1994 Topographical, Meteorological and Airborne Contaminant Characterization at Kettleman Hills Facility

Volume I

Prepared for:

Chemical Waste Management, Inc.
Kettelman Hills Facility
Kettelman City, CA

Prepared by:

Rust Environment & Infrastructure Inc.
Minneapolis, Minnesota 55441

Rust Project No.: 42971.900
April 1995

QUALITY

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INTEGRITY

◆

CREATIVITY

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RESPONSIVENESS

RUST ENVIRONMENT & INFRASTRUCTURE

Chemical Waste Management, Inc.
[illegible]
[illegible] California [illegible]
[illegible]

CERTIFIED MAIL-Return Receipt Requested

April 28, 1995

John Papathakis (P 783 228 504)
Department of Toxic Substances Control
Region 1
10151 Croydon Way, Suite 3
Sacramento, California 95827

RE: SUBMITTAL OF THE 1994 TOPOGRAPHICAL, METEOROLOGICAL AND AIRBORNE CONTAMINANT CHARACTERIZATION AT KETTLEMAN HILLS FACILITY, (CAT000646117)

Dear Sir:

The above mentioned report is being submitted in accordance with the California Department of Toxic Substances Control Hazardous Waste Facility Permit, condition V.C.. The air characterization project began January, 1994 with the initial modeling of the meteorological data and ended February, 1995 with the Final Stabilization Unit (FSU) stack testing. The results of this project show that there is no need for continued monitoring of the ambient air at the Kettleman Hills Facility (KHF).

The KHF appreciates all the time spent by you and Anne Ely helping get this project approved by the San Joaquin Valley Unified Air Pollution Control District to meet "Hot Spots" requirements. Your knowledge of stack sampling and air testing methodologies during the FSU stack testing was also very helpful. Please give me a call at the above number to arrange a meeting to discuss this report and other air monitoring issues.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based upon my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to be the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Sincerely,
Chemical Waste Management, Inc.

Catherine R. Pool

Catherine R. Pool
Assistant Environmental Manager

enclosure

Courtesy Copy w/Enclosure by Certified Mail: Mailed 7/6/95

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TABLE OF CONTENTS

Volume I

Chapter

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

ABSTRACT

Chemical Waste Management, Inc., Kettleman Hills Facility (CWMI) has performed an emissions characterization study in accordance with the requirements of its Resource Conservation and Recovery Act (RCRA) Part B Permits. The purpose of this study was to identify and quantify hazardous constituents being emitted into the air from the facility and to fully characterize the topography and meteorological conditions at the facility which would affect their transport. These results were then used to develop a proposed list of target compounds for sampling, and to determine the locations for siting ambient air monitoring stations.

Based upon the sampling data, air dispersion modeling, and analysis of predicted property line ambient air concentrations, the results of this study conclude that the potential impact to off-site receptors was not great enough to justify an ambient air monitoring system around the CWMI Kettleman Hills facility.

1.0 INTRODUCTION

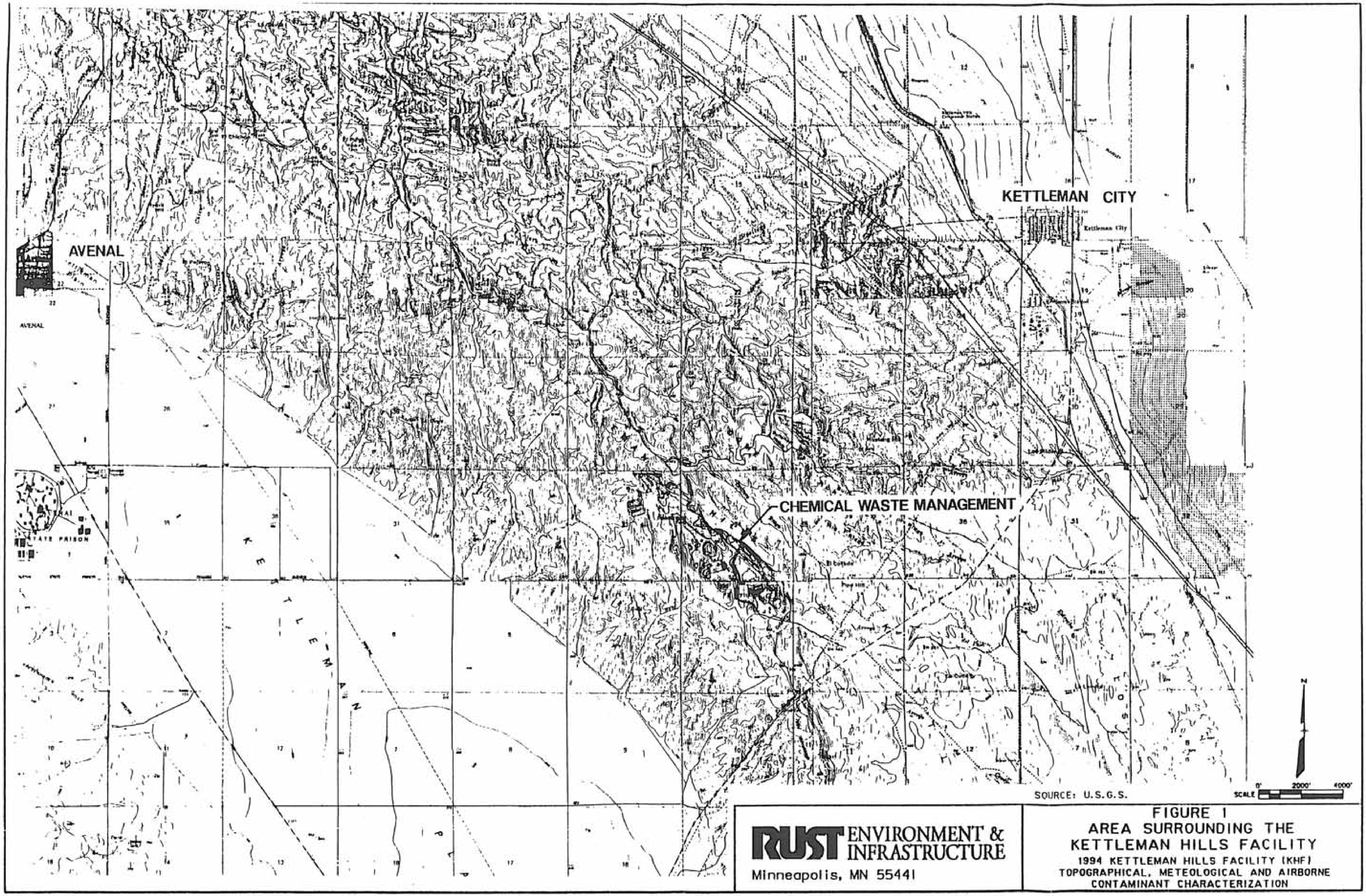
The Kettleman Hills Facility (CWMI) is a Class-I Disposal Site located on the western slope of the Kettleman Hills bordering the western edge of the San Joaquin Valley. The facility is located within U.S. EPA Region IX in Kings County, California, approximately 3.5 miles southwest of Kettleman City and 5 miles southwest of Avenal (See Figure 1).

In February 1988, CWMI was issued a RCRA Part B permit by the U.S. EPA and the State of California Environmental Protection Agency's Department of Toxic Substances Control (DTSC) (formerly the Toxic Substances Control Division of the California Department of Health Services (CDHS)). As required under U.S. EPA condition V.D. and DTSC condition V.C. in the RCRA permits, CWMI must perform the following:

- Fully characterize the topography and meteorological condition that affect the airborne transport of hazardous constituents
- Identify hazardous constituents being emitted into the air from the facility, based on analyses specified in the permits
- Quantify the hazardous constituents through ambient air sampling

In 1991, a workplan was prepared by AeroVironment Inc. entitled "Kettleman Hills Facility Workplan, Topographical and Meteorological Characterization and Airborne Contaminant Identification" (henceforth referred to as the Workplan and included here as Appendix A). This Workplan detailed a strategy to accomplish the emission characterization requirements listed as conditions by the RCRA permits. The Workplan was submitted to the DTSC for review and ultimately obtained approval in a letter dated December 13, 1991 from John A. Papathakis, of DTSC, to Mr. Mark Langowski, the General Manager of CWMI.

In February, 1994, Rust Environment & Infrastructure (Rust) was contracted to carry out the emission characterization project as described in the approved Workplan. From March 15, 1994 through May 04, 1994, Rust collected field samples from each of the active sources of the landfill targeted for this study to determine the presence and quantity of any hazardous constituents. The Final Stabilization Unit (FSU) had subsequent source testing of air emissions performed between January 31, 1995, and February 9, 1995. Once the on-site sampling was complete, air dispersion modeling was performed by combining the hazardous constituent characterization data with the meteorological and topographical data to predict the locations beyond the facility boundaries where maximum impacts from facility emissions were likely to occur. This data was then used to determining the necessity for selecting air monitoring locations to measure the ambient air impacts of facility emissions.



SOURCE: U.S.G.S.

RUST ENVIRONMENT & INFRASTRUCTURE
Minneapolis, MN 55441

FIGURE 1
AREA SURROUNDING THE KETTLEMAN HILLS FACILITY

1994 KETTLEMAN HILLS FACILITY (KHF)
TOPOGRAPHICAL, METEOLOGICAL AND AIRBORNE CONTAMINANT CHARACTERIZATION

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2.0 SITE BACKGROUND/STUDY OBJECTIVES

The objectives of this study were to sample the applicable matrices of all the active sources at the facility and fully characterize their respective hazardous constituent composition. As described in the Workplan, the RCRA permits identify which sources at the facility are potential sources of airborne contaminants. These sources were the surface impoundments, the landfills, and the Hazardous Waste Treatment Units (HWTUs). Figure 2-1 displays the locations of all the CWMI sources and property boundaries. The Workplan went on to further discuss evaporative tanks as a potential source for airborne contaminants. At the time of this study however, no evaporative tanks were active, so these were not included in the sampling. Outlined below is a description of the sources studied at the time of the emission characterization.

2.1 SURFACE IMPOUNDMENTS

The CWMI has had 20 surface impoundments, designated P-1 through P-20. Of these, P-9, P-14, and P-16 were the only active surface impoundments containing aqueous waste during the emissions characterization study.

2.2 LANDFILLS

The CWMI has had 18 landfills, designated B-1 through B-19. Three of the landfills (B-2, B-3, and B-14) have undergone final closure and most of the remaining landfills (B-1 and B-4 through B-11) were undergoing closure activity at the time of this emission characterization study. The proposed landfill B-17 was not in operation at the time of the characterization study. The remaining landfills which were included in this study were:

B-13	This landfill was awaiting final closure.
B-15	This landfill was awaiting final closure.
B-16	This landfill was awaiting final closure.
B-18	This landfill was divided into two Phases, I & II. At the time of the emissions characterization study, Phase II was actively taking waste and Phase I had interim cover. Samples were collected from both phases of the B-18 landfill.
B-19	This landfill was divided into four phases (IA, IB, II, and III). At the time of the emissions characterization study, Phases II and III were covered with a geomembrane liner, and Phase IA had been emptied so that a damaged portion of its liner system could be repaired. Therefore, none of these three phases were included in the study. Phase IB, however, had interim cover and samples were collected from this phase of the landfill.

2.3 HAZARDOUS WASTE TREATMENT UNITS

The Workplan describes the HWTUs to be included in the emissions characterization study. These are listed below:

- The Central Processing Area (CPA) units, which include:
  - the Drum Decant Unit (DDU).
  - the Cyanide Treatment Unit (CTU).
  - the PCB Storage/Flushing Unit.
  - the Drum Storage Unit (DSU).
- The Final Stabilization Unit (FSU), along with the two FSU staging areas

2.4 TARGET COMPOUND LIST

The characterization of the hazardous constituents involved collecting samples from the above named sources and analyzing them for the parameters in the approved Target Compound List (TCL). The TCL is the list of compounds identified in the RCRA Permits to be targeted for sampling in the emissions characterization study. The list of compounds was initially presented in Table 5-2 of the Workplan and is included as Appendix B.

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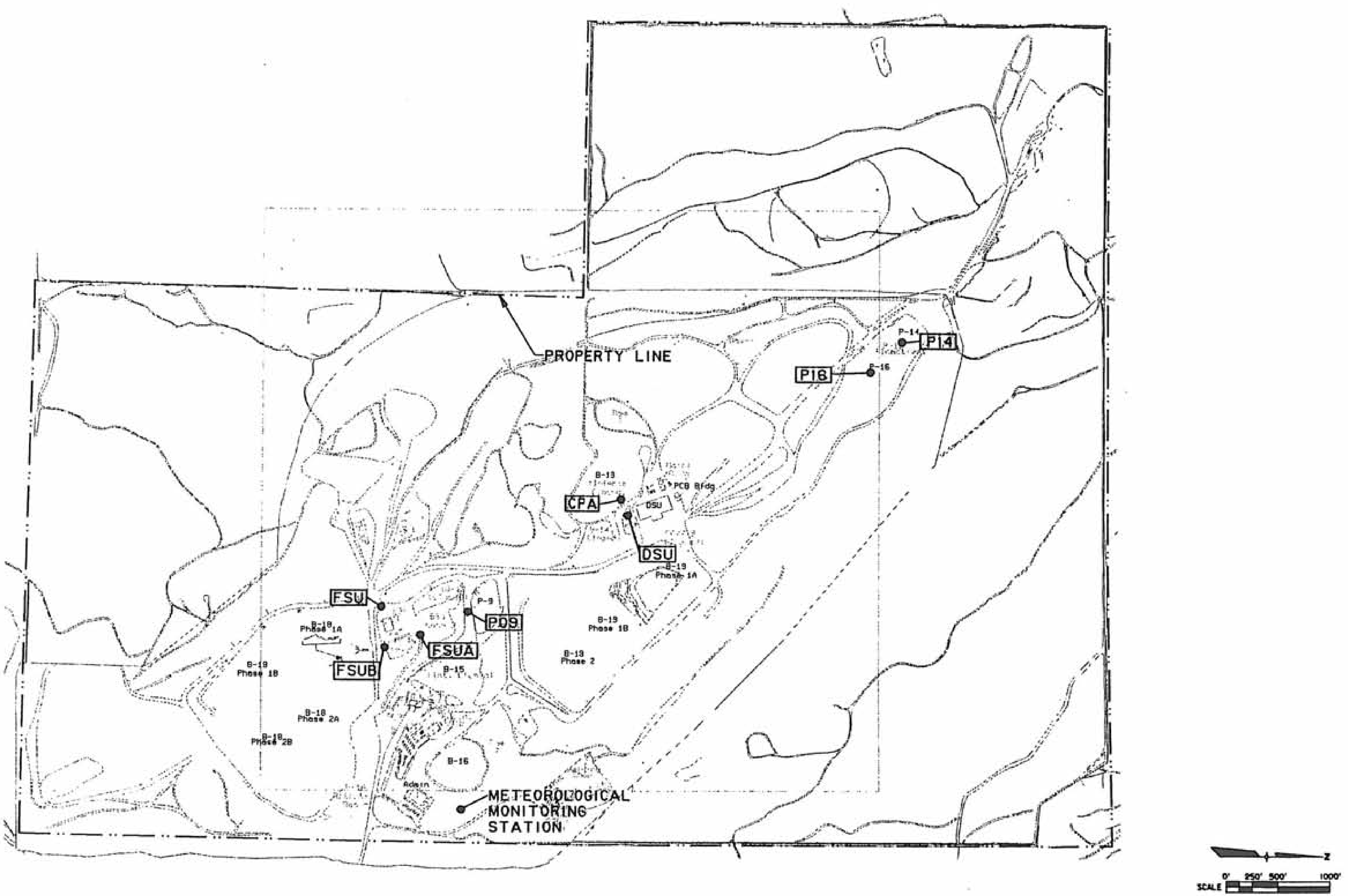

RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 2
EXISTING SITE CONDITION AND AIR SAMPLING LOCATIONS

1994 KETTLEMAN HILLS FACILITY (KHF)
TOPOGRAPHICAL, METEOLOGICAL AND AIRBORNE CONTAMINANT CHARACTERIZATION

3.0 SAMPLING & ANALYSIS STRATEGIES

3.1 INTRODUCTION

Because of the complexity of air emissions sources at the CWMI, characterization of emissions from CWMI sometimes involved collecting samples from more than one matrix per source. This enabled the most accurate determination of air emission rates. For example, at the surface impoundments, both the impoundment liquid and downwind ambient air were sampled. The landfill sampling involved collection of soil composite samples as well as integrated surface samples (ISS) of soil gas emissions. For the hazardous waste treatment units, only downwind air samples were collected. Figure 2 displays the sampling locations respective to each targeted source.

The approaches for sample collection in each specific matrix are described in detail in the Workplan. These approved sampling methods were followed except as discussed in Section 3.2.

3.1.1 Surface Impoundments

In accordance with the approved Workplan, each of the three surface impoundments were sampled once a week over a six-week period. Appendix E displays the dates of actual sampling events throughout the duration of this emission characterization study along with the targeted compound groups for each source. In addition, each sampling episode included collection of ambient air samples downwind from each impoundment. Each air sample was analyzed for the volatile parameters listed in the approved TCL (Appendix B).

3.1.2 Landfills

As stated in the approved Workplan, only surface soils from the active landfills or landfills not finally closed were to be sampled and analyzed for the required semivolatile and inorganic analytes. The Workplan specified that soil samples be collected from B-16, B-18 Phases I and II, and B-19 Phases IA, IB, II, and III. Between the time of development of the Workplan and authorization of the project, B-19 Phases IA, II and III became inactive and covered with plastic sheeting. Therefore, only the areas B-16, B-18 Phases I and II, and B-19 Phase IB were sampled.

At the targeted landfills, B-13, B-15, B-16, B-18 Phases I and II, and B-19, a soil gas sample was also collected using the integrated surface sampling (ISS) method described in the Workplan.

3.1.3 Hazardous Waste Treatment Units

In order to characterize emissions from the hazardous waste treatment units, ambient air monitoring was performed downwind of the CPA, DSU, FSU and FSU Storage areas. Two downwind sampling locations were chosen to characterize the CPA emissions with one of the two located directly downwind of the DSU. An ambient air sampling station was located downwind of the FSU along with each FSU storage area. Stack Test-Monitoring of the FSU stack was also performed to monitor the stack effluent emissions for presence of the hazardous compound targeted in this study. The Stack Test-Monitoring is discussed in Section 3.2.5 of this report.

3.2 SAMPLING AND ANALYTICAL PROCEDURES

3.2.1 Surface Impoundment Liquid Sampling and Analysis

The Workplan required the impoundment sampling events to take place once a week over a 6-week period. The samples were to be taken every sixth day so as not to bias sample representativeness due to weekly operations.

Overall, the actual sampling was performed in accordance with the intent of the plan. However, the sampling was not scheduled to coincide with discharge of wastes because of the costs and difficulty associated with rescheduling (re-arranging for personnel to be available, deliveries of containers, etc.), and because discharge activities were judged to occur for less than 10% of the time and therefore would bias the findings of the study if only those times were selected.

The Workplan prescribed collection of a discrete liquid sample within three feet of the measured bottom of each sampled surface impoundment (ponds). The purpose of sample collection at depth in the ponds was to better characterize potential sources of airborne contaminants originating within the impoundments, as samples collected closer to the surface could be more VOC depleted. Several options for suspending a sampler over the impoundment surface and collecting a discrete sample 3 feet above the bottom of the pond were eliminated for safety and cost reasons. Collecting samples with a pump was not considered good sampling technique because the analyses required volatile organic compound testing and a pump would lead to more VOC losses. Instead, a 2-inch PVC pipe with a slotted end section was slid down the side of each pond to reach areas to be sampled. Using as-built data provided by the CWMI Engineering Department, the required pipe length was calculated using the slope and depth of each pond.

The locations for collecting the discrete samples were chosen to be approximately midway along the length of each pond. This location was determined as reasonably representative of the total pond mixture. The calculated length of pipe was pushed into the pond to the position calculated from the as-built data. This method of placement was used because the heel of the side slope meeting the bottom could not be determined during pipe placement. Following placement, the pipe location was surveyed.

As specified in the Workplan, sampling equipment was dedicated to each surface impoundment. Preceding and following each sampling event, the equipment was rinsed with deionized water. All equipment associated with each pond was wrapped in visqueen and stored adjacent to the pond. All sampling equipment was disposed of at the facility. Equipment blanks and duplicates were also collected as specified in the Workplan.

The Workplan required the surface impoundment samples to be analyzed for volatile and semi-volatile organic compounds. The methods specified for each compound group were those generally used for wastewater and hazardous waste characterization. However, the detection limits required by the DTSC were closer to those more commonly associated with drinking water analyses. Each liquid sample was analyzed by the chemical analysis methods listed below:

EPA Method 624 for volatile organic compounds (VOCs) including allyl chloride, 2-butanol, 1,2-dibromoethane, n-heptane, hexanal, hexane, pentanal, propanal, acrolein, acrylonitrile, and total volatile hydrocarbons (TVH);

EPA Method 8315 for aldehydes;

EPA Method 8080 for polychlorinated biphenyls (PCBs);

EPA Method 608 organochlorine pesticides (pesticides);

EPA Method 8280 for isomer-specific polychlorinated dioxins (dioxins); and

EPA Method 625 for semi-volatile organic compounds (SVOCs) including cumene and n-nitrosodimethylamine.

One modification to the Workplan was to have acrolein and acrylonitrile analyzed by Method 624 instead of the specified Method 603. This modification was made because the analytical laboratory contracted to perform the Method 624 analysis was not EPA-accredited for Method 603 analysis. Because of the need for additional sample handling to forward the samples to a Chemical Waste Management, Inc. (CWM) approved laboratory, a decision was made to have the analysis of acrolein and acrylonitrile included in the Method 624 analysis. A second modification was to have xylenes reported as total xylenes rather than by speciated isomers.

The targeted practical quantitation limits (PQLs) were those specified in the Workplan. These PQLs reflect the detection limits required by the CWMI RCRA Part B permits. Several of the detection limits identified in the Workplan were listed as "to be determined" (TBD). When no detection limits were specified, the analytical laboratory assigned a detection limit similar to other PQLs in the same analyte group.

The (TVH) analysis was performed under Method 624 by quantifying the area associated with the top ten detected peaks selected from the Method 624 sample analysis. This area was then integrated and correlated to the concentration of an associated standard.

EPA Method 607 was the requested analytical method for liquid analysis of n-nitrosodimethylamine, n-nitrosodiphenylamine, and n-nitroso-n-propylamine. These compounds were included with the Method 625 analysis for SVOCs because the analytical lab satisfactorily demonstrated the ability to analyze these compounds with this method. As with the discussed volatiles, the analytical laboratory assigned a PQL to cumene similar to others in the same compound group.

3.2.2 Landfill Soil Sampling and Analysis

The purpose of investigating the landfill soil surface was to characterize the nature of this area as a potential source of air contaminants. In order to accomplish this characterization at each landfill unit or (in the case of B-18 and B-19, each phase) ten sub-samples were collected and lab-composited into one sample for analysis. The composite samples were then analyzed for the targeted semi-volatile organic compounds by EPA Methods 8270 (Semivolatiles), 8080 (Organochlorine Pesticides and PCBs) and 8280 (Dioxins), and selected metals by EPA Methods 6010 and 7471 (CAM Metals).

3.2.3 HWTU and Surface Impoundment Ambient Air Sampling and Analysis

The strategy for collecting ambient air samples followed the procedures outlined in the Workplan except for the specific method modifications described in sections 3.2.3.1 through 3.2.3.5.

All of the locations for placement of sampling equipment followed the prescribed siting requirements stated in the Workplan. For sampling around the HWTUs, two sampling locations for the CPA, one of which specifically targeted the DSU, were selected, along with one station for the FSU, and one station for each of the FSU storage area. The samplers were placed at locations downwind of the specific HWTU based upon current prevailing wind directions.

All of the analytical methodologies described in the Workplan were followed unless specifically discussed in the following sections.

3.2.3.1 VOCs - TO-14 and Total Volatile Hydrocarbons

Ambient air samples were collected in electropolished stainless steel cylinders using the instrumentation and sampling procedures described in the Workplan and EPA Method TO-14 (EPA, 1988). A XonTech model 911A directional sampling system was used with a 12-volt diaphragm pump with an all stainless steel and Teflon construction. Air flow was controlled by a back pressure flow controller.

Several minor modifications to the workplan were proposed to improve the quality of data collected. These proposed modifications were presented to the DTSC and were ultimately approved for incorporation into the Workplan. The first approved modification proposed the addition of acetone and methyl ethyl ketone to the method TO-14 target analytes instead of being sampled and analyzed by method TO-11. The second approved modification proposed the use of directional sampling for VOCs. (The Workplan did not address the use of directional sampling techniques.)

The purpose of directional sampling was to avoid diluting the sample with air which did not come from the source when the wind direction changed during a sampling event. The directional sampling for TO-14 VOCs utilized a wind vane mounted eight feet from the ground surface and located with each VOC sampler (see Figure 3-1). The wind vane activated a solenoid switch which routed the sampled air stream either to or away from the canister. The wind vane was programmed to collect air samples (in-sector) inside of a 180° window. If the wind changed and came from a direction outside of this 180° window (out-sector), the solenoid switch would route the sampled air stream out to vent. During a scheduled sampling event the samplers would be located downwind of the source with the center of the 180° in-sector window directed at the source.

3.2.3.2 VOCs - Carbonyls

Formaldehyde and other carbonyl compounds in air were sampled and analyzed following the procedures discussed in the Workplan. These procedures utilized a method based on EPA Method TO-11 [from the EPA Publication Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, (May, 1988)].

Although not required by the method, two cartridges were used in series to increase the collection capacity of the media and to be able to detect overloading or "breakthrough" of the collection media. Air was pulled through the media using Neuberger pumps with inert Viton diaphragms. The airflow rates were adjusted using needle valve flow controllers. Sampling train airflow calibrations were performed periodically using a precision rotometer calibrated against a primary standard. All direct connections to the SepPak cartridges involved stainless steel luer fittings. Sampling media were handled only with polyethylene or nitrile gloves

The carbonyl samples were collected at airflow rates of approximately 0.3 liters of air per minute (L/min) for eight-hour period sampling, or higher rates of airflow for shorter sampling periods. Flow calibration was done before sampling, periodically during sampling, and after sampling using a precision rotometer calibrated quarterly against a primary volume standard.

