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NSPS SUBPART WWW
TIER 2
EVALUATION REPORT

PREPARED FOR
CITY OF FLAGSTAFF,
CINDER LAKE LANDFILL

URS Job No. 27644689.02001
August 30, 2002



August 30, 2002

James Duffield
City of Flagstaff - Environmental Services
211 West Aspen Ave.
Flagstaff, Arizona 86001

Re: Tier 2 Report for Cinder Lake Landfill
URS Job No. 27644689.02001

Dear Mr. Duffield:

Enclosed are the final Tier 2 Reports for the Cinder Lake Landfill. As we discussed, a copy of this report has been filed on behalf of the City with Ms. Lynn Ogata, Manager of Field Services for the Arizona Department of Environmental Quality. A copy will also be sent to the responsible EPA Administrator at the Region IX office, on your behalf.

We look forward to working with you on future environmental projects. Thank you for allowing URS to assist with this compliance program. If you should have any questions please call Bill Jamieson at (602) 861-7437, or Bob Farmer at (602) 861-7451.

Sincerely,

URS Corporation

Bill Jamieson
Environmental Scientist

Robert W. Farmer, Ph.D. P.E.
Practice Leader, Air Quality Services

BJ/RWF/tc

Enclosures

cc: D. Marx, URS
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US EPA Method 25C (40 CFR Part 60, Appendix A) Determination of Nonmethane Organic Compounds (NMOC) in MSW Landfill Gases

1.0 INTRODUCTION AND SUMMARY

This report addresses one of the compliance requirements in the "Standards of Performance for New Stationary Sources and Guidelines for Control of Existing Sources: Municipal Solid Waste Landfills," contained in Subpart WWW to 40 CFR Part 60 (referred to as the NSPS regulations) promulgated on March 12, 1996 by the United States Environmental Protection Agency (EPA). This NSPS has been identified as an applicable requirement in the Title V operating permit for the Cinder Lake Landfill, owned and operated by the City of Flagstaff.

As part of the requirements, a landfill with a capacity greater than 2.5 million-megagrams (Mg) must conduct a subsurface gas sampling program every five years to estimate emissions of Non-Methane Organic Carbon (NMOC). The result of this NMOC emission evaluation is used to determine if the landfill will be required to install and operate a landfill gas collection and control system. The NMOC emissions from the landfill are determined using procedures provided in 40 CFR 60, Subpart WWW §60.754 (a)(3) (Tier 2) which is reproduced in Appendix C of this report.

The Cinder Lake Landfill conducted Tier 2 evaluation of NMOC emissions pursuant to 40 CFR 60.754 (a)(3) in July 2002. Tier 2 sampling utilizes active collection and analysis of the total NMOC gases emanating from the landfill. Samples collected in 6-liter Summa canisters were analyzed by US EPA Reference Method 3C (for nitrogen and other gases), and Method 25C (for NMOC). Results of the Tier 2 analysis, summarized in Tables 2 and 3, indicate that landfill emissions are below the threshold of 50 Mg/year. Based on these results, a landfill gas collection system is not required at this time. The emission estimates will be recalculated on an annual basis and Tier 2 sampling will be conducted in 2007 (5 years) as required by the NSPS regulations.

2.0 PROJECT BACKGROUND

The Cinder Lake Landfill (CLL) is located approximately 8 miles northeast of Flagstaff, Arizona (Figure 1) and is owned and operated by the City of Flagstaff (City). The initial permit for landfill operations at the site was issued by the USFS (Permit No. 53) on December 10, 1963. Based on information from the City, the site began receiving municipal solid waste (MSW) in 1965 in an area from which cinders were excavated for off-site uses.

The initial compliance assessment under Subpart WWW was conducted in 1997. During this program, historical files from the City of Flagstaff were reviewed to evaluate the quantity of municipal solid waste (MSW) that has been deposited since the opening of the CLL. This information was compiled to develop estimates of the in-place MSW tonnage in CLL. Additionally, population data for the City of Flagstaff and Coconino County for the period between 1960 and 1995 were collected in order to evaluate historic per capita disposal rates. Utilizing this data, the design capacity of the landfill was estimated to be 3.47 million-Mg. This design capacity exceeds the 2.5 million-Mg NSPS regulations de minimis level for Tier 1 and Tier 2 applicability (40 CFR § 60.752b), thus requiring the city to estimate NMOC emissions for the site.

As part of the 1997 evaluation, a conservative Tier 1 NMOC emissions estimate was conducted using default values, and the results indicated a NMOC emission rate of 279.1 Mg/year. Based on discussions with the US EPA, the Tier 1 evaluation was also conducted using the modified k value for arid regions (0.02) and the resulting NMOC emissions estimate was 163.7 Mg/year. Since the estimated Tier 1 emission rates exceeded the 50 Mg/year regulatory threshold, a more-quantitative Tier 2 emissions rate evaluation was required.

The 1997 Tier 2 sampling consisted of collecting landfill gas samples from 50 locations at the CLL. These samples were analyzed for NMOC, nitrogen and oxygen. The resulting average NMOC concentration ($C_{(NMOC)}$) was calculated to be 629.3 ppm. This $C_{(NMOC)}$ value was used to replace the Tier 1 default value of 4000 ppm $C_{(NMOC)}$ to recalculate the NMOC emission rate from the site. The resulting NMOC emission rate estimate for 1997 was 25.8 Mg/year. Since this value is below the 50 Mg/year threshold specified in Subpart WWW, a landfill gas collection system was not required at that time.

To comply with Subpart WWW requirements, the CLL is required to recalculate the NMOC emission rate annually (based on refuse addition rate) and Tier 2 sampling is to be conducted every 5 years. The activities described in this report comprise the required 5-year periodic evaluation of NMOC, which was completed in mid-2002. Utilizing current MSW data provided by the City and historical estimates and trends determined in the 1997 report, the in-place tonnage at the end of FY 2000/01 at CLL is estimated at approximately 3,232,324 tons or 2,932,934 Mg. This value is consistent with the modeling result of 2.93 million Mg listed in Table 1 from the 1997 Tier 1 compliance evaluation.

3.0 SAMPLING METHODOLOGY

Tier 2 analysis under Subpart WWW requires a landfill owner or operator to determine the NMOC concentration in the landfill soil gas by installing at least two sub-surface sample probes per hectare of landfill surface that has retained waste for at least 2 years. If the landfill is larger than 25 hectares in area, only 50 samples are required. The area of CLL where waste has been in place is approximately 110 acres (44.5 hectares) and therefore 50 samples are required. The locations of the 50 sample points are shown on Figure 1. It should be noted that locations where MSW has been disposed within the last 2 years and areas with inert material (demolition debris) have been excluded as required by the NSPS regulations. Due to the decrease in size of the inactive area of the landfill, the distribution of sampling locations differs from the 1997 testing program.

Tier 2 field sampling was conducted by URS and Johnson Environmental. A sampling plan with a grid pattern was developed to ensure sufficient coverage of the landfill area. To mark approximate sampling locations, long stakes were placed at various points in the landfill to provide as reference points. Samples were collected using a direct-push sampling probe (Figure 2). This type of soil vapor probe meets the specifications of Subpart WWW, and consists of four main components:

- Body of the probe - a hollow steel rod with an outside diameter (OD) of 1-3/8 inches;
- Drive adapter at the top of the probe - provides an interface with the drive apparatus;
- Probe tip - a hollow steel connector with holes machined through its surface, which permit vapor to pass into the tip and up the center of the connector; and
- Stainless steel compression fitting - at the top of the tip, a used to connect the 1/4-inch (OD) transfer line through which the vapor passes to the vapor collection receptacle.

All samples were collected at a depth of 6 feet. These samples were defined by color (white, red, blue, green, and orange) and direction (north or south). Figure 1 shows the location of the sampling sites. Each symbol represents the 6 sample probes collected for each canister. Once the probe was in place at each location, a volume of air equal to five times the transfer line volume was purged using the 'purge' configuration. After purging, the valve on each end of the sample train was switched from the purge setting to the sample setting. A soil gas sample was extracted and at the probe tip and passed along the length of the probe and through the transfer line to a

stainless steel Summa® canister. A rotometer was used to verify the soil gas flow rate of 400 cubic centimeters per minute. The Summa® canisters are 6.0 liters in volume and are equipped with stainless steel Nupro valves.

Samples from 5 probe locations were composited into each of 10 canisters with closely equal volumes taken from each sample probe (1.2 liters \pm 100 cc) in accordance with the regulations. Due to the loss of vacuum in canister 2553, only 2 probes were collected from Orange North to form the composite for that canister. The remaining 3 probes for Orange North were collected and formed the composite for canister 3414. For quality assurance, a system sample blank was obtained by sampling high purity air through the cleaned sampling probe.

To insure proper decontamination, prior to relocating to a new location, the vapor probe parts were washed in Alconox and purified water, and then triple rinsed with purified water. At the end of a sampling period, a steam cleaner was used to wash the sampling train components.

The canisters were delivered via Air Toxics Ltd. to Performance Analytical Inc. for some of the analyses (Arizona Department of Health Services License AZ0550) under chain of custody. The sample tanks were pressurized with helium to a measured final absolute pressure and were analyzed using Method 25C as described in the NSPS regulations (as revised in 2001, refer to Appendix D). The NMOC concentration was divided by six to convert from C_{NMOC} as carbon to C_{NMOC} as hexane as specified by the Subpart procedures. Additionally, the composite samples were analyzed to determine the percent of N_2 and O_2 in the sample using Method 3C. Presence of N_2 above a threshold level of 20 volume percent is taken as an indication of infiltration of ambient air into the gas sample. This was observed on the CCL samples, due to relatively high permeability of the surface sandy clay soil. Consequently, of the eleven available sample analyses available, four samples were omitted from the emission calculation due to excessive air infiltration.

Copies of the field sampling logs and chain of custody forms are provided in Appendix A of this report. Refer to Appendix B for the analytical laboratory reports for results of Methods 3C and 25C.

4.0 ANALYTICAL PROCEDURES

4.1 METHODOLOGY

The analysis of VOCs in the soil gas samples was accomplished by Air Toxics and/or Performance Analytical using US EPA Method 3C (40 CFR Part 60, Appendix A, Method 3C, Determination of Carbon Dioxide, Methane, Nitrogen, and Oxygen from Stationary Sources). The method calls for a portion of the sample to be injected into a gas chromatograph (GC), and use of a thermal conductivity detector (TCD) and integrator to assess the concentration for each compound in the sample.

The URS and the contract laboratory (Air Toxics, Inc.) accomplished the measurement of non-methane organic compounds (NMOC) as carbon using US EPA Method 25C (40 CFR Part 60, Appendix A, Method 25C, Determination of Nonmethane Organic Compounds in MSW Landfill Gases). Using this method, a sample probe that has been perforated at one end is driven to a depth of about 1.0 meter below the bottom of the landfill cover. A sample of the landfill gas is extracted into an evacuated cylinder. The NMOC content of the gas is determined by injecting a portion of the gas into a gas chromatographic column to separate the NMOC from carbon monoxide (CO), carbon dioxide (CO₂), and methane (CH₄); the NMOC are oxidized to CO₂, reduced to CH₄, and measured by a flame ionization detector (FID). In this manner, the variable response of the FID associated with different types of organics is eliminated.

For quality assurance, sample system blanks to check sample probes and equipment and method blanks to check analytical equipment were used.

4.2 ANALYTICAL RESULTS

The compiled analytical results and field data are shown on Table 2. The analytical results for the field blank and method blanks are all within acceptable laboratory quality assurance/control parameters. The NMOC concentrations (ppmv as hexane) range from a low of 140 ppmv to a high of 333 ppmv, prior to correction for air infiltration (as nitrogen) and moisture. Canister 2586, Blue North, had the highest concentration of NMOC. Method 25C provides a criteria for sample content of nitrogen and/or oxygen to be used to reject samples that exhibit excessive air infiltration. Based on this criteria, samples Red South, White North, Orange North, and Green North were omitted from the data set. Using the equation from EPA Method 25C, Section 6.3 for the remaining seven sample analyses, the average C_{NMOC} was calculated to be 948.0 ppmv.

This average C_{NMOC} value represents a 50 percent increase from the 1997 Tier 2 study's average C_{NMOC} of 629.3 ppmv. In part, this is viewed as a result of the conservative adjustment for air infiltration. Also, the increase in concentration may represent a tangible increase in the emanation of VOC from the reservoir of material in the landfill mass. The Tier 2 NMVOC emission estimate was performed using this result.

5.0 NMOC EMISSION RATE CALCULATIONS

5.1 CALCULATED NMOC CONCENTRATION

The laboratory analysis and field measurements provide the variables needed for the calculations outlined in US EPA Method 3C- Determination of Carbon Dioxide, Methane, Nitrogen, and Oxygen from Stationary Sources and Method 25C-Determination of NMOC Concentration (C_{NMOC}) in MSW Landfill Gases. For reference, a copy of Methods 3C and 25C are included in Appendix D of this report. Note that all equations are written using absolute pressure; absolute pressure is determined by adding the measured barometric pressure to the measured gauge manometer pressure. The raw data for NMOC is provided as ppmv carbon by Method 25C, for purposes of Subpart WWW Tier 2, this concentration is divided by 6 to yield the equivalent concentration as hexane (40 CFR 60.754(a)(3)). The equations, moisture correction data (Table 25C-1), nomenclature, compiled analytical results and field data are shown on Table 2.

Two significant corrections were applied to the raw NMOC concentration data. To account for water in the sample, the fraction B_w was calculated using Table 25C-1, the LFG temperature, and barometric pressure at the sampling site. This value was then used in the calculation of C_{NMOC} for each sample tank. The calculation Method 25C also corrects the concentration of NMOC based on nitrogen in the sample, to account for air infiltration. Both of these corrections tend to increase the corrected NMOC concentration that is attributed to the landfill gas contribution. The final NMOC concentrations of the sample group are then averaged to obtain the C_{NMOC} for landfill emission calculation. Due to excessive nitrogen and/or oxygen samples Red South, White North, Orange North, and Green North were omitted from the concentration average. The overall average C_{NMOC} is 948.0 ppmv as hexane.

5.2 CALCULATED NMOC EMISSION RATE

The corrected C_{NMOC} value of 948.0 ppmv was used in the Tier 2 equation for estimating NMOC emissions in arid regions as shown on Table 3. The calculated NMOC emission rate is

48.5 Mg/year. For comparison purposes, the estimated NMOC emission rate in 1997 was 25.8 Mg/year. This increase in the emission rate can be attributed to a combination of the twelve percent increase in the average annual acceptance rate of 81470 Mg/yr in 2001 compared to 72376 Mg/yr in 1997, and the 50 percent increase in the corrected C_{NMOC} value. An increase in NMOC emissions from the landfill is also supported by comparison with the 1997 raw analytical data. The 1997 sample concentrations ranged from 80 to 250 ppmv as hexane, while the 2002 samples ranged from 140 to 333 ppmv as hexane.

Based on these results, a landfill gas collection system is not required at this time. The emission estimates will be recalculated on an annual basis and Tier 2 sampling will be conducted in 2007 (5 years) as required by the NSPS regulations.

