29-2013	

CITY OF FLAGSTAFF
PUBLIC WORKS
SOLID WASTE SECTION
CINDER LAKE LANDFILL
6770 E LANDFILL ROAD FLAGSTAFF, AZ 86004
PHONE: 928-527-9843

CLL-TIERII.DWG

HOR SCALE: 1:600
DATE: 10/15/13
SHEET NO: 1 OF 1

DESIGN BY:
DRAFTED BY:
CHECKED BY:

Drawing provided by the City of Flagstaff

APPENDIX A

FIELD LOGS

Cornerstone Environmental Group, LLC
Tier 2 Sampling Log

LANDFILL NAME: Cinder Lake Landfill
CLIENT: City of Flagstaff
CLIENT FIELD REP: Craig Young
PROJECT START DATE: 21-Oct-13

Meter: GEM 2000
Probe: Stainless Steel Sampling Rod
Flowmeter: Sample Train Rotameter
Vac. Gauge: Sample Train Gauge
Sample Tech: Craig Young

			PRESAMPLING SYSTEM PURGE (<500ml/min.)			FIELD GAS ANALYSIS (VIA GEM 2000)				SAMPLE TRAIN LEAK CHECK			SAMPLE COLLECTION SUMMA CANNISTER (<500ml/min)						
DATE	SAMPLE NO.	Sample Depth (ft)	START (Time)	END (Time)	AMOUNT (Time)	<20% N2	<5% O2	CH4	CO2	START PRESSURE (inHg)	END PRESSURE (inHg)	CHANGE	I.D.	INITIAL PRESSURE (inHg)	FINAL PRESSURE (inHg)	AMOUNT (inHg)	SAMPLE START TIME	Outside TEMP. (F)	Barometric Pressure
10/21/2013	1	10	939	940	11	2.0	0.0	56.4	36.6				5413	-17	-11	6	1002		23.65
10/21/2013	2	10	1029	1031	2	0.1	0.0	57.5	42.5				5413	-11	-7	4	1032		23.65
10/21/2013	3	10	1050	1052	2	0.1	0.0	58.2	41.7				5416	-18	-13	5	1059		23.65
10/21/2013	4	10	1127	1129	2	0.2	0.0	62.0	37.8				5416	-11	-8	3	1130		23.65
10/21/2013	5	10	1146	1149	3	0.2	0.0	67.5	32.3				5416	-7	-5	2	1150		23.65
10/21/2013	6	10	1210	1212	2	0.1	0.0	61.9	38.0				1305	-15	-8	7	1213		23.65
10/21/2013	7	15	1230	1252	2	0.5	0.0	60.4	38.1				1305	-8	-5	3	1252		23.65
10/21/2013	8	10	1312	1314	2	0.2	0.1	60.0	39.7				3143	-17	-15	2	1317		23.65
10/21/2013	9	10	1339	1341	2	0.2	0.2	56.9	42.7				3143	-14	-12	2	131		23.65
10/21/2013	10	10	1356	1358	2	0.1	0.1	56.8	43.0				3143	-9	-6	3	1359		23.65
10/21/2013	11	10	1413	1415	2	0.1	0.1	58.7	41.1				1370	-16	-12	4	1416		23.65
10/21/2013	12	10	1431	1433	2	0.1	0.1	58.6	41.2				1370	-11	-10	1	1433		23.65
10/21/2013	13	10	1449	1451	2	1.0	0.1	62.1	36.8				1370	-8	-7	1	1452		23.65
10/21/2013	14	10	1522	1524	2	1.1	0.0	62.0	36.9				GL0167	-14	-11	3	1525		23.65
10/21/2013	15	10	1541	1543	2	0.1	0.2	56.2	43.5				GL0167	-8	-6	2	1543		23.65
10/21/2013	16	10	1555	1555	2	0.2	0.1	57.8	41.9				GL0167	-6	-5	1	1556		23.65
10/21/2013	17	10	1610	1612	2	0.1	0.1	58.3	41.5				3619	-17	-13	4	1612		23.65
10/21/2013	18	10	1634	1636	2	0.2	0.1	56.6	43.1				3619	-11	-7	4	1636		23.65
10/21/2013	19	10	1649	1651	2	0.2	0.1	57.9	41.9				3619	-7	-5	2	1651		23.65
10/22/2013	20	10	858	900	2	>>.>	0.0	>>.>	42.1				3624	-16	-13	3	902		23.72
10/22/2013	21	10	917	918	2	0.2	0.1	58.3	41.4				3624	-13	-11	2	920		23.72
10/22/2013	22	10	935	937	2	0.2	0.0	58.2	41.6				3624	-9	-6	3	936		23.72
10/22/2013	23	10	953	955	2	0.1	0.0	25.2	41.7				1383	-18	-15	3	954		23.72
10/22/2013	24	10	1007	1010	3	0.1	0.0	58.0	41.9				1383	-13	-10	3	1011		23.72
10/22/2013	25	10	1024	1026	2	0.2	0.0	58.7	41.1				1383	-9	-6	3	1027		23.72

Cornerstone Environmental Group, LLC
Tier 2 Sampling Log

LANDFILL NAME: Cinder Lake Landfill
CLIENT: City of Flagstaff
CLIENT FIELD REP: Craig Young
PROJECT START DATE: 21-Oct-13

Meter: GEM 2000
Probe: Stainless Steel Sampling Rod
Flowmeter: Sample Train Rotameter
Vac. Gauge: Sample Train Gauge
Sample Tech: Craig Young

			PRESAMPLING SYSTEM PURGE (<500ml/min.)			FIELD GAS ANALYSIS (VIA GEM 2000)				SAMPLE TRAIN LEAK CHECK			SAMPLE COLLECTION SUMMA CANNISTER (<500ml/min)						
DATE	SAMPLE NO.	Sample Depth (ft)	START (Time)	END (Time)	AMOUNT (Time)	<20% N2	<5% O2	CH4	CO2	START PRESSURE (inHg)	END PRESSURE (inHg)	CHANGE	I.D.	INITIAL PRESSURE (inHg)	FINAL PRESSURE (inHg)	AMOUNT (inHg)	SAMPLE START TIME	Outside TEMP. (F)	Barometric Pressure
10/22/2013	26	10	1042	1044	2	1.2	0.0	58.1	40.7				1416	-17	-15	2	1045		23.70
10/22/2013	27	10	1101	1103	2	1.9	0.1	60.1	37.9				1416	-13	-10	3	1104		23.70
10/22/2013	28	10	1120	1122	2	1.8	0.0	58.0	40.2				1416	-8	-5	3	1122		23.70
10/22/2013	29	10	1156	1158	2	1.3	0.1	59.0	39.4				1447	-13	-11	2	1158		23.70
10/22/2013	30	10	1212	1214	2	0.1	0.2	59.4	40.3				1447	-10	-8	2	1213		23.70
10/22/2013	31	10	1231	1233	2	0.3	0.2	57.8	41.7				1447	-7	-5	2	1233		23.70
10/22/2013	32	10	1247	1249	2	1.4	0.3	58.7	39.6				3105	-16	-13	3	1248		23.70
10/22/2013	33	10	1306	1308	2	0.3	0.1	61.0	38.6				3105	-11	-9	2	1308		23.70
10/22/2013	34	10	1343	1345	2	0.3	0.3	60.5	38.9				1168	-15	-13	2	1349		23.70
10/22/2013	35	10	1401	1403	2	0.2	0.2	58.7	40.9				1168	-13	-10	3	1403		23.70
10/22/2013	36	10	1421	1426	2	1.4	0.3	58.5	39.8				1168	-8	-6	2	1423		23.70
10/22/2013	37	10	1444	1446	2	0.2	0.3	57.2	42.3				6459	-17	-15	2	1447		23.70
10/22/2013	38	10	1507	1509	2	0.1	0.4	58.3	41.2				6459	-13	-10	3	1509		23.70
10/22/2013	39	10	1524	1526	2	0.0	0.3	61.8	37.4				6459	-8	-5	3	1523		23.70
10/22/2013	40	10	1540	1542	2	1.5	0.2	59.8	38.5				1374	-15	-11	4	1542		23.70
10/23/2013	41	25	832	835	3	0.1	0.0	55.9	44.0				1374	-5	-4	1	835		23.70
10/23/2013	42	23	902	904	2	0.1	0.0	56.4	43.5				3720	-17	-14	3	905		23.70
10/23/2013	43	23	932	934	2	0.4	0.0	56.3	43.3				3720	-13	-8	5	934		23.70
10/23/2013	44	23	1001	1003	2	0.2	0.0	58.2	41.6				3720	-7	-4	3	1004		23.70
10/23/2013	45	23	1035	1037	2	2.9	0.1	56.8	40.2				1358	-13	-10	3	1038		23.70
10/22/2013	46	10	1558	1600	2	0.3	0.2	58.9	40.6				1374	-9	-6	3	1600		23.70
10/23/2013	47	23	1232	1232	2	2.6	0.2	57.3	39.9				3582	-8	-5	3	1232		23.70
10/23/2013	48	23	1200	1200	2	2.3	0.1	58.3	39.3				3582	-15	-10	5	1200		23.70
10/23/2013	49	23	1129	1129	2	0.1	0.1	57.0	42.8				1358	-7	-5	2	1129		23.70
10/23/2013	50	23	1104	1104	2	1.1	0.0	58.4	40.5				1358	-8	-7	1	1104		23.7

Cornerstone Environmental Group, LLC
Tier 2 Sampling Log

LANDFILL NAME: Cinder Lake Landfill
CLIENT: City of Flagstaff
CLIENT FIELD REP: Craig Young
PROJECT START DATE: 21-Oct-13

Meter: GEM 2000
Probe: Stainless Steel Sampling Rod
Flowmeter: Sample Train Rotameter
Vac. Gauge: Sample Train Gauge
Sample Tech: Craig Young