3.2.3.3 VOCs - Carbonyl Chloride (Phosgene)

Although the original Workplan called for use of EPA Method TO-6, ambient air samples for phosgene (carbonyl chloride) in air were collected and analyzed according to OSHA Salt Lake City Analytical Laboratory Method No. 61. The modification to use OSHA Method 61 instead of TO-11 was approved by the DTSC in the December 13, 1991, letter from John A. Papathakis of DTSC. This method uses personal air sampling pumps to pull air through solid adsorbent tubes containing XAD-2 adsorbent media treated with 2-(hydroxymethyl) piperidine (2-HMP). 2-HMP reacts with phosgene to form a stable and unique derivative.

This method was used instead of EPA Method TO-6 for several reasons. Method TO-6 uses midget impingers with an aniline in toluene solution. The hazards of handling and shipping this volatile mixture are avoided using OSHA Method No. 61, which uses a solid adsorbent medium. Also, the risk of cross-contamination of other volatile organic compound (VOC) samples with toluene vapors is eliminated using 2-HMP coated solid sorbet media.

SKC Model 224-PCRX7 personal air sampling pumps with variable orifice tube holder (THVO) controllers were used to provide a sampling rate of between 0.5 and 0.7 liters of air per minute. Flow calibration was done before and after sampling using a precision rotometer calibrated quarterly against a primary volume standard. When duplicate samples were collected, two identical sampling trains were used and identical sample airflow collection rates were targeted.

The samples were removed form the sampling train after the sampling period (usually eight hours) and were capped using a polypropylene end cap. Samples were shipped overnight in insulated coolers. Reduced temperatures were not used because the method reports that samples are stable for over two weeks at ambient temperatures.

2-HMP reacts with phosgene to form a stable and unique derivative. The derivative was analyzed by gas chromatography with a nitrogen-phosphorous detector (GC-NPD).

3.2.3.4 Semivolatile Organic Compounds (SVOCs)

The methodologies listed in the Workplan to sample and analyze for SVOCs in air include U.S. EPA methods TO-4 (pesticides and PCBs), TO-7 (nitrosamines), TO-8 (phenols and cresols), TO-9 (dioxins), and TO-13 (polynuclear aromatic hydrocarbons). Method TO-7 uses an adsorption cartridge for the detection of nitrosamines, and Method TO-8 uses an impinger sampling train for collection of phenols and cresols. The sample collection method for TO-4, TO-9, and TO-13 involve a modified high volume sampler with a sample collection cartridge consisting of a small glass fiber filter followed by a polyurethane foam (PUF) plug. Once a sample is collected, the filter and PUF plug undergo extraction and analysis for the compounds in the above lists. This sampling method is often modified to include a layer of XAD-2 adsorbent resin sandwiched within the PUF plug to allow for greater capture of gas phase volatiles. An approved modification to the Workplan included the utilization of such a PUF/XAD-2 cartridge.

Another modification to the procedures described in the Workplan involved the sampling of all the SVOCs by Method TO-13 sampling techniques. The laboratory chosen for the analysis of SVOCs demonstrated the ability to detect and quantify compounds beyond the TO-13 list after the extraction of a filter and PUF/XAD-2 cartridge. This expanded compound list was very similar to the 8270 compound list for soil analysis and included the target phenols and nitrosamines. Furthermore, once the sample was extracted, pesticides and PCBs could also be analyzed from the extract, as well as dioxins, by shipping an aliquot of the sample extract to an approved dioxin laboratory. By following the sampling procedures in TO-13, all of the required detection limits were achievable based on a sample volume of approximately 100 m^3 of air. Therefore, because of the demonstrated ability to collect and analyze all of the targeted SVOCs to the required detection limits, the DTSC approved the modification to utilize a single sample collection method (TO-13) to identify all of the SVOCs on the TCL.

The procedure for sampling SVOCs involved drawing air through a quartz filter and PUF/XAD-2 cartridge at approximately 0.214 m^3/min for an eight hour sampling period in order to collect the minimum required sample volumes. The quartz filter was used to collect particulate matter, including any SVOCs in particulate form. Vapor phase SVOCs are drawn into the PUF/XAD-2 plug and chemically react with the PUF/XAD-2 to remain bound to this media until chemically extracted in the laboratory.

3.2.3.5 Inorganic Metals

To characterize particulate and metals emissions from the HWTUs, the Workplan described the collection method of taking the small glass fiber filter from the TO-13 sampling apparatus and cutting it in half, using one half for SVOC analysis and the other half for metals analysis. An alternative procedure was approved by the DTSC, which used a separate high volume particulate sampler to be located along with the other sampling equipment at the designated sampling locations. The high volume sampler would operate over the course of a working day and collect particulate onto an 8 by 10 inch quartz fiber filter. Once the sample was collected, the filter was removed, measured for total particulate matter, and then analyzed for the metal compounds listed on the TCL.

Sampling techniques followed the protocol outlined in 40 CFR, Part 50 Appendix J, as well as the EPA Quality Assurance Handbook for Air Pollution Measurement Systems: Volume II Ambient Air Specific Methods; Section 2.2, January, 1983. The advantage to using a separate sampling apparatus for particulate/metals sample collection was that the TO-13 filter would not have to be cut in half. Cutting the filter in half raises detection limits and increases the potential for inaccurate weighing of collected particulates.

3.2.4 Landfill Integrated Surface Sampling (ISS) and Analysis

In order to characterize gas emissions from the surface of the landfills, an integrated surface sample (ISS) was collected from each of the landfills targeted by this study. These landfills included B-13, B-15, B-16, B-18, Phases I and II, and B-19, Phases IA, IB, II, and III. As described in Section 3.1.2, only B-19 Phase IB of the B-19 phases could be sampled at the time of the study.

To collect the ISS samples, a portable sampling device was required that enabled multiple sampling apparatus to be attached. This allowed more than one type of sample to be collected simultaneously. As stated in the Workplan, the strategy was to walk a 50,000 ft^2 grid, for 25 minutes, with a sample probe located two to three inches above the surface of the landfill and collect a time-integrated soil gas emissions sample. Once collected, this sample would be analyzed for the VOCs on the TCL.

The Workplan briefly described the ISS sampling apparatus as a backpack equipped with an internal power source, 12-volt pump with an unlubricated Viton rubber diaphragm, Teflon tubing sample line with a six inch diameter, 316 stainless steel funnel, Tedlar bag sample containers for TO-14 VOCs, along with other sampling media, pumps and impingers for the carbonyls and phosgene. Several modifications to the sampling apparatus and sampling methodologies were proposed to DTSC in order to improve the likelihood of maintaining sample integrity while logistically carrying such a sampling apparatus. These modifications which were approved by DTSC included:

- Substitution of OSHA Method 61 in place of the impinger method for phosgene collection. This modification was previously described in the ambient air sample collection section.
- Substitution of an electropolished stainless steel canister in place of the Tedlar bag. Canisters maintain sample integrity longer and are easier to ship and handle.
- Substitution of the backpack with the sampling equipment being placed on a small dolly. This dolly was wheeled around the landfill surface, collecting samples according to the procedures described in the Workplan. Figure 3-2 displays the modified sample collection device.

3.2.5 Final Stabilization Unit (FSU) Stack Sampling

To determine if any target analytes were being discharged from the FSU building, source testing was performed. Due to the effort and expense associated with stack testing for the number of analytes targeted in this study, CWMI decided to use the stack testing data for emission inventory reporting to the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD). This data was used to help comply with the "Hot Spots" reporting requirements regulated by the SJVUAPCD. As a result of using this data for "Hot Spots" the source testing methods were selected and modified to meet the sampling requirements of both DTSC and the SJVUAPCD.

Parsons Engineering Science, Inc. (PES) from Irwindale, California was selected to perform the required stack sampling. PES, CWMI and Rust composed the source testing protocol (STP) which described sampling and analytical methods, along with a general approach for testing the stack emissions from the FSU. The STP was submitted to the SJVUAPCD and the California Air Resources Board (CARB) for review. The STP went through several modifications in order to meet the requirements of the "Hot Spots" program while still meeting the objectives of the emissions characterization study regulated by DTSC. A copy of the STP, along with a summary of the final approved modifications, is located with the FSU source testing report in Appendix J.

Figure 3-1

VOC SAMPLING PHOTOS

Figure 3-2

ISS SAMPLING PHOTOS

4.0 SAMPLING OPERATIONS

4.1 LANDFILL SOIL SAMPLING

In order to determine the specific locations where soil samples were to be taken, Rust obtained topographic maps of the appropriate landfills and landfill phases from the CWMI Engineering Department, divided each into 10 approximately equal subareas and randomly identified a sample location in each subarea. The preliminary locations were reviewed by CWMI and suggestions were made for repositioning several sample collection points to avoid sampling on steep slopes or through deep cover material. As a result of the suggestions made by CWMI, several sample locations were moved to more accessible points where cover was estimated to be 1-2 feet rather than 6-8 feet thick. The CWMI survey team identified the sampling locations with flagged stakes, and then surveyed and plotted the locations. The figures found in Appendix C identify the final sampling locations by their respective survey points and sample identification.

Additionally, CWMI requested that two additional sets of 10 samples be collected in Phases I and II of B-18. It was agreed that an "A" and "B" sample would be collected at different locations in two sets of subareas within the phases. Also, one set of 10 samples (B-18-II-1A through 10A) was split by the laboratory to generate a replicate. The split samples were designated as COMP A and COMP B for separate laboratory analysis.

A stainless steel slide-hammer device fitted with a stainless steel sample sleeve was used for the collection of the 10 samples from each landfill area. The sampling technicians collected the samples from 0-6 inches below ground surface immediately adjacent to each staked sample location. All 10 samples were then sent to the laboratory where composite samples were prepared to be analyzed as representative of each landfill area.

Sample equipment coming into contact with the soil was rinsed using deionized water between collection of each sample in each subarea. The equipment was washed with deionized water and non-phosphate detergent and further rinsed with deionized water between collection of samples from different phases or landfills. Equipment was sun dried after rinsing.

In order to meet the project start date agreed with DTSC, the soil samples were collected on March 15 and 16, 1994. The tables found in Appendix E indicate the sample collection date along with the required analysis for all of the landfill soil samples.

4.2 LANDFILL INTEGRATED SURFACE SAMPLING

4.2.1 VOCs

The ISS sampling for VOCs followed the procedures described in the Workplan and any approved modifications discussed in Section 3.0

In order to establish the exact grid locations, an approximate position of the grid was located by Rust. After the general area was agreed upon, the CWMI survey team surveyed and plotted the locations of the four corners of each landfill grid. The target grid size was approximately 50,000 quare feet, with the exact grid area determined by surveying. The figures found in Appendix D, display the surveyed ISS exact grid area respective to each sampled landfill. Appendix E lists the sampling dates and the required analysis for all ISS sampling.

In order to lower compound detection limits without significantly modifying the approved collection procedures, the duration of sample collection was increased from 25 to 30 minutes at each site.

4.2.1.1 TO-14

All TO-14 sampling was done in accordance to the Workplan and any approved modifications. No significant problems were encountered with the TO-14 and TVH sampling and analysis.

4.2.1.2 Carbonyl Chloride (Phosgene)

The airflow rates for phosgene samples were increased to the extent possible in order to maximize the sensitivity of the method (OSHA Method 61 for carbonyl chloride [phosgene]), Because of the maximum sample time consideration for other samples, however, it was not possible to extend the sample collection period. Thus, the airflow rate was critical in determining airborne detection limits. The highest flow rates which the pumps could maintain were used.

Limitations of the sampling pumps' ability to overcome the back-pressure of the sampling media made it impossible to achieve the same airborne detection limits as with the eight-hour samples collected at the surface impoundments and hazardous waste treatment units. In order to improve the detection limits of collected samples, ISS samples which were collected on or before April 20, 1994 at less than 0.8 L/min were re-sampled at 1.3 to 1.5 L/min from May 2 - 5, 1994. The actual method detection limits are shown in Table 4-1.

4.2.1.3 Carbonyls

As with Phosgene, in order to obtain the lowest achievable detection limits, the air sampling rates for the ISS samples collected by EPA Method TO-11 were increased to maximize sensitivity. Due to the large back-pressure across the treated SepPak sampling media cartridges, however, it was not possible to collect samples at significantly higher flow rates. Most of the actual flow rates used were below 1.5 L/min. Lower flow rate increases were necessary in some cases, due in part to the high back pressure on the cartridges or related Neuberger pump limitations.

The initial results of carbonyl sample analysis indicated higher levels of aldehydes in the secondary cartridge than the primary cartridge. Once it was verified that the primary and secondary cartridges had not been placed in reverse order, it was hypothesized that the sampling train might be contributing contaminants to the secondary tube. Amber latex tubing was used upstream of the sampling media in the original sampling train configuration. This was replaced with polytetrafluoroethylene (PTFE)-lined Tygon tubing. Additionally, three instead of two cartridges were used in series to further investigate the possibility of sampling media breakthrough. The results are discussed in Section 5.1.

4.3 SURFACE IMPOUNDMENT LIQUID SAMPLING

For sample collection, a standard 2-inch, single-ball PTFE bailer was pushed down the inside of the PVC pipe to a distance of 3 feet vertically above the base of the pond. Surface impoundment liquid sampling followed all of the discussed procedures and no significant problems were encountered.

4.4 HAZARDOUS WASTE TREATMENT UNIT AND SURFACE IMPOUNDMENT AMBIENT AIR SAMPLING

The techniques and sampling procedures for collecting ambient air downwind of the targeted surface impoundments and HWTUs were the same for each source type. Therefore, they will be discussed together in the following sections.

For each surface impoundment and hazardous waste treatment unit, a reference location was identified to serve as a benchmark for locating the sampling equipment. This location was surveyed and plotted by the CWMI survey team. Figure 2-1 displays the general locations for locating the ambient air sample equipment at each of these sources. During each sampling event, the exact placement of the sample trailer was referenced to each source's respective benchmark and was generally within 20 feet of the surveyed benchmark..

The locations for placement of the ambient air sampling equipment downwind of the surface impoundments and HWTUs were dependent upon the wind direction at the time of sampling. Therefore, the sampling equipment had to be portable. To accommodate this portability requirement, the sampling equipment was placed upon open-top trailers which could be moved from about the site and adjusted for specific wind conditions. Figure 4-1 displays the equipment/trailer setup. Each trailer was configured with the equipment needed to collect all target compounds at a specific site during a scheduled sampling event, including the required duplicates. Three trailers were setup with sampling equipment and used throughout the project.

The VOC sampling equipment was battery powered so it did not require continuous 110 volt power supply. However, the high volume (Hi-Vol) air samplers, utilized at the HWTUs to collect the metals and SVOCs, required 110 volt continuous power supplied to the units for the entire duration of sample collection. Because the exact sampling locations were wind direction dependent, 110 volt receptacles with extension cords could not be used. To obtain the required power for sampling, a diesel-powered generator was used at each site. The generators were placed at least 50 feet downwind of the sampling location and moved if the wind direction changed enough for the collected samples to be impacted by the generators. Figure 4-1 displays the generator placement relative to the respective sample trailer.

4.4.1 VOCs

4.4.1.1 TO-14

Canister sampling for TO-14 VOCs and TVHs utilized the directionally controlled Xontech Model 911A sampler. The inlet consisted of a stainless steel inverted cone connected to stainless steel and/or Teflon tubing and fittings which routed the air through a viton sealed pump and into the canister. The inlet was placed approximately five feet above the ground surface and was gently packed with silanized glass wool for particulate filtration. Because the units were directionally controlled and had the potential for sample interruption, air collection flow rates were adjusted to collect approximately 12 liters of air over the eight hour sampling event. The minimum required sample volume was approximately six liters.

The Workplan specified equipment blanks and duplicate samples to be collected. Because the Workplan did not discuss how these QA/QC samples should be taken, a discussion is provided in the following paragraphs.

Duplicate samples were collected by splitting the metered flow exhaust from the sampler between two canisters. The duplicates were rotated between the three sample locations and collected at a rate of one per sampling event. When a duplicate sample was taken, flow rates were doubled to accommodate the required increase in collected volume.

Equipment blanks were collected by attaching a zero air supply to the sampler inlet and collecting an air sample through the system. An in-line activated charcoal filter was placed between the zero air supply and the sampler to further scrub the clean air source. Sample flow rates were increased so that blanks could be collected in one to two hours. Once an equipment blank was taken, the sampler was sealed until the next sampling event. Most of the blanks collected immediately prior to a scheduled sampling event with the equipment blank sampling rotated between the three samplers each sampling event. One equipment blank was collected during each sampling event as required by the Workplan.

All of the sampling procedures followed the protocol discussed in the Workplan and any approved method modifications. The only problems encountered with the TO-14 and TVH sampling occurred on May 2, 1994, at FSU-A and on May 3, 1994, at Surface Impoundment P-9. On both of these days the sampling equipment malfunctioned midway through the sampling event. As a result the samples were voided and both recollected on May 4, 1994. No further problems with the sampling or analysis were encountered.

4.4.1.2 Phosgene

Phosgene samples were collected as described in Section 3.2. The only modification in field sampling protocol was the increase of the sampling rate from 0.5 to 0.7 L/min to up to 1.3 to 1.5 L/min.

4.4.1.3 Carbonyls

As discussed previously, the results of analysis of initial rounds of carbonyl samples indicated higher levels of aldehydes in the secondary cartridge than the primary section. Although this may have indicated breakthrough, further investigation found fairly good agreement between duplicate samples. This would not be expected if significant breakthrough occurred. This is discussed further in 5.1.2. No further problems were encountered with the carbonyl sampling.

4.4.2 SVOCs

Sample collection and analysis of all SVOCs followed the sampling procedures described in the Workplan and any approved modifications. To collect the required 100 m^3 of ambient air, the sample collection flow rates were adjusted to approximated 0.214 m^3/min for the eight hour sampling event.

Field blanks were collected by identifying a clean filter as the designated blank sample for a given sampling event. This filter accompanied the sample filters to the respective sampling site and remained with these filters throughout the sampling process and shipment to the laboratory. The field blank was analyzed and reported identically as the associated sampled filters.

No problems were encountered with the SVOC sampling by Method TO-13.

4.4.3 Metals

Sample collection and analysis of the inorganic metals followed the approved modification to the sampling and analysis procedures described in Section 3.2.3.5.

Field blanks were collected by identifying a clean filter as the designated blank sample for a given sampling event. This filter accompanied the sample filters to the respective sampling site and remained with these filters throughout the sampling process and shipment to the laboratory. The field blank was analyzed and reported identically as the associated sampled filters.

No problems were encountered with the sampling and analysis of inorganic metals by the approved procedures.

4.5 FINAL STABILIZATION UNIT STACK SAMPLING

Once final approval of the FSU - STP was obtained from both CARB and SJVUAPCD, all subsequent sampling and analysis followed the STP and approved modifications.

One week prior to performing the required FSU stack testing, all of the pre-test calculations were submitted to the SJVUAPCD for review and approval. The pre-test calculations included the method practical quantitation limits (PQLs) and estimated source concentrations (ESCs). The PQLs were calculated using the targeted sample volumes along with background contaminant concentrations found in the sampling media batches to be used for the testing. The PQLs were compared to the ESCs to verify that the approved sampling methods were capable of detecting the target analyte concentrations estimated to be present in the exhaust gas. All of the approved pre-test calculations are included with the FSU source testing report located in Appendix J.

All of the FSU source testing was performed between January 31, 1995, and February 9, 1995. The FSU source testing report describes the sampling operations occurring during the testing period.

Figure 4-1

POWER GENERATION PLACEMENT PHOTOS

TABLE 4-1

VOLATILE ORGANIC COMPOUND AIR MONITORING AIRBORNE DETECTION LIMITS FOR PHOSGENE

Page 1 of 2

SAMPLE NUMBER	PHOSGENE (ppbv)	Comment
B13 - 050294	< 51.89	See Note 4
B15 - 050294	< 46.03	See Note 4
B16 -050494	< 44.12	See Note 4
B18 PHI - 050194	< 50.33	B18 Phase I - See Note 3
B18 PHII - 050194	< 41.74	B18 Phase II - See Note 3
B18 PHII - 050194-D	< 43.42	B18 Phase II - See Note 3
B19 -050494	< 43.02	See Note 4
CPA -041494	< 6.15	
CPA -042094	< 5.49	
CPA -050194	< 3.14	
DSU -041494	< 6.09	
DSU -042094	< 5.13	
DSU -042094D	< 5.57	
DSU -050194	< 2.98	
FSU -041394	< 5.94	
FSU -041394D	< 6.02	
FSU -041994	< 6.07	
FSU -050294	< 3.60	
FSUA -041394	< 6.00	
FSUA -041994	< 6.06	
FSUA -050294	< 3.09	
FSUA -050294D	< 3.49	
FSUB -041394	< 6.16	
FSUB -041994	< 6.30	
FSUB -041994D	< 6.20	
FSUB -050294	< 3.32	
P 9 -033194	< 9.28	
P 9 -040694	< 5.26	
P 9 -040694D	< 5.11	
P 9 -041294	< 5.41	
P 9 -041894	< 6.23	

TABLE 4-1

VOLATILE ORGANIC COMPOUND AIR MONITORING AIRBORNE DETECTION LIMITS FOR PHOSGENE

Page 2 of 2

SAMPLE NUMBER	PHOSGENE (ppbv)	Comment
P 9 -043094	< 3.88	
P 9 -043094D	< 3.19	
P 9 -050394	< 4.37	
P14 -033194	< 7.83	
P14 -040694	< 6.23	
P14 -041294	< 5.69	
P14 -041294D	< 5.69	
P14 -041894	< 6.28	
P14 -043094	< 4.59	
P14 -050394	< 4.43	
P14 -050394D	< 4.15	
P16 -033194	< 5.19	
P16 -033194D	< 5.19	
P16 -040694	< 5.80	
P16 -041294	< 5.98	
P16 -041894	< 6.04	
P16 -041894D	< 6.22	
P16 -043094	< 3.81	
P16 -050394	< 4.07	
NOTES:		

1) "ppbv" means parts per billion by volume in air

2) "<" means less than stated value (airborne detection limit)

3) The analytical detection limit was 8 micrograms (μg) per sample

4) Based on method and flow rate constraints, this was the best detection limit possible within the time allowed

Table displays positively detected sampling results only.

5.0 ANALYSIS OF SAMPLES

5.1 DISCUSSION OF RESULTS

All analyses were performed by either California Laboratory Services (CLS), Enseco California Analytical Laboratory (Enseco, a CLS subcontractor), Air Toxics LTD., Ross Analytical Services, Inc. (Ross), West Coast Analytical Service, Inc. (an Air Toxics LTD subcontractor), and ALTA Analytical (an Air Toxics LTD subcontractor). California Laboratory Services had been identified during the project approval process to perform the soils and liquids sample analyses by methods for which they have approval. Ross performed all analysis of inorganic metal samples, WCAS performed the phosgene analysis and Air Toxics LTD, along with their subcontractors, performed all remaining analysis of collected air samples.

Table 5-1 shows the detected concentration ranges of all analytes for each sampled matrix. This table summarizes the data from all the analyses performed and readily allows correlation between matrices when more than one matrix per source was sampled for the same compound. For example, Acetone was detected in the liquid samples collected from the surface impoundments at 15,000 ug/L. Acetone was also detected in the air collected downwind of the surface impoundments from 6.9 - 120 ppbv. The following sections, 5.1.1 - 5.1.5, discuss the results from each targeted source and contain tables of detected hits for each compound group.

5.1.1 Landfill Soil Sampling

The analysis of landfill soil samples followed the Methods specified in the Workplan. However, the required Method Detection Limits (MDLs) listed in the Workplan were generally lower than those achieved by CLS and similar laboratories. It was agreed in a telephone conversation between CWMI, Rust and DTSC personnel (March 15, 1994) that the higher CLS detection limits would be used for EPA Method 6010, EPA Method 8270 and EPA Method 8080.

Of the parameters analyzed in the soil samples collected at sources B-16, B-18 Phase I and IA, B-18 Phase II and IIB, and B-19 Phase IB, many were not detected including all SVOCs (EPA Method 8270), all pesticides (EPA Method 8080) and a number of metals including antimony, beryllium, cadmium, molybdenum and silver, thallium. Mercury and selenium were detected in several samples. The metals results are shown in Table 5-2. Finally, other SVOC parameter groups including PCBs (EPA Method 8080) and polychlorinated dioxins/furans (EPA Method 8280) had sporadic detections of some of the analytes. These are shown in Table 5-3.

5.1.2 Landfill Integrated Surface Sampling

5.1.2.1 VOCs

<u>TO-14</u>

The analysis for TO-14 VOCs indicated the presence of ten target compounds. These results are shown in Table 5-4. Acetone, methylene chloride and hexane are common laboratory solvents and detected hits are often attributed to laboratory contamination.

Phosgene

No phosgene was detected at or above the airborne detection limit in any of the integrated surface samples collected at landfill sites B13, B15, B16, B18 (Phase I and II), and B19 Phase IB. However, since these air sample volumes were much lower than for the eight-hour samples (integrated surface sample periods were only 30 minutes in duration, as required by the work plan), the airborne detection limits were higher. The laboratory also reported an overlap of chromatographic peaks which were reported as co-eluting compounds. This resulted in a higher analytical method detection limit than anticipated, based on the OSHA Salt Lake City Analytical Laboratory Method and telephone conversations with Warren Hendricks, an OSHA chemist and developer of the method. The actual airborne detection limits are as shown in Table 4-1.

Carbonyl

As shown in Table 5-5, the carbonyl results were generally low. No acrolein, benzaldehyde, or hexanal were detected in any of the integrated surface samples.

The TO-11 samples were collected with two or three SepPak cartridges in series. Generally, more carbonyls were found in the second cartridge than the first cartridge. The results shown in Table 5-5 are based on the total amounts of each compound reported for the sampling train.

The results of the carbonyl analysis by method TO-11, performed on each individual SepPak cartridge, were added together per species to form a total result per sample. For many of the TO-11 samples, the second (or third in some cases) SepPak cartridge results were higher than those found in the first cartridge. This phenomena would indicate that the first cartridge was saturated with analyte and breakthrough to the backup cartridges was occurring. However, because the results in the backup cartridges were higher, in some cases, than those in the preceding cartridges, it also appeared that the front cartridge was not saturated with a given analyte. If breakthrough of analyte between SepPak cartridges was occurring, the possibility for compound loss would probably yield erratic results with poor sampling precision between samples. Table 5-6 displays the sample and associated duplicate results, along with the calculated percent difference, for all TO-11 duplicate sampling. In most cases the percent difference between the sample results and associated duplicate were less than 25 %. This would indicate that overall good precision was achieved with the TO-11 sampling. Because of the demonstrated precision of the sampling technique, the results of the carbonyl sampling and analysis probably accurately represent the order of magnitude of carbonyls present in the air directly above the soil surface of the sampled landfills.

