TOWN OF CLARKSTOWN
DEPARTMENT OF ENVIRONMENTAL CONTROL
NEW CITY, NEW YORK

OPERATION & MAINTENANCE REPORT

CLARKSTOWN SANITARY LANDFILL

APRIL 2001 – MARCH 2002

JUNE 2002

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Project No. 679-004

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

The purpose of this annual report is to summarize operation and maintenance information for the period April 1, 2001 through March 31, 2002 for the Clarkstown Sanitary Landfill in West Nyack, Rockland County, New York. The landfill, which is located approximately 1,000 feet south of Route 59, is bounded on the East Side by New York State Route 303, and on the North, South and West sides by unoccupied land. The landfill property encompasses approximately 100 acres.

The Town of Clarkstown retained the services of Lawler, Matusky & Skelly Engineer LLP (LMS) to assist in the operation and maintenance of the facility. LMS performed routine inspections and maintenance of the facility under the guidance of the Clarkstown Sanitary Landfill Operation & Maintenance Manual. In addition, LMS conducted off-site gas monitoring to investigate possible migration of landfill gas and directed repairs to the gas collection system and flare system electrical conduits. Normal landfill operation was maintained without major deficiencies during this reporting period.

CHAPTER 2

LANDFILL GAS (LFG) SYSTEM MONITORING/BALANCING/MAINTENANCE

This chapter provides a description of the monitoring/maintenance of the landfill gas system including the followings:

1. LFG System Collection Piping
2. LFG Surface Collector Networks
3. LFG Drip Leg Assemblies
4. LFG System Wellheads, Vaults and Valves
5. LFG Enclosed Ground Flare
6. LFG Monitoring For System Control

2.1 LFG SYSTEM COLLECTION PIPING

Routine maintenance was conducted including visual inspection of the valve and valve vaults for damage or improper operation, and visual inspection of the landfill surface above the buried pipe manifold for any signs of differential settlement or other problems. The Site inspection checklists for the LFG Header Network (Form LFGH-1) and the LFG Lateral Network (Form LFGL-1) are attached in Appendix A.

Some unsatisfactory conditions of zone control valves due to damage in sampling ports and hoses were found in April 2001. By January 2002, all deficiencies related to the sampling ports were fixed.

Unsatisfactory suction pressure of some extraction wells located in Zones I and B was noticed in October 2001 and January 2002, respectively. Preliminary investigation conducted on January 25, 2002 revealed sagging of the buried conveyance pipe between GE 37 and GE 38. This provided a low spot for condensate to build up and fill the main, resulting in loss of suction pressure behind the problem point. Repair was done by resloping the gas main (as best as possible) to drain to the drip leg. In addition, a riser was installed at the mid point to serve as a sleeve for the insertion of a suction line so that

the condensate can be pumped directly out of the main line in case it does not all drain to the drip leg.

A similar repair was performed between GE 2 and GE 3, the area directly west of the flare station. In this line, the grade of the area was too shallow to reslope so that the repair consisted only of placing a riser at the low point.

Well measurements taken after the repairs showed normal suction pressures, indicating successful repairs around the problem areas.

2.2 LFG SURFACE COLLECTOR NETWORKS

Routine visual inspection of the collector areas, especially for signs of excessive differential settlement, was conducted. No major deficiencies were reported.

2.3 LFG DRIP LEG ASSEMBLIES

Quarterly inspections for damage, improper operation, or other problems were conducted. Particular attention was paid to settlement of the drip leg vault, surrounding cover, leakage either in or around the drip leg, liquid pooling in the vaults, and clogging of the drip leg piping. The inspections were detailed on Form FS-4, included in Appendix A. No major deficiencies were found.

2.4 SYSTEM WELLHEAD, VAULTS AND VALVES

The 52 LFG extraction wells were inspected during each well balancing. Visual inspection of each well was conducted for leakage, liquid pooling and hazardous conditions in the surrounding area. Deficiencies were reported on Form DP-1. Several extraction wells have experienced vault settlement. This differential settlement between vault box and the wellhead assembly provided low or no head space between the wellhead and the vault cover. Several damaged sampling ports in the well heads were reported due to this problem. The deficiencies, however, did not affect the overall operation of the landfill.

The gas quality at the 52 gas wells for the 9 months, April, June, August, September, October, November 2001 and January, February and March 2002, is summarized on Figure 2-1 and in the following table:

Table 2-1

Summary of Extraction Well Data

	SCFM Ave. Q/well	SCFM Total Est. Flow	(%) CH_4	(%) CO_2	(%) O_2	(%) N_2	(in. H_2O) S. Pre.
Apr-01	5.7	298	40	29	4	27	-0.8
Jun-01	5.3	278	48	27	5	20	-2
Aug-01	3.4	-	44	28	4	24	-3
Sep-01	2.6	123	41	25	2	23	-2
Oct-01	4.7	235	42	25	5	26	-3
Nov-01	2.5	130	46	26	4	26	-4
Jan-02	2.1	108	48	25	6	23	-4
Feb-02	1.8	91	49	26	3	21	-2
Mar-02 [1]	2.0	104	50	29	4	19	-3

[1] Due to malfunction of the landfill portable gas analyzer, not all wells were sampled for gas analysis.