DATE	SAMPLE NO.	PRESAMPLING SYSTEM PURGE (<500ml/min.) START (Time)	END (Time)	AMOUNT (Time)	FIELD GAS ANALYSIS (VIA GEM 2000) <20% N2	<5% O2	CH4	CO2	SAMPLE TRAIN LEAK CHECK START PRESSURE (inHg)	END PRESSURE (inHg)	CHANGE	SAMPLE COLLECTION SUMMA CANNISTER (<500ml/min) I.D.	INITIAL PRESSURE (inHg)	FINAL PRESSURE (inHg)	AMOUNT (inHg)	SAMPLE START TIME	Outside TEMP. (F)	Barometric Pressure
10/21	1	9:35	9:40	11	2.0	0.0	1.4	36.6	~~-7~~	~~-11~~	~~4~~	5413	-17	-11	6	10:02		23.65
10/21	2	10:29	10:31	2	0.1	0.0	57.5	42.5				5413	-11	-7	4	10:32		
10/21	3	10:50	10:52	2	0.1	0.0	58.2	41.7	5416	-18		~~5413~~	-6 18	-13	5	10:59		
10/21	4	11:27	11:29	2	0.2	0.0	62.0	37.8				5416	-11	-8	3	11:30		
	5	11:46	11:49	3	0.2	0.0	67.5	32.3				5416	-7	-5	2	11:50		
	6	12:10	12:12	2	0.1	0.0	61.9	38.0				1305	-15	-8	7	12:13		
	7	12:30	12:32	2	0.5	0.0	60.4	38.1				1305	-8	-5	3	12:32		
	8	13:12	13:14	2	0.2	0.1	60.0	39.7			3143	~~1305~~	-17	-15	2	13:17		
	9	13:39	13:41	2	0.2	0.2	56.9	42.7				3143	-14	-12	2	13:41		
	10	13:56	13:58	2	0.1	0.1	56.8	43.0				3143	-9	-6	3	13:59		
	11	14:13	14:15	2	0.2	0.1	58.7	41.1				1370	-16	-12	4	14:16		
	12	14:31	14:33	2	0.1	0.1	58.6	41.2				1370	-11	-10	1	14:33		
	13	14:49	14:51	2	1.0	0.1	62.1	36.8				1370	-8	-7	1	14:52		
	14	15:22	15:24	2	1.1	0.0	62.0	36.9				GL0167	-14	-11	3	15:25		
	15	15:41	15:43	2	0.1	0.2	56.2	43.5				GL0167	-8	-6	2	15:43		
	16	15:53	15:55	2	0.2	0.1	57.8	41.9				GL0167	-6	-5	1	15:56		
	17	16:10	16:12	2	0.1	0.1	58.3	41.5				3619	-17	-13	4	16:12		
	18	16:34	16:36	2	0.2	0.1	56.6	43.1				3619	-11	-7	4	16:36		
10/24	19	16:49	16:51	2	0.1	0.1	57.9	41.9				3619	-7	-5	2	16:51		
10/22	20	8:58	9:00	2	22.7	0.0	77.7	42.1	CH4 above upper limit			3624	-16	-13	3	9:02		23.72
	21	9:17	9:18	2	0.2	0.1	58.3	41.4				3624	-13	-11	2	9:20		
	22	9:35	9:37	2	0.2	0.0	58.2	41.6				3624	-9	-6	3	9:36		
	23	9:53	9:55	2	0.1	0.0	58.2	41.7				1383	-18	-15	3	9:54		
	24	10:07	10:10	3	0.1	0.2	58.0	41.9				1383	-13	-10	3	10:11		
	25	10:24	10:26	2	0.2	0.0	58.7	41.1				1383	-9	-6	3	10:27		

2min
3min
2min
2min

Cornerstone Environmental Group, LLC
Tier 2 Sampling Log

LANDFILL NAME: Cinder Lake Landfill
CLIENT: City of Flagstaff
CLIENT FIELD REP: Craig Young
PROJECT START DATE: 21-Oct-13

Meter: GEM 2000
Probe: Stainless Steel Sampling Rod
Flowmeter: Sample Train Rotameter
Vac. Gauge: Sample Train Gauge
Sample Tech: Craig Young

		PRESAMPLING SYSTEM PURGE (<500ml/min.)			FIELD GAS ANALYSIS (VIA GEM 2000)				SAMPLE TRAIN LEAK CHECK			SAMPLE COLLECTION SUMMA CANNISTER (<500ml/min)						
DATE	SAMPLE NO.	START (Time)	END (Time)	AMOUNT (Time)	<20% N2	<5% O2	CH4	CO2	START PRESSURE (inHg)	END PRESSURE (inHg)	CHANGE	I.D.	INITIAL PRESSURE (inHg)	FINAL PRESSURE (inHg)	AMOUNT (inHg)	SAMPLE START TIME	Outside TEMP. (F)	Barometric Pressure
10/22	26	10:42	10:44	2	1.2	0.0	58.1	40.7				1416	-17	-15	2	10:45		23.70
	27	11:01	11:03	2	1.9	0.1	60.1	37.9				1416	-13	-10	3	11:04		
	28	11:20	11:22	2	1.8	0.0	58.0	40.2				1416	-8	-5	3	11:22		
	29	11:56	11:58	2	1.3	0.1	59.0	39.6				1447	-13	-11	2	11:58		
	30	12:12	12:14	2	0.1	0.2	59.4	40.3				1447	-10	-8	2	12:13		
	31	12:31	12:33	2	0.3	0.2	57.8	41.7				1447	-7	-5	2	12:33		
	32	12:47	12:49	2	1.4	0.3	58.7	39.6				3105	-16	-13	3	12:48		
	33	13:06	13:08	2	0.3	0.1	61.0	38.6				3105	-11	-9	2	13:08		
	34	13:43	13:45	2	0.3	0.3	60.5	38.9			1168	~~3105~~	-15	-13	2	13:49		
	35	14:01	14:03	2	0.2	0.2	58.7	40.9				1168	-13	-10	3	14:03		
	36	14:21	14:23	2	1.4	0.3	58.5	39.8				1168	-8	-6	2	14:23		
	37	14:44	14:46	2	0.2	0.3	57.2	42.3				6459	-17	-15	2	14:47		
	38	15:07	15:09	2	0.1	0.4	58.3	41.2				6459	-13	-10	3	15:09		
	39	15:24	15:26	2	0.0	0.3	61.8	37.9				6459	-8	-5	3	15:20		
	40	15:40	15:42	2	1.5	0.2	59.8	38.5				1374	-15	-11	4	15:42		
10/23	41	08:32	08:35	3	0.1	0.0	55.9	44.0			1374	~~1374~~	-5	-4	1	08:35		
	42	0902	09:04	2	0.1	0.0	56.4	43.5				3720	-17	-14	3	09:05		
	43	09:32	09:34	2	0.4	0.0	56.3	43.3				3720	-13	-8	5	09:34		
	44	10:01	10:03	2	0.2	0.0	58.2	41.6				3720	-7	-4	3	10:04		
	45	10:35	10:37	2	2.9	0.1	56.8	40.2				1358	-13	-10	3	10:38		
10/22	46	15:58	16:00	2	0.3	0.2	58.9	40.6				1374	-9	-6	3	16:00		
10/23	47	12:30	12:32	2	2.6	0.2	57.3	39.9				3582	-8	-5	3	12:32		
	48	11:58	12:00	2	2.3	0.1	58.3	39.3				3582	-15	-10	5	12:02		
	49	11:27	11:29	2	0.1	0.1	57.0	42.8				1358	-7	-5	2	11:30		
	50	11:02	11:04	2	1.1	0.0	58.4	40.5				1358	-8	-7	1	11:04		

Client Name: City of Flagstaff Project Name: Cinder Lake Landfill
Subject: Tier 2 Testing

CORNERSTONE Environmental Group, LLC

Designed By: CWY Date: 10/23/13 Checked By: _____ Date: _____ Sheet No. _____ of _____

Site 1	Start 9:30		10 Ft		
Sampled	10:02-10:04				
Canister	5413				
Site 2	10:25 - 10:40	Canister 5413		10 Ft	
Site 3	10:40 - 11:05	Switched To	5416	10 Ft	
Site 4	11:05 - 11:35	5416	10 Ft		
Site 5	11:40 - 12:00	546	10 Ft		
		1305	10 Ft		
Site 6	12:00 - 12:20				
Site 7	12:25 - 12:55	1305	15 Ft		
Site 8	13:00 - 13:25	3143	10 Ft	- Not pulling gas pulled probe up 4 Ft and got gas	
Site 9	13:30 - 13:50	3143	10 Ft		
Site 10	13:50 - 14:10	3133	10 Ft		
Site 11	14:10 - 14:20	1370	10 Ft		
Site 12	14:25 - 14:40	1370	10 Ft		
Site 13	14:45 - 14:55	1370	10 Ft		

Client Name: City of Flagstaff Project Name: Cinder Lake Landfill

Subject: Tier 2 Testing

CORNERSTONE Environmental Group, LLC

Designed By: CWY Date: 10/21/13 Checked By: _____ Date: _____ Sheet No. _____ of _____

Site 14	15:00 - 15:35		GL0167	10Ft	wet waste pulled up 4 Ft
					Relocated due to wet waste and gas quality ≈ 40 Ft North
Site 15	15:35 - ~~15:00~~ 15:50		GL0167	10 Ft	
Site 16	~~16:05~~ 15:50 - 16:05		GL0167	10Ft	
Site 17	16:05 - 16:15		3619	10Ft	
Site 18	16:20 - 16:40		3619	10Ft	
Site 19	16:40 - 17:00		3619	10 Ft	
	Done For Day 10/21/13				

Client Name: City of Flagstaff Project Name: Cinder Lake Landfill
Subject: Tier 2 Testing

CORNERSTONE Environmental Group, LLC

Designed By: CWY Date: 10/22/13 Checked By: _____ Date: _____ Sheet No. _____ of _____

8:15	starting at site 20				
site 20		8:15 - 9:05	3624	10 Ft.	GEM reading >>.> CHy saying above detectable limits
Recalibrated GEM using 50% CH4. Still read >>.> CHy. Took sample. O_2 read was 0.0% CO_2 42.1%					
site 21		9:10 - 9:25	3624	10 Ft	
site 22		9:25 - 9:45	3624	10 Ft	
site 23		9:50 - 10:00	1383	10 Ft	
site 24		10:00 - 10:15	1383	10 Ft	
site 25		10:15 - 10:35	1383	10 Ft	
site 26	10:35	- 10:50	1416	10 Ft	
site 27	10:50	- 11:05	1416	10 Ft	
site 28	11:10	- 11:30	1416	10 Ft	
site 29	11:35	- 12:05	1447	10 Ft	
site 30		12:10 - 12:25	1447	10 Ft	

Client Name: City of Flagstaff Project Name: Cinder Lake LF

Subject: Tier 2 analysis

CORNERSTONE Environmental Group, LLC

Designed By: CWY Date: 10/22/13 Checked By: _____ Date: _____ Sheet No. 2 of _____

Site 31	12:30 - 12:40	~~3105~~ 1447	10 Ft		
Site 32	12:40 - 13:00	3105	10 Ft		
Site 33	13:00 - 13:15	3105	10 Ft	Water in Geoprobe ~~3~~ Ft. Raised probe by 4 ft. Got Good gas.	
Site 34	13:15 - 13:55	~~3105~~ 1168	10 Ft	Driller lost drill bit had to redo hole	
No vacuum when tried 3105 on hole. Switch to canister 1168.					
Site 35	13:55 - 14:10	1168	10 Ft		
Site 36	14:10 - 14:30	1168	10 ft		
Site 37	14:35 - 14:55	6459	10 Ft		
Site 38	15:00 - 15:15	6459	10 ft		
Site 39	15:15 - 15:30	6459	10 ft		
Site 40	15:35 - 15:50	1374	10 ft		
Site 46	15:50 - 16:05	1374	10 ft		

Client Name: City of Flagstaff Project Name: Cinder Lake Landfill
Subject: Tier 2 Testing

CORNERSTONE Environmental Group, LLC

Designed By: CWY Date: 10/23/13 Checked By: _____ Date: _____ Sheet No. _____ of _____

8:00 am at site 41. Calibrated GEM							
Site 41	08:00 - 08:40			1374	25 Ft		
Site 42	08:45 - 09:10			3720	23 Ft Hit hard point. took gas sample. gas was good. Took sample		
Site 43	09:15 - 09:45			3720			
Site 44	09:50 - 10:10			3720	23.5 Ft Hit hard point. driller stopped at that point. Gas was good. Took sample		
Site 45	10:15 - 10:50			1358			
Site 50	10:50 - 11:15			1358	23 Ft hit hard point. driller stopped. Took gas sample. Gas good. Took sample.		
Site 49	11:20 - 11:40			1358			
site 48	11:40 - 12:10			3582			
site 47	12:10 - 12:40			3582			
Finish Work							

CASCADE DRILLING, L.P.
LEADERS IN SAFETY

CASCADE DRILLING DAILY WORK REPORT

PO Box 1184 – Woodinville, WA 98072 – 425-485-8908 # CASCADL91508
13600 SE Ambler Road – Clackamas, OR 97015 – 503-775-4118 #CCB-187984
555 S. Harbor Blvd. – La Habra, CA 90631 – 562-929-8176 #C57-938110
3632 Omec Circle – Rancho Cordova, CA 95742 – 916-638-1169 #C57-938110

