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Project 50023D

SOLID WASTE AIR QUALITY ASSESSMENT TEST REPORT
UNITED STATES MARINE CORPS AIR STATION
EL TORO, CALIFORNIA
COMMUNICATIONS STATION LANDFILL
INACTIVE DISPOSAL SITE

Prepared for

James M. Montgomery, Consulting Engineers, Inc.
365 Lennon Lane
Walnut Creek, California 94598

By

Strata Technologies, Inc.
222 E. Huntington Drive
Monrovia, CA 91016

P.O. Box 5031
Monrovia, CA 91016



Mr. Allan Campbell
Project Manager

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PREAMBLE

This Air Quality Assessment Test (SWAT) Report for the Communication Station Landfill at Marine Corps Air Station (MCAS) El Toro has been prepared within the context of the Navy Installation Restoration Program (IRP). This program is designed in part, to evaluate and remediate, if necessary, contamination caused by hazardous substances, pollutants, or contaminants, pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986.

This document is intended to satisfy a portion of the remedial investigation phase of the IRP, as well as the substantive requirements of Assembly Bill (3374), the Calderon Bill, which has been identified as an applicable or relevant and appropriate requirement (ARAR) pursuant to Section 121 of CERCLA.

EXECUTIVE SUMMARY

In May and June, 1990, Strata Technologies, Inc. (STRATA), a wholly-owned subsidiary of AeroVironment Inc., conducted a Solid Waste Air Quality Assessment Test as required by Assembly Bill 3374 (Calderon) at the Communications Station Landfill, U.S. Marine Corps Air Station, El Toro, California. During the field program, seven landfill gas samples, one integrated surface sample, fourteen integrated air samples, and six migration gas samples were collected and analyzed for specific chemical compounds.

The landfill gas collected from the inactive Communications Station Landfill contained one of the Attachment 1 compounds in concentrations above the minimum detection limits determined by the California Air Resources Board for reporting purposes (DLRs). Dichloromethane (MeCl_2) was detected in all five of the landfill gas probes in concentrations ranging from 76 to 820 parts per billion by volume (ppb). However, a sampler blank collected during the study had a concentration of 720 ppb MeCl_2 . No methane was detected in any of the samples and the carbon dioxide concentrations ranged from 1.1 to 15 percent by volume ($\%_v$). The air immediately above the landfill surface contained 4.1 parts per million by volume (ppm) total organic compounds.

The ambient air samples collected at the Communications Station Landfill contained several of the Attachment 1 compounds in concentrations above their respective DLRs. All of the samples contained 1,1,1-trichloroethane (TCA) and MeCl_2 . Tetrachloroethene (PCE) was detected in five of the ambient air samples. MeCl_2 and PCE were also detected at near DLR concentrations in presampling equipment blanks. Of the compounds detected only MeCl_2 was present in the landfill gas samples collected at the landfill. Generally, corresponding upwind and downwind drainage samples contained similar concentrations of the Attachment 1 compounds. These results suggest that the landfill may not be the source of the Attachment 1 compounds or other sources may be present in the area.

Off-site migration of volatile organic compounds was evident at each perimeter of the landfill in concentrations ranging from 1.6 to 13 ppm.

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Section 1

INTRODUCTION

1.1 BACKGROUND

In 1984, the California State Government enacted Assembly Bill (AB) 3525 (Calderon), which defined the ambient air testing requirements for disposal sites in California. In response to the passage of AB 3525, the California Air Pollution Control Officers Association (CAPCOA) and the California Air Resources Board (ARB) began to develop testing and evaluation guidelines for test reports to be submitted pursuant to the statute. In September 1986, the governor signed AB 3374 (Calderon), which made modifications to AB 3525. The new Calderon Bill requires all active disposal sites to conduct tests and measurements to determine the composition of landfill gases, to test for the presence of specific chemical compounds in the ambient air, and to determine whether off-site subsurface migration of landfill gas is occurring. For inactive sites, a screening questionnaire is completed to determine whether or not Calderon testing is required at the site. As part of the new statute, the ARB was directed to develop, in consultation with the air pollution control districts, guidelines to implement the new statute. Several agencies, including the ARB, CAPCOA, the California Waste Management Board, the California Water Resources Control Board, and the Government Refuse Collection and Disposal Association, assembled and published "Testing Guidelines for Active Solid Waste Disposal Sites" in December 1986. The guidelines specified the chemical compounds to be tested and identified acceptable sampling, analytical and reporting methods to fulfill the Calderon Bill requirements.

James M. Montgomery Consulting Engineers, Inc., contracted Strata Technologies, Inc. (STRATA), a subsidiary of AeroVironment, Inc., to fulfill the Calderon requirements for the inactive Communications Station Landfill. In May 1988, the U.S. Marine Corps submitted a Solid Waste Air Quality Assessment Test (Air SWAT) Proposal for the site to the South Coast Air Quality Management District (SCAQMD) for approval. The proposal presented methods for sample collection, handling and analysis, as well as procedures for data validation and reporting. Following approval by the SCAQMD, STRATA conducted the field sampling. This Air SWAT Report discusses the field methods and sampling equipment employed and the analytical results for the Communications Station Landfill.

1.2 SITE LOCATION

The Marine Corps Air Station in El Toro (MCAS-El Toro) is located in Orange County approximately 45 miles southeast of Los Angeles, in the City of El Toro (Figure 1-1). It is located in the El Toro quadrangle. The inactive Communications Station Landfill is located in the hills on the northwest side of

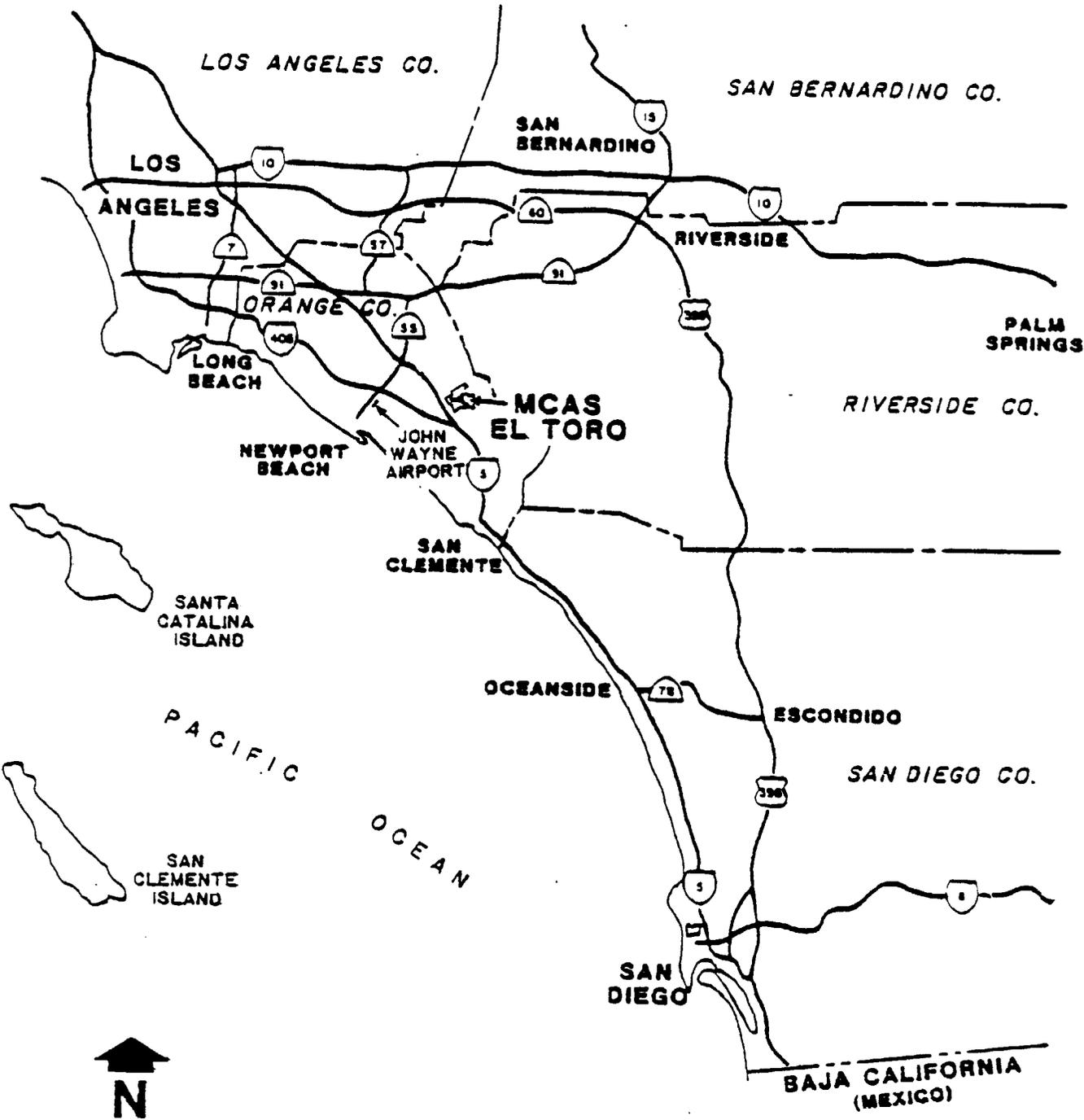


FIGURE 1-1.
 SITE LOCATION MAP
 MCAS EL TORO, CA
 BY
STRATA Technologies, Inc.

REFERENCE: B.C. 1986.

the base, approximately 1400 feet north of Trabuco Road. The landfill is located in the southeast quarter of the southwest quarter of Section 3, Township 6 south, Range 8 west, San Bernardino Baseline and Meridian.

1.3 SITE DESCRIPTION

The Communications Station Landfill is owned by MCAS-El Toro and was in operation from 1981 through 1983. It was operated as a waste pile that received base municipal wastes, construction rubble, empty drums, cooking grease, oil, and fuel. There are no records of septage waste being disposed of at this site. There are no evaporation ponds at this site. Although the total volume of waste in this landfill is unknown, an estimated 36,000 gallons of cooking grease, oil, and fuel were disposed of at this site (Brown & Caldwell, 1986). The waste pile was eventually covered with soil from a nearby hill that was lowered to provide better clearance for the runways at the base (Brown & Caldwell, 1986). The thickness of the cover is unknown.

The total landfill area is approximately 34 acres and the perimeter of the waste area is estimated to be 5,600 feet (Figure 1-2). The landfill is located in the drainage between two hills, with a toe extending approximately 400 feet to the west. The diagram used in this report is based on a geophysical report, information from the Station Facilities Maintenance Department, and on-site observations.

The nearest occupied building is the Remote Receiver Building, located approximately 740 feet from the landfill site. MCAS residences are 1600 feet to the northwest of the site. Trabuco Road, a public thoroughfare, is approximately 1400 feet southwest of the landfill.

Neither liners nor a gas-venting system have been used at this landfill. No previous gas testing data are available for the site.

1.4 SITE ACCESS

The Communications Station Landfill was never open to the public. Station personnel, including Station residents, used the landfill for general waste disposal. It was also used for the industrial wastes produced during Station operations. Access to the Station and to the landfill must be coordinated through the Station military police and environmental engineering division at the MCAS-El Toro.

1.5 AIR SWAT CLASSIFICATION

In accordance with the ARB guidelines and a review meeting with the SCAQMD, the landfill has been classified as a Category I landfill because there are inhabited buildings within 1,000 feet of the site perimeter and because there are more than 25 acres of disposal area.

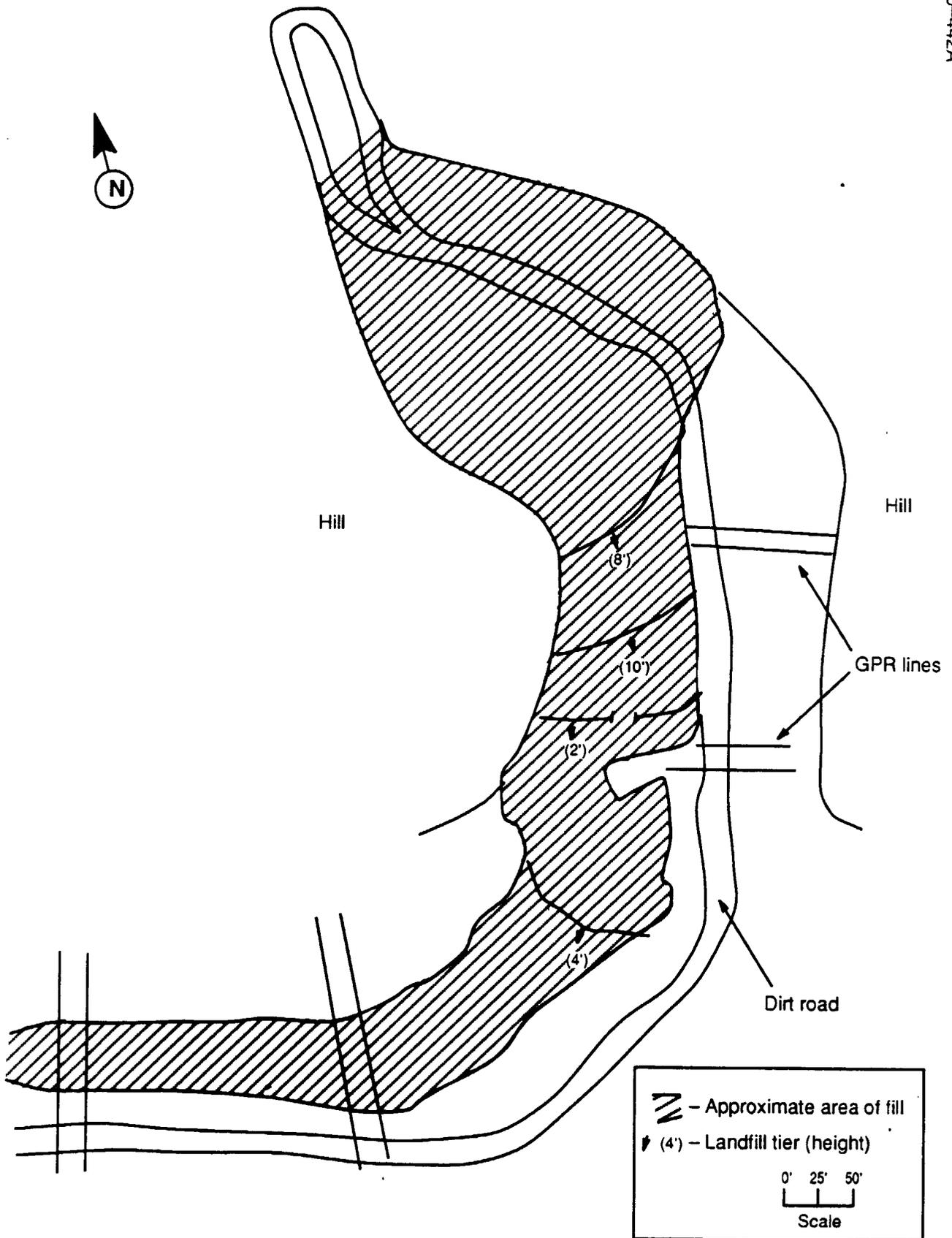


FIGURE 1-2. Communications Station Landfill.

1.6 CONTENTS OF THE REPORT

Section 2 describes the geology and meteorology of the Communications Station Landfill area. Sections 3, 4, 5 and 6 review the field sampling and monitoring program and analytical results for gas stream characterization, ambient air testing, gas migration, and wind monitoring, respectively. Section 7 describes the analytical methods used throughout the program; Section 8 discusses the quality assurance program and results; and Section 9 presents the data reduction, validation, and storage procedures. Section 10 lists the references cited in the report. Appendix A contains photographs that document sampling methods and locations; Appendix B presents the results of three laboratory quality control studies; Appendix C contains field sample documentation; Appendix D contains laboratory data reports; and Appendix E contains the inactive site screening questionnaire and communications with the SCAQMD.

Section 2

PHYSICAL SITE CHARACTERISTICS

In order to better understand the factors controlling subsurface gas migration and the movement of landfill emissions in ambient air, the geology and meteorology of the Communications Station Landfill area are discussed in the following sections.

2.1 GEOLOGY

The Communications Station Landfill lies at the boundary of the Tustin Plain and the Santa Ana Mountains. The Tustin Plain is the southernmost extension of the central plain of the Los Angeles Basin. The Santa Ana Mountains are a member of the northwest-trending peninsular ranges. The landfill is flanked by foothills of the Santa Ana Mountains and is situated at the mouth of an unnamed watershed to the northwest of Borrego Canyon Wash.

The surficial alluvium of the Tustin Plain comprises a series of coalescing alluvial fans derived from the Santa Ana Mountains and, to a lesser extent, the San Joaquin Hills. This alluvial mantle is underlain by a thick section of Tertiary strata that overlie Jurassic metamorphic and igneous rocks.

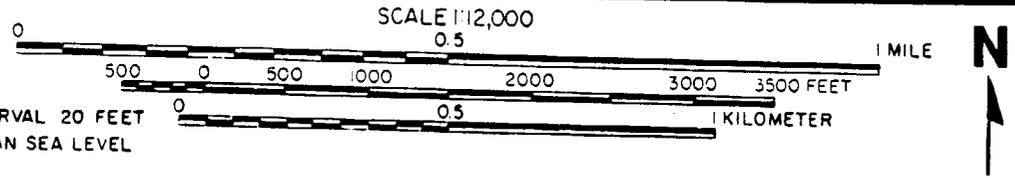
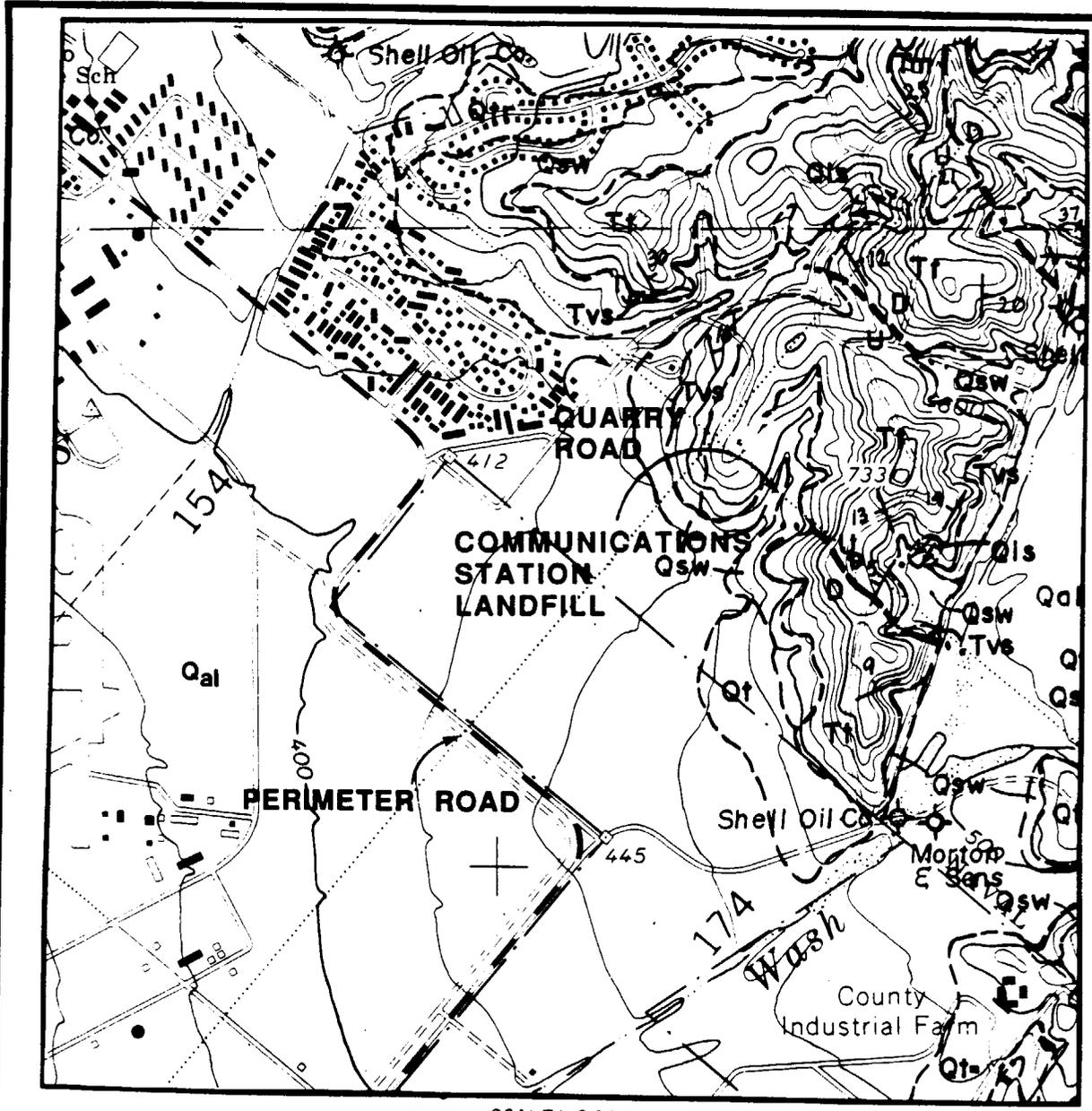
The Santa Ana Mountains are a southwest-tilted range with a central core composed of Mesozoic plutonic igneous rocks of the Southern California Batholith. This central core is overlain by an extensive section of Mesozoic through Cenozoic sedimentary rocks. The hills adjacent to the landfill are composed of the Tertiary sandstones of the Topanga Formation (Figure 2-1). The landfill is situated on recent colluvium and alluvium derived from the surrounding hills.

A northwest-trending fault is exposed in the hills immediately to the southwest of the landfill (Morton and Miller, 1981). This fault may pass beneath a portion of the landfill.

The U.S. Department of Agriculture Soil Conservation Service (1978) identified the Capistrano sandy loam, the San Emigdio fine sandy loam, and the Soper gravelly loam as the soil types in the vicinity of the landfill. The Capistrano and San Emigdio soil series consist of permeable soils that occur on alluvial fans and flood plains of the area. The Soper gravelly loam is a permeable soil that occurs on hillsides in the area. These soils are likely to present a pathway for gas migration from the landfill.

2.2 REGIONAL CLIMATOLOGY

The climate of California is largely influenced by the presence of the Pacific High, a semipermanent high pressure system characterized by divergence of its eastern edge. The divergence allows air aloft to subside, becoming relatively warm and dry, thus producing clear skies and low humidities. Also, due to



CONTOUR INTERVAL 20 FEET
 DATUM IS MEAN SEA LEVEL

- LEGEND:**
- Qal Quaternary Younger Alluvium
 - Qsw Quaternary Slope Wash
 - Qt Quaternary Nonmarine Terrace
 - Qls Quaternary Landslides
 - Tm Tertiary Monterey Formation
 - Tt Tertiary Topanga Formation
 - Tvs Tertiary Vaqueros and Sespe Formation Undifferentiated

FIGURE 2-1.
 Geologic map
 Communications Station Landfill
 MCAS, El Toro, California

REFERENCE: CALIFORNIA DIVISION OF MINES & GEOLOGY SPECIAL REPORT 110, 1974.

the subsiding air, persistent temperature inversions are common.

During the summer there is little precipitation, as the Pacific High blocks extratropical storms from entering California. During this season, the high produces predominantly northwesterly flow over the California coastal waters. The northwesterly flow is modified by coastal mountains and other inland topographical features so that wind direction is the product of local terrain rather than the prevailing circulation. By winter, the high has moved southward, allowing for cooler temperatures, frontal passages, rainfall, and weaker and less persistent northwesterly flow along the California coast.

During the winter, Santa Ana conditions are common in Southern California. These north or northeasterly winds occur when a large high pressure system builds over the Great Basin area of Utah and Nevada and spreads southward over the the Southeast Desert Basin of California. These winds can persist from several hours to a few days and can reach sustained speeds of up to 60 miles per hour.

o Local Climatology

The climate of the El Toro area is classified as mid-latitude dry summer (Trewartha, 1968). This climatic type is characterized by a winter maximum in precipitation, a high percentage of sunshine, and a relatively small diurnal and seasonal temperature range. A major influence on the climate of the area is the land/sea breeze circulation, which shows a seasonal variation. During the summer, the intense heating of the inland deserts induces a thermal low or heat trough responsible for an onshore pressure gradient (onshore flow or sea breeze). Drainage flow (land breeze) becomes almost nonexistent. By winter, the sea breeze becomes weaker and of shorter duration, while the land breeze persists for more hours during the day.

Along the coastal areas of Southern California, the sea breeze moderates warm summer days. Average maximum temperatures may vary by as much as 20 degrees Fahrenheit (°F) from the coast to the inland areas during the month of August. In contrast, the average daily minimum temperatures are higher along the coast during January because of the proximity to the relatively warm ocean. Based on data from MCAS-El Toro for a 14-year period of record, the annual average temperature is 62°F. The coldest month is January, with a mean maximum temperature of 63°F and a mean minimum temperature of 44°F. The warmest month is August, with a mean maximum temperature of 81°F and a mean minimum temperature of 61°F (Keith, 1980). Temperatures as high as 107°F and as low as 25°F were recorded at MCAS-El Toro during the data period.