Table 2-2

Summary of Flare Measurements

	CFM Average Flow	CFM Est. Ave. Q/well [2]	(%) CH_4	(%) CO_2	(%) O_2	(%) N_2
Apr-01	344	6.6	48	31	3	18
Jun-01	351	6.7	58	36	1	7
Sep-01	375	7.2	45	29	3	24
Oct-01	357	6.9	45	25	5	26
Nov-01	331	6.4	46	27	3	25
Jan-02	341	6.6	41	23	4	29
Feb-02	345	6.6	41	27	3	30
Mar-02	385	7.4	40	26	3	32

[2] Based on 24 hr/day and 30 day/month

Several observations should be noted with respect to these extraction well data, as they stand and in conjunction with data collected at the flare system:

- The nitrogen concentration showed consistently between 20% and 30%, and there was general consistency between the measurements at the extraction wells and at the flare station. The usual explanation for the nitrogen content is intrusion of air into the landfill, caused by over extraction by the blower(s); action taken to reduce over-extraction is determined in 2.6, below.

- The system ran at a metered gas flow of 300-400 CFM during this reporting period. The reason for the inconsistency between the sum of the individual gas well readings and the total flow as measured at the flare system is being investigated. The flow transmitter at the flare station was calibrated in 2002 and should transmit reliable readings. The most likely cause is imprecision of flow measurement device through orifice plates in the extraction wells. This discrepancy is not of great importance to the operation of the system.

A recurring or common problem was liquid pooling in the extraction well vaults. Seven extraction wells were pumped out during the routine operation of November and January.

2.5 ENCLOSED GROUND FLARE

The flare is typically operated automatically by the blower and flare control system, though problems with the control system occasionally shut down the system. Detailed inspection/maintenance are reported in Chapter 3 & Form FS-4 in Appendix A.

Maintenance of the flare included the following:

Monthly:	Inspect flame arrestor
Quarterly:	Check igniter gap, igniter wiring, thermocouple voltage, shutdown valve, all components against "set-point" sheet.
	Test high temperature shutdown, pilot fail shutdown, flame fail shutdown, test low temperature shutdown.
Semi-annually:	Inspect, clean thermocouples and spark igniter

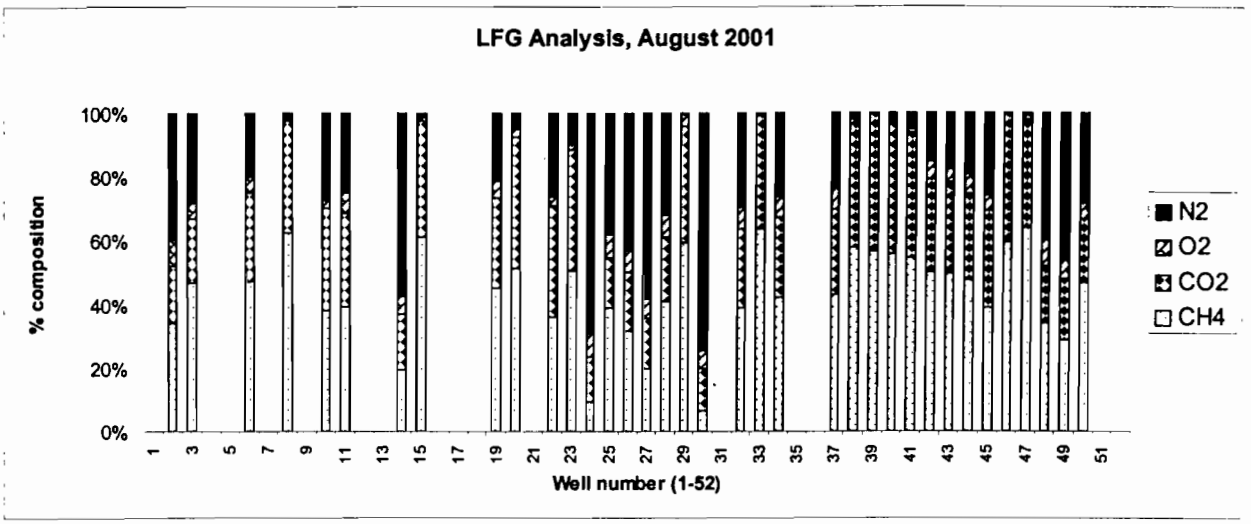
2.6 LFG MONITORING FOR SYSTEM CONTROL

In order to optimize the gas recovery in terms of gas flow rate and gas quality, LFG System balancing was performed by adjusting the vacuum applied to each lateral and each well, and measuring the resulting gas quality and landfill vacuum. Methodology used was that given in the O & M Manual.