CLIENT	Cornerstone	PROJECT NO	U3045	DATE	10-21-13	DAY	Monday
JOB LOCATION	Flagstaff AZ			DIG ALERT #		CD-LP#	

Well # / Bore #	Depth Drilled	DESCRIPTION OF WORK Please explain reasons for Down Time and Standby Time and Shop Time	HOURS Start	HOURS Stop	Total Hrs	Charge Hrs
		AM Shop Time				
		Travel to Site	7:30	8:30	1	
		U45	8:30	9:00	.5	
		Probe to 10' on 18 locations	9:00			
		Probe to 15' on 1 location				
		Re-Probe 3 holes to 10'		5:00	8	
		Travel to Shop	5:00	5:30	.5	
		PM Shop Time				
Total Ft.		TOTAL CHARGEABLE RIG HOURS				

RIG ENGINE HOURS: START _____ STOP _____ TOTAL 10

EQUIPMENT

DRILL RIG #	U1382	COMPRESSOR/JACKHAMMER	
SUPPORT TRUCK #		SNOW FENCE RENTAL	
SUPPORT TRUCK #		CONTINUOUS SAMPLER	
TRAILER #		CONTINUOUS SAMPLER FOOTAGE	
BOBCAT		# OF CORE CUTS	
AUTO HAMMER		# OF BULLDOG CUTS	
GROUT MIXER		# OF SERVICE RUNS	
GROUT PUMP		# OF SAW CUTS	
PERISTALTIC PUMP		PORTABLE RESTROOM	
FORKLIFT/HOPPER			

LABOR

CREW WITH PER DIEM: 1 — CHARGEABLE EXTRA LABOR HRS:

NAME	SIGNATURE	SHOP	DRILL	TOTAL HRS
Ben Hansen	Ben Hansen			10

CASING

TYPE ___ SLOT ___	2	4	
20' SCREEN			
10' SCREEN			
5' SCREEN			
20' BLANK			
10' BLANK			
5' BLANK			
5' PP SCREEN			
10' PP SCREEN			
SLIP CAP			
THREADED CAPS			
LOCKING CAPS			
DRIVE SHOE			
CENTRALIZERS			
LOCKS			

UTILITIES FOUND OR HIT

MATERIALS

ITEM	QTY	ITEM	QTY
SAND		WELL COVER 8"	
READYMIX		WELL COVER 12"	
QUICKSET		MONUMENT CASING	
PORTLAND		BOLLARDS	
ASPHALT		DRUMS	
BENTONITE GROUT		HOLE COVER PLATES	
BENTONITE CHIPS		PLASTIC SHEETING	
BENTONITE POWDER		TRAFFIC CONTROL	
BENTONITE PELLETS		CORE BOXES	
BENTONITE GRANULAR		PLYWOOD	
SAMPLER TUBES 4"	346'	WATER SAMPLES	
SHELBY TUBES		HYDROPUNCH SAMPLES	
PROBE POINTS "		AUGER PLUGS	
GW PROBE POINTS	22	DRILL OUT BITS	
MACRO LINERS			
SAMPLER SHOE			

REMARKS

Client Signature Craig Jones — Operator Signature Ben Hansen

CASCADE DRILLING, L.P.
LEADERS IN SAFETY

CASCADE DRILLING DAILY WORK REPORT

PO Box 1184 – Woodinville, WA 98072 – 425-485-8908 # CASCADL91508
13600 SE Ambler Road – Clackamas, OR 97015 – 503-775-4118 #CCB-187984
555 S. Harbor Blvd. – La Habra, CA 90631 – 562-929-8176 #C57-938110
3632 Omec Circle – Rancho Cordova, CA 95742 – 916-638-1169 #C57-938110

CLIENT	Cornerstone	PROJECT NO	4 3045	DATE	10-22-13	DAY	Tue
JOB LOCATION	Flagstaff AZ			DIG ALERT #		CD-LP#	

Well # / Bore #	Depth Drilled	DESCRIPTION OF WORK (Please explain reasons for Down Time and Standby Time and Shop Time)	HOURS Start	HOURS Stop	Total Hrs	Charge Hrs
		AM Shop Time				
		Travel to Site	6:30	7:00	.5	
		H/S	7:00	7:30	.5	
		Probe 22 locations & take soil gas samples	7:30	4:30	9	
		Travel to Shop	4:30	5:00	.5	
		PM Shop Time				
Total Ft.		TOTAL CHARGEABLE RIG HOURS				

RIG ENGINE HOURS: START ____ STOP ____ TOTAL 10.5

EQUIPMENT

DRILL RIG #	4138	COMPRESSOR/JACKHAMMER	
SUPPORT TRUCK #		SNOW FENCE RENTAL	
SUPPORT TRUCK #		CONTINUOUS SAMPLER	
TRAILER #		CONTINUOUS SAMPLER FOOTAGE	
BOBCAT		# OF CORE CUTS	
AUTO HAMMER		# OF BULLDOG CUTS	
GROUT MIXER		# OF SERVICE RUNS	
GROUT PUMP		# OF SAW CUTS	
PERISTALTIC PUMP		PORTABLE RESTROOM	
FORKLIFT/HOPPER			

LABOR

CREW WITH PER DIEM: 1 — CHARGEABLE EXTRA LABOR HRS:

NAME	SIGNATURE	SHOP	DRILL	TOTAL HRS
Dan Hansen	Dan			10.5

CASING

TYPE SLOT	2	4	
20' SCREEN			
10' SCREEN			
5' SCREEN			
20' BLANK			
10' BLANK			
5' BLANK			
5' PP SCREEN			
10' PP SCREEN			
SLIP CAP			
THREADED CAPS			
LOCKING CAPS			
DRIVE SHOE			
CENTRALIZERS			
LOCKS			

UTILITIES FOUND OR HIT:

MATERIALS

ITEM	QTY	ITEM	QTY
SAND		WELL COVER 8"	
READYMIX		WELL COVER 12"	
QUICKSET		MONUMENT CASING	
PORTLAND		BOLLARDS	
ASPHALT		DRUMS	
BENTONITE GROUT		HOLE COVER PLATES	
BENTONITE CHIPS		PLASTIC SHEETING	
BENTONITE POWDER		TRAFFIC CONTROL	
BENTONITE PELLETS		CORE BOXES	
BENTONITE GRANULAR		PLYWOOD	
SAMPLER TUBES 4	3	WATER SAMPLES	
SHELBY TUBES		HYDROPUNCH SAMPLES	
PROBE POINTS "		AUGER PLUGS	
GW PROBE POINTS	35	DRILL OUT BITS	
MACRO LINERS			
SAMPLER SHOE			

REMARKS

Client Signature _____ Operator Signature _____

CASCADE DRILLING, L.P.
LEADERS IN SAFETY

CASCADE DRILLING DAILY WORK REPORT

PO Box 1184 – Woodinville, WA 98072 – 425-485-8908 # CASCADL91508
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3632 Omec Circle – Rancho Cordova, CA 95742 – 916-638-1169 #C57-938110

CLIENT	Cornerstone	PROJECT NO	U 3045	DATE	10-23-15	DAY	Wed
JOB LOCATION	Flagstaff AZ	DIG ALERT #		CD-LP#			

Well # / Bore #	Depth Drilled	DESCRIPTION OF WORK (Please explain reasons for Down Time and Standby Time and Shop Time)	HOURS Start	HOURS Stop	Total Hrs	Charge Hrs
		AM Shop Time				
		Travel to Site	6:30	7:00	.5	
		H&S	7:00	7:30	.5	
		Probe 9 holes to 25' collect vapor sample	7:30			
		Probe 1 hole to 10'		1:00	5.5	
		Travel to Shop Hotel	1:00	1:30	.5	
		PM Shop Time 1 hour to clean rods at shop			1	
Total Ft.		TOTAL CHARGEABLE RIG HOURS				

RIG ENGINE HOURS: START _____ STOP _____ TOTAL 8

EQUIPMENT

DRILL RIG #	U 1382	COMPRESSOR/JACKHAMMER	
SUPPORT TRUCK #		SNOW FENCE RENTAL	
SUPPORT TRUCK #		CONTINUOUS SAMPLER	
TRAILER #		CONTINUOUS SAMPLER FOOTAGE	
BOBCAT		# OF CORE CUTS	
AUTO HAMMER		# OF BULLDOG CUTS	
GROUT MIXER		# OF SERVICE RUNS	
GROUT PUMP		# OF SAW CUTS	
PERISTALTIC PUMP		PORTABLE RESTROOM	
FORKLIFT/HOPPER			

LABOR

CREW WITH PER DIEM: 1 — CHARGEABLE EXTRA LABOR HRS:

NAME	SIGNATURE	SHOP	DRILL	TOTAL HRS
Dan Warner	Dan W			8

CASING

TYPE SLOT	2	4	
20' SCREEN			
10' SCREEN			
5' SCREEN			
20' BLANK			
10' BLANK			
5' BLANK			
5' PP SCREEN			
10' PP SCREEN			
SLIP CAP			
THREADED CAPS			
LOCKING CAPS			
DRIVE SHOE			
CENTRALIZERS			
LOCKS			

UTILITIES FOUND OR HIT: 1½" x 5' rod 4

MATERIALS

ITEM	QTY	ITEM	QTY
SAND		WELL COVER 8"	
READYMIX		WELL COVER 12"	
QUICKSET		MONUMENT CASING	
PORTLAND		BOLLARDS	
ASPHALT		DRUMS	
BENTONITE GROUT		HOLE COVER PLATES	
BENTONITE CHIPS		PLASTIC SHEETING	
BENTONITE POWDER		TRAFFIC CONTROL	
BENTONITE PELLETS		CORE BOXES	
BENTONITE GRANULAR		PLYWOOD	
SAMPLER TUBES: 1.5"	200'	WATER SAMPLES	
SHELBY TUBES		HYDROPUNCH SAMPLES	
PROBE POINTS "		AUGER PLUGS	
GW PROBE POINTS	10	DRILL OUT BITS	
MACRO LINERS			
SAMPLER SHOE			

REMARKS

Client Signature _____ Operator Signature Dan W

APPENDIX B

LABORATORY RESULTS

Air TECHNOLOGY Laboratories, Inc.

November 7, 2013

ACLASS Accredited DoD ELAP
ADE-1461
EPA Methods TO-3, TO14A,TO15 SIM & Scan, ASTM D1946

nelac
LA Cert 04140
EPA Methods TO3, TO14A, TO15, 25C/3C, RSK-175
TX Cert T104704450-09-TX
EPA Methods TO14A, TO15

Cornerstone Environmental Group
ATTN: Scott Johnson
2726 E. Hillery Dr.
Phoenix, AZ 85032

LABORATORY TEST RESULTS

Project Reference: Cinder Lake Landfill; 130674-004
Lab Number: E102503-01/18

Enclosed are results for sample(s) received 10/25/13 by Air Technology Laboratories. Analyses were performed according to specifications on the chain of custody provided with the sample(s).

Report Narrative:

- Unless otherwise noted in the report, sample analyses were performed within method performance criteria and meet all requirements of the NELAC Standards.
- The enclosed results relate only to the sample(s).

Preliminary results were e-mailed to Scott Johnson on 11/06/13 and 11/07/13.

ATL appreciates the opportunity to provide testing services to your company. If you have any questions regarding these results, please call me at (626) 964-4032.

Sincerely,

Mark Johnson
Operations Manager
MJohnson@AirTechLabs.com

Note: The cover letter is an integral part of this analytical report.

CHAIN OF CUSTODY RECORD

AirTECHNOLOGY Laboratories, Inc.