5.1.3 Surface Impoundment Liquid Sampling

Tables 5-7 (SVOC Analysis Results) and 5-8 (VOC Analysis Results) display the detected compounds of the liquid analysis from the surface impoundment sampling. As indicated on Table 5-7, the only detected SVOCs were PCBs and dioxins.

The dioxin analysis by Method 8280 indicated low level OCDD concentrations in most of the samples collected ranging from 0.51 - 12 ng/L. The only other detected dioxin was 1,2,3,4,6,7,8-HpCDD which was found in P-9 at 0.58 ng/L and P-16 at 1.9 ng/L.

The PCB analysis by Method 8080 showed Arclors 1016, 1248 and 1254 present in P-16 and Arclor 1260 present in P-9 and P-14. The low level concentrations of detected PCBs ranged from 0.89 - 2.6 ug/L.

No other SVOCs were present in any of the surface impoundment liquid samples.

As indicated on Table 5-8, only acetone, methylene chloride and acetaldehyde were present in the liquid samples analyzed for VOCs. Acetaldehyde was also present at 1.1 mg/L in the P-14 equipment blank collected on March 31, 1994. TVHs were not detected in any of the samples.

5.1.4 Surface Impoundment Ambient Air Sampling (VOCs)

5.1.4.1 VOCs

TO14

The analysis for TO-14 VOCs indicated the presence of 14 compounds in the air sampled downwind of the surface impoundments. Table 5-9 displays the concentrations for all detected TO-14 compounds present in the samples. Acetone, benzene, hexane, 2-butanone, toluene and xylenes were found in most of the samples collected. The equipment blanks collected immediately prior to a scheduled sampling event found acetone present at 6.2 - 89 ppbv, benzene present in one blank at 0.80 ppbv, hexane present at 0.66 - 4.0 ppbv, toluene present at 0.55 - 16 ppbv and xylenes present at 0.28 - 0.41 ppbv. The fact that these compounds were found in most of the samples, as well as most of the collected equipment blanks, indicate the compounds may have been introduced to the sample from the equipment. The other detected compounds were all present at very low levels and only detected sporadically.

Phosgene

No phosgene was detected in any of the samples collected at the surface impoundment ponds. Note that airborne detection limits varied because of varied air sample volumes. Table 4-1 presents the airborne detection limits for this method.

Carbonyl

As shown in Table 5-5, the carbonyl results were generally low. No acrolein was detected in any of the surface impoundment air samples. Hexanal was only detected in two of the samples. Low quantities of other carbonyl compounds were reported, as shown in Table 5-5.

As with the ISS sampling for carbonyl compounds, the TO-11 samples were collected with two or three SepPak cartridges in series. As discussed in Section 5.1.2 under Carbonyls, the potential for breakthrough was present, however, the duplicate precision data display in Table 5-6 support the results as shown.

5.1.5 Hazardous Waste Treatment Unit Sampling

5.1.5.1 VOCs

TO14

The analysis for TO-14 VOCs indicated 13 compounds present in the air samples collected downwind of the HWTUs. Table 5-10 displays the resulting concentrations of those detected hits. Acetone, benzene, hexane, 2-butanone, toluene, 1,1,1-trichloroethane and xylenes were present in most of the collected samples. As with the surface impoundment results, acetone (6.8 - 15 ppbv), hexane (0.33 - 1.2 ppbv), benzene (0.95), toluene (2.1 - 12 ppbv), and xylenes (0.24 - 3.1 ppbv) were sporadically present in equipment blanks collected just prior to a scheduled sampling event. Again this would indicate the possibility that these compounds may have been introduced to the sampling equipment from the equipment. No 1,1,1-trichloroethane was detected in any of the equipment blanks. The other detected VOCs were all present at low levels and only periodically detected.

Phosgene

No phosgene was detected in any of the samples collected at the Hazardous Waste Treatment Units. Note that airborne detection limits varied, because of varied air sample volumes. Table 4-1 presents the airborne detection limits for this method.

Carbonyl

As shown in Table 5-5, the carbonyl results were generally low. No acrolein was detected in any of the Hazardous Waste Treatment Unit air samples. Low quantities of other carbonyl compounds were reported, as shown in Table 5-5.

The discussion on breakthrough, as presented in Sections 5.1.2 and 5.1.4, applies here as well.

5.1.5.2 SVOCs

The analysis for SVOCs indicated two dioxins as well as napthalene and phenol present in the air samples collected downwind of the HWTUs. Table 5-11 displays the resulting concentrations of these detected hits. OCDD was present in all but one of the samples with a concentration ranging from 33E-06 - 1500E-06 pptv. 1,2,3,4,6,7,8-HpCdd was detected at the CPA on April 14, 1994, at

9

21E-06 pptv and at the FSU on April 13, 1994, at 100E-06 pptv. Napthalene was present in many of the samples with a concentration ranging from 0.004 - 0.012 ppbv. Phenol was detected only once. No SVOCs were found in the collected field blanks.

5.1.5.3 Metals

The analysis for inorganic metals indicated ten metals present in the air samples collected downwind of the HWTUs. Table 5-12 displays the resulting concentrations of the detected hits of metals. Barium, copper and zinc were present in almost all of the samples ranging from 0.023 - 0.43 ug/m^3, 0.042 - 0.34 ug/m^3, and 0.10 - 5.5 ug/m^3 respectively. Chromium, nickel and vanadium were present in many of the samples collected near the FSU. Cadmium, cobalt, lead and mercury were only present in several of the HWTU air samples.

5.1.6 Final Stabilization Unit Stack Sampling

A complete discussion of the stack sampling and analysis of the final stabilization unit is located in Appendix J.

TABLE 5-1[j]
CONCENTRATION RANGE OF TARGETED COMPOUNDS
Page 1 of 4

	CAS[a] No.	Air Analysis Method	Concentration Range of Detected Compounds (ppbv)[b]	Water Analysis Method	Concentration Range of Detected Compounds (ug/L)[c]	Soil Analysis Method	Concentration Range of Detected Compounds (mg/kg)[d]
SEMIVOLATILES							
PESTICIDES							
Aldrin	309-00-2	TO-13[e]	ND	608	ND	8080	ND
Chlordane	57-74-9	TO-13[e]	ND	608	ND	8080	ND
4,4'-DDD	72-54-8	TO-13[e]	ND	608	ND	8080	ND
4,4'-DDE	72-55-9	TO-13[e]	ND	608	ND	8080	ND
4,4'-DDT	50-29-3	TO-13[e]	ND	608	ND	8080	ND
SVOCs							
Acenaphthylene	208-96-8	TO-13	ND	625	ND	8270	ND
Anthracene	120-12-7	TO-13	ND	625	ND	8270	ND
Benzo(a)anthracene	56-55-3	TO-13	ND	625	ND	8270	ND
Benzo(b)fluoranthene	205-99-2	TO-13	ND	625	ND	8270	ND
Benzo(k)fluoranthene	207-08-9	TO-13	ND	625	ND	8270	ND
Benzo(g,h,i)perylene	191-24-2	TO-13	ND	625	ND	8270	ND
Benzo(a)pyrene	50-32-8	TO-13	ND	625	ND	8270	ND
2-Chloronaphthalene	91-58-7	TO-13	ND	625	ND	8270	ND
Chrysene	218-01-9	TO-13	ND	625	ND	8270	ND
o-Cresol	95-48-7	TO-13[e]	ND	625	ND	8270	NR[g]
p-Cresol	106-14-5	TO-13[e]	ND	625	ND	8270	NR
Cumene	98-82-8	TO-13	ND	625	ND	8270	NR
Dibenzo(a,h)anthracene	53-70-3	TO-13	ND	625	ND	8270	ND
Fluoranthene	206-44-0	TO-13	ND	625	ND	8270	ND
Fluorene	86-73-7	TO-13	ND	625	ND	8270	ND
Indeno(1,2,3-c,d)pyrene	193-39-5	TO-13	ND	625	ND	8270	ND
Naphthalene	91-20-3	TO-13	0.004-0.012	625	ND	8270	ND
Nitrobenzene	98-95-3	TO-13	ND	625	ND	8270	ND

TABLE 5-1
CONCENTRATION RANGE OF TARGETED COMPOUNDS
Page 2 of 4

	CAS[a] No.	Air Analysis Method	Concentration Range of Detected Compounds (ppbv)[b]	Water Analysis Method	Concentration Range of Detected Compounds (ug/L)[c]	Soil Analysis Method	Concentration Range of Detected Compounds (mg/kg)[d]
N-Nitrosodimethylamine	62-75-9	TO-13[e]	ND	625	ND	8270	ND
N-Nitrosodiphenylamine	86-30-9	TO-13[e]	ND	625	ND	8270	ND
N-Nitroso-di-n-propylamine	621-64-7	TO-13[e]	ND	625	ND	8270	ND
Phenanthrene	85-01-8	TO-13	ND	625	ND	8270	ND
Pyrene	129-00-0	TO-13	ND	625	ND	8270	ND
Phenol	108-95-2	TO-13[e]	ND	625	ND	8270	ND
PCBs (Total)	1336-36-3	TO-13[e]		8080		8080	
PCB 1016		TO-13[e]	ND	8080	1.8	8080	ND
PCB 1221		TO-13[e]	ND	8080	ND	8080	ND
PCB 1232		TO-13[e]	ND	8080	ND	8080	ND
PCB 1242		TO-13[e]	ND	8080	ND	8080	ND
PCB 1248		TO-13[e]	ND	8080	1.6-2.6	8080	ND
PCB 1254		TO-13[e]	ND	8080	1.8	8080	36-260
PCB 1260		TO-13[e]	ND	8080	0.89-2.5	8080	ND
<u>DIOXINS/FURANS</u>							
Polychlorinated dibenzo-p-dioxins					<u>ng/L</u>[h]		<u>ng/g</u>
1,2,3,4,6,7,8-HpCDD		TO-9[e]	0.021-0.017	8280	0.58-1.9		0.11-0.18
Total HpCdd		TO-9[e]	0.038-0.23	8280	0.58		0.21-0.28
OCDD		TO-9[e]	0.034-1.6	8280	0.51-12		0.055-1.2
VOCs					<u>ug/L</u>		<u>ug/L</u>
Acetaldehyde	75-07-0	TO-11	3.7-88	8315	710-1100	NA	NA
Acetone	67-64-1	TO-14	6.9-120	624	15000	NA	NA
Acrolein	107-02-8	TO-11	ND	624	ND	NA	NA
Acrylonitrile	107-13-1	TO-14	0.76-15	624	ND	NA	NA
Allyl chloride	107-05-1	TO-14	ND	624	ND	NA	NA
Benzaldehyde	100-52-7	TO-11	0.17-8.2	8315	ND	NA	NA

TABLE 5-1
CONCENTRATION RANGE OF TARGETED COMPOUNDS
Page 3 of 4

	CAS[a] No.	Air Analysis Method	Concentration Range of Detected Compounds (ppbv)[b]	Water Analysis Method	Concentration Range of Detected Compounds (ug/L)[c]	Soil Analysis Method	Concentration Range of Detected Compounds (mg/kg)[d]
Benzene	71-43-2	TO-14	0.2-1.3	624	ND	NA	NA
Bromoform	75-25-2	TO-14	ND	624	ND	NA	NA
2-Butanal	123-72-8	TO-11	1.1-68	624	ND	NA	NA
Carbon tetrachloride	56-23-5	TO-14	ND	624	ND	NA	NA
Carbonyl chloride (Phosgene)	75-44-5	OSHA Method 61	1	NA	NA	NA	NA
Chlorobenzene	108-90-7	TO-14	ND	624	ND	NA	NA
Chloroform	67-66-3	TO-14	0.28-1.4	624	ND	NA	NA
1,2-Dibromoethane	106-93-4	TO-14	ND	624	ND	NA	NA
1,4-Dichlorobenzene	106-46-7	TO-14	ND	624	ND	NA	NA
1,1-Dichloroethane	75-34-3	TO-14	ND	624	ND	NA	NA
1,2-Dichloroethane	107-06-2	TO-14	ND	624	ND	NA	NA
1,1-Dichloroethene	75-35-4	TO-14	ND	624	ND	NA	NA
1,2-Dichloropropane	78-87-5	TO-14	ND	624	ND	NA	NA
cis-1,3-Dichloropropene	10061-01-5	TO-14	ND	624	ND	NA	NA
trans-1,3-Dichloropropene	10061-02-6	TO-14	ND	624	ND	NA	NA
Ethylbenzene	100-41-4	TO-14	0.21-0.58	624	ND	NA	NA
Formaldehyde	50-00-0	TO-11	2.3-77	8315	ND	NA	NA
n-Heptane	142-82-5	TO-14	0.22-1.0	624	ND	NA	NA
Hexanal	66-25-1	TO-11	0.34-0.53	624	ND	NA	NA
Hexane	110-54-3	TO-14	0.21-11	624	ND	NA	NA
Bromomethane (methyl bromide)	74-83-9	TO-14	ND	624	ND	NA	NA
Methylene chloride	75-09-2	TO-14	0.21-2.7	624	400	NA	NA
2-Butanone (MEK)	78-93-3	TO-14	1.1-12	624	ND	NA	NA
Pentanal	110-62-3	TO-11	0.34-9.7	624	ND	NA	NA
Propanal	123-38-6	TO-11	0.69-23	624	ND	NA	NA
Tetrachloroethene	127-18-4	TO-14	0.26	624	ND	NA	NA
Toluene	108-88-3	TO-14	0.2-20	624	ND	NA	NA
1,1,1-Trichloroethane	71-55-6	TO-14	0.2-0.38	624	ND	NA	NA
Trichloroethene	79-01-6	TO-14	0.5-1.2	624	ND	NA	NA
Vinyl chloride	75-01-4	TO-14	ND	624	ND	NA	NA
Xylenes, total	1330-20-7	TO-14	0.21-1.9	624	ND	NA	NA
Total Volatile Hydrocarbons	-----	EPA Method 25	ND	624	ND	NA	NA

TABLE 5-1
CONCENTRATION RANGE OF TARGETED COMPOUNDS
Page 4 of 4

	CAS[a] No.	Air Analysis Method	Concentration Range of Detected Compounds (ug/m^3)[b]	Water Analysis Method	Concentration Range of Detected Compounds (ug/L)[c]	Soil Analysis Method	Concentration Range of Detected Compounds (mg/kg)[d]
INORGANICS							
METALS							
Antimony	7440-36-0	PF/6010	ND	NA	NA	6010	ND
Arsenic	7440-38-2	PF/6010	ND	NA	NA	7060	3.3-5.5
Barium	7440-39-3	PF/6010	0.023-0.43	NA	NA	6010	42-97
Berylium	7440-41-7	PF/6010	ND	NA	NA	6010	ND
Cadmium	7440-43-9	PF/6010	0.015	NA	NA	6010	ND
Chromium	7440-47-3	PF/6010	0.058-0.24	NA	NA	6010	23-260
Cobalt	7440-48-4	PF/6010	0.027-0.032	NA	NA	6010	11-17
Copper	7440-50-8	PF/6010	0.042-0.34	NA	NA	6010	8.9-2700
Lead	7439-92-1	PF/6010	0.20-0.23	NA	NA	6010	12-140
Mercury	7439-97-6	PF/6010	0.0011-0.0012	NA	NA	7471	0.055-0.12
Molybdenum	7439-98-7	PF/6010	ND	NA	NA	6010	ND
Nickel	7440-02-0	PF/6010	0.052-0.16	NA	NA	6010	45-150
Selenium	7783-00-8	PF/6010	ND	NA	NA	7740	0.53
Silver	7440-22-4	PF/6010	ND	NA	NA	6010	NA
Thallium	7440-28-0	PF/6010	ND	NA	NA	6010	NA
Vanadium	7440-62-2	PF/6010	0.020-0.14	NA	NA	6010	27-53
Zinc	7440-66-6	PF/6010	0.13-5.5	NA	NA	6010	48-1600

[a] CAS = Chemical Abstracts Service
[b] ppbv = Parts per Billion by Volume
[c] ug/L = Micrograms per Liter
[d] mg/kg = Milligrams per Kilogram
[e] Sampling method followed procedure outlined in TO-13. Analytical method utilized modified 8270 procedures (see Section 3.2.3.4 describing approved method modifications).
[f] NA = Not Applicable
[g] NR = Not Reported
[h] ng/L = Nanogram per Liter
[i] ug/m^3 = Micrograms per m^3
[j] Does not include FSU Source Testing Results

TABLE 5-2
SOIL MONITORING DATA
METALS ANALYSIS RESULTS

SAMPLE NUMBER	Arsenic (mg/kg)	Barium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)
B16	3.3	46	30	11	17	15		49		32	48
B18-IA	4.4	67	50	13	8.9	23		55		53	77
B18-IB	4.7	79	38	16	13	21		54	0.53	38	75
B18-IIA COMP A	4	95	41	11	2700	140	0.12	55		29	1600
B18-IIA COMP B	5.5	97	32	11	47	51	0.12	53		29	240
B18-IIB	5.3	69	260	17	32	55	0.055	150		39	130
B19-IB	4.2	42	23	13	18	12		45		27	48

Table displays positively detected sampling results only.

TABLE 5-3
SOIL MONITORING DATA
SVOC ANALYSIS RESULTS

SAMPLE NUMBER	OCDD (ug/kg)	1,2,3,4,6,7,8-HpCDD (ug/kg)	Total HpCDD (ug/kg)	AROCLOR 1254 (ug/kg)
B16-I	0.36	0.11	0.21	
B18-IA	1.2	0.15	0.28	
B18-IB	0.055			
B18-IIA COMP A				220
B18-IIA COMP B				260
B18-IIB				36
B19-IB	0.4	0.13	0.26	

Table displays positively detected sampling results only.

TABLE 5-4
ISS MONITORING DATA
VOC RESULTS (TO-14 ANALYSIS, ppbv)

SAMPLE NUMBER	Acetone	Acrylonitrile	Benzene	Chloroform	Hexane	Methylene Chloride	2-Butanone (MEK)	Toluene	1,1,1-Trichloroethane	m,p-Xylene
B13-041494	120			1.40	0.53		9.3	1.6	0.34	0.33
B13-041494LD	120		0.31	1.40	0.65		7.3	1.6	0.37	0.32
B15-042094	34	15	0.34		11	0.49	7.0	0.50		
B16-042094		4.9	0.32		0.84	0.51	2.5	1.3		0.30
B18PHI-050194	40									
B18PHII-050194	44					2.3				
B18PHII-050194D	29				3.5	2.1				
B18PHII-050194LD	44					2.7				
B19-042094	17				0.60		1.6			

D = Duplicate Sample
LD = Laboratory Duplicate

Table displays positively detected sampling results only.

TABLE 5-5
AIR MONITORING DATA
VOLATILE RESULTS
(TO-11 ANALYSIS)
Page 1 of 3

SAMPLE NUMBER	Acetaldehyde (ppbv)	Benzaldehyde (ppbv)	2-Butanal[a] (ppbv)	Formaldehyde (ppbv)	Hexanal (ppbv)	Pentanal (ppbv)	Propanal (ppbv)
B13-041494	6.00		4.58	6.90			2.41
B15-042094	12.77		20.81	9.02		2.90	2.15
B16-042094	16.66		32.85	16.77			5.70
B18 PHI050194-1/-2/-3	9.94		8.19	10.48			2.23
B18 PHII050194-1/-2/-3	87.56		48.16	69.86		5.60	15.36
B18 PHII050194-1/-2/-3D	86.45		67.93	76.90		9.67	15.98
B18 PH1050194B			0.3 ug				
B19-042094	10.26		25.81	10.04			3.37
CPA-041494	4.64		1.73	2.44		0.34	1.09
CPA-042094	12.96		4.42	6.52		0.85	1.74
CPA-050194-1/-2/-3	25.38	0.84	8.23	15.71		0.93	3.61
CPA-050194B	0.1 ug		0.23 ug				
DSU-041494	4.39		2.53	2.52		0.39	0.97
DSU-042094	12.02	0.23	3.33	6.22		0.92	1.80
DSU-042094D	15.05	0.81	3.74	10.27		0.77	2.15
DSU-042094DL	11.90	0.35	3.52	5.65		0.95	1.73
DSU-050194-1/-2/-3	21.91	0.77	6.89	13.30		1.10	2.69
FSU-041394	3.77		1.75	2.71		0.91	0.69
FSU-041994	14.69		3.33	8.38		0.92	1.92
FSU-050294-1/-2/-3	23.12	0.17	5.24	11.12		1.65	2.64
FSUA-041394	16.08	0.70	3.76	9.87		0.90	2.81
FSUA-041994	12.71		2.80	7.93			1.76

TABLE 5-5
AIR MONITORING DATA
VOLATILE RESULTS
(TO-11 ANALYSIS)
Page 2 of 3

SAMPLE NUMBER	Acetaldehyde (ppbv)	Benzaldehyde (ppbv)	2-Butanal[a] (ppbv)	Formaldehyde (ppbv)	Hexanal (ppbv)	Pentanal (ppbv)	Propanal (ppbv)
FSUA-050294-1/-2/-3	23.03		5.55	11.83		2.16	2.80
FSUA-050294-1/-2/-3D	24.25	0.22	5.72	11.12		1.07	2.87
FSUB-041394	3.73		1.13	2.30		0.86	0.93
FSUB-041994	14.37		3.56	6.66		1.16	1.84
FSUB-041994D	11.38		2.54	5.39			1.36
FSUB-050294-1/-2/-3	22.83	0.50	5.41	11.53		1.42	2.64
FSUB-050294-1/-2/-3D	22.83	0.50	5.65	11.53		1.53	2.61
P 9-033194	13.87	8.18	4.36	9.64		1.49	2.69
P 9-040694	18.26		3.57	10.72		0.98	2.25
P 9-040694D	12.24	1.54	3.03	7.07		0.68	1.66
P 9-041294	20.60	1.36	14.17	13.11		1.17	2.86
P9-041294B	0.26 ug		0.25 ug	0.14 ug			
P 9-041894	19.17		6.61	13.78		3.08	23.37
P 9-043094-1/-2/-3	29.40	0.77	8.05	16.70		1.60	3.49
P 9-043094-1/-2/-3D	30.25	0.59	7.67	15.03		1.35	3.40
P 9-050394-1/-2	17.33	0.28	4.70	7.51		0.70	1.82
P14-033194	18.17	0.35	4.82	6.52	0.34	1.47	2.27
P14-033194D	18.58	0.35	4.82	6.52	0.34	1.61	2.36
P14-033194B			0.48 ug				
P14-040694	13.64		3.33	6.67		0.41	2.01
P14-040694D	14.02		2.62	6.67		0.87	1.84
P14-041294	15.57	1.28	2.96	10.09		0.93	2.55

TABLE 5-5
AIR MONITORING DATA
VOLATILE RESULTS
(TO-11 ANALYSIS)
Page 3 of 3

SAMPLE NUMBER	Acetaldehyde (ppbv)	Benzaldehyde (ppbv)	2-Butanal* (ppbv)	Formaldehyde (ppbv)	Hexanal (ppbv)	Pentanal (ppbv)	Propanal (ppbv)
P14-041294D	17.36	1.32	3.48	11.38		0.94	3.08
P14-041894	18.30	0.91	19.56	9.67		1.57	2.30
P14-041894B			0.19 ug				
P14-043094-1/-2/-3	25.47	0.86	5.89	15.94		1.17	2.84
P14-050394-1/-2	21.29		4.76	9.72		0.85	2.44
P14-050394-1/-2D	21.23		5.08	9.64		1.06	2.57
P16-033194	15.34	0.40	4.47	6.59		1.61	2.10
P16-033194D	15.03	0.35	4.12	7.35		1.48	2.19
P16-040694	12.91		2.23	6.84		0.64	1.58
P16-041294	19.12	0.84	3.37	11.22		1.35	2.87
P16-041294DL	19.50	0.95	3.12	11.22		2.15	2.90
P16-041894	22.18		5.15	9.90	0.53	2.05	2.89
P16-041894D	20.69		3.25	11.04			2.53
P16-043094-1/-2/-3	19.35		4.73	9.46		1.45	2.20
P16-043094B	0.11 ug		0.2 ug				
P16-050394-1/-2	16.42	0.32	3.67	7.50		1.03	1.77

* Lab blanks analyzed on 04/30/94 and 05/09/94 contained 0.19 ug and 0.17 ug respectively

Table displays positively detected sampling results only.

TABLE 5-6
DUPLICATE PRECISION RESULTS - VOLATILE RESULTS (TO-11 ANALYSIS)

SAMPLE NUMBER/ DUPLICATE SAMPLE NUMBER	FORMALDEHYDE (ug)	ACETALDEHYDE (ug)	PROPANAL (ug)	BENZALDEHYDE (ug)	PENTANAL (ug)	2-BUTANAL (ug)
B18 PHII- 050194-1/-2/-3/	0.87	1.60	**0.37**		0.20	1.40
B18 PHII- 050194-1/-2/-3D	0.97	1.60	**0.39**		0.35	2.00
% Difference	**11%**	**0%**	**5%**		**75%**	**43%**
DSU - 042094/	**1.20**	3.40	0.67	0.16	0.51	1.50
DSU - 042094D	**2.00**	4.30	0.81	0.56	0.43	1.70
% Difference	**67%**	**26%**	**21%**	**250%**	**-16%**	**13%**
FSUA - 050294-1/-2/-3/	2.10	6.00	0.96		1.10	2.30
FSUA - 050294-1/-2/-3D	2.00	6.40	1.00	0.14	0.55	2.40
% Difference	**-5%**	**7%**	**4%**	**100%**	**-50%**	**4%**
FSUB - 041994/	1.20	3.80	0.64		0.60	1.50
FSUB - 041994D	1.00	3.10	0.49			1.10
% Difference	**-17%**	**-18%**	**-23%**		**-100%**	**-27%**
P9 - 040694/	1.80	4.50	0.73		0.47	1.40
P9 - 040694D	1.30	3.30	0.59	1.00	0.36	1.30
% Difference	**-28%**	**-27%**	**-19%**	**100%**	**-23%**	**-7%**
P9 - 043094-1/-2/-3/	2.40	6.20	0.97	0.39	0.66	2.70
P9 - 043094-1/-2/-3D	2.10	6.20	0.92	0.29	0.54	2.50
% Difference	**-13%**	**0%**	**-5%**	**-26%**	**-18%**	**-7%**
P14 - 041294/	1.90	4.30	0.93	0.85	0.50	1.30
P14 - 041294D	2.10	4.70	1.10	0.86	0.50	1.50
% Difference	**11%**	**9%**	**18%**	**1%**	**0%**	**15%**
P14 - 050394-1/-2	1.40	4.50	0.68		0.35	1.60
P14 - 050394-1/-2D	1.30	4.20	0.67		0.41	1.60
% Difference	**-7%**	**-7%**	**-1%**		**17%**	**0%**
P16 - 033194/	1.20	4.10	0.74	0.26	0.84	1.90
P16 - 033194D	1.30	3.90	0.75	0.22	0.75	1.70
% Difference	**8%**	**-5%**	**1%**	**-15%**	**-11%**	**-11%**
P16 - 041894/	1.40	4.60	0.79		0.83	1.70
P16 - 041894D	1.60	4.40	0.71			1.10
% Difference	**14%**	**-4%**	**-10%**		**-100%**	**-35%**
Average Absolute % Difference	**18%**	**10%**	**11%**	**82%**	**41%**	**16%**

Table displays positively detected sampling results only.