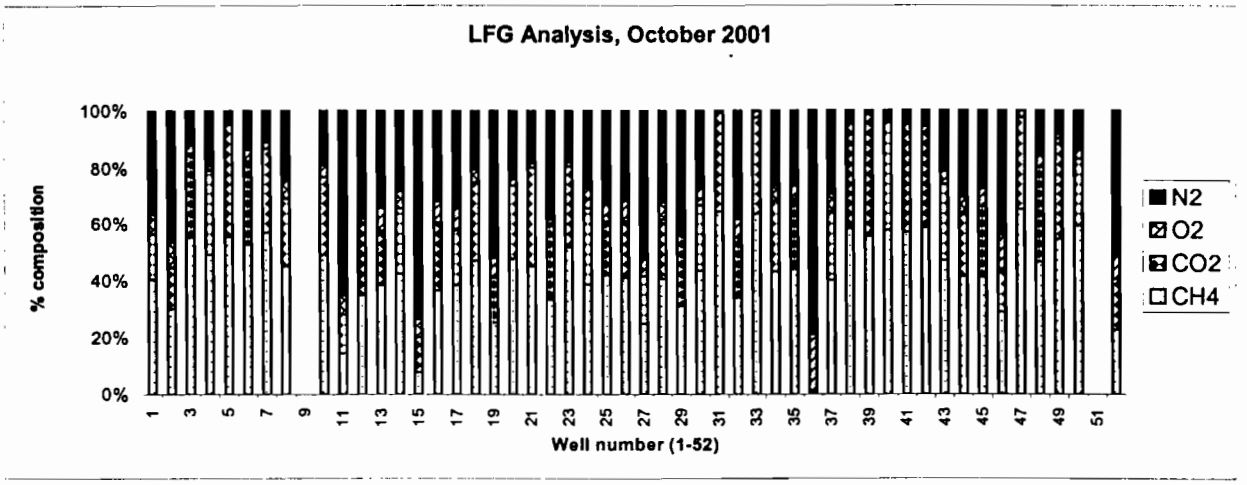
- Zone Valves A, K and L are 10 to 15% open as recommended in O&M Manual.
- During the January 2002 well balancing, Zone Valve G experienced excessive suction pressure. Valve G was closed 40% in order to maintain a suction pressure of 3 in. of water.
- Zone valve C was 90% closed during March 02 well balancing. Zone C has only two extraction wells, GE 9 and GE 10.
- GE 9 has been flooded since LMS started O&M. Despite several efforts to drain the water from the vault, it remains flooded due to its location in an area of low grade.
- GE 10, behind GE 9, has been reported having zero or positive suction pressure indicating blockage of the main line. Zone C, therefore, became inoperable. Zone C is located in the innermost area of the landfill; thus closing the zone valve should not post any risk of gas migration outside the landfill property.
- GE valve 36 & 42 were closed 90% due to its zero methane content.
- GE valve 41 and 47 were partially closed due to its low methane content.

All other extraction well valves are fully open, since the current operating flow rate is between 300 and 400 cfm, significantly below the rate for early period of operation. Though the balancing procedure as described in the O&M Manual assumed that the flare operates at about 600 cfm, it is still valid to follow in adjusting vacuum pressures throughout the extraction wells. However, the reduced gas production rate is best matched by opening the extraction well valves and adjusting the blower system valve accordingly.