The annual average precipitation along the coastal portion of Orange County is approximately 12 inches and generally increases inland to a maximum in the San Gabriel and San Bernardino Mountains (Keith, 1980). Based on data from the City of Santa Ana (located approximately six miles northwest of El Toro) for a 53-year period of record, the annual average precipitation at the site is approximately 14 inches, with

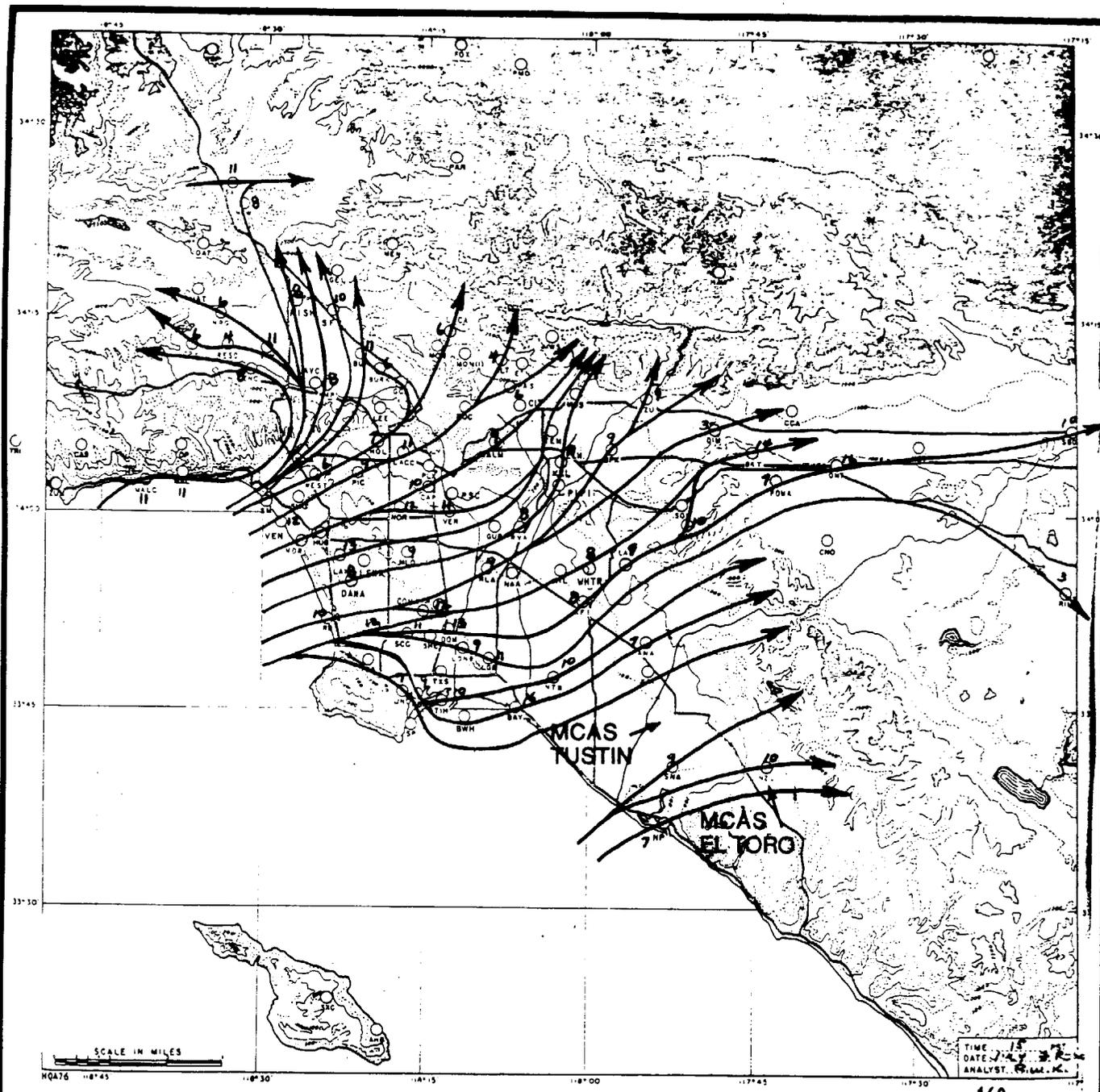
approximately 91 percent of this rainfall occurring from November through April (Keith, 1980). Most of the precipitation is associated with eastward moving cyclones and associated frontal systems.

Summer winds in the California South Coast Air Basin are predominantly onshore. The initial onshore flow is generally southerly; then, as the day progresses, westerly flow becomes predominant (Keith and Selik, 1977). Figures 2-2 and 2-3 show typical streamline patterns during summertime conditions for both daytime and nighttime flow. Figure 2-2 reveals the persistent onshore flow in the El Toro area, producing a high frequency of westerly winds. The nighttime flow (Figure 2-3) becomes more easterly, but instead of moving offshore, the flow is joined with the weak onshore flow and moves toward the northwest.

Wind data from El Toro for the period 1973 to 1977 are shown in Table 2-1. Annually, predominant winds are from the west, occurring about 15 percent of the time. Secondary predominant winds are from the east, occurring about 12 percent of the time. During the summer, the frequency of westerly winds reaches a maximum (about 22 percent), then decreases to a minimum in winter (about 9 percent). As fall approaches, radiational cooling of the Santa Ana Mountains at night, coupled with less persistent onshore flow, produces an increase in drainage winds from the east. Winds from the east become predominant in winter, occurring about 17 percent of the time.

The annual average wind speed at El Toro is 4.7 miles per hour with calms occurring about 16 percent of the time. Seasonal changes in mean wind speed are relatively small, varying by less than one mile per hour between a maximum in spring (5 miles per hour) and a minimum in fall (4.2 miles per hour).

During a preliminary meteorological survey conducted for two weeks between 9 April and 24 April, 1990, the winds were variable. The predominant wind directions were northeast through east-southeast, south-southeast through south, and west. Northeast through east-southeast winds predominated between the hours of 0100 and 0500. Figures 2-4 and 2-5 depict wind roses for the preliminary meteorological survey.



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FIGURE 2-2.
 Normal wind flow
 pattern and average wind speeds:
 July 1500 PST



FIGURE 2-3.
NORMAL WIND FLOW
PATTERN & AVERAGE WIND SPEEDS:
JULY 0200 PST

TABLE 2-1. Wind data from El Toro.

SURFACE WIND SUMMARY				Period of Record:				Bias Index: 0.26			
Station Name: El Toro				1973 - 1977				Speed Units: MPH			
Elevation: 383 Feet								Source Code			
Degrees Minutes								Data: 1			
North Latitude: 33		40		Observations: 14,607				Summary: D			
West Longitude: 117		44		24 OBS/DAY							
DIRECTION	WINTER		SPRING		SUMMER		FALL		ANNUAL		
	% OF TIME	MEAN SPEED	% OF TIME	MEAN SPEED	% OF TIME	MEAN SPEED	% OF TIME	MEAN SPEED	% OF TIME	MEAN SPEED	
N	2.9	6.3	1.9	5.9	1.2	3.3	2.1	4.4	2.0	5.3	
NNE	4.5	8.8	1.7	4.7	0.4	3.3	2.3	5.4	2.2	6.9	
NE	7.0	7.0	2.8	5.3	0.9	3.2	3.6	6.5	3.6	6.3	
ENE	9.0	5.2	4.6	4.3	1.6	3.1	6.9	4.1	5.5	4.5	
E	17.0	4.6	12.1	4.4	8.0	3.6	11.8	4.1	12.2	4.2	
ESE	7.1	5.1	6.5	4.6	4.0	3.9	4.8	4.1	5.6	4.5	
SE	4.7	5.5	5.3	5.3	3.7	4.7	3.4	4.1	4.3	5.0	
SSE	4.9	6.0	6.6	6.1	4.7	5.5	3.4	5.1	4.9	5.8	
S	4.3	5.5	7.8	6.0	7.5	5.4	4.3	5.4	6.0	5.6	
SSW	2.1	4.8	4.0	6.6	3.1	5.4	1.8	5.4	2.7	5.7	
SW	1.8	5.6	4.3	6.7	2.2	4.9	1.3	6.0	2.4	6.0	
WSW	3.8	6.6	7.3	7.4	6.1	6.9	4.9	7.4	5.6	7.1	
W	8.6	5.9	13.1	7.4	22.4	7.1	15.3	6.5	14.9	6.8	
WNW	4.7	5.3	5.1	5.5	11.4	6.4	8.7	5.5	7.5	5.8	
NW	2.1	4.8	1.8	5.1	4.9	5.3	3.5	4.4	3.1	4.9	
NNW	1.6	4.7	1.0	4.8	2.6	4.2	2.0	3.9	1.8	4.3	
CALM	13.8		14.0		15.2		19.8		15.6		
ALL		4.9		5.0		4.8		4.2		4.7	
		WINTER		SPRING		SUMMER		FALL		ANNUAL	
DIRECTION:		79		200		256		270		238	
SPEED:		1.2		1.4		2.4		0.7		0.7	
PER. RATIO:		0.24		0.28		0.49		0.17		0.16	
DIRECTION:		E		W		W		W		W	
SPEED:		4.9		7.0		6.9		6.4		6.6	
PERCENTAGE:		33.1		25.5		39.9		28.9		28.0	
DIRECTION:		W		ESE		SSE		E		E	
SPEED:		5.9		4.7		5.3		4.1		4.3	
PERCENTAGE:		17.1		23.9		15.9		23.5		23.3	
Source: California Air Resources Board											

EL TORO AIR SWATS
COMMUNICATION STATION LANDFILL
09/APR/90 - 24/APR/90

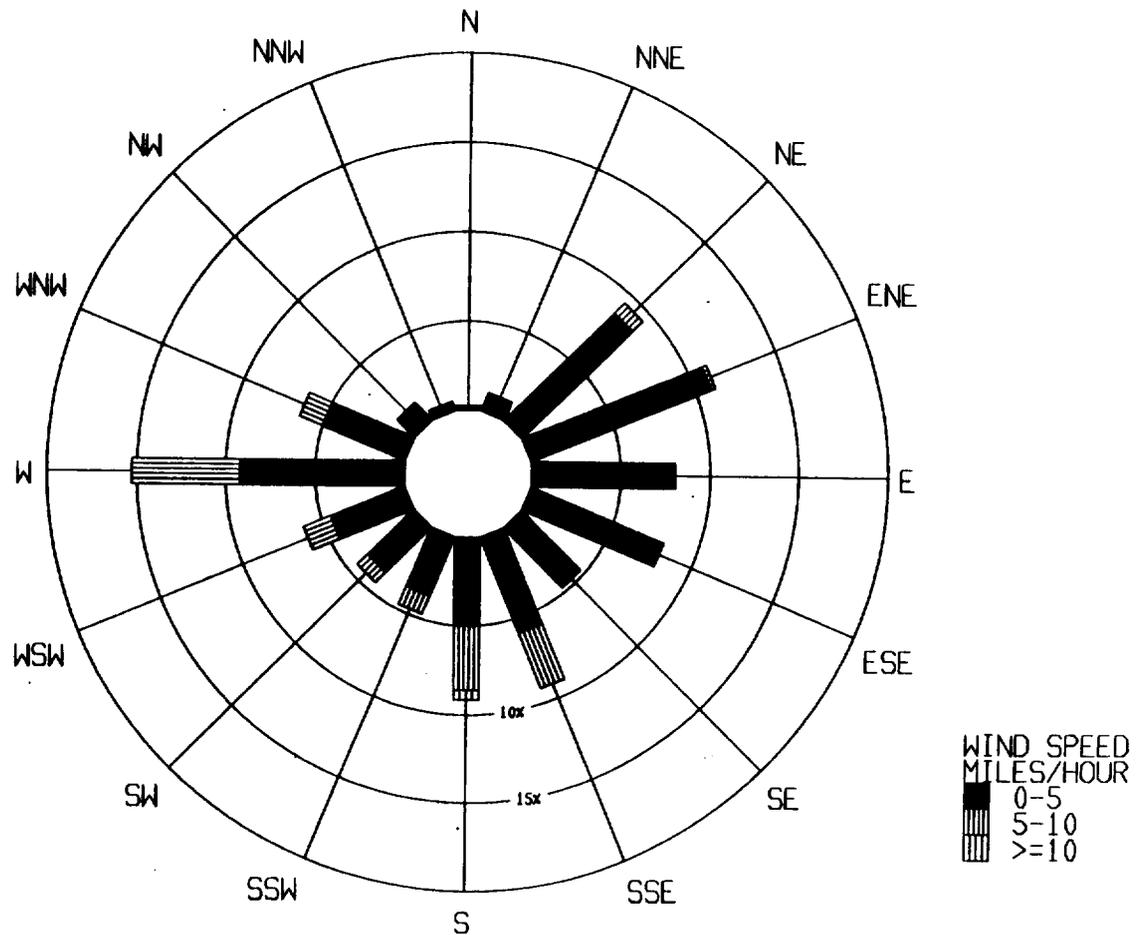


FIGURE 2-4. Wind rose for preliminary meteorological survey of the Communications Station Landfill.

EL TORO AIR SWATS
COMMUNICATION STATIONS LANDFILL
10/APR/90 - 24/APR/90 (Hour 1,2,3,4)

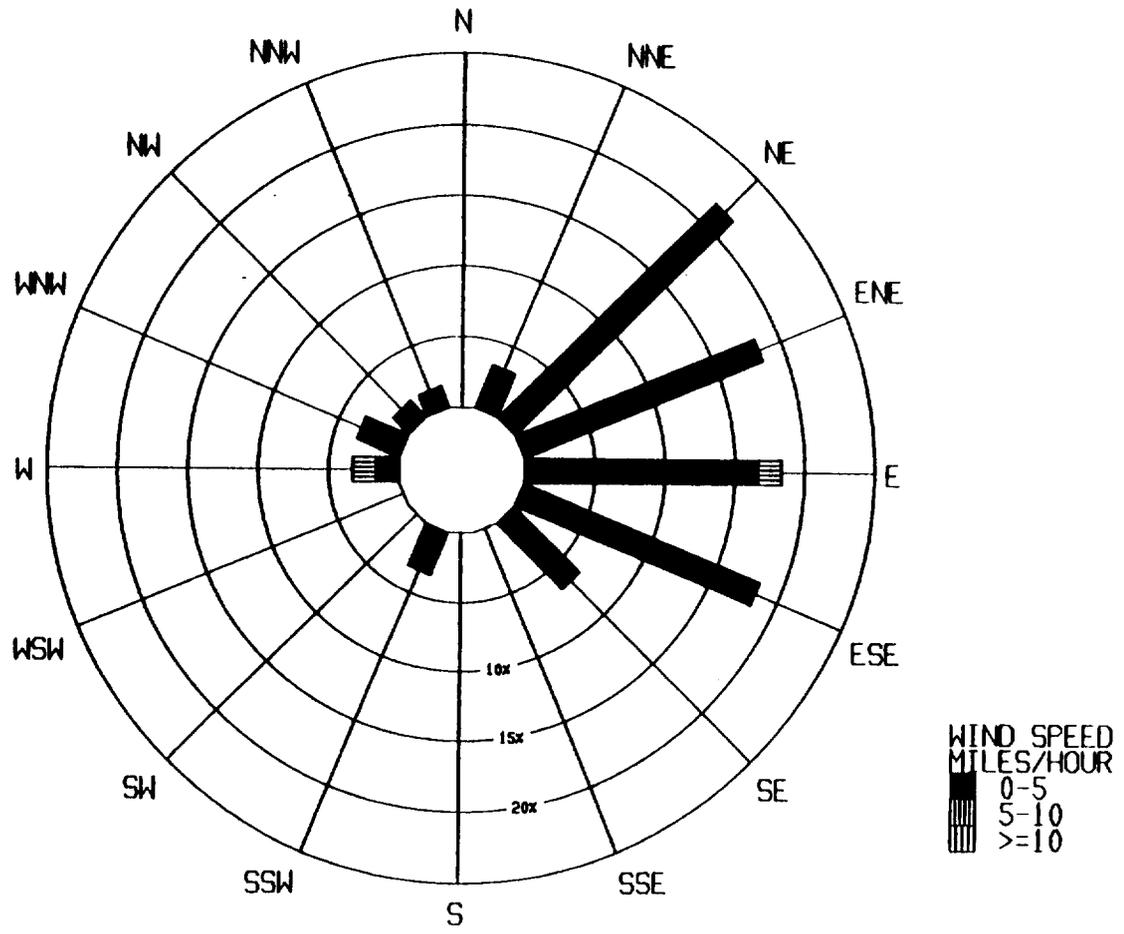


FIGURE 2-5. Wind rose for drainage flow (100-0500 hours) during preliminary meteorological survey of the Communications Station Landfill.

Section 3

GAS STREAM CHARACTERIZATION

3.1 LANDFILL GAS TEST

3.1.1 Overview of the Monitoring Program

To determine the composition of landfill gas, five landfill gas tests, one integrated surface sample, and one surface screening were conducted at the Communications Station Landfill. Gas samples were collected on 25 May and 4-5 June 1990, from landfill gas probes that were installed on 8 May 1990 (Figure 3-1). The depths of the probes were eight feet below grade. Two of the probes, LG-01 and LG-02 were resampled on 22 June. Table 3-1 summarizes the landfill gas sample collection. Photographs in Appendix A illustrate the sampling apparatus and equipment.

The landfill gas samples were sent to Environmental Analytical Service, Inc. (EAS), where they were analyzed within 120-hours of their collection. The samples were tested for the Attachment 1 compounds (Table 3-2), using the disposal detection limits designated by the Air Resources Board (ARB) for reporting purposes (DLRs), and for the permanent gases (methane, carbon dioxide, oxygen and nitrogen). The SCAQMD approved DLR for methane and carbon dioxide was 20 ppm; for oxygen and nitrogen, it was 0.1%. Section 7 describes the methods used for sample analysis, and Section 8 discusses the field and laboratory quality assurance results.

3.1.2 Landfill Gas Sample Collection

The landfill gas probes were installed at the locations shown in Figure 3-1. These locations were selected because of the geometry of the site in order to provide representative sampling. The five landfill gas sampling probes were constructed using a 3/4-inch outer diameter, 5/8-inch inner diameter galvanized steel pipe that had been steam-cleaned. Galvanized steel does not adsorb or offgas chemicals that would contaminate samples. Several 1/8-inch holes were drilled in the bottom foot of the pipe to collect the gas sample, and a point at the end of the probe prevented soil from entering the pipe (Figure 3-2). A jackhammer was used to drive the probe into the ground. This method does not leave an annular space. Because of this, there is no pathway for ambient air to be drawn down into the well from the ground surface. The top of the pipe is threaded and was capped with a PVC cap after installation. During sampling, the probe was capped with a plug pierced by Teflon tubing to provide connection to the sampling system. Samples were collected at least 24 hours after probe installation. Before sampling, two well volumes of gas were evacuated from the probe.

The landfill gas sampling system is constructed entirely of stainless steel and Teflon (Figure 3-3). The sampling system uses a 12-volt DC diaphragm pump that is protected from moisture and dust by an in-line liquid trap and filter. A gauge monitors any vacuum that may occur while drawing a sample from the

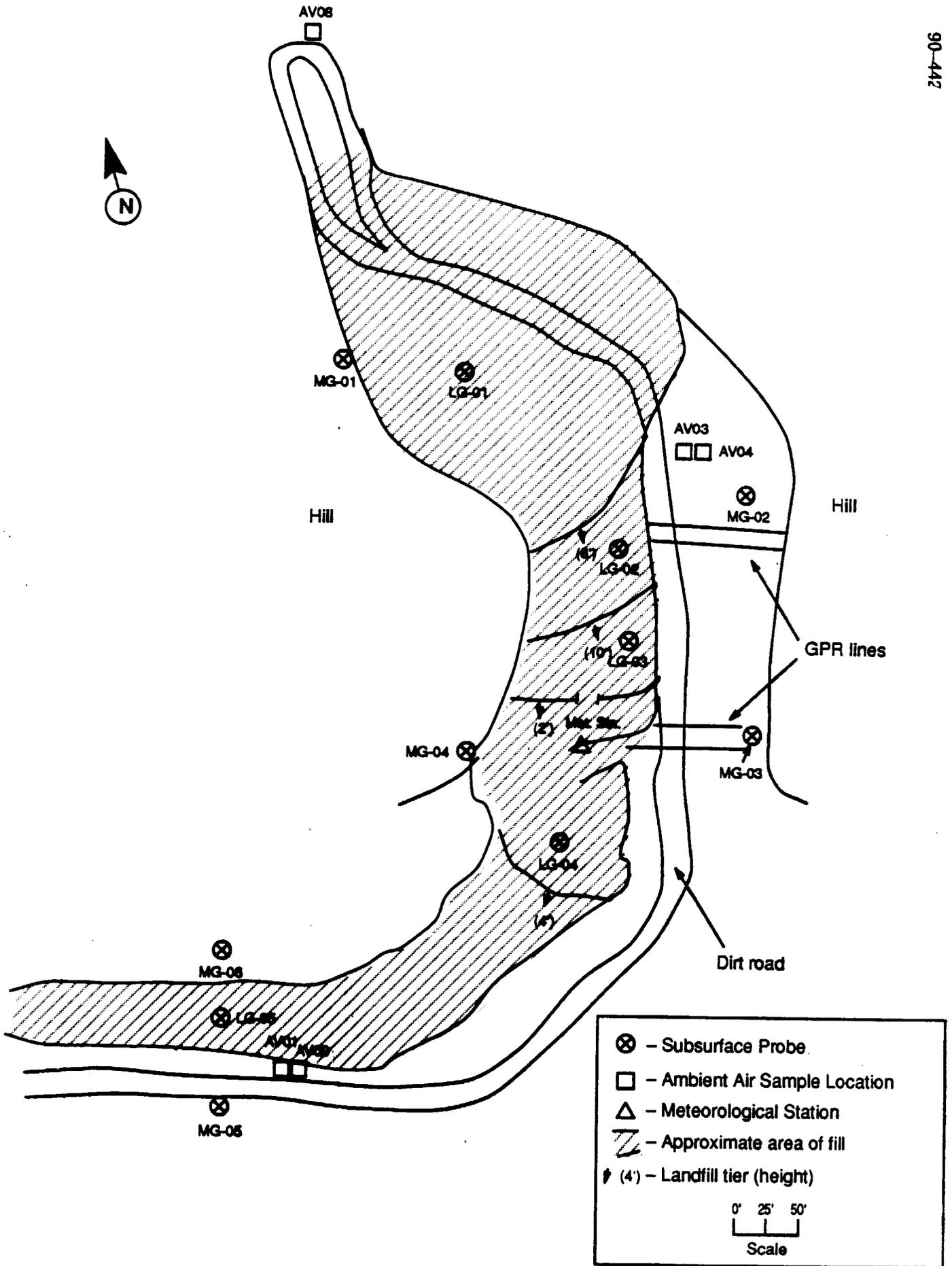


FIGURE 3-1. Communications Station Landfill sampling results.

TABLE 3-1.

Landfill gas well installation and sample collection
Communications Station Landfill.

Well Number	Well Installation (Date Hour)		Sample Collection (Date Hour)		Well Depth (Feet)
CO-LG-00-02*	-----	---	6/05/90	1241	---
CO-LG-01-02	5/08/90	0955	5/25/90	0917	8.0
CO-LG-R1-02	5/08/90	0955	6/22/90	1035	8.0
CO-LG-02-02	5/08/90	1040	5/25/90	1400	7.5
CO-LG-R2-02	5/08/90	1040	6/22/90	1100	7.5
CO-LG-03-02	5/08/90	1115	6/04/90	1612	8.0
CO-LG-04-02	5/08/90	1155	6/05/90	0821	8.0
CO-LG-05-02	5/08/90	1225	6/05/90	1026	8.0

*Field System Blank

TABLE 3-2. Attachment 1 compounds - specified air contaminants.

Compound		Detection Limits, ppb	
		Air	Disposal
Chloroethene (Vinyl Chloride)	$\text{CH}_2\text{:CHCl}$	2	500
Benzene	C_6H_6	2	500
1,2-Dibromoethane (Ethylene Dibromide)	$\text{BrCH}_2\text{CH}_2\text{Br}$	0.5	1
1,2-Dichloroethane (Ethylene Dichloride)	$\text{ClCH}_2\text{CH}_2\text{Cl}$	0.2	20
Dichloromethane (Methylene Chloride)	CH_2Cl_2	1	60
Tetrachloroethene (Perchloroethylene)	$\text{Cl}_2\text{C:CCl}_2$	0.2	10
Tetrachloromethane (Carbon Tetrachloride)	CCl_4	0.2	5
1,1,1-Trichloroethane (Methyl Chloroform)	CH_3CCl_3	0.5	10
Trichloroethylene	HCIC:CCl_2	0.6	10
Trichloromethane (Chloroform)	CHCl_3	0.8	2

From Testing Guidelines for Active Solid Waste Disposal Sites, prepared by the California Air Resources Board, December 1986.

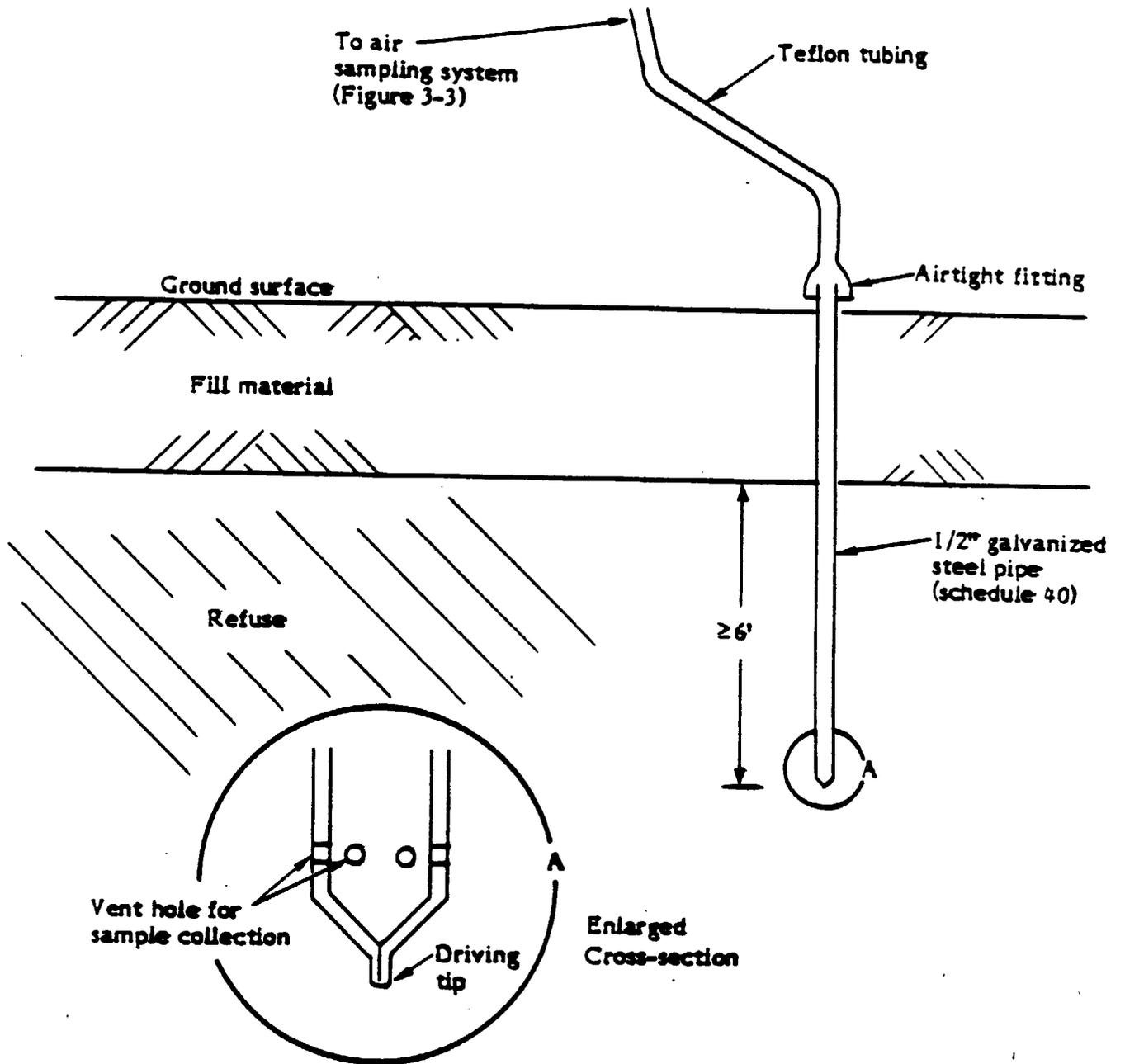


FIGURE 3-2. Gas sampling probe design.