TABLE 5-7
WATER MONITORING DATA
SVOC ANALYSIS RESULTS

		8080 PCB ug/L	8080 PCB ug/L	8080 PCB ug/L	8080 PCB ug/L	8280 Diox. ng/L	8280 Diox. ng/L
		PCB-1016	PCB-1248	PCB-1254	PCB-1260	1,2,3,4,6,7,8-HpCDD	OCDD
P9	3/31/94				1	0.58	4.5
P9	4/06/94				2.5		11
P9	4/06/94D				2.5		12
P9	4/18/94				0.89		11
P9	4/30/94D						1.1
P9	5/03/94						2.5
P14	3/31/94				1.2		
P16	3/31/94					1.9	
P16	3/31/94D						1.5
P16	4/06/94	1.8		1.8			1.9
P16	4/18/94		2.6				0.51
P16	4/18/94D		1.6				1.1
P16	5/03/94						3.2

Table displays positively detected sampling results only.

TABLE 5-8
WATER MONITORING DATA
VOC ANALYSIS RESULTS

		624 Volatiles ug/L	624 Volatiles ug/L	8315 Aldehydes mg/L
		Acetone	Methylene Chloride	Acetaldehyde
P9	3/31/94		400	1.1
P16	3/31/94			1.1
P16	3/31/94D			0.71
P16	4/12/94	15000		

Table displays positively detected sampling results only.

TABLE 5-9
AIR MONITORING DATA SURFACE IMPOUNDMENTS
VOC RESULTS (TO-14 ANALYSIS, ppbv)
Page 1 of 2

SAMPLE NUMBER	Acetone	Acrylonitrile	Benzene	Chloroform	Ethyl-benzene	n-Heptane	Hexane
P9-033194	18		0.32		0.21		0.21
P9-040694	46						0.46
P9-040694-D	67		0.20				0.68
P9-041294	84	1.8	0.28				0.60
P9-041294B	89		0.80	0.81		0.87	4.0
P9-041894	93		0.28				0.55
P9-043094	16		0.63	0.28	0.3		
P9-043094-D	7.6		0.65	0.3	0.28		
P9-050494	20						
P9-050494B	21						
P14-033194	72		0.27				1.3
P14-040694	97		0.21				1.1
P14-041294	15	3.7	0.36				0.43
P14-041294-D	27	11	0.78		0.46	0.22	0.36
P14-041894	11						
P14-041894B	6.2						0.73
P14-043094	37						
P14-043094B							26
P14-050394	11						
P14-050394-D	7.6						
P16-033194	31		0.21				5.1
P16-033194-D	35		0.23				4.3
P16-040694	19		0.24				
P16-040694B	9.8						1.3
P16-040694B-Dup	10						1.3
P16-041294	71	1.0	0.29			0.74	0.32
P16-041894	28			0.31			0.24
P16-041894-D	38		0.85		0.58	0.99	0.72
P16-043094	7.7						
P16-043094B							0.66
P16-043094B-Dup							0.65
P16-050394	22						

Table displays positively detected sampling results only.

TABLE 5-9
AIR MONITORING DATA SURFACE IMPOUNDMENTS
VOC RESULTS (TO-14 ANALYSIS, ppbv)
Page 2 of 2

SAMPLE NUMBER	Methylene Chloride	2-Butanone (MEK)	Tetrachloro-ethene	Toluene	1,1,1-Trichloroethane	Trichloro-ethene	Xylene (Total)
P9-033194	0.24	1.7	0.26	20	0.26		1.3
P9-040694		4.8		0.54	0.26		
P9-040694-D		4.9		1.1	0.30		0.53
P9-041294		12		1.6			0.99
P9-041294B		8.6		12			
P9-041894		6.4		1.6			0.75
P9-043094		1.9		2.4		0.96	1.2
P9-043094-D		1.7		2.2		0.99	1.2
P9-050494		2.7					
P9-050494B	1.2			0.55		1.6	
P14-033194		6.5		1.0			0.34
P14-040694		6.4		0.51			0.22
P14-041294		1.8		0.54			0.21
P14-041294-D		3.8		3.9			2.6
P14-041894				0.56			
P14-041894B	0.24			4.0			0.28
P14-043094		3.0		5.6			
P14-043094B				5.4			
P14-050394							
P14-050394-D							
P16-033194		2.2		0.34			
P16-033194-D		1.2		0.20			
P16-040694		1.1		0.95			0.35
P16-040694B				16			0.41
P16-040694B-Dup				16			0.4
P16-041294		5.3		0.99			0.50
P16-041894		2.3		0.41			0.33
P16-041894-D		3.0		5.8			2.3
P16-043094				0.33			
P16-043094B				3.7			0.41
P16-043094B-Dup				3.6			0.39
P16-050394				0.88		1.2	

Table displays positively detected sampling results only.

TABLE 5-10
AIR MONITORING DATA HAZARDOUS WASTE UNITS
VOC RESULTS (TO-14 ANALYSIS, ppbv)
Page 1 of 2

SAMPLE NUMBER	Acetone	Acrylonitrile	Benzene	Chloroform	Ethylbenzene	n-Heptane	Hexane
CPA-041494	47		0.35	1.00			0.29
CPA-042094	34		0.27				0.67
CPA-050194	11						
CPA-050194B						0.21	0.66
DSU-041494	13	0.84	1.3		0.34	1.0	1.6
DSU-042094	12		0.48		0.37		0.52
DSU-042094D	12		0.46		0.39		0.61
DSU-050194	36						
FSU-041394	17		0.96			0.85	1.5
FSU-041394D	15		0.46		0.33	0.22	0.33
FSU-041994	38	0.76					
FSU-041994B	6.8	6.1					0.33
FSU-050294	74						
FSUA-041394	46	1.0	0.32	1.10			0.84
FSUA-041394B	15	0.99	0.95		0.78	1.2	1.2
FSUA-041994	42	14					0.42
FSUA-050494		0.96					
FSUB-041394	66		0.43		0.37	0.30	0.64
FSUB-041994	9.9						
FSUB-041994D	7.2		0.20				0.23
FSUB-041994DL	6.9		0.24				0.23
FSUB-050294	9.8						

Table displays positively detected sampling results only.

TABLE 5-10
AIR MONITORING DATA HAZARDOUS WASTE UNITS
VOC RESULTS (TO-14 ANALYSIS, ppbv)
Page 2 of 2

SAMPLE NUMBER	Methylene Chloride	2-Butanone (MEK)	Toluene	1,1,1-Trichloroethane	Trichloroethene	Xylenes
CPA-041494		4.2		0.32		0.55
CPA-042094		2.9	1.0	0.28		0.52
CPA-050194			0.88			
CPA-050194B	1.7		2.1		3.6	0.9
DSU-041494	0.46	2.3	2.3	0.37		1.7
DSU-042094	0.24		2.2	0.38		1.7
DSU-042094D	0.22		2.2	0.38		1.7
DSU-050194			0.51		0.5	
FSU-041394		1.7	0.42	0.20		0.32
FSU-041394D		1.7	2.4	0.20		1.3
FSU-041994		3.0	2.1			0.68
FSU-041994B			2.7			0.24
FSU-050294		11	0.94			
FSUA-041394		5.2	0.77			
FSUA-041394B		2.4	12			3.1
FSUA-041994		2.9	0.50			0.26
FSUA-050494			0.27			0.25
FSUB-041394		5.3	2.0	0.27		1.7
FSUB-041994			1.2	0.26		0.23
FSUB-041994D			1.8			0.74
FSUB-041994DL	0.21		1.8			0.83
FSUB-050294						

Table displays positively detected sampling results only.

TABLE 5-11
AIR MONITORING DATA-HAZARDOUS WASTE TREATMENT UNITS
PCDD/SVOCs RESULTS
(MOD. TO-9/TO-13 ANALYSES)

SAMPLE NUMBER	OCDD (pptv)	1,2,3,4,6,7,8-HpCDD (pptv)	Napthalene (ppbv)	Phenol (ppbv)
CPA-041494	180 E-06	21 E-06	0.004	
CPA-042094	95 E-06			
CPA-042094D	75 E-06			
CPA-050194	33 E-06			
CPA-050194B	63pg			
DSU-041494	60 E-06		0.012	0.005
DSU-042094	59 E-06		0.009	
DSU-050194	64 E-06			
FSU-041394	1500 E-06	100 E-06	0.008	
FSU-041394D	58 E-06		0.009	
FSU-041994	56 E-06		0.007	
FSU-050294	68 E-06		0.007	
FSU-050294D	130 E-06		0.010	
FSU-050294D-Dup			0.010	
FSU-050294B	58 pg			
FSUA-041394	33 E-06			
FSUA-041994	74 E-06			
FSUA-041994D	60 E-06			
FSUA-050294	56 E-06			
FSUB-041394	39 E-06		0.008	
FSUB-041994	240 E-06			
FSUB-050294	74 E-06			

Table displays positively detected sampling results only.

TABLE 5-12
AIR MONITORING DATA-HAZARDOUS WASTE TREATMENT UNITS
METALS ANALYSIS RESULTS

SAMPLE NUMBER	Barium (μg/m³)	Cadmium (μg/m³)	Chromium (μg/m³)	Cobalt (μg/m³)	Copper (μg/m³)	Lead (μg/m³)	Mercury (μg/m³)	Nickel (μg/m³)	Vanadium (μg/m³)	Zinc (μg/m³)
CPA-041494	0.06				0.042					
CPA-042094	0.15				0.093					0.17
CPA-050194	0.034				0.099					0.15
CPA-050194B	3.8 ug			48 ug						66 ug
DSU-041494	0.076				0.17					0.17
DSU-042094	0.092				0.18			0.052		0.10
DSU-042094D	0.09				0.18					
DSU-050194	0.023				0.23					0.24
FSU-041394	0.25	0.015	0.24		0.28	0.23	0.0011	0.16	0.069	0.30
FSU-041394D	0.24		0.23		0.34	0.20	0.0012	0.16	0.065	0.27
FSU-041994	0.2		0.13		0.14	0.20		0.13	0.055	0.20
FSU-050294	0.43		0.14	0.032	0.20			0.13	0.078	5.50
FSU-050294B	2.5 ug									
FSUA-041394	0.073			0.027	0.15					0.22
FSUA-041994	0.15		0.058		0.13			0.064		0.15
FSUA-050294	0.11				0.14					0.20
FSUA-050294D	0.11				0.15				0.14	
FSUB-041394	0.059				0.19					
FSUB-041994	0.15		0.071		0.12			0.066	0.025	0.12
FSUB-041994D	0.15		0.059		0.10			0.066	0.020	0.15
FSUB-050294	0.064				0.096					0.17

Table displays positively detected sampling results only.

6.0 AIR DISPERSION MODELING

Using the combined results of all on-site soil, liquid, ambient air, soil gas, and FSU stack sampling performed at the KHF, air dispersion modeling was performed to determine where maximum property line impacts from facility emissions were likely to occur. Air dispersion modeling was performed only for compounds which were positively quantified by soil, liquid, and ambient air sampling. Results less than the sampling and analytical detection limits were assumed to be not present and were not modeled.

In order to complete the air dispersion modeling a number of preparatory tasks were required. The first step involved processing all of the meteorological data collected at the facility into a format which was compatible with the model. All of the receptor and source elevations needed to be determined and input into model in order to complete the topographical and meteorological characterization.

The next step involved calculating emission rates for all of the compounds detected in the field samples collected at the facility. Target analyte concentrations were measured from samples collected at each of the active sources at the facility. In order to predict the ambient air concentration of target analytes at the facility property boundary, the measured concentration for all compounds detected above the target detection limit were converted into an air emission rate. Emission rates from the FSU were determined by measuring the concentration of all the targeted pollutants using approved source testing methods. These concentrations were converted to FSU stack emission rates using the measured volumetric flow rate through the FSU stack.

Once all of the required modeling parameters were determined and entered into the model, ambient air concentrations were calculated at the facility property boundary.

A copy of the air dispersion modeling protocol complete with a summary of the methods and calculations used to perform the concentration conversions, tables of modeled emission rates, discussion of the modeling information, along with a report of the modeling results is located in Appendix K.

7.0 DISCUSSION OF RESULTS

The air dispersion modeling predicted the ambient air concentration for each of the 54 modeled compounds at the facility property line. The predicted maximum annual average concentration for each compound was then analyzed to determine if the concentrations were high enough to justify routine ambient air monitoring at the facility property line. This analysis compared the predicted maximum property line concentrations to the DTSC approved ambient air detection limits for the study, California approved risk assessment guidelines, and field blank data collected during the sampling phase of this study.

The maximum annual property line concentrations were compared to the DTSC approved ambient air sampling detection limits (Tables 7.1A - 7.1C). This comparison was made to determine if the predicted concentrations were high enough to have been reported in the ambient air samples collected during this study. The purpose of this comparison was to eliminate any compound from consideration for ambient monitoring if the predicted property line concentration was below the ambient air monitoring detection limits established for this study. The rationale being that the predicted maximum annual concentrations below the ambient air detection limits would not be observed if fenceline monitoring was required. All but nine of the 54 compounds modeled were eliminated for further consideration because the predicted concentrations were below the DTSC approved ambient air detection limits for this study. These nine compounds include:

2-Butanal
2-Butanone
Acetaldehyde
Acetone
Acrylonitrile
Formaldehyde
Hexane
Toluene
Xylenes

The nine compounds which the model showed to have property line concentrations greater than the approved ambient air detection limits were then compared to a concentration value associated with a cancer risk. The California Air Pollution Control Officers Association (CAPCOA), Air Toxics "Hot Spots" Program, Risk Assessment Guidelines, January 1992, were used to determine a chronic (annual) exposure risk concentration. For the compounds in which CAPCOA has determined a cancer potency unit risk factor, this value was converted to a chronic exposure risk concentration associated with a cancer risk of 10^{-6}. Table 7.2 compares the predicted annual property line concentration for each compound to the calculated chronic exposure risk concentration.

The risk exposure comparison was used to conclude that, if the maximum annual property line concentration was less than an associated chronic risk exposure concentration, ambient air monitoring at the property line would not be required for the given compound. Of the nine compounds with predicted property line concentrations greater than the DTSC approved ambient air detection limits, only acrylonitrile and formaldehyde exceeded the chronic exposure risk concentration. Chronic risk exposure concentrations are currently unavailable for 2-butanal and acetone. Based on this comparison, 2-butanone, acetaldehyde, hexane, toluene, and xylenes were eliminated from any further consideration for ambient air monitoring at the property line.

Predicted property line concentrations for acrylonitrile, formaldehyde, 2-butanal and acetone were compared to the sampling quality assurance data to determine if the predicted concentrations originated from the facility or were introduced to the samples by another means. As shown in the tables of sampling results located in section 5.0, many of the compounds detected in the collected air samples were also detected in associated field blanks. Table 5-5 shows that 2-butanal was detected in all six field blanks, as well as being detected in two associated lab blanks. Tables 5-9 and 5-10 show acetone and acrylonitrile being detected in multiple field blanks at concentrations the same order of magnitude as the associated samples. Because these compounds are detected in numerous field blanks, it cannot be concluded that the detected results originated from the facility. Therefore, the data for these compounds is too inconclusive to determine that routine ambient air monitoring at the property line is required.

Formaldehyde was the only compound to have a predicted property line concentration high enough to consider for routine ambient air monitoring. However, the California Air Resources Board ambient air monitoring site in Fresno routinely detected formaldehyde ranging in concentration from 0.5 - 5.3 ppbv. This data, which has been collected from November 2, 1991 - present, shows that formaldehyde may be indicative of background ambient air in the central San Joaquin Valley.

TABLE 7.1-A

METALS

PREDICTED ANNUAL PROPERTY LINE CONCENTRATIONS VERSUS THE DTSC APPROVED AMBIENT AIR DETECTION LIMITS

Compound	Maximum Annual – Property Line Concentrations (ug/m^3)	DTSC Approved Ambient Air Detection Limit (ug/m^3)	Exceeds Detection Limit
Antimony	6.5E-06	5.0	No
Aresnic	1.6E-03	3.1	No
Barium	7.0E-02	5.6	No
Cadmium	6.9E-05	4.6	No
Chromium	1.2E-02	2.1	No
Cobalt	1.7E-03	2.4	No
Copper	1.0E-01	2.6	No
Lead	6.9E-03	8.5	No
Mercury	6.5E-06	8.2	No
Nickel	1.2E-02	2.4	No
Selenium	1.1E-05	3.2	No
Silver	2.5E-05	4.4	No
Vanadium	8.7E-03	2.1	No
Zinc	9.9E-02	2.7	No

TABLE 7.1-B

SEMI VOLATILE ORGANIC COMPOUNDS (SVOCs)

PREDICTED ANNUAL PROPERTY LINE CONCENTRATIONS VERSUS THE DTSC APPROVED AMBIENT AIR DETECTION LIMIT

Compound	Maximum Annual Property Line Concentrations (ppbv)	DTSC Approved Ambient Air Detection Limit (ppbv)	Exceeds Detection Limit
Acenaphthylene	6.4E-08	1.0	No
Anthracene	2.0E-07	1.0	No
Benzo(a)anthracene	1.5E-08	1.0	No
Benzo(a)pyrene	6.0E-09	1.0	No
Benzo(b)fluoranthene	7.0E-09	1.0	No
Benzo(g,h,i)perylene	1.0E-09	1.0	No
Benzo(k)fluoranthene	2.0E-09	1.0	No
Crysene	6.4E-08	1.0	No
Cumene	2.0E-04	1.0	No
Dioxin (OCDD)	1.6E-08	1.0	No
Dioxin (HpCDD)	3.4E-09	1.0	No
Fluoranthene	3.4E-07	1.0	No
Fluorene	1.0E-07	1.0	No
Naphthalene	4.4E-04	1.0	No
PCBs (total)	1.5E-06	1.0	No
Phenanthrene	1.1E-06	1.0	No
Phenol	2.6E-05	1.0	No
Pyrene	4.4E-07	1.0	No

TABLE 7.1-C

VOLATILE ORGANIC COMPOUNDS (VOCs)

PREDICTED ANNUAL PROPERTY LINE CONCENTRATIONS VERSUS THE DTSC APPROVED AMBIENT AIR DETECTION LIMITS

Compound	Maximum Annual Property Line Concentrations (ppbv)	DTSC Approved Ambient Air Detection Limit (ppbv)	Exceeds Detection Limits
2-Butanal	5.2	1.0	Yes
2-Butanone (MEK)	1.1	1.0	Yes
1,1,1 Trichloroethane	2.9E-02	0.20	No
1,4, Dichlorobenzene	4.8E-05	0.20	No
Acetaldehyde	4.5	1.0	Yes
Acetone	16	1.0	Yes
Acrylonitrile	1.7	0.20	Yes
Benzaldehyde	2.5E-01	1.0	No
Benzene	1.3E-01	0.20	No
Chloroform	7.9E-02	0.20	No
Ethyl Benzene	7.6E-02	0.20	No
Formaldehyde	2.9	1.0	Yes
Hexanal	5.6E-02	1.0	No
Hexane	2.6E-01	0.20	Yes
Methylene Chloride	6.6E-03	1.5	No
n-Heptane	4.6E-02	0.20	No
Pentanal	2.8E-01	1.0	No
Phosgene (Carbonyl Chloride)	1.5E-05	1.0	No
Propanal	7.9E-01	1.0	No
Tetrachloroethene	3.9E-03	0.20	No
Toluene	9.3E-01	0.20	Yes
Trichloroethylene	2.2E-02	0.20	No
Xylenes (total)	4.4E-01	0.20	Yes

TABLE 7.2

VOLATILE ORGANIC COMPOUNDS (VOCs)

PREDICTED ANNUAL PROPERTY LINE CONCENTRATIONS VERSUS RISK CONCENTRATIONS FOR CHRONIC EXPOSURE

Compound	Maximum Annual Property Line Concentrations	Chronic Exposure Risk Concentrations	Carcinogen (C) or Non-Carcinogen (NC)	Exceeds Chronic Risk Concentration
	ug/m^3	ug/m^3		
2-Butanal	1.5	(a)		
2-Butanone (MEK)	3.3	1000 (b)	NC	No
Acetaldehyde	8.1	9.0	NC	No
Acetone	38	(a)	NC	
Acrylonitrile	3.7	3.4E-03	C	Yes
Formaldehyde	3.5	7.7E-02	C	Yes
Hexane	9.0E-01	200 (b)	NC	No
Toluene	3.5	200	NC	No
Xylenes	1.9	300	NC	No

[a] No California values have been determined

[b] Criteria shown represents U.S. EPA chronic RfC (IRIS; HEAST)

8.0 CONCLUSIONS

After comparing the predicted property line ambient air concentrations to the approved DTSC detection limits, CAPCOA approved chronic risk exposure concentrations and the sampling field blank data, only formaldehyde has a concentration high enough (2.9 ppbv) to potentially justify ambient air monitoring at the property line. However, because the predicted maximum annual property line concentration for formaldehyde was only 3.5 times higher than the DTSC approved ambient air detection limit, and the CWMI Kettleman Hills facility is over two miles from nearest resident, routine ambient air monitor at the facility property line should not be required.

Appendix A
Workplan

[illegible]
[illegible] Kettleman [illegible]
[illegible]

AV-R-91/9183
AV Project 19107D

KETTLEMAN HILLS FACILITY WORK PLAN
TOPOGRAPHICAL AND METEOROLOGICAL CHARACTERIZATION AND AIRBORNE CONTAMINANT IDENTIFICATION

Prepared for

Chemical Waste Management, Inc.
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By

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October 1991

TABLE OF CONTENTS

Section 1

EXECUTIVE SUMMARY

In accordance with the requirements of its Resource Conservation and Recovery Act (RCRA) Part B permits, Chemical Waste Management, Inc. (CWMI) is submitting this work plan for its Kettleman Hills Facility (KHF). The guidelines in this work plan will be used to

- fully characterize the topography and meteorological conditions at the KHF that affect the airborne transport of hazardous constituents
- identify hazardous constituents being emitted into the air from the KHF, based on analyses specified in the permits

Hazardous constituent identification will include

- sampling liquid wastes from active surface impoundments and evaporative tanks and analyzing them for volatile and semivolatile compounds
- sampling ambient air downwind from each active impoundment and analyzing it for volatile compounds
- compositing surface soil samples from active landfills and analyzing them for semivolatile and inorganic analytes
- collecting integrated surface samples of landfill gas from active and inactive landfills that have not undergone final closure and analyzing them for volatile compounds
- sampling ambient air downwind from major hazardous waste treatment units and their support storage areas and analyzing it for volatile, semivolatile, and inorganic analytes

The data obtained during this characterization study will be used to develop a list of compounds for CWMI to include in an ambient air sampling plan, in which the hazardous constituents will be quantified.

Section 2

INTRODUCTION

In February 1988, the U.S. Environmental Protection Agency, Region IX (U.S. EPA) and the California Department of Health Services (CDHS) issued RCRA Part B permits to CWMI for the KHF. The facility, located near Kettleman City in Kings County, California, provides commercial hazardous waste treatment, storage, and disposal (TSD) services. Under U.S. EPA permit condition V.D. and CDHS permit condition V.C., which deal with air monitoring, CWMI is required to

- fully characterize the topography and meteorological conditions at the KHF that affect the airborne transport of hazardous constituents
- identify hazardous constituents being emitted into the air from the KHF, based on analyses specified in the permits
- quantify the hazardous constituents through ambient air sampling

This work plan, prepared by AeroVironment Inc. (AV), deals with topographical and meteorological characterization and hazardous constituent identification at the KHF. After reviewing the data obtained during this initial phase of work, the U.S. EPA and the California Environmental Protection Agency's Department of Toxic Substances Control (DTSC) (formerly the Toxic Substances Control Division of the CDHS) will issue a list of compounds for CWMI to include in an ambient air sampling plan. As required in the RCRA permits, CWMI will submit a work plan for ambient air sampling to the agencies no later than 180 calendar days after receiving the list of analytes.

Section 3

SITE BACKGROUND AND SETTING

3.1 SITE DESCRIPTION

3.1.1 Facility Description

The KHF is a commercial hazardous waste TSD facility owned and operated by CWMI (U.S. EPA Facility Identification Number CAT 000646117). It is located within U.S. EPA Region IX in Kings County, California, in a rural area approximately 3.5 miles southwest of Kettleman City and 5 miles southeast of Avenal (Figure 3-1).