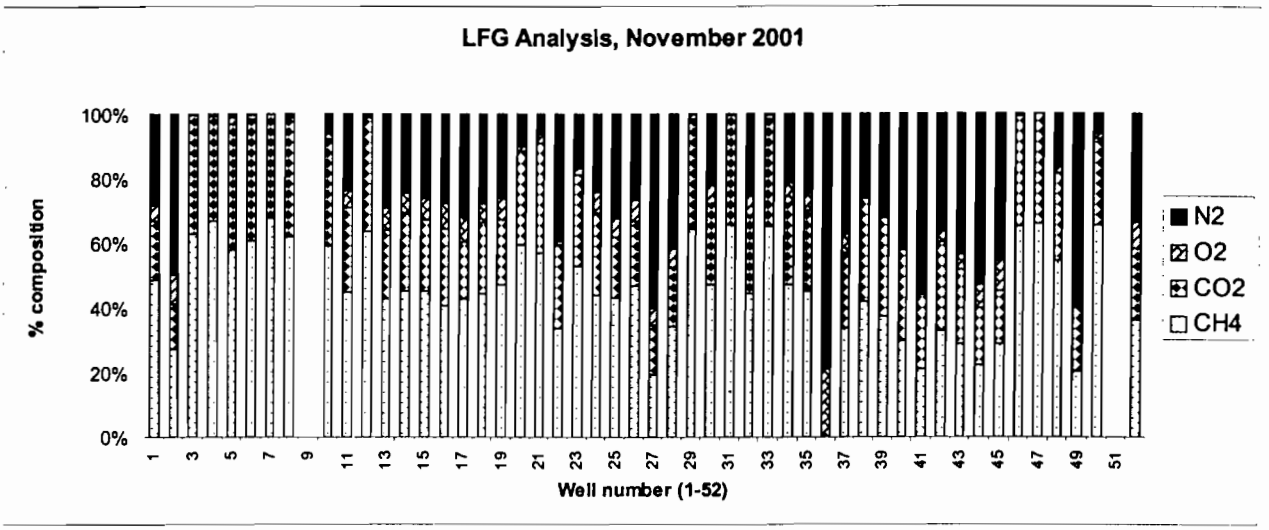
August 2001



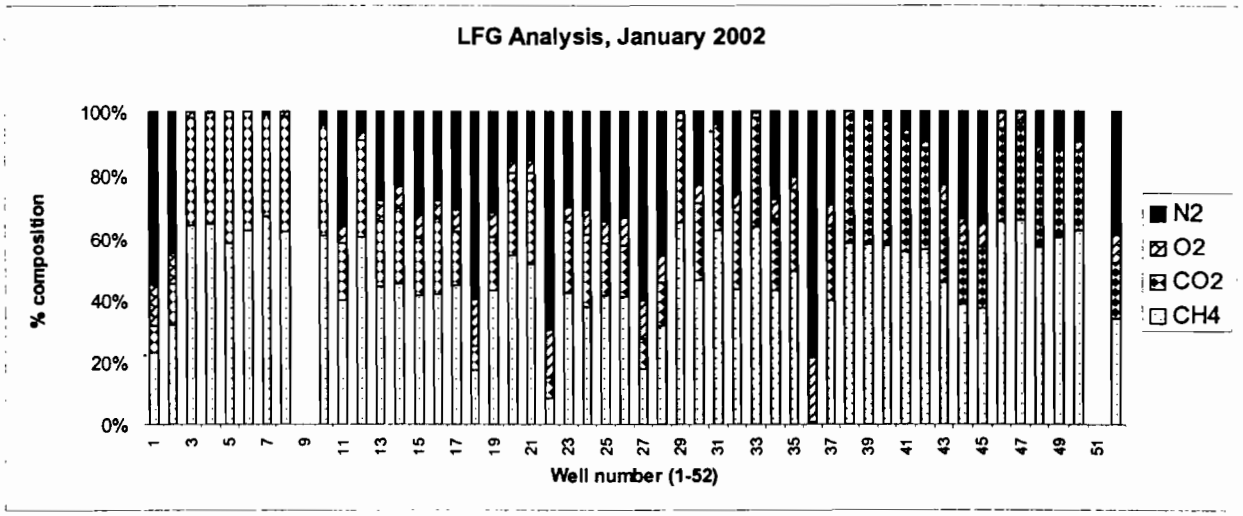
October 2001



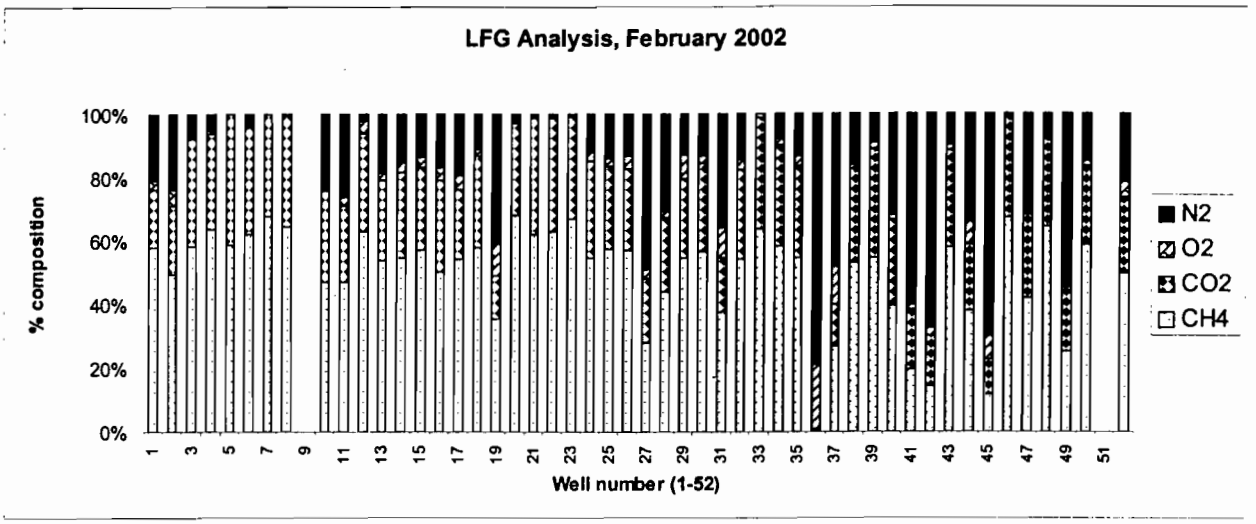
November 2001



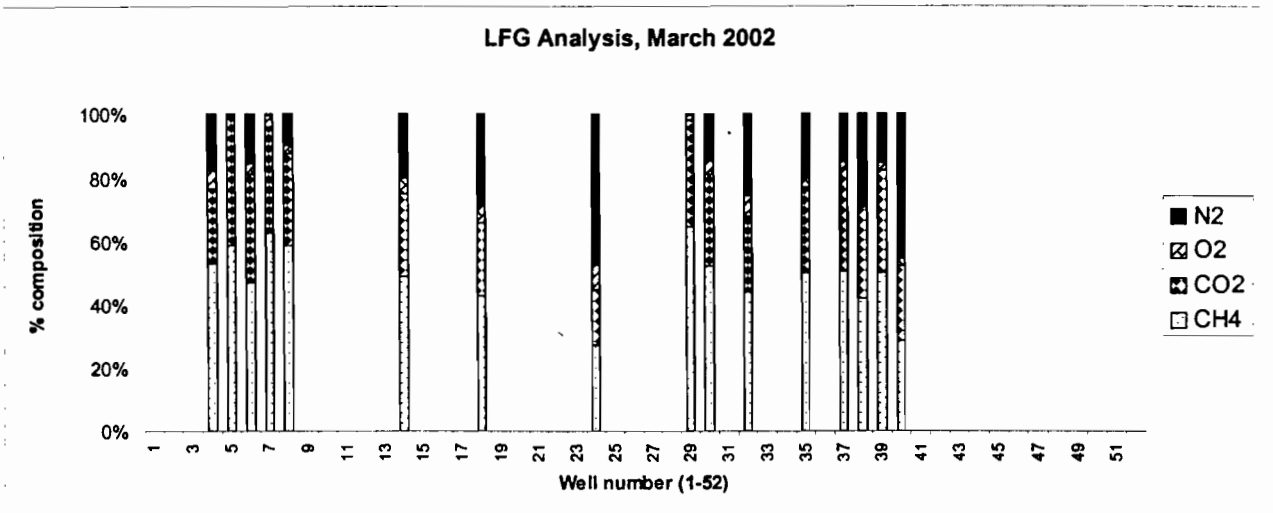
January 2002



February 2002



*March 2002***



**Due to malfunction of the landfill portable gas analyzer, not all wells were sampled for gas analysis. The suction pressures, however, were all sampled

CHAPTER 3

LANDFILL GAS(LFG) SYSTEM
FLARE CONTROL SYSTEM

This chapter provides a description of the monitoring/maintenance of the landfill gas system.