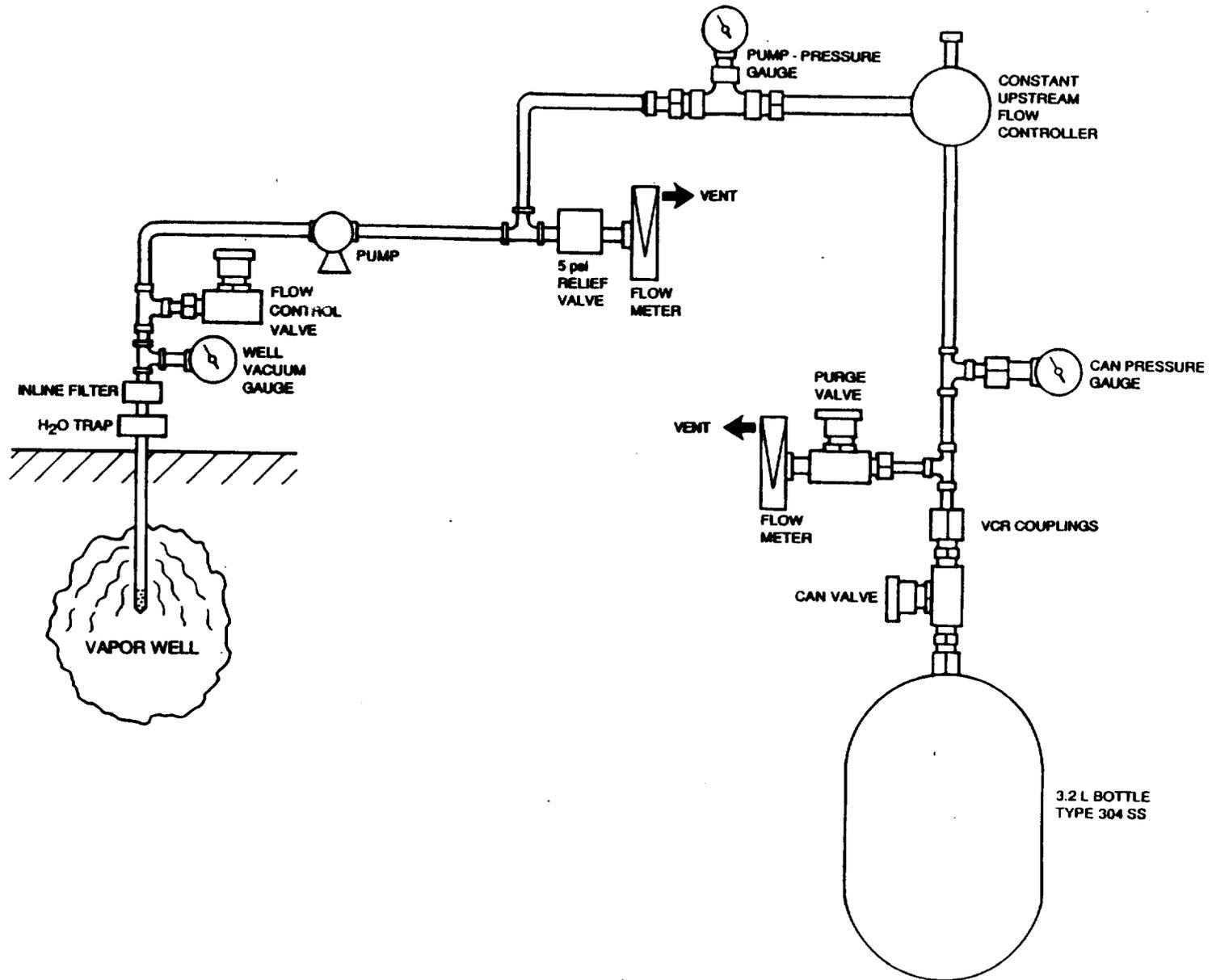


FIGURE 3-3. Probe sampling system.

well. A valve and an upstream flow controller regulate the sample flow rate, which is monitored by a calibrated rotameter. A purge tee connects the sampling system to the sample container. It flushes the valve dead space and acts as a bypass valve for flow measurement.

The samples were collected at a flow rate of one liter per minute into 3.2-liter electropolished stainless steel canisters with noncontaminating bellows valves. The canisters were used instead of Tedlar bags, because they allow greater stability of the Attachment 1 compounds and other chemicals of interest. Because of the increased sample stability, the SCAQMD approved the use of canisters and increased the allowable sample holding time from 72 to 120 hours.

The sample canisters were leak tested before use. They were assigned unique identification numbers while in service. Usage information, such as the date, sample time, sample location, canister number, sample identification number, initial and final canister pressures, and initial and final flow rates for each sampling canister was kept in a log book and on sample data sheets.

After each sample was collected, the final pressure of the canister was recorded. The canisters were shipped to the laboratory under positive pressure. When they arrived, the pressure was checked and compared to the pressure before shipment to confirm sample integrity. During sampling and shipping, the canisters were maintained at approximately 25°C.

Between uses, the landfill gas sampler was decontaminated by flushing the system with ambient air while screening the outflow emissions from the sampler for total organic compounds as methane (TOC) using a Century 128 field portable organic vapor analyzer (OVA). Flushing continued until no TOC was detected. The system was then flushed with zero air for ten minutes. Before sample collection, the sampling system was purged with two probe volumes of landfill gas to avoid diluting the sample with zero air.

Following landfill gas sampling, a field system blank was collected using the landfill gas sampler to evaluate the effectiveness of our decontamination procedures. The blank was collected by pumping zero air through the sampling system into a stainless steel canister. It was handled similar to the landfill gas samples. The blank was submitted to the laboratory where it was analyzed for the Attachment 1 compounds using the air DLRs.

3.1.3 Results

Table 3-3 presents the analytical results for landfill gas samples collected at the Communications Station Landfill. The detection limits shown are those recommended by the ARB guidelines and approved by SCAQMD for reporting purposes. Each sample was assigned a unique eight-digit label that identified the site, type of sample, well number, and sampler number. The following is an example and explanation of sample numbers assigned to landfill gas samples collected at the Communications Station Landfill.

<u>Sample Label</u>	<u>Explanation</u>
CO-LG-03-02	CO Communications Station Landfill (site name) LG = Landfill Gas Sample 03 = Landfill Gas Probe Number 3 02 = Identification number of the sampler used to collect the sample
CO-LG-R1-02	CO Communications Station Landfill (site name) LG = Landfill Gas Sample 03 = Landfill Gas Probe Number 3 02 = Identification number of the sampler used to collect the sample

The samples collected from Wells LG-01 and LG-02 were not analyzed for permanent gases by the laboratory. Because of this the wells were resampled on 22 June 1990. Table 3-3 also includes the results of the Attachment 1 compounds for the original two samples. Five of the landfill gas samples collected from the Communications Station Landfill contained dichloromethane (MeCl_2) in concentrations greater than their respective DLRs. The MeCl_2 ranged in concentration from 76 to 820 ppb. No other Attachment 1 compounds were present in levels above the ARB DLRs. The permanent gas concentrations averaged 76% nitrogen, 14% oxygen, and 7.1% carbon dioxide. Methane was not detected in any of the samples.

3.1.4 Discussion

The landfill gas collected from the Communications Station Landfill contained MeCl_2 . A system blank of the sampler had 720 ppb MeCl_2 . The source of the MeCl_2 is uncertain, but it is most likely due to system or laboratory contamination rather than the landfill gas. A more in depth discussion of the sampler contamination is presented in the Section 8.1.2. The permanent gas concentrations were reasonably consistent and showed generally low levels of carbon dioxide. Methane was not detected in any of the landfill gas probes.

3.2 INTEGRATED SURFACE SAMPLE

3.2.1 Integrated Surface Sample Collection

One integrated surface (IS) sample was collected at the landfill on 1 June 1990. Table 3-4 summarizes the date and time of the sample collection; photographs in Appendix A illustrate the sampling apparatus and equipment; and Figure 3-1 shows the sampling location.

The IS sampler used is a portable, self-contained unit with an internal power source. The system is constructed entirely of stainless steel and Teflon parts. Landfill emissions were drawn through a 6-inch diameter 316 stainless steel funnel by a 12-volt DC pump with an unlubricated Viton rubber diaphragm.

TABLE 3-4. Integrated surface sample collection Communications Station Landfill.

Date Sampled	Start Time	End Time	Elapsed Time (minutes)
6/01/90	1015	1040	25

They were collected into a 10-liter Tedlar bag. A purge tee connecting the sample bag to the IS sampler acts as a bypass valve for flow measurement, which was measured with a calibrated rotameter.

The complete system was leak tested before being sent to the field. Between uses, the IS sampler was decontaminated by flushing the system with ambient air for five minutes, followed by zero air for five minutes. Immediately before sampling the sampler lines were purged with landfill emissions so that the sample was not diluted by zero air.

The IS sample was collected from two to three inches above the landfill surface while a technician walked a 50,000-square-foot grid in approximately 25 minutes. Figure 3-4 shows the walking pattern. Sampling proceeded only when the ten minute average wind speed was five miles per hour or less, and the instantaneous wind speed was less than ten miles per hour. During sampling, the wind speed was monitored using a hand-held anemometer and confirmed with a mechanical weather station. The mechanical weather station is described in Section 6. The IS sample was collected when the landfill surface was dry; that is, when no rain had fallen within the previous 72 hours.

After the sample was collected and the final condition of the sample bag was recorded, the bag was shipped to EAS in a light-proof box. When it arrived at the laboratory, its condition was checked and compared to the condition before shipment to confirm sample integrity. During shipment, the sample was maintained at approximately 25°C. The IS sample was analyzed for TOC using a 2 ppm DLR in accordance with the ARB guidelines.

At the same time as the IS sample collection, a surface screening of the landfill was performed using a Century 128 OVA. The OVA was calibrated using zero air and a 50 ppm methane standard. During the screening, a sampling technician held the inlet to the OVA two to three inches above the landfill surface while walking the same grid pattern as was used for the IS sample collection. During the screening, a 2 ppm TOC DLR was used, in accordance with the ARB guidelines. OVA readings were recorded once per minute during the screening.

Before the screening, the background TOC concentration was measured by standing upwind of the landfill, holding the inlet of the OVA 10 feet above the ground and taking a reading after one minute. A second background reading was taken following the surface screening.

3.2.2 Results

The TOC concentration of the IS sample collected from immediately above the Communications Station Landfill was 4.1 ppm. The average wind speed was below 5 miles per hour for the duration of the sampling period, and at no time during the testing did the instantaneous wind speed exceed 10 miles per hour. During the surface screening no readings were measured above the 2 ppm DLR.

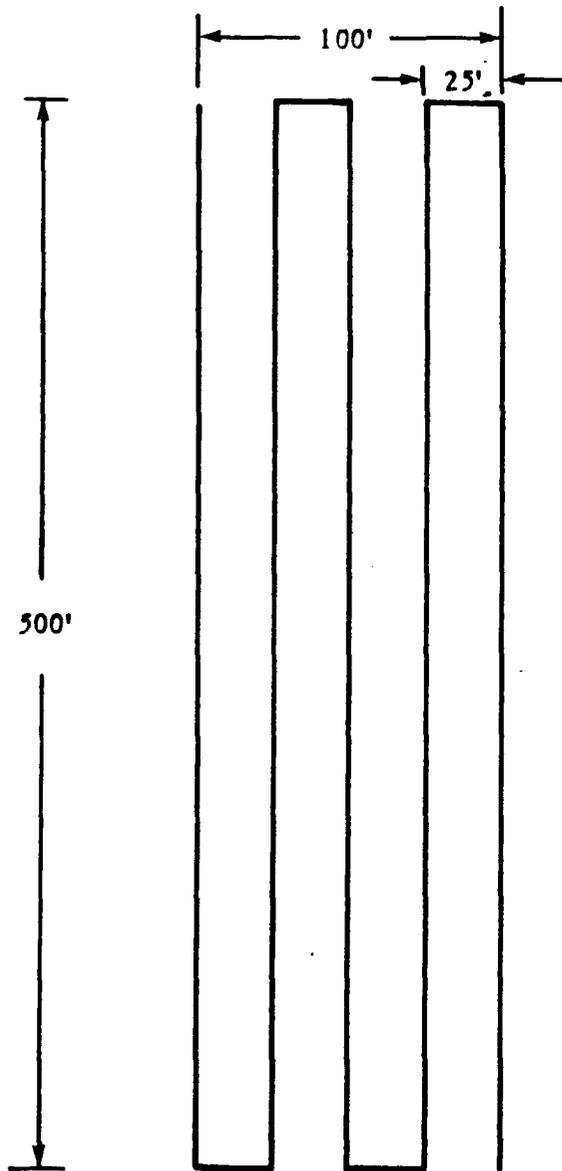


FIGURE 3-4. Walking pattern for integrated surface sample collection.

87-674

Source: South Coast AQMD

Section 4

AMBIENT AIR MONITORING

4.1 OVERVIEW OF THE MONITORING PROGRAM

To test for the presence of the Attachment 1 compounds in the ambient air at the Communications Station Landfill, 24-hour and four-hour drainage integrated air samples were collected adjacent to the disposal site. A total of 14 samples were collected over a period of three consecutive days. The samplers were located based on the prevailing winds at the site, as determined during a preliminary meteorological survey. One 24-hour and one drainage sampler were placed on the southwest side of the fill, the two collocated samplers were placed on the east side of the fill within the canyon, and the other drainage sampler was placed at the northern side of the landfill.

Wind data collected during the sampling periods showed that winds were variable. Daytime winds were predominantly from the west-southwest through west-northwest. Nighttime drainage winds were from the northeast through east-northeast for two of the sampling periods and south-southwest for the third, resulting in a reversal of the upwind and downwind locations for that period. Table 4-1 summarizes the integrated air sample collection times; photographs in Appendix A illustrate the sampling apparatus; and Figure 3-1 shows the sampling locations.

The samples were sent to EAS, where they were analyzed within 120 hours of collection for the Attachment 1 compounds (Table 3-2), using the air detection limits designated by the Air Resources Board (ARB) for reporting purposes (DLRs). Section 7 describes the methods used for sample analysis, and Section 8 discusses the field and laboratory quality assurance results.

4.2 INTEGRATED AMBIENT AIR SAMPLE COLLECTION

The integrated ambient air samplers were located at or near the perimeter of the landfill site, away from obstacles such as trees, shrubbery, and hills. The inlet probe was 6.1 feet off the ground, and air flow around it was unrestricted.

During sample collection, the wind speed and direction were monitored continuously by a mechanical weather station. The 24-hour samples of 23, 24, and 25 May 1990 were collected during average wind speeds of 3.5, 4.0, and 4.8 mph, respectively. The drainage samples from 23, 24, and 25 May 1990 were collected during average wind speeds of 2.8, 1.8, and 3.8 mph, respectively. The 24-hour downwind collocated sampler on 25 May failed to operate properly and, therefore, did not collect a sample on this date. Section 6 presents the wind direction and wind speed data for the sample collection periods. All of the samples were collected when the surface of the landfill was dry; that is, at least 72-hours following rainfall.

TABLE 4-1. Integrated ambient air sample collection Communications Station Landfill.

Sample Number	Start Date	Start Time	End Date	End Time	Elapsed Time (hours)
CO-IA-01-09	5/22/90	0825	5/23/90	0830	24.1
CO-IA-01-03	5/22/90	0820	5/23/90	0825	24.1
CO-IA-C1-04	5/22/90	0820	5/23/90	0825	24.1
CO-IA-02-09	5/23/90	0830	5/24/90	0820	23.9
CO-IA-02-03	5/23/90	0825	5/24/90	0815	23.9
CO-IA-C2-04	5/23/90	0825	5/24/90	0815	23.9
CO-IA-03-09	5/24/90	0855	5/25/90	0855	24.0
CO-IA-03-03	5/24/90	0850	5/25/90	0850	24.0
CO-IA-D1-08	5/23/90	0100	5/23/90	0500	4.0
CO-IA-D1-01	5/23/90	0100	5/23/90	0500	4.0
CO-IA-D2-08	5/24/90	0100	5/24/90	0500	4.0
CO-IA-D2-01	5/24/90	0100	5/24/90	0500	4.0
CO-IA-D3-08	5/25/90	0100	5/25/90	0500	4.0
CO-IA-D3-01	5/25/90	0100	5/25/90	0500	4.0

The integrated ambient air samplers are constructed entirely of stainless steel and Teflon (Figure 4-1). Air is drawn into the system by a 12-volt DC diaphragm pump and is controlled with a back pressure flow controller. A purge tee connects the system to the air sampling container and is used to flush the valve dead space and to act as a bypass for flow measurements using a calibrated rotameter. Each sampler is contained in weatherproof housing.

Each complete sampling system was cleaned and vacuum leak tested before being sent to the field. Between uses, the integrated ambient air samplers were decontaminated by flushing the systems with ambient air for five minutes followed by zero air for five minutes. Before sampling, the samplers were purged with ambient air so that the samples would not be diluted with zero air.

The integrated air samples were collected in 3.2-liter electropolished stainless steel canisters and were handled as described in Section 3.1.2.

4.3 RESULTS

The analytical results for the ambient air samples are presented in Table 4-2. The detection limits shown are those recommended by the ARB guidelines and approved by SCAQMD for reporting purposes. Each sample was assigned a unique eight-digit label that identified the landfill, type of sample, sampling order, and sampler number. Examples of labels used for the ambient air samples and corresponding explanations follow:

<u>Sample Label</u>	<u>Explanation</u>
CO-IA-01-03	CO = Communications Station Landfill IA = Integrated Ambient Air Sample 01 = First 24-hour sample collected 03 = Identification number of the sampler used to collect the sample
CO-IA-D2-01	CO = Communications Station Landfill IA = Integrated Ambient Air Sample D2 = Second drainage (less than 12-hour) sample collected 01 = Identification number of the sampler used to collect the sample
CO-IA-C2-04	CO = Communications Station Landfill IA = Integrated Ambient Air Sample C2 = Second Collocated sample collected 04 = Identification number of the sampler used to collect the sample

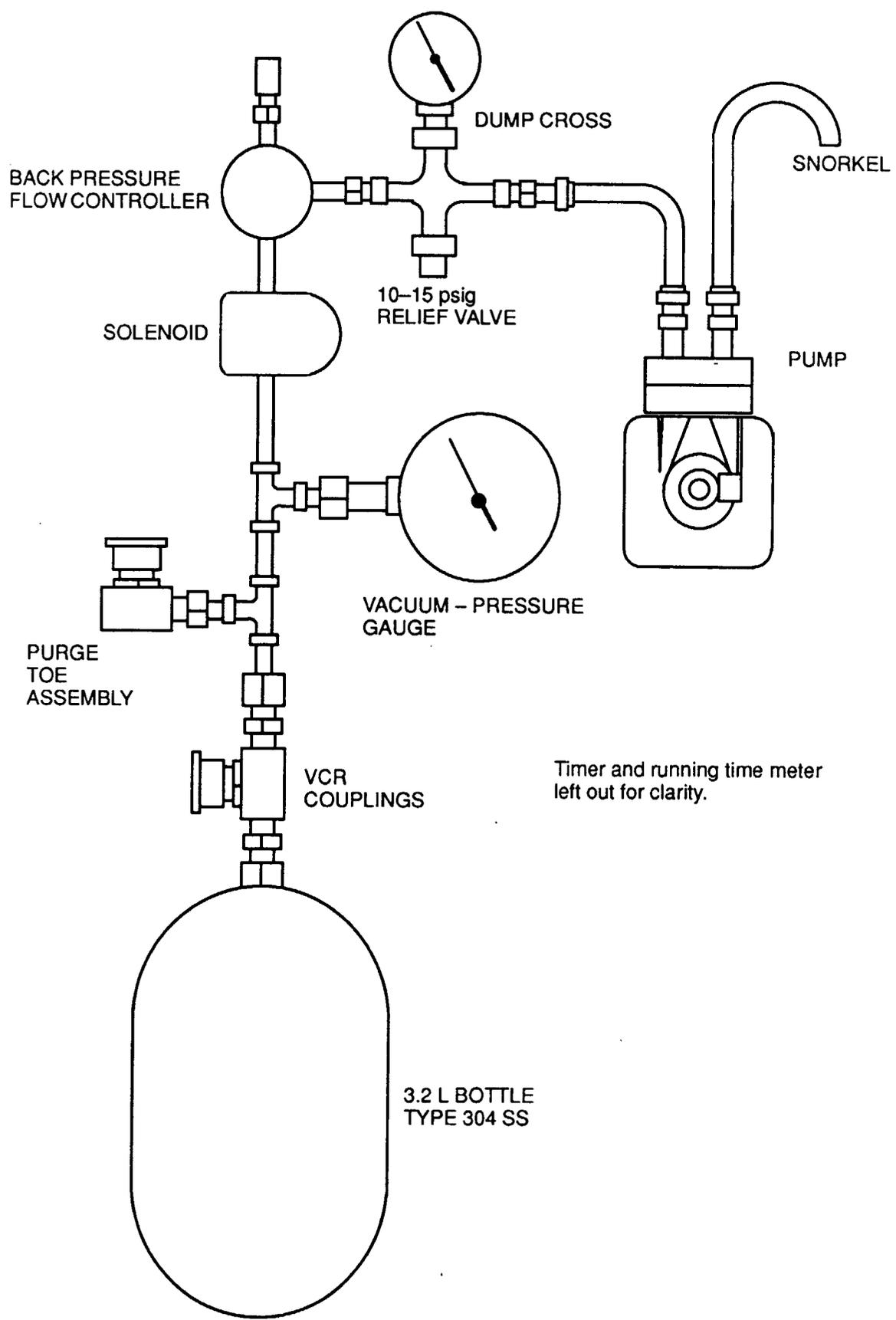


FIGURE 4-1. Air sampling system.

TABLE 4-2. Ambient air sample results, Communications Station Landfill.

Sample Type / Location :	24 hr/dwnwnd	24 hr c/dwnwnd	24 hr/upwind	24 hr/dwnwnd	24 hr c/dwnwnd	24 hr/upwind
Date Sampled :	5-23-90	5-23-90	5-23-90	5-24-90	5-24-90	5-24-90
Date Analyzed :	5-25-90	5-25-90	5-25-90	5-25-90	5-25-90	5-25-90
Sample ID :	CO-IA-01-03	CO-IA-C1-04	CO-IA-01-09	CO-IA-02-03	CO-IA-C2-04	CO-IA-02-09
Laboratory No. :	00551	00552	00550	00556	00557	00555
Average Wind Speed (mph) :	3.5	3.5	3.5	4.0	4.0	4.0

Compound	DLR (ppb) _v	Sample Concentration (ppb) _v					
Vinyl Chloride	2.00	ND	ND	ND	ND	ND	ND
Dichloromethane	1.00	1.2	6	2.2	1.1	4.3	1.7
Chloroform	0.80	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	0.50	1	6.4	1.2	0.87	2.7	0.73
1,2-Dichloroethane	0.20	ND	ND	ND	ND	ND	ND
Benzene	2.00	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	0.20	ND	ND	ND	ND	ND	ND
Trichloroethene	0.60	ND	ND	ND	ND	ND	ND
1,2-Dibromoethane	0.50	ND	ND	ND	ND	ND	ND
Tetrachloroethene	0.20	0.26	0.29	0.26	ND	ND	ND

Sample Type / Location :	24 hr/dwnwnd	24 hr/upwind
Date Sampled :	5-25-90	5-25-90
Date Analyzed :	5-30-90	5-30-90
Sample ID :	CO-IA-03-03	CO-IA-03-09
Laboratory No. :	00574	00573
Average Wind Speed (mph) :	4.8	4.8

Compound	DLR (ppb) _v	Sample Concentration (ppb) _v	
Vinyl Chloride	2.00	ND	ND
Dichloromethane	1.00	1.2	1.8
Chloroform	0.80	ND	ND
1,1,1-Trichloroethane	0.50	0.66	0.74
1,2-Dichloroethane	0.20	ND	ND
Benzene	2.00	ND	ND
Carbon Tetrachloride	0.20	ND	ND
Trichloroethene	0.60	ND	ND
1,2-Dibromoethane	0.50	ND	ND
Tetrachloroethene	0.20	ND	ND

ND = Not Detected
 ppb_v = Parts per Billion Volumetric
 DLR = Detection Limits for Reporting Purposes

TABLE 4-2. (Continued).