18501 E. Gale Ave., Suite 130
City of Industry, CA 91748
Ph: 626-964-4032
Fx: 626-964-5832

TURNAROUND TIME			DELIVERABLES	PAGE: OF
Standard ☒	48 hours ☐		EDD ☐	Condition upon receipt:
Same Day ☐	72 hours ☐		EDF ☐	Sealed Yes ☐ No ☐
24 hours ☐	96 hours ☐		LEVEL 3 ☐	Intact Yes ☐ No ☐
Other:			LEVEL 4 ☐	Chilled _____ deg C

Project No.:
Project Name: Cinder Lake LandFill
Report To: Scott Johnson
Company: Cornerstone
Street: 17 W. Wetmore Rd Ste 310
City/State/Zip: Tucson, AZ 85705
Phone& Fax: 520-888-4800 / 520-888-4804
e-mail: scott.johnson@cornerstoneeg.com

BILLING
P.O. No.:
Bill to:

ANALYSIS REQUEST

LAB USE ONLY	SAMPLE IDENTIFICATION	SAMPLE DATE	SAMPLE TIME	MATRIX	CONTAINER TYPE	Method 25C/3C (Entech 3)					
E102503-01	CLLF 1 - 5413	10/21/13	10:02	LF gas	Summa	X					
-02	CLLF 2 - 5416	10/21/13	11:00	LF gas	Summa	X					
-03	CLLF 3 - 1305	10/21/13	12:13	LF gas	Summa	X					
-04	CLLF 4 - 3143	10/21/13	13:17	LF gas	Summa	X					
-05	CLLF 5 - 1370	10/21/13	14:16	LF gas	Summa	X					
-06	CLLF 6 - GL0167	10/21/13	15:25	LF gas	Summa	X					
-07	CLLF 7 - 3619	10/21/13	16:12	LF gas	Summa	X					
-08	CLLF 8 - 3624	10/22/13	09:02	LF gas	Summa	X					
-09	CLLF 9 - 1383	10/22/13	09:54	LF gas	Summa	X					
-10	CLLF 10 - 1416	10/22/13	10:45	LF gas	Summa	X					

AUTHORIZATION TO PERFORM WORK: Craig Young - Craig Young	COMPANY: Cornerstone	DATE/TIME: 10/23/13	
SAMPLED BY: Craig Young Craig Young	COMPANY: Cornerstone	DATE/TIME: 10/21-22/13	
RELINQUISHED BY: Craig Young	DATE/TIME: 10/23/13	RECEIVED BY	DATE/TIME
RELINQUISHED BY: FedEx	DATE/TIME: 10/25/13 1058	RECEIVED BY: [signature]	DATE/TIME: 10/25/13 1058
RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME

METHOD OF TRANSPORT (circle one): Walk-In FedEx UPS Courier ATLI Other _____

COMMENTS

*NOTE: CORRECTION TO PO # VIA TELECON WITH CRAIG YOUNG 10/28/13 10:33 SRO

DISTRIBUTION: White & Yellow - Lab Copies / Pink - Customer Copy

Preservation: **H**=HCL **N**=None / Container: **B**=Bag **C**=Can **V**=VOA **O**=Other

Rev. 03 - 5/7/09

AirTECHNOLOGY Laboratories, Inc.

18501 E. Gale Ave., Suite 130
City of Industry, CA 91748
Ph: 626-964-4032
Fx: 626-964-5832

CHAIN OF CUSTODY RECORD

TURNAROUND TIME
Standard ☒ 48 hours ☐
Same Day ☐ 72 hours ☐
24 hours ☐ 96 hours ☐
Other:

DELIVERABLES
EDD ☐
EDF ☐
LEVEL 3 ☐
LEVEL 4 ☐

PAGE: OF

Condition upon receipt:
Sealed Yes ☐ No ☐
Intact Yes ☐ No ☐
Chilled _____ deg C

Project No.:
Project Name: Cinder Lake LandFill
Report To: Scott Johnson
Company: Cornerstone
Street: 17 W. Wetmore Rd ste 310
City/State/Zip: Tucson, AZ 85705
Phone& Fax: 520-888-4800 / 520-888-4804
e-mail: Scott.johnson@cornerstoneeg.com

BILLING
P.O. No.:
Bill to:

ANALYSIS REQUEST
Method 25C/3C

LAB USE ONLY	SAMPLE IDENTIFICATION	SAMPLE DATE	SAMPLE TIME	MATRIX	CONTAINER TYPE	Method 25C/3C					
E102503-11	CLLF 11 - 1447	10/22/13	11:58	LF Gas	Summa	X					
-12	CLLF 12 - 3105	10/22/13	12:48	LF Gas	Summa	X					
-13	CLLF 13 - 1168	10/22/13	13:49	LF Gas	Summa	X					
-14	CLLF 14 - 6459	10/22/13	14:47	LF Gas	Summa	X					
-15	CLLF 15 - 1374	10/22/13	15:42	LF Gas	Summa	X					
-16	CLLF 16 - 3720	10/23/13	09:05	LF Gas	Summa	X					
-17	CLLF 17 - 1358	10/23/13	10:38	LF Gas	Summa	X					
-18	CLLF 18 - 3582	10/23/13	12:02	LF Gas	Summa	X					

AUTHORIZATION TO PERFORM WORK: Craig Young	COMPANY: Cornerstone	DATE/TIME: 10/23/13	
SAMPLED BY: Craig Young	COMPANY: Cornerstone	DATE/TIME: 10/23/13	
RELINQUISHED BY: Craig Young Craig Young	DATE/TIME: 10/23/13	RECEIVED BY	DATE/TIME
RELINQUISHED BY: FedEx	DATE/TIME: 10/25/13 1058	RECEIVED BY: [signature]	DATE/TIME: 10/25/13 1058
RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME

METHOD OF TRANSPORT (circle one): Walk-in FedEx UPS Courier ATLI Other _____

COMMENTS

DISTRIBUTION: White & Yellow - Lab Copies / Pink - Customer Copy

Preservation: **H**=HCL **N**=None / Container: **B**=Bag **C**=Can **V**=VOA **O**=Other

Client: Cornerstone Environmental Group
Attn: Scott Johnson

Project Name: Cinder Lake Landfill
Project Number: NA
Date Received: 10/25/2013
Matrix: Vapor

TNMOC by EPA METHOD 25C
Fixed Gases by EPA METHOD 3C

Lab Number:			E102503-01		E102503-02		E102503-03		E102503-04		E102503-05	
Client Sample ID:			CLLF 1 - 5413		CLLF 2 - 5416		CLLF 3 - 1305		CLLF 4 - 3143		CLLF 5 - 1370	
Date Collected:			10/21/2013		10/21/2013		10/21/2013		10/21/2013		10/21/2013	
Date Analyzed:			11/4/2013		11/4/2013		11/4/2013		11/4/2013		11/5/2013	
Analyst Initials:			AS		AS		AS		AS		AS	
QC Batch:			131104GC8A1		131104GC8A1		131104GC8A1		131104GC8A1		131104GC8A1	
Dilution Factor:			3.2		3.2		3.2		3.2		3.5	
ANALYTE	Units	PQL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL
TNMOC	ppmv C	10	600	32	480	32	390	32	1,500	32	810	35
TNMOC uncorr*	ppmv C	10	560	32	450	32	310	32	1,400	32	780	35
Nitrogen	% v/v	1.0	ND	3.2	ND	3.2	14	3.2	ND	3.2	ND	3.5
Oxygen	% v/v	0.50	ND	1.6	ND	1.6	4.0	1.6	ND	1.6	ND	1.7

ND = Not detected at or above reporting limit.
PQL = Practical Quantitation Limit.
TNMOC = Total Non-Methane Organic Carbon.
TNMOC uncorr* = TNMOC concentration in sample without nitrogen/moisture correction.
NA = Nitrogen/moisture correction causes division by zero.

Reviewed/Approved By: _____ Date: 11-6-13

Mark Johnson
Operations Manager

The cover letter is an integral part of this analytical report.

Client: Cornerstone Environmental Group
Attn: Scott Johnson

Project Name: Cinder Lake Landfill
Project Number: NA
Date Received: 10/25/2013
Matrix: Vapor

TNMOC by EPA METHOD 25C
Fixed Gases by EPA METHOD 3C

Lab Number:			E102503-06		E102503-07		E102503-08		E102503-09		E102503-10	
Client Sample ID:			CLLF 6 - GLO167		CLLF 7 - 3619		CLLF 8 - 3624		CLLF 9 - 1383		CLLF 10 - 1416	
Date Collected:			10/21/2013		10/21/2013		10/22/2013		10/22/2013		10/22/2013	
Date Analyzed:			11/5/2013		11/5/2013		11/5/2013		11/5/2013		11/5/2013	
Analyst Initials:			AS		AS		AS		AS		AS	
QC Batch:			131104GC8A1		131105GC8A1		131105GC8A1		131105GC8A1		131105GC8A1	
Dilution Factor:			3.2		3.2		3.4		3.4		3.2	
ANALYTE	Units	PQL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL
TNMOC	ppmv C	10	410	32	550	32	25,000	34	1,500	34	400	32
TNMOC uncorr*	ppmv C	10	380	32	260	32	24,000	34	1,400	34	380	32
Nitrogen	% v/v	1.0	ND	3.2	39	3.2	ND	3.4	ND	3.4	ND	3.2
Oxygen	% v/v	0.50	ND	1.6	11	1.6	ND	1.7	ND	1.7	ND	1.6

ND = Not detected at or above reporting limit.
PQL = Practical Quantitation Limit.
TNMOC = Total Non-Methane Organic Carbon.
TNMOC uncorr* = TNMOC concentration in sample without nitrogen/moisture correction.
NA = Nitrogen/moisture correction causes division by zero.

Reviewed/Approved By: _____ Date: 11-6-13

Mark Johnson
Operations Manager

The cover letter is an integral part of this analytical report.

Client: Cornerstone Environmental Group
Attn: Scott Johnson

Project Name: Cinder Lake Landfill
Project Number: NA
Date Received: 10/25/2013
Matrix: Vapor

TNMOC by EPA METHOD 25C
Fixed Gases by EPA METHOD 3C

Lab Number:			E102503-11		E102503-12		E102503-13		E102503-14		E102503-15	
Client Sample ID:			CLLF 11 - 1447		CLLF 12 - 3105		CLLF 13 - 1168		CLLF 14 - 6459		CLLF 15 - 1374	
Date Collected:			10/22/2013		10/22/2013		10/22/2013		10/22/2013		10/22/2013	
Date Analyzed:			11/5/2013		11/6/2013		11/6/2013		11/6/2013		11/6/2013	
Analyst Initials:			AS		AS		AS		AS		AS	
QC Batch:			131105GC8A1		131106GC8A1		131105GC8A1		131105GC8A1		131105GC8A1	
Dilution Factor:			3.2		3.2		3.3		3.2		3.2	
ANALYTE	Units	PQL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL
TNMOC	ppmv C	10	1,600	32	1,200	32	1,400	33	2,400	32	740	32
TNMOC uncorr*	ppmv C	10	1,600	32	860	32	1,300	33	2,300	32	690	32
Nitrogen	% v/v	1.0	ND	3.2	20	3.2	ND	3.3	ND	3.2	ND	3.2
Oxygen	% v/v	0.50	ND	1.6	5.6	1.6	ND	1.6	ND	1.6	ND	1.6

ND = Not detected at or above reporting limit.
PQL = Practical Quantitation Limit.
TNMOC = Total Non-Methane Organic Carbon.
TNMOC uncorr* = TNMOC concentration in sample without nitrogen/moisture correction.
NA = Nitrogen/moisture correction causes division by zero.