TABLES

Table 1
NMOC EMISSION PROJECTIONS
US EPA LANDFILL AIR EMISSIONS
ESTIMATION MODEL OUTPUT

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Model Parameters

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Lo : 169.90 m³ / Mg
k : 0.0200 1/yr ***** User Mode Selection *****
NMOC : 629.30 ppmv ***** User Mode Selection *****
Methane : 50.0000 % volume
Carbon Dioxide : 50.0000 % volume

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Landfill Parameters

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Year Opened : 1965 Current Year : 1996 Year Closed: 2005
Capacity : 3470000 Mg
Average Acceptance Rate Required from
Current Year to Closure Year : 136258.89 Mg/year

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Model Results

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Year	Refuse In Place (Mg)	NMOC Emission Rate	
		(Mg/yr)	(Cubic m/yr)
1966	1.295E+04	1.985E-01	5.538E+01
1967	2.870E+04	4.360E-01	1.216E+02
1968	4.728E+04	7.123E-01	1.987E+02
1969	6.875E+04	1.027E+00	2.866E+02
1970	9.315E+04	1.381E+00	3.853E+02
1971	1.205E+05	1.773E+00	4.947E+02
1972	1.506E+05	2.200E+00	6.136E+02
1973	1.835E+05	2.660E+00	7.420E+02
1974	2.192E+05	3.154E+00	8.799E+02
1975	2.576E+05	3.682E+00	1.027E+03
1976	2.990E+05	4.243E+00	1.184E+03
1977	3.460E+05	4.879E+00	1.361E+03
1978	3.987E+05	5.590E+00	1.560E+03
1979	4.572E+05	6.376E+00	1.779E+03
1980	5.214E+05	7.234E+00	2.018E+03
1981	5.914E+05	8.164E+00	2.278E+03
1982	6.673E+05	9.166E+00	2.557E+03
1983	7.490E+05	1.024E+01	2.856E+03
1984	8.365E+05	1.138E+01	3.174E+03

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Table 1
NMOC EMISSION PROJECTIONS
US EPA LANDFILL AIR EMISSIONS
ESTIMATION MODEL OUTPUT

Year	Refuse In Place (Mg)	NMOC Emission Rate	
		(Mg/yr)	(Cubic m/yr)
1985	9.300E+05	1.258E+01	3.511E+03
1986	1.032E+06	1.390E+01	3.877E+03
1987	1.166E+06	1.567E+01	4.372E+03
1988	1.268E+06	1.693E+01	4.722E+03
1989	1.373E+06	1.821E+01	5.080E+03
1990	1.480E+06	1.949E+01	5.436E+03
1991	1.596E+06	2.088E+01	5.824E+03
1992	1.731E+06	2.253E+01	6.287E+03
1993	1.886E+06	2.447E+01	6.825E+03
1994	2.010E+06	2.588E+01	7.220E+03
1995	2.117E+06	2.701E+01	7.535E+03
1996	2.244E+06	2.841E+01	7.927E+03
1997	2.380E+06	2.994E+01	8.353E+03
1998	2.516E+06	3.144E+01	8.770E+03
1999	2.652E+06	3.290E+01	9.179E+03
2000	2.789E+06	3.434E+01	9.580E+03
2001	2.925E+06	3.575E+01	9.973E+03
2002	3.061E+06	3.713E+01	1.036E+04
2003	3.197E+06	3.848E+01	1.074E+04
2004	3.334E+06	3.981E+01	1.111E+04
2005	3.470E+06	4.111E+01	1.147E+04
2006	3.470E+06	4.030E+01	1.124E+04
2007	3.470E+06	3.950E+01	1.102E+04
2008	3.470E+06	3.872E+01	1.080E+04
2009	3.470E+06	3.795E+01	1.059E+04
2010	3.470E+06	3.720E+01	1.038E+04
2011	3.470E+06	3.646E+01	1.017E+04
2012	3.470E+06	3.574E+01	9.971E+03
2013	3.470E+06	3.503E+01	9.773E+03
2014	3.470E+06	3.434E+01	9.580E+03
2015	3.470E+06	3.366E+01	9.390E+03
2016	3.470E+06	3.299E+01	9.204E+03
2017	3.470E+06	3.234E+01	9.022E+03
2018	3.470E+06	3.170E+01	8.843E+03
2019	3.470E+06	3.107E+01	8.668E+03
2020	3.470E+06	3.046E+01	8.497E+03
2021	3.470E+06	2.985E+01	8.328E+03
2022	3.470E+06	2.926E+01	8.163E+03

Table 1
NMOC EMISSION PROJECTIONS
US EPA LANDFILL AIR EMISSIONS
ESTIMATION MODEL OUTPUT

Year	Refuse In Place (Mg)	NMOC Emission Rate	
		(Mg/yr)	(Cubic m/yr)
2023	3.470E+06	2.868E+01	8.002E+03
2024	3.470E+06	2.811E+01	7.843E+03
2025	3.470E+06	2.756E+01	7.688E+03
2026	3.470E+06	2.701E+01	7.536E+03
2027	3.470E+06	2.648E+01	7.387E+03
2028	3.470E+06	2.595E+01	7.240E+03
2029	3.470E+06	2.544E+01	7.097E+03
2030	3.470E+06	2.494E+01	6.956E+03
2031	3.470E+06	2.444E+01	6.819E+03
2032	3.470E+06	2.396E+01	6.684E+03
2033	3.470E+06	2.348E+01	6.551E+03
2034	3.470E+06	2.302E+01	6.422E+03
2035	3.470E+06	2.256E+01	6.294E+03
2036	3.470E+06	2.212E+01	6.170E+03
2037	3.470E+06	2.168E+01	6.048E+03
2038	3.470E+06	2.125E+01	5.928E+03
2039	3.470E+06	2.083E+01	5.811E+03
2040	3.470E+06	2.042E+01	5.695E+03
2041	3.470E+06	2.001E+01	5.583E+03
2042	3.470E+06	1.961E+01	5.472E+03
2043	3.470E+06	1.923E+01	5.364E+03
2044	3.470E+06	1.885E+01	5.258E+03
2045	3.470E+06	1.847E+01	5.153E+03
2046	3.470E+06	1.811E+01	5.051E+03
2047	3.470E+06	1.775E+01	4.951E+03
2048	3.470E+06	1.740E+01	4.853E+03
2049	3.470E+06	1.705E+01	4.757E+03
2050	3.470E+06	1.671E+01	4.663E+03
2051	3.470E+06	1.638E+01	4.571E+03
2052	3.470E+06	1.606E+01	4.480E+03
2053	3.470E+06	1.574E+01	4.391E+03
2054	3.470E+06	1.543E+01	4.305E+03

**TABLE 2
NSPS TIER 2 ANALYTICAL RESULTS AND CALCULATED C_{NMOC}**

Sample ID	Lab ID	P _{ti} mm Hg	P _t mm Hg	P _{tf} mm Hg	D.F.	NMOC as Hexane (C _{tm})		Nitrogen (%, v/v) *		Oxygen (%, v/v) *		C _{N2} (fraction)	P _b	P _w	B _w	T _{ti}	T _t	T _{tf}	C _{NMOC} calculated (hexane)**
						Concentration in ppm, v/v Result	Reporting Limit	Result	Reporting Limit	Result	Reporting Limit								
232 Red South	P2201474-001	0.01	550	1018	1.94	283.33	19.00	40	0.19	7.3	0.19	0.400	750	17.5	0.023	302.0	295.9	295.9	N/A
2586 Blue North	P2201474-003 Lab Duplicate	0.01 0.01	575 575	1018 1018	1.86 1.86	333.33 333.33	19.00 19.00	28 28	0.20 0.19	5.2 5.1	0.19 0.19	0.280 0.280	765	17.5	0.023	302.0	295.7	295.7	949.2
3406 Red North	P2201474-004	0.01	585	1018	1.84	316.67	19.00	23	0.18	4.8	0.18	0.230	765	17.5	0.023	302.0	295.7	295.7	803.8
394 Orange South	P2201474-005	0.01	585	1018	1.84	316.67	18.00	36	0.18	2.5	0.18	0.360	765	17.5	0.023	302.0	295.9	295.9	1058.8
3116 White North	P2201474-006	0.01	585	1018	1.72	250.00	18.00	48	0.18	11.0	0.18	0.480	765	17.5	0.023	302.0	296.0	296.0	N/A
3414 Orange North 7-18-02	P2201474-007	0.01	345	1018	3.07	140.00	32.00	36	0.31	5.7	0.31	0.360	765	17.5	0.023	302.0	295.9	295.9	793.4
2553 Orange North 7-11-02	P2201474-008	0.01	585	1018	1.81	200.00	18.00	51	0.18	10.0	0.18	0.510	765	17.5	0.023	301.5	296.3	296.3	N/A
2648 Green North	P2201474-009	0.01	515	1018	2.37	183.33	24.00	57	0.24	10.0	0.24	0.570	765	17.5	0.023	302.0	296.2	296.2	N/A
3421 Blue South	P2201474-010	0.01	575	1018	1.88	266.67	19.00	36	0.19	1.6	0.19	0.360	765	17.5	0.023	302.0	296.2	296.2	907.1
3407 Green South	P2201474-011 Lab Duplicate	0.01 0.01	605 605	1018 1018	1.67 1.67	233.33 NT	18.00 NT	44.5 44.4	0.10 0.10	6.0 6.0	0.10 0.10	0.445 0.444	765	17.5	0.023	302.0	296.2	296.2	950.3
3129 White South	P2201474-012	0.01	585	1018	1.73	316.67	18.00	40	0.10	2.6	0.10	0.400	765	17.5	0.023	302.0	296.2	296.2	1173.3
2980 (Field Blank)	P2201474-002	0.01	575	1018	1.95	ND	20.00	84	0.20	21.0	0.20								
8/16/02	Method Blank	N/A	N/A	N/A	1.00	ND	0.17	ND	0.10	ND	0.10								
8/16/02	Method Blank	N/A	N/A	N/A	1.00	ND	0.17	107.00	0.10	86.0	0.10								
Average:																			948.0

TR = Detected Below Indicated Reporting Limit

NT = Not tested

ND = Not Detected

* = Total Gas Composition Normalized to 99.99%, Corrected For Argon

** = Calculated CNMOC concentration using equation from US EPA Method 25C

*** = Corrected CNMOC concentration adjusting for air in the sample.

$$(79/21) \times \text{vol \% O}_2 = \text{vol \% N}_2 \text{ from air}$$

$$\text{vol \% O}_2 + \text{vol \% N}_2 = \text{vol \% Air}$$

$$[(\text{CNMOC calculated}) / (100 - \text{volume \% air})] \times 100 = \text{CNMOC corrected}$$

EPA Method 25C-Determination of NMOC Concentration in MSW Landfill Gases

WATER CORRECTION: Use table 3C-1.

Equation to calculate B_w using LFG Temp and P_b at the sampling site.

$$B_w = P_w / P_b$$

Equation to Convert Measured NMOC to Calculated NMOC Concentration:

$$C_t = \frac{P_{tf}}{T_{tf}} \frac{1}{\frac{P_t}{T_t} - \frac{P_{ti}}{T_{ti}} (1 - B_w - (99/78)C_{N2})^r} \sum_{j=1}^r C_{tmj}$$

$$C_{NMOC} (\text{hexane}) = C_t / 6$$

TABLE 25C-1 MOISTURE CORRECTION	
LFG Temp, °C	P _w , mm HG
4	6.1
6	7
8	8
1	9.2
12	10.5
14	12
16	13.6
18	15.5
20	17.5
22	19.8
24	22.4
26	25.2
28	28.3
30	31.8

N/A

Sample Not Accepted Due to High N₂ or O₂

P_{tf} = final gas sample tank pressure after pressurizing, mm Hg absolute.

T_{tf} = sample tank temperature after pressurizing, deg. K.

P_t = gas sample tank pressure at completion of sampling, but before pressurizing, mm Hg absolute.

T_t = sample tank temperature at completion of sampling, but before pressurizing, deg. K.

P_{ti} = gas sample tank pressure before sampling, mm Hg absolute.

T_{ti} = sample tank temperature before sampling, deg K.

LFG Temp = temperature of soil gas, deg. C.

P_w = vapor pressure of water (from Table 25C-1, EPA Method 25C), mm Hg.

P_b = barometric pressure, mm Hg.

B_w = water correction factor, ratio of P_w to P_b, fraction.

C_{N2} = measured Nitrogen concentration, fraction.

C_{tm} = measured NMOC concentration, ppmv C equiv.

r = total number injections of sample tank during analysis (where j = injection number, 1...r), #.

C_{calc.} = calculated NMOC concentration, ppmv C equiv.

Table 3
NMOC EMISSIONS - ARID REGION k VALUE AND TIER 2 C_{NMOC}
Cinder Lake Landfill, Flagstaff, Arizona

Equation 1. (For landfills where the annual acceptance rate is not known) ⁽¹⁾

$$M_{NMOC} = 2L_o R(e^{-kc} - e^{-kt})(C_{NMOC})(3.595 \times 10^{-9})$$

Where,

M_{NMOC} = mass emission rate of NMOC, Mg/yr

Refuse methane generation potential:	170 ⁽²⁾	L_o (m ³ /Mg)
Average annual acceptance rate:	81470 ⁽³⁾	R (Mg/yr)
Methane generation rate constant:	0.02 ⁽⁴⁾	k (1/yr)
Years since closure (c = 0 for active and/or new landfills):	0	c (yrs)
Age of landfill:	36 ⁽⁵⁾	t (yrs)
Calculated Concentration of NMOC:	948.0 ⁽⁶⁾	C_{NMOC} (ppm as hexane)
Conversion factor:	3.6×10^{-9} ⁽²⁾	

$M_{NMOC} = 48.5$ Mg/yr

(1) As per 40 CRF - Subpart WWW § 60.754(a)(1)

(2) Default EPA values.