Sample Type / Location :	drng/dwnwnd		drng/upwind		drng/dwnwnd		drng/upwind		drng/upwind		drng/dwnwnd
Date Sampled :	5-23-90		5-23-90		5-24-90		5-24-90		5-25-90		5-25-90
Date Analyzed :	5-25-90		5-25-90		5-25-90		5-25-90		5-30-90		5-30-90
Sample ID :	CO-IA-D1-01		CO-IA-D1-08		CO-IA-D2-01		CO-IA-D2-08		CO-IA-D3-01		CO-IA-D3-08
Laboratory No. :	00548		00549		00553		00554		00571		00572
Average Wind Speed (mph) :	2.8		2.8		1.8		1.8		3.8		3.8

Compound	DLR (ppb) _v		Sample Concentration (ppb) _v							
Vinyl Chloride	2.00		ND	ND	ND	ND	ND	ND	ND	ND
Dichloromethane	1.00		1.2	1.2	ND	1.2	1.2	1.2	1.2	1.2
Chloroform	0.80		ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	0.50		0.89	0.94	0.69	0.51	0.72	0.72	0.72	0.7
1,2-Dichloroethane	0.20		ND	ND	ND	ND	ND	ND	ND	ND
Benzene	2.00		ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	0.20		ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	0.60		ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromoethane	0.50		ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	0.20		0.23	0.25	ND	ND	ND	ND	ND	ND

ND = Not Detected
 ppb_v = Parts per Billion Volumetric
 DLR = Detection Limits for Reporting Purposes

4-6

The 24-hour samples collected at the Communications Station Landfill contained several of the Attachment 1 compounds in concentrations above their respective DLRs. All of the 24-hour ambient air samples contained dichloromethane (MeCl_2) and 1,1,1-trichloroethane (TCA) in concentrations ranging from 1.1 to 6.0 ppb and 0.66 to 6.4 ppb, respectively. Tetrachloroethene (PCE) was detected in two of the samples at 0.26 ppb and one sample at 0.29 ppb. No other Attachment 1 compounds were detected in the 24 hour samples.

MeCl_2 , TCA, and PCE were also measured in the 4 hour drainage samples collected at the landfill. TCA was detected in all of the samples at concentrations ranging from 0.51 to 0.94 ppb. MeCl_2 was detected in five samples at a concentration of 1.2 ppb. PCE was detected in two of the samples at concentrations of 0.23 ppb and 0.25 ppb. No other Attachment 1 compounds were detected in the drainage samples at the landfill.

4.4 DISCUSSION

MeCl_2 was measured near its ARB DLR in all but one of the ambient air samples collected and in comparable concentrations in both the upwind and downwind drainage samples. MeCl_2 was also detected in the landfill gas at the site. However, the latter results are suspect due to system contamination. Near DLR concentrations of MeCl_2 were measured in four of the presampling ambient air equipment blanks collected prior to the study (Section 8). The comparable concentrations of MeCl_2 in both the upwind and downwind samples suggest that the landfill may not be the source of the MeCl_2 detected, or that other sources contribute to ambient levels of MeCl_2 in this area.

TCA was also measured in comparable, near DLR concentrations in all of the 24-hour and upwind and downwind drainage samples. It was not detected in the landfill gas samples collected at the site. These results suggest that the landfill is probably not the source of the TCA detected.

PCE was detected in several of the 24-hour and upwind and downwind drainage air samples at concentrations close to its ARB DLR. It was not detected in the landfill gas samples collected at the site. A near DLR concentration of PCE was measured in one of the presampling ambient air equipment blanks collected prior to the study (Section 8). These results suggest that the landfill is probably not the source of the PCE detected.

Section 5

GAS MIGRATION TESTING

5.1 OVERVIEW OF THE MONITORING PROGRAM

To evaluate whether landfill gas is migrating off site through the subsurface, soil gas was collected from gas migration probes that were installed at the site perimeter on 8 May 1990. Since the landfill has a perimeter of approximately 5600 feet, six migration gas probes were installed and sampled.

Migration gas samples were collected on 24 May 1990. They were sent to EAS where they were analyzed for total organic compounds as methane (TOC) using a 2 ppm_v DLR in accordance with the Air Resources Board (ARB) guidelines. Table 5-1 summarizes the migration gas sampling; Appendix A contains photographs of probe installation, sampling procedures, and equipment; and Figure 3-1 shows the sampling locations.

5.2 MIGRATION GAS SAMPLE COLLECTION

The migration gas samples were obtained using the landfill gas sampling system described in Section 3.1.2. The samples were collected in 3.2 liter electropolished stainless steel canisters. Initially, the gas probes were purged of two well volumes of gas and then the samples were collected following the methods described in Section 3.1.2.

After collecting each migration gas sample, the sampler was decontaminated by purging it with ambient air for at least 10 minutes, or until the TOC concentration at the purge valve vent was the same as in the ambient air, whichever took longer. The sampler was then flushed with zero air for 10 minutes. The initial evacuation of the migration gas probes ensured that the TOC measurements did not reflect dilution with zero air.

5.3 RESULTS

Table 5-2 presents the analytical data for the six migration gas samples collected at the Communications Station Landfill site. Each sample was assigned a unique eight-digit number that identified the site, type of sample, sampling order, and sampler number. The following is an example of a sample label assigned to a migration gas sample and an explanation of that label.

TABLE 5-1

Migration gas probe installation and sample collection
Communications Station Landfill.

Probe Number	Probe Installation (Date Hour)		Sample Collection (Date Hour)		Probe Depth (feet)
CO-MG-01-02	5/08/90	0935	5/24/90	1153	5.0
CO-MG-02-02	5/08/90	1020	5/24/90	1225	5.0
CO-MG-03-02	5/08/90	1100	5/24/90	1251	5.5
CO-MG-04-02	5/08/90	1140	5/24/90	1322	6.0
CO-MG-05-02	5/08/90	1210	5/24/90	1352	6.0
CO-MG-06-02	5/08/90	1235	5/24/90	1422	6.0

TABLE 5-2. Migration gas sample results, Communications Station Landfill.

Compound	DLR (ppm) _v	01	02	03	04	05	06
TOC	2.00	ND	3.5	ND	13	4.9	7.2

ND = Not Detected
 ppm_v = Parts per Million Volumetric
 DLR = Detection Limits for Reporting Purposes

Sample Number

Explanation

CO-MG-02-02

CO = Communications Station Landfill (site name)
MG = Gas Migration Sample
02 = Second Gas Migration sample collected
02 = Identification number of the sampler used to collect
the sample

The gas sample concentrations ranged from <2.0 ppm at Probes MG-01 and MG-03 to 13 ppm at Probe MG-04.

Section 6

WIND MONITORING

6.1 OVERVIEW OF MONITORING PROGRAM

The ARB's recommendations for wind speed and wind direction during Air SWAT surface screening and ambient air sample collection have been discussed in Sections 3 and 4 and are briefly summarized below.

1. Surface screening should be conducted only when the average wind speed is 5 miles per hour or less, and the instantaneous wind speed is less than 10 miles per hour.
2. Ambient air samples should be collected only when nighttime wind speeds average 5 miles per hour or less.
3. Ambient air samples should be collected only when daytime wind speeds average 10 miles per hour or less.
4. Ambient air samples should not be collected when 24-hour average wind speeds are greater than 10 miles per hour.
5. Integrated air samplers, collecting 24-hour samples, should be placed at the upwind and downwind site perimeters, based on the prevailing wind direction.
6. Integrated air samplers, collecting drainage samples, should collect air that has not passed over the landfill and air that has.

A mechanical weather station (MWS) was set up at the Communications Station Landfill near the bottom of the main portion of the fill, at the mouth of the canyon, to monitor the wind speed and direction during sample collection (Figure 3-1). The MWS recorded representative winds from May 21, 1990 to May 25, 1990. All wind dependent sampling was conducted during this period.

6.2 MEASUREMENT OF WIND SPEED AND DIRECTION

The MWS uses a rotating anemometer with three 4-1/2 inch aluminum cups. The anemometer has a starting threshold of 0.75 miles per hour and is able to measure wind speeds between 0.75 and 50 miles per hour accurately. Wind direction is defined as the direction from which the wind is blowing and is measured in degrees from true north. A single-blade aluminum wind-vane with nose-damping measured the wind direction. It is mounted directly below the anemometer on a central shaft, so that wind direction and wind speed are measured from the same point in space. It has a range of 0 to 360 degrees and a starting threshold of one mile per hour. Data points are recorded once a minute by a chart recorder that is accurate to ± 60 seconds per 24-hours when it is operated in ambient temperatures between -25°F and 160°F . The chart recorder produces black traces on plastic-coated, pressure-sensitive paper with a white background.

The MWS was installed 12 feet above the ground and more than 60 feet away from obstacles such as trees and hills. The wind vane was aligned to true north after accounting for the 15 degree local magnetic declination. The time, date, location, project number and technician's initials were marked at the beginning and end of the chart, and whenever the technician checked the MWS. The data were collected relative to local time.

6.3 RESULTS

The chart data were reduced into wind speed and wind direction hourly averages. For example, the data collected between 1:00 p.m. and 2:00 p.m. were averaged and are reported as the 1:00 p.m. hourly average. Wind speeds are reported in miles per hour. Wind directions are reported in sixteen directional points—north (N), north-northeast (NNE), northeast (NE), east-northeast (ENE), east (E), east-southeast (ESE), southeast (SE), south-southeast (SSE), south (S), south-southwest (SSW), southwest (SW), west-southwest (WSW), west (W), west-northwest (WNW), northwest (NW), and north-northwest (NNW)—which are each a 22-1/2 degree sector of a 360-degree circle.

The average prevailing wind direction is determined by the most occurrences of a specific direction over the averaging period. If wind directions prevail equally in two sectors that are adjacent (i.e., north and north-northwest), then the direction that occurs first within the averaging period becomes the prevailing wind direction. Variable wind direction is defined as the wind direction prevailing equally in two separate sectors that are not adjacent over the period being averaged. For example, if the wind direction was north (0 degrees) for 30 minutes and south (180 degrees) for 30 minutes, the average wind direction for that hour would mathematically be 90 degrees, or east. Because the wind direction was never east during that hour, it is defined as being variable.

Wind speed and wind direction hourly averages are presented in Tables 6-1 and 6-2, respectively, for the Communications Station Landfill field program. The average wind speeds for the integrated surface sample and integrated air sample collection periods are shown in Table 6-3.

TABLE 6-1. Wind speed hourly averages (miles per hour), Communications Station Landfill.

DATE	HOURL	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
May 21, 1990																								2.0	4.5
May 22, 1990		1.5	2.0	2.5	4.0	5.0	2.5	1.0	1.5	2.5	3.0	4.0	5.5	5.5	9.5	8.5	9.0	ND	ND	ND	3.0	2.0	1.5	2.0	1.0
May 23, 1990		2.5	2.5	2.5	3.0	3.0	1.5	2.0	1.5	2.0	3.0	3.5	4.5	7.5	9.5	9.5	9.0	7.5	6.5	6.0	4.5	4.0	1.5	2.0	2.5
May 24, 1990		3.0	2.5	1.0	1.5	2.0	1.5	1.5	1.5	3.5	3.5	4.5	5.5	7.5	8.5	9.0	9.0	7.0	7.0	5.0	1.5	1.5	2.0	3.0	5.0
May 25, 1990		4.0	3.0	3.5	3.5	5.0	6.0	3.5	2.5	3.5	5.0	5.0													

(ND) - No data available

TABLE 6-2. Wind direction hourly averages Communications Station Landfill.

DATE	HOOR	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
May 21, 1990																								ENE	E	
May 22, 1990		NE	NE	ENE	ENE	ENE	NE	NE	WNW	W	WNW	WNW	WNW	W	W	W	WNW	ND	ND	ND	W	NNW	N	NNE	N	
May 23, 1990		NNE	NE	NE	NE	NE	ENE	NNE	WNW	W	WNW	WSW	WSW	WNN	W	W	W	W	W	WSW	WSW	WSW	SSW	SSW	SSW	
May 24, 1990		SSW	SSW	SSW	SSW	NW	MNW	NE	MNW	SW	SSE	SSW	WSW	WNW	W	W	W	W	W	W	W	W	NE	NNE	ENE	E
May 25, 1990		NE	NE	ENE	ENE	ENE	ENE	NE	SE	SE	SSE	S														

(ND) = No data available

TABLE 6-3

Average wind speeds for the sampling periods
Communications Station Landfill.

Sample Identification	Wind Speed (mph)
CO-IS-01-03	1.5
CO-IA-01-09	3.5
CO-IA-01-03	3.5
CO-IA-C1-04	3.5
CO-IA-02-09	4.0
CO-IA-02-03	4.0
CO-IA-C2-04	4.0
CO-IA-03-09	4.8
CO-IA-03-03	4.8
CO-IA-D1-08	2.8
CO-IA-D1-01	2.8
CO-IA-D2-08	1.8
CO-IA-D2-01	1.8
CO-IA-D3-08	3.8
CO-IA-D3-01	3.8

Section 7

ANALYTICAL METHODS

The analytical methods used for the Communications Station Landfill study satisfy the requirements of California Statute AB 3374 (Calderon), including HSC 41805.5. They include procedures for evaluating the chemical composition of landfill and migration gas samples, surface emissions, and ambient air samples.

o Total Organic Compounds as Methane (TOC)

During field analysis for TOC, the sample is introduced into a Foxboro Century 128 field organic vapor analyzer (OVA) with a flame ionization detector. The OVA pumps the sample continuously through a detection chamber where organic compounds are ionized by a hydrogen flame. An electric field in the detection chamber drives the ions to a detection electrode. As the positive ions collect at the electrode, a current is generated that is proportional to rate of ion accumulation. This current is amplified by the instrument to be read on the output display. Before use, the OVA is calibrated with zero air and a methane gas standard. Therefore, the TOC concentration is read as methane, in accordance with the ARB guidelines.

Laboratory analysis for low levels of TOC is accomplished using a gas chromatograph with a flame ionization detector by direct injection onto a Poropak Q column. After the methane peak is measured, all the nonmethane hydrocarbons are backflushed directly through the detector. The nonmethane hydrocarbon area is compared to a methane standard to calculate the concentrations relative to methane. Finally, the methane concentrations and the nonmethane hydrocarbon concentration relative to methane are added to determine the concentrations of TOC.

Laboratory analysis for high levels of TOC is accomplished using the methods described below. The TOC concentration is determined by adding the nonmethane hydrocarbon results to the methane results.

o Nonmethane Hydrocarbons

The sample is run through a sorbent trap to separate the methane and nonmethane organics. The nonmethane organics are then catalytically converted to carbon dioxide, which is analyzed using nondispersive infrared spectrophotometry.

o Permanent Gases (Methane)

The samples are analyzed for low levels of methane using a gas chromatograph with a flame ionization detector. The sample is introduced into the gas chromatograph by direct injection onto a Poropak Q column. After the analytical run is completed, the peak areas are integrated and compared to a methane

standard. For high concentrations of methane, the samples are analyzed by combusting the sample to convert the methane to carbon dioxide and then introducing the sample into a gas chromatograph with a thermal conductivity detector.

o Permanent Gases (Carbon Dioxide, Nitrogen, and Oxygen)

Carbon dioxide, nitrogen and oxygen gases are measured using a gas chromatograph with a thermal conductivity detector. The sample is introduced into the gas chromatograph through a gas sampling loop and is separated by a molecular sieve 5A column.

o Attachment 1 Compounds

Samples are analyzed for the Attachment 1 compounds using a gas chromatograph/mass spectrometer (GC/MS) system. The sample is introduced into the system through a Nafion dryer and concentrated using a freeze-out loop. The compounds are separated by a 30-meter fused-silica capillary column and are measured by a mass spectrometer detector. The GC/MS system has a complete data system, capable of collecting, storing and interpreting the data. The system is calibrated using an external standard containing all ten Attachment 1 compounds. Each compound is calibrated directly against this standard so that no response factors are used.

Table 7-1 summarizes the analytical methods, method detection limits, sample holding times, and sample temperature requirements adhered to throughout the program.

TABLE 7-1. Analytical method summary.

Parameter	Method Number	Analytical Method	DLR for Air	DLR for Landfill Gases	Holding Time (hrs)	Temperature Requirements (°C)
TOC as Methane	NA	GC Analysis using an FI Detector	2 ppm _v	2 ppm _v	120	Approx. 25
Chloroethene*	ADDL002	GC Analysis using a PI or MS Detector 10% Confirmation by GC/MS	2 ppb _v	500 ppb _v	120	Approx. 25
Benzene*	ADD002	GC Analysis using a PI or MS Detector Confirmation by GC/MS	2 ppb _v	500 ppb _v	120	Approx. 25
1,2-Dibromoethane*	ARB 103	GC Analysis using an EC or MS Detector 10% Confirmation by GC/MS	0.5 ppb _v	1 ppb _v	120	Approx. 25
1,2-Dichloroethane*	ARB 103	GC Analysis using an EC or MS Detector 10% Confirmation by GC/MS	0.2 ppb _v	20 ppb _v	120	Approx. 25
Dichloromethane*	ARB 103	GC Analysis using an EC or MS Detector 10% Confirmation by GC/MS	1 ppb _v	60 ppb _v	120	Approx. 25
Tetrachloroethene*	ARB 103	GC Analysis using an EC or MS Detector 10% Confirmation by GC/MS	0.2 ppb _v	10 ppb _v	120	Approx. 25
Tetrachloromethane*	ARB 103	GC Analysis using an EC or MS Detector 10% Confirmation by GC/MS	0.2 ppb _v	5 ppb _v	120	Approx. 25
1,1,1-Trichloroethane*	ARB 103	GC Analysis using an EC or MS Detector 10% Confirmation by GC/MS	0.5 ppb _v	10 ppb _v	120	Approx. 25
Trichloroethylene*	ARB 103	GC Analysis using an EC or MS Detector 10% Confirmation by GC/MS	0.6 ppb _v	10 ppb _v	120	Approx. 25
Trichloromethane*	ARB 103	GC Analysis using an EC or MS Detector 10% Confirmation by GC/MS	0.8 ppb _v	2 ppb _v	120	Approx. 25
Permanent Gases (N ₂ , O ₂)	NA	GC Analysis using a Thermal Conductivity Detector	0.1 % _v	0.1 % _v	120	Approx. 25
Permanent Gases (CO ₂ , CH ₄)	EPA 25	GC Analysis using an FI Detector	20 ppm _v	20 ppm _v	120	Approx. 25

NA Not available.
 * Attachment 1 Compound.
 (ppb)_v Concentration in parts per billion by volume at 25 °C.
 (ppm)_v Concentration in parts per million by volume at 25 °C.
 %_v Concentration in percent by volume at 25 °C.
 DLR Detection Limits for Reporting Purposes

Section 8

QUALITY ASSURANCE SUMMARY

8.1 QUALITY ASSURANCE OBJECTIVES

The quality assurance (QA) objectives of the Communications Station Landfill study are described in terms of accuracy, precision and completeness. QA objectives are determined for each measured parameter, whether from sample collection, field measurement, or laboratory analysis. Table 8-1 summarizes the field and laboratory QA objectives for accuracy, precision and completeness.

8.1.1 Analytical Detection Limits

The Air Resources Board (ARB) established detection limits for reporting purposes (DLRs) for each parameter to be measured during the Calderon program (Table 3-2). For the Communications Station Landfill study, if the detection limit achieved by the laboratory was lower than the ARB DLR, the ARB detection limit was used for reporting purposes.

8.1.2 Accuracy

Accuracy is defined as the degree of agreement of a measurement or an average of measurements for a parameter with the accepted reference or true value. It is a combination of the bias and precision in a measurement system. Accuracy is usually expressed as the difference between the measured value "X" and the reference or true value "T", $(X-T)$, or the difference, in percent, between the two values, $(100(X-T)/T)$, or a ratio of the two values, (X/T) (EPA, 1980).

o **Field Measurements**

Accurate sample collection requires the collection of samples that are undisturbed and representative of the entity being sampled. The sampling methodology must not alter the composition of the sample chemically or physically. To minimize the introduction of error during the field program, specific protocols were established for sample collection and handling. These are described in Sections 3 through 6 of this report and in more detail in the Calderon Air SWAT Monitoring Plan and Quality Assurance Project Plan (AeroVironment, 1988). At the start of the sampling program, all of the field personnel participated in an on-site training course that provided hands-on instruction in the correct procedures for sample collection, handling and documentation.

Accurate sample collection also requires the use of equipment that is constructed and decontaminated such that it minimizes sample degradation or contamination. Prior to and during the Air SWAT program, blanks were collected to ensure that the sampling equipment was relatively clean at the start of the project

TABLE 8-1. Summary of QA objectives.

Parameter	Sampling Accuracy (+/- %)	Sampling Precision (+/- %)	Sampling Completeness (%)	Analytical Accuracy (+/- %)	Analytical Precision (+/- %)	Analytical Completeness (%)
	Blind Spike Recovery	Collocated Samplers		Interlab Comparison	Duplicate Samples	
TOC as Methane (GC-FID)	NA	NA	80	15	10	90
Attachment 1 Compounds (GC-PID/ECD)	20	20	80	20	10	90
Attachment 1 Compounds (GC-MSD)	20	30	80	30	20	90
Permanent Gases (GC-TCD)	NA	NA	80	5	5	90
	<u>Performance Audits</u>					
Flow Rates	15					
Timers	1					
Wind Speed	1mph					
Wind Direction	5 degrees					

and that the decontamination procedures used during the testing were adequate. The decontamination procedures are described for each type of sampler in Sections 3 through 6 of this report.

The ambient air samplers used for Calderon sampling were cleaned and tested at the time they were assembled and immediately before conducting the field work for this project. Prior to conducting any Calderon sampling, EAS cleaned and leak-tested each ambient air sampler. Equipment blanks were collected and analyzed for the Attachment 1 compounds using the air detection limits to verify that each sampler was free of contamination. The blanks were collected by pumping zero air through each sampler into a stainless steel canister; if contamination was detected, the sampler was recleaned and retested.

Before conducting the field work for this project, another set of equipment blanks were collected from the ambient air samplers to be used during the project. The blanks were collected using ultrapure zero air that was bled through the sampler for a six-hour sampling period. They were analyzed for the Attachment 1 compounds using the air DLRs. Table 8-2 presents the results of these analyses and Appendix E contains analytical reports and chain-of-custody documentation for the blank samples.

In general, the results of the presampling blanks indicate that the samplers were clean at the beginning of the field effort. While MeCl_2 and tetrachloroethene (PCE) were detected in some of the blanks, the concentrations were close to the ARB DLRs for these compounds. In no case did the concentration of an Attachment 1 compound in a presampling blank exceed 1.5 times its DLR. All but two of the sampler blanks had MeCl_2 at concentrations ranging from 1.1 to 1.3 ppb. The DLR for this compound is 1.0 ppb. One of the sampler blanks had PCE at 0.24 ppb; the DLR for this compound is 0.20 ppb. One of the sampler blanks had no Attachment 1 compounds above the ARB designated DLRs.

Throughout the program, the laboratory analyzes canister blanks to ensure that the decontamination procedures being used to clean the sample vessels are satisfactory. The laboratory analyzes canister blanks for 10 percent of the recycled canisters by filling them with zero air and analyzing a sample of it for the Attachment 1 compounds using the air DLRs. If any contamination is detected, the decontamination procedures are improved and the canister is recleaned and retested.

After completing the landfill gas sampling, a field system blank was collected for the migration and landfill gas sampler by pumping zero air through the decontaminated sampling system and collecting it in a stainless steel canister. The blank was collected and handled the same way as the gas samples. It was submitted to the laboratory blind where it was analyzed for the Attachment 1 compounds, using the air DLRs.

As shown in Table 8-3, the blank collected during the field sampling contained 720 ppm MeCl_2 . The blank did not contain any other Attachment 1 compounds in concentrations above their respective air DLRs. The concentration of MeCl_2 in the system blank was greater than the concentration in all but one

TABLE 8-2. Ambient air presampling equipment blank results, Communications Station Landfill.

Sampler No. :	AV01	AV03	AV04	AV06	AV08	AV09
Date Sampled :	5-10-90	4-26-90	5-10-90	4-26-90	5-10-90	4-26-90
Date Analyzed :	5-15-90	4-28-90	5-12-90	4-28-90	5-12-90	4-28-90
Sample ID :	ET-IA-00-01	ET-IA-00-03	ET-IA-00-04	ET-IA-00-06	ET-IA-00-08	ET-IA-00-09
Laboratory No. :	00467	00335	00440	00328	00441	00331

Compound	DLR (ppb) _v	Sample Concentration (ppb) _v					
Vinyl Chloride	2.00	ND	ND	ND	ND	ND	ND
Dichloromethane	1.00	ND	1.3	1.1	1.2	ND	1.1
Chloroform	0.80	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	0.50	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	0.20	ND	ND	ND	ND	ND	ND
Benzene	2.00	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	0.20	ND	ND	ND	ND	ND	ND
Trichloroethene	0.60	ND	ND	ND	ND	ND	ND
1,2-Dibromoethane	0.50	ND	ND	ND	ND	ND	ND
Tetrachloroethene	0.20	0.24	ND	ND	ND	ND	ND

ND = Not Detected

ppb_v = Parts per Billion Volumetric

DLR = Detection Limits for Reporting Purposes

TABLE 8-3. Field quality control results, Communications Station Landfill.