3.1 LFG GROUND FLARE CONTROL SYSTEM

The Automatic Flare control system provides temperature control by adjusting the amount of combustion air mixed with the gas via the electrically actuated air intake louvers. It also provides safety shutdowns for emergency conditions. The safety shutdowns are:

1. High Lower Explosive limit (each of 4 building combustible detectors & gas analyzer cabinet (GAC))
2. Blower Overload (each of 2 blowers)
3. High oxygen content in LFG
4. Low Methane content in LFG
5. Flame failure
6. Pilot failure
7. High Flame temperature
8. Low Flame temperature
9. Low Landfill Gas flow
10. Shutdown Valve Fail closed
11. Shutdown Valve Fail open
12. High liquid level in Condensate Tank

The control system receives signals from the sensors & detectors to monitor the operation of the enclosed ground flare. Malfunction of the sensing/detecting devices will trigger alarms and shutdowns of the system.

The landfill experienced several instrumentation problems from May 2001 to February 2002; the problems and their resolutions are described.

A. Malfunction of the electrical power surge protector in the flare control station shut down the entire flare system. Flare operation was suspended from 5/28/01 to 6/8/01 due to this reason.

To solve this problem, the BP 1400 UPS unit was replaced. Flare was re-started in June 8, 2001.

B. Several flare shutdowns at midnight revealed a minor software problem in the PLC. With the help of Perennial Energy, the PLC program was modified to fix this bug. The flare has not experienced midnight shutdown since 10/31/01.

C. Two operator input devices, YIC-1 and YIC-2, in the flare control panel, experienced scrolling problems, resulting in the inability to change setpoints. Upon the town's approval, LMS performed replacement services of two OP1333 interfaces on 2/25/2002.

D. The main incoming power conduit had settled with the surrounding soil, with the result that there was a separation of the conduit in its above grade portion. This problem was fixed in January 2002 by a new pull box installation on the settled conduit. A similar repair was done at the same time for the conduits between the condensate lift station and the flare control platform

E. The temperature transmitter for the GAC temperature caused low temperature warning. This deficiency is being investigated.

F. Incorrect gas readings have caused low methane warning. The Methane analyzer inside the GAC reads 0 % methane, whereas the portable gas analyzer read around 45%. The manufacturer is being contacted for further investigation. In the meantime, the flare temperature readings, taken several times per week, would provide an early warning that methane content of the gas to the flare was decreasing.

CHAPTER 4

LANDFILL GAS(LFG) SYSTEM OVERALL GAS VOLUME

This chapter discusses:

1. Quantitative analysis of gas recovery
2. Off-site monitoring of LFG

4.1 QUANTITATIVE ANALYSIS OF GAS RECOVERY

For the period April 1, 2001 to March 31, 2002, LMS kept a log sheet at the flare station to record flows, flare temperatures and blower run-time readings on a more frequent basis. The log sheet data are summarized below. The raw data sheets are attached in Appendix B.

The total LFG recovered during this period was 124.6 million cubic feet. Total estimated methane volume was 52 million cubic feet. Total operating time was 5720 hours, i.e., 65.3% uptime. Total number of shutdowns reported was 40, an average of 3.3 per month.

April 2001

	Q(cfm)	10-HR (B301)	10-HR (B302)	Temp	Comments
3/29/01	327	1370		1465	
4/5/01	344	1393		1423	
4/6/01	311	1394		1430	
4/23/01					Down
4/23/01	377	1424		1475	

Average Q (cfm)	340
Total Op.Hr	540
% in Operation	75
Gas Volume (cu.ft)	11,016,000

May 2001

	Q(cfm)	10-HR	10-HR	Temp	Comments
5/6/01	320	1440		1442	
5/10/01		1441			Down
5/10/01	373	1441			
5/20/01		1451			Down
5/20/01	372	1451		1455	
5/29/00		1457			Down
					No power

Average Q (cfm)	355
Total Op.Hr	330
% in Operation	46
Gas Volume (cu.ft)	7,029,000

June 2001

	Q(cfm)	10-HR	10-HR	Temp	Comments
6/8/01		1457			UPS fixed
6/8/01	367	1457	1277	1436	B302 started
6/15/01	347		1281	1471	
6/19/01			1287		Down
6/19/01	370		1287	1420	
6/22/01			1292		Down
6/22/01	361		1292	1460	
7/2/01			1296		Down

Average Q	361
Total Op.Hr	190
% in Operation	26
Gas Volume	4,115,400

July 2001

	Q(cfm)	10-HR	10-HR	Temp	Comments
7/2/01	402	1457		1461	B301 Started
7/6/01		1461			Down
	407	1461			
7/13/01	391	1467		1480	
7/19/01		1472			Down
7/19/01	412	1472			
7/20/01	387	1475			
7/21/01		1476			Down
7/25/01	415	1476			
8/2/01	390	1493		1440	