The facility occupies 1,600 acres, of which 499 acres are permitted for waste management operations. Figure 3-2 shows the layout of the site. KHF waste management units of concern in this study include

- surface impoundments, where aqueous wastes are treated by solar evaporation and chemical precipitation
- evaporative tanks, proposed structures that would serve a purpose similar to that of the surface impoundments
- landfills, where wastes are buried and covered with clean fill
- waste treatment units, where hazardous substances are treated by stabilization or other methods

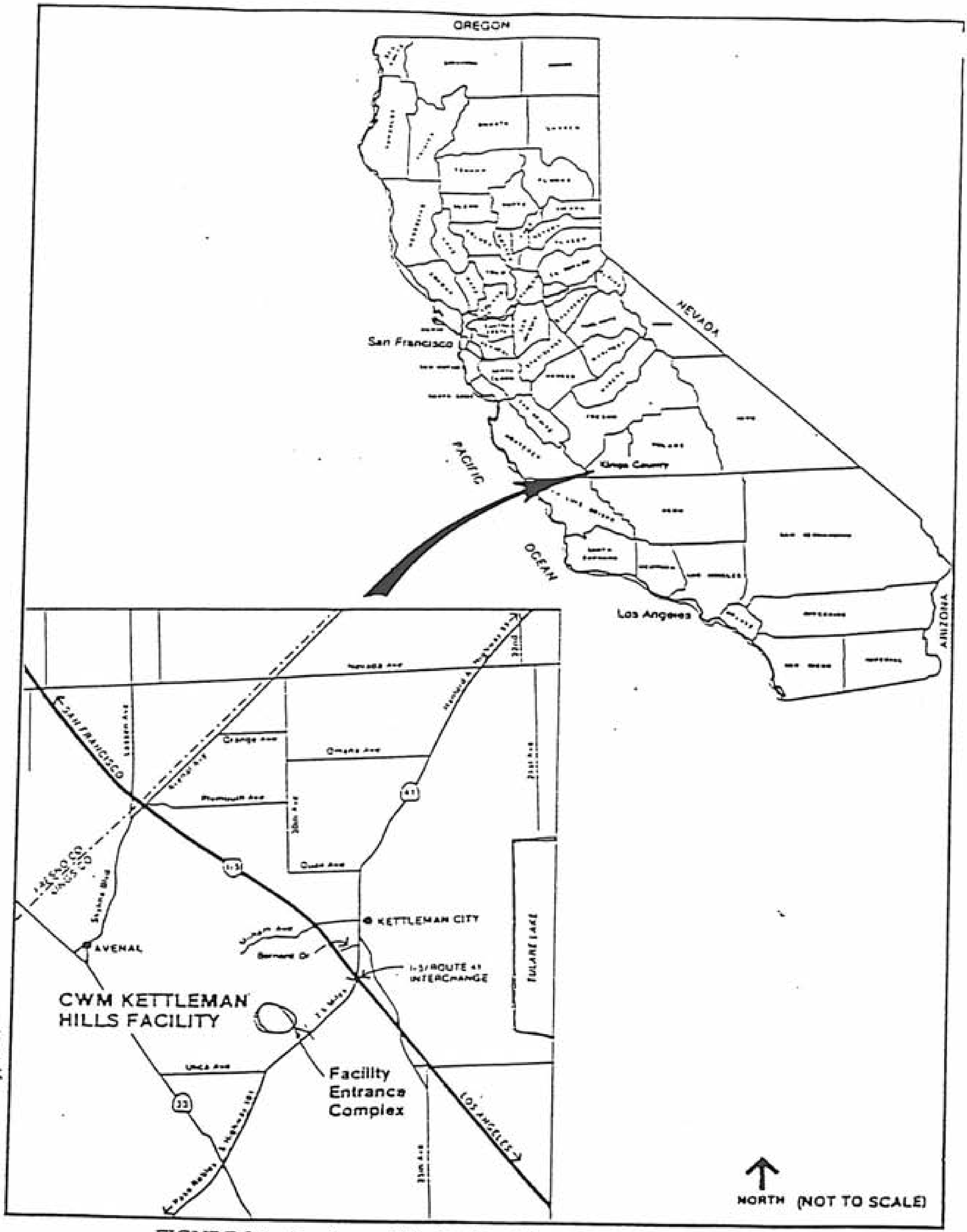
Some of the waste management units shown in the figure are inactive. While active, they employed methods no longer in use at the KHF. These include

- spreading areas, where bulk liquids were applied to the open ground surface
- mud ponds, which received non-RCRA drilling muds, drilling waters, and sand

Appendix A contains a description of the waste management units noted above.

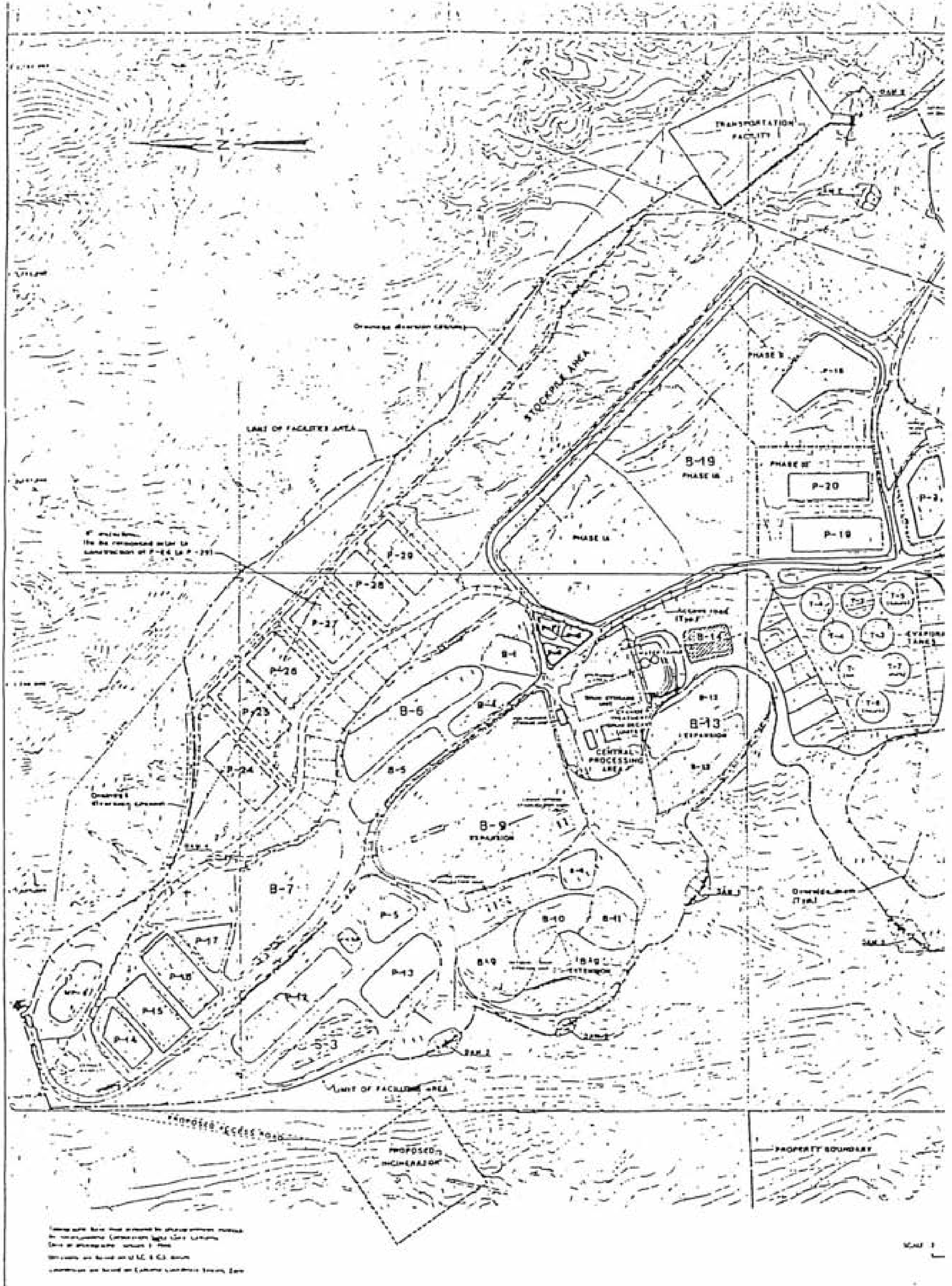
3.1.2 Facility History

Formal disposal operations have been conducted at the KHF since 1975, when McKay Trucking Company was issued a permit to use a 60-acre portion of the current site as a petroleum waste disposal facility. Environmental Disposal Services (EDS) absorbed McKay Trucking Company in 1978. EDS expanded both the size of the facility and the scope of operations, making the KHF a Class-I Disposal Site. CWMI acquired the site in April 1979 (A.T. Kearney Inc., 1987).



From A.T. Kearney, 1987

FIGURE 3-1. Kettleman Hills Facility, Kings County, California
Prepared for Chemical Waste Management, Inc.
by AeroVironment Inc.


N
TRANSPORTATION FACILITY
Drainage diversion channel
STOCKPILE AREA
LIMIT OF FACILITIES AREA
PHASE II
P-18
B-19
PHASE IA
PHASE III
P-20
P-19
PHASE IA
P-29
P-28
P-27
P-26
P-25
P-24
B-1
B-6
B-4
B-5
B-14
B-13
EXPANSION
CENTRAL PROCESSING AREA
Access road
T-1
T-2
T-3
T-4
T-5
T-6
T-7
T-8
EVAPORATION TANKS
B-9
EXPANSION
Drainage diversion channel
B-7
P-5
B-10
B-11
P-13
B-9
B-9 EXTENSION
P-17
P-16
P-15
P-14
P-12
B-3
DAM 1
DAM 2
DAM 3
LIMIT OF FACILITIES AREA
Drainage ditch
PROPOSED ACCESS ROAD
PROPOSED INCINERATOR
PROPERTY BOUNDARY
SCALE

3.1.3 Topographical Setting

The KHF is located on the crest and western slope of the Kettleman Hills, a low range of steep hills bordering the western margin of the San Joaquin Valley. Arroyos and other erosional features of an arid to semiarid climate characterize these sparsely vegetated slopes. There are no perennial surface water bodies within one mile of the facility (A.T. Kearney Inc., 1987).

The surface elevation of the KHF ranges from about 775 feet above mean sea level (amsl) at the southeastern edge of the active area to about 950 feet amsl at the northwestern end. The general trend in elevation is downslope to the southeast. The highest terrain point in the vicinity is Cerro Ultimo (approximate elevation 1125 feet amsl), which is located less than 1.3 miles northwest of the center of the facility (ENSR, 1989).

3.1.4 Meteorological Setting

The region is characterized by a semiarid climate and an extremely low rainfall. Average annual precipitation is 6.12 inches, with 90 percent of the rainfall occurring from November through April. The estimated 100-year, 24-hour storm would result in 2.31 inches of precipitation. Mean annual evaporation in the area is 102.94 inches (pan measurement). The mean annual temperature is 65 degrees Fahrenheit. Seasonal average temperatures range from the low 50s in winter to the high 90s in the summer.

Winds at the KHF are predominantly from the north-northwest. Conditions are rarely calm (less than 0.5 percent of the time); the average wind speed is approximately 8 miles per hour (mph). Winter conditions include variable winds and dense valley fog (A.T. Kearney Inc., 1987; ENSR, 1989.)

3.2 PERMIT STATUS

The KHF has operated under interim status since 19 November 1980, in accordance with the RCRA. The most recent revision to the RCRA Part B permit application for the facility was filed with the U.S. EPA and the CDHS in December 1986. KHF has received and is currently operating under a CDHS Part B permit that was issued on 19 February 1988. The U.S. EPA permit, originally issued on 22 February 1988, was subsequently modified; the revised version became effective on 25 April 1989.

3.3 PREVIOUS AND ONGOING STUDIES

The RCRA Part B permit application that CWMI submitted to the U.S. EPA and CDHS contains numerous documents and reports that discuss studies conducted at the facility, agency-required plans developed for the facility, and sampling and monitoring programs. Of these, the Potential Release Report and the RCRA Facility Assessment conducted by A.T. Kearney, Inc. (1987) were the principal sources of information for this work plan.

Extensive studies have been conducted at the facility on air emissions and their off-site impacts. Most of these studies dealt with units other than those included in this work plan. However, the various unit emissions studies agreed that the previously studied evaporation ponds were the major source of fugitive volatile organic compounds (VOCs) (ENSR, 1989).

3.3.1 California Air Resources Board Study

In the summer of 1983, the California Air Resources Board (ARB) conducted a sampling program at the facility in coordination with the Kings County Health Department, the Kings County Air Pollution Control District (APCD), CDHS, Air and Industrial Hygiene Laboratory (AIHL), and the Haagen-Smit Laboratory of the ARB. The program included monitoring for chlorinated hydrocarbons and pesticides, organic hydrocarbons, sulfur dioxide and other sulfurous compounds, and particulate matter. Seven stations were operated at the facility: three were stationary and the other four were moved to test various units. The ARB concluded that the data were insufficient to adequately assess the total emissions from the facility. In order to determine the emissions associated with temporary storage of solvents in the KHF Central Processing Area, the ARB also conducted an ambient air sampling survey of the Drum Decant Unit and the Polychlorinated Biphenyl (PCB) Flushing/Storage Area. No emissions were detected (ENSR, 1984).

3.3.2 KHF Air Monitoring Program

CWMI has an ongoing air monitoring program to characterize ambient levels of selected VOCs at the KHF. This program, which provides data for evaluating the potential for off-site transport of air emissions from the KHF, includes on-site and off-site ambient monitoring for a select set of indicator compounds. The program was initiated on 1 April 1986, in accordance with the agency-approved KHF Air Monitoring Technical Work Plan and associated Standard Operatin Procedures (N~~V~~S, 1986).
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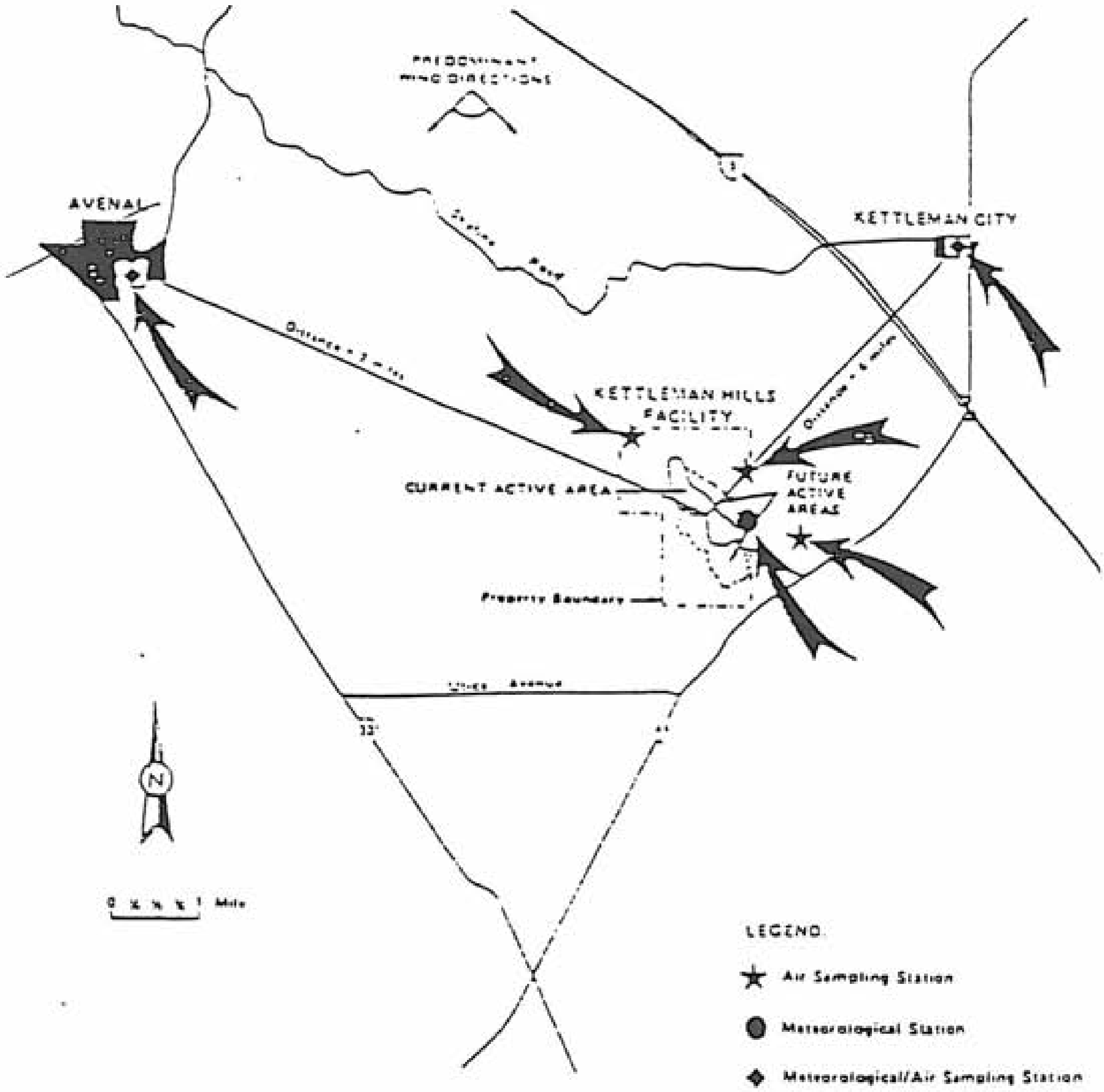
The indicator compounds for this program were selected based on the ARB's listing of Level-I VOCs and the VOCs that CWMI considered to be primary constituents of potential KHF air emissions. These indicator compounds are

- Benzene
- Chloroform
- Ethylene dichloride
- Methyl chloroform
- Methylene chloride
- Trichloroethene
- Total hydrocarbons

The air monitoring program focuses on the characterization of site boundary concentrations at the KHF. Three stationary air monitoring stations have been installed near the site boundary to provide monitoring coverage of the site. Station sites were selected based on predominant wind directions and the location of local population centers. An on-site meteorological station provides data that facilitate interpretation of air sampling results. Off-site air monitoring and meteorological data are collected at stations situated at the nearest population centers of Kettleman City and Avenal. Figure 3-3 shows the layout of the monitoring stations contributing data to this program.

The on-site air sampling stations are operated 24 hours a day year-round. The off-site air sampling stations at Avenal and Kettleman City are operated every sixth day and are designed also begin sampling automatically in the event of a 15-minute average wind direction from the KHF.



from ENSR (1989)

FIGURE 3-3. Kettleman Hills Facility Onsite/Offsite Air Monitoring Network, Kings County, California Prepared for Chemical Waste Management, Inc. by AeroVironment Inc.

All three meteorological stations operate 24 hours a day year-round. At each of these stations, sensors atop a 10-meter tower monitor wind speed, wind direction, and temperature. The standard deviation of wind direction (sigma theta) is also routinely calculated by the data acquisition system. Appendix B includes a typical meteorological data comparison between the KHF and the towns of Avenal and Kettleman City.

In addition to the tower measurements, precipitation and evaporation are also measured on site. Evaporation is measured as the change in water level in a Class A evaporation pan, and precipitation is measured as the level of accumulated water in a standard rain gauge.

The program results continue to show that the KHF has no discernible impact on air quality in the neighboring communities of Avenal and Kettleman City (ENSR, 1989). Appendix B includes a typical summary of VOC concentrations on site, in the nearby communities, and in the San Joaquin Valley.

Section 4

PLANNED CHARACTERIZATION STUDY

4.1 PURPOSE

The characterization study described in this work plan is required by the KHF's RCRA permits. This study must (1) fully characterize the topography and meteorological conditions at the facility that affect the airborne transport of hazardous constituents and (2) identify hazardous constituents being emitted into the air from the facility. The results of this study will be used in designing the facility's ambient air sampling plan, which will describe how the KHF will conduct ambient monitoring to determine whether air emissions from the facility may impact off-site receptors. Appendix C includes the RCRA permit sections that detail the requirements for the characterization study and subsequent ambient air monitoring.

Characterizing the site topography and meteorology will enable CWMI to select locations where and conditions under which ambient air samples that are representative of facility emissions can be collected. Identifying the hazardous vapors or particulates the facility emits into the air will enable CWMI to create a list of proposed analytes for ambient air monitoring. Initial characterization of the hazardous constituents will involve collecting samples from surface impoundments and evaporative tanks, landfills, and treatment units at the facility and analyzing them for the parameters listed in the RCRA permits. The U.S. EPA and DTSC, after reviewing the characterization study data and CWMI's proposed list, will issue a final list of analytes to be included in the ambient monitoring program.

4.2 PROJECT DESCRIPTION

Sections V.D. and V.C. of the U.S. EPA and CDHS RCRA permits (Appendix C) outline the general approach CWMI will take in conducting its characterization study. The following text provides a more detailed description of the project.

4.2.1 Characterization of Topography and Meteorology

CWMI will characterize the topography of the facility using the KHF master plan map (Figure 3-2) and aerial photographs of the facility. The topography of the general Kettleman Hills area will also be described based on 7.5-minute series maps obtained from the United States Geological Survey.

To characterize meteorological conditions at the facility, CWMI will use extant meteorological data from the facility's on-site monitoring station (as described in Section 3.3.2). This characterization will include a review of a minimum of one year's on-site meteorological data. Monthly and annual summary reports will be generated from these data. As required in the RCRA permits, the reports will include temperature averages and extremes, wind frequency distributions (wind roses), stability frequency distributions, and barometric pressure data.

From a pollutant transport/dispersion perspective, the primary meteorological parameters concern are wind speed, wind direction, and temperature. The standard deviation of wi. direction, commonly referred to as sigma-theta, is also important because it can be used to assign an atmospheric stability class, which is an indication of the dispersive potential of the atmosphere. All of these data are generated by the on-site monitoring station. While barometric pressure is not measured on site, barometric pressure data is a permit requirement. Barometric pressure data from the U.S. Weather Bureau station in Fresno, California, can be used, since barometric pressure and trends in barometric pressure will vary little over the region. Relative humidity and solar radiation are not included in this study, as these parameters are not necessary to meet the objectives of this work plan and are not a RCRA permit requirement.

The on-site meteorological data can be analyzed in conjunction with the topographical data and information regarding sources of contaminants to determine the locations beyond the facility boundaries where maximum impacts would be expected to occur. This knowledge would then be used in selecting sites for air monitoring of contaminants.

4.2.2 Hazardous Constituent Identification

The KHF waste management units designated as potential sources of airborne contaminants in the RCRA permits will be monitored for the parameters listed in the permits (Appendix C). These units include surface impoundments, landfills, and hazardous waste treatment units Evaporative tanks, which are similar in principal to surface impoundments, are a propos addition to the facility; while not mentioned in the RCRA permits, they would be a poten contaminant source and are therefore addressed in this work plan. Former spreading areas and mud ponds will not be monitored; the reason for their exclusion is explained below.

CWMI has selected the units to be included in the characterization study based on their anticipated status at the time the project begins. Many of the units are inactive, and some have been closed, dismantled, or assimilated into another unit. A major closure effort, known as "Bigfoot," will affect several inactive units in the northwest portion of the facility (Figure 4-1) and is expected to be in progress during the characterization study. Table 4-1 summarizes the current status of the facility's units, the units to be included in the study, and the matrices to be sampled.

4.2.2.1 Surface Impoundments

The KHF has had 20 surface impoundments, designated P-1 through P-20 (see Figure 3-2). Of these, P-9, P-14, and P-16 are currently active; these units are the only surface impoundments expected to contain aqueous waste during the project.

- P-9 has a surface area of 1.9 acres and a capacity of 4,000,000 gallons. As of September 1991, P-9 contained approximately 3,200,000 gallons of waste.

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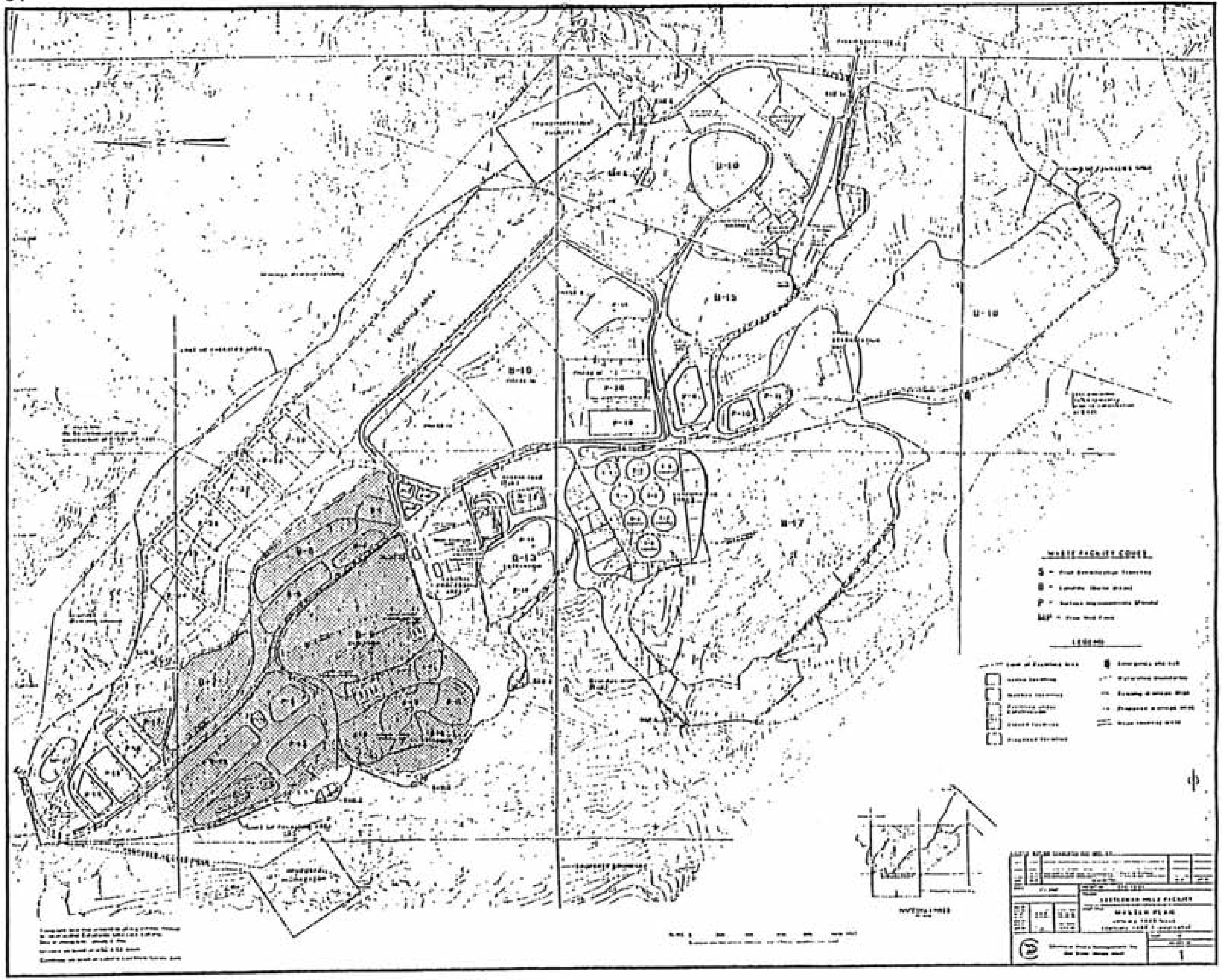

FIGURE 4-1. "Bigfoot" closure area.
Prepared for Chemical Waste Management Inc. by AeroVironment Inc.

TABLE 4-1. Waste management unit status summary.