Sample Type / Location :	24 hr/dwnwnd	24 hr c/dwnwnd		24 hr/dwnwnd	24 hr c/dwnwnd		Field Blank
Date Sampled :	5-23-90	5-23-90		5-24-90	5-24-90		6-5-90
Date Analyzed :	5-25-90	5-25-90		5-25-90	5-25-90		6-8-90
Sample ID :	CO-IA-01-03	CO-IA-C1-04		CO-IA-02-03	CO-IA-C2-04		CO-LG-00-02
Laboratory No. :	00551	00552		00556	00557		00625

Compound	DLR (ppb) _v	-Sample Concentration (ppb) _v -		RPD		-Sample Concentration (ppb) _v -		RPD		Concentration
				--%--		--%--		--%--	-(ppb) _v -	
Vinyl Chloride	2.00	ND	ND	NA		ND	ND	NA		ND
Dichloromethane	1.00	1.2	6.0	400		1.1	4.3	NA		720
Chloroform	0.80	ND	ND	NA		ND	ND	NA		ND
1,1,1-Trichloroethane	0.50	1.0	6.4	540		0.87	2.7	130		ND
1,2-Dichloroethane	0.20	ND	ND	NA		ND	ND	NA		ND
Benzene	2.00	ND	ND	NA		ND	ND	NA		ND
Carbon Tetrachloride	0.20	ND	ND	NA		ND	ND	NA		ND
Trichloroethene	0.60	ND	ND	NA		ND	ND	NA		ND
1,2-Dibromoethane	0.50	ND	ND	NA		ND	ND	NA		ND
Tetrachloroethene	0.20	0.26	0.29	NA		ND	ND	NA		ND

ND = Not Detected
 NA = RPD Not Calculated
 ppb_v = Parts per Billion Volumetric

of the landfill gas samples.

MeCl₂ and freon are common contaminants of flow controllers because they are used to clean the controller parts at the time they are being assembled. Flow controllers are used in both the field sampling and analytical systems. Periodically, MeCl₂ has been measured in association with freon in the field system blanks as the result of flow controller offgassing. It is likely that the MeCl₂ observed in the field system blank collected during the Perimeter Road Landfill study was similarly introduced and is not indicative of inadequate decontamination procedures.

The integrated air and landfill/migration gas sampling systems used at Communications Station Landfill are similar in design and construction. The landfill/migration gas sampler was chosen for the field system blank because it provides a worst-case test, since the landfill and migration gas samples are expected to have the highest concentrations of the chemicals of interest.

In summary, the system blank collected at the Communications Station Landfill contained MeCl₂ at a concentration greater than most of the landfill gas samples. It did not contain detectable levels of the other Attachment 1 compounds. In general, good sample quality was preserved throughout the Communications Station Landfill study.

o Analytical Measurements

Analytical accuracy is determined from spike analyses and interlaboratory comparisons. Accuracy can be expressed as a percent difference as follows:

$$\text{Percent Difference} = \frac{Y - X}{X} \times 100$$

where: Y = the measured concentration of the spike
 X = the true concentration of the spike

At least one out of every ten samples analyzed was a spike or duplicate. The spike is a reference standard that is representative of the landfill gas, migration gas or ambient air samples being analyzed. The spike is analyzed by a separate laboratory to evaluate analytical accuracy and interlaboratory precision. Table 8-1 lists the QA objectives for analytical accuracy.

Analytical accuracy is also monitored by daily check standards and instrument blanks, three-point and five-point calibration curves, and monthly routine maintenance and quality assurance checks. The latter include system leak checks, volume calibration checks, column performance checks, retention time checks and precision checks.

8.1.3 Precision

Precision is a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. It is often expressed in terms of the standard deviation of the measurement or relative percent difference (EPA, 1980).

For the field sampling methods and the laboratory analytical methods, precision is quantified as the relative percent difference (RPD), which is calculated by the following equation:

$$\text{Precision (RPD)} = \frac{X - X}{X} \times 100$$

where: X = the larger of the two replicate values
X = the smaller of the two

Laboratory precision of several pairs of duplicate or replicate samples is determined as the relative standard deviation (RSD). It is calculated as follows:

$$\text{Precision (RSD)} = \frac{s}{X}$$

where: s = the standard deviation of the sample concentrations
X = the mean of the sample concentrations

Table 8-1 lists the precision objectives for the field and laboratory measurements. Sample concentrations that are less than five times the detection limit are not expected to meet the precision objectives and are not included in precision calculations, because small differences in low concentrations result in large relative percent differences. For example, using the equation presented above, the relative percent difference between 0.1 and 0.2 ppb is 100 percent.

o **Field Measurements**

To ensure precise sample collection, uniform sampling containers that were cleaned and prepared using the same protocol were used throughout the Communications Station Landfill sampling program, as were uniform sampling methods and uniform sample handling and transporting procedures. Field sampling precision is evaluated for collocated integrated ambient air sample analysis and sample flow rates.

Collocated Sample Precision. Collocated samples were collected during the 24-hour ambient air sampling periods. They were analyzed for the Attachment 1 compounds using the air detection limits. They were collected, handled, and analyzed the same way as the primary samples. Table 8-3 shows the

precision results for the collocated samples. For the first set of samples, MeCl₂ and 1,1,1-trichloroethane (TCA) were both greater than five times the MDL in the collocated sample. The RPD's were 400 and 540 percent, respectively. In the second round of samples, the RPD was calculated for TCA at 130 percent. No collocated sample was collected in the third round.

Qualitatively the primary and collocated samples correlate well. In every case where a compound was detected in the primary sample, it was also detected in the collocated sample. The analytical results for the primary and collocated 24-hour integrated air samples correlate reasonably well with the following disparities. The first 24-hour primary sample contained MeCl₂ at 1.2 ppb, and the collocated sample contained 6.0 ppb of MeCl₂. The first 24-hour primary sample contained a concentration of TCA at 1.0 ppb, and the collocated sample contained 6.4 ppb. As discussed in Section 8.1.2, MeCl₂ and TCA were detected at low levels in the presampling equipment blanks. Accordingly, the low levels of these compounds detected in the Communications Station Landfill air samples may reflect low level system contamination.

Sample Flow Rate Precision. Flow rate precision was evaluated for the integrated air samples collected during the Communications Station Landfill study (Table 8-4). It was calculated as the RPD of the initial and final flow rates and evaluated using the final canister pressure. To collect a sample, the flow rate was adjusted so that the final pressure of the sample canister would be approximately 5 to 7 pounds per square inch (psig). When the final pressure exceeds 10 psig, the sample is not properly integrated. Samples were considered to be properly integrated when the flow rate RPD was less than 15 percent, or the final canister pressure showed that a constant flow rate was maintained during most of the sample collection.

The initial and final flow rates for all but one of the ambient air samples collected at the Communications Station Landfill had a RPD of less than 15 percent. One 24-hour collocated downwind sample had a RPD of 26.1 percent. However, the sample had a final canister pressure of 6.0 psig. Therefore, all of the samples collected during the Communications Station Landfill study are considered to be integrated properly.

o Analytical Measurements

Analytical precision is determined from duplicate analysis. At least one of every ten samples analyzed is a duplicate or a spike. The laboratory duplicate is an actual air sample that is representative of the landfill gas, migration gas or ambient air samples being analyzed. Table 8-1 lists the objectives for analytical precision.

8.1.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions (EPA, 1980). It is calculated as the ratio of acceptable measurements obtained to the total number of planned measurements.

TABLE 8-4.

Sample flow rates and final canister pressures
Communications Station Landfill.

Sample Identification Number	Initial Flow Rate (cc/min)	Final Flow Rate (cc/min)	Relative Percent Difference (%)	Initial Canister Vacuum (in Hg)	Final Canister Pressure (psig)	Sampling Period (Hrs)
CO-IA-01-09	2.7	2.9	7.4	30	6.5	24.1
CO-IA-01-03	2.7	2.7	0.0	29	6.0	24.1
CO-IA-C1-04	2.9	2.9	0.0	29	6.0	24.1
CO-IA-02-09	2.9	2.9	0.0	30	5.5	23.9
CO-IA-02-03	2.7	2.7	0.0	29	4.5	23.9
CO-IA-C2-04	2.9	2.3	26.1	30	6.0	23.9
CO-IA-03-09	2.9	2.7	7.4	29	5.0	24.0
CO-IA-03-03	2.9	2.7	7.4	29.5	7.0	24.0
CO-IA-D1-08	16.7	18.6	11.4	28	7.0	4.0
CO-IA-D1-01	17.1	17.7	3.5	30	5.0	4.0
CO-IA-D2-08	17.1	17.9	4.7	29	6.5	4.0
CO-IA-D2-01	16.7	16.9	1.2	29	3.0	4.0
CO-IA-D3-08	16.7	18.6	11.4	29	8.0	4.0
CO-IA-D3-01	16.3	16.3	0.0	30	4.0	4.0

o Field Measurements

Field sampling and measurement completeness is adversely affected by problems with sample recovery or instrument malfunctions. Data are invalidated when the duration of the sample collection cannot be verified or the sampler does not function properly during the sampling period. To avoid problems that might have affected field completeness, difficult and unexpected situations were prepared for before starting the field testing. Such preparations included identifying potential access problems, regularly performing maintenance on sampling equipment and field instrumentation, bringing spare parts and equipment to the field and keeping them readily available, and training the field team members to perform basic repairs. The overall completeness goal for the field program is 90 percent. Because of one ambient air sampler failure, field completeness for the Communications Station study was 96 percent.

As shown in Table 8-3, the blank collected during the field sampling contained 11 ppb MeCl₂. MeCl₂ and freon are common contaminants of flow controllers because they are used to clean the controller parts at the time they are being assembled. Flow controllers are used in both the field sampling and analytical systems. Periodically, MeCl₂ has been measured in association with freon in the field system blanks as the result of flow controller offgassing. It is likely that the MeCl₂ observed in the field system blank collected during the Perimeter Road Landfill study was similarly introduced and is not indicative of inadequate decontamination procedures.

o Analytical Measurements

Analytical completeness is affected when a sample is damaged during unpacking or storage, when it is not analyzed before its holding time is expired, or when the laboratory data cannot be validated as described in Section 9.2 and the sample cannot be reanalyzed. The overall completeness goal for the analytical program is 90 percent. Analytical completeness for the Communications Station Landfill study was 100 percent.

8.2 ADDITIONAL LABORATORY QUALITY CONTROL STUDIES

EAS Laboratory conducted three additional quality control studies to verify that the sample collection and analysis methods used throughout the Calderon program would provide quality data. The results of the studies are contained in Appendix B. The first study demonstrated that the Attachment 1 compounds are stable in the electropolished stainless steel sample canisters for more than the 120-hour sample holding time. The second study confirms the fact that the use of a Nafion dryer for removing atmospheric water vapor from the Calderon samples before analysis does not affect the analytical results. Finally, the third study reports the accuracy and precision of the total measurement process. It contains the results of a field test during which a spike was introduced into six separate sampling systems and collected into unique

sample containers. Each container was analyzed for the Attachment 1 compounds by gas chromatography using a mass spectrometer detector. The accuracy and precision reported are the cumulative result of variability in sample collection, analytical instrument calibration, and sample analysis.

Section 9

DATA REDUCTION, VALIDATION, AND STORAGE

9.1 FIELD DATA

Field data and meteorological conditions were recorded in field and instrument log books and on appropriate data forms. Following sample collection, the field team member reduced any associated meteorological data and verified that the required weather conditions existed throughout the sampling period. After each day of field activities, all field data were reviewed by the field team leader for deficiencies or suspected inaccuracies. If problems were identified, the field team leader worked with the team member to correct or amend the log book or data forms. Before reporting, field measurement, meteorological and laboratory data were converted to accepted standard units. Following completion of the landfill investigation, original copies of the field data were given to the data administrator. Appendix C contains the of field sample documentation for the Communications Station Landfill Air SWAT.

9.2 LABORATORY DATA

Laboratory data were validated by blank, duplicate and spike sample analyses. Analyses were repeated when: the blank level was elevated, causing the detection limit to be in the quantitative area of interest, or the laboratory quality assurance objectives for accuracy and precision were not met.

At the completion of each set of analyses, the laboratory data were recorded in logbooks and placed in a data file. The analyst entered the associated quality control data onto quality control charts and verified them as being within control limits. Once verified, the data were transferred to the laboratory director for review. The director reviewed the data calculations for accuracy. Following his approval, the data were prepared for reporting. Appendix D contains the laboratory data reports.

Section 10

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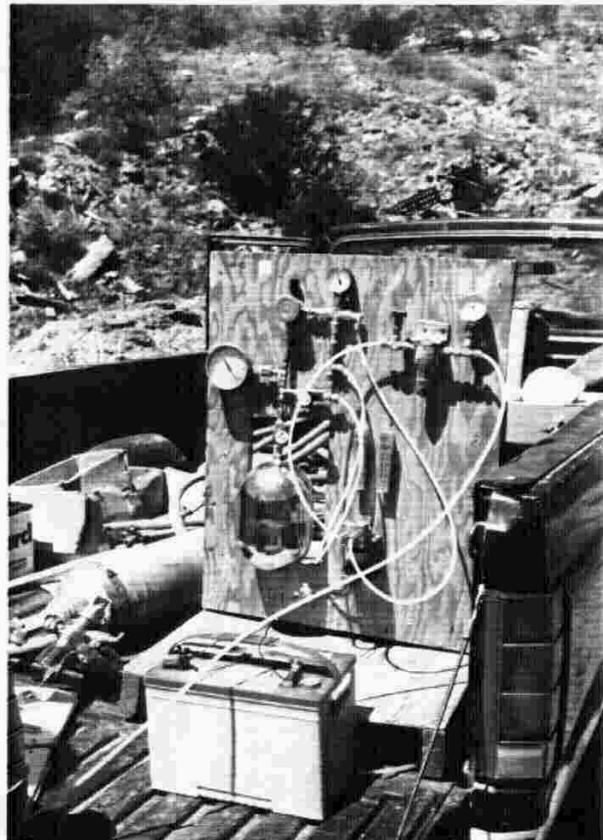
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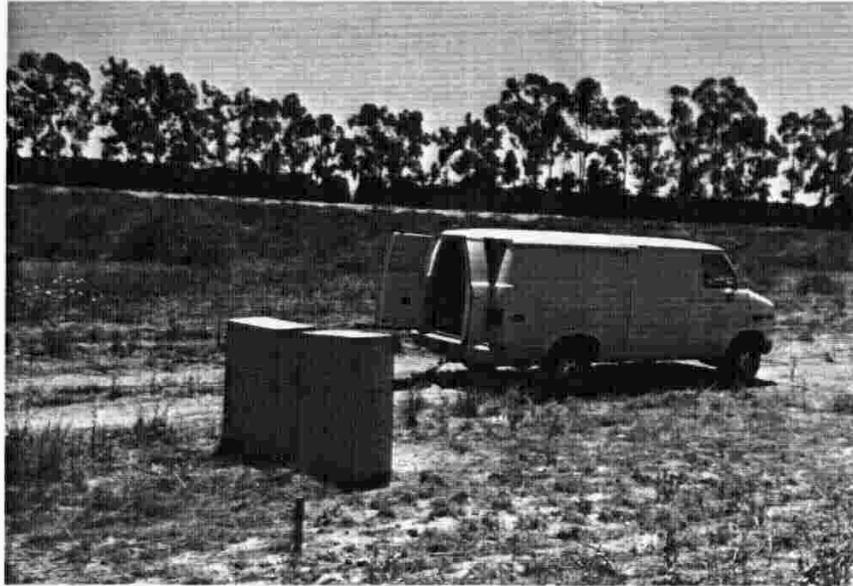
Appendix A
PHOTOGRAPHS



Mechanical weather station.



Landfill gas/migration
gas probe sampler.



24 hour integrated and four hour drainage samplers.



Checking sample flow rate (Moffett Trenches Landfill).



Integrated surface sample collection.



Installing landfill gas probe.

Appendix B

LABORATORY QUALITY CONTROL STUDIES

ENVIRONMENTAL ANALYTICAL SERVICE

ITEM NUMBER 1

The stability of the Calderon compounds in a typical 3.2 Liter SS Sample Canister is shown on the next page. The study is not the result of an exhaustive research program but does demonstrate that there is no significant change in concentration. For more detailed studies reference should be made to the McClenny EPA study (1986) which demonstrated stability of all of these compounds in identical canisters.

ENVIRONMENTAL ANALYTICAL SERVICE

CANISTER STABILITY STUDY GC/MS

Plan #77 Compound	12-12-88 Sample Concentration	12-31-88 Concentration ppbv
Vinyl Chloride	58	55
Dichloromethane	7.1	5.7
Chloroform	0.49	0.48
1,1,1-Trichloroethane	0.57	0.5
1,2-Dichloroethane	1.3	1.5
Carbon Tetrachloride	0.41	0.56
Benzene	4.5	3.4
Trichloroethene	0.49	0.39
Toluene	0.87	1.1
Tetrachloroethene	0.33	0.37

4.2 liter stainless steel canister

SAMPLE INTEGRITY OF TRACE LEVEL VOLATILE ORGANIC COMPOUNDS IN AMBIENT AIR STORED IN SUMMA[®] POLISHED CANISTERS

KAREN D. OLIVER^{*} and JOACHIM D. PLEIL

Northrop Services, Inc., Environmental Sciences, P. O. Box 12313, Research Triangle Park, NC 27709, U.S.A.

and

WILLIAM A. McCLENNY

Methods Development Branch, Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711, U.S.A.

(First received 19 August 1985 and in final form 19 December 1985)

Abstract—Sets of new and used SUMMA[®] polished stainless steel canisters were tested for storage stability of volatile organic compounds (VOCs). Evacuated canisters were filled at a controlled rate with ambient air containing added concentrations of 15 VOCs (14 chlorinated, one brominated) at < 2 ppbv. Concentrations of VOCs in each canister were then periodically determined during 7-day or 30-day storage periods using simultaneous flame ionization and electron capture detection. No initial decrease in concentrations of target compounds were observed. Statistical analysis of data showed that the relative standard deviation of concentrations of most VOCs in each canister set was 10% or less during the storage periods. For the 7-day tests, the mean change in concentration per day was within $\pm 1.2\%$. These canisters appear suitable as an alternative to other sampling techniques, at least for most of the compounds tested here.

Key word index: Volatile organic compounds, ambient air, SUMMA[®] polished containers, stainless steel canisters.

INTRODUCTION

The accurate determination of trace level volatile organic compounds (VOCs) in ambient air requires sophisticated instrumentation. To avoid the cost, inconvenience and difficulty of transporting such equipment to sampling sites, field samples are collected in stainless steel canisters and returned to a central laboratory for analysis. Stainless steel canisters are not subject to sample permeation or photo-induced chemical effects, and they can be reused after a simple clean-up procedure. Interior surfaces of these stainless steel canisters are passivated using the Molecular SUMMA[®] process.

Various sample integrity studies of gases stored in SUMMA[®] polished stainless steel canisters have been conducted in other laboratories. Harach (1980) reported stability of a number of halocarbons stored in canisters at parts per trillion by volume levels. Cox (1983) has discussed the storage stabilities of certain hydrocarbons in canisters at concentrations greater than 250 ppbv. Also, Rasmussen and Khalil (1980) and

Rasmussen and Lovelock (1983) have used stainless steel canisters extensively in the field and have reported the stability of halocarbons stored in canisters at high pressures for extended periods. Westberg *et al.* (1984) reported stability of parts per billion by volume levels of benzene and toluene in canisters, but observed losses of *o*-xylene. A comparison of sampling containers, including stainless steel canisters, was reported by Pellizzari *et al.* (1984). They observed an initial decrease in concentrations of halocarbons stored in canisters, which our tests did not confirm. The sample storage characteristics of stainless steel canisters were previously tested in this laboratory using a mixture of 15 VOCs in humidified zero air. These results were documented in an EPA contract report from Battelle Columbus Laboratories (Holdren *et al.*, 1984).

This work reports more detailed experiments that have been conducted using ambient air spiked with less than 2 ppbv of each of 15 VOCs in both new and used stainless steel canisters. The mixtures were initially stored at ~ 30 psig in the canisters. These experiments were designed to test sample stability under anticipated field sampling conditions in which compounds such as H₂O, CO₂, O₃, NO and NO₂ would be present.

^{*} Author to whom correspondence should be addressed.

vacuum gauge was used for measuring vacuum. This cleaning process usually required 5-6 h.

Test procedures

Before beginning the sample integrity experiments, all new and used canisters were cleaned. Humidified zero air was passed through the pump, mass flow controller, and tubing of the canister-filling apparatus and analyzed for comparison with chromatograms of instrument background to ensure that the filling apparatus would not contaminate samples. Chromatograms of instrument background were obtained by passing zero grade air or nitrogen through a 500 ml impinger flask of water, through a mass flow controller, and into the analysis system. The canisters were then pressurized to 15-20 psig with humidified zero gas. Samples from each canister were analyzed and compared with instrument background. All canisters were cleaned again at least once before beginning the experiments.

For the sample integrity experiments, spiked ambient air samples were obtained by pulling ambient air from a parking area through a glass 'candy-cane' inlet to the sampling manifold at a rate of 40 l min⁻¹. The standard mixture of 15 VOCs in cylinder 2 was bled through tubing to the candy-cane inlet area at a rate of 12 ml min⁻¹ during the canister filling period. This procedure was designed so that ambient air spiked with roughly 1 ppbv of each of the 15 compounds would be available in the sampling manifold.

To test initial sample integrity, used 6-l canisters were pressurized individually with spiked ambient air from the sampling manifold. For these experiments, canisters were filled at a rate of 1.2 l min⁻¹ for 14 min to exactly coincide with the 14-min sample collection cycle of the analytical system. As soon as the analysis of the real-time sample was

completed, an air sample from the canister was analyzed. This experiment was performed eight times.

Four sets of sample integrity experiments were then performed at separate times using the same procedure. The following sets of canisters were evaluated over a 7-day period in separate experiments: four new 6-l canisters, four new 3-l canisters, and five used 6-l canisters. A fourth set of three used 6-l canisters was also evaluated over a 30-day period.

The instrument was calibrated before beginning each experiment. On Day 0 of each experiment, canisters were pressurized simultaneously to approximately 12 psig with the spiked ambient air mixture from the sampling manifold. Canisters were filled in the mornings during peak traffic activity. Control samples from the sampling manifold were analyzed continually during the filling cycles to provide an estimate of VOC concentrations placed in the canisters. Each analysis required 64 min, so control samples were taken approximately at hourly intervals. A graph of the 14-min control sampling periods within the filling cycles for each canister set is shown in Fig. 2. Air samples from each canister in the 7-day test were analyzed on Days 0, 2, 4 and 7 after filling the 6-l canisters and on Days 0, 4 and 7 after filling the 3-l canisters. Samples from canisters in the 30-day test were analyzed on Days 1, 15 and 30 after filling. Calibrations were conducted on each day of the experiments.

RESULTS AND DISCUSSION

Canister blank tests

Before beginning the sample integrity study, each canister was cleaned and filled with humidified zero

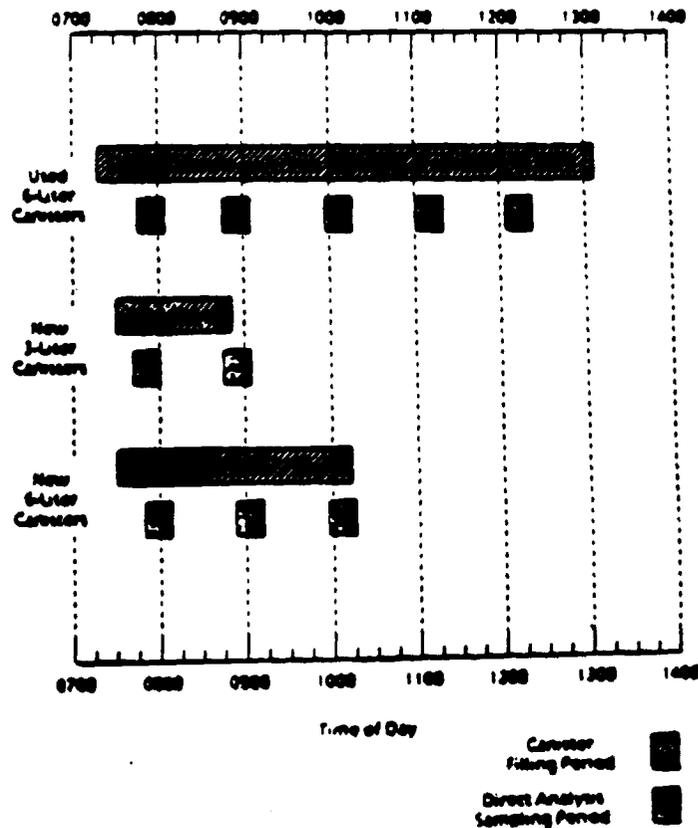


Fig. 2. Time periods for filling canisters and for simultaneous control analysis during the filling period.

Table 2. Sample integrity results for four new 3-l canisters tested on Days 0, 4 and 7.

Compound	Control samples		Canister samples	
	Mean (ppbv) (N = 2)	Mean (ppbv) (N = 12)	S.D. (ppbv)	Mean % change/day
FID				
vinyl chloride	0.71	0.74	0.07	-0.946
vinylidene chloride	0.98	2.32	0.35	-2.20
trichlorotrifluoroethane	0.98	1.04	0.08	-1.44
chloroform	1.05	1.19	0.17	3.03
1,2-dichloroethane	0.88	0.88	0.04	-1.02
methyl chloroform	1.27	1.28	0.05	-0.547
benzene	0.31	0.35	0.01	-0.286
carbon tetrachloride	0.99	0.91*	0.01	-
tetrachloroethylene	0.97	0.98	0.05	-0.816
cis-1,3-dichloropropene	0.48	0.47	0.03	-1.49
trans-1,3-dichloropropene	0.37	0.37	0.03	-1.35
toluene	0.47	0.51	0.02	-0.196
1,2-dibromoethane	1.07	1.00	0.06	-1.40
tetrachloroethylene	1.21	1.06	0.06	-1.23
chlorobenzene	0.87	0.85	0.06	-1.76
o-xylene	0.12†	0.09	0.03	1.11
benzyl chloride	1.05	0.94	0.10	-2.77
hexachlorobutadiene	1.14	1.19	0.15	-2.77
ECD				
trichlorotrifluoroethane	1.01	1.02	0.02	0.294
chloroform	1.04	1.00	0.02	-0.400
methyl chloroform	1.21	1.20	0.01	0.000
carbon tetrachloride	1.23	1.24	0.04	0.645
tetrachloroethylene	1.06	1.05	0.02	0.190
1,2-dibromoethane	1.09	1.05	0.06	-1.14
tetrachloroethylene	1.21	1.16	0.08	1.64
hexachlorobutadiene	1.01	1.02	0.05	0.882

* N = 2, † N = 1.

canisters, mean concentrations for control samples were typically within 0.05 ppbv of the mean concentrations for canister samples. Because these differences were of the same magnitude as the standard deviations of the canister data, the control data and the canister data were essentially identical. Daily drift values (given as a numerical indicator of temporal stability) were calculated by normalizing slopes of linear regression plots to obtain a percent-per-day change, i.e. slope divided by mean concentration. For the 7-day storage tests, the mean change was within $\pm 1.2\%$ per day, and concentrations of most compounds changed within $\pm 1\%$ per day. With the exception of o-xylene, daily drifts for most compounds in the 30-day test were equivalent to those observed in 7-day tests. For each set of canisters, the mean percentage change/day for compounds on one detector was consistently either slightly positive or negative, whereas the mean percentage change/day of compounds on the other detector was consistently the opposite. This is most likely due to a slight change in the FID/ECD split ratio rather than a canister storage problem. This phenomenon had been previously encountered during analyses that did not involve canisters.