Reviewed/Approved By: _____ Date: 11-7-13

Mark Johnson
Operations Manager

The cover letter is an integral part of this analytical report.

Client: Cornerstone Environmental Group
Attn: Scott Johnson

Project Name: Cinder Lake Landfill
Project Number: NA
Date Received: 10/25/2013
Matrix: Vapor

TNMOC by EPA METHOD 25C
Fixed Gases by EPA METHOD 3C

Lab Number:			E102503-16		E102503-17		E102503-18					
Client Sample ID:			CLLF 16 - 3720		CLLF 17 - 1358		CLLF 18 - 3582					
Date Collected:			10/23/2013		10/23/2013		10/23/2013					
Date Analyzed:			11/6/2013		11/6/2013		11/7/2013					
Analyst Initials:			AS		AS		AS					
QC Batch:			131106GC8A1		131106GC8A1		131106GC8A1					
Dilution Factor:			3.4		3.3		3.2					
ANALYTE	Units	PQL	Result	RL	Result	RL	Result	RL				
TNMOC	ppmv C	10	980	34	1,500	33	710	32				
TNMOC uncorr*	ppmv C	10	930	34	960	33	680	32				
Nitrogen	% v/v	1.0	ND	3.4	26	3.3	ND	3.2				
Oxygen	% v/v	0.50	ND	1.7	7.4	1.6	ND	1.6				

ND = Not detected at or above reporting limit.
PQL = Practical Quantitation Limit.
TNMOC = Total Non-Methane Organic Carbon.
TNMOC uncorr* = TNMOC concentration in sample without nitrogen/moisture correction.
NA = Nitrogen/moisture correction causes division by zero.

Reviewed/Approved By: _____ Date: 11-7-13
Mark Johnson
Operations Manager

The cover letter is an integral part of this analytical report.

APPENDIX C

LANDFILL GAS EMISSIONS MODEL (LANDGEM) RESULTS

Summary Report

Landfill Name or Identifier: City of Flagstaff - Cinder Lake Landfill

Date: Wednesday, December 11, 2013

Description/Comments:

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_{CH4} = 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/landflpg.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 convential 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	**1965**	
Landfill Closure Year (with 80-year limit)	**2044**	
Actual Closure Year (without limit)	***2044***	
Have Model Calculate Closure Year?	**No**	
Waste Design Capacity	**11,205,770**	*megagrams*

MODEL PARAMETERS

Methane Generation Rate, k	**0.020**	*year $^{-1}$*
Potential Methane Generation Capacity, L_o	**170**	*m^3/Mg*
NMOC Concentration	**433**	*ppmv as hexane*
Methane Content	**50**	*% by volume*

GASES / POLLUTANTS SELECTED

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

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
1965	12,976	14,274	0	0
1966	15,781	17,359	12,976	14,274
1967	18,626	20,489	28,757	31,633
1968	21,515	23,666	47,384	52,122
1969	24,447	26,892	68,898	75,788
1970	27,425	30,168	93,345	102,680
1971	30,165	33,182	120,771	132,848
1972	32,936	36,230	150,936	166,030
1973	35,739	39,313	183,873	202,260
1974	38,575	42,432	219,612	241,573
1975	41,443	45,587	258,186	284,005
1976	47,115	51,826	299,629	329,592
1977	52,821	58,103	346,744	381,418
1978	58,564	64,420	399,565	439,521
1979	64,345	70,779	458,128	503,941
1980	70,187	77,206	522,473	574,720
1981	76,007	83,608	592,660	651,926
1982	81,865	90,052	668,667	735,534
1983	87,764	96,540	750,533	825,586
1984	93,703	103,073	838,296	922,126
1985	102,006	112,207	931,999	1,025,199
1986	134,135	147,549	1,034,005	1,137,406
1987	102,182	112,400	1,168,141	1,284,955
1988	105,853	116,438	1,270,323	1,397,355
1989	107,013	117,714	1,376,175	1,513,793
1990	116,026	127,629	1,483,188	1,631,507
1991	135,455	149,000	1,599,215	1,759,136
1992	155,407	170,948	1,734,669	1,908,136
1993	69,014	75,915	1,890,076	2,079,084
1994	114,222	125,644	1,959,090	2,154,999
1995	108,284	119,112	2,073,312	2,280,643
1996	135,665	149,232	2,181,595	2,399,755
1997	120,230	132,253	2,317,261	2,548,987
1998	126,797	139,477	2,437,491	2,681,240
1999	127,729	140,502	2,564,288	2,820,717
2000	106,906	117,597	2,692,017	2,961,219
2001	99,850	109,835	2,798,924	3,078,816
2002	115,136	126,650	2,898,774	3,188,651
2003	107,164	117,880	3,013,910	3,315,301
2004	122,152	134,367	3,121,074	3,433,181

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2005	124,497	136,947	3,243,225	3,567,548
2006	138,395	152,234	3,367,723	3,704,495
2007	143,098	157,408	3,506,117	3,856,729
2008	141,336	155,470	3,649,215	4,014,137
2009	115,445	126,990	3,790,552	4,169,607
2010	122,875	135,162	3,905,997	4,296,597
2011	122,494	134,743	4,028,872	4,431,759
2012	124,497	136,947	4,151,365	4,566,502
2013	128,232	141,055	4,275,863	4,703,449
2014	132,079	145,287	4,404,095	4,844,504
2015	136,042	149,646	4,536,174	4,989,791
2016	140,123	154,135	4,672,215	5,139,437
2017	144,326	158,759	4,812,338	5,293,572
2018	148,655	163,521	4,956,665	5,452,331
2019	153,115	168,427	5,105,320	5,615,852
2020	157,709	173,480	5,258,435	5,784,279
2021	162,440	178,684	5,416,145	5,957,759
2022	167,314	184,045	5,578,585	6,136,443
2023	172,333	189,566	5,745,898	6,320,488
2024	177,503	195,253	5,918,231	6,510,054
2025	182,828	201,111	6,095,734	6,705,307
2026	188,313	207,144	6,278,562	6,906,418
2027	193,963	213,359	6,466,875	7,113,562
2028	199,781	219,759	6,660,837	7,326,921
2029	205,775	226,352	6,860,618	7,546,680
2030	211,948	233,143	7,066,393	7,773,032
2031	218,306	240,137	7,278,341	8,006,175
2032	224,855	247,341	7,496,647	8,246,312
2033	231,601	254,761	7,721,503	8,493,653
2034	238,549	262,404	7,953,104	8,748,414
2035	245,705	270,276	8,191,653	9,010,818
2036	253,077	278,385	8,437,358	9,281,094
2037	260,669	286,736	8,690,435	9,559,479
2038	268,489	295,338	8,951,105	9,846,215
2039	276,544	304,198	9,219,594	10,141,553
2040	284,840	313,324	9,496,137	10,445,751
2041	293,385	322,724	9,780,977	10,759,075
2042	302,187	332,406	10,074,363	11,081,799
2043	311,253	342,378	10,376,550	11,414,205
2044	320,590	352,649	10,687,803	11,756,583

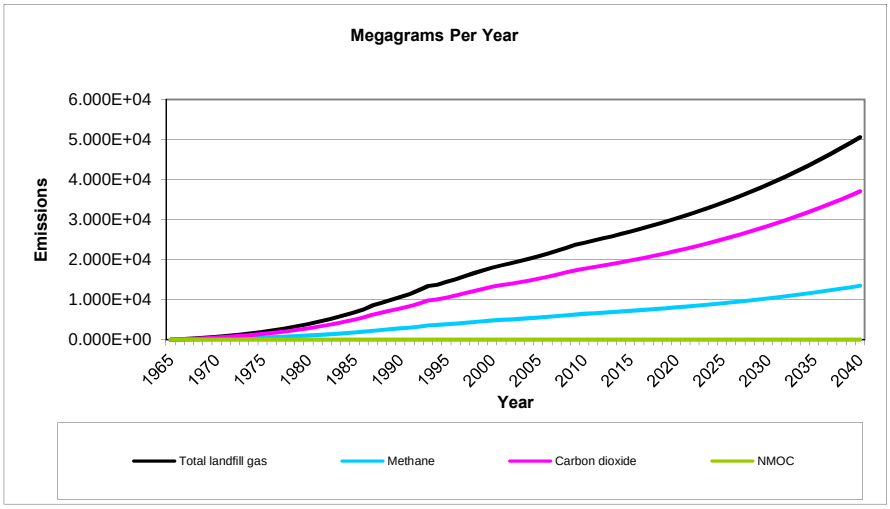
Pollutant Parameters

		Gas / Pollutant Default Parameters:		*User-specified Pollutant Parameters:*	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl chloroform) - HAP	0.48	133.41		
	1,1,2,2-Tetrachloroethane - HAP/VOC	1.1	167.85		
	1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	2.4	98.97		
	1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	0.20	96.94		
	1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	0.41	98.96		
	1,2-Dichloropropane (propylene dichloride) - HAP/VOC	0.18	112.99		
	2-Propanol (isopropyl alcohol) - VOC	50	60.11		
	Acetone	7.0	58.08		
	Acrylonitrile - HAP/VOC	6.3	53.06		
	Benzene - No or Unknown Co-disposal - HAP/VOC	1.9	78.11		
	Benzene - Co-disposal - HAP/VOC	11	78.11		
	Bromodichloromethane - VOC	3.1	163.83		
	Butane - VOC	5.0	58.12		
	Carbon disulfide - HAP/VOC	0.58	76.13		
	Carbon monoxide	140	28.01		
	Carbon tetrachloride - HAP/VOC	4.0E-03	153.84		
	Carbonyl sulfide - HAP/VOC	0.49	60.07		
	Chlorobenzene - HAP/VOC	0.25	112.56		
	Chlorodifluoromethane	1.3	86.47		
	Chloroethane (ethyl chloride) - HAP/VOC	1.3	64.52		
	Chloroform - HAP/VOC	0.03	119.39		
	Chloromethane - VOC	1.2	50.49		
	Dichlorobenzene - (HAP for para isomer/VOC)	0.21	147		
	Dichlorodifluoromethane	16	120.91		
	Dichlorofluoromethane - VOC	2.6	102.92		
	Dichloromethane (methylene chloride) - HAP	14	84.94		
	Dimethyl sulfide (methyl sulfide) - VOC	7.8	62.13		
	Ethane	890	30.07		
	Ethanol - VOC	27	46.08		

Pollutant Parameters (Continued)

		Gas / Pollutant Default Parameters:		*User-specified Pollutant Parameters:*	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Pollutants	Ethyl mercaptan (ethanethiol) - VOC	2.3	62.13		
	Ethylbenzene - HAP/VOC	4.6	106.16		
	Ethylene dibromide - HAP/VOC	1.0E-03	187.88		
	Fluorotrichloromethane - VOC	0.76	137.38		
	Hexane - HAP/VOC	6.6	86.18		
	Hydrogen sulfide	36	34.08		
	Mercury (total) - HAP	2.9E-04	200.61		
	Methyl ethyl ketone - HAP/VOC	7.1	72.11		
	Methyl isobutyl ketone - HAP/VOC	1.9	100.16		
	Methyl mercaptan - VOC	2.5	48.11		
	Pentane - VOC	3.3	72.15		
	Perchloroethylene (tetrachloroethylene) - HAP	3.7	165.83		
	Propane - VOC	11	44.09		
	t-1,2-Dichloroethene - VOC	2.8	96.94		
	Toluene - No or Unknown Co-disposal - HAP/VOC	39	92.13		
	Toluene - Co-disposal - HAP/VOC	170	92.13		
	Trichloroethylene (trichloroethene) - HAP/VOC	2.8	131.40		
	Vinyl chloride - HAP/VOC	7.3	62.50		
	Xylenes - HAP/VOC	12	106.16		