Waste Management Unit	Unit Area (acres)[a]	Status[b]	Matrix to be Sampled[c]	Comments
Surface Impoundments				
P-1	≤0.5	I	N	Located within B-9 (expansion). Upper interim stabilization unit site (part of scheduled "Bigfoot" closure). Completed in 1983; waste removed to B-9.
P-2	≤0.5	I	N	Located within B-9 (expansion). Upper interim stabilization unit site (part of scheduled "Bigfoot" closure). Completed in 1983; waste removed to B-9.
P-3	≤0.5	I	N	Located within B-9 (expansion). Upper interim stabilization unit site (part of scheduled "Bigfoot" closure). Completed in 1983; waste removed to B-9.
P-4	≤0.5	I	N	Located within B-9 (expansion). Upper interim stabilization unit site (part of scheduled "Bigfoot" closure). Completed in 1983; waste removed to B-9.
P-5	1.0	I	N	Constructed over old S-2 site; part of scheduled "Bigfoot" closure. Backfilled in mid-1980s.
P-6	0.3	I	N	Completed in 1983. Part of scheduled "Bigfoot" closure.
P-7	0.2	I	N	Completed in 1983. Part of scheduled "Bigfoot" closure.
P-8	0.4	I	N	Completed in 1983. Part of scheduled "Bigfoot" closure.
P-9	1.9	A	L/AA	Currently accepting RCRA liquid wastes.
P-10	1.0	I	N	Completed 10/86.
P-11	0.7	I	N	Completed 10/86.

TABLE 4-1. (continued).

Waste Management Unit	Unit Area (acres)	Status[a]	Matrix to be Sampled[b]	Comments
P-12/12A	2.9	I	N	Constructed over old S-2 site; part of scheduled "Bigfoot" closure. Completed in 1985.
P-13	3.8	I	N	Completed in 1985. Part of scheduled "Bigfoot" closure.
P-14	1.3	A	L/AA	Constructed over old S-4 site. Currently accepting RCRA liquid wastes.
P-15	1.7	I	N	Constructed over old S-4 site. Unit completed in mid-1991.
P-16	1.8	A	L/AA	Constructed over old S-4 site. Currently accepting RCRA liquid wastes.
P-17	0.7	I	N	Completed in 1984, wastes removed to B-16. Part of scheduled "Bigfoot" closure.
P-18	3.0	I	N	Constructed over old S-6 site. Completed 6/85; wastes stockpiled B-13 (expansion). Within B-19 (Phase II).
P-19	2.3	I	N	Constructed over old S-6 site. Completed in 1985; wastes landfilled. Within B-19 (Phase III).
P-20	1.6	I	N	Constructed over old S-6 site. Completed in early 1988; wastes removed to B-19 (Phase IB). Within B-19 (Phase III).
<u>Evaporative Tanks</u>				
T-1	---	P	L	Will be sampled if active during this project
T-2	--	P	L	Will be sampled if active during this project
T-3	--	P	L	Will be sampled if active during this project
T-4		P	L	Will be sampled if active during this project

TABLE 4-1. (continued).

Waste Management Unit	Unit Area (acres)	Status[a]	Matrix to be Sampled[b]	Comments
Landfills				
B-1	0.7	I	N	Completed in mid-1978. Now under section of Central Process Area access road. Part of scheduled "Bigfoot" closure.
B-2	0.2	C	N	Completed late 1978; closure certified 8/88. Waste & contaminated soil moved to B-13.
B-3	0.2	C	N	Completed late 1978; closure certified 8/88. Waste & contaminated soil moved to B-13.
B-4	0.5	I	N	Completed in mid-1980. Part of scheduled "Bigfoot" closure.
B-5	1.8	I	N	Completed in mid-1980. Part of scheduled "Bigfoot" closure.
B-6	3.0	I	N	Completed 8/83. Part of scheduled "Bigfoot" closure.
B-7	5.6	I	N	Completed in late 1979. Part of scheduled "Bigfoot" closure.
B-8	NA	I	N	Completed 5/79. Within B-9 (extension). Part of scheduled "Bigfoot" closure.
B-9	NA	I	N	Within B-9 (expansion). Part of scheduled "Bigfoot" closure.
B-9 (extension)	NA	I	N	Incorporates B-8, B-10, B-11, P-1, P-2, P-3, P-4. Part of scheduled "Bigfoot" closure.
B-9 (expansion)	38.3	I	N	Incorporates S-1, B-9 (extension). Part of scheduled "Bigfoot" closure.

TABLE 4-1. (continued).

Waste Management Unit	Unit Area (acres)	Status[a]	Matrix to be Sampled[b]	Comments
B-10	2.0	I	N	Completed 10/80. Within B-9 (expansion). Part of scheduled "Bigfoot" closure.
B-11	1.6	I	N	Completed 10/80. Within B-9 (expansion). Part of scheduled "Bigfoot" closure.
B-12	2.8	I	N	Completed in mid-1980. Within B-13 (expansion).
B-13 (expansion)	5.0	~~I~~ A	LG	Completed in 1987. Incorporates B-12 and original B-13.
B-14	0.8	C	N	Closed with clay cap in 1984.
B-15	7.2	I	LG	Completed 5/85; currently used as heavy equipment parking lot. Will be sampled if scheduled closure is not completed before project startup.
B-16	4.7	A	S/LG	Currently accepting bulk & containerized PCB solids.
B-17	NA	P	N	Proposed landfill; will not be active during this project.
B-18 ph.I Phase II	29.4	P	S/LG	Proposed landfill currently under construction; will be sampled if active during this project.
TOS B-19 (Phase IA)	11.7	A	S/LG	Incorporates S-5. Damaged liner 1988, repaired 1991. Expected to be active during project.
B-19 (Phase IB)	12.8	A	S/LG	Incorporates S-5. Currently accepting solid RCRA wastes.

TABLE 4-1. (continued).

Waste Management Unit	Unit Area (acres)	Status[a]	Matrix to be Sampled[b]	Comments
B-19 (Phase II)	11.5	A	S/L,G	Incorporates P-18. Currently accepting solid RCRA wastes. Includes wastes from damaged B-19 (Ph.1A).
B-19 (Phase III)	6.5	A	S/L,G	Incorporates P-19 & P-20. Currently accepting solid RCRA wastes. Includes wastes from damaged B-19 (Ph.1A).
Spreading Areas				
S-1	13.7	I	N	Within B-9 (expansion) -- southern edge current site of Central Processing Area. Part of scheduled "Bigfoot" closure. Completed in 1983; contaminated soil moved to B-11.
S-2	8.0	I	N	Completed in mid-1980; contaminated soil removed to B-9 of B-11. Current site of P-5 and P-12/12A -- part of scheduled "Bigfoot" closure.
S-3	2.7	I	N	Completed in mid-1981; wastes removed to B-15. Part of scheduled "Bigfoot" closure.
S-4	4.8 (approx)	I	N	Completed in mid-1982; wastes removed to B-9. Current site of P-14, P-15, and P-16. Part of scheduled "Bigfoot" closure.
S-5	10.2	I	N	Completed 5/85; wastes removed to B-9 (expansion). Within current B-19 (Phase 1A and 1B).
S-6	6.0 (approx)	I	N	Completed 12/83; wastes removed to S-5. P-18, P-19,and P-20 constructed at this site -- current location of B-19 (Phase II and III).

TABLE 4-1. (continued).

Waste Management Unit	Unit Area (acres)	Status[a]	Matrix to be Sampled[b]	Comments
Mud Ponds				
MP-1	0.7	I	N	Drilling muds excavated in early 1980s and used as liner material for B-16.
MP-E	--	I	N	South of Central Processing Area. Drilling muds excavated in late 1970s and used as liner material for B-6.
Treatment Units				
Central Processing Area	--	A	AA	Includes Drum Decant Unit, Cyanide Treatment Unit, PCB Storage/Flushing Unit, and Drum Storage Unit
Final Stabilization Unit	--	A	AA	Includes associated storage areas
Interim Stabilization Units (upper & lower)	--	I	N	These unit and associated interim storage areas have been removed. Located within B-9 (expansion) -- part of scheduled "Bigfoot" closure

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a NA = Not available

b A = Active
I = Inactive
C = Closed

c AA = Ambient Air
LG = Landfill Gas
S = Soil
L = Liquid
N = No sampling

- P-14 has a surface area of 1.3 acres and a capacity of 2,100,000 gallons. As of September 1991, P-14 contained approximately 890,000 gallons of waste.

- P-16 has a surface area of 1.8 acres and a capacity of 3,900,000 gallons. As of September 1991, P-16 contained approximately 2,400,000 gallons of waste.

Each of these impoundments is a slope-sided structure with a double composite liner and a leachate-collection system. Vacuum trucks empty wastes into the impoundment from an adjacent concrete discharge pad. Discharge pipes extend from the pad and along the side and bottom of the impoundment, emptying at the bottom of the impoundment near its center.

The impoundments receive aqueous wastes that are shown to be compatible by the Liquid Waste Compatibility Test and that are not generally restricted from discharge to surface impoundments by the conditions of the Part B permit. Wastes include heavy metal solutions, scrubber wastes, brines, pesticides, and aqueous organic solutions. The liquids discharged to the impoundments contain less than one percent each of total organics and oil and grease, and less than 0.1 percent halogenated organics by volume. As of September 1991, the impoundments contained a total of almost 6,500,000 million gallons of aqueous waste and were receiving approximately 150,000 gallons per month.

In accordance with the RCRA permits (see Appendix C), each of the three surface impoundments will be sampled once a week over a six-week period. A liquid sample will be collected at depth from each impoundment and analyzed for the volatile and semivolatile organics listed in permits. Because the structure of the impoundments makes it difficult to collect a liquid sam at or near the discharge point without compromising worker safety or sample integrity, the liquid sample will be collected at depth from the edge of each impoundment. In addition, each sampling episode will include an ambient air sample collected downwind from each impoundment. The air samples will be analyzed for the volatile parameters specified in the permits. The air monitoring data will supplement the liquid analysis data.

4.2.2.2 Evaporative Tanks

Four evaporative tanks, designated T-1 through T-4, are scheduled for construction in the near future and may be active during the project. While Tanks T-5 through T-8 may be added at a later date, these four tanks will not be in use by the time this project begins. Figure 3-2 shows the proposed locations of these structures.

Each open-topped tank will be 10 feet high and 115 feet in diameter, and will have a capacity of 1,000,000 gallons. Liquid wastes with a total organics content of up to 0.05 percent by volume will be discharged to the tanks for solar evaporation and chemical precipitation.

To sample the evaporative tanks, CWMI will use the approach outlined in the RCRA permits for surface impoundments. Liquid from each of the four tanks will be sampled once a week over a six-week period. The samples will be collected at depth and analyzed for volatile and semivolatile organics.

4.2.2.3 Landfills

The KHF has had 19 landfills, designated B-1 through B-19 (see Figure 3-2). Three of the landfills (B-2, B-3, and B-14) have undergone final closure, and most of the remaining landfills (B-1 and B-4 through B-11) will be closed during the upcoming "Bigfoot" operation. The proposed landfill B-17 will not be in operation at the time of the characterization study. The remaining landfills, which will be included in this work plan, are

- The B-13 expansion, an inactive landfill that incorporated B-12, B-13, and the natural ravine between the units. Until 1987, this 5.0-acre burial unit received empty crushed acid drums, acid-contaminated soil, and animal rendering wastes excavated from other discontinued units. The original B-12 and B-13 received drummed acids and oxidizers. While the B-13 expansion is scheduled for final closure, the closure is not expected to be under way during the characterization study.

- B-15, an inactive landfill that currently serves as a heavy-equipment parking lot for the KHF. The 7.2-acre landfill was 47 feet deep and had a capacity of 290,000 cubic yards (yd^3). Wastes buried in the landfill include containerized liquids, paint sludge, solidified alkaline corrosives, PCB wastes, empty crushed drums, solidified sulfide wastes, and contaminated soil. The unit has been inactive since May 1985. A final closure operation is scheduled for B-15; however, the closure may not be under way by the time the characterization study commences.

- B-16, an active landfill excavated below grade. Its area is 4.7 acres and its capacity is 166,000 yd^3. It has a three-foot-thick clay liner with a leachate collection and removal system and a vadose zone monitoring system. Since it opened in 1983, the unit has accepted bulk and containerized hazardous solids and sludges and PCB solids. B-16 is the only active PCB disposal unit on site.

- B-18, a proposed 55-acre landfill that may be active during the characterization study. This landfill will be divided into two phases and will have a total capacity of 9,000,000 yd^3. B-18 is scheduled to receive all types of solid RCRA wastes, as described in Part IV of the Part B permit. Phase I & II .

- B-19, an active landfill divided into four phases (IA, IB, II, and ~~III~~). It has a surface area of 41.5 acres and a capacity of 6,800,000 yd^3. As of September 1991, Phase IA was inactive, having recently been emptied so that a damaged portion of its liner system could be repaired. All four phases of the unit are expected to be active during the project. B-19 has a double composite liner with vadose zone monitoring. Since it opened in 1987, the unit has accepted all types of solid RCRA wastes, as describe Part IV of the Part B permit.

As described in the RCRA permits (see Appendix C), surface soils from the active landfills will be analyzed for the required semivolatile and inorganic analytes. At each landfill unit or (in the case of B-18 and B-19) each phase, ten subsamples will be composited into one sample for analysis. At active and inactive burial areas, a landfill gas sample will also be collected from each unit or phase, using an integrated surface sampling (ISS) method.

B-18 and B-19 are the site of a scheduled landfill cover study. In this study, a mixture of wood pulp and chemical binder known as ConCover will be sprayed over the active landfill in place of the usual soil cover. This study should not interfere with hazardous component characterization efforts, provided it does not precede or coincide with the project described in this work plan. Once the cover is emplaced, however, it will be impossible to collect a surface soil sample from the covered unit. The presence of this experimental cover could also hinder landfill gas sampling operations, since ISS methods require personnel to walk a grid pattern across the landfill. The field crew would run the risk of rupturing the cover by walking over it and thereby exposing themselves to the landfilled wastes. Should the ConCover study schedule conflict with the characterization study, CWMI and the DTSC will determine at that time how landfill monitoring is to proceed.

4.2.2.4 Spreading Areas and Mud Ponds

Six spreading areas (S-1 through S-6) and numerous mud ponds were used during past operati at the KHF and are currently inactive. With the exception of Spreading Area S-3 and Mud Pond MP-1, these sites are now occupied by other waste management units (Table 4-1). S-1 through S-4 and MP-1 are included in the planned "Bigfoot" closure, and S-5 and S-6 are within landfill B-19. None of the former spreading areas or mud ponds will be monitored during this investigation.

4.2.2.5 Hazardous Waste Treatment Units

The KHF hazardous waste treatment units to be addressed in this study are as follows:

- the Central Processing Area units, which include
    - the Drum Decant Unit, where aqueous organic and solvent wastes are transferred from individual drums to bulk storage tanks. Drums are moved on a conveyor to the decant station. An extraction wand is inserted into the bunghole of the drum and free liquids are pumped out of the drum into one of the 700-gallon surge tanks. Accumulated liquids are then pumped into the storage tanks for phase separation, then stabilized and landfilled. This unit may receive a wide variety of organic solvents, gasoline, diesel sludge, and oils; however, these materials are commonly recycled now, so that use of the D Decant Unit has dropped sharply. As of September 1991, this unit had not b used all year.

  - the Cyanide Treatment Unit, where waste cyanides are mixed with sulfur compounds to form the less reactive and less toxic thiocyanate complex. Cyanide wastes thus treated are transferred to the Final Stabilization Unit (FSU). Stabilized thiocyanate residues are disposed of in a secure, on-site landfill. As of September 1991, this unit was being used about once every quarter.

  - the PCB Storage/Flushing Unit, an enclosed unit where PCB-contaminated electrical equipment and drums are drained and flushed into a 10,000-gallon storage tank. Liquids with a PCB concentration of under 50 parts per million (ppm) may be transported off site for incineration or (less frequently) solidified for on-site disposal, while PCB-contaminated solids are landfilled on site.

  - the Drum Storage Unit, where drummed wastes are held pending treatment or disposal. Wastes are segregated so that drums targeted for a particular treatment unit are placed in the same storage module.

- the FSU, which in 1989 replaced the Upper and Lower Interim Stabilization Units described in earlier drafts of this work plan.

  The FSU is an enclosed unit consisting of four rectangular, subsurface open-top steel tanks. Each tank is 14 feet by 28 feet by 12 feet deep, with a capacity of 10,000 gallons. Secondary containment is provided by external synthetic liners. Wastes amenable to the stabilization process are mixed with a stabilization material in the tanks. When the stabilization reaction has been completed, the mixture is removed to a landfill for final disposal.

  - Up to two support storage areas may be established near the FSU. These areas would be used for the temporary containerized storage of wastes requiring stabilization or of stabilized wastes awaiting burial.

Figure 3-2 shows the locations of these units.

In accordance with the RCRA permits (see Appendix C), CWMI will collect representative samples of air emissions resulting from operations at these units. Samples will be collected downwind from each unit over three separate workdays, with sampling episodes scheduled to coincide with unit operating periods. Two air sampling stations will be installed to monitor the Central Processing Area. One station will be installed downwind from the FSU; an additional station will be installed for each FSU storage area. A stack-monitoring test of the FSU stack may also be added, if the unit's extended effluent stack has been constructed and is in use by the time this study begins.

Section 5

SAMPLING PROCEDURES

This section of the work plan outlines the procedures that the field team will follow to collect water, soil and air samples at the KHF. Table 5-1 summarizes the number and type of samples to be collected at each waste management unit. Table 5-2 lists the analytes, analysis methods, and detection limits for each matrix, and Table 5-3 summarizes container requirements, preservation methods, and holding times for the various analyses.

5.1 SURFACE IMPOUNDMENTS

Surface impoundments P-9, P-14, and P-16 will be sampled once a week over a six-week period. Sampling will be scheduled for every sixth day; however, this schedule will be modified to allow sample collection during periods of waste discharge to the impoundments. CWMI's records of wastes discharged will be compared with the analysis data.

5.1.1 Liquid Sample Collection Method

A discrete liquid sampling device will be used to obtain liquid samples from the surface impoundments. The sampling device will be constructed of stainless steel and Teflon attached to stainless steel extension rods, materials that will not be degraded by the chemicals in the impoundments. One sampling device will be assigned to each impoundment.

Before an impoundment sample is collected, field personnel will measure the depth to liquid and to the bottom of the impoundment using a rod or weighted tape. The sampling device will be washed in a solution of nonphosphate detergent and tap water, rinsed with tap water, and rinsed again with distilled water. It will then be lowered into the impoundment, and a liquid sample will be collected within three feet of the measured bottom of the impoundment.

Samples for purgeable organics analysis (EPA Method 624) and aldehydes analysis (EPA Method 8315) will be collected in 40 milliliter (ml) glass vials with Teflon-lined septa fitted into the screw caps. To hold the vial steady and minimize aeration during sampling, the vial will be held in a clamp mounted on a bunsen stand while the sampling device's bottoming dump valve is used to transfer water from the sampling device to the vial. The vial will be carefully filled until a meniscus forms at its mouth. The container will then be capped, inverted, and tapped to check for air bubbles. If no bubbles are present, the sample has been taken correctly; otherwise, the vial must be discarded for a fresh vial and a sample without bubbles must be collected. Two vials for each analysis method (a total of four 40-ml vials) will be collected per sample.

Samples for acrolein and acrylonitrile analysis (EPA Method 603) will be collected in a 500-ml glass bottle, using the collection method outlined above. One container will be filled per sample.

TABLE 5-1. Sampling plan summary.

Waste Management Unit	Ambient Air		Landfill Gas		Soil		Liquid	
	Analysis Parameters[a]	No. of Samples[b]	Analysis Parameters[a]	No. of Samples[b]	Analysis Parameters[a]	No. of Samples[b]	Analysis Parameter[a]	No. of Samples[b]
LANDFILLS								
B-13 (expansion)	--	--	VO	1+1D	--	--	--	--
B-15	--	--	VO	1	--	--	--	--
B-16	--	--	VO	1	SVO, IO	1	--	--
B-18 (Phase I [illegible])	--	--	VO	1+1B	SVO, IO	1	--	--
B-18 (Phase II)	--	--	VO	1 [illegible]	SVO, IO	1	--	--
B-19 (Phase IB)	--	--	VO	1	SVO, IO	1	--	--
B-19 (Phase II)	--	--	VO	1	SVO, IO	1	--	--
B-19 (Phase III)	--	--	VO	1	SVO, IO	1+1R	--	--
SURFACE IMPOUNDMENTS[d]								
P-9	VO	6+2D+2B	--	--	--	--	VO, SVO	6+2D+2B
P-14	VO	6+2D+2B	--	--	--	--	VO, SVO	6+2D+2B
P-16	VO	6+2D+2B	--	--	--	--	VO, SVO	6+2D+2B
EVAPORATIVE TANKS[e]								
T-1	--	--	--	--	--	--	VO, SVO	6+2D+1B
T-2	--	--	--	--	--	--	VO, SVO	6+1D+2B
T-3	--	--	--	--	--	--	VO, SVO	6+2D+1B
T-4	--	--	--	--	--	--	VO, SVO	6+1D+2B
TREATMENT UNITS[f]								
Central Processing Area	VO, SVO, IO	6+1D+1B	--	--	--	--	--	--
Final Stabilization Unit (FSU)	VO, SVO, IO	3+1D+1B	--	--	--	--	--	--
FSU Storage Area	VO, SVO, IO	3+1D	--	--	--	--	--	--
Auxiliary FSU Storage Area	VO, SVO, IO	3+1B	--	--	--	--	--	--

TABLE 5-1. (continued)

[a] VO = volatile organics; SVO = semivolatile organics; IO = inorganics.

[b] Landfill gas samples will be collected by integrated surface sampling. For landfill soils, each sample will be composited from 10 subsamples.

[c] D = duplicate, R = replicate, B = (equipment) blank. One trip blank will also accompany every sample shipment scheduled for VOC analysis.

[d] Surface impoundments will be sampled once a week over a six week period. Each sampling episode will include one downwind ambient air sample collected over a six- to eight-hour daytime period and one liquid sample obtained from the impoundment at depth.

[e] One liquid sample will be collected from each evaporative tank every week over a six-week period.

[f] Downwind ambient air samples will be collected for each of the treatment units and their storage areas. In the Central Processing Area, two sampling locations will be used. collection will be during transport conditions under ten miles per hour over a six- to eight-hour daytime period.

TABLE 5-2. Analysis methods and detection limits for required analytes.

Analyte	CAS[a] No.	Air	Detection Limit (ppbv)[b]	Water	Detection Limit (µg/L)[c]	Soil	Detection Limit (mg/kg)[d]
VOLATILES							
Acetaldehyde	75-07-0	TO-11	1	8315	TBD[e]	NA[f]	NA
Acetone	67-64-1	TO-11	1	624	10	NA	NA
Acrolein	107-02-8	TO-11	1	603	1	NA	NA
Acrylonitrile	107-13-1	TO-14	0.20	603	1	NA	NA
Allyl chloride	107-05-1	TO-14	0.20	624	TBD	NA	NA
Benzaldehyde	100-52-7	TO-11	1	8315	TBD	NA	NA
Benzene	71-43-2	TO-14	0.20	624	1	NA	NA
Bromoform	75-25-2	TO-14	0.20	624	1	NA	NA
2 Butanal	123-73-8	TO-11	1	624	TBD	NA	NA
Carbon tetrachloride	56-23-5	TO-14	0.20	624	1	NA	NA
Carbonyl chloride	75-44-5	TO-6	1	NA[g]	NA	NA	NA
Chlorobenzene	108-90-7	TO-14	0.20	624	1	NA	NA
Chloroform	67-66-3	TO-14	0.20	624	1	NA	NA
1,2-Dibromoethane	106-93-4	TO-14	0.20	624	1	NA	NA
1,4-Dichlorobenzene	106-46-7	TO-14	0.20	624	1	NA	NA
1,1-Dichloroethane	75-34-3	TO-14	0.20	624	1	NA	NA
1,2-Dichloroethane	107-06-2	TO-14	0.20	624	1	NA	NA
1,1-Dichloroethene	75-35-4	TO-14	0.20	624	1	NA	NA
1,2-Dichloropropane	78-87-5	TO-14	0.20	624	1	NA	NA
cis-1,3-Dichloropropene	10061-02-6	TO-14	0.20	624	1	NA	NA
trans-1,3-Dichloropropene	10061-02-6	TO-14	0.20	624	1	NA	NA
Ethylbenzene	100-41-4	TO-14	0.20	624	1	NA	NA
Formaldehyde	50-00-0	TO-11	1	8315	TBD	NA	NA
n-Heptane	142-82-5	TO-14	0.20	624	TBD	NA	NA
Hexanal	66-25-1	TO-11	1	624	TBD	NA	NA
Hexane	110-54-3	TO-14	0.20	624	TBD	NA	NA

Analysis methods and detection limits [illegible] quired analytes (continued).

Analyte	CAS No.	Air	Detection Limit (ppbv)	Water	Detection Limit (µg/L)	Soil	Detection Limit (mg/kg)	
VOLATILES								
Methyl bromide	74-83-9	TO-14	0.20	624	1	NA	NA	
Methylene chloride	75-09-2	TO-14	1.50	624	1	NA	NA	
Methyl ethyl ketone	78-93-3	TO-11	1	624	5	NA	NA	
Pentanal	110-62-3	TO-11	1	624	TBD	NA	NA	
Propanal	123-38-6	TO-11	1	624	TBD	NA	NA	
Tetrachloroethene	127-18-4	TO-14	0.20	624	1	NA	NA	
Toluene	108-88-3	TO-14	0.20	624	1	NA	NA	
1,1,1-Trichlorethane	71-55-6	TO-14	0.20	624	1	NA	NA	
Trichloroethene	79-01-6	TO-14	0.20	624	1	NA	NA	
Vinyl chloride	75-01-4	TO-14	0.20	624	1	NA	NA	
m-Xylene	108-38-3	TO-14	0.20	624	1	NA	NA	
o-Xylene	95-47-6	TO-14	0.20	624	1	NA	NA	
p-Xylene	106-42-3	TO-14	0.20	624	1	NA	NA	
Total volatile hydrocarbons		--	25	--	624	--	NA	NA
SEMIVOLATILES								
Acenaphthylene	208-96-8	TO-13	1	625	5	8270	0.2	
Aldrin	309-00-2	TO-14	1	608	0.03	8080	0.001	
Anthracene	120-12-7	TO-13	1	625	5	8270	0.2	
Benzo (a) anthracene	56-55-3	TO-13	1	625	5	8270	0.2	
Benzo (b) fluoranthene	205-99-2	TO-13	1	625	5	8270	0.2	
Benzo (k) fluoranthene	207-08-9	TO-13	1	625	5	8270	0.2	
Benzo (g,h,i) perylene	191-24-2	TO-13	1	625	5	8270	0.2	
Benzo (a) pyrene	50-32-8	TO-13	1	625	5	8270	0.2	

Analysis methods and detection limits for required analytes (Continued).