Typical concentrations of compounds in individual canisters are presented in Table 5. As examples, FID

and ECD data are tabulated for tetrachloroethylene stored in used 6-l canisters, and FID data are tabulated for chlorobenzene stored in new 3-l canisters. The data are representative of all experiments and show that concentrations of compounds were reproducible for individual canisters.

A comparison of the relative standard deviation (R.S.D.), i.e. standard deviation divided by the mean, for data from canister tests and calibrations is presented in Table 6. For the majority of target compounds in each canister set, the R.S.D. of concentrations was 10% or less when all results of canister sample analyses were averaged for each compound. A statistical evaluation of calibration response factors (ppbv/area counts) has shown the instrumental error to average approximately 3.6% R.S.D. for the ECD and 6.6% R.S.D. for the FID over a 6-week period. The R.S.D.s of calibration response factors for individual compounds are presented in Table 6. In most cases the percent R.S.D. for compounds in the canisters was similar to the percent R.S.D. for the calibrations. Approximately one-third of the compounds exhibited somewhat greater scatter in data during the 30-day tests than in the 7-day tests.

FID data for vinylidene chloride, chloroform, o-xylene, benzyl chloride and hexachlorobutadiene were

Sample integrity of trace level volatile organic compounds in ambient air

Table 4. Sample integrity results for three used 6-l canisters tested on Days 1, 15 and 30

Compound	Control samples	Canister samples		
	Mean (ppbv) (N = 5)	Mean (ppbv) (N = 9)	S.D. (ppbv)	Mean % change/day
FID				
vinyl chloride	0.81*	—	—	—
vinylidene chloride	1.11	1.09	0.07	-0.14
trichlorotrifluoroethane	1.13	1.13	0.09	-0.44
chloroform	1.19	1.32	0.45	1.14
1,2-dichloroethane	0.90	0.93	0.06	-0.40
methyl chloroform	1.41	1.41	0.09	-0.37
benzene	0.57	0.61	0.03	0.18
carbon tetrachloride	0.94†	0.87	0.09	-0.49
trichloroethylene	1.01	1.02	0.03	-0.38
cis-1,2-dichloropropene	0.49	0.50	0.04	0.12
trans-1,2-dichloropropene	0.38‡	—	—	—
toluene	0.99	1.01	0.12	0.67
1,2-dibromoethane	1.23	1.23	0.07	0.10
tetrachloroethylene	1.09	1.09	0.03	-0.10
chlorobenzene	0.97	0.97	0.04	0.24
o-xylene	0.14‡	0.23	0.13	4.40
benzyl chloride	0.75	0.84	0.08	0.36
hexachlorobutadiene	0.96	1.05	0.20	1.17
ECD				
trichlorotrifluoroethane	0.99	0.97	0.02	-0.18
chloroform	1.02	0.97	0.03	-0.21
methyl chloroform	1.20	1.19	0.02	-0.14
carbon tetrachloride	1.52	1.39	0.07	-0.30
trichloroethylene	1.01	1.00	0.02	-0.07
1,2-dibromoethane	0.84	0.87	0.04	0.11
tetrachloroethylene	0.97	1.01	0.03	0.34
hexachlorobutadiene	0.96	0.98	0.10	0.53

* N = 2; † N = 4; ‡ N = 1

Table 5. Typical examples of data for canister samples*

a. FID—trichloroethylene†					
Day	CAN 106	CAN 04	CAN 11	CAN 15	CAN 190
0	1.04	1.06	1.00	1.01	1.04
2	0.94	0.99	1.00	1.00	1.01
4	0.96	0.93	0.93	—‡	0.96
7	1.04	0.97	1.00	1.11	1.08
b. ECD—tetrachloroethylene†					
Day	CAN 106	CAN 04	CAN 11	CAN 15	CAN 190
0	0.97	1.00	1.01	1.00	1.00
2	1.00	0.99	0.98	0.98	0.96
4	0.99	1.00	0.95	—‡	0.83
7	0.96	1.01	1.00	0.99	0.99
c. FID—chlorobenzene‡					
Day	CAN 3	CAN 6	CAN 7	CAN 8	
0	0.80	0.92	0.93	0.96	
4	0.80	0.80	0.79	0.80	
7	0.81	0.82	0.84	0.87	

* Values expressed as parts per billion by volume; † Stored in used 6-l canisters; ‡ Data for this run not available due to column blockage; § Stored in new 3-l canisters.

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ENVIRONMENTAL ANALYTICAL SERVICE

ITEM NUMBER 2

A suitability study using the Nafion Dryer to remove atmospheric water vapor is shown on the next page. This was the result of a study on a single sample and shows some variability. This variability is due in part to difficulty of running a spike without water vapor removal. This preliminary information shows that the Nafion dryer is suitable for ambient air analysis (This has also been confirmed studies conducted at OGC). Additional work is currently in progress to improve the data set for the dryer comparison.

ENVIRONMENTAL ANALYTICAL SERVICE

NAFION DRYER STUDY GC/MS

Compound	500ml with dryer	500ml without dryer
Sample Concentration ppbv		
.....
Allyl Chloride	8.01	7.71
Dichloromethane	5.55	2.95
Chloroform	1.87	1.4
1,1,1-Trichloroethane	2.67	0.88
1,2-Dichloroethane	4.28	2.07
Carbon Tetrachloride	2.34	1.87
Benzene	7.37	5.15
Trichloroethene	4.36	5.14
1,2-Dibromoethane
Tetrachloroethene	6.15	5.64

Item Number 3

SPIKED SAMPLER STUDY

Environmental Analytical Service
SPIKED SAMPLER MONTHLY WORKSHEET

December 31, 1987

Samples Collected in 3.2 Liter SS Sample Canisters

Compound	Spike	Concentration ppbv						RSD
Sample Site Number	B106	1	2	3	4	5	6	%
Vinyl Chloride	377.0	530.0	355.0	396.0	381.0	264.0	310.0	22
Dichloromethane	39.0	40.0	32.0	36.0	37.0	23.0	30.0	17
Chloroform	3.8	3.5	3.3	3.5	3.2	2.4	3.1	12
Methylchloroform	28.0	34.0	27.0	29.0	25.0	21.0	27.0	14
1,2-Dichloroethane	11.0	----	7.8	8.7	7.1	6.3	7.9	11
Benzene	31.0	29.0	22.0	27.0	25.0	17.0	22.0	16
Carbon Tetrachloride	3.6	3.5	3.1	3.4	3.1	2.2	2.9	14
Trichloroethene								
Toluene	3.3	5.6	3.7	5.0	4.4	3.0	4.3	19
Tetrachloroethene	0.2	0.2	0.2	0.2	0.2	0.1	0.2	16

	Percent Deviation from Spike Concentration					
	1	2	3	4	5	6
Vinyl Chloride	41	-6	5	1	-30	-18
Dichloromethane	3	-18	-8	-5	-41	-23
Chloroform	-8	-13	-8	-16	-37	-18
Methylchloroform	21	-4	4	-11	-25	-4
1,2-Dichloroethane		-29	-21	-35	-43	-28
Benzene	-6	-29	-13	-19	-45	-29
Carbon Tetrachloride	-3	-14	-6	-14	-39	-19
Trichloroethene						
Toluene	70	12	52	33	-9	30
Tetrachloroethene	0	-25	-5	-10	-40	-20

Appendix C

FIELD SAMPLE DOCUMENTATION

LANDFILL GAS SAMPLE COLLECTION DATA SHEET

		Minutes										
		Start	1	2	3	4	5	6	7	8	9	10
Initial Flow Rate	14 $\frac{1}{2}$ m	Canister Pressure	29" Hg	22" Hg	13" Hg	5" Hg	1 PSI	4 $\frac{1}{2}$ PSI	6 $\frac{1}{2}$ PSI			
Final Flow Rate	14 $\frac{1}{2}$ m	Vacuum Rate	N/A									
Start Time		1241					Field Gas Chromatography Results					
Evacuation Time		N/A					N/A					
Sample Time		6 min 15 sec					Remarks					
Final Canister Pressure		7 $\frac{1}{2}$ PSI										

Canister I.D. No. AV 072 Initial Canister Pressure 29" Hg

Decon. 10 min ambient (FID=ND) 10 min zero

Sample I.D. Number CO-LG-00-02

Operator Signature D. Van Dusen

Operator Printed Name D. VAN DUSEN

Date 6-5-90

Landfill Name Communicated

Comments ZERO AIR BLANK

LANDFILL GAS SAMPLE COLLECTION DATA SHEET

		Minutes										
		Start	1	2	3	4	5	6	7	8	9	10
Initial Flow Rate	1 1/4 m	Carister Pressure	29" Hg	21" Hg	13" Hg	5" Hg	1 PSI	5 PSI	7 1/2 PSI			
Final Flow Rate		Vacuum Rate	N/A	N/A	→							
Start Time		0917					Field Gas Chromatography Results					
Evacuation Time		45 sec					N/A					
Sample Time		6 min 0 sec					Remarks					
Final Carister Pressure		7 1/2 PSI										

Carister I.D. No. AV049 Initial Carister Pressure 29" Hg

Decon. 10 min hurb 10 min Zero

Sample I.D. Number CO-LG-01-02

Operator Signature D. Van Dusen

Operator Printed Name D. VAN DUSEN

Date 5-25-90

Landfill Name COMMUNICATIONS

Comments VACUUM GAGE BROKEN → no readings. will monitor flow

LANDFILL GAS SAMPLE COLLECTION DATA SHEET

		Minutes										
		Start	1	2	3	4	5	6	7	8	9	10
Initial Flow Rate	14pm	Canister Pressure	29"	23"	15"	8"	0	3.5	7.5			
Final Flow Rate	14pm	Vacuum Rate	0	0	0	0	0	0	0			
Start Time		1035					Field Gas Chromatography Results					
Evacuation Time		45sec.					N/A					
Sample Time		5 min. 50 sec.					Remarks					
Final Canister Pressure		7.5 psi										

Canister I.D. No. AV086 Initial Canister Pressure 29" Hg.

Decon. 1hr Ambient Air (NO-FID) 10 min zero

Sample I.D. Number CO-16-R1-02

Operator Signature N. Contreras / AGC

Operator Printed Name N. Contreras / AGC

Date 6-22-90

Landfill Name Communication

Comments _____ CAN No. AV086

LANDFILL GAS SAMPLE COLLECTION DATA SHEET

		Minutes										
		Start	1	2	3	4	5	6	7	8	9	10
Initial Flow Rate	1 Lpm	Carister Pressure	29" Hg	21" Hg	10" Hg	0	4.5 psi	8 psi	9			
Final Flow Rate	1 Lpm		Vacuum Rate	∅	∅	∅	∅	∅	∅			
Start Time		1400					Field Gas Chromatography Results					
Evacuation Time		245 sec.					∅					
Sample Time		6 min.					Remarks					
Final Carister Pressure		9 psi.					∅					

Carister I.D. No. AV122 Initial Carister Pressure _____

Decon. 3 hrs. Ambient 25 min. Zero Air

Sample I.D. Number C0-L6-~~02~~⁰²-02

Operator Signature Nick C. Contreras Jr.

Operator Printed Name Nick C. Contreras Jr.

Date 5-25-90

Landfill Name Communications

Comments _____

LANDFILL GAS SAMPLE COLLECTION DATA SHEET

		Minutes										
		Start	1	2	3	4	5	6	7	8	9	10
Initial Flow Rate	14PM	Canister Pressure	29"	22"	14"	7"	0	35psi	7.5			
Final Flow Rate	14PM	Vacuum Rate	0	0	0	0	0	0	0			
Start Time		11:00					Field Gas Chromatography Results					
Evacuation Time		45 sec.					N/A					
Sample Time		6 min.					Remarks					
Final Canister Pressure		7.5										

Canister I.D. No. AV 103 Initial Canister Pressure _____

Decon. 20 min Ambient (ND = FID) 10 min zero

Sample I.D. Number CO-LG-Ra-02

Operator Signature Niel Contreras / AEC

Operator Printed Name N. Contreras / AEC

Date 6-22-90

Landfill Name Communications

Comments _____

LANDFILL GAS SAMPLE COLLECTION DATA SHEET

		Minutes										
		Start	1	2	3	4	5	6	7	8	9	10
Initial Flow Rate	1 L/min	Carister Pressure	28" Hg	21" Hg	11.5" Hg	4" Hg	2.5 PSI	5.5 PSI	7.5 PSI			
Final Flow Rate	1 L/min	Vacuum Rate	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
Start Time		1612					Field Gas Chromatography Results					
Evacuation Time		45 sec					N/A					
Sample Time		6 min 0 sec					Remarks					
Final Carister Pressure		7 1/2 PSI										

Carister I.D. No. AV 76 Initial Carister Pressure 28" Hg

Decon. 10 min AMB, 10 min zero

Sample I.D. Number CO-LG-03-02

Operator Signature D. Van Dusen

Operator Printed Name D. VAN DUSEN

Date 6-4-90

Landfill Name COMMUNICATIONS

Comments no vacuum gage on sampler

LANDFILL GAS SAMPLE COLLECTION DATA SHEET

		Minutes										
		Start	1	2	3	4	5	6	7	8	9	10
Initial Flow Rate	14/m	Carister Pressure	29" Hg	21" Hg	105" Hg	∅	1.5 PSI	5.5 PSI				
Final Flow Rate	14/m	Vacuum Rate	N/A	N/A	N/A	N/A	N/A	N/A				
Start Time		0821					Field Gas Chromatography Results					
Evacuation Time		45 sec					N/A					
Sample Time		20 min 5 min, 30 sec					Remarks					
Final Carister Pressure		7 1/2 PSI										

Carister I.D. No. AV061 Initial Carister Pressure 29" Hg

Decon. 3 hrs ambient, 10 min zero

Sample I.D. Number CO-LG-04-02

Operator Signature D. Van Dusen

Operator Printed Name D. VAN DUSEN

Date 6-5-90

Landfill Name COMMUNICATIONS

Comments no vacuum gauge on sampler.

LANDFILL GAS SAMPLE COLLECTION DATA SHEET

		Minutes										
		Start	1	2	3	4	5	6	7	8	9	10
Initial Flow Rate	1 1/4 m	Carister Pressure	29" Hg	23" Hg	15" Hg	6" Hg	0	3 1/2 PSI	6 PSI			
Final Flow Rate	1 1/4 m		Vacuum Rate	N/A	N/A	N/A	N/A	N/A	N/A			
Start Time		1026					Field Gas Chromatography Results N/A					
Evacuation Time		45 sec										
Sample Time		6 min 30 sec					Remarks					
Final Carister Pressure		7 1/2 PSI										

Carister I.D. No. AV069 Initial Carister Pressure 29" Hg

Decon. 1 1/2 hr ambient, 10 min zero

Sample I.D. Number CO-LG-05-02

Operator Signature D. Van Dusen

Operator Printed Name D. VAN DUSEN

Date 6-5-90

Landfill Name Communications

Comments no vacuum gage on sampler

INTEGRATED
SURFACE SAMPLING COLLECTION
DATA SHEET

DATE W-25-90 / 6-1-90

SAMPLE TIME 1015

CANISTER IDENTIFICATION NO. BAG # 66

LOCATION COMMUNICATION

INITIAL CANISTER PRESSURE N/A

INITIAL FLOW RATE 0.3 L/min

FINAL CANISTER PRESSURE "FULL"

FINAL FLOW RATE 0.3 L/min

MAX. WIND SPEED/DIRECTION 4.4 mph / SW

APPROX. AVERAGE WIND SPEED/DIRECTION 2 mph / SW

OPERATOR PRINTED NAME D. VAN DUSEN

OPERATOR SIGNATURE D. Van Dusen

SAMPLE IDENT. NO. CO-15-01-03

LANDFILL NAME COMMUNICATIONS STATION

COMMENTS _____

LANDFILL GAS SAMPLE COLLECTION DATA SHEET

		Minutes										
		Start	1	2	3	4	5	6	7	8	9	10
Initial Flow Rate	14/min	Canister Pressure	29" Hg	21" Hg	11" Hg	2" Hg	3 1/2 PSI	6 1/2 PSI				
Final Flow Rate	14/min		Vacuum Rate	Ø	Ø	Ø	Ø	Ø	Ø			
Start Time		115.3					Field Gas Chromatography Results N/A					
Evacuation Time		45 sec										
Sample Time		5 min 20 sec					Remarks					
Final Canister Pressure		7 1/2 PSI										

Canister I.D. No. AV 114 Initial Canister Pressure 29" Hg

Decon. 10 min AmB, 10 min ZERO

Sample I.D. Number CO-MG-01-02

Operator Signature D. Van Dusen

Operator Printed Name D. VAN DUSEN

Date 5-24-90

Landfill Name COMMUNICATIONS

Comments _____

LANDFILL GAS SAMPLE COLLECTION DATA SHEET

		Minutes										
		Start	1	2	3	4	5	6	7	8	9	10
Initial Flow Rate	14/min	Canister Pressure	29" Hg	21" Hg	11" Hg	∅	3 1/2 PSI	6 1/2 PSI				
Final Flow Rate	14/min	Vacuum Rate	∅	∅	∅	∅	∅	∅				
Start Time		1225					Field Gas Chromatography Results					
Evacuation Time		45 sec					N/A					
Sample Time		5 min 15 sec					Remarks					
Final Canister Pressure		7 1/2 PSI										

Canister I.D. No. AV061 Initial Canister Pressure 29" Hg

Decon. 10 min AMB, 10 min ZERO

Sample I.D. Number CO-MG-02-02

Operator Signature D. Van Dusen

Operator Printed Name D. VAN DUSEN

Date 5-24-90

Landfill Name COMMUNICATIONS

Comments _____

LANDFILL GAS SAMPLE COLLECTION DATA SHEET

		Minutes										
		Start	1	2	3	4	5	6	7	8	9	10
Initial Flow Rate	1 1/4 in	Carister Pressure	29" Hg	21" Hg	11" Hg	1" Hg	3 PSI	6 PSI				
Final Flow Rate	1 1/4 in	Vacuum Rate	Ø	Ø	Ø	Ø	Ø	Ø				
Start Time		1251					Field Gas Chromatography Results N/A					
Evacuation Time		45 sec										
Sample Time		5 min 30 sec					Remarks					
Final Carister Pressure		7 1/2 PSI										

Carister I.D. No. AV091 Initial Carister Pressure 29" Hg

Decon. 10 min AMB, 10 min ZERO

Sample I.D. Number CO-MG-03-02

Operator Signature D. Van Dusen

Operator Printed Name D. VAN DUSEN

Date 5-24-90

Landfill Name COMMUNICATIONS

Comments _____

LANDFILL GAS SAMPLE COLLECTION DATA SHEET

		Minutes										
		Start	1	2	3	4	5	6	7	8	9	10
Initial Flow Rate	1 1/4 min	Canister Pressure	29" Hg	22" Hg	11" Hg	2" Hg	3 PSI	6 PSI				
Final Flow Rate	1 1/4 min	Vacuum Rate	Ø	Ø	Ø	Ø	Ø	Ø				
Start Time		1352					Field Gas Chromatography Results					
Evacuation Time		45 sec					N/A					
Sample Time		5 min 30 sec					Remarks					
Final Canister Pressure		7 1/2 PSI										

Canister I.D. No. AV089 Initial Canister Pressure 29" Hg

Decon. 10 min Amb, 10 min Zero

Sample I.D. Number CO-MB-05-02

Operator Signature D. Van Dusen

Operator Printed Name D. VAN DUSEN

Date 5-24-80

Landfill Name COMMUNICATIONS

Comments _____

LANDFILL GAS SAMPLE COLLECTION DATA SHEET

		Minutes										
		Start	1	2	3	4	5	6	7	8	9	10
Initial Flow Rate	14m	Canister Pressure	29" Hg	26" Hg	11" Hg	2" Hg	2 1/2 PSI	6 PSI				
Final Flow Rate	14m	Vacuum Rate	1	1	1	1	1					
Start Time		1322					Field Gas Chromatography Results					
Evacuation Time		45 sec					N/A					
Sample Time		5 min 30 sec					Remarks					
Final Canister Pressure		7 1/2 PSI										

Canister I.D. No. AV069 Initial Canister Pressure 29" Hg

Decon. 10 min bub, 10 min @ 20psi

Sample I.D. Number CO-MG-04-02

Operator Signature [Signature]

Operator Printed Name D. VAN DUSEN

Date 5-24-90

Landfill Name COMMUNICATIONS

Comments _____

LANDFILL GAS SAMPLE COLLECTION DATA SHEET

		Minutes										
		Start	1	2	3	4	5	6	7	8	9	10
Initial Flow Rate	1.4 μ m	Canister Pressure	29 1/2" Hg	21" Hg	12" Hg	5" Hg	2 1/2 PSI	5 1/2 PSI				
Final Flow Rate		Vacuum Rate	Ø	Ø	Ø	Ø	Ø	Ø				
Start Time		1422					Field Gas Chromatography Results					
Evacuation Time		45 sec					N/A					
Sample Time		5 min 45 sec					Remarks					
Final Canister Pressure		7 1/2 PSI										

Canister I.D. No. AVØ24 Initial Canister Pressure 29 1/2" Hg

Decon. 10 min Amb, 10 min Zero

Sample I.D. Number CO-MG-Ø6-Ø2

Operator Signature D. Van Dusen

Operator Printed Name D. VAN DUSEN

Date 5-24-90

Landfill Name Communications

Comments _____

AMBIENT AIR SAMPLE COLLECTION DATA SHEET

4-1

START FINAL

FLOW RATE 18(2.7) 19(2.9)

SAMPLE TIME 0825(5-22) 0830(5-23)

CANSITER PRESSURE 30" Hg 6 1/2 PSI

DECON. 1 HR AMBIENT

EVACUATION TIME _____

SAMPLER NO. AV09

SAMPLE IDENTIFICATION NO. CO-1A-01-09

TYPE OF SAMPLE 24 hr , ~~_____~~

CANISTER IDENTIFICATION NUMBER AV071

DATE 5-23-90

OPERATOR PRINTED NAME D. VAN DUSEN / NC

OPERATOR SIGNATURE D. Van Dusen

LANDFILL NAME COMMUNICATIONS

COMMENTS _____

AMBIENT AIR SAMPLE COLLECTION DATA SHEET

	START	FINAL
FLOW RATE	<u>18(2.7)</u>	<u>18(2.7)</u>
SAMPLE TIME	<u>0820(5-22)</u>	<u>0825(5-23)</u>
CANSITER PRESSURE	<u>29 "Hg</u>	<u>6 PSI</u>
DECON.	<u>1 hr AMBIENT</u>	
EVACUATION TIME	_____	
SAMPLER NO.	<u>AV03</u>	
SAMPLE IDENTIFICATION NO.	<u>CO-1A-01-03</u>	
TYPE OF SAMPLE	<u>24 hr, demanded</u>	
CANISTER IDENTIFICATION NUMBER	<u>E055</u>	
DATE	<u>5-23-90</u>	
OPERATOR PRINTED NAME	<u>D. VAN DUSEN / NC</u>	
OPERATOR SIGNATURE	<u>D. Van Dusen</u>	
LANDFILL NAME	<u>COMMUNICATIONS</u>	
COMMENTS	_____ _____ _____ _____	

AMBIENT AIR SAMPLE COLLECTION DATA SHEET

START FINAL

FLOW RATE 19(2.9) 19(2.9)

SAMPLE TIME 08 20(5-22) 08 25 (5-23)

CANSITER PRESSURE 29" Hg 6 PSI

DECON. 1 hr AMBIENT

EVACUATION TIME _____

SAMPLER NO. AV04

SAMPLE IDENTIFICATION NO. CO-1A⁽⁰⁴⁾ - 04

TYPE OF SAMPLE 24 hr, ~~ambient~~

CANISTER IDENTIFICATION NUMBER E043

DATE 5-23-90

OPERATOR PRINTED NAME D. VAN DUSEN (~~NC~~)

OPERATOR SIGNATURE D. Van Dusen

LANDFILL NAME COMMUNICATIONS

COMMENTS _____

AMBIENT AIR SAMPLE COLLECTION DATA SHEET

	START	FINAL
FLOW RATE	<u>19(2.9)</u>	<u>19(2.9)</u>
SAMPLE TIME	<u>0830(5-27)</u>	<u>0820(5-24)</u>
CANSITER PRESSURE	<u>30" Hg</u>	<u>5 1/2 PSI</u>
DECON.	<u>1/2 hr ambient</u>	
EVACUATION TIME	_____	
SAMPLER NO.	<u>AV09</u>	
SAMPLE IDENTIFICATION NO.	<u>CO-1A-02-09</u>	
TYPE OF SAMPLE	<u>upwind 24-hr, SW location</u>	
CANISTER IDENTIFICATION NUMBER	<u>AV104</u>	
DATE	<u>5-24-90</u>	
OPERATOR PRINTED NAME	<u>D VAN DUSEN</u>	
OPERATOR SIGNATURE	<u><i>D. Van Dusen</i></u>	
LANDFILL NAME	<u>COMMUNICATIONS</u>	
COMMENTS	_____ _____ _____ _____	

AMBIENT AIR SAMPLE COLLECTION DATA SHEET

	START	FINAL
FLOW RATE	<u>18 (2.7)</u>	<u>18 (2.7)</u>
SAMPLE TIME	<u>0825 (5-27)</u> 27 <u>FDV</u>	<u>0815 (5-24)</u>
CANSITER PRESSURE	<u>29" Hg</u>	<u>4 1/2 PSI</u>