Graphs


Megagrams Per Year
Emissions
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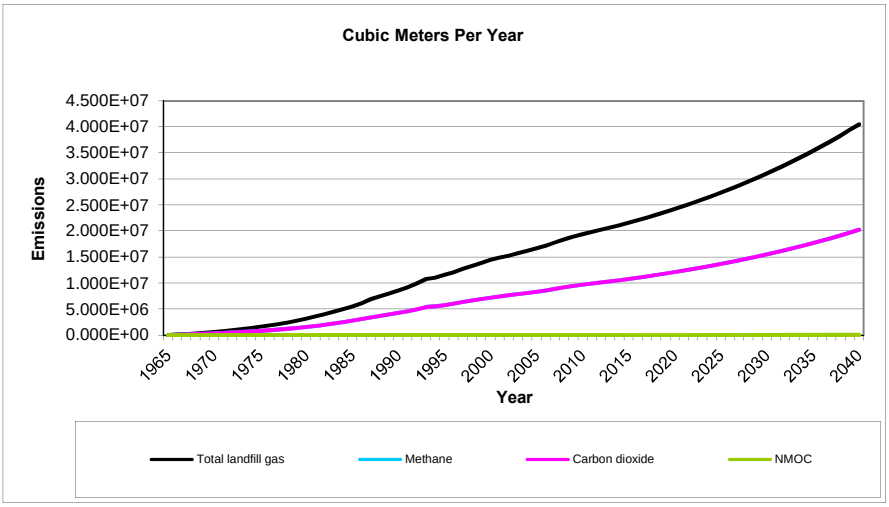
5.000E+04
4.000E+04
3.000E+04
2.000E+04
1.000E+04
0.000E+00
1965 1970 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
Emissions
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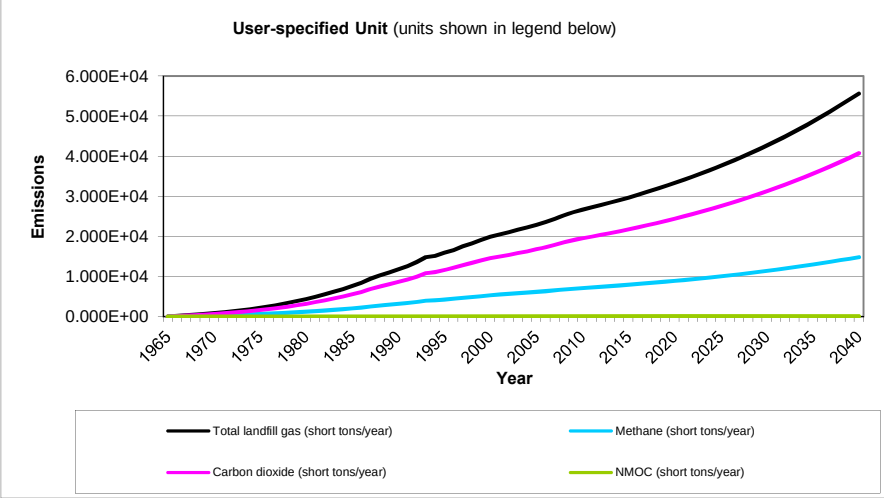
3.000E+07
2.500E+07
2.000E+07
1.500E+07
1.000E+07
5.000E+06
0.000E+00
1965 1970 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
Emissions
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5.000E+04
4.000E+04
3.000E+04
2.000E+04
1.000E+04
0.000E+00
1965 1970 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040
Year
Total landfill gas (short tons/year)
Methane (short tons/year)
Carbon dioxide (short tons/year)
NMOC (short tons/year)

Results

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*
1965	0	0	0	0	0	0
1966	1.092E+02	8.745E+04	1.201E+02	2.917E+01	4.373E+04	3.209E+01
1967	2.399E+02	1.921E+05	2.638E+02	6.407E+01	9.603E+04	7.048E+01
1968	3.919E+02	3.138E+05	4.311E+02	1.047E+02	1.569E+05	1.151E+02
1969	5.652E+02	4.526E+05	6.217E+02	1.510E+02	2.263E+05	1.661E+02
1970	7.597E+02	6.084E+05	8.357E+02	2.029E+02	3.042E+05	2.232E+02
1971	9.755E+02	7.811E+05	1.073E+03	2.606E+02	3.906E+05	2.866E+02
1972	1.210E+03	9.690E+05	1.331E+03	3.232E+02	4.845E+05	3.555E+02
1973	1.463E+03	1.172E+06	1.610E+03	3.909E+02	5.859E+05	4.299E+02
1974	1.735E+03	1.389E+06	1.909E+03	4.635E+02	6.947E+05	5.098E+02
1975	2.025E+03	1.622E+06	2.228E+03	5.410E+02	8.109E+05	5.951E+02
1976	2.334E+03	1.869E+06	2.567E+03	6.235E+02	9.345E+05	6.858E+02
1977	2.684E+03	2.150E+06	2.953E+03	7.170E+02	1.075E+06	7.887E+02
1978	3.076E+03	2.463E+06	3.383E+03	8.216E+02	1.231E+06	9.037E+02
1979	3.508E+03	2.809E+06	3.859E+03	9.370E+02	1.404E+06	1.031E+03
1980	3.980E+03	3.187E+06	4.378E+03	1.063E+03	1.593E+06	1.169E+03
1981	4.492E+03	3.597E+06	4.941E+03	1.200E+03	1.798E+06	1.320E+03
1982	5.042E+03	4.038E+06	5.547E+03	1.347E+03	2.019E+06	1.482E+03
1983	5.632E+03	4.510E+06	6.195E+03	1.504E+03	2.255E+06	1.655E+03
1984	6.259E+03	5.012E+06	6.885E+03	1.672E+03	2.506E+06	1.839E+03
1985	6.923E+03	5.544E+06	7.616E+03	1.849E+03	2.772E+06	2.034E+03
1986	7.645E+03	6.122E+06	8.409E+03	2.042E+03	3.061E+06	2.246E+03
1987	8.622E+03	6.904E+06	9.485E+03	2.303E+03	3.452E+06	2.533E+03
1988	9.312E+03	7.456E+06	1.024E+04	2.487E+03	3.728E+06	2.736E+03
1989	1.002E+04	8.022E+06	1.102E+04	2.676E+03	4.011E+06	2.944E+03
1990	1.072E+04	8.584E+06	1.179E+04	2.863E+03	4.292E+06	3.150E+03
1991	1.148E+04	9.196E+06	1.263E+04	3.068E+03	4.598E+06	3.374E+03
1992	1.240E+04	9.927E+06	1.364E+04	3.311E+03	4.963E+06	3.643E+03
1993	1.346E+04	1.078E+07	1.481E+04	3.595E+03	5.389E+06	3.955E+03
1994	1.377E+04	1.103E+07	1.515E+04	3.679E+03	5.515E+06	4.047E+03
1995	1.446E+04	1.158E+07	1.591E+04	3.863E+03	5.790E+06	4.249E+03
1996	1.509E+04	1.208E+07	1.660E+04	4.030E+03	6.041E+06	4.433E+03
1997	1.593E+04	1.276E+07	1.752E+04	4.255E+03	6.378E+06	4.681E+03
1998	1.663E+04	1.331E+07	1.829E+04	4.441E+03	6.657E+06	4.885E+03
1999	1.736E+04	1.390E+07	1.910E+04	4.638E+03	6.952E+06	5.102E+03
2000	1.810E+04	1.449E+07	1.991E+04	4.834E+03	7.245E+06	5.317E+03
2001	1.864E+04	1.492E+07	2.050E+04	4.978E+03	7.462E+06	5.476E+03
2002	1.911E+04	1.530E+07	2.102E+04	5.104E+03	7.651E+06	5.614E+03
2003	1.970E+04	1.577E+07	2.167E+04	5.262E+03	7.887E+06	5.788E+03
2004	2.021E+04	1.618E+07	2.223E+04	5.399E+03	8.092E+06	5.938E+03
2005	2.084E+04	1.669E+07	2.292E+04	5.566E+03	8.343E+06	6.123E+03
2006	2.147E+04	1.720E+07	2.362E+04	5.736E+03	8.598E+06	6.310E+03
2007	2.221E+04	1.779E+07	2.443E+04	5.933E+03	8.894E+06	6.527E+03
2008	2.298E+04	1.840E+07	2.528E+04	6.138E+03	9.200E+06	6.751E+03
2009	2.371E+04	1.899E+07	2.608E+04	6.334E+03	9.494E+06	6.967E+03
2010	2.421E+04	1.939E+07	2.664E+04	6.468E+03	9.695E+06	7.115E+03
2011	2.477E+04	1.983E+07	2.725E+04	6.616E+03	9.917E+06	7.278E+03
2012	2.531E+04	2.027E+07	2.784E+04	6.760E+03	1.013E+07	7.436E+03
2013	2.586E+04	2.070E+07	2.844E+04	6.906E+03	1.035E+07	7.597E+03
2014	2.642E+04	2.116E+07	2.907E+04	7.058E+03	1.058E+07	7.764E+03