(3) R = 2,932,934 Mg / 36 yrs = 81470 Mg/yr

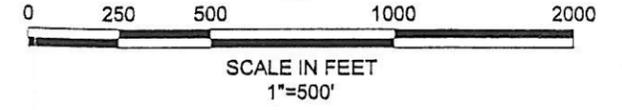
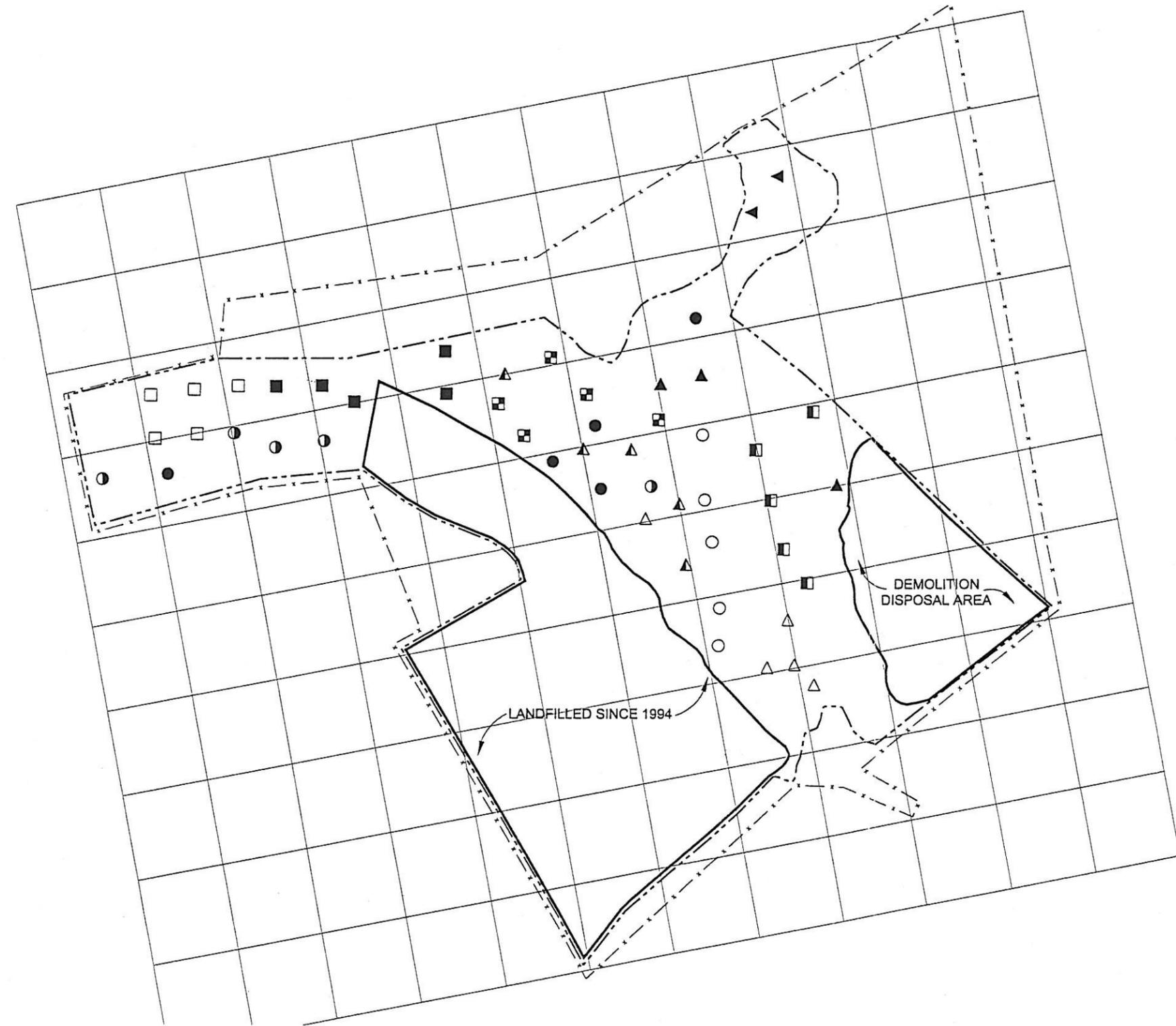
(4) k value of 0.02 for arid regions was provided by US EPA Region 9

(5) t = 2001 - 1965 = 36 yrs

(6) C_{NMOC} (ppm as hexane) calculated based on sampling results (Table 2)

FIGURES

G:\22E\158-0066A\199\A15427.DWG 8-20-02



LEGEND:

- WHITE NORTH CANISTER #3116
- RED NORTH CANISTER #3406
- ◐ BLUE NORTH CANISTER #2586
- ORANGE NORTH CANISTER #2553
- GREEN NORTH CANISTER #2648

- ◻ WHITE SOUTH CANISTER #3129
- ◼ RED SOUTH CANISTER #0232
- △ BLUE SOUTH CANISTER #3421
- ▲ ORANGE SOUTH CANISTER #0394
- ▲ GREEN SOUTH CANISTER #3409

- PERIMETER FENCE
- - - LANDFILL AREA
- RECENTLY ACTIVE AREA

NSPS TIER 2 LFG
 SAMPLING LOCATIONS
 Cinder Lake Landfill

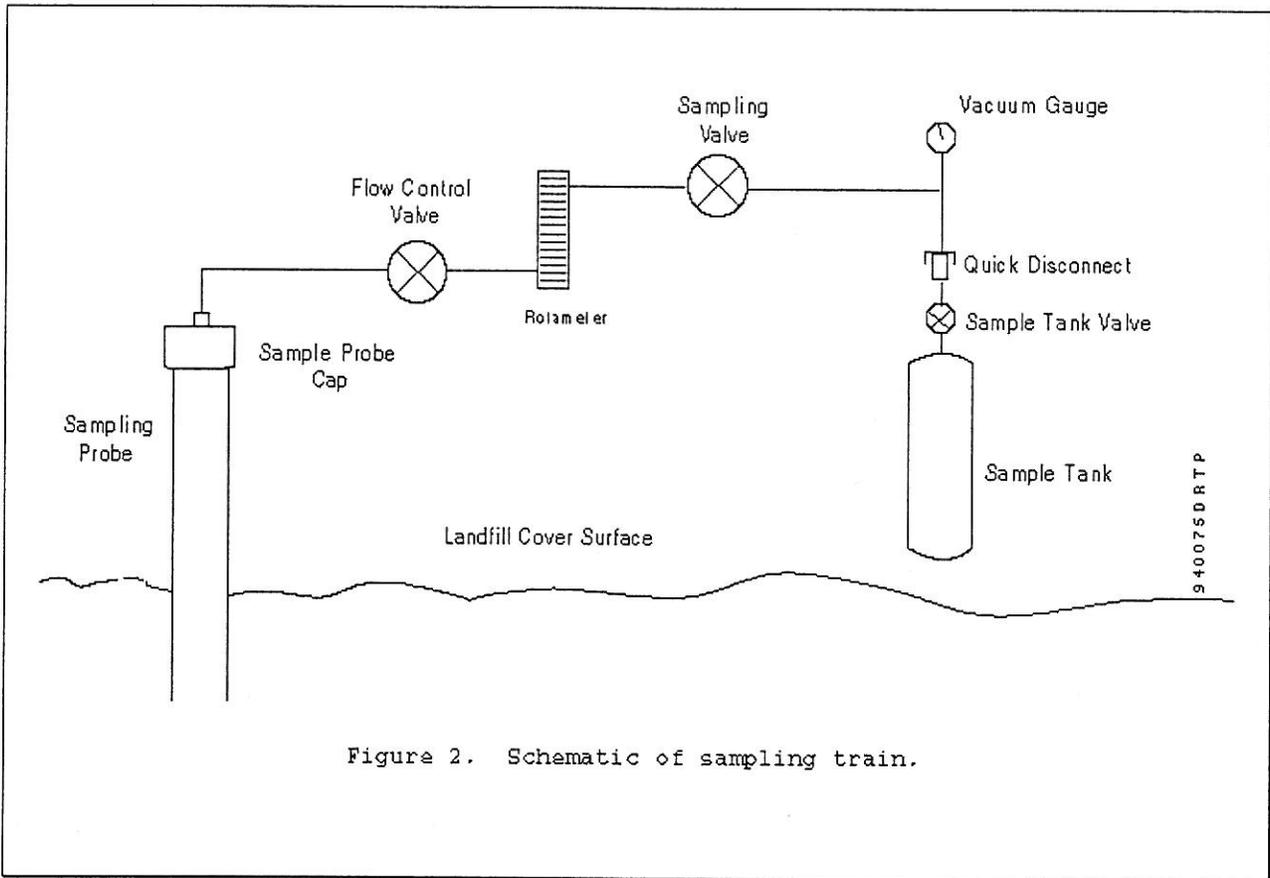


Figure 2. Schematic of sampling train.

APPENDIX A

**CHAIN OF CUSTODY
FIELD SAMPLING LOGS**

CHAIN-OF-CUSTODY RECORD

Sample Transportation Notice

Relinquishing signature on this document indicates that sample is being shipped in compliance with all applicable local, State, Federal, national, and international laws, regulations and ordinances of any kind. Air Toxics Limited assumes no liability with respect to the collection, handling or shipping of these samples. Relinquishing signature also indicates agreement to hold harmless, defend, and indemnify Air Toxics Limited against any claim, demand, or action of any kind, related to the collection, handling, or shipping of samples. D.O.T. Hotline (800) 467-4922

180 BLUE RAVINE ROAD, SUITE B
FOLSOM, CA 95630-4719
(916) 985-1000 FAX: (916) 985-1020

Contact Person <u>Bill Jamieson</u> Company <u>KRS</u> Address <u>7720 N 16th ST</u> City <u>Phoenix</u> State <u>AZ</u> Zip <u>85020</u> Phone <u>602.861.7437</u> FAX _____ Collected By: Signature <u>Bill Jamieson</u>		Project info: P.O. # _____ Project # _____ Project Name <u>Cinder LAKE</u>		Turn Around Time: <input type="checkbox"/> Normal <input type="checkbox"/> Rush _____ Specify _____ <u>ML 7/24/02</u>			
Lab I.D.	Field Sample I.D.	Date & Time	Analyses Requested	Canister Pressure / Vacuum	Initial	Final	Receipt
01A	Red South	July 18/19, 02	RMZSC CAN # 232				8.0"Hg 22.7 ^o
02A	BLANK	July 19, 02	" " "				7.5"Hg 22.5 ^o
03A	BLUE North	July 11/18/19, 02	" " "				7.5"Hg 22.5 ^o
04A	RED North	July 18/19, 02	" " "				7.0"Hg 22.5 ^o
05A	ORANGE South	July 18/19, 02	" " "				7.0"Hg 22.7 ^o
06A	White North	July 18, 02	" " "				7.0"Hg 22.8 ^o
07A	ORANGE North	July 18, 02	" " "				6.5"Hg 22.7 ^o
08A	ORANGE North	July 11, 02	" " "				6.5"Hg 23.1 ^o
09A	GREEN North	July 11/18, 02	" " "				10.0"Hg 23.0 ^o
10A	BLUE South	July 18/19, 02	" " "				7.5"Hg 23.0 ^o
Relinquished By: (Signature) <u>Bill Jamieson</u> Date/Time <u>July 19, 02</u>		Received By: (Signature) _____ Date/Time _____		Notes:			
Relinquished By: (Signature) _____ Date/Time _____		Received By: (Signature) <u>Kelly Hunter</u> Date/Time <u>0910</u>		Custody Seals Intact? Yes No <u>None</u> Work Order # <u>0207493A</u>			
Air Bill # <u>83274857460</u>		Opened By: <u>KCB</u>		Condition <u>good</u>		Temp. (°C) _____	
Shipper Name: <u>Fed Ex</u>		Air Bill # <u>83274857460</u>		Condition <u>good</u>		Temp. (°C) _____	
Lab Use Only							



CHAIN-OF-CUSTODY RECORD

Sample Transportation Notice

Relinquishing signature on this document indicates that sample is being shipped in compliance with all applicable local, State, Federal, national, and international laws, regulations and ordinances of any kind. Air Toxics Limited assumes no liability with respect to the collection, handling or shipping of these samples. Relinquishing signature also indicates agreement to hold harmless, defend, and indemnify Air Toxics Limited against any claim, demand, or action of any kind, related to the collection, handling, or shipping of samples. D.O.T. Hotline (800) 457-4922

180 BLUE RAVINE ROAD, SUITE B
FOLSOM, CA 95630-4719
(916) 985-1000 FAX: (916) 985-1020

Contact Person <u>Bill Jamieson</u> Company <u>URS</u> Address <u>720 N 16th St</u> City _____ State _____ Zip _____ Phone <u>007.861.7437</u> FAX _____		Project info: P.O. # _____ Project # _____ Project Name <u>Cinder Lake</u>		Turn Around Time: <input type="checkbox"/> Normal <input type="checkbox"/> Rush _____ Specify _____ <u>ML 7/24/02</u>	
Collected By: Signature _____		Analyses Requested <u>RM ZSC / 3C CAN# 3407</u> <u>RM ZSC / 3C '1 3129</u>		Canister Pressure / Vacuum Initial _____ Final _____ Receipt _____ <u>6.5"Hg</u> <u>22.9"</u> <u>7.0"Hg</u> <u>23.0"</u>	
Lab I.D. _____	Field Sample I.D. _____	Date & Time _____	Notes: _____		
Relinquished By: (Signature) <u>[Signature]</u> Date/Time <u>July 19, 02</u>	Received By: (Signature) _____ Date/Time _____	Condition _____ Custody Seals Intact? <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> None			
Relinquished By: (Signature) _____ Date/Time _____	Received By: (Signature) <u>Kelly Muth</u> Date/Time <u>0910</u>	Air Bill # <u>833747857480</u>	Opened By: <u>KUR</u>	Temp. (°C) _____	Work Order # <u>02074930</u>
Relinquished By: (Signature) _____ Date/Time _____	Shipper Name <u>FedEx</u>	Air Bill # <u>833747857480</u>	Opened By: <u>KUR</u>	Temp. (°C) _____	Work Order # <u>02074930</u>
Lab Use Only	_____				

APPENDIX B

ANALYTICAL LABORATORY REPORTS

(AIR TOXICS, INC. / PERFORMANCE ANALYTICAL, INC.)

WORK ORDER #: 0207493C

Work Order Summary

CLIENT: Mr. Bill Jamieson
URS Corporation
7720 N. 16th Street
Suite 100
Phoenix, AZ 85020

BILL TO: Mr. Bill Jamieson
URS Corporation
7720 N. 16th Street
Suite 100
Phoenix, AZ 85020

PHONE: 602-861-7437

FAX: 602-371-1615

DATE RECEIVED: 8/14/02

DATE COMPLETED: 8/20/02

P.O. #

PROJECT # Cinder Lake

CONTACT: Karen Burden

<u>FRACTION #</u>	<u>NAME</u>	<u>TEST</u>	<u>RECEIPT VAC./PRES.</u>
01A	Red South	Modified Method 3C	8.0 "Hg
03A	Blue North	Modified Method 3C	7.5 "Hg
03AA	Blue North Duplicate	Modified Method 3C	7.5 "Hg
04A	Red North	Modified Method 3C	7.0 "Hg
05A	Orange South	Modified Method 3C	7.0 "Hg
06A	White North	Modified Method 3C	7.0 "Hg
07A	Orange North	Modified Method 3C	16.5 "Hg
08A	Orange North	Modified Method 3C	6.5 "Hg
09A	Green North	Modified Method 3C	10.0 "Hg
10A	Blue South	Modified Method 3C	7.5 "Hg
11A	Lab Blank	Modified Method 3C	NA
12A	LCS	Modified Method 3C	NA

CERTIFIED BY: *Linda D. Furrer*
Laboratory Director

DATE: 08/21/02

Certification numbers: CA NELAP - 02110CA, NY NELAP - 11291, UT NELAP - 9166389892, LA NELAP/LELAP- AI 30763
Name of Accrediting Agency: NELAP/Florida Department of Health, Scope of Application: Clean Air Act,
Accreditation number: E87680, Effective date: 01/01/02, Expiration date: 06/30/02

Air Toxics Ltd. certifies that the test results contained in this report meet all requirements of the NELAC standards
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180 BLUE RAVINE ROAD, SUITE B FOLSOM, CA - 95630
(916) 985-1000 . (800) 985-5955 . FAX (916) 985-1020

LABORATORY NARRATIVE

Modified Method 3C

URS Corporation

Workorder# 0207493C

Twelve 6 Liter Summa Canister samples were received on August 14, 2002. The laboratory performed analysis via Modified EPA Method 3C for Oxygen, Nitrogen, Carbon Dioxide and Methane using GC/TCD. The method involves direct injection of 1.0 mL of landfill gas. The analytical system consists of a multidimensional gas chromatograph equipped with a variety of gas switching valves and columns. See the data sheet for the reporting limits.