Average Q	400
Total Op.Hr	360
% in Operation	50
Gas Volume	8,640,000

August 2001

	Q(cfm)	10-HR	10-HR	Temp	Comments
8/2/01		1493			Down
8/3/01	410				
8/8/01		1501			Down
8/9/01		1505			Down
9/5/01	384	1540		1429	

Average Q	397
Total Op.Hr	500
% in Operation	69
Gas Volume	11,910,000

September 2001

	Q(cfm)	10-HR	10-HR	Temp	Comments
9/7/01		1540			Down
9/12/01		1543			Down
9/12/01	400	1543			
9/17/01		1549			Down
9/17/01	395	1549			
9/19/01	367	1554		1398	
9/21/01	345	1558		1382	
9/24/01		1563			Down
9/26/01	369	1567		1420	
10/8/01		1588			Down

Average Q	375
Total Op.Hr	480
% in Operation	67
Gas Volume	10,800,000

October 2001

	Q(cfm)	10-HR	10-HR	Temp	Comments
10/8/01	403	1588			
10/15/01	396	1597		1441	
10/17/01	368	1601		1439	
10/18/01	345	1603		1446	
10/19/01		1605			Down
10/20/01	380	1608		1400	
10/22/01	350	1612		1425	
10/23/01					Down
10/24/01	378	1617		1427	
10/25/01	364	1619		1453	
10/26/01	355	1622		1455	
10/28/01	320	1627		1452	
10/29/01		1628			Down
10/30/01	350	1630		1447	
10/31/01		1632			Down

Average Q	364
Total Op.Hr	440
% in Operation	80
Gas Volume	9,609,600

November 2001

	Q(cfm)	10-HR	10-HR	Temp	Comments
11/1/01	386	1634		1442	
11/5/01	348	1644		1436	
11/6/01	320	1646		1439	
11/7/01	313	1649		1440	
11/9/01		1654			Down
11/12/01	325	1661		1441	
11/13/01		1663			Down
11/15/01	365	1667			
11/16/01	348	1670		1437	
11/17/01	325	1672		1444	
11/19/01	320	1677		1418	
11/20/01	305	1679		1442	
11/21/01	365	1681		1455	
11/26/01	318	1693		1447	
11/27/01	285	1696		1400	
11/28/01	350	1698		1450	
11/29/01	340	1700		1450	
11/30/01	355	1703		1425	

Average Q	335
Total Op.Hr	710
% in Operation	99
Gas Volume	14,271,000

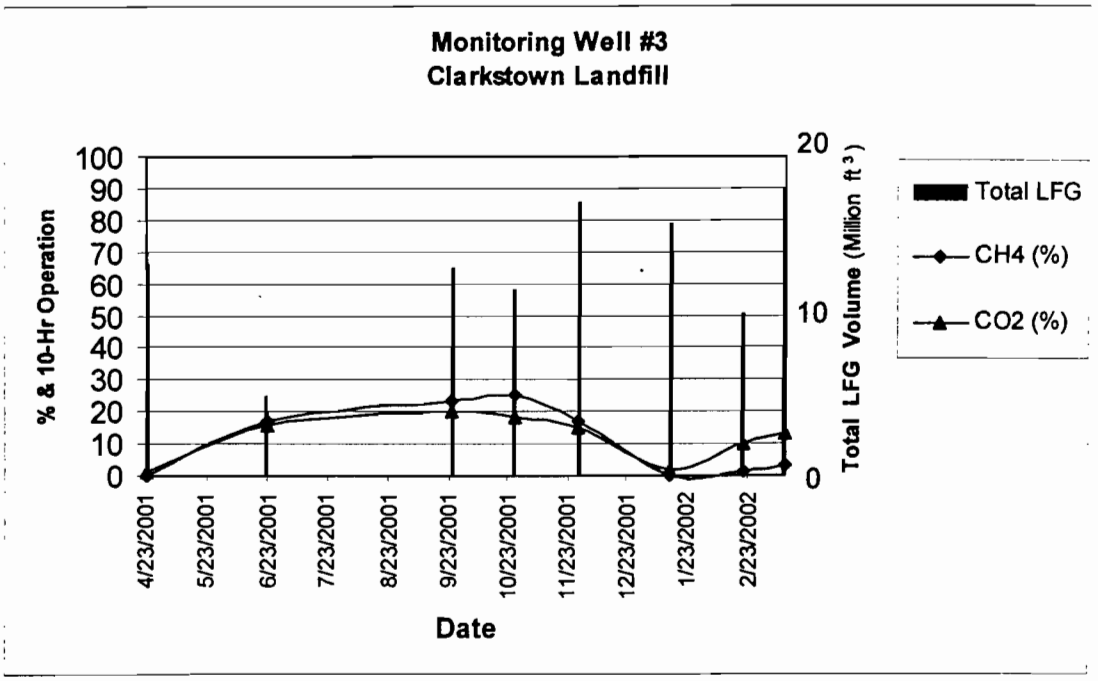
1/25/02	324	1806		1450	
1/28/02		1812			Down
1/30/02	355	1817		1425	Turned off For service