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*
2015	2.701E+04	2.163E+07	2.971E+04	7.215E+03	1.081E+07	7.937E+03
2016	2.762E+04	2.212E+07	3.038E+04	7.378E+03	1.106E+07	8.116E+03
2017	2.825E+04	2.262E+07	3.108E+04	7.547E+03	1.131E+07	8.302E+03
2018	2.891E+04	2.315E+07	3.180E+04	7.722E+03	1.157E+07	8.494E+03
2019	2.959E+04	2.369E+07	3.255E+04	7.903E+03	1.185E+07	8.694E+03
2020	3.029E+04	2.426E+07	3.332E+04	8.091E+03	1.213E+07	8.900E+03
2021	3.102E+04	2.484E+07	3.412E+04	8.285E+03	1.242E+07	9.114E+03
2022	3.177E+04	2.544E+07	3.495E+04	8.486E+03	1.272E+07	9.335E+03
2023	3.255E+04	2.606E+07	3.581E+04	8.694E+03	1.303E+07	9.564E+03
2024	3.336E+04	2.671E+07	3.669E+04	8.910E+03	1.335E+07	9.801E+03
2025	3.419E+04	2.738E+07	3.761E+04	9.132E+03	1.369E+07	1.005E+04
2026	3.505E+04	2.807E+07	3.856E+04	9.363E+03	1.403E+07	1.030E+04
2027	3.594E+04	2.878E+07	3.954E+04	9.600E+03	1.439E+07	1.056E+04
2028	3.686E+04	2.952E+07	4.055E+04	9.846E+03	1.476E+07	1.083E+04
2029	3.781E+04	3.028E+07	4.160E+04	1.010E+04	1.514E+07	1.111E+04
2030	3.880E+04	3.107E+07	4.268E+04	1.036E+04	1.553E+07	1.140E+04
2031	3.981E+04	3.188E+07	4.379E+04	1.063E+04	1.594E+07	1.170E+04
2032	4.086E+04	3.272E+07	4.495E+04	1.091E+04	1.636E+07	1.201E+04
2033	4.194E+04	3.359E+07	4.614E+04	1.120E+04	1.679E+07	1.232E+04
2034	4.306E+04	3.448E+07	4.737E+04	1.150E+04	1.724E+07	1.265E+04
2035	4.422E+04	3.541E+07	4.864E+04	1.181E+04	1.770E+07	1.299E+04
2036	4.541E+04	3.636E+07	4.995E+04	1.213E+04	1.818E+07	1.334E+04
2037	4.664E+04	3.735E+07	5.131E+04	1.246E+04	1.867E+07	1.370E+04
2038	4.791E+04	3.837E+07	5.270E+04	1.280E+04	1.918E+07	1.408E+04
2039	4.922E+04	3.942E+07	5.414E+04	1.315E+04	1.971E+07	1.446E+04
2040	5.058E+04	4.050E+07	5.563E+04	1.351E+04	2.025E+07	1.486E+04
2041	5.197E+04	4.162E+07	5.717E+04	1.388E+04	2.081E+07	1.527E+04
2042	5.341E+04	4.277E+07	5.875E+04	1.427E+04	2.138E+07	1.569E+04
2043	5.490E+04	4.396E+07	6.039E+04	1.466E+04	2.198E+07	1.613E+04
2044	5.643E+04	4.519E+07	6.207E+04	1.507E+04	2.259E+07	1.658E+04
2045	5.801E+04	4.645E+07	6.381E+04	1.550E+04	2.323E+07	1.704E+04
2046	5.686E+04	4.553E+07	6.255E+04	1.519E+04	2.277E+07	1.671E+04
2047	5.574E+04	4.463E+07	6.131E+04	1.489E+04	2.232E+07	1.638E+04
2048	5.463E+04	4.375E+07	6.009E+04	1.459E+04	2.187E+07	1.605E+04
2049	5.355E+04	4.288E+07	5.890E+04	1.430E+04	2.144E+07	1.573E+04
2050	5.249E+04	4.203E+07	5.774E+04	1.402E+04	2.102E+07	1.542E+04
2051	5.145E+04	4.120E+07	5.660E+04	1.374E+04	2.060E+07	1.512E+04
2052	5.043E+04	4.038E+07	5.547E+04	1.347E+04	2.019E+07	1.482E+04
2053	4.943E+04	3.958E+07	5.438E+04	1.320E+04	1.979E+07	1.452E+04
2054	4.845E+04	3.880E+07	5.330E+04	1.294E+04	1.940E+07	1.424E+04
2055	4.749E+04	3.803E+07	5.224E+04	1.269E+04	1.902E+07	1.395E+04
2056	4.655E+04	3.728E+07	5.121E+04	1.244E+04	1.864E+07	1.368E+04
2057	4.563E+04	3.654E+07	5.020E+04	1.219E+04	1.827E+07	1.341E+04
2058	4.473E+04	3.582E+07	4.920E+04	1.195E+04	1.791E+07	1.314E+04
2059	4.384E+04	3.511E+07	4.823E+04	1.171E+04	1.755E+07	1.288E+04
2060	4.297E+04	3.441E+07	4.727E+04	1.148E+04	1.721E+07	1.263E+04
2061	4.212E+04	3.373E+07	4.634E+04	1.125E+04	1.687E+07	1.238E+04
2062	4.129E+04	3.306E+07	4.542E+04	1.103E+04	1.653E+07	1.213E+04
2063	4.047E+04	3.241E+07	4.452E+04	1.081E+04	1.620E+07	1.189E+04
2064	3.967E+04	3.177E+07	4.364E+04	1.060E+04	1.588E+07	1.166E+04
2065	3.889E+04	3.114E+07	4.277E+04	1.039E+04	1.557E+07	1.143E+04

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*
2066	3.812E+04	3.052E+07	4.193E+04	1.018E+04	1.526E+07	1.120E+04
2067	3.736E+04	2.992E+07	4.110E+04	9.979E+03	1.496E+07	1.098E+04
2068	3.662E+04	2.932E+07	4.028E+04	9.782E+03	1.466E+07	1.076E+04
2069	3.590E+04	2.874E+07	3.949E+04	9.588E+03	1.437E+07	1.055E+04
2070	3.518E+04	2.817E+07	3.870E+04	9.398E+03	1.409E+07	1.034E+04
2071	3.449E+04	2.762E+07	3.794E+04	9.212E+03	1.381E+07	1.013E+04
2072	3.381E+04	2.707E+07	3.719E+04	9.030E+03	1.353E+07	9.933E+03
2073	3.314E+04	2.653E+07	3.645E+04	8.851E+03	1.327E+07	9.736E+03
2074	3.248E+04	2.601E+07	3.573E+04	8.676E+03	1.300E+07	9.543E+03
2075	3.184E+04	2.549E+07	3.502E+04	8.504E+03	1.275E+07	9.354E+03
2076	3.121E+04	2.499E+07	3.433E+04	8.335E+03	1.249E+07	9.169E+03
2077	3.059E+04	2.449E+07	3.365E+04	8.170E+03	1.225E+07	8.987E+03
2078	2.998E+04	2.401E+07	3.298E+04	8.009E+03	1.200E+07	8.810E+03
2079	2.939E+04	2.353E+07	3.233E+04	7.850E+03	1.177E+07	8.635E+03
2080	2.881E+04	2.307E+07	3.169E+04	7.695E+03	1.153E+07	8.464E+03
2081	2.824E+04	2.261E+07	3.106E+04	7.542E+03	1.131E+07	8.296E+03
2082	2.768E+04	2.216E+07	3.045E+04	7.393E+03	1.108E+07	8.132E+03
2083	2.713E+04	2.172E+07	2.984E+04	7.247E+03	1.086E+07	7.971E+03
2084	2.659E+04	2.129E+07	2.925E+04	7.103E+03	1.065E+07	7.813E+03
2085	2.607E+04	2.087E+07	2.867E+04	6.962E+03	1.044E+07	7.659E+03
2086	2.555E+04	2.046E+07	2.810E+04	6.825E+03	1.023E+07	7.507E+03
2087	2.504E+04	2.005E+07	2.755E+04	6.689E+03	1.003E+07	7.358E+03
2088	2.455E+04	1.966E+07	2.700E+04	6.557E+03	9.828E+06	7.213E+03
2089	2.406E+04	1.927E+07	2.647E+04	6.427E+03	9.634E+06	7.070E+03
2090	2.359E+04	1.889E+07	2.594E+04	6.300E+03	9.443E+06	6.930E+03
2091	2.312E+04	1.851E+07	2.543E+04	6.175E+03	9.256E+06	6.793E+03
2092	2.266E+04	1.815E+07	2.493E+04	6.053E+03	9.073E+06	6.658E+03
2093	2.221E+04	1.779E+07	2.443E+04	5.933E+03	8.893E+06	6.526E+03
2094	2.177E+04	1.743E+07	2.395E+04	5.815E+03	8.717E+06	6.397E+03
2095	2.134E+04	1.709E+07	2.347E+04	5.700E+03	8.544E+06	6.270E+03
2096	2.092E+04	1.675E+07	2.301E+04	5.587E+03	8.375E+06	6.146E+03
2097	2.050E+04	1.642E+07	2.255E+04	5.477E+03	8.209E+06	6.024E+03
2098	2.010E+04	1.609E+07	2.211E+04	5.368E+03	8.047E+06	5.905E+03
2099	1.970E+04	1.577E+07	2.167E+04	5.262E+03	7.887E+06	5.788E+03
2100	1.931E+04	1.546E+07	2.124E+04	5.158E+03	7.731E+06	5.674E+03
2101	1.893E+04	1.516E+07	2.082E+04	5.056E+03	7.578E+06	5.561E+03
2102	1.855E+04	1.486E+07	2.041E+04	4.956E+03	7.428E+06	5.451E+03
2103	1.819E+04	1.456E+07	2.000E+04	4.857E+03	7.281E+06	5.343E+03
2104	1.783E+04	1.427E+07	1.961E+04	4.761E+03	7.137E+06	5.237E+03
2105	1.747E+04	1.399E+07	1.922E+04	4.667E+03	6.995E+06	5.134E+03