DECON. 1/2 hr ambient

EVACUATION TIME _____

SAMPLER NO. AV03

SAMPLE IDENTIFICATION NO. CD-1A-02-03

TYPE OF SAMPLE down wind 24 hr, NE location

CANISTER IDENTIFICATION NUMBER ~~A045~~ E045

DATE 5-24-90

OPERATOR PRINTED NAME D. VAN DUSEN

OPERATOR SIGNATURE D. Van Dusen

LANDFILL NAME COMMUNICATIONS

COMMENTS _____

AMBIENT AIR SAMPLE COLLECTION DATA SHEET

START

FINAL

FLOW RATE 1.9 (2.9) 1.6 (2.3)

SAMPLE TIME 0825 (5-27) 0815 (5-24)

CANSITER PRESSURE 30" Hg 6 PSI

DECON. 1/2 hr ambient

EVACUATION TIME _____

SAMPLER NO. AV04

SAMPLE IDENTIFICATION NO. CD-1A-C2-04

TYPE OF SAMPLE 24 hr co-located, NE location

CANISTER IDENTIFICATION NUMBER AV131

DATE 5-24-90

OPERATOR PRINTED NAME D. VAN DUSEN

OPERATOR SIGNATURE D. Van Dusen

LANDFILL NAME COMMUNICATIONS

COMMENTS _____

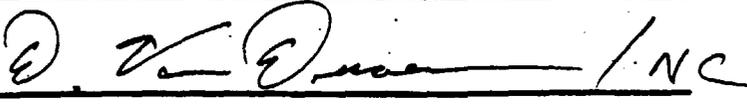
AMBIENT AIR SAMPLE COLLECTION DATA SHEET

	START	FINAL
FLOW RATE	<u>19(2.9)</u>	<u>18(2.7)</u>
SAMPLE TIME	<u>0850(5-24)</u>	<u>0850(5-25)</u>
CANSITER PRESSURE	<u>29 1/2" Hg</u>	<u>5 PSI</u>
DECON.	<u>1/2 hr ambient</u>	
EVACUATION TIME	_____	
SAMPLER NO.	<u>AV03</u>	
SAMPLE IDENTIFICATION NO.	<u>CO-1A-03-03</u>	
TYPE OF SAMPLE	<u>24hr, NE location</u>	
CANISTER IDENTIFICATION NUMBER	<u>AV.129</u>	
DATE	<u>5-25-90</u>	
OPERATOR PRINTED NAME	<u>D. VAN DUSEN</u>	
OPERATOR SIGNATURE	<u>D. Van Dusen</u>	
LANDFILL NAME	<u>Communities</u>	
COMMENTS	_____ _____ _____	

AMBIENT AIR SAMPLE COLLECTION DATA SHEET

	START	FINAL
FLOW RATE	<u>90(16.7)</u>	<u>100(18.6)</u>
SAMPLE TIME	<u>0100</u>	<u>0400 0500 (2)</u>
CANSITER PRESSURE	<u>28" Hg</u>	<u>7 PSI</u>
DECON.	<u>2 HRS AMB</u>	
EVACUATION TIME	_____	
SAMPLER NO.	<u>AV08</u>	
SAMPLE IDENTIFICATION NO.	<u>CO-1A-D1-08</u>	
TYPE OF SAMPLE	<u>4hr DRAINAGE, UPWIND</u>	
CANISTER IDENTIFICATION NUMBER	<u>E051</u>	
DATE	<u>5-23-90</u>	
OPERATOR PRINTED NAME	<u>D. VAN DUSEN (RC)</u>	
OPERATOR SIGNATURE	<u></u>	
LANDFILL NAME	<u>COMMUNICATIONS</u>	
COMMENTS	_____ _____ _____	

AMBIENT AIR SAMPLE COLLECTION DATA SHEET

	START	FINAL
FLOW RATE	92 (17.1)	95 (17.7)
SAMPLE TIME	0100	0400 0500 (20)
CANSITER PRESSURE	30 "Hg	5 PSI
DECON.	2 HRS AMBIENT	
EVACUATION TIME		
SAMPLER NO.	AV01	
SAMPLE IDENTIFICATION NO.	CO-1A-D1-01	
TYPE OF SAMPLE	4 hr DRAINAGE, DOWNWIND	
CANISTER IDENTIFICATION NUMBER	A008	
DATE	5-23-90	
OPERATOR PRINTED NAME	D. VAN DOSEN	
OPERATOR SIGNATURE	 / NC	
LANDFILL NAME	COMMUNICATIONS	
COMMENTS		

AMBIENT AIR SAMPLE COLLECTION DATA SHEET

START FINAL
FLOW RATE 92 (17.1) 96 (17.9)

SAMPLE TIME 0100 0500

CANSITER PRESSURE 29" Hg 6 1/2 PSI

DECON. 2 hr Ambient

EVACUATION TIME _____

SAMPLER NO. AV08

SAMPLE IDENTIFICATION NO. ^{copied} CO-1A-D2-08

TYPE OF SAMPLE 4hr Drawings - NE location

CANISTER IDENTIFICATION NUMBER AV130

DATE 5-24-90

OPERATOR PRINTED NAME D. VAN DUSEN

OPERATOR SIGNATURE D. Van Dusen

LANDFILL NAME COMMUNICATIONS

COMMENTS _____

AMBIENT AIR SAMPLE COLLECTION DATA SHEET

	START	FINAL
FLOW RATE	<u>92(16.7)</u>	<u>9(16.9)</u>
SAMPLE TIME	<u>0100</u>	<u>0500</u>
CANSITER PRESSURE	<u>29" Hg</u>	<u>3991</u>

DECON. 2 hrs ambient

EVACUATION TIME _____

SAMPLER NO. AV01

SAMPLE IDENTIFICATION NO. CO-1A-D2-01

TYPE OF SAMPLE downwind ~~CO-1A-D2-01~~ 4hr drainage
- SW location

CANISTER IDENTIFICATION NUMBER AV029

DATE 5-24-90

OPERATOR PRINTED NAME D. VAN DUSEN / NC

OPERATOR SIGNATURE D. Van Dusen

LANDFILL NAME COMMUNICATIONS

COMMENTS _____

AMBIENT AIR SAMPLE COLLECTION DATA SHEET

START FINAL
FLOW RATE 90 (6.7) 100 (8.6)

SAMPLE TIME 0100 0500

CANSITER PRESSURE 29" Hg 8 PSI

DECON. 6 hrs ambient

EVACUATION TIME _____

SAMPLER NO. AV08

SAMPLE IDENTIFICATION NO. CD-1A-D3-08

TYPE OF SAMPLE downwind 4 hr drainage, NE LOCATI X

CANISTER IDENTIFICATION NUMBER AV128

DATE 5-25-90

OPERATOR PRINTED NAME D. VAN DUSEN

OPERATOR SIGNATURE D. Van Dusen

LANDFILL NAME Communities

COMMENTS _____

AMBIENT AIR SAMPLE COLLECTION DATA SHEET

	START	FINAL
FLOW RATE	<u>8.2 (16.3)</u>	<u>8.8 (16.3)</u>
SAMPLE TIME	<u>0100</u>	<u>0500</u>
CANSITER PRESSURE	<u>30" Hg</u>	<u>47.91</u>

DECON. 6 hr ambient

EVACUATION TIME _____

SAMPLER NO. AV01

SAMPLE IDENTIFICATION NO. CO-1A-D3-01

TYPE OF SAMPLE upwind 4hr breeze - SW location

CANISTER IDENTIFICATION NUMBER E026

DATE 5-25-90

OPERATOR PRINTED NAME D. VAN DUSEN

OPERATOR SIGNATURE D. Van Dusen

LANDFILL NAME COMMUNICATIONS

COMMENTS _____

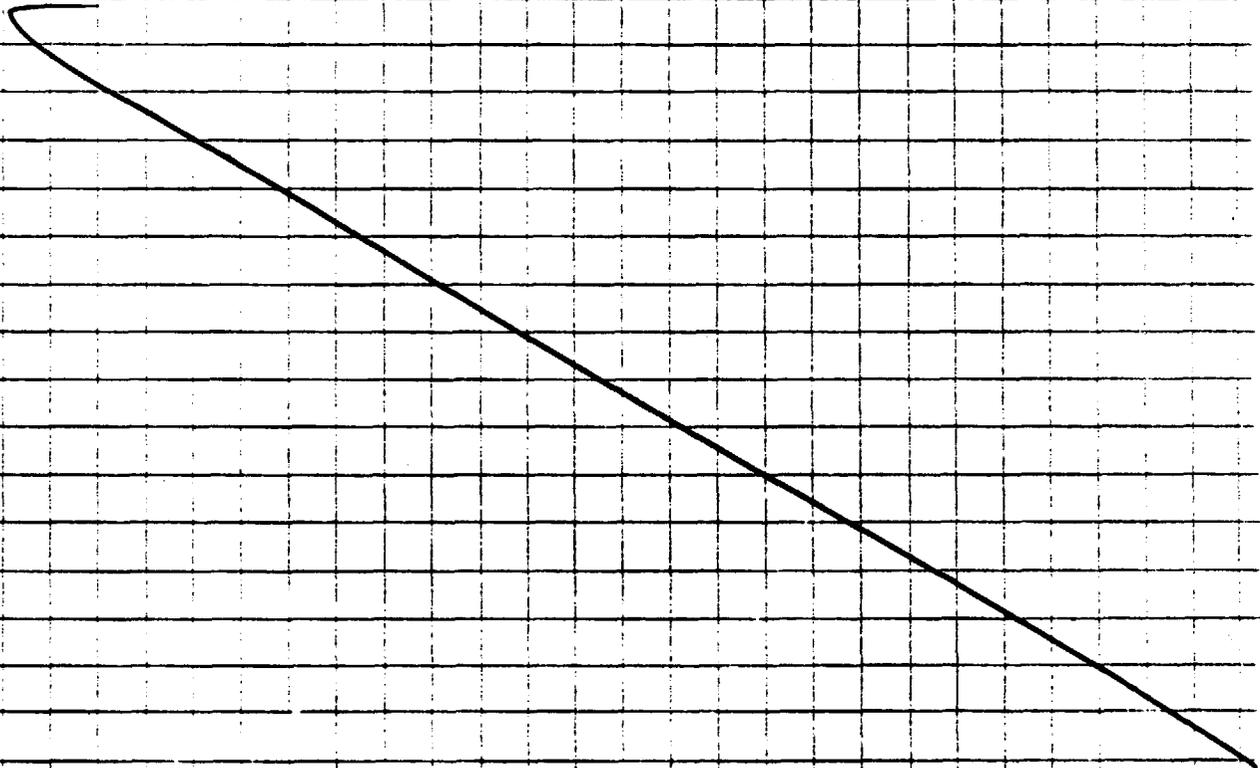
FIELD LOGBOOK

From Page No. _____

3/23 1200 AGC & DVD on site. Scouting around for a road over to landfill. Looks like access o.k. around fuel tank farm but need 4x4. Will carry MM station equip over.

1245 Set up net station #1017 Oriented to true north, operating properly.

1300 AGC and DVD off site



To Page No _____

Witnessed & Understood by me, _____

Date _____

Invented by _____

Recorded by _____

[Signature]

Date

3/23/90

From Page No. _____

4/9/90

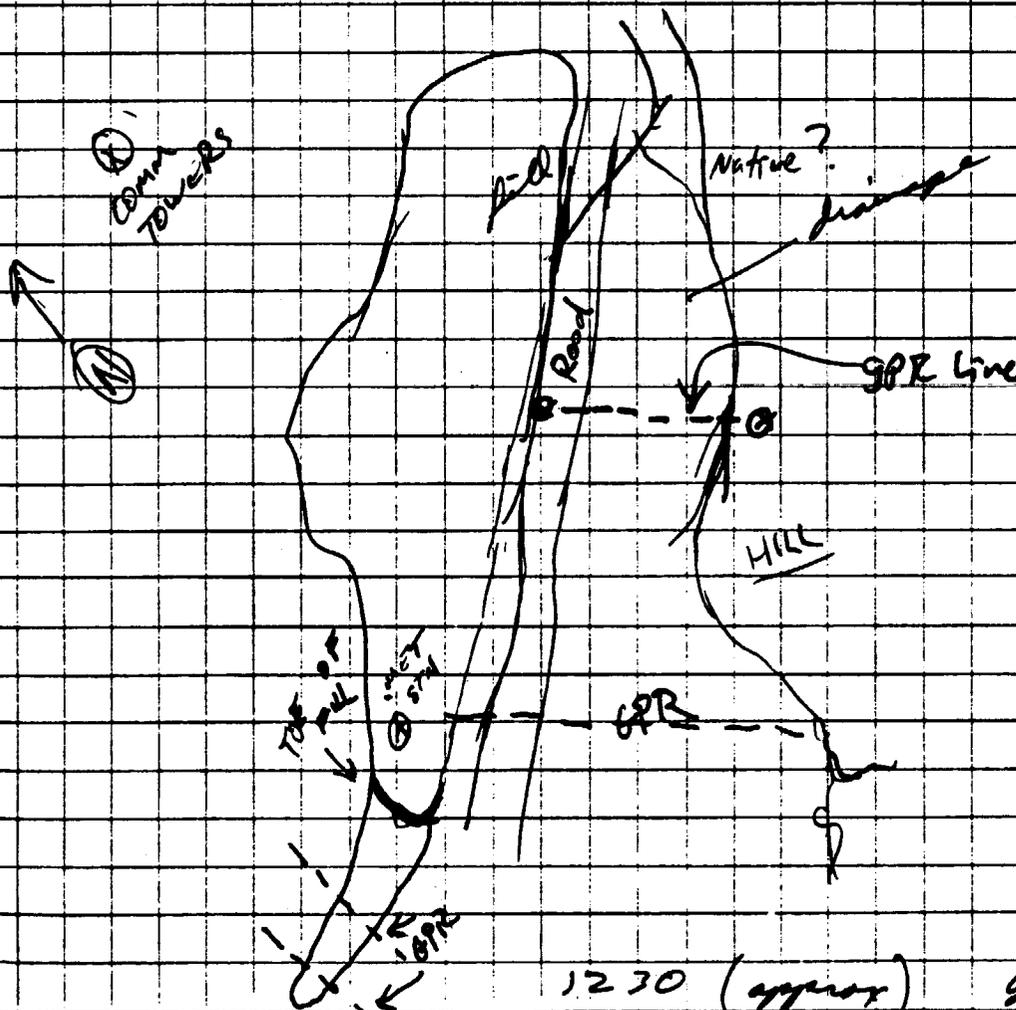
1100 Tearing down net station. ASC + DVD onsite

1115 Net station not working, restarted w/ New battery. will have to try again!

1130 Can't get net station to run. Replaced w/ station # 1018

~~ASC~~

1145 Scouting around for perimeter + locations that are questionable for GPR survey.



1230 (approx) off site

To Page 1

Witnessed & Understood by me,

Date

Invented by

Date

Recorded by

4/9/90

ASC

TITLE

Cann Stan

Project No. 50233B

Book No. _____

From Page No. _____

1225

D. J. [unclear] on site to check net status

4-10-90

1235

net working fine. off site.

(EX)

To Page N

Witnessed & Understood by me,

Date

Invented by

Date

Recorded by

[Signature]

TITLE

Common to GPR

Project No. 50233A

Book No. _____

From Page No. _____

4-11-)

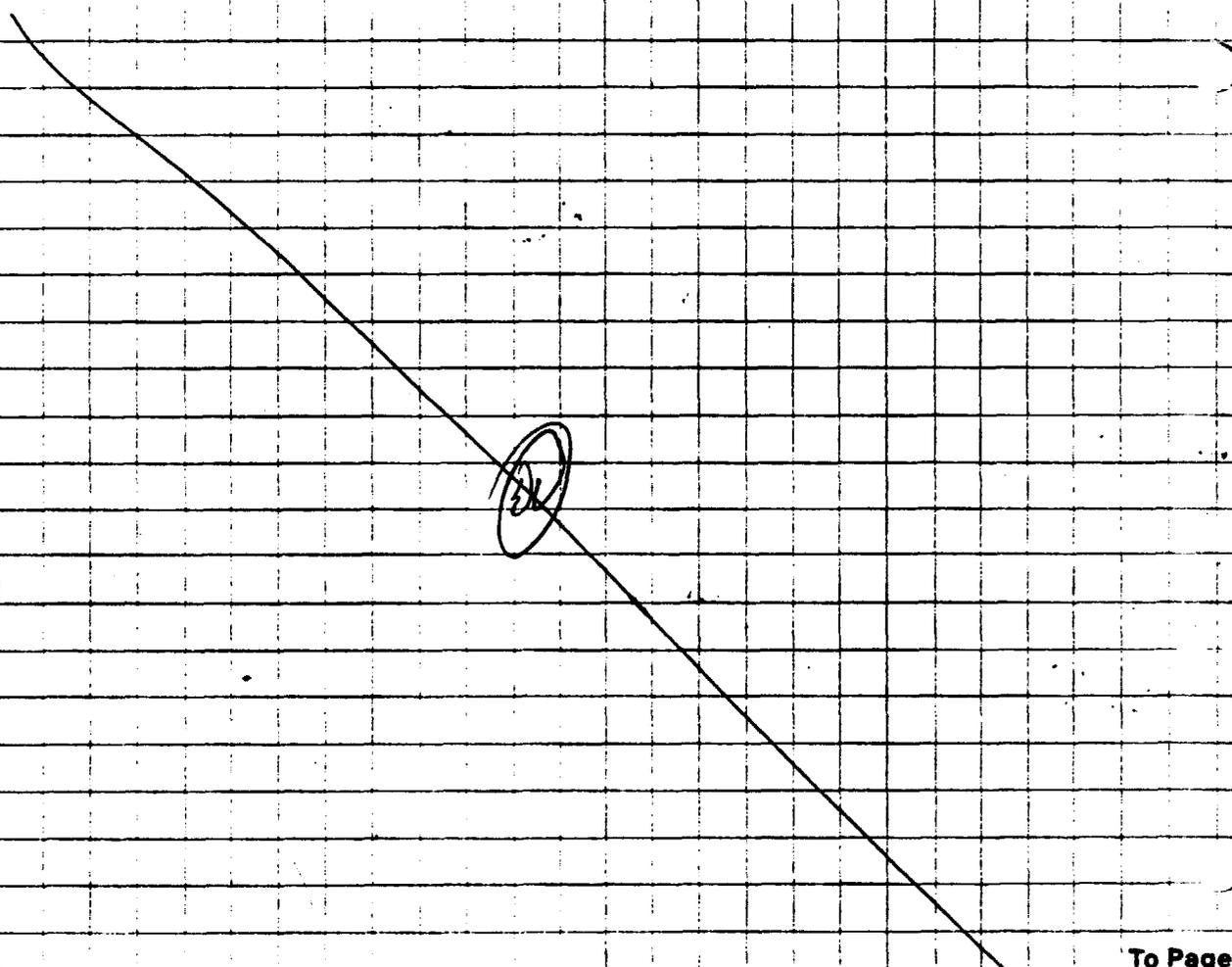
1630 In Dunes, in-sock on site. Marking GPR lines, measuring, mapping. Will do return GPR lines tomorrow.

1645 Contacted A. Campbell at state office. Discussed work schedule for tomorrow.

1655 checked net station. Running ~5 minutes slow. Re-net time otherwise working fine

1715 GPR lines laid out.

off site



To Page No. _____

Witnessed & Understood by me,

Date

Invented by

Date

Recorded by

[Signature]

⊕ BLUE STAKE
- BOUNDARY

4-12-90 (20)

RADIO
ANTENNA'S

8' FACE

HILL

RAISED
FILL

⊕
NET
STN

1007
20'
1007
1006
1007
20'
1007

HILL

1007
1007

50'

120'

DIRT ROAD

To Page No. _____

Read & Understood by me,

Date

Invented by

Date

Recorded by

From Page No. _____

#-12

0715 Met Ed. George, Ted of Er-Tech on site
Setting up lines 1001, 1002

0740 1001 complete

0745 1001 run in opposite direction

0755 1002 complete

0800 1002 run opposite direction

Boundaries apparent ~10 feet either side of raised mound. Does not appear to be deep fill. App. to be superficial. Construction rubble visible on surface

0810 Moving to 1003, 1004

0830 Complete 1003 S → N

0840 re-run 1003 in opposite direction.

0855 Run 1003 S → N again with larger antenna.

Northern boundary fairly clear, but southern boundary not well defined. Still appears to be surface dumping. No evidence of deeper tra

0900 setting up 1004

0905 Run 1004 N → S with large antenna.

0910 1004 S → N with smaller antenna

To Page No. _____

Witnessed & Understood by me, _____

Date _____

Invented by _____

Date _____

Recorded by _____

TITLE

GPR

From Page No. _____

4-12-90 (P)

0915 Similar pattern to 1003. Southern boundary to be defined. Appears to be surface dumping. Marked with blue stakes.

Moving to 1005

0945 1005 complete. No obvious garbage

0950 1006 complete. Similar to 1005

1000 setting up 1009 to run further onto hill near to next stn. Crosses 1005

1005 1009 complete.

Material on road and to east does not appear to have anything buried. Cannot tell if it is or fill material, but uniform.

1010 Picking up, moving to 1007, 1008.

1035 1007 complete. Appears uniform all the way. Setting up 1008

1055 1008 complete. No apparent buried trash. Mapping out locations, picking up equipment

1115 off site.

(AV)

Witnessed & Understood by me,

Date

Invented by

Date

Recorded by

(AV)

To Page

4-24-90

1120 D. V. Owen on site to break down mechanical net station

1130 Collect strip chart. Time is exactly on.

1200 Off site, heading to main gate to obtain vehicle permit.

(Signature)

To Page #

Witnessed & Understood by me,

Date

Invented by

Date

Recorded by

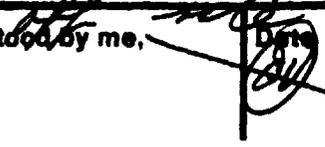
(Signature)

Page No. _____

5/8/90

- 0830 AGC & DVD on site to install probes.
setting up to install MG-1 (see map pg 167)
- 0935 MG-1 installed to 5'. second attempt. first attempt to only 2'. Probe located approx. 20' up-slope from surface of fill. Left first attempt in place with flagging to mark location
- 0955 LG-01 complete to ^{AGC} 8' near trench on upper tier of fill, across from MG-01
- 1020 MG-02 complete - 5' opposite side of road from fill (SE). Next to large tree.
- 1040 LG-02 complete to 7.5' on 2nd lift down from top of fill.
- 1100 MG-03 complete - 5 1/2' across from lower lift on SE side
- 1115 LG-03 complete to 8' eastern side of lower lift.
- 1140 MG-04 complete to 6'
- 1155 LG-04 complete to 8'. second attempt. First attempt to 2', left in place w/ flagging to mark location
- 1210 MG-05 complete to 6', west side of spur
- 1225 LG-05 complete to 8', center of spur
- 1235 MG-06 complete - 6' north side spur.

To Page No. _____

Witnessed & Understood by me, 	Date 	Invented by	Date
		Recorded by 	

No. _____

MG-1

LG-01

MG-2

LG-02

ROAD

LG-03

~2 ft lift

MG-3

MG-06

MG-04

LG-04

LG-05

MG-05

To Page No. _____

I & Understood by me,

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Recorded by

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5/8/90

Page No. _____

5-21-90

00 M. Cantor, D. Van Dusen on site
to set up drainage sampler.

sampler AV01 on SW side

1:30 setting up wet station.

45 placing sampler ^{AV02} on NE side

00 not have instrument with me. Found
samplers remaining while going back
to motel for instrument.

1:50 Back on site sampler AV01 on SW side
flow = 90

2:00 ^{AV02} AV02, NE side, anemometer #E062
timer set to go off at 0100 and shut off
at 0400.

Flow = 89, vacuum = 28" Hg

2:30 Back at AV01. Anemometer #E063, setting timer
to go off at 0100, shut off at 0400
vacuum = 29" Hg, flow = 89

2:35 off site.

(Signature)

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Read & Understood by me,	Date	Invented by	Date
		Recorded by <i>Van Dusen</i>	

Page No. _____

5-22-90

555 H. Lohman, D. Van Dusen on site.

checking SW sampler (4 hr) AV01.

Timer did not shut sampler off and pressure
in can 0 PSI.testing timer. works OK. May have to switch
timer

605 checking NE 4 hr sampler AV08.

2 PSI. flow = 100

Location may not be accurate. Flow needs
to be to the east of NE for upwind
location to not be affected by the fill

630 checking met station

Met station mis-oriented by 5°-10° to west
of north. Corrected.Both 4 hr drainage samples are acceptable
from a wind point of view, but NE
location may need to be moved650 setting up 24 hr sampler AV09 at SW located
chimney # AV071730 setting up co-located samplers # AV03, AV04
at location from last night's drainage
sample. Moving NE drainage to far end
of fill.

7750 setting up AV08 at far side (NE) of fill.

To Page No. _____

Read & Understood by me,

Date

Invented by

Date

Recorded by

D. Van Dusen

Page No. _____

5-22-90

WS	WD
2.0	ENE
4.5	E
1.5	NE

2.0	NE
2.5	ENE
4.0	ENE
5.0	ENE
2.5	NE
1	NE
1.5	WNW
1.5	W
3.0	WNW
4.0	WNW
5.5	WNW
5.5	W
9.5	W
8.5	W
2.0	WNW
N/A	N/A
N/A	N/A
N/A	N/A
3.0	W
2.0	NNW
1.5	N
2.0	NNE
1.0	N
2.5	NNE

no met data for this period

Ⓚ based on 1/2 hr 2130 to 2200

Read & Understood by me,	Date	Invented by	Date
		Recorded by	

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5-22-90 (P.2)

800 Checking AVO9, SW 24 hr. flow = 15. will
 leave as is and check again

805 checking AVO3, AVO4.