Analyte	CAS No.	Air	Detection Limit (ppbv)	Water	Detection Limit (µg/L)	Soil	Detection Limit (mg/kg)	
SEMIVOLATILES								
Chlordane	57-74-9	TO-4	1	608	0.3	8080	0.01	
2-Chloronaphthalene	91-58-7	TO-13	1	625	10	8270	0.4	
Chrysene	218-01-9	TO-13	1	625	5	8270	0.2	
o-Cresol	95-48-7	TO-8	1	625	5	8270	0.2	
p-Cresol	106-44-5	TO-8	1	625	5	8270	0.2	
Cumene	98-82-8	TO-13	1	625	TBD	8270	TBD	
4,4'-DDD	72-54-8	TO-4	1	608	0.03	8080	0.001	
4,4'-DDE	72-55-9	TO-4	1	608	0.03	8080	0.001	
4,4'-DDT	50-29-3	TO-4	1	608	0.03	8080	0.001	
Dibenzo (a,h) anthracene	53-70-3	TO-13	1	625	5	8270	0.2	
1,4-Dichlorobenzene	106-46-7	TO-14	0.02	625	5	8270	0.2	
Fluoranthene	206-44-0	TO-13	1	625	5	8270	0.2	
Fluorene	86-73-7	TO-13	1	625	5	8270	0.2	
Ideno (1,2,3-c,d)pyrene	193-39-5	TO-13	1	625	5	8270	0.2	
Naphthalene	91-20-3	TO-13	1	625	5	8270	0.2	
Nitrobenzene	98-95-3	TO-13	1	625	5	8270	0.2	
n-Nitrosodimethylamine	62-75-9	TO-7	1	607	1	8270	0.2	
n-Nitrosodiphenylamine	86-30-6	TO-7	1	607	1	8270	0.2	
n-Nitrosodi-n-propylamine	621-64-7	TO-7	1	607	1	8270	0.4	
Phenanthrene	85-01-8	TO-13	1	625	5	8270	0.2	
Phenol	108-95-2	TO-8	1	625	5	8270	0.2	
PCB (total)	-	TO-4	1	608	.06	8080	0.01	
Polychlorinated dibenzo-p-dioxins		1746-01-6	TO-9	1	8270	0.002	8270	0.2
Pyrene	129-00-0	TO-13	1	625	10	8270	0.4	

TABLE 5-2. Analysis methods and detection is for required analytes (Continued).

Analyte	CAS[a] No.	Air	Detection Limit (ppbv)[b]	Water	Detection Limit (µg/L)[c]	Soil	Detection Limit (mg/kg)[d]
INORGANICS							
Antimony	7440-36-0	PF/6010[h]	1	NA	NA	6010	1
Arsenic	7440-38-2	PF/6010	1	NA	NA	6010	1
Barium	7440-39-3	PF/6010	1	NA	NA	6010	1
Beryllium	7440-41-7	PF/6010	1	NA	NA	6010	1
Cadmium	7440-43-9	PF/6010	1	NA	NA	6010	1
Chromium	7440-47-3	PF/6010	1	NA	NA	6010	1
Cobalt	7440-48-4	PF/6010	1	NA	NA	6010	1
Copper	7440-50-8	PF/6010	1	NA	NA	6010	1
Lead	7439-92-1	PF/6010	1	NA	NA	6010	1
Mercury	7439-97-6	PF/7471	1	NA	NA	7471	1
Molybdenum	7439-98-7	PF/6010	1	NA	NA	6010	1
Nickel	7440-02-0	PF/6010	1	NA	NA	6010	1
Selenium	7782-49-2	PF/6010	1	NA	NA	6010	1
Silver	7440-22-4	PF/6010	1	NA	NA	6010	1
Thallium	7440-28-0	PF/6010	1	NA	NA	6010	1
Vanadium		PF/6010	1	NA	NA	6010	1
Zinc	7440-66-6	PF/6010	1	NA	NA	6010	1

[a] CAS = Chemical Abstracts Service

[b] ppbv = parts per billion by volume

[c] µg/L = micrograms per liter

[d] mg/kg = milligrams per kilogram

[e] TBD = to be determined

[f] NA = not applicable

[g] There is no recommended analysis method for carbonyl chloride (phosgene) in aqueous wastes, since the compound decomposes in water. The only matrix that will be analyzed for carbonyl chloride is air.

[h] PF = particulate filter

TABLE 5-3. Sample containers, preservation, and holding times.

Matrix	EPA Analysis Method	No. of Containers Per Sample	Container Volume	Container Type	Preservation	Molding Time
Water	603	1	500 ml	Glass bottle[a]	cool to 4^{0}C	3 days
	607	1	1L	Amber glass bottle[a]	cool to 4^{0}C	7 days (extraction)
	608	1	1L	Amber glass bottle[a]	cool to 4^{0}C	7 days (extraction)
	624	2	40 ml	Glass vial w/Teflon septa	cool to 4^{0}C	14 days
	625	1	1L	Amber glass bottle[a]	cool to 4^{0}C	7 days (extraction)
	8280	1	1L	Amber glass bottle[a]	cool to 4^{0}C	7 days (extraction)
	8315	2	40 ml	Glass vial w/Teflon septa	cool to 4^{0}C	14 days
Soil	6010	10	19 in^3	stainless steel sleeve	cool to 4^{0}C	28 days
	7471	10	19 in^3	stainless steel sleeve	cool to 4^{0}C	28 days
	8070	10	19 in^3	stainless steel sleeve	cool to 4^{0}C	28 days
	8080	10	19 in^3	stainless steel sleeve	cool to 4^{0}C	28 days
	8270	10	19 in^3	stainless steel sleeve	cool to 4^{0}C	28 days
	8280	10	19 in^3	stainless steel sleeve	cool to 4^{0}C	28 days
Air	25	1	6L	stainless steel canister	cool to 4^{0}C	14 days
	6010	1	--	particulate filter	--	28 days
	7471	1	--	particulate filter	--	28 days
	TO-4	1	--	particulate filter/PUF cartridge	cool to 4^{0}C	7 days (extraction)
	TO-6	1	20 ml	glass vial[a]	cool to 4^{0}C	28 days
	TO-7	1	--	absorption cartridge	--	7 days
	TO-8	1	25 ml	glass vial[a]	cool to 4^{0}C	48 hours
	TO-9	1	--	particulate filter/PUF cartridge	cool to 4^{0}C	28 days
	TO-11	1	--	absorption cartridge	cool to 4^{0}C	30 days
	TO-13	1	--	particulate filter/ adsorption cartridge	cool to 4^{0}C	28 days
	TO-14	1	6L	stainless steel canister	ship under positive pressure	7 days

[a] with Teflon-lined screwcap

ml = [illegible]ters, L = liters, in^3 = cubic inches

Samples being analyzed for nitrosamines (EPA Method 607), organochlorine pesticides and PCBs (EPA Method 608), base/neutral and acid extractables (EPA Method 625), and dioxins (EPA Method 8280) will be taken in one-liter amber glass bottles with Teflon-lined screw caps. Each sample container will be dedicated to only one analysis method; hence, a total of four amber glass containers per sample will be filled. A headspace is permissible for these samples.

One duplicate sample will be collected from a surface impoundment during every sampling round. The duplicate sampling location will be rotated, so that two duplicates will be obtained from each impoundment over the course of the study. The duplicate will be analyzed for the same suite of impoundment analytes.

An equipment blank will also be collected at every sampling round. Before one of the impoundment samples is collected and after the dedicated sampling device for that impoundment has been decontaminated, ultrapure deionized distilled (ASTM Type II) water will be poured into the device. This water will be decanted from the device into the same suite of containers as is used for impoundment sampling. The equipment blank will be analyzed as an impoundment sample. The equipment blank sampling will be rotated, so that over the course of the study two blanks will be collected from each impoundment's dedicated sampler.

All containers will be labeled and an accompanying chain-of-custody form filled out, following the procedures outlined in Section 5.5.8. After labeling, the samples will be kept at 4 degrees Centigrade (^{O}C) in an ice chest until they are transported to the laboratory for the required analyses. Sample preservation methods and holding times are summarized in Table 5-3. (A trip blank will be kept in the cooler with the samples and will be analyzed by EPA Method 624.)

After use, the sampling and depth-measurement equipment will be decontaminated with a solution of nonphosphate detergent and tap water, rinsed with tap water, and rinsed again with distilled water. The equipment will be stored at the KHF.

5.1.2 Ambient Air Sample Collection Method

The ambient air downwind of each of the three active surface impoundments will be sampled to determine volatile emissions. The sampling will be performed at the same frequency as the liquid sampling at these impoundments, as described above.

The sampling periods will be selected when the wind conditions will be relatively constant during an eight-hour sampling period. The meteorological criteria will be further restricted to include the same criteria as specified for monitoring for VOC emissions from landfills by the ARB (ARB, 1986) for compliance with Calderon (AB3525 and AB3374). Specifically, sampling will only be performed (or samples will only be considered valid) if the wind speed is

10 mph or less and it is not currently raining or has not rained during the 72 hours before sample collection. Three sampling devices and sampling media will be used to collect the samples.

5.1.2.1 VOCs – Total Air

Ambient air samples will be collected in electropolished stainless steel cylinders using the sample train shown in Figure 5-1. The instrumentation for sampling and analysis is described in detail in EPA Method TO-14 (EPA, 1988). The parts of the ambient air sampling system that come in contact with the sample air are constructed entirely of stainless steel and Teflon to prevent contaminant adsorption and offgassing and to minimize the potential for cross contamination. The sampling system uses a 12-volt diaphragm pump with an all stainless steel and Teflon construction. Air flow is controlled by a back pressure flow controller. The pump is protected from dust by an in-line filter.

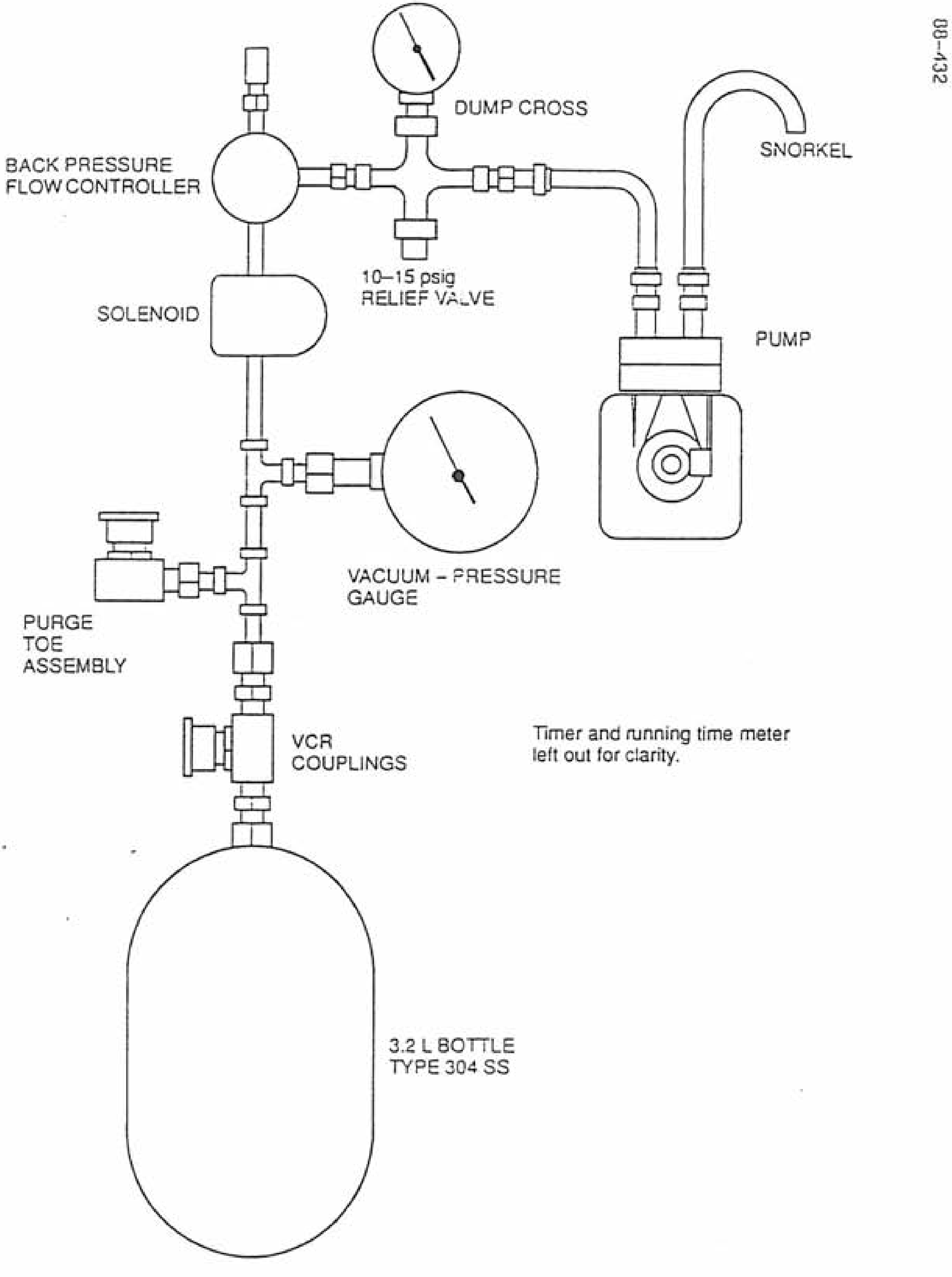
A purge tee connects the system to the sampling container. It is used to flush the valve dead space and to act as a bypass valve for flow measurement.

The sample canisters are shipped to the site under vacuum. The laboratory cleans and leak tests the canisters before use. In addition, the laboratory assigns each canister a unique number while it is in service and documents its leak test results and usage information in a logbook.

The sample canisters are cleaned by placing them in an oven heated to 110^{0}C for four hours. While the canisters are in the oven, they are under a 10-micron vacuum (10^{-3} torr) provided by a two-stage vacuum pump. The pump is equipped with a cold trap to prevent back diffusion of pump oil into the container. After cleaning, new canisters are tested for remnant contamination by filling them with zero air and analyzing a sample of it by gas chromatography using an electron capture detector.

When sampling is complete, the final pressure of the sampling canister is recorded and the canisters are shipped back to the laboratory under positive pressure. When the canisters arrive at the laboratory, the pressure is checked and compared with the pressure before shipment to check sample integrity. As required by EPA Method TO-14, samples collected in the stainless steel canisters are analyzed within 14 days of collection. In order to quantify acrylonitrile and allyl chloride (additional compounds on the VOC target list that are not part of the EPA list of TO-14 compounds), the hold time will be further restricted to seven days to assure that these more reactive VOCs are not degraded by the allowable hold for the less reactive TO-14 compounds. Any sample held for over 7 days will be considered invalid.

Parafin, olefin, aromatic and halogenated volatile organic compounds will be determined from samples collected in stainless steel canisters using a gas chromatograph with a mass spectrometer detector (GC/MS). The procedures are consistent with EPA Method TO-14.



Timer and running time meter left out for clarity.

FIGURE 5–1. Sampling train for VOCs (TO–14)
Prepared for Chemical Waste Mangement, Inc. by AeroVironment Inc.

The analytical method includes opening the stainless steel sample cylinder and allowing 500 ml of sample to pass through a short piece of tubing that is bent in a "U" shape and submerged in liquid oxygen "cryotrap." The organic compounds of interest condense in the loop due to the extremely cold temperature maintained by the liquid oxygen bath. The oxygen bath is removed and the concentrated organic species volatilize and pass into the GC/MS, where they are detected and quantified. A computer connected to the GC/MS stores the data and compares the information to calibration data to speciate and quantify the sample.

5.1.2.2 VOCs Carbonyls

Ambient air samples will be collected by adsorption cartridges using the sample train shown in Figure 5-2. The instrumentation for sampling and analysis is described in detail elsewhere (Lipari and Swarin, 1985; Fung and Wright, 1990) and is similar to EPA Method TO-11 (EPA, 1988); however, the collection media substrate is Waters Sep-PAK C_{18} instead of silica gel. This alternate substrate has improved quantification of carbonyls that have a greater molecular weight than formaldehyde. Ambient air is drawn through a Teflon sample line to a cartridge packed with 2,4-dinitrophenolhydrazine (DNPH), on the Sep-PAK for carbonyl collection. A differential pressure flow controller and diaphragm pump are both downstream of the sampling cartridge.

When sampling is complete, the final flow rate of the sampler is recorded and the cartridges are shipped back to the laboratory using a cold shipping protocol (sufficient cold packs to maintain the samples below 25°C during transit). When the samples arrive at the laboratory, the temperature inside the shipping box is checked for compliance with the cold shipping protocol. The samples are refrigerated (below 20°C) until analyzed. Studies have shown (Fung and Wright, 1990), that samples collected in these cartridges are stable for at least a year after collection, if stored at or below 20°C.

Carbonyls will be determined from samples collected in these cartridges using high performance liquid chromatography (HPLC). The procedures are consistent with EPA Method TO-11. The analytical method includes chemically extracting the carbonyl/DNPH derivatives using acetonitrile. An aliquot of the extract is injected into the HPLC where the carbonyl derivatives are chromatographically separated and detected using an ultraviolet detector set for 360 nm. A computer connected to the HPLC stores the data and compares the information with calibration data to speciate and quantify the sample.

5.1.2.3 VOCs – Phosgene

Phosgene (carbonyl chloride) will be collected using an impinger sample train. Ambient air samples will be collected by an impinger using the sample train shown in Figure 5-3. The sampling and analysis will be performed according to EPA Method TO-6 (EPA, 1988). Ambient air is drawn through a Teflon sample line to the impinger. Phosgene will react with an aniline/toluene solution in the impinger. Sample will be drawn through the impingers via a downstream diaphram pump. Sample flow will be maintained at 100cc/min by a differential pressure flow controller connected to the sample pump.

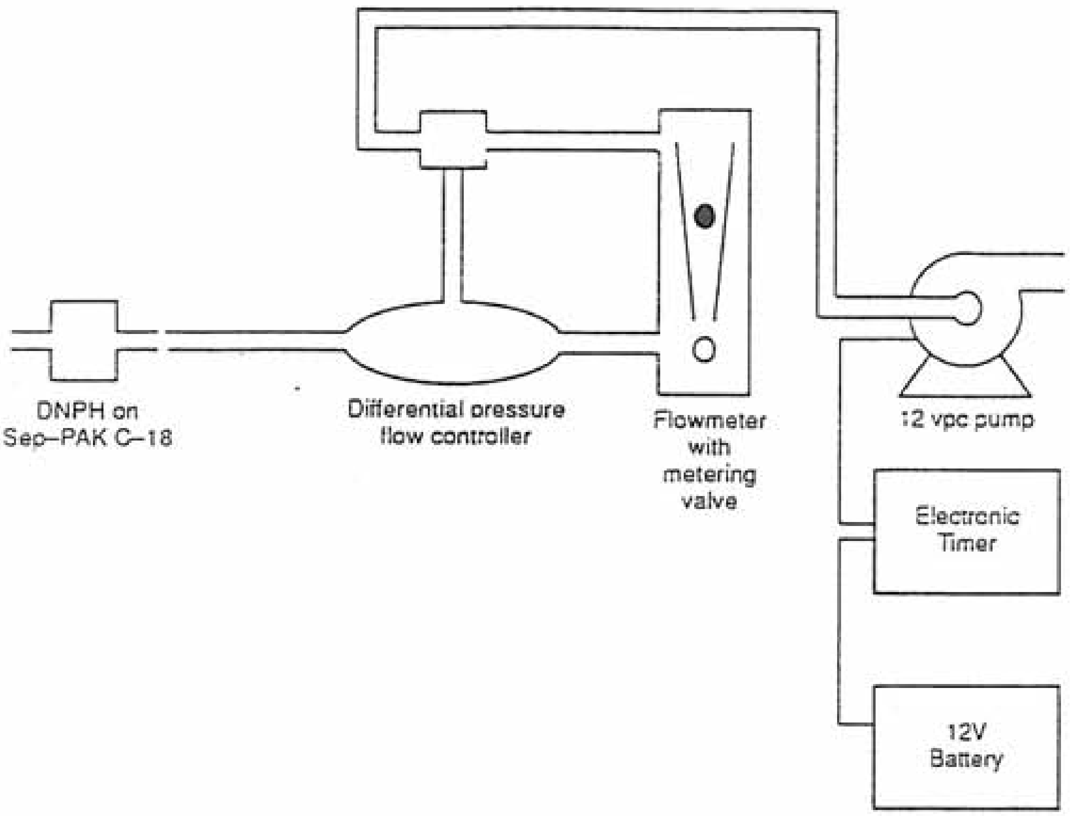


FIGURE 5-2. Sampling train for carbonyls (TO-11).
Prepared for Chemical Waste Management, Inc.,
by AeroVironment Inc.

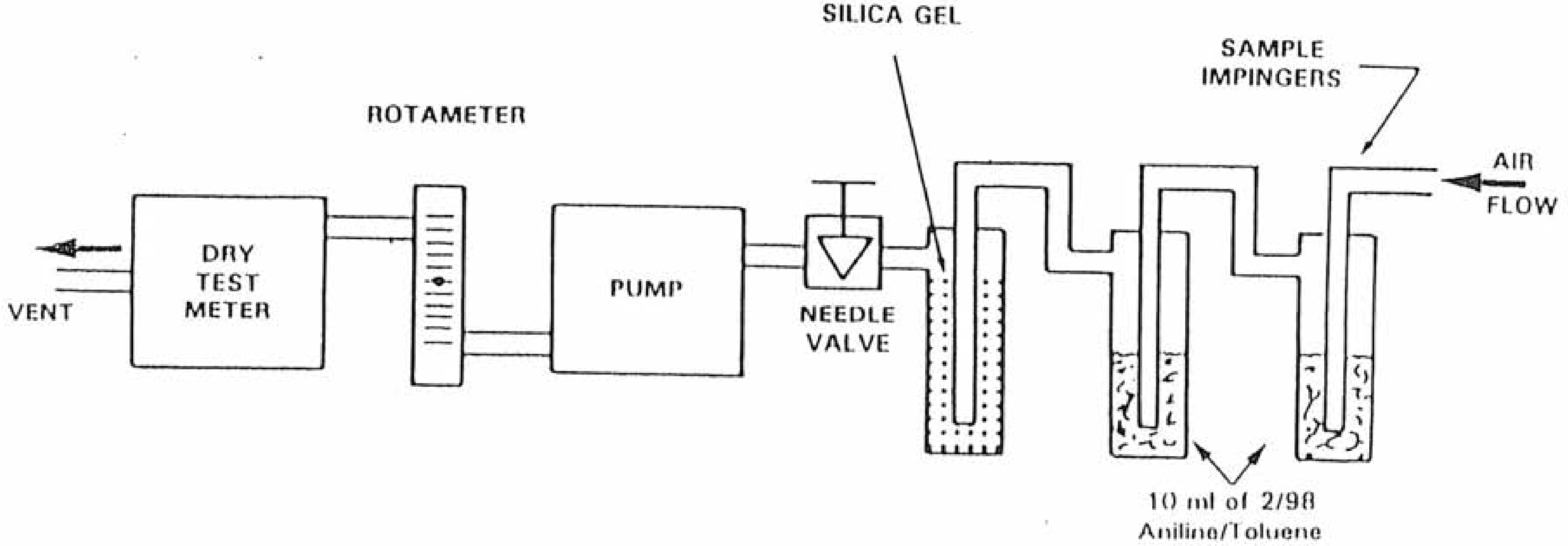


FIGURE 5–3. Sampling train for phosgene (TO–6.)
Prepared for Chemical Waste Mangement, Inc. AeroVironment Inc.

from EPA (1986)

The impinger sample train will be included with the backpack sampler. In order to avoid disturbing the impinger sampling, the operator will take care not to tip or bounce the backpack during sampling.

When sampling is complete, the final flow rate of the sampler is recorded and the impinger solutions will be transferred to sample vial and the impingers are washed with additional toluene, which is added to the sample vial. The samples will be shipped under the same cold shipping protocol as described previously for the carbonyl samples.

An aliquot of sample will be analyzed by HPLC for phosgene.

5.1.2.4 Total Volatile Hydrocarbons

Total volatile hydrocarbons will be determined using EPA Method 25 (40 CFR, Part 60, 1989), modified for use with stainless steel sample canisters. An aliquot from the VOC sample canisters will be used to determine methane (CH_4), and total nonmethane hydrocarbons (NMHC) using the EPA Method 25 analysis protocol.

An aliquot from each sample canister will be injected onto a gas chromatographic column, where the species of interest are separated, and the NMHC is converted to methane via a hydrogenated catalyst. The original CH_4 plus the converted NMHC individually elute from the column and are detected by a flame ionization detector (FID).

5.2 EVAPORATIVE TANKS

Evaporative tanks T-1, T-2, T-3, and T-4 will be sampled once a week over a six-week period. Sampling will be scheduled for every sixth day; however, this schedule will be modified to allow sample collection during periods of waste discharge to the tanks. CWMI's records of wastes discharged will be compared with the analysis data.

A discrete sampling device (as described in Section 5.1.1) attached to a chemical-resistant rope, cord, or extension rod will be used to collect liquid samples from the evaporative tanks. One sampling device will be assigned to each tank.

Before a tank sample is collected, field personnel will measure the depth to liquid and to the bottom of the tank using a weighted tape. The sampling device will be washed in a solution of nonphosphate detergent and tap water, rinsed with tap water, and rinsed again with distilled water. It then will be lowered into the tank, and a liquid sample will be collected within three feet of the measured bottom of the tank.

Sample collection, handling, and analysis for volatiles and semivolatiles will follow the procedures described in Section 5.1.1. One duplicate and one equipment blank will be collected per sampling round; the location of these samples will rotate so that over the course of the study at least one duplicate and one blank will be collected from each tank.

5.3 LANDFILLS

Landfill sampling will include active units B-16, B-18, and B-19 and inactive units B-13 and B-15. Composited surface soil sampling will be restricted to active units, while integrated surface sampling (ISS) of landfill gas will be conducted across each of the aforementioned sites.

5.3.1 Soil Sample Collection Method

Surface soil samples will be laboratory-composited from ten subsamples collected within a landfill (B-16) or phase (B-18 and B-19). Each landfill or phase will be divided into ten subareas of roughly equal area, and a sample will be collected from a random point within each subarea. A stainless steel slide hammer device fitted with a stainless steel sample sleeve (6 inches long by 2 inches in diameter; approximate volume 19 cubic inches) will be driven into the surface soil to a depth of approximately six inches below ground surface. The sampler then will be withdrawn and the sample sleeve removed from the device. The ends of the sleeve will be covered with Teflon sheeting and sealed with plastic caps. The caps will then be attached to the sample sleeve with duct tape. A label with a unique sample number will be affixed to the sleeve, and the sleeve will be place in an insulated cooler. Samples will be kept at 4°C until they are transported to the laboratory under chain of custody (as described in Section 5.5.8) for the required semivolatiles (EPA Methods 8080, 8270, and 8280) and inorganics (EPA Methods 6010 and 7471) analyses.