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*
1965	0	0	0	0	0	0
1966	8.004E+01	4.373E+04	8.804E+01	1.356E-01	3.784E+01	1.492E-01
1967	1.758E+02	9.603E+04	1.934E+02	2.979E-01	8.311E+01	3.277E-01
1968	2.872E+02	1.569E+05	3.159E+02	4.867E-01	1.358E+02	5.354E-01
1969	4.142E+02	2.263E+05	4.556E+02	7.019E-01	1.958E+02	7.721E-01
1970	5.568E+02	3.042E+05	6.125E+02	9.436E-01	2.632E+02	1.038E+00
1971	7.149E+02	3.906E+05	7.864E+02	1.212E+00	3.380E+02	1.333E+00
1972	8.868E+02	4.845E+05	9.755E+02	1.503E+00	4.193E+02	1.653E+00
1973	1.072E+03	5.859E+05	1.180E+03	1.817E+00	5.070E+02	1.999E+00
1974	1.272E+03	6.947E+05	1.399E+03	2.155E+00	6.012E+02	2.370E+00
1975	1.484E+03	8.109E+05	1.633E+03	2.515E+00	7.018E+02	2.767E+00
1976	1.711E+03	9.345E+05	1.882E+03	2.899E+00	8.087E+02	3.189E+00
1977	1.967E+03	1.075E+06	2.164E+03	3.334E+00	9.301E+02	3.667E+00
1978	2.254E+03	1.231E+06	2.480E+03	3.820E+00	1.066E+03	4.202E+00
1979	2.571E+03	1.404E+06	2.828E+03	4.356E+00	1.215E+03	4.792E+00
1980	2.917E+03	1.593E+06	3.208E+03	4.943E+00	1.379E+03	5.437E+00
1981	3.292E+03	1.798E+06	3.621E+03	5.579E+00	1.556E+03	6.136E+00
1982	3.696E+03	2.019E+06	4.065E+03	6.263E+00	1.747E+03	6.889E+00
1983	4.127E+03	2.255E+06	4.540E+03	6.994E+00	1.951E+03	7.694E+00
1984	4.587E+03	2.506E+06	5.046E+03	7.773E+00	2.169E+03	8.550E+00
1985	5.074E+03	2.772E+06	5.581E+03	8.599E+00	2.399E+03	9.458E+00
1986	5.603E+03	3.061E+06	6.163E+03	9.495E+00	2.649E+03	1.044E+01
1987	6.319E+03	3.452E+06	6.951E+03	1.071E+01	2.987E+03	1.178E+01
1988	6.824E+03	3.728E+06	7.507E+03	1.156E+01	3.226E+03	1.272E+01
1989	7.342E+03	4.011E+06	8.076E+03	1.244E+01	3.471E+03	1.369E+01
1990	7.857E+03	4.292E+06	8.642E+03	1.331E+01	3.714E+03	1.465E+01
1991	8.417E+03	4.598E+06	9.259E+03	1.426E+01	3.979E+03	1.569E+01
1992	9.086E+03	4.963E+06	9.994E+03	1.540E+01	4.295E+03	1.694E+01
1993	9.864E+03	5.389E+06	1.085E+04	1.672E+01	4.664E+03	1.839E+01
1994	1.009E+04	5.515E+06	1.110E+04	1.711E+01	4.772E+03	1.882E+01
1995	1.060E+04	5.790E+06	1.166E+04	1.796E+01	5.011E+03	1.976E+01
1996	1.106E+04	6.041E+06	1.216E+04	1.874E+01	5.228E+03	2.061E+01
1997	1.168E+04	6.378E+06	1.284E+04	1.978E+01	5.520E+03	2.176E+01
1998	1.219E+04	6.657E+06	1.340E+04	2.065E+01	5.761E+03	2.271E+01
1999	1.273E+04	6.952E+06	1.400E+04	2.157E+01	6.017E+03	2.372E+01
2000	1.326E+04	7.245E+06	1.459E+04	2.247E+01	6.270E+03	2.472E+01
2001	1.366E+04	7.462E+06	1.502E+04	2.315E+01	6.458E+03	2.546E+01
2002	1.400E+04	7.651E+06	1.540E+04	2.373E+01	6.621E+03	2.611E+01
2003	1.444E+04	7.887E+06	1.588E+04	2.447E+01	6.825E+03	2.691E+01
2004	1.481E+04	8.092E+06	1.629E+04	2.510E+01	7.003E+03	2.761E+01
2005	1.527E+04	8.343E+06	1.680E+04	2.588E+01	7.220E+03	2.847E+01
2006	1.574E+04	8.598E+06	1.731E+04	2.667E+01	7.440E+03	2.934E+01
2007	1.628E+04	8.894E+06	1.791E+04	2.759E+01	7.697E+03	3.035E+01
2008	1.684E+04	9.200E+06	1.852E+04	2.854E+01	7.962E+03	3.139E+01
2009	1.738E+04	9.494E+06	1.912E+04	2.945E+01	8.216E+03	3.240E+01
2010	1.775E+04	9.695E+06	1.952E+04	3.007E+01	8.390E+03	3.308E+01
2011	1.815E+04	9.917E+06	1.997E+04	3.076E+01	8.582E+03	3.384E+01
2012	1.855E+04	1.013E+07	2.040E+04	3.143E+01	8.769E+03	3.458E+01
2013	1.895E+04	1.035E+07	2.084E+04	3.211E+01	8.959E+03	3.532E+01
2014	1.937E+04	1.058E+07	2.130E+04	3.282E+01	9.155E+03	3.610E+01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*
2015	1.980E+04	1.081E+07	2.178E+04	3.355E+01	9.359E+03	3.690E+01
2016	2.024E+04	1.106E+07	2.227E+04	3.431E+01	9.571E+03	3.774E+01
2017	2.071E+04	1.131E+07	2.278E+04	3.509E+01	9.790E+03	3.860E+01
2018	2.119E+04	1.157E+07	2.331E+04	3.590E+01	1.002E+04	3.949E+01
2019	2.168E+04	1.185E+07	2.385E+04	3.675E+01	1.025E+04	4.042E+01
2020	2.220E+04	1.213E+07	2.442E+04	3.762E+01	1.050E+04	4.138E+01
2021	2.273E+04	1.242E+07	2.501E+04	3.852E+01	1.075E+04	4.238E+01
2022	2.328E+04	1.272E+07	2.561E+04	3.946E+01	1.101E+04	4.340E+01
2023	2.386E+04	1.303E+07	2.624E+04	4.043E+01	1.128E+04	4.447E+01
2024	2.445E+04	1.335E+07	2.689E+04	4.143E+01	1.156E+04	4.557E+01
2025	2.506E+04	1.369E+07	2.756E+04	4.246E+01	1.185E+04	4.671E+01
2026	2.569E+04	1.403E+07	2.826E+04	4.353E+01	1.214E+04	4.789E+01
2027	2.634E+04	1.439E+07	2.898E+04	4.464E+01	1.245E+04	4.910E+01
2028	2.702E+04	1.476E+07	2.972E+04	4.578E+01	1.277E+04	5.036E+01
2029	2.771E+04	1.514E+07	3.048E+04	4.696E+01	1.310E+04	5.166E+01
2030	2.843E+04	1.553E+07	3.128E+04	4.818E+01	1.344E+04	5.300E+01
2031	2.918E+04	1.594E+07	3.210E+04	4.945E+01	1.379E+04	5.439E+01
2032	2.995E+04	1.636E+07	3.294E+04	5.075E+01	1.416E+04	5.582E+01
2033	3.074E+04	1.679E+07	3.381E+04	5.209E+01	1.453E+04	5.730E+01
2034	3.156E+04	1.724E+07	3.472E+04	5.348E+01	1.492E+04	5.883E+01
2035	3.241E+04	1.770E+07	3.565E+04	5.492E+01	1.532E+04	6.041E+01
2036	3.328E+04	1.818E+07	3.661E+04	5.640E+01	1.573E+04	6.204E+01
2037	3.418E+04	1.867E+07	3.760E+04	5.793E+01	1.616E+04	6.372E+01
2038	3.511E+04	1.918E+07	3.863E+04	5.950E+01	1.660E+04	6.546E+01
2039	3.607E+04	1.971E+07	3.968E+04	6.113E+01	1.705E+04	6.725E+01
2040	3.707E+04	2.025E+07	4.077E+04	6.281E+01	1.752E+04	6.909E+01
2041	3.809E+04	2.081E+07	4.190E+04	6.455E+01	1.801E+04	7.100E+01
2042	3.914E+04	2.138E+07	4.306E+04	6.633E+01	1.851E+04	7.297E+01
2043	4.023E+04	2.198E+07	4.426E+04	6.818E+01	1.902E+04	7.500E+01
2044	4.136E+04	2.259E+07	4.549E+04	7.008E+01	1.955E+04	7.709E+01
2045	4.251E+04	2.323E+07	4.677E+04	7.205E+01	2.010E+04	7.925E+01
2046	4.167E+04	2.277E+07	4.584E+04	7.062E+01	1.970E+04	7.768E+01
2047	4.085E+04	2.232E+07	4.493E+04	6.922E+01	1.931E+04	7.614E+01
2048	4.004E+04	2.187E+07	4.404E+04	6.785E+01	1.893E+04	7.464E+01
2049	3.925E+04	2.144E+07	4.317E+04	6.651E+01	1.855E+04	7.316E+01
2050	3.847E+04	2.102E+07	4.232E+04	6.519E+01	1.819E+04	7.171E+01
2051	3.771E+04	2.060E+07	4.148E+04	6.390E+01	1.783E+04	7.029E+01
2052	3.696E+04	2.019E+07	4.066E+04	6.263E+01	1.747E+04	6.890E+01
2053	3.623E+04	1.979E+07	3.985E+04	6.139E+01	1.713E+04	6.753E+01
2054	3.551E+04	1.940E+07	3.906E+04	6.018E+01	1.679E+04	6.620E+01
2055	3.481E+04	1.902E+07	3.829E+04	5.899E+01	1.646E+04	6.489E+01
2056	3.412E+04	1.864E+07	3.753E+04	5.782E+01	1.613E+04	6.360E+01
2057	3.344E+04	1.827E+07	3.679E+04	5.667E+01	1.581E+04	6.234E+01
2058	3.278E+04	1.791E+07	3.606E+04	5.555E+01	1.550E+04	6.111E+01
2059	3.213E+04	1.755E+07	3.535E+04	5.445E+01	1.519E+04	5.990E+01
2060	3.150E+04	1.721E+07	3.465E+04	5.337E+01	1.489E+04	5.871E+01
2061	3.087E+04	1.687E+07	3.396E+04	5.232E+01	1.460E+04	5.755E+01
2062	3.026E+04	1.653E+07	3.329E+04	5.128E+01	1.431E+04	5.641E+01
2063	2.966E+04	1.620E+07	3.263E+04	5.027E+01	1.402E+04	5.529E+01
2064	2.907E+04	1.588E+07	3.198E+04	4.927E+01	1.375E+04	5.420E+01
2065	2.850E+04	1.557E+07	3.135E+04	4.829E+01	1.347E+04	5.312E+01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*
2066	2.793E+04	1.526E+07	3.073E+04	4.734E+01	1.321E+04	5.207E+01
2067	2.738E+04	1.496E+07	3.012E+04	4.640E+01	1.294E+04	5.104E+01
2068	2.684E+04	1.466E+07	2.952E+04	4.548E+01	1.269E+04	5.003E+01
2069	2.631E+04	1.437E+07	2.894E+04	4.458E+01	1.244E+04	4.904E+01
2070	2.579E+04	1.409E+07	2.837E+04	4.370E+01	1.219E+04	4.807E+01
2071	2.528E+04	1.381E+07	2.780E+04	4.283E+01	1.195E+04	4.712E+01
2072	2.478E+04	1.353E+07	2.725E+04	4.198E+01	1.171E+04	4.618E+01
2073	2.428E+04	1.327E+07	2.671E+04	4.115E+01	1.148E+04	4.527E+01
2074	2.380E+04	1.300E+07	2.618E+04	4.034E+01	1.125E+04	4.437E+01
2075	2.333E+04	1.275E+07	2.567E+04	3.954E+01	1.103E+04	4.349E+01
2076	2.287E+04	1.249E+07	2.516E+04	3.876E+01	1.081E+04	4.263E+01
2077	2.242E+04	1.225E+07	2.466E+04	3.799E+01	1.060E+04	4.179E+01
2078	2.197E+04	1.200E+07	2.417E+04	3.724E+01	1.039E+04	4.096E+01
2079	2.154E+04	1.177E+07	2.369E+04	3.650E+01	1.018E+04	4.015E+01
2080	2.111E+04	1.153E+07	2.322E+04	3.578E+01	9.981E+03	3.935E+01
2081	2.069E+04	1.131E+07	2.276E+04	3.507E+01	9.784E+03	3.858E+01
2082	2.028E+04	1.108E+07	2.231E+04	3.437E+01	9.590E+03	3.781E+01
2083	1.988E+04	1.086E+07	2.187E+04	3.369E+01	9.400E+03	3.706E+01
2084	1.949E+04	1.065E+07	2.144E+04	3.303E+01	9.214E+03	3.633E+01
2085	1.910E+04	1.044E+07	2.101E+04	3.237E+01	9.031E+03	3.561E+01
2086	1.872E+04	1.023E+07	2.060E+04	3.173E+01	8.853E+03	3.490E+01
2087	1.835E+04	1.003E+07	2.019E+04	3.110E+01	8.677E+03	3.421E+01
2088	1.799E+04	9.828E+06	1.979E+04	3.049E+01	8.505E+03	3.354E+01
2089	1.763E+04	9.634E+06	1.940E+04	2.988E+01	8.337E+03	3.287E+01
2090	1.729E+04	9.443E+06	1.901E+04	2.929E+01	8.172E+03	3.222E+01
2091	1.694E+04	9.256E+06	1.864E+04	2.871E+01	8.010E+03	3.158E+01
2092	1.661E+04	9.073E+06	1.827E+04	2.814E+01	7.851E+03	3.096E+01
2093	1.628E+04	8.893E+06	1.791E+04	2.759E+01	7.696E+03	3.034E+01
2094	1.596E+04	8.717E+06	1.755E+04	2.704E+01	7.544E+03	2.974E+01
2095	1.564E+04	8.544E+06	1.720E+04	2.650E+01	7.394E+03	2.915E+01
2096	1.533E+04	8.375E+06	1.686E+04	2.598E+01	7.248E+03	2.858E+01
2097	1.503E+04	8.209E+06	1.653E+04	2.547E+01	7.104E+03	2.801E+01
2098	1.473E+04	8.047E+06	1.620E+04	2.496E+01	6.964E+03	2.746E+01
2099	1.444E+04	7.887E+06	1.588E+04	2.447E+01	6.826E+03	2.691E+01
2100	1.415E+04	7.731E+06	1.557E+04	2.398E+01	6.691E+03	2.638E+01
2101	1.387E+04	7.578E+06	1.526E+04	2.351E+01	6.558E+03	2.586E+01
2102	1.360E+04	7.428E+06	1.496E+04	2.304E+01	6.428E+03	2.535E+01
2103	1.333E+04	7.281E+06	1.466E+04	2.259E+01	6.301E+03	2.484E+01
2104	1.306E+04	7.137E+06	1.437E+04	2.214E+01	6.176E+03	2.435E+01
2105	1.281E+04	6.995E+06	1.409E+04	2.170E+01	6.054E+03	2.387E+01