Average Q	351
Total Op.Hr	620
% in Operation	86
Gas Volume	13,062,923

February 2002

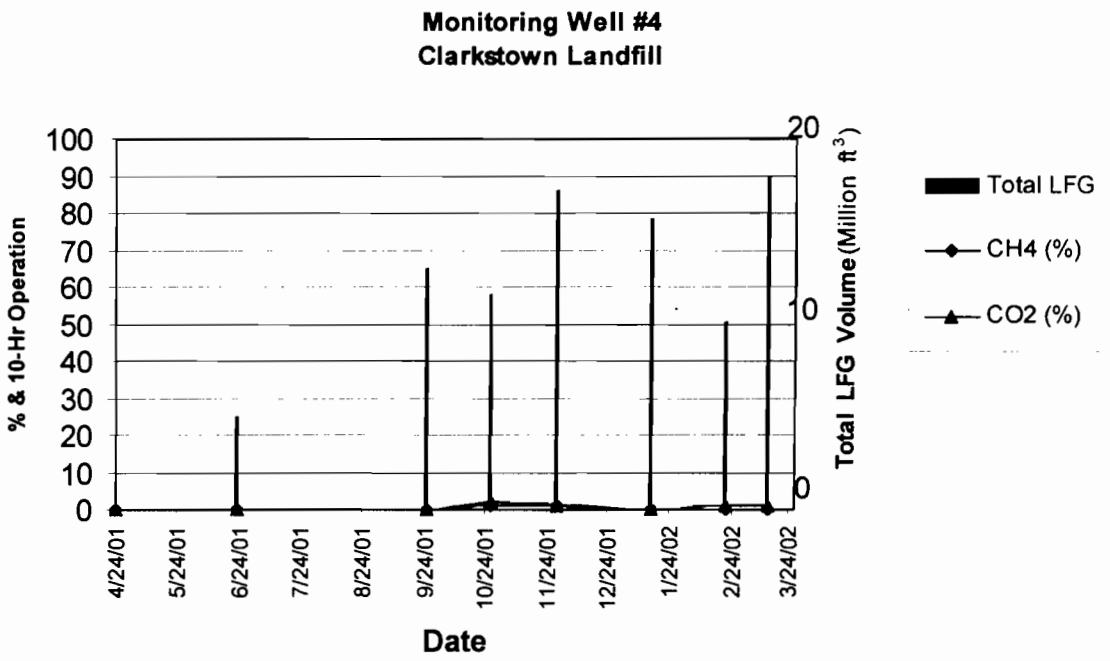
	Q(cfm)	10-HR	10-HR	Temp	Comments
2/4/02		1817			Off for service
2/6/02		1817			Restarted
2/7/02	395	1819		1439	
2/11/02	368	1829		1475	
2/14/02	360	1836		1433	
2/19/01	320	1848		1430	
2/20/02	310	1851		1443	
2/22/02		1855			**Off for calibrations**
2/22/02	380	1855		1450	Restarted
2/25/02		1856			Down, breaker tripped
2/27/02					Flame fail
2/27/02	380		1296	1452	B302 started

Average Q	359
Total Op.Hr	390
% in Operation	58
Gas Volume	8,400,600



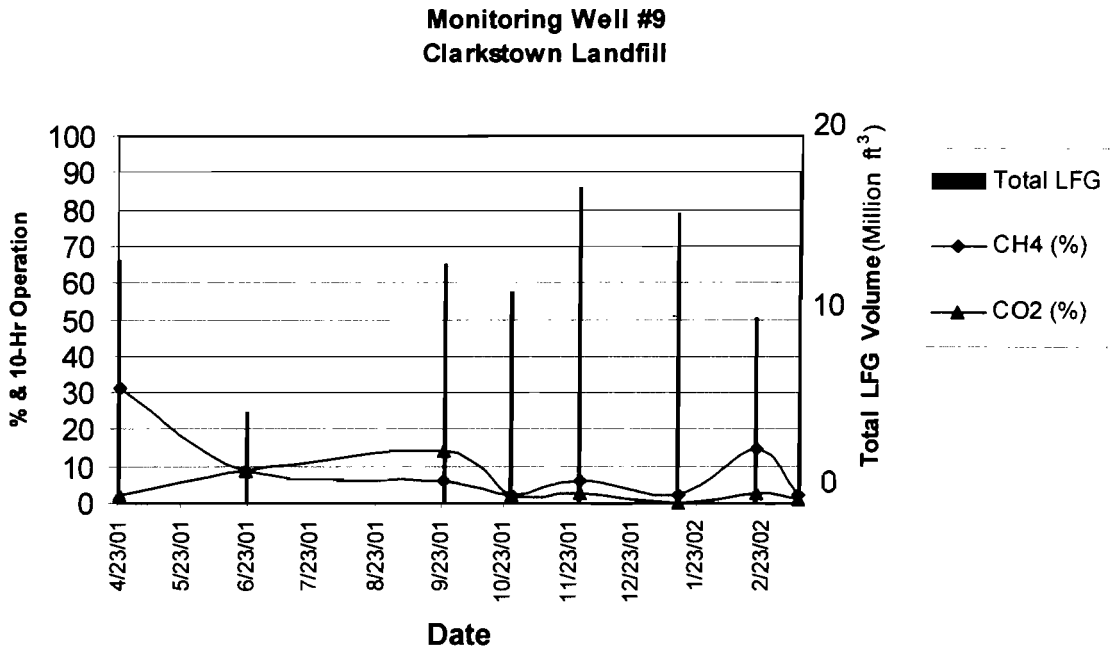
4.2.2 *Monitoring Well #4*

11	23-Apr				
4	22-Jun				
11	24-Sep				
10	26-Oct	1	18	2	79
14	28-Nov	1	19	1	79
13	14-Jan				
8	20-Feb	0	19	1	80
15	13-Mar	0	19	1	80