Receiving Notes

Sample Orange North was received with significant vacuum remaining in the canister. The client was contacted and analysis proceeded. The residual canister vacuum resulted in elevated reporting limits.

Analytical Notes

All of the samples were analyzed past the 30-day holding time. The client was notified and permission given to proceed with analysis and reporting.

There were no other analytical discrepancies.

Definition of Data Qualifying Flags

Seven qualifiers may have been used on the data analysis sheets and indicate as follows:

- B - Compound present in laboratory blank greater than reporting limit.
- J - Estimated value.
- E - Exceeds instrument calibration range.
- S - Saturated peak.
- Q - Exceeds quality control limits.
- U - Compound analyzed for but not detected above the detection limit.
- M - Reported value may be biased due to apparent matrix interferences.

File extensions may have been used on the data analysis sheets and indicates as follows:

- a-File was requantified
- b-File was quantified by a second column and detector
- r1-File was requantified for the purpose of reissue

AIR TOXICS LTD.

ID#: 0207493C-01A

Modified EPA Method 3C
GC/TCD

Sample Name:	Red South	Date of Collection: 7/18/02
Dil. Factor:	1.94	Date of Analysis: 8/16/02

Compound	Rpt. Limit (%)	Amount (%)
Oxygen	0.19	7.3
Nitrogen	0.19	40
Methane	0.19	27
Carbon Dioxide	0.19	26

AIR TOXICS LTD.

ID#: 0207493C-03A

Modified EPA Method 3C
GC/TCD

Sample Name:	Blue North	Date of Collection: 7/11/02
Dil. Factor:	1.86	Date of Analysis: 8/16/02

Compound	Rpt. Limit (%)	Amount (%)
Oxygen	0.19	5.2
Nitrogen	0.19	28
Methane	0.19	38
Carbon Dioxide	0.19	29

AIR TOXICS LTD.

ID#: 0207493C-03AA

Modified EPA Method 3C
GC/TCD

Sample Name: Blue North Duplicate Date of Collection: 7/11/02
Dil. Factor: 1.86 Date of Analysis: 8/16/02

Compound	Rpt. Limit (%)	Amount (%)
Oxygen	0.19	5.1
Nitrogen	0.19	28
Methane	0.19	38
Carbon Dioxide	0.19	29

AIR TOXICS LTD.

ID#: 0207493C-04A

Modified EPA Method 3C
GC/TCD

Sample Name:	Red North	Date of Collection: 7/18/02
Dil. Factor:	1.84	Date of Analysis: 8/16/02

Compound	Rpt. Limit (%)	Amount (%)
Oxygen	0.18	4.8
Nitrogen	0.18	23
Methane	0.18	41
Carbon Dioxide	0.18	33

AIR TOXICS LTD.

ID#: 0207493C-05A

Modified EPA Method 3C
GC/TCD

Sample Name:	Orange South	Date of Collection:	7/18/02
Dil. Factor:	1.84	Date of Analysis:	8/16/02

Compound	Rpt. Limit (%)	Amount (%)
Oxygen	0.18	2.5
Nitrogen	0.18	36
Methane	0.18	26
Carbon Dioxide	0.18	29

AIR TOXICS LTD.

ID#: 0207493C-06A

Modified EPA Method 3C GC/TCD

Sample Name:	White North	Date of Collection: 7/18/02
Dil. Factor:	1.84	Date of Analysis: 8/16/02

Compound	Rpt. Limit (%)	Amount (%)
Oxygen	0.18	11
Nitrogen	0.18	48
Methane	0.18	24
Carbon Dioxide	0.18	19

AIR TOXICS LTD.

ID#: 0207493C-07A

Modified EPA Method 3C
GC/TCD

Sample Name: Orange North Date of Collection: 7/18/02
Dil. Factor: 3.07 Date of Analysis: 8/16/02

Compound	Rpt. Limit (%)	Amount (%)
Oxygen	0.31	5.7
Nitrogen	0.31	36
Methane	0.31	13
Carbon Dioxide	0.31	20

AIR TOXICS LTD.

ID#: 0207493C-08A

Modified EPA Method 3C
GC/TCD

Sample Name:	Orange North	Date of Collection:	7/11/02
Dil. Factor:	1.81	Date of Analysis:	8/16/02

Compound	Rpt. Limit (%)	Amount (%)
Oxygen	0.18	10
Nitrogen	0.18	51
Methane	0.18	21
Carbon Dioxide	0.18	20

AIR TOXICS LTD.

ID#: 0207493C-09A

Modified EPA Method 3C
GC/TCD

Sample Name:	Green North	Date of Collection:	7/11/02
Dil. Factor:	2.37	Date of Analysis:	8/16/02

Compound	Rpt. Limit (%)	Amount (%)
Oxygen	0.24	10
Nitrogen	0.24	57
Methane	0.24	17
Carbon Dioxide	0.24	18

AIR TOXICS LTD.

ID#: 0207493C-10A

Modified EPA Method 3C
GC/TCD

Sample Name:	Blue South	Date of Collection: 7/18/02
Dil. Factor:	1.88	Date of Analysis: 8/16/02

Compound	Rpt. Limit (%)	Amount (%)
Oxygen	0.19	1.6
Nitrogen	0.19	36
Methane	0.19	32
Carbon Dioxide	0.19	30

WORK ORDER #: 0207493E

Work Order Summary

CLIENT: Mr. Bill Jamieson
URS Corporation
7720 N. 16th Street
Suite 100
Phoenix, AZ 85020

BILL TO: Mr. Bill Jamieson
URS Corporation
7720 N. 16th Street
Suite 100
Phoenix, AZ 85020

PHONE: 602-861-7437

FAX: 602-371-1615

DATE RECEIVED: 8/14/02

DATE COMPLETED: 8/23/02

P.O. #

PROJECT # Cinder Lake

CONTACT: Karen Burden

<u>FRACTION #</u>	<u>NAME</u>	<u>TEST</u>	<u>RECEIPT VAC./PRES.</u>
01A	Red South	Modified Method 25C	8.0 "Hg
02A	BLANK	Modified Method 25C	7.5 "Hg
03A	Blue North	Modified Method 25C	7.5 "Hg
03AA	Blue North Duplicate	Modified Method 25C	7.5 "Hg
04A	Red North	Modified Method 25C	7.0 "Hg
05A	Orange South	Modified Method 25C	7.0 "Hg
06A	White North	Modified Method 25C	7.0 "Hg
07A	Orange North	Modified Method 25C	16.5 "Hg
08A	Orange North	Modified Method 25C	6.5 "Hg
09A	Green North	Modified Method 25C	10.0 "Hg
10A	Blue South	Modified Method 25C	7.5 "Hg
11A	Green South	Modified Method 25C	6.5 "Hg
12A	White South	Modified Method 25C	7.0 "Hg
13A	Lab Blank	Modified Method 25C	NA
14A	LCS	Modified Method 25C	NA

CERTIFIED BY: *Sinda J. Freeman*
Laboratory Director

DATE: 08/22/02

Certification numbers: CA NELAP - 02110CA, NY NELAP - 11291, UT NELAP - 9166389892, LA NELAP/LELAP- AI 30763
Name of Accrediting Agency: NELAP/Florida Department of Health, Scope of Application: Clean Air Act,
Accreditation number: E87680, Effective date: 01/01/02, Expiration date: 06/30/02

Air Toxics Ltd. certifies that the test results contained in this report meet all requirements of the NELAC standards
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LABORATORY NARRATIVE
Modified Method 25C
URS Corporation
Workorder# 0207493E

Twelve 6 Liter Summa Canister samples were received on August 14, 2002. The laboratory performed analysis for non-condensable hydrocarbons via Modified EPA Method 25C for Non-Methane Organic Carbon (NMOC) using GC/FID. The method involves direct injection of 1.0 mL of landfill gas. The analytical system consists of a multidimensional gas chromatograph equipped with a variety of gas switching valves and columns. The NMOC value reported is obtained by oxidation of the non-methane carbons to Carbon Dioxide followed by reduction to methane. See the data sheet for the reporting limit for NMOC.

Receiving Notes

Sample Orange North was received with significant vacuum remaining in the canister. The client was contacted and analysis proceeded. The residual canister vacuum resulted in elevated reporting limits.

Analytical Notes

Samples Blue North, Orange North and Green North were analyzed past the 30-day holding time. The client was notified and permission given to proceed with analysis and reporting.

Definition of Data Qualifying Flags

Seven qualifiers may have been used on the data analysis sheets and indicate as follows:

- B - Compound present in laboratory blank greater than reporting limit.
- J - Estimated value.
- E - Exceeds instrument calibration range.
- S - Saturated peak.
- Q - Exceeds quality control limits.
- U - Compound analyzed for but not detected above the detection limit.
- M - Reported value may be biased due to apparent matrix interferences.

File extensions may have been used on the data analysis sheets and indicates as follows:

- a-File was requantified
- b-File was quantified by a second column and detector
- r1-File was requantified for the purpose of reissue

AIR TOXICS LTD.

ID#: 0207493E-01A

Modified EPA Method 25C
GC/FID

Sample Name:	Red South	Date of Collection:	7/18/02
DIL Factor:	1.94	Date of Analysis:	8/16/02

Compound	Rpt. Limit (ppmvC)	Amount (ppmvC)
NMOC as Methane	19	1700

Notes:

Initial Canister Pressure (P_i) = 0.005 mm Hg (absolute)
Canister Pressure after Sampling (P_s) = 200 mm Hg (gauge)
Canister Pressure after Pressurization (P_{pr}) = 258 mm Hg (gauge)
Canister Temperature after Pressurization (T_{pr}) = 22..7

Canisters are leak-checked according to Section 4.1 of the method.

AIR TOXICS LTD.

ID#: 0207493E-02A

Modified EPA Method 25C
GC/FID

Sample Name:	BLANK	Date of Collection:	7/19/02
Dil. Factor:	1.95	Date of Analysis:	8/16/02

Compound	Rpt. Limit (ppmvC)	Amount (ppmvC)
NMOC as Methane	20	Not Detected

Notes:

Initial Canister Pressure (P_u) = 0.005 mm Hg (absolute)
Canister Pressure after Sampling (P_1) = 190 mm Hg (gauge)
Canister Pressure after Pressurization (P_{1f}) = 258 mm Hg (gauge)
Canister Temperature after Pressurization (T_{1f}) = 22.5 C

Canisters are leak-checked according to Section 4.1 of the method.

AIR TOXICS LTD.

ID#: 0207493E-03A

Modified EPA Method 25C
GC/FID

Sample Name:	Blue North	Date of Collection:	7/11/02
Dil. Factor:	1.86	Date of Analysis:	8/16/02

Compound	Rpt. Limit (ppmvC)	Amount (ppmvC)
NMOC as Methane	19	2000

Notes:

Initial Canister Pressure (P_{if}) = 0.005 mm Hg (absolute)
Canister Pressure after Sampling (P_i) = 190 mm Hg (gauge)
Canister Pressure after Pressurization (P_{if}) = 258 mm Hg (gauge)
Canister Temperature after Pressurization (T_{if}) = 22.5 C

Canisters are leak-checked according to Section 4.1 of the method.

AIR TOXICS LTD.

ID#: 0207493E-03AA

Modified EPA Method 25C GC/FID

Sample Name:	Blue North Duplicate	Date of Collection:	7/17/02
DIL Factor:	1.86	Date of Analysis:	8/16/02

Compound	Rpt. Limit (ppmvC)	Amount (ppmvC)
NMOC as Methane	19	2000

Notes:

Initial Canister Pressure (P_{if}) = 0.005 mm Hg (absolute)
Canister Pressure after Sampling (P_i) = 190 mm Hg (gauge)
Canister Pressure after Pressurization (P_{if}) = 258 mm Hg (gauge)
Canister Temperature after Pressurization (T_{if}) = 22.5 C

Canisters are leak-checked according to Section 4.1 of the method.

AIR TOXICS LTD.

ID#: 0207493E-04A

Modified EPA Method 25C GC/FID

Sample Name:	Red North	Date of Collection:	7/18/02
Dil. Factor:	1.86	Date of Analysis:	8/16/02

Compound	Rpt. Limit (ppmvC)	Amount (ppmvC)
NMOC as Methane	19	1900

Notes:

Initial Canister Pressure (P_{i1}) = 0.005 mm Hg (absolute)
Canister Pressure after Sampling (P_1) = 180 mm Hg (gauge)
Canister Pressure after Pressurization (P_{i2}) = 258 mm Hg (gauge)
Canister Temperature after Pressurization (T_{i2}) = 22.5 C

Canisters are leak-checked according to Section 4.1 of the method.

AIR TOXICS LTD.

ID#: 0207493E-05A

Modified EPA Method 25C GC/FID

Sample Name:	Orange South	Date of Collection:	7/18/02
Dil. Factor:	1.84	Date of Analysis:	8/16/02

Compound	Rpt. Limit (ppmvC)	Amount (ppmvC)
NMOC as Methane	18	1900

Notes:

Initial Canister Pressure (P_{i1}) = 0.005 mm Hg (absolute)
Canister Pressure after Sampling (P_t) = 180 mm Hg (gauge)
Canister Pressure after Pressurization (P_{t1}) = 258 mm Hg (gauge)
Canister Temperature after Pressurization (T_{t1}) = 22.7 C

Canisters are leak-checked according to Section 4.1 of the method.

AIR TOXICS LTD.

ID#: 0207493E-06A

Modified EPA Method 25C
GC/FID

Sample Name:	White North	Date of Collection: 7/18/02
Dil. Factor:	1.84	Date of Analysis: 8/16/02

Compound	Rpt. Limit (ppmvC)	Amount (ppmvC)
NMOC as Methane	18	1500

Notes:

Initial Canister Pressure (P_{if}) = 0.005 mm Hg (absolute)
Canister Pressure after Sampling (P_i) = 180 mm Hg (gauge)
Canister Pressure after Pressurization (P_{if}) = 258 mm Hg (gauge)
Canister Temperature after Pressurization (T_{if}) = 22.8 C

Canisters are leak-checked according to Section 4.1 of the method.

AIR TOXICS LTD.

ID#: 0207493E-07A

Modified EPA Method 25C
GC/FID

Sample Name:	Orange North	Date of Collection:	7/18/02
Dil. Factor:	3.16	Date of Analysis:	8/16/02

Compound	Rpt. Limit (ppmvC)	Amount (ppmvC)
NMOC as Methane	32	840

Notes:

Initial Canister Pressure (P_{ii}) = 0.005 mm Hg (absolute)
Canister Pressure after Sampling (P_i) = 420 mm Hg (gauge)
Canister Pressure after Pressurization (P_{if}) = 258 mm Hg (gauge)
Canister Temperature after Pressurization (T_{if}) = 22.7 C

Canisters are leak-checked according to Section 4.1 of the method.

AIR TOXICS LTD.