AVO3 constant # E055 flow = adjusted to 17
 AVO4 " E043 " = 18

810 checking AVO8 - 4 hr drainage, con # E051

815 AVO9 adjusted from 15 to 19
 AVO1 at 89

820 AVO8 flow = 18 29" Hg
 (24 hr) AVO4 " = 19 29" Hg
 (NE)

822 shutting off AVO8 (NE 4 hr)

825 shut off AVO1
 starting SW 24 hr

flow = 18, 30" Hg

830 heading off site.

1540 Back on site to check 24 hr samples,
 warm up 4 hr samples.

1525 AVO9 (24 hr SW) 25" Hg
 starting AVO1 (4 hr, SW) - flow = 90

1550 AVO8 started. flow = 89

will let AVO1 and AVO8 run for
 a couple of hours and then set

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Date

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5-22-90 (p. 3)

1855) AV03 -15" Hg
 AV04 -15" Hg

1855 checking met station. winds picking up. wind 8-9 mph from the west

1900 off site

1900 Back on site to start (set) drainage samples

1910 SW site

AV09 (24 hr) at 17" Hg
 AV01 flow = 92, timer seems to be working well

1920 setting timer - 05:40 delay, 04:00 run time, #A008, flow = 92, vac 30" Hg

1923 checking NE location

AV03 10" Hg
 AV04 8" Hg

1925 setting AV08 (4 hr - NE) - flow = 90

28" Hg, ca #E051 - timer delay 05:35, run time 04:00.

1930 Forgot to re-engage screws on met station. No data from 1800 to 1930. Re-set.

1940 off site.

(SV)

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Recorded by

(SV)

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5-23-90

0800 N. Contreras, D. Van Dusen on site
 checking SW ambient samples flow = 95
 AV01 - 4hr drainage - can # A008 5 PSI
 AV02 - 24 hr - 3 1/2 PSI can # AV071

0805 Collect strip chart from meter station

0815 NE site 4 hr drainage
 AV05, 7 PSI, can # E051, flow = 100

0825 NE 24 hr location - changing out cans
 AV03 - 6 PSI, can # E055, flow = 18
 AV04 - 6 PSI, can # E043, flow = 19
 new cans - AV03 - can # AV113 E045
 AV04 - can # AV131

Begin second 24 hr samples
 can # AV113 low pressure

AV03 - flow = 18, 29" Hg
 AV04 - flow = 19, 30" Hg START

0830 SW site - collect 24 hr sample
 AV09, 5 1/2 PSI, can # AV071, flow = 19
 @ 6 1/2

start 2nd 24 hr sample, can # AV109, flow = 19
 30" Hg
 2nd 4hr → AV029

0845 off site

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1500 Back on site.
 setting 4hr SW AVO1 -
 flow = 90, 29" Hg, $C_{\text{a}} = \text{AVO29} \rightarrow \text{START}$
 AVO9, 20" Hg

1610 NE site AVO8 \rightarrow setting ~~time~~
 flow = 92, 29" Hg, $C_{\text{a}} = \text{AV130}$

1645 checking NE 4hr
 AVO3 - 16" Hg
 AVO4 - 12" Hg

1730 D. Van Dusen off site. M. Contreras
 sampling 16 wells

To Page No. _____

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~~AN~~

5-23-90

	<u>WS</u>	<u>WD</u>
100 -	2.5 -	NE
200 -	2.5 -	NE
300 -	3.0 -	NE
400 -	3.0 -	NE
500 -	1.5 -	ENE
600 -	2.0 -	NNE
700 -	1.5 -	WNW
800 -	2.0 -	W
900 -	3.0 -	WNW
000 -	3.5 -	WSW
100 -	4.5 -	WSW
200 -	7.5 -	WNW
300 -	9.5 -	W
400 -	9.5 -	W
500 -	9.0 -	W
600 -	7.5 -	W
700 -	6.5 -	W
800 -	6.0 -	WSW
900 -	4.5 -	WSW
000 -	4.0 -	WSW
100 -	1.5 -	SSW
200 -	2.0 -	SSW
300 -	2.5 -	SSE
400 -	3.0 -	SSW

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5-24-90

27) 2. 2 - Down on site

checking SW ambient samples

AV01 - 4 hr - 3 PSI, can # AV029, flow
AV09 - 24 hr - 3 PSI

15) NE 4 hr sample AV08, 6 1/2 PSI, can # AV130, flow

50 Collocated 24 hr

AV03 - 4 PSI
AV04 - 5 1/2 PSI

755 checking net station

815 shutting off NE 24 hr samples

AV07 4 1/2 PSI, can # ED45, flow = 18
AV04 6 PSI, can # AV131, flow = 16

2420 shutting off SW 24 hr

AV09, 5 1/2 PSI, can # AV104, flow = 19

0 start NE 24 hr samples

AV03, can # AV129, flow = 19, 29 1/2" Hg
AV04, can # AV090, flow = 18, 30" Hg

855 start SW 24 hr

AV09, can # AV057, flow = 19, 29" Hg

296 ~~off site~~

To Page No. _____

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Date

Recorded by

V. Queen

MET DATA

5-24-90

	<u>WS</u>	<u>WD</u>
0100	2.5	SSW
0200	1.0	SSW
0300	1.5	SSW
0400	2.0	NW
0500	1.5	NNW
0600	1.5	NE
0700	1.5	NNW
0800	3.5	SW
0900	3.5	SSE
1000	4.5	SSW
1100	5.5	WSW
1200	7.5	WNW
1300	8.5	W
1400	9.0	W
1500	8.0	W
1600	2.0	W
1700	2.0	W
1800	5.0	W
1900	1.5	W
2000	1.5	NE
2100	2.0	NNE
2200	3.0	ENE
2300	5.0	E
2400	4.0	NE

Observed & Understood by me,	Date	Invented by	Date
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5-24-90 (A.2)

checking direction of wind flow for
4hr drainage samples.

a small front moved through the
area late last night and disrupted
wind flows. However, the wind ~~is~~
was from the SSW, which places
AV01 upwind and AV02 downwind.

At AV06, a SSW flow does cross a
large part of the fill, so samples
should be acceptable

915 Talked to L. Campbell by phone and relayed
status of project.

930 off site

1130 K. Olson back on site, setting up to
sample MG-01

Purging ambient air

1140 Purge zero air

1153 Begin collecting MG-01

1200 CO-MG-01-02 collected
can # AV114, 7 1/2 PSI

Purging ambient air

1210 Purge zero air

1215 begin collecting MG-02

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5-24-90 (R 3)

1230 CO-M6-02-02 complete
can # AV061, 7 1/2 PSI

purging ambient air

1240 purge zero air

1250 begin sampling M6-03

1300 CO-M6-03-02 collected
can # AV091, 7 1/2 PSI

purge sample or ambient air

1310 purge zero air

1320 begin sampling M6-04

1330 CO-M6-04-02 collected
can # AV069, 7 1/2 PSI

purging ambient air

1340 purge zero air

1350 Begin sampling M6-05

1400 CO-M6-05-02 collected
can # AV089, 7 1/2 PSI

purge sample ambient air

1410 purge zero air

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5-24-90 (p. 4)

1420 begin sampling MG-06

1430 CO-MG-06-02 collected
in AV024, 7 1/2 PSI

1440 off site, heading to Fed Ex

1450 - Southwest side drainage sampler set up.

sampler	can	flow	Bar. Pk.	Bar. Time
AV01		88	30" Hg.	0100

1450 - Northeast side drainage set up.

sampler	can	flow	Bar. Pk.	Bar. Time
AV03	AV128	90	29" Hg.	0100

To Page No. _____

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(Signature)

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	<u>WS</u>	<u>WD</u>	
0100	3.0	NE	
0200	3.5	ENE	
0300	3.5	ENE	
0400	5.0	ENE	
0500	6.0	ENE	
0600	2.5	NE	
0700	2.5	NE	

5-25-90

(24)

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Inspected & Understood by me,

Date

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Date

Recorded by

0720 - ON SITE preparing to remove ~~and reload~~ 24hr NE samples.

0830 - ~~Rem~~ Removed 4hr drainage sample NORTHEAST

SAMPLER	can	flow	End Pk	END TIME	SAMPLE ID
AV08	AV128	100	8PSIG	0400	C

0740 0.7m Dueson on site

0745 SW samples
AV01, 4hr SW, 4PSI, can # E026, flow = 98, END
AV09, 24hr SW, 4PSI, can # AV057

0750 AV08, 4hr NE, 8 1/2 PSI, can # AV128

0755 AV03, 24hr NE, 4PSI, can # AV129
AV04 not running, apparently a dead battery, no pressure/volume in can

0800 checking met station. A batteries on site

0850 AV03, 5PSI, can # AV129 END

0855 AV09, 5PSI, can # AV057 END

0900 setting up to sample LG-01
sampler purging on ambient since 0855

0905 sampler on zero air

0915 begin collecting LG-01

0920 CO-LG-01-02 can # AV049, 7 1/2 PSI

Read & Understood by me,	Date	Invented by	Date
		Recorded by <i>[Signature]</i> / EC	

Page No. _____

5-25-90 (p 2)

0825 NOTE: OVA not working.
cannot measure exhaust from sampler
to check de-con time

will de-con sampler a minimum of 2 hrs on
ambient

1000 off site

1300 Back on site. Picking up ambient sampler

1330 setting up at LG-02. sampler purged
3 hrs on ambient

Purging on zero air

1400 start sampling

1405 CO-LG-02-02 collected
can # AV122, 9PS1

1430 off site. heading to FED-EX to
ship samples

~~OV~~

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~~OV~~

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6-1-90

ISS / SURFACE MONITORING

(OV)

Mix into walk

TIME	WIND	SP (mph)	OVA (ppm)
0 0947	2.3		1.0
1 0948	4.3		1.0
2 0949	∅		0.8
3 0950	0.8		1.2
4 0951	3.1		1.6
5 0952	4.4		1.5
6 0953	3.2		1.4
7 0954	1.4		1.2
8 0955	1.8		1.0
9 0956	3.6		1.0
10 0957	∅		1.0
11 0958	1.0		1.0
12 0959	0.2		1.0
13 1000	0.4		1.0
14 1001	∅	0.1	0.9
15 1002	0.2		0.8
16 1003	∅		0.8
17 1004	0.1		0.8
18 1005	∅		0.9
19 1006	∅		1.0
20 1007	∅		0.9
21 1008	1.5		0.9
22 1009	2.3		0.8
23 1010	0.8		0.9
24 1011	2.9		1.0
25 1012	4.1		1.0

flow = 0.3 Lpm

flow = 0.3 Lpm

flow = 0.3 Lpm

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Witnessed & Understood by me,

Date

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Recorded by

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6-1-90

0815

D. J. Owen, B. Hamilton on site to walk 155, sample 46 wells.

0830

check met station. winds calm (1-2 mph) but picking up.

calibrating OVA #3 to zero air, 50 ppm

0845

Batteries to wind sensor dead. will have to head off site to purchase new batteries.

0920

Back on site wind sensor working well.

0945

Begin walking 155 / surface monitoring. wind 2-3 mph. Background reading 1 ppm. B. Hamilton collecting 155 sample. D. J. Owen doing surface monitoring / wind check.

1015

surface walk completed. wind calm 5 mph for entire walk. No OVA reading > 1.5 ppm

Kedlar bag #62

1030

setting up to sample LG-03.

Problem with sampler. No flow to collector / exhaust.

Called office. spoke w/ D. Christopher @ sampler. He suggested trying a pump from an ambient air sampler and adjusting overflow valve (also setting).

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6-1-90 (p. 2)

1145. Completely tore down sampler after dismantled flow control valve, the sampler appears to be working properly.

1150 Cannot find sampling cap. Suspect it is still at office. Breaking down equipment and heading to FED-EX to ship 155 sample.

1200 Off site.

(Handwritten initials)

To Page No. _____

Reviewed & Understood by me,

Date

Invented by

Date

Recorded by

(Handwritten initials)

From Page No. _____

6-4-90

1530 D. Van Dusen H. Contreras on-site to sample LG probes

Setting up at LG-03

1540 Purging 10 min on ambient air

1550 Purge 10 min zero air

1612 Begin collecting sample

1620 Sample CO-LG-03-02 collected
can # AV076, 7 1/2 PSI

1645 off site.

(2)

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Date

Invented by

Date

Recorded by

LG

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Book No. _____

49

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6-5-90

805 D.K. Dusen H. Contreras on site to sample LG probes.

Sampler purged 3 hrs on ambient.

Purge 10 min zero air

820 Begin sampling LG-04

830 CO-LG-04-02 collected
can # AV061, 7 1/2 PSI

845 Off site

900 Back on site. Setting up at LG-05

Sampler purged 1 1/2 hr ambient air. FID=ND

910 Purge on zero air

920 Begin sampling LG-05

1045 Off site. Heading to FED-EX

All sampling complete at Communications Station Landfill.

1230 NOTE: Blank not collected previously. Will collect after OR-16-01. Standard decan

1245 CO-LG-00-02
can # AV072, 7 1/2 PSI

To Page No. _____

Communications Station

Project No. 50233
Book No. _____

From Page No. 6/22/90

1030 KGC & NC on site @ Communications Station landfill.
preparing to sample probe LG-01. Resampling.

1035 Sampled LG-01 on Communications.

<u>sampler</u>	<u>can</u>	<u>sample Id</u>	<u>collection time.</u>	<u>PSI</u>
AV02	AV086	CO-LG-R1-02	5 min. 50 sec.	7.5

1100 -

<u>sampler</u>	<u>can</u>	<u>sample Id</u>	<u>collection Time</u>	<u>PSI</u>
AV02	AV103	CO-LG-R2-02	6 min.	7.5

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Witnessed & Understood by me,

Date

Invented by AGC

Date 6/22/90

TITLE Communication Station Arr SWAT

Project No. 50233

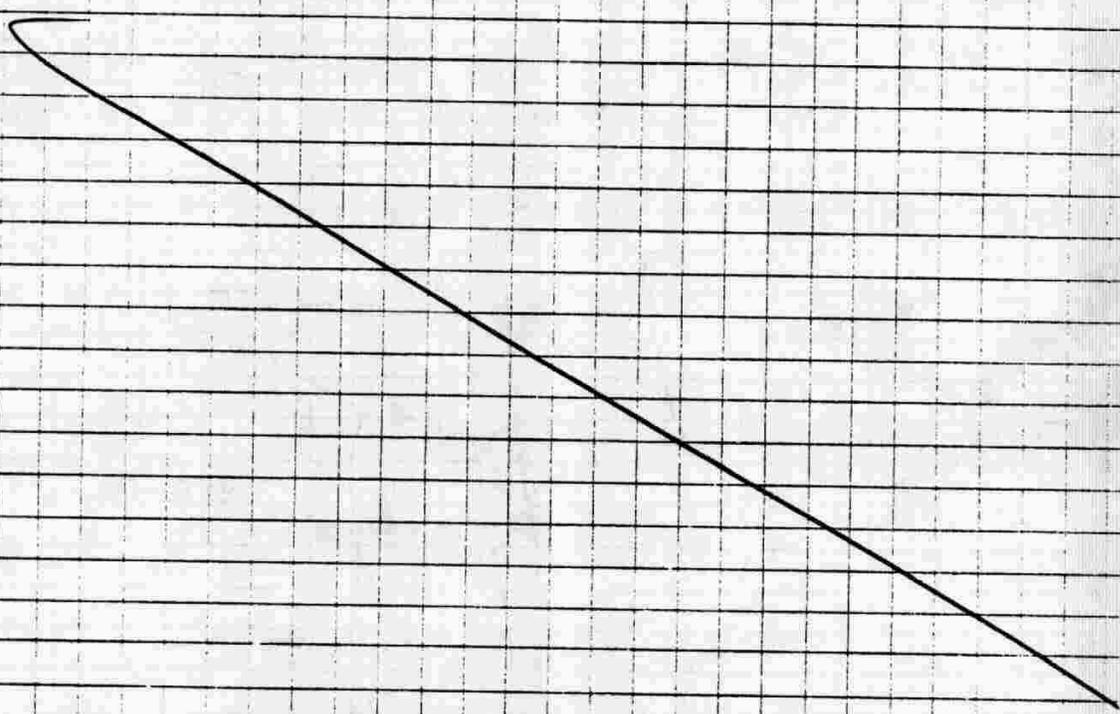
Book No. _____

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3/23 1200 AGC & DVD on site. Scouting around for a road over to landfill. Looks like access o.k. around fuel tank farm but need 4x4. Will carry Ma station equip over.

1245 Set up net station #1017
Oriented to true north, operating properly.

1300 AGC and DVD off site



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Date

Invented by

Recorded by

[Signature]

Date

3/23/90

TITLE

Communications Station

Project No. 50233

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4/9/90

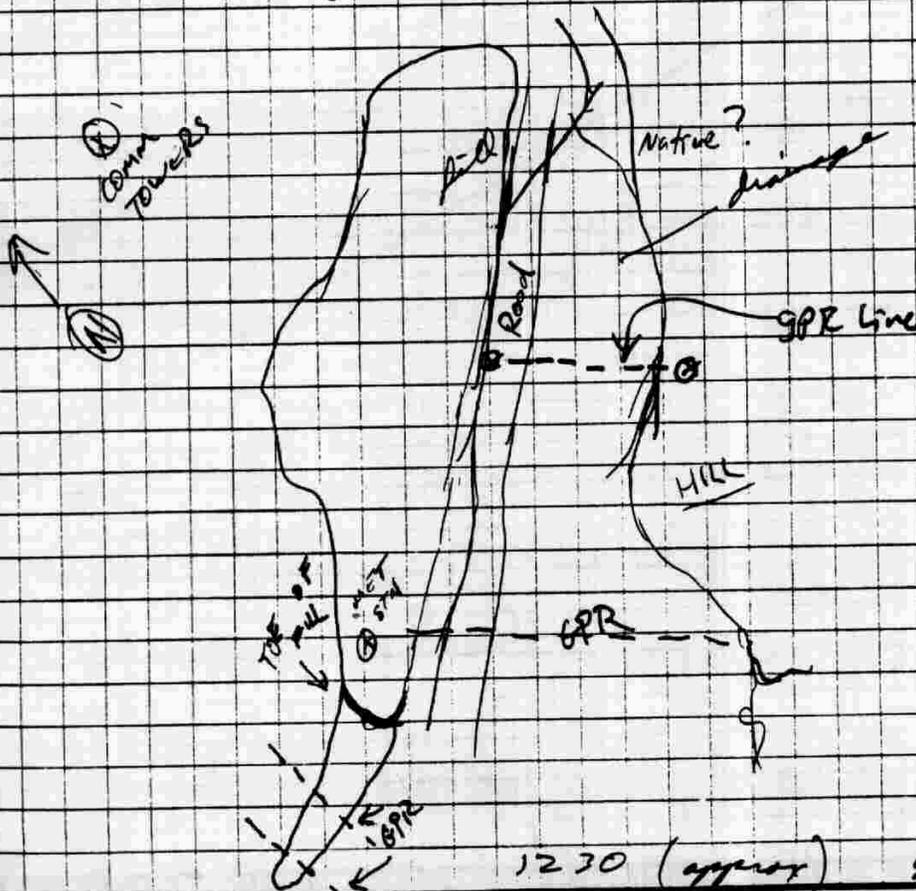
1100 Tearing down net station. ASC + DVD onsite.

1115 Net station not working, restarted w/ New battery. will have to try again!

1130 Can't get net station to run. Replaced w/ station # 1018

ASC

1145 Scouting around for perimeter + locations that are questionable for GPR survey.



1230 (approx) off site

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Date

Invented by

Date

Recorded by

4/9/90

11
TITLE

Comm Sta

Project No. 50233B
Book No. _____

From Page No. _____

1235 ~~D. Johnson~~ on site to check net state 4-10-90

1235 ~~net~~ working fine. off site.

(EX)

To Page N

Witnessed & Understood by me,

Date

Invented by

Date

Recorded by *[Signature]*

TITLE

Common str GPR

Project No. 50233A

Book No. _____

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4-11-

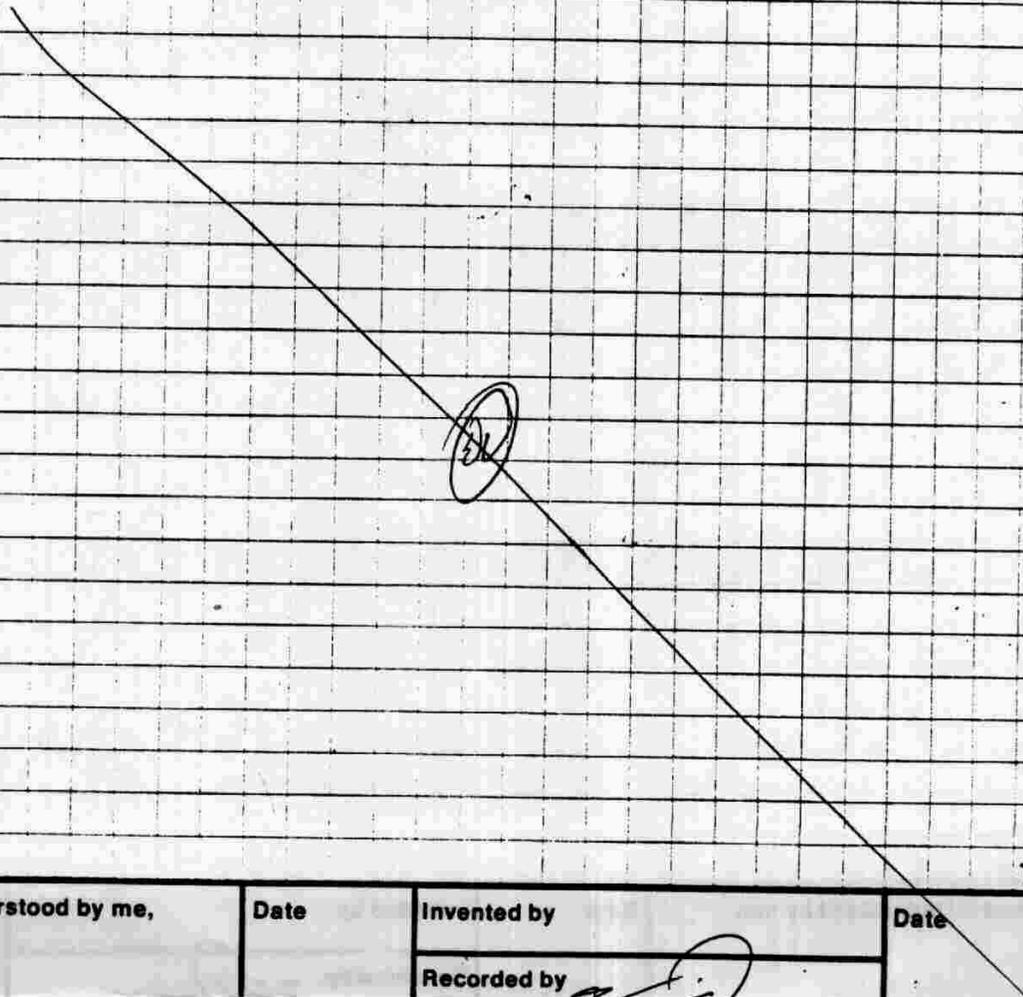
1630 Van Dusen, G. Back on site. Marking GPR lines, measuring, mapping. Will do actual GPR lines tomorrow.

1645 Contacted A. Campbell at State office. Discussed work schedule for tomorrow.

1655 checked met station. Running ~5 minutes slow. Re-set time otherwise working fine.

1715 GPR lines laid out.

off site



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Book No. _____ TITLE _____

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⊕ BLUE STAKE
- BOUNDARY

4-12-90 (20)

RADIO
ANTENNA

8' FACE

1008
20'
1007

HILL

RAISED
FILL

1006
1007
1005
20'

HILL

⊗
NET
STN

102
101

50'

20'

120'

DIRT ROAD

To Page No. _____

Used & Understood by me,

Date

Invented by

Date

Recorded by

TITLE

COMM. STN. GPR

Project No. 50273A

Book No. _____

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#-12

0715 Met Ed. George, Ted of Er-Tech on site
 setting up lines 1001, 1002

0740 1001 complete

0745 1001 run in opposite direction

0755 1002 complete

0800 1002 run opposite direction

Boundaries apparent ~10 feet either side of raised mound. Does not appear to be deep fill. Appears to be superficial. Construction rubble visible on surface

0810 Moving to 1003, 1004

0830 Complete 1003 S → N

0840 re-run 1003 in opposite direction.

0855 Run 1003 S → N again with larger antenna.

Northern boundary fairly clear, but southern boundary not well defined. Still appears to be surface dumping. No evidence of deeper structure.

0900 setting up 1004

0905 Run 1004 N → S with large antenna.

0910 1004 S → N with smaller antenna

To Page No. _____

Witnessed & Understood by me,

Date

Invented by

Date

Recorded by

V. J. Rose

4-24-90

1120

D. V. Jones on site to break down mechanical net station

1130

Collect strip chart. Time is exactly on.

1200

Off site, heading to main gate to obtain vehicle permit.

(D.V.)

To Page N

Witnessed & Understood by me,

Date

Invented by

Date

Recorded by

D. V. Jones

Page No.

5/8/90

0800 AGC & DVD on site to install probes.
setting up to install MG-1 (see map pg 1617)

0935 MG-1 reinstalled to 5'. second attempt. first attempt to only 2'. Probe located approx. 20' up-slope from surface of fill. left first attempt in place with flogging to mark location

0955 LG-01 complete to ^{ABC} 8' Near trees on upper tier of fill, across from MG-01

1020 MG-02 complete - 5' opposite side of road from fill (SE), next to large tree.

1040 LG-02 complete to 7.5' on 2nd lift down from top of fill.

1100 MG-03 complete - 5 1/2' across from lower lift on SE side

1115 LG-03 complete to 8' eastern side of lower lift.

1140 MG-04 complete to 6'

1155 LG-04 complete to 8'. second attempt. first attempt to 2', left in place w/ flogging to mark location.

1210 MG-05 complete to 6', west side of spur

1225 LG-05 complete to 8', center of spur

1235 MG-06 complete - 6' north side spur.

To Page No.

Witnessed & Understood by me,

Date

Invented by

Date

Recorded by

[Signature]