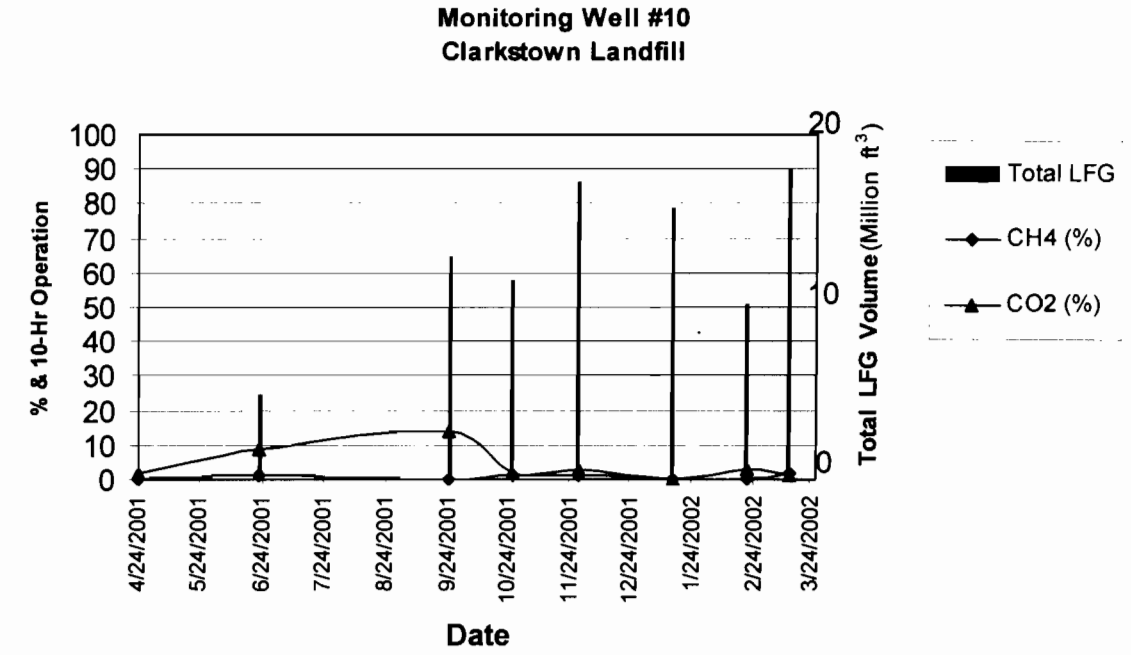
4.2.3 *Monitoring Well #9*

11	23-Apr	31	6	2	61
4	22-Jun	9	9	9	74
11	24-Sep	6	3	14	78
10	26-Oct	2	20	2	77
14	28-Nov	6	17	3	73
13	14-Jan	2	20	0	78
8	20-Feb	15	13	3	69
15	13-Mar	2	20	1	78



4.2.4 *Monitoring Well #10*

11	23-Apr	0	14	4	82
4	22-Jun	1	3	15	61.6
11	24-Sep	0	2	15	83
10	26-Oct	1	1	15	83
14	28-Nov	1	3	13	83
13	14-Jan	0	15	5	80
8	20-Feb	0	13	5	83
15	13-Mar	2	20	1	78



CHAPTER 5

OTHER LANDFILL GAS (LFG) SYSTEMS

This chapter provides the inspection/maintenance reports for

1. LFG knockout Tank and LFG Condensate Pump Station
2. Aboveground LFG Condensate Storage Tank
3. Landfill Final Cover System

5.1 LFG KNOCKOUT TANK AND LFG CONDENSATE PUMP STATION

During the repairs to the electrical conduits at the flare station in January 2002, it was discovered that the piping between the LFG knockout tank and the blowers had a leak at the knockout tank connection, due to ground settlement. On February 5th, repair work was performed by re-welding the connection at the knockout tank. A detailed service memo is attached in Appendix C. In order to avoid further settling, the area remains partially open with the pipe exposed.

Routine visual inspection of the leachate collection chambers and surrounding area was performed on a monthly base. Not all of the pump stations appeared to be operable. Pump station #2, #4 and #7 did not turn on under "Hand" operation. Visual inspection of the collection chamber, however, indicated that the water level in each was below the inlet inverts. This ensured that there was no ongoing loss of leachate off the site. In addition to the inoperability of the pumps, the signal back to the main service building was reported to be having problems.

Leachate pump station #1 has experienced excess incoming flow throughout the reporting period. Manual pumping with the existing submersible pump failed to drain the collection chamber indicating significant inflow into the chamber. The source and nature of the infiltration is being investigated.

5.2 ABOVEGROUND LFG CONDENSATE STORAGE TANK

Annual routine visual inspection of tank, piping, valves, and other appurtenant items was performed; quarterly testing of the leak detection system and weekly inspection of vents were conducted to assure there is no restriction in flow.

5.3 LANDFILL FINAL COVER SYSTEM

Final cover inspection was performed quarterly according to the inspection procedures for the final cover described on the checklist and form FCS-1 in Appendix A. As noted in the forms, there has been several minor problems related to settling, i.e., the soil settling caused pipe sagging, as discussed in Chapter 2. There is no major deficiency related to the final cover system of the facility.