ID#: 0207493E-08A

Modified EPA Method 25C
GC/FID

Sample Name:	Orange North	Date of Collection:	7/11/02
Dil. Factor:	1.81	Date of Analysis:	8/16/02

Compound	Rpt. Limit (ppmvC)	Amount (ppmvC)
NMOC as Methane	18	1200



AIR TOXICS LTD.

ID#: 0207493E-09A

Modified EPA Method 25C
GC/FID

Sample Name:	Green North	Date of Collection:	7/11/02
Dil. Factor:	2.37	Date of Analysis:	8/16/02

Compound	Rpt. Limit (ppmvC)	Amount (ppmvC)
NMOC as Methane	24	1100

Notes:

Initial Canister Pressure (P_{ij}) = 0.005 mm Hg (absolute)
Canister Pressure after Sampling (P_t) = 250 mm Hg (gauge)
Canister Pressure after Pressurization (P_{tr}) = 258 mm Hg (gauge)
Canister Temperature after Pressurization (T_{tr}) = 23.0 C

Canisters are leak-checked according to Section 4.1 of the method.

AIR TOXICS LTD.

ID#: 0207493E-10A

Modified EPA Method 25C
GC/FID

Sample Name:	Blue South	Date of Collection: 7/18/02
Dil. Factor:	1.88	Date of Analysis: 8/16/02

Compound	Rpt. Limit (ppmvC)	Amount (ppmvC)
NMOC as Methane	19	1600

Notes:

Initial Canister Pressure (P_{ti}) = 0.005 mm Hg (absolute)
Canister Pressure after Sampling (P_t) = 190 mm Hg (gauge)
Canister Pressure after Pressurization (P_{tf}) = 258 mm Hg (gauge)
Canister Temperature after Pressurization (T_{tf}) = 23.0 C

Canisters are leak-checked according to Section 4.1 of the method.

AIR TOXICS LTD.

ID#: 0207493E-11A

Modified EPA Method 25C
GC/FID

Sample Name:	Green South	Date of Collection: 7/18/02
Dil. Factor:	1.80	Date of Analysis: 8/16/02

Compound	Rpt. Limit (ppmvC)	Amount (ppmvC)
NMOC as Methane	18	1400

Notes:

Initial Canister Pressure (P_{if}) = 0.005 mm Hg (absolute)
Canister Pressure after Sampling (P_i) = 160 mm Hg (gauge)
Canister Pressure after Pressurization (P_{if}) = 258 mm Hg (gauge)
Canister Temperature after Pressurization (T_{if}) = 22.9 C

Canisters are leak-checked according to Section 4.1 of the method.

AIR TOXICS LTD.

ID#: 0207493E-12A

Modified EPA Method 25C
GC/FID

Sample Name:	White South	Date of Collection:	7/18/02
Dil. Factor:	1.82	Date of Analysis:	8/16/02

Compound	Rpt. Limit (ppmvC)	Amount (ppmvC)
NMOC as Methane	18	1900

Notes:

Initial Canister Pressure (P_{ii}) = 0.005 mm Hg (absolute)
Canister Pressure after Sampling (P_i) = 180 mm Hg (gauge)
Canister Pressure after Pressurization (P_{if}) = 258 mm Hg (gauge)
Canister Temperature after Pressurization (T_{if}) = 23.0 C

Canisters are leak-checked according to Section 4.1 of the method.

AIR TOXICS LTD.

ID#: 0207493E-13A

Modified EPA Method 25C
GC/FID

Sample Name:	Lab Blank	Date of Collection: NA
Dil. Factor:	1.00	Date of Analysis: 8/16/02

Compound	Rpt. Limit (ppmvC)	Amount (ppmvC)
NMOC as Methane	10	Not Detected

Notes:

Initial Canister Pressure (P_{i1}) = NA (absolute)
Canister Pressure after Sampling (P_1) = NA (gauge)
Canister Pressure after Pressurization (P_{i2}) = NA (gauge)
Canister Temperature after Pressurization (T_{i2}) = NA

Canisters are leak-checked according to Section 4.1 of the method.

AIR TOXICS LTD.

ID#: 0207493E-14A

Modified EPA Method 25C
GC/FID

Sample Name:	LCS	Date of Collection:	NA
Dil. Factor:	1.00	Date of Analysis:	8/16/02

Compound	Rpt. Limit (ppmvC)	% Recovery
NMOC as Methane	10	91

Notes:

Initial Canister Pressure (P_0) = NA (absolute)
Canister Pressure after Sampling (P_1) = NA (gauge)
Canister Pressure after Pressurization (P_2) = NA (gauge)
Canister Temperature after Pressurization (T_2) = NA

Canisters are leak-checked according to Section 4.1 of the method.

AIR TOXICS LTD.

ID#: 0207493C-12A

Modified EPA Method 3C
GC/TCD

Sample Name:	LCS	Date of Collection: NA
Dil. Factor:	1.00	Date of Analysis: 8/16/02

Compound	Rpt. Limit (%)	% Recovery
Oxygen	0.1	86
Nitrogen	0.1	107
Methane	0.1	96
Carbon Dioxide	0.1	99

AIR TOXICS LTD.

ID#: 0207493C-11A

Modified EPA Method 3C
GC/TCD

Sample Name:	Lab Blank	Date of Collection: NA
Dil. Factor:	1.00	Date of Analysis: 8/16/02

Compound	Rpt. Limit (%)	Amount (%)
Oxygen	0.1	Not Detected
Nitrogen	0.1	Not Detected
Methane	0.1	Not Detected
Carbon Dioxide	0.1	Not Detected

AIR TOXICS LTD.

ID#: 0207493C-02A

Modified EPA Method 3C GC/TCD

Sample Name:	Blank	Date of Collection: 7/19/02
Dil. Factor:	1.95	Date of Analysis: 8/16/02

Compound	Rpt. Limit (%)	Amount (%)
Oxygen	0.20	21
Nitrogen	0.20	84
Methane	0.20	Not Detected
Carbon Dioxide	0.20	Not Detected



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RESULTS OF ANALYSIS

Page 1 of 1

Client : Air Toxics Ltd.
Client Sample ID: Green South

PAI Project ID: P2201474
 PAI Sample ID: P2201474-011

Test Code: Modified EPA Method 3C
Instrument ID: HP5890/TCD #1
Analyst: Annie Calvagna
Sampling Media: Summa Canister
Test Notes:

Date Collected: 7/18/02
Date Received: 8/1/02
Date Analyzed: 8/3/02
Volume(s) Analyzed: 0.10 ml

PI1 = -3.2 PF1 = 4.5

D.F. = 1.67

CAS #	Compound	Result (%, v/v)	MRL (%, v/v)	Data Qualifier
1333-74-01	Hydrogen	ND	0.100	
7782-44-7	Oxygen +			
7440-37-1	Argon *	6.04	0.100	
7727-37-9	Nitrogen	44.5	0.100	
630-08-0	Carbon Monoxide	ND	0.100	
74-82-8	Methane	25.7	0.100	
124-38-9	Carbon Dioxide	23.8	0.100	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

* = Coeluting Compounds

Verified By: RL Date: 8/13/02



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RESULTS OF ANALYSIS

Page 1 of 1

Client : Air Toxics Ltd.
Client Sample ID: Green South

PAI Project ID: P2201474
PAI Sample ID: P2201474-011DUP

Test Code: Modified EPA Method 3C
Instrument ID: HP5890/TCD #1
Analyst: Annie Calvagna
Sampling Media: Surroma Canister
Test Notes:

Date Collected: 7/18/02
Date Received: 8/1/02
Date Analyzed: 8/5/02
Volume(s) Analyzed: 0.10 ml

Pi 1 = -3.2 Pf 1 = 4.5

D.F. = 1.67

CAS #	Compound	Result (%, v/v)	MRL (%, v/v)	Data Qualifier
1333-74-01	Hydrogen	ND	0.100	
7782-44-7	Oxygen +			
7440-37-1	Argon *	6.02	0.100	
7727-37-9	Nitrogen	44.4	0.100	
630-08-0	Carbon Monoxide	ND	0.100	
74-82-8	Methane	25.8	0.100	
124-38-9	Carbon Dioxide	23.8	0.100	

ND - Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

* = Coeluting Compounds

Verified By: RL Date: 8/13/02

014748V0.R03 - DUP (11)

2665 Pluck Center Drive, Suite D, Simi Valley, California 93065 - Phone (805) 326-7161 • Fax (805) 526-7270



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RESULTS OF ANALYSIS

Page 1 of 1

Client : Air Toxics Ltd.
Client Sample ID: White South

PAI Project ID: P2201474
 PAI Sample ID: P2201474-012

Test Code: Modified EPA Method 3C
Instrument ID: HP5890/TCD #1
Analyst: Annie Calvagna
Sampling Media: Summa Canister
Test Notes:

Date Collected: 7/18/02
Date Received: 8/1/02
Date Analyzed: 8/5/02
Volume(s) Analyzed: 0.10 ml

PI 1 = -3.4 Pf 1 = 4.8

D.F. = 1.73

CAS #	Compound	Result (%, v/v)	MRL (%, v/v)	Data Qualifier
1333-74-01	Hydrogen	ND	0.100	
7782-44-7 7440-37-1	Oxygen + Argon *	2.57	0.100	
7727-37-9	Nitrogen	40.0	0.100	
630-08-0	Carbon Monoxide	ND	0.100	
74-82-8	Methane	29.1	0.100	
124-38-9	Carbon Dioxide	28.3	0.100	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

* = Coeluting Compounds

Verified By: RG Date: 8/13/02

014745VCLRD2 - Sample (12)

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RESULTS OF ANALYSIS

Page 1 of 1

Client : Air Toxics Ltd.
Client Sample ID: Method Blank

PAI Project ID: P2201474
 PAI Sample ID: P020805-MB

Test Code: Modified EPA Method 3C
Instrument ID: HP5890/TCD #1
Analyst: Annie Calvagna
Sampling Media: Summa Canister
Test Notes:

Date Collected: NA
 Date Received: NA
 Date Analyzed: 8/5/02
 Volume(s) Analyzed: 0.10 ml

D.F. = 1.00

CAS #	Compound	Result (%, v/v)	MRL (%, v/v)	Data Qualifier
1333-74-01	Hydrogen	ND	0.100	
7782-44-7	Oxygen +			
7440-37-1	Argon *	ND	0.100	
7727-37-9	Nitrogen	ND	0.100	
630-08-0	Carbon Monoxide	ND	0.100	
74-82-8	Methane	ND	0.100	
124-38-9	Carbon Dioxide	ND	0.100	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

* = Coeluting Compounds

Verified By: RC Date: 8/9/02

01474890.003 - Method

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CHAIN-OF-CUSTODY RECORD

Sample Transportation Notice

Relinquishing signature on this document indicates that sample is being shipped in compliance with all applicable local, State, Federal, national, and international laws, regulations and ordinances of any kind. Air Toxics Limited assumes no liability with respect to the collection, handling or shipping of these samples. Relinquishing signature also indicates agreement to hold harmless, defend, and indemnify Air Toxics Limited against any claim, demand, or action of any kind, related to the collection, handling, or shipping of samples. D.O.T. Hotline (800) 457-4922

180 BLUE RAVINE ROAD, SUITE B
FOLSOM, CA 95630-4719
(916) 985-1000 FAX: (916) 985-1020

Contact Person Bill Jamieson
 Company KRS
 Address 7720 N 16th St City Phoenix State AZ Zip 85020
 Phone 602.861.7437 FAX _____
 Collected By: Signature [Signature]

Project info:
 P.O. # _____
 Project # _____
 Project Name Cinder Lake

Turn Around Time:
 Normal
 Rush _____ Specify _____
ML 7/24/02

Lab I.D.	Field Sample I.D.	Date & Time	Analyses Requested	Canister Pressure / Vacuum	Receipt
01A	Red South	July 18/19, 02	RMZSC CAN # 232		9.0"Hg
02A	BLAKE	July 19, 02	" " "		7.5"Hg
03A	BLUE North	July 11/18/19, 02	" " "		7.5"Hg
04A	RED North	July 18/19, 02	" " "		7.0"Hg
05A	ORANGE South	July 18/19, 02	" " "		7.0"Hg
06A	White North	July 18, 02	" " "		7.0"Hg
07A	ORANGE North	July 18, 02	" " "		7.0"Hg
08A	ORANGE North	July 11, 02	" " "		16.5"Hg
09A	GREEN North	July 11/18, 02	" " "		6.5"Hg
10A	BLUE South	July 18/19, 02	" " "		10.0"Hg
					7.5"Hg

Notes: _____

Relinquished By: (Signature) _____ Date/Time July 19, 02
 Relinquished By: (Signature) _____ Date/Time _____
 Relinquished By: (Signature) _____ Date/Time _____

Received By: (Signature) _____ Date/Time _____
 Received By: (Signature) _____ Date/Time _____

Received By: (Signature) _____ Date/Time 09/10
Kelly Hunter AR 7/23/02

Shipper Name: Fed Ex 833747857460 | KCB | _____
 Air Bill # _____
 Opened By: _____ Temp. (°C) _____

Condition: good
 Custody Seals Intact? Yes No None
 Work Order # 0207493A



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FOLSOM, CA 95630-4719
(916) 985-1000 FAX: (916) 985-1020

Contact Person <u>Bill Jamieson</u> Company <u>URS</u> Address <u>720 N 16th St</u> City _____ State _____ Zip _____ Phone <u>602.861.7437</u> FAX _____		Project info: P.O. # _____ Project # _____ Project Name <u>Cinder Lake</u>		Turn Around Time: <input type="checkbox"/> Normal <input type="checkbox"/> Rush _____ Specify _____ <u>ML 7/24/02</u>	
Collected By: Signature _____		Analyses Requested <u>RM 25C / 3C CAN# 3407</u> <u>RM 25C / 3C " 3129</u>		Canister Pressure / Vacuum Initial Final Receipt <u>6.5" Hg</u> <u>7.0" Hg</u> <u>22.9"</u> <u>23.0"</u>	
Lab I.D. <u>11A</u> <u>12A</u>	Field Sample I.D. <u>6 R F E N South</u> <u>White South</u>	Date & Time <u>July 18/19 02</u> <u>July 18/19, 02</u>	Notes: 		
Relinquished By: (Signature) <u>[Signature]</u> Date/Time <u>July 19, 02</u>		Received By: (Signature) _____ Date/Time _____		Condition _____ Custody Seals Intact? <u>None</u> Work Order # <u>02074938</u>	
Relinquished By: (Signature) _____ Date/Time _____		Received By: (Signature) <u>Kelly Bueth AR</u> Date/Time <u>09/10</u>		Air Bill # <u>833747857480</u> Temp. (°C) <u>KUR</u>	
Relinquished By: (Signature) _____ Date/Time _____		Received By: (Signature) _____ Date/Time _____		Shipper Name <u>Fedex</u>	

APPENDIX C

40 CFR PART 60, SUBPART WWW, §60.752 & §60.754

[Code of Federal Regulations]
[Title 40, Volume 6]
[Revised as of July 1, 2001]
From the U.S. Government Printing Office via GPO Access
[CITE: 40CFR60.752]

[Page 583-586]

TITLE 40--PROTECTION OF ENVIRONMENT

CHAPTER I--ENVIRONMENTAL PROTECTION AGENCY

PART 60--STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES--Table of Content

Subpart WWW--Standards of Performance for Municipal Solid Waste
Landfills

Sec. 60.752 Standards for air emissions from municipal solid waste landfills.

(a) Each owner or operator of an MSW landfill having a design capacity less than 2.5 million megagrams by mass or 2.5 million cubic meters by volume shall submit an initial design capacity report to the Administrator as provided in Sec. 60.757(a). The landfill may calculate design capacity in either megagrams or cubic meters for comparison with the exemption values. Any density conversions shall be documented and submitted with the report. Submittal of the initial design capacity report shall fulfill the requirements of this subpart except as provided for in paragraphs (a)(1) and (a)(2) of this section.

(1) The owner or operator shall submit to the Administrator an amended design capacity report, as provided for in Sec. 60.757(a)(3).

(2) When an increase in the maximum design capacity of a landfill exempted from the provisions of Sec. 60.752(b) through Sec. 60.759 of this subpart on the basis of the design capacity exemption in paragraph (a) of this section results in a revised maximum design capacity equal to or greater than 2.5 million megagrams and 2.5 million cubic meters, the owner or operator shall comply with the provision of paragraph (b) of this section.

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(b) Each owner or operator of an MSW landfill having a design capacity equal to or greater than 2.5 million megagrams and 2.5 million cubic meters, shall either comply with paragraph (b)(2) of this section or calculate an NMOC emission rate for the landfill using the procedures specified in Sec. 60.754. The NMOC emission rate shall be recalculated annually, except as provided in Sec. 60.757(b)(1)(ii) of this subpart. The owner or operator of an MSW landfill subject to this subpart with a design capacity greater than or equal to 2.5 million megagrams and 2.5 million cubic meters is subject to part 70 or 71 permitting requirements.

(1) If the calculated NMOC emission rate is less than 50 megagrams per year, the owner or operator shall:

(i) Submit an annual emission report to the Administrator, except as provided for in Sec. 60.757(b)(1)(ii); and

(ii) Recalculate the NMOC emission rate annually using the procedures specified in Sec. 60.754(a)(1) until such time as the calculated NMOC emission rate is equal to or greater than 50 megagrams per year, or the landfill is closed.

(A) If the NMOC emission rate, upon recalculation required in paragraph (b)(1)(ii) of this section, is equal to or greater than 50 megagrams per year, the owner or operator shall install a collection and control system in compliance with paragraph (b)(2) of this section.

(B) If the landfill is permanently closed, a closure notification

shall be submitted to the Administrator as provided for in Sec. 60.757(d).

(2) If the calculated NMOC emission rate is equal to or greater than 50 megagrams per year, the owner or operator shall:

(i) Submit a collection and control system design plan prepared by a professional engineer to the Administrator within 1 year:

(A) The collection and control system as described in the plan shall meet the design requirements of paragraph (b)(2)(ii) of this section.

(B) The collection and control system design plan shall include any alternatives to the operational standards, test methods, procedures, compliance measures, monitoring, recordkeeping or reporting provisions of Secs. 60.753 through 60.758 proposed by the owner or operator.

(C) The collection and control system design plan shall either conform with specifications for active collection systems in Sec. 60.759 or include a demonstration to the Administrator's satisfaction of the sufficiency of the alternative provisions to Sec. 60.759.

(D) The Administrator shall review the information submitted under paragraphs (b)(2)(i) (A), (B) and (C) of this section and either approve it, disapprove it, or request that additional information be submitted. Because of the many site-specific factors involved with landfill gas system design, alternative systems may be necessary. A wide variety of system designs are possible, such as vertical wells, combination horizontal and vertical collection systems, or horizontal trenches only, leachate collection components, and passive systems.

(ii) Install a collection and control system that captures the gas generated within the landfill as required by paragraphs (b)(2)(ii)(A) or (B) and (b)(2)(iii) of this section within 30 months after the first annual report in which the emission rate equals or exceeds 50 megagrams per year, unless Tier 2 or Tier 3 sampling demonstrates that the emission rate is less than 50 megagrams per year, as specified in Sec. 60.757(c)(1) or (2).

(A) An active collection system shall:

(1) Be designed to handle the maximum expected gas flow rate from the entire area of the landfill that warrants control over the intended use period of the gas control or treatment system equipment;

(2) Collect gas from each area, cell, or group of cells in the landfill in which the initial solid waste has been placed for a period of:

(i) 5 years or more if active; or

(ii) 2 years or more if closed or at final grade.

(3) Collect gas at a sufficient extraction rate;

(4) Be designed to minimize off-site migration of subsurface gas.

(B) A passive collection system shall:

(1) Comply with the provisions specified in paragraphs

(b)(2)(ii)(A)(1), (2), and (2)(ii)(A)(4) of this section.

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(2) Be installed with liners on the bottom and all sides in all areas in which gas is to be collected. The liners shall be installed as required under Sec. 258.40.

(iii) Route all the collected gas to a control system that complies with the requirements in either paragraph (b)(2)(iii) (A), (B) or (C) of this section.

(A) An open flare designed and operated in accordance with Sec. 60.18;

(B) A control system designed and operated to reduce NMOC by 98 weight-percent, or, when an enclosed combustion device is used for control, to either reduce NMOC by 98 weight percent or reduce the outlet NMOC concentration to less than 20 parts per million by volume, dry basis as hexane at 3 percent oxygen. The reduction efficiency or parts per million by volume shall be established by an initial performance test to be completed no later than 180 days after the initial startup of

the approved control system using the test methods specified in Sec. 60.754(d).

(1) If a boiler or process heater is used as the control device, the landfill gas stream shall be introduced into the flame zone.

(2) The control device shall be operated within the parameter ranges established during the initial or most recent performance test. The operating parameters to be monitored are specified in Sec. 60.756;

(C) Route the collected gas to a treatment system that processes the collected gas for subsequent sale or use. All emissions from any atmospheric vent from the gas treatment system shall be subject to the requirements of paragraph (b)(2)(iii) (A) or (B) of this section.

(iv) Operate the collection and control device installed to comply with this subpart in accordance with the provisions of Sec. Sec. 60.753, 60.755 and 60.756.

(v) The collection and control system may be capped or removed provided that all the conditions of paragraphs (b)(2)(v) (A), (B), and (C) of this section are met:

(A) The landfill shall be a closed landfill as defined in Sec. 60.751 of this subpart. A closure report shall be submitted to the Administrator as provided in Sec. 60.757(d);

(B) The collection and control system shall have been in operation a minimum of 15 years; and

(C) Following the procedures specified in Sec. 60.754(b) of this subpart, the calculated NMOC gas produced by the landfill shall be less than 50 megagrams per year on three successive test dates. The test dates shall be no less than 90 days apart, and no more than 180 days apart.

(c) For purposes of obtaining an operating permit under title V of the Act, the owner or operator of a MSW landfill subject to this subpart with a design capacity less than 2.5 million megagrams or 2.5 million cubic meters is not subject to the requirement to obtain an operating permit for the landfill under part 70 or 71 of this chapter, unless the landfill is otherwise subject to either part 70 or 71. For purposes of submitting a timely application for an operating permit under part 70 or 71, the owner or operator of a MSW landfill subject to this subpart with a design capacity greater than or equal to 2.5 million megagrams and 2.5 million cubic meters, and not otherwise subject to either part 70 or 71, becomes subject to the requirements of Secs. 70.5(a)(1)(i) or 71.5(a)(1)(i) of this chapter, regardless of when the design capacity report is actually submitted, no later than:

(1) June 10, 1996 for MSW landfills that commenced construction, modification, or reconstruction on or after May 30, 1991 but before March 12, 1996;

(2) Ninety days after the date of commenced construction, modification, or reconstruction for MSW landfills that commence construction, modification, or reconstruction on or after March 12, 1996.

(d) When a MSW landfill subject to this subpart is closed, the owner or operator is no longer subject to the requirement to maintain an operating permit under part 70 or 71 of this chapter for the landfill if the landfill is not otherwise subject to the requirements of either part 70 or 71 and if either of the following conditions are met:

(1) The landfill was never subject to the requirement for a control system under paragraph (b)(2) of this section; or

[[Page 586]]

(2) The owner or operator meets the conditions for control system removal specified in paragraph (b)(2)(v) of this section.

[Code of Federal Regulations]
[Title 40, Volume 6]
[Revised as of July 1, 2001]
From the U.S. Government Printing Office via GPO Access
[CITE: 40CFR60.754]

[Page 587-590]

TITLE 40--PROTECTION OF ENVIRONMENT

CHAPTER I--ENVIRONMENTAL PROTECTION AGENCY

PART 60--STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES--Table of Content

Subpart WWW--Standards of Performance for Municipal Solid Waste
Landfills

Sec. 60.754 Test methods and procedures.

(a)(1) The landfill owner or operator shall calculate the NMOC emission rate using either the equation provided in paragraph (a)(1)(i) of this section or the equation provided in paragraph (a)(1)(ii) of this section. Both equations may be used if the actual year-to-year solid waste acceptance rate is known, as specified in paragraph (a)(1)(i), for part of the life of the landfill and the actual year-to-year solid waste acceptance rate is unknown, as specified in paragraph (a)(1)(ii), for part of the life of the landfill. The values to be used in both equations are 0.05 per year for k , 170 cubic meters per megagram for L , and 4,000 parts per million by volume as hexane for the C . For landfills located in geographical areas with a thirty year annual average precipitation of less than 25 inches, as measured at the nearest representative official meteorologic site, the k value to be used is 0.02 per year.

(i) The following equation shall be used if the actual year-to-year solid waste acceptance rate is known.

[GRAPHIC] [TIFF OMITTED] TR12MR96.025

where,

M = Total NMOC emission rate from the landfill, megagrams per year

k = methane generation rate constant, year⁻¹

L = methane generation potential, cubic meters per megagram solid waste

M_i = mass of solid waste in the i th section, megagrams

t_i = age of the i th section, years

C = concentration of NMOC, parts per million by volume as hexane

3.6×10^{-9} = conversion factor

The mass of nondegradable solid waste may be subtracted from the total mass of solid waste in a particular section of the landfill when calculating the value for M_i if documentation of the nature and amount of such wastes is maintained

(ii) The following equation shall be used if the actual year-to-year solid waste acceptance rate is unknown.

$$M = 2L \sum R (e^{-kc} - e^{-kt}) C (3.6 \times 10^{-9})$$

Where:

M<INF>NMOC</INF>=mass emission rate of NMOC, megagrams per year
L<INF>o</INF>=methane generation potential, cubic meters per megagram
solid waste
R=average annual acceptance rate, megagrams per year
k=methane generation rate constant, year⁻¹
t = age of landfill, years
C<INF>NMOC</INF>=concentration of NMOC, parts per million by volume as
hexane
c=time since closure, years; for active landfill c=0 and
e^{-kc}>1
3.6 x 10⁻⁹=conversion factor

The mass of nondegradable solid waste may be subtracted from the total mass of solid waste in a particular section of the landfill when calculating the value of R, if documentation of the nature and amount of such wastes is maintained.

(2) Tier 1. The owner or operator shall compare the calculated NMOC mass emission rate to the standard of 50 megagrams per year.

(i) If the NMOC emission rate calculated in paragraph (a)(1) of this section is less than 50 megagrams per year, then the landfill owner shall submit an emission rate report as provided in Sec. 60.757(b)(1), and shall recalculate the NMOC mass emission rate annually as required under Sec. 60.752(b)(1).

(ii) If the calculated NMOC emission rate is equal to or greater than 50 megagrams per year, then the landfill owner shall either comply with

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Sec. 60.752(b)(2), or determine a site-specific NMOC concentration and recalculate the NMOC emission rate using the procedures provided in paragraph (a)(3) of this section.

(3) Tier 2. The landfill owner or operator shall determine the NMOC concentration using the following sampling procedure. The landfill owner or operator shall install at least two sample probes per hectare of landfill surface that has retained waste for at least 2 years. If the landfill is larger than 25 hectares in area, only 50 samples are required. The sample probes should be located to avoid known areas of nondegradable solid waste. The owner or operator shall collect and analyze one sample of landfill gas from each probe to determine the NMOC concentration using Method 25 or 25C of Appendix A of this part. Method 18 of Appendix A of this part may be used to analyze the samples collected by the Method 25 or 25C sampling procedure. Taking composite samples from different probes into a single cylinder is allowed; however, equal sample volumes must be taken from each probe. For each composite, the sampling rate, collection times, beginning and ending cylinder vacuums, or alternative volume measurements must be recorded to verify that composite volumes are equal. Composite sample volumes should not be less than one liter unless evidence can be provided to substantiate the accuracy of smaller volumes. Terminate compositing before the cylinder approaches ambient pressure where measurement accuracy diminishes. If using Method 18, the owner or operator must identify all compounds in the sample and, as a minimum, test for those compounds published in the most recent Compilation of Air Pollutant Emission Factors (AP-42), minus carbon monoxide, hydrogen sulfide, and mercury. As a minimum, the instrument must be calibrated for each of the compounds on the list. Convert the concentration of each Method 18 compound to C<INF>NMOC</INF> as hexane by multiplying by the ratio of its carbon atoms divided by six. If more than the required number of samples are taken, all samples must be used in the analysis. The landfill owner or operator must divide the NMOC concentration from Method 25 or 25C of Appendix A of this part by six to convert from

C<INF>NMOC</INF> as carbon to C<INF>NMOC</INF> as hexane. If the landfill has an active or passive gas removal system in place, Method 25 or 25C samples may be collected from these systems instead of surface probes provided the removal system can be shown to provide sampling as representative as the two sampling probe per hectare requirement. For active collection systems, samples may be collected from the common header pipe before the gas moving or condensate removal equipment. For these systems, a minimum of three samples must be collected from the header pipe.

(i) The landfill owner or operator shall recalculate the NMOC mass emission rate using the equations provided in paragraph (a)(1)(i) or (a)(1)(ii) of this section and using the average NMOC concentration from the collected samples instead of the default value in the equation provided in paragraph (a)(1) of this section.

(ii) If the resulting mass emission rate calculated using the site-specific NMOC concentration is equal to or greater than 50 megagrams per year, then the landfill owner or operator shall either comply with Sec. 60.752(b)(2), or determine the site-specific methane generation rate constant and recalculate the NMOC emission rate using the site-specific methane generation rate using the procedure specified in paragraph (a)(4) of this section.

(iii) If the resulting NMOC mass emission rate is less than 50 megagrams per year, the owner or operator shall submit a periodic estimate of the emission rate report as provided in Sec. 60.757(b)(1) and retest the site-specific NMOC concentration every 5 years using the methods specified in this section.

(4) Tier 3. The site-specific methane generation rate constant shall be determined using the procedures provided in Method 2E of appendix A of this part. The landfill owner or operator shall estimate the NMOC mass emission rate using equations in paragraph (a)(1)(i) or (a)(1)(ii) of this section and

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using a site-specific methane generation rate constant k , and the site-specific NMOC concentration as determined in paragraph (a)(3) of this section instead of the default values provided in paragraph (a)(1) of this section. The landfill owner or operator shall compare the resulting NMOC mass emission rate to the standard of 50 megagrams per year.

(i) If the NMOC mass emission rate as calculated using the site-specific methane generation rate and concentration of NMOC is equal to or greater than 50 megagrams per year, the owner or operator shall comply with Sec. 60.752(b)(2).

(ii) If the NMOC mass emission rate is less than 50 megagrams per year, then the owner or operator shall submit a periodic emission rate report as provided in Sec. 60.757(b)(1) and shall recalculate the NMOC mass emission rate annually, as provided in Sec. 60.757(b)(1) using the equations in paragraph (a)(1) of this section and using the site-specific methane generation rate constant and NMOC concentration obtained in paragraph (a)(3) of this section. The calculation of the methane generation rate constant is performed only once, and the value obtained from this test shall be used in all subsequent annual NMOC emission rate calculations.

(5) The owner or operator may use other methods to determine the NMOC concentration or a site-specific k as an alternative to the methods required in paragraphs (a)(3) and (a)(4) of this section if the method has been approved by the Administrator.

(b) After the installation of a collection and control system in compliance with Sec. 60.755, the owner or operator shall calculate the NMOC emission rate for purposes of determining when the system can be removed as provided in Sec. 60.752(b)(2)(v), using the following equation:

$$M_{\text{NMOC}} = 1.89 \times 10^{-3} \frac{Q_{\text{LFG}}}{C_{\text{NMOC}}}$$

where,

M_{NMOC} = mass emission rate of NMOC, megagrams per year
 Q_{LFG} = flow rate of landfill gas, cubic meters per minute
 C_{NMOC} = NMOC concentration, parts per million by volume as hexane

(1) The flow rate of landfill gas, Q_{LFG} , shall be determined by measuring the total landfill gas flow rate at the common header pipe that leads to the control device using a gas flow measuring device calibrated according to the provisions of section 4 of Method 2E of appendix A of this part.

(2) The average NMOC concentration, C_{NMOC} , shall be determined by collecting and analyzing landfill gas sampled from the common header pipe before the gas moving or condensate removal equipment using the procedures in Method 25C or Method 18 of appendix A of this part. If using Method 18 of appendix A of this part, the minimum list of compounds to be tested shall be those published in the most recent Compilation of Air Pollutant Emission Factors (AP-42). The sample location on the common header pipe shall be before any condensate removal or other gas refining units. The landfill owner or operator shall divide the NMOC concentration from Method 25C of appendix A of this part by six to convert from C_{NMOC} as carbon to C_{NMOC} as hexane.

(3) The owner or operator may use another method to determine landfill gas flow rate and NMOC concentration if the method has been approved by the Administrator.

(c) When calculating emissions for PSD purposes, the owner or operator of each MSW landfill subject to the provisions of this subpart shall estimate the NMOC emission rate for comparison to the PSD major source and significance levels in Secs. 51.166 or 52.21 of this chapter using AP-42 or other approved measurement procedures.

(d) For the performance test required in Sec. 60.752(b)(2)(iii)(B), Method 25, 25C, or Method 18 of Appendix A of this part must be used to determine compliance with the 98 weight-percent efficiency or the 20 ppmv outlet concentration level, unless another method to demonstrate compliance has been approved by the Administrator as provided by Sec. 60.752(b)(2)(i)(B). Method 3 or 3A shall be used to determine oxygen for correcting the NMOC concentration as hexane to 3 percent. In cases where the outlet concentration is less than 50 ppm NMOC as carbon (8 ppm NMOC as hexane), Method 25A should be used in place of Method 25. If using Method 18 of appendix A of this part, the minimum list of compounds to be tested

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shall be those published in the most recent Compilation of Air Pollutant Emission Factors (AP-42). The following equation shall be used to calculate efficiency:

$$\text{Control Efficiency} = \frac{(\text{NMOC}_{\text{in}} - \text{NMOC}_{\text{out}})}{(\text{NMOC}_{\text{in}})}$$

where,

NMOC_{in} = mass of NMOC entering control device
 NMOC_{out} = mass of NMOC exiting control device

APPENDIX D

40 CFR PART 60, APPENDIX A, METHOD 3C & 25C

* * * * *

METHOD 3C- DETERMINATION OF CARBON DIOXIDE, METHANE, NITROGEN AND OXYGEN FROM STATIONARY SOURCES

1. Applicability and Principle

1.1 Applicability. This method applies to the analysis of carbon dioxide (CO₂), methane (CH₄), nitrogen (N₂), and oxygen (O₂) in samples from municipal solid waste landfills and other sources when specified in an applicable subpart.

1.2 Principle. A portion of the sample is injected into a gas chromatograph (GC) and the CO₂, CH₄, N₂, and O₂ concentrations are determined by using a thermal conductivity detector (TCD) and integrator.

2. Range and Sensitivity

2.1 Range. The range of this method depends upon the concentration of samples. The analytical range of TCD's is generally between approximately 10 ppmv and the upper percent range.

2.2 Sensitivity. The sensitivity limit for a compound is defined as the minimum detectable concentration of that compound, or the concentration that produces a signal-to-noise ratio of three to one. For CO₂, CH₄, N₂, O₂, the sensitivity limit is in the low ppmv range.

3. Interferences

Since the TCD exhibits universal response and detects all gas components except the carrier, interferences may occur. Choosing the appropriate GC or shifting the retention times by changing the column flow rate may help to eliminate resolution interferences.

To assure consistent detector response, helium is used to prepare calibration gases. Frequent exposure to samples or carrier gas containing oxygen may gradually destroy filaments.

4. Apparatus

4.1 Gas Chromatograph. GC having at least the following components

4.1.1 Separation Column. Appropriate column(s) to resolve CO₂, CH₄, N₂, O₂, and other gas components that may be present in the sample.

4.1.2 Sample Loop. Teflon or stainless steel tubing of the appropriate diameter. NOTE: Mention of trade names or specific products does not constitute endorsement or recommendation by the U. S. Environmental Protection Agency.

4.1.3 Conditioning System. To maintain the column and sample loop at constant temperature.

4.1.4 Thermal Conductivity Detector.

4.2 Recorder. Recorder with linear strip chart. Electronic integrator (optional) is recommended.

4.3 Teflon Tubing. Diameter and length determined by connection requirements of cylinder regulators and the GC.

4.4 Regulators. To control gas cylinder pressures and flow rates.

4.5 Adsorption Tubes. Applicable traps to remove any O₂ from the carrier gas.

5. Reagents

5.1 Calibration and Linearity Gases. Standard cylinder gas mixtures for each compound of interest with at least three concentration levels spanning the range of suspected sample concentrations. The calibration gases shall be prepared in helium.

5.2 Carrier Gas. Helium, high-purity.

6. Analysis

6.1 Sample Collection. Use the sample collection procedures described in Methods 3 or 25C to collect a sample of landfill gas (LFG).

6.2 Preparation of GC. Before putting the GC analyzer into routine operation, optimize the operational conditions according to the manufacturer's specifications to provide good resolution and minimum analysis time. Establish the appropriate carrier gas flow and set the detector sample and reference cell flow rates at exactly the same levels. Adjust the column and detector temperatures to the recommended levels. Allow sufficient time for temperature stabilization. This may typically require 1 hour for each change in temperature.

6.3 Analyzer Linearity Check and Calibration. Perform this test before sample analysis. Using the gas mixtures in section 5.1, verify the detector linearity over the range of suspected sample concentrations with at least three points per compound of interest. This initial check may also serve as the initial instrument calibration. All subsequent calibrations may be performed using a single-point standard gas provided the calibration point is within 20 percent of the sample component concentration. For each instrument calibration, record the carrier and detector flow rates, detector filament and block temperatures, attenuation factor, injection time, chart speed, sample loop volume, and component concentrations. Plot a linear regression of the standard concentrations versus area values to obtain the response factor of each compound. Alternatively, response factors of uncorrected component concentrations (wet basis) may be

generated using instrumental integration. NOTE: Peak height may be used instead of peak area throughout this method.

6.4 Sample Analysis. Purge the sample loop with sample, and allow to come to atmospheric pressure before each injection. Analyze each sample in duplicate, and calculate the average sample area (A). The results are acceptable when the peak areas for two consecutive injections agree within 5 percent of their average. If they do not agree, run additional samples until consistent area data are obtained. Determine the tank sample concentrations according to section 7.2.

7. Calculations

Carry out calculations retaining at least one extra decimal figure beyond that of the acquired data. Round off results only after the final calculation.

7.1 Nomenclature.

A = average sample area

B_w = moisture content in the sample, fraction

C = component concentration in the sample, dry basis, ppmv

C_t = calculated NMOC concentration, ppmv C equivalent

C_{tm} = measured NMOC concentration, ppmv C equivalent

P_b = barometric pressure, mm Hg

P_{ti} = gas sample tank pressure before sampling, mm Hg absolute

P_t = gas sample tank pressure at completion of sampling, but before pressurizing, mm Hg absolute

P_{tf} = final gas sample tank pressure after pressurizing, mm Hg absolute

P_w = vapor pressure of H₂O (from table 25C-1), mm Hg

T_{ti} = sample tank temperature before sampling, °K

T_t = sample tank temperature at completion of sampling, but before pressuring, °K

T_{tf} = sample tank temperature after pressurizing, °K

r = total number of analyzer injections of sample tank during analysis (where j = injection number, 1...r)

R = Mean calibration response factor for specific sample component, area/ppmv

Table 3C-1. MOISTURE CORRECTION

Temperature, °C	Vapor Pressure of H ₂ O, mm HG	Temperature, °C	Vapor Pressure of H ₂ O, mm HG
4	6.1	18	15.5
6	7.0	20	17.5
8	8.0	22	19.8
1	9.2	24	22.4
12	10.5	26	25.2
14	12.0	28	28.3
16	13.6	30	31.8

7.2 Concentration of Sample Components. Calculate C for each compound using Equations 3C-1 and 3C-2. Use the temperature and barometric pressure at the sampling site to calculate B_w. If the sample was diluted with helium using the procedures in Method 25C, use Equation 3C-3 to calculate the concentration.

$$B_w = \frac{P_w}{P_b} \quad 3C-1$$

$$C = \frac{A}{R(1-B_w)} \quad 3C-2$$

$$C = \frac{\frac{P_{tf}}{T_{tf}}}{\frac{P_t}{T_t} - \frac{P_u}{T_u}} \frac{A}{R(1-B_w)} \quad 3C-3$$

8. Bibliography

1. McNair, H.M. and E.J. Bonelli. Basic Gas Chromatography. Consolidated Printers, Berkeley, CA. 1969.

METHOD 25C - DETERMINATION OF NONMETHANE ORGANIC
COMPOUNDS (NMOC) IN LANDFILL GASES

NOTE: This method does not include all of the specifications (e.g., equipment and supplies) and procedures (e.g., sampling and analytical) essential to its performance. Some material is incorporated by reference from other methods in this part. Therefore, to obtain reliable results, persons using this method should also have a thorough knowledge of EPA Method 25.

1.0 Scope and Application.

1.1 Analytes.

Analyte	CAS No.
Nonmethane organic compounds (NMOC)	No CAS number assigned

1.2 Applicability. This method is applicable to the sampling and measurement of NMOC as carbon in landfill gases (LFG).

1.3 Data Quality Objectives. Adherence to the requirements of this method will enhance the quality of the data obtained from air pollutant sampling methods.

2.0 Summary of Method.

2.1 A sample probe that has been perforated at one end is driven or augured to a depth of 0.9 m (3 ft) below the bottom

of the landfill cover. A sample of the landfill gas is extracted with an evacuated cylinder. The NMOC content of the gas is determined by injecting a portion of the gas into a gas chromatographic column to separate the NMOC from carbon monoxide (CO), carbon dioxide (CO₂), and methane (CH₄); the NMOC are oxidized to CO₂, reduced to CH₄, and measured by a flame ionization detector (FID). In this manner, the variable response of the FID associated with different types of organics is eliminated.

3.0 *Definitions.* [Reserved]

4.0 *Interferences.* [Reserved]

5.0 *Safety.*

5.1 Since this method is complex, only experienced personnel should perform this test. LFG contains methane, therefore explosive mixtures may exist on or near the landfill. It is advisable to take appropriate safety precautions when testing landfills, such as refraining from smoking and installing explosion-proof equipment.

6.0 *Equipment and Supplies.*

6.1 *Sample Probe.* Stainless steel, with the bottom third perforated. The sample probe must be capped at the bottom and must have a threaded cap with a sampling attachment at the top. The sample probe must be long enough to go through and extend

no less than 0.9 m (3 ft) below the landfill cover. If the sample probe is to be driven into the landfill, the bottom cap should be designed to facilitate driving the probe into the landfill.

6.2 Sampling Train.

6.2.1 Rotameter with Flow Control Valve. Capable of measuring a sample flow rate of 100 ± 10 ml/min. The control valve must be made of stainless steel.

6.2.2 Sampling Valve. Stainless steel.

6.2.3 Pressure Gauge. U-tube mercury manometer, or equivalent, capable of measuring pressure to within 1 mm Hg (0.5 in H₂O) in the range of 0 to 1,100 mm Hg (0 to 590 in H₂O).

6.2.4 Sample Tank. Stainless steel or aluminum cylinder, equipped with a stainless steel sample tank valve.

6.3 Vacuum Pump. Capable of evacuating to an absolute pressure of 10 mm Hg (5.4 in H₂O).

6.4 Purging Pump. Portable, explosion proof, and suitable for sampling NMOC.

6.5 Pilot Probe Procedure. The following are needed only if the tester chooses to use the procedure described in Section 8.2.1.

6.5.1 Pilot Probe. Tubing of sufficient strength to withstand being driven into the landfill by a post driver and

an outside diameter of at least 6 mm (0.25 in.) smaller than the sample probe. The pilot probe shall be capped on both ends and long enough to go through the landfill cover and extend no less than 0.9 m (3 ft) into the landfill.

6.5.2 Post Driver and Compressor. Capable of driving the pilot probe and the sampling probe into the landfill. The Kitty Hawk portable post driver has been found to be acceptable.

6.6 Auger Procedure. The following are needed only if the tester chooses to use the procedure described in Section 8.2.2.

6.6.1 Auger. Capable of drilling through the landfill cover and to a depth of no less than 0.9 m (3 ft) into the landfill.

6.6.2 Pea Gravel.

6.6.3 Bentonite.

6.7 NMOC Analyzer, Barometer, Thermometer, and Syringes. Same as in Sections 6.3.1, 6.3.2, 6.33, and 6.2.10, respectively, of Method 25.

7.0 *Reagents and Standards.*

7.1 NMOC Analysis. Same as in Method 25, Section 7.2.

7.2 Calibration. Same as in Method 25, Section 7.4, except omit Section 7.4.3.

7.3 Quality Assurance Audit Samples.

7.3.1 It is recommended, but not required, that a performance audit sample be analyzed in conjunction with the field samples. The audit sample should be in a suitable sample matrix at a concentration similar to the actual field samples.

7.3.2 When making compliance determinations, and upon availability, audit samples may be obtained from the appropriate EPA Regional Office or from the responsible enforcement authority and analyzed in conjunction with the field samples.

NOTE: The responsible enforcement authority should be notified at least 30 days prior to the test date to allow sufficient time for sample delivery.

8.0 *Sample Collection, Preservation, Storage, and Transport.*

8.1 Sample Tank Evacuation and Leak-Check. Conduct the sample tank evacuation and leak-check either in the laboratory or the field. Connect the pressure gauge and sampling valve to the sample tank. Evacuate the sample tank to 10 mm Hg (5.4 in H₂O) absolute pressure or less. Close the sampling valve, and allow the tank to sit for 30 minutes. The tank is acceptable if no change more than ± 2 mm is noted. Include the results of the leak-check in the test report.

8.2 Sample Probe Installation. The tester may use the procedure in Section 8.2.1 or 8.2.2.

8.2.1 Pilot Probe Procedure. Use the post driver to drive the pilot probe at least 0.9 m (3 ft) below the landfill cover. Alternative procedures to drive the probe into the landfill may be used subject to the approval of the Administrator's designated representative.

8.2.1.1 Remove the pilot probe and drive the sample probe into the hole left by the pilot probe. The sample probe shall extend at least 0.9 m (3 ft) below the landfill cover and shall protrude about 0.3 m (1 ft) above the landfill cover. Seal around the sampling probe with bentonite and cap the sampling probe with the sampling probe cap.

8.2.2 Auger Procedure. Use an auger to drill a hole to at least 0.9 m (3 ft) below the landfill cover. Place the sample probe in the hole and backfill with pea gravel to a level 0.6 m (2 ft) from the surface. The sample probe shall protrude at least 0.3 m (1 ft) above the landfill cover. Seal the remaining area around the probe with bentonite. Allow 24 hours for the landfill gases to equilibrate inside the augered probe before sampling.

8.3 Sample Train Assembly. Just before assembling the sample train, measure the sample tank vacuum using the pressure

gauge. Record the vacuum, the ambient temperature, and the barometric pressure at this time. Assemble the sampling probe purging system as shown in Figure 25C-1.

8.4 Sampling Procedure. Open the sampling valve and use the purge pump and the flow control valve to evacuate at least two sample probe volumes from the system at a flow rate of 500 ml/min or less. Close the sampling valve and replace the purge pump with the sample tank apparatus as shown in Figure 25C-2. Open the sampling valve and the sample tank valve and, using the flow control valve, sample at a flow rate of 500 ml/min or less until either a constant flow rate can no longer be maintained because of reduced sample tank vacuum or the appropriate composite volume is attained. Disconnect the sampling tank apparatus and pressurize the sample cylinder to approximately 1,060 mm Hg (567 in. H₂O) absolute pressure with helium, and record the final pressure. Alternatively, the sample tank may be pressurized in the lab.

8.4.1 The following restrictions apply to compositing samples from different probe sites into a single cylinder: (1) individual composite samples per cylinder must be of equal volume; this must be verified by recording the flow rate, sampling time, vacuum readings, or other appropriate volume measuring data, (2) individual composite samples must have a

minimum volume of 1 liter unless data is provided showing smaller volumes can be accurately measured, and (3) composite samples must not be collected using the final cylinder vacuum as it diminishes to ambient pressure.

8.4.2 Use Method 3C to determine the percent N₂ in each cylinder. The presence of N₂ indicates either infiltration of ambient air into the landfill gas sample or an inappropriate testing site has been chosen where anaerobic decomposition has not begun. The landfill gas sample is acceptable if the concentration of N₂ is less than 20 percent. Alternatively, Method 3C may be used to determine the oxygen content of each cylinder as an air infiltration test. With this option, the oxygen content of each cylinder must be less than 5 percent.

9.0 Quality Control.

9.1 Miscellaneous Quality Control Measures.

Section	Quality Control Measure	Effect
8.4.1	Verify that landfill gas sample contains less than 20 percent N ₂ or 5 percent O ₂	Ensures that ambient air was not drawn into the landfill gas sample.
10.1, 10.2	NMOC analyzer initial and daily performance checks	Ensures precision of analytical results
11.1.4	Audit Sample Analyses	Evaluate analytical technique and instrument calibration

10.0 Calibration and Standardization.

NOTE: Maintain a record of performance of each item.

10.1 Initial NMOC Analyzer Performance Test. Same as in Method 25, Section 10.1, except omit the linearity checks for CO₂ standards.

10.2 NMOC Analyzer Daily Calibration.

10.2.1 NMOC Response Factors. Same as in Method 25, Section 10.2.2.

10.3 Sample Tank Volume. The volume of the gas sampling tanks must be determined. Determine the tank volumes by weighing them empty and then filled with deionized water; weigh to the nearest 5 g, and record the results. Alternatively, measure the volume of water used to fill them to the nearest 5 ml.

11.0 Analytical Procedures.

11.1 The oxidation, reduction, and measurement of NMOC's is similar to Method 25. Before putting the NMOC analyzer into routine operation, conduct an initial performance test. Start the analyzer, and perform all the necessary functions in order to put the analyzer into proper working order. Conduct the performance test according to the procedures established in Section 10.1. Once the performance test has been successfully

completed and the NMOC calibration response factor has been determined, proceed with sample analysis as follows:

11.1.1 Daily Operations and Calibration Checks. Before and immediately after the analysis of each set of samples or on a daily basis (whichever occurs first), conduct a calibration test according to the procedures established in Section 10.2. If the criteria of the daily calibration test cannot be met, repeat the NMOC analyzer performance test (Section 10.1) before proceeding.

11.1.2 Operating Conditions. Same as in Method 25, Section 11.2.1.

11.1.3 Analysis of Sample Tank. Purge the sample loop with sample, and then inject the sample. Under the specified operating conditions, the CO₂ in the sample will elute in approximately 100 seconds. As soon as the detector response returns to baseline following the CO₂ peak, switch the carrier gas flow to backflush, and raise the column oven temperature to 195°C (383°F) as rapidly as possible. A rate of 30°C/min (54°F/min) has been shown to be adequate. Record the value obtained for any measured NMOC. Return the column oven temperature to 85°C (185°F) in preparation for the next analysis. Analyze each sample in triplicate, and report the average as C_{tm}.

11.2 Audit Sample Analysis. When the method is used to analyze samples to demonstrate compliance with a source emission regulation, an audit sample, if available, must be analyzed.

11.2.1 Concurrently analyze the audit sample and the compliance samples in the same manner to evaluate the technique of the analyst and the standards preparation.

11.2.2 The same analyst, analytical reagents, and analytical system must be used for the compliance samples and the audit sample. If this condition is met, duplicate auditing of subsequent compliance analyses for the same enforcement agency within a 30-day period is waived. An audit sample set may not be used to validate different sets of compliance samples under the jurisdiction of separate enforcement agencies, unless prior arrangements have been made with both enforcement agencies.

11.3 Audit Sample Results.

11.3.1 Calculate the audit sample concentrations and submit results using the instructions provided with the audit samples.

11.3.2 Report the results of the audit samples and the compliance determination samples along with their identification numbers, and the analyst's name to the

responsible enforcement authority. Include this information with reports of any subsequent compliance analyses for the same enforcement authority during the 30-day period.

11.3.3 The concentrations of the audit samples obtained by the analyst must agree within 20 percent of the actual concentration. If the 20-percent specification is not met, reanalyze the compliance and audit samples, and include initial and reanalysis values in the test report.

11.3.4 Failure to meet the 20-percent specification may require retests until the audit problems are resolved. However, if the audit results do not affect the compliance or noncompliance status of the affected facility, the Administrator may waive the reanalysis requirement, further audits, or retests and accept the results of the compliance test. While steps are being taken to resolve audit analysis problems, the Administrator may also choose to use the data to determine the compliance or noncompliance status of the affected facility.

12.0 *Data Analysis and Calculations.*

NOTE: All equations are written using absolute pressure; absolute pressures are determined by adding the measured barometric pressure to the measured gauge or manometer pressure.

12.1 Nomenclature.

B_w = Moisture content in the sample, fraction.

C_{N_2} = Measured N_2 concentration, fraction.

C_t = Calculated NMOC concentration, ppmv C equivalent.

C_{tm} = Measured NMOC concentration, ppmv C equivalent.

P_b = Barometric pressure, mm Hg.

P_t = Gas sample tank pressure after sampling, but before pressurizing, mm Hg absolute.

P_{tf} = Final gas sample tank pressure after pressurizing, mm Hg absolute.

P_{ti} = Gas sample tank pressure after evacuation, mm Hg absolute.

P_w = Vapor pressure of H_2O (from Table 25C-1), mm Hg.

r = Total number of analyzer injections of sample tank during analysis (where j = injection number, 1... r).

T_t = Sample tank temperature at completion of sampling, °K.

T_{ti} = Sample tank temperature before sampling, °K.

T_{tf} = Sample tank temperature after pressurizing, °K.

12.2 Water Correction. Use Table 25C-1 (Section 17.0), the LFG temperature, and barometric pressure at the sampling site to calculate B_w .

$$B_w = \frac{P_w}{P_b} \quad \text{Eq. 25C-1}$$

12.3 NMOC Concentration. Use the following equation to calculate the concentration of NMOC for each sample tank.

$$C_t = \frac{\frac{P_{ct}}{T_{ct}}}{\frac{P_t}{T_t} - \frac{P_{ci}}{T_{ci}}} \frac{1}{\left(1 - \frac{99}{78} C_{H_2}\right) - B_w} \sum_{i=1}^r C_{ci} \quad \text{Eq. 25C-2}$$

13.0 *Method Performance.* [Reserved].

14.0 *Pollution Prevention.* [Reserved].

15.0 *Waste Management.* [Reserved].

16.0 *References.*

1. Salo, Albert E., Samuel Witz, and Robert D. MacPhee. Determination of Solvent Vapor Concentrations by Total Combustion Analysis: A Comparison of Infrared with Flame Ionization Detectors. Paper No. 75-33.2. (Presented at the 68th Annual Meeting of the Air Pollution Control Association, Boston, Massachusetts. June 15-20, 1975.) 14 p.

2. Salo, Albert E., William L. Oaks, and Robert D. MacPhee. Measuring the Organic Carbon Content of Source Emissions for Air Pollution Control. Paper No. 74-190. (Presented at the 67th Annual Meeting of the Air Pollution

Control Association. Denver, Colorado. June 9-13, 1974.) 25

p.

17.0 *Tables, Diagrams, Flowcharts, and Validation Data.*

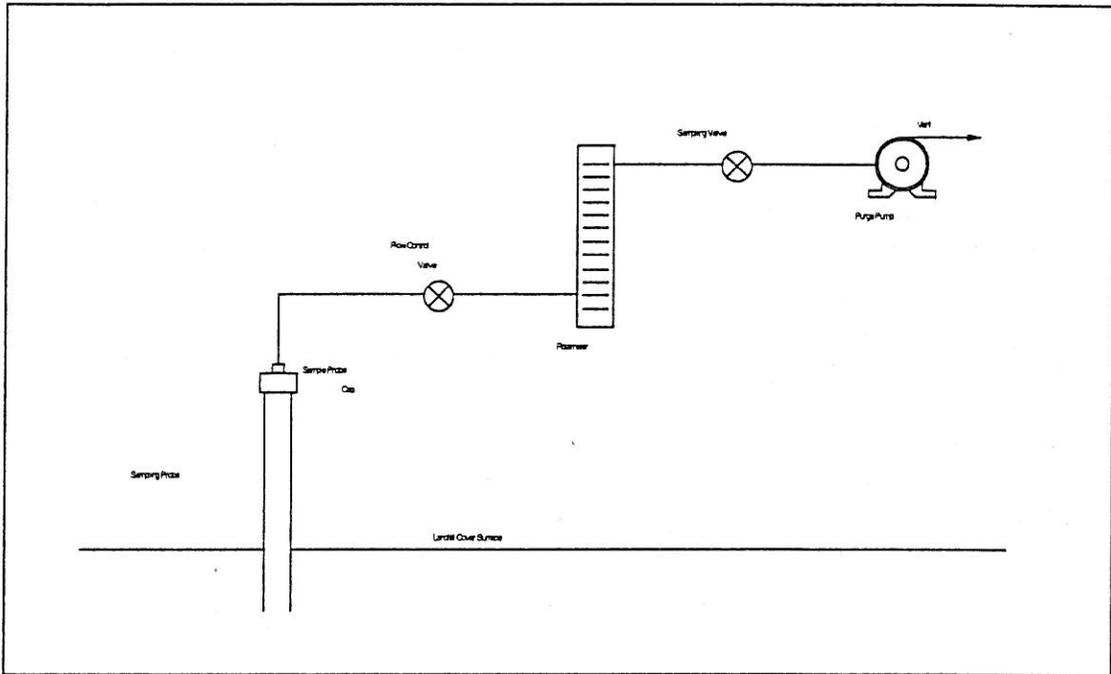


Figure 25C-1. Schematic of Sampling Probe Purging System

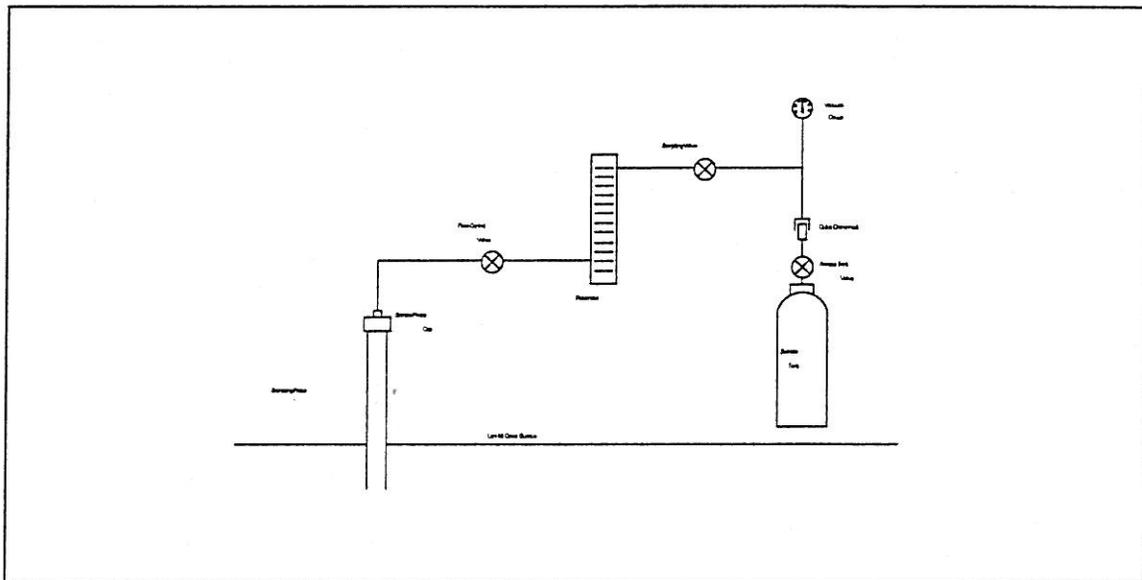


Figure 25C-2. Schematic of Sampling Train.

TABLE 25C-1. MOISTURE CORRECTION

Temperature, °C	Vapor Pressure of H ₂ O, mm Hg	Temperature, °C	Vapor Pressure of H ₂ O, mm Hg
4	6.1	18	15.5
6	7.0	20	17.5
8	8.0	22	19.8
10	9.2	24	22.4
12	10.5	26	25.2
14	12.0	28	28.3
16	13.6	30	31.8