Before initial use and between samples, sampling equipment will be washed in a solution of tap water and nonphosphate detergent, rinsed in tap water, and rinsed a final time in deionized water. A replicate sample will be composited from the subsamples from one landfill phase or unit. The replicate will be analyzed for the same suite of analytes as the other landfill soil samples.

5.3.2 Landfill Gas Sample Collection Method

The ISS sample will be collected using a portable, backpack-type self-contained unit with an internal power source. Landfill emissions are drawn through a six-inch diameter 316 stainless steel funnel by a 12-volt pump with an unlubricated Viton rubber diaphragm. The sample will be drawn up to the backpack through Teflon tubing by a purge pump connected to the exhaust of this sample line. The purge flow is controlled to 200 cc/min by a metering valve mounted in a rotameter and attached to the purge pump. A manifold upstream of the pump will allow multiple sample lines, one each for total air, carbonyls, phosgene and total volatile hydrocarbon sample collection to draw a sample from the purge line. It may be necessary to have two or more ISS samplers to house all of these sample methods. In this case, the ISS sampler technicians would walk together during sampling. The carbonyl sample and phosgene streams and subsequent analyses will be the same as described in Section 5.1.2.2 and Section 5.1.2.3, respectively, except the samplers will be installed in the backpack. Because of weight restraints, the VOC samples will be collected in a Tedlar bag as opposed to using the stainless steel canister sample train described in Section 5.1.2.1. The Tedlar bag will be filled just 3/4 full to avoid overpressurization and bursting during shipment to the analysis laboratory. Sample extraction, cryotrapping and GC/MS analysis of the Tedlar bag sample will be the same as described previously for VOC analysis of the stainless steel canisters for total air and hydrocarbons.

The complete systems will be vacuum leak tested before being sent to the field. Between uses, the samplers will be decontaminated by flushing the systems with ambient air for five minutes followed by zero air for five minutes. Immediately before sampling, the sampler lines will be purged with ambient air from over the landfill so that the sample will not be diluted by zero air.

The samples will be collected two to three inches above the landfill surface while a technician walks a 50,000-square-foot grid in approximately 25 minutes. If two ISS backpaks are necessary to house all of these sampling systems, the two technicians will walk together during sampling. The sample flow rate will be maintained at 333 milliliters per minute. Sampling will proceed only when the ten-minute average wind speed is 5 mph or less, as determined by a hand-held anemometer, and the other wind speed and rain criteria described previously are met.

Sample custody will follow procedures detailed in Section 5.5.8.

The landfill gas samples will be analyzed for volatile organic compounds, phosgene, carbonyls and total hydrocarbons, using the methods described in Sections 5.1.2.1 and 5.1.2.2, 5.1.2.3, and 5.1.2.4, respectively.

A duplicate ISS sample will be collected from one of the landfill units or phases. These QC samples will be collected, handled, and analyzed the same way as the primary samples. After half of the landfills have completed ISS sampling, a field system blank will also be collected from zero air pumped through the sampling system.

5.4 HAZARDOUS WASTE TREATMENT UNITS

The hazardous waste treatment units of concern in this study are those located in the CPA (the Drum Decant Unit, the Cyanide Treatment Unit, the PCB Storage/Flushing Unit, and the Drum Storage Unit) and the FSU and its support storage area(s). Two sampling stations for the CPA and one station each for the FSU and its storage area(s) will be set up at downwind locations, and ambient air samples will be collected and analyzed for volatile, semivolatile, and inorganic components. If the new air stack for the FSU has been constructed and is in use during this characterization study, stack samples will also be collected and analyzed for these parameters.

On three separate days, samples will be collected over eight-hour periods (conforming to appropriate wind direction conditions). The sampling periods will be selected to coincide with unit operations and times when the wind conditions will be relatively constant during the sampling period, using the same criteria described above in Section 5.1.2. Samplers will be placed at locations to be determined based on current meteorological and topographical data.

Samples will be collected to determine VOC, carbonyl, semivolatile organic carbon (SVOC), and selected particulate metal emissions. The sampling and analysis protocol for VOCs, carbonyls, phosgene, and total hydrocarbons will be the same as described in Sections 5.1.2.1, 5.1.2.2, 5.1.2.3 and 5.1.2.4, respectively. The SVOCs will be collected using a sampling train consisting of a particulate filter upstream of an adsorbent sponge. The selected particulate metals will be collected on the same particulate filter as the SVOCs.

5.4.1 SVOCs – Hydrocarbons and Chlorocarbons

Ambient air samples will be collected on quartz fiber prefilters and polyurethane foam (PUF) sponges using the sample train shown in Figure 5-4. The instrumentation for sampling and analysis is described in detail in EPA Methods TO-4 (EPA, 1988). The system consists of a medium-volume sampler operating at a flow rate of approximately 300 liters per minute. A prefired quartz filter is used to collect particulate matter, including SVOCs. SVOCs, which may be in the vapor phase or which may volatilize off the particulate filter during the sampling, are drawn to the PUF sponge. These vapor-phase SVOCs chemically react with the PUF and will remain bound to this collection media for subsequent laboratory extraction and analysis.

Laboratory analysis begins by equilibrating the filters in a humidity/temperature controlled environment, then weighing the filters to determine the total particulate loading pursuant to the EPA filter weighing protocol (EPA, 1987b). The filters will then be cut in half: one half to be analyzed to determine particulate SVOCs, the other half to be analyzed for metals as described in the next section.

The filter halves and PUFs will be extracted individually using an ether/hexane solvent and a Soxhlet extractor for 8 to 24 hours followed by extraction with benzene solvent to obtain any remaining aromatics, including dioxins. The extracts will be run through a cleanup column, then an aliquot will be injected into a gas chromatograph with electron capture detection, GC/ECD, for determination of select species shown in Table 5-2 following the procedures in EPA Method TO-4 (EPA, 1988). A second aliquot will be injected into a high resolution gas chromatograph (HRGC) with high resolution mass spectroscopy (HRMS) detection for determination of select species shown in Table 5-2 following the procedures in EPA Method TO-9 (EPA, 1986). A third aliquot will be analyzed by GC/MS to determine the concentration of the lower boiling point polynuclear aromatic hydrocarbons (PAHs) following EPA Method TO-13 (EPA, 1988).

Quartz filters will be used for sample collection. The media will be prepared by baking the filters at 700°C to drive off any organic impurities. The filters will be allowed to equilibrate in a temperature- and humidity-controlled environment and preweighed following the EPA filter weighing protocol (EPA, 1987b). The PUFs will be made of 1.3 lb/ft^3 open cell foam with about 20 ppi (pores per square inch). The PUFs will be precut to fit the sampler (about 3-1/4"-diameter and 3"-long "plugs"). The PUFs will be precleaned for 10–24 hours in a Soxhlet extractor with hexane solvent.

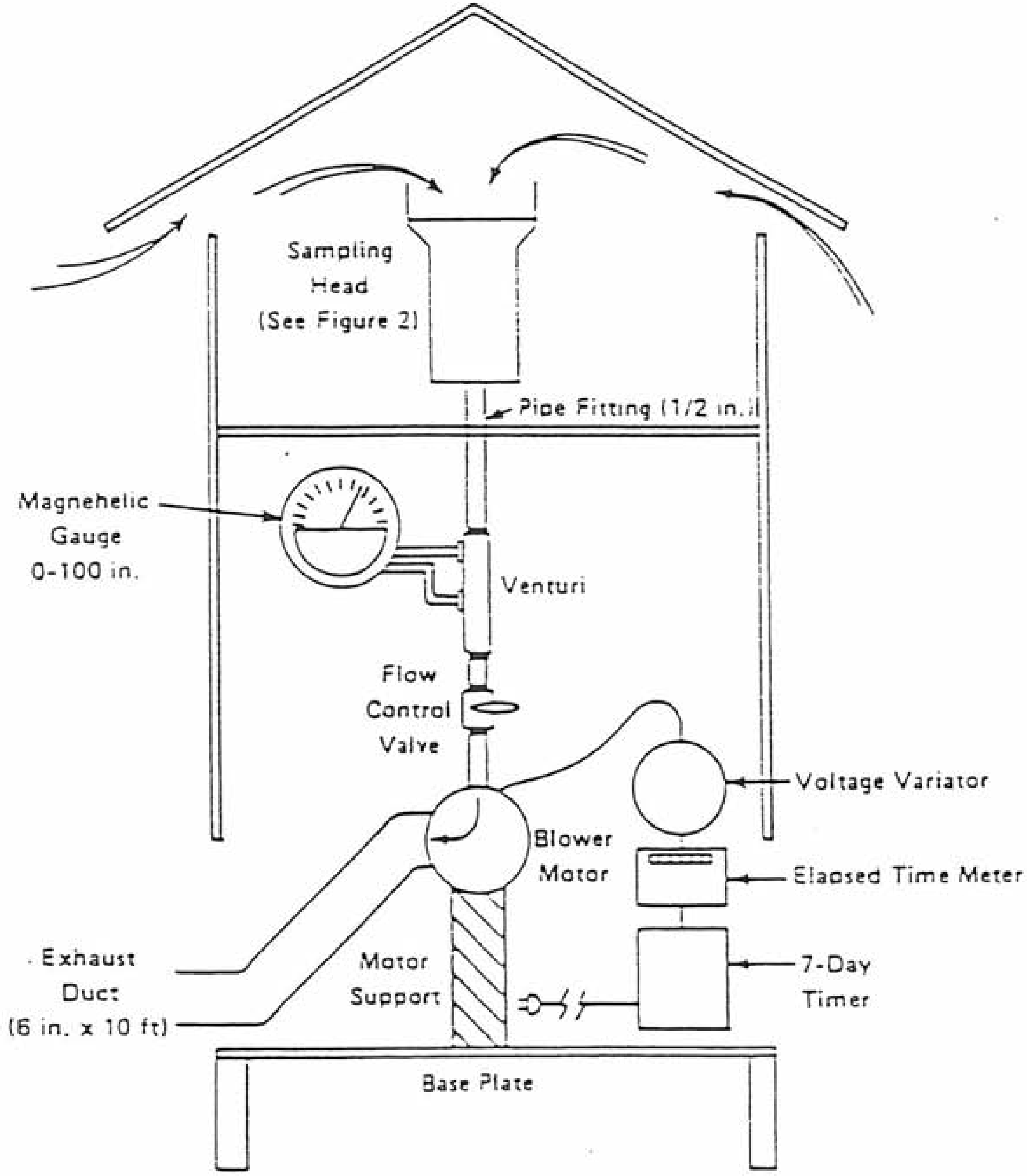


FIGURE 5–4. Particulate/PUF sampler.
Prepared for Chemical Waste Management, Inc. by AeroVironment Inc.

5.4.2 SVOCs – Phenols

Phenols and creosols will be collected using an impinger sample train. Ambient air samples will be collected by a pair of impingers using the sample train shown in Figure 5-5. The sampling and analysis will be performed according to EPA Method TO-8 (EPA, 1988). Ambient air is drawn through a Teflon sample line to two impingers connected in series. Phenols and creosols will be trapped in a sodium hydroxide solution in the impingers. Sample will be drawn through the impingers via a downstream diaphram pump. Sample flow will be maintained at 100cc/min by a differential pressure flow controller connected to the sample pump.

When sampling is complete, the final flowrate of the sampler is recorded and the impinger solutions will be transferred to sample vial and the impingers are washed with additional sampling reagent, which is added to the sample vials. The samples will be shipped under the same cold shipping protocol as described previously for the carbonyl samples. Pursuant to Method TO-8, the samples will be analyzed within 48 hours of collection.

An aliquot of each front and back impinger solution will be analyzed by HPLC for the phenols and creosols shown in Table 5-2.

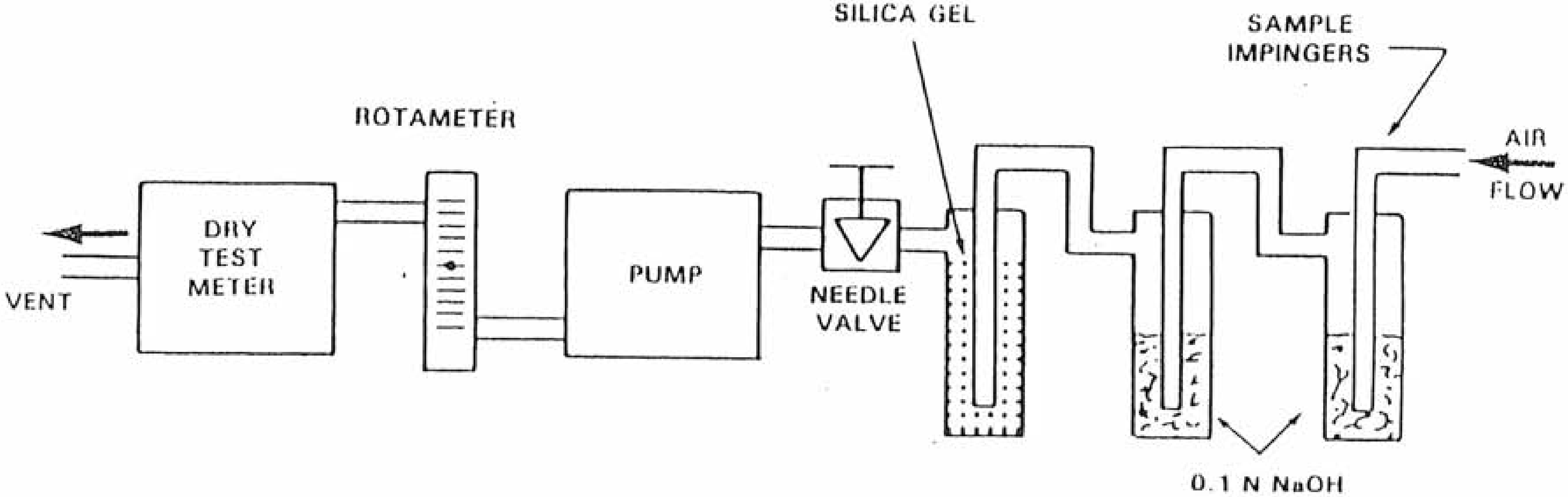
5.4.3 SVOCs – Nitrosamines

Ambient air samples will be collected by adsorption cartridges using the same type of sample train as used for the carbonyl sampling. A Thermosorb/N adsorbent material will be used in a sampling cartridge to trap ambient nitrosamines. The sampling and analysis method is pursuant to EPA Method TO-7 (EPA, 1988). The samples will be shipped under ambient conditions for laboratory analysis. The samples will be analyzed within one week of collection. The nitrosamines will be desorbed using acetone. An aliquot of this extract will be analyzed by GC/MS for the nitrosamines shown in Table 5-2.

5.4.4 Particulate Metals

As presented in the above section, following final weighing of the particulate filters, the filters will be halved, one half for SVOC determination and the second half for determination of selected metals.

The filter halves for metal determination will be extracted using hot nitric acid, then an aliquot will be analyzed using an inductively coupled plasma atomic emission spectrometer (ICP) for the inorganic species shown in Table 5-2. The method is essentially EPA Method 6010 (EPA, 1986), which has had filter extraction added to the straight wastewater extraction and analysis procedures. A second aliquot will be analyzed by atomic adsorption, AA, using cold-vapor technique for mercury determination. The method is essentially EPA Method 7471 (EPA, 1986), which has had filter extraction added to the soil. sediment, sludge type material extraction and analysis method.



from EPA (1988)

FIGURE 5-5. Sampling train for phenols/cresols (TO-8).
Prepared for Chemical Waste Mangement, Inc. AeroVironment Inc.

5.5 QUALITY ASSURANCE PLAN

The principal objective of this quality assurance (QA) plan is to ensure that the environmental monitoring data are collected, analyzed, and documented in accordance with professional standards.

There are five parameters that must be considered in order for an investigation to produce information for intelligent decision-making. They are

- Comparability
- Completeness
- Representativeness
- Accuracy
- Precision

Discussions of each of these parameters follow.

5.5.1 Comparability

The objective of the assessment of comparability is to assure the data developed during the investigation are comparable with applicable hazard criteria and, where appropriate, with data available from previous scientific studies in the area. Hazard criteria applicable to groundwater and surface water quality have been developed, and criteria to assess potential hazards of soil and air contaminants are being developed. In formulating the sampling plan, an attempt has been made to specify analyses and analytical methods consistent with those used in developing the hazard criteria.

Comparability may be maximized through the use of standardized procedures and methodologies. All sample collection techniques employed for this investigation will conform to accepted standard protocols. Sample analyses will be performed using U.S. EPA methods.

5.5.2 Completeness

Completeness will be assessed by comparing the number of valid sample results (these meeting the project QA objectives) with the number of samples collected and the number of samples planned. Analytical completeness is affected when a sample is damaged, when it is analyzed after its holding time has elapsed, or when laboratory analysis results are determined to be invalid and the sample cannot be reanalyzed. Completeness is expressed as a percentage. The objective for completeness is that the investigation provide enough of the planned data that any existing data gaps can be closed.

5.5.3 Representativeness

Data representativeness is defined as the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. It is expressed in terms of bias and is often described in terms of the standard error of the measurement.

Representative data collection is ensured by good field and analytical protocols as well as thorough documentation of field conditions, observations and measurements. Representativeness for the investigation will be assessed after initial data validation and reduction and will be based only on validated data.

5.5.4 Accuracy and Precision

The laboratory QC limits of accuracy and precision for inorganic and organic analysis of liquid soil and air have been established by B C Analytical and EAS, the laboratories that will be providing analytical services for this project. The control limits should be completely met, without any outliers. If any out-of-control result occurs and the QC coordinator does not believe it necessary to rerun the sample, it will be flagged and a memorandum written to the data user regarding the utility of the data.

Accuracy, as percent recovery, will be determined in the laboratory from both spiked sample analyses and performance audit reviews. Accuracy will be calculated by the following equation:

$$\text{Accuracy} = \frac{A-B}{C} \times 100$$

Where:

A = the analyte determined experimentally from the spiked sample or the control standard

B = the background level determined by a separate analysis of the unspiked sample

C = the amount of the spike added or the control standard

Method precision will be determined in the laboratory from spike duplicate analyses. For a single pair of duplicate samples, precision is calculated as the relative percent difference using the following equation:

$$\text{Precision} = \frac{X_1 - X_2}{\bar{X}} \times 100$$

Where:

X_1 = the larger value and X_2 = the smaller value of two duplicate or replicate values and

$\bar{X}$ = the mean of the two duplicate values

The precision of several pairs of duplicate samples is calculated as the coefficient of variation using the following equation:

$$\text{Precision} = \frac{s}{\bar{X}}$$

Where

s = the standard deviation of the duplicate values

$\bar{X}$ = the mean of the duplicate values

In addition to the analysis of laboratory spike duplicates, which will provide an estimate of the precision of the analytical system, field replicate, or "split," soil samples and duplicate water and air samples will be collected by the field team and submitted "blind" (i.e., not marked as split samples) to the laboratory. The data from field QA/QC samples will be used to assess the precision of the entire measurement system, including sampling, sample handling, shipping, analysis and reporting. Section 5.5.5 discusses field QA/QC samples further.

5.5.5 Field QA/QC

To maintain data quality, AV personnel will adhere to standard sampling techniques and decontamination procedures, as noted in Section 5.5.7. Data quality (precision and bias) for the combined sampling and analytical system will be evaluated through a combination of field replicate samples (soil sampling episodes) and field duplicates, field blanks, and trip blanks (water and air sampling episodes). Table 5-1 shows the number of QA/QC samples to be collected during the study. Field blanks for water samples will consist of ultrapure deionized distilled (ASTM Type II) water.

Replicates (commonly referred to as "splits") are samples that are collected and then subdivided into two equal parts. Soil replicate samples will be composited in the laboratory from the same subsamples as the primary soil sample. Field duplicates are two samples collected independently at a sampling location during a single act of sampling. Soil replicates and water and air duplicates will be collected with an approximate frequency of ten percent per sample matrix type (soil, water, or air) and will be analyzed for the same parameters as the accompanying soil, water, or air samples.

One set of field blanks will be collected for the water sampling. The blank will be ASTM Type II reagent water that is poured through the sampling equipment, transferred to the sample bottle, and then transported to the laboratory. The field blanks will be analyzed for the same parameters as the water samples. One volatile organics analysis (Method 624) trip blank will be included in each cooler containing water samples to monitor whether cross-contamination is occurring during sample transport.

Blanks, duplicates, and replicates will be handled in the same way as the natural samples they accompany. They will be submitted to the laboratory "blind" to ensure that they are not given preferential treatment by the analysis. It will be the responsibility of the field team leader to ensure that the QA/QC samples are obtained.

5.5.6 Laboratory QA/QC Samples

Data quality (accuracy, precision, and bias) is evaluated for the analytical system through the use of laboratory method blanks, duplicate samples, matrix spike samples, surrogate spikes and control standard samples.

5.5.7 Sampling Procedures

The objective of using standard sampling procedures for field measurements is to obtain samples and measurements that are representative and comparable. The use of experienced and well-trained field personnel, good sampling techniques, proper sampling equipment, and adequate decontamination should prevent cross-contamination. Sections 5.1 through 5.4 outline the procedures for field activities. Samples will be preserved and handled following the guidelines in Table 5-3. The inclusion of QA/QC samples, such as field blanks, will provide a check for inadvertent contamination.

Sample containers and preservatives for water sampling will be provided by the laboratory. The containers for organics analysis will be prepared according to U.S. EPA specifications by the manufacturer; the laboratory will not perform any additional cleaning. Plastic containers for metals sampling will be washed with detergent, rinsed with tap water, rinsed again with deionized water, and soaked in nitric acid for approximately 24 hours. The acid-washed bottles will then be rinsed with deionized water.

Before each soil sample is collected, the sampling device will be washed with a solution of detergent approved for laboratory use (such as Alconox), rinsed with tap water, and rinsed again with distilled water. Sample sleeves will be decontaminated in the same fashion as the soil sampling device. Before a liquid sample is collected, the liquid sample device will be washed in a solution of detergent approved for laboratory use (such as Alconox), rinsed with tap water, and rinsed again with distilled water. An individual sample device will be assigned to each impoundment or tank to avoid cross-contamination between sampling locations.

To ensure that the established procedures and protocols are being carried during the field activities, the AV project manager will conduct periodic spot-audits of field operations.

5.5.8 Sample Custody

The objective of chain-of-custody procedures is to document the history and handling of each sample. Custody records trace a sample from its container's origin (laboratory) and sample collection, through all transfers of custody until it is received by the analytical laboratory. Internal laboratory records then document the custody of the sample through its final disposition. The field sampling team will ensure that custody procedures are followed.

5.5.8.1 Procedures to Ensure Sample Validity

In order to establish sample validity, it is necessary to document measures taken to prevent or detect tampering. Specific such procedures are the following:

- Precleaned sample containers will be received from the laboratory in sealed boxes. On receipt by the AV field team leader, the containers will be inspected for evidence of tampering.

- Sample containers will be stored in a secure area with custody seals until they are issued for sampling. These containers will be kept in locked storage with custody seals or under personal observation at all times. Figure 5-6 shows a sample custody seal.

- An individual sample number will be affixed to each set of containers for a single sample, and a sample label will identify each sample (Figure 5-7). A chain-of-custody form will be filled out for each delivery of samples (Figure 5-8).

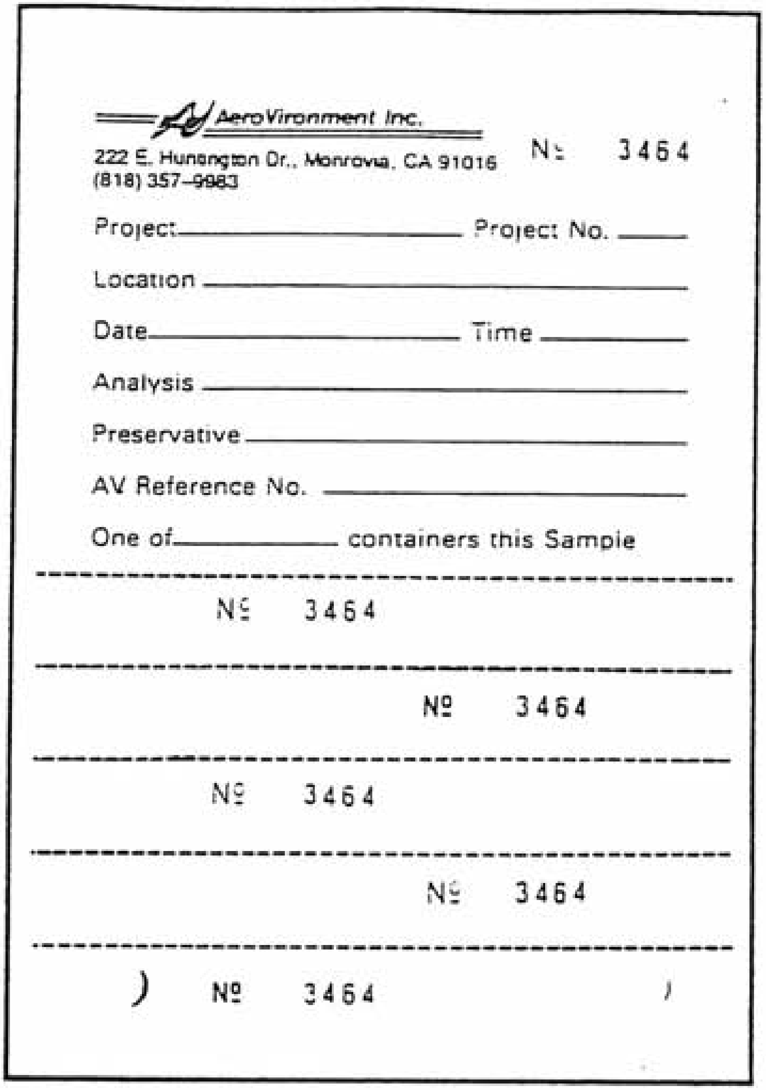
- Decontaminated sampling equipment and sample containers will be kept under observation at all times.

CUSTODY SEAL

Signature ______________________________

Date ______________________________

FIGURE 5–6. Custody seal.



AeroVironment Inc.

222 E. Huntington Dr., Monrovia, CA 91016
(818) 357-9983

Nº 3464

Project ______________________ Project No. ______

Location ______________________________________

Date ______________________ Time ____________

Analysis ______________________________________

Preservative ___________________________________

AV Reference No. ______________________________

One of __________ containers this Sample

Nº 3464

Nº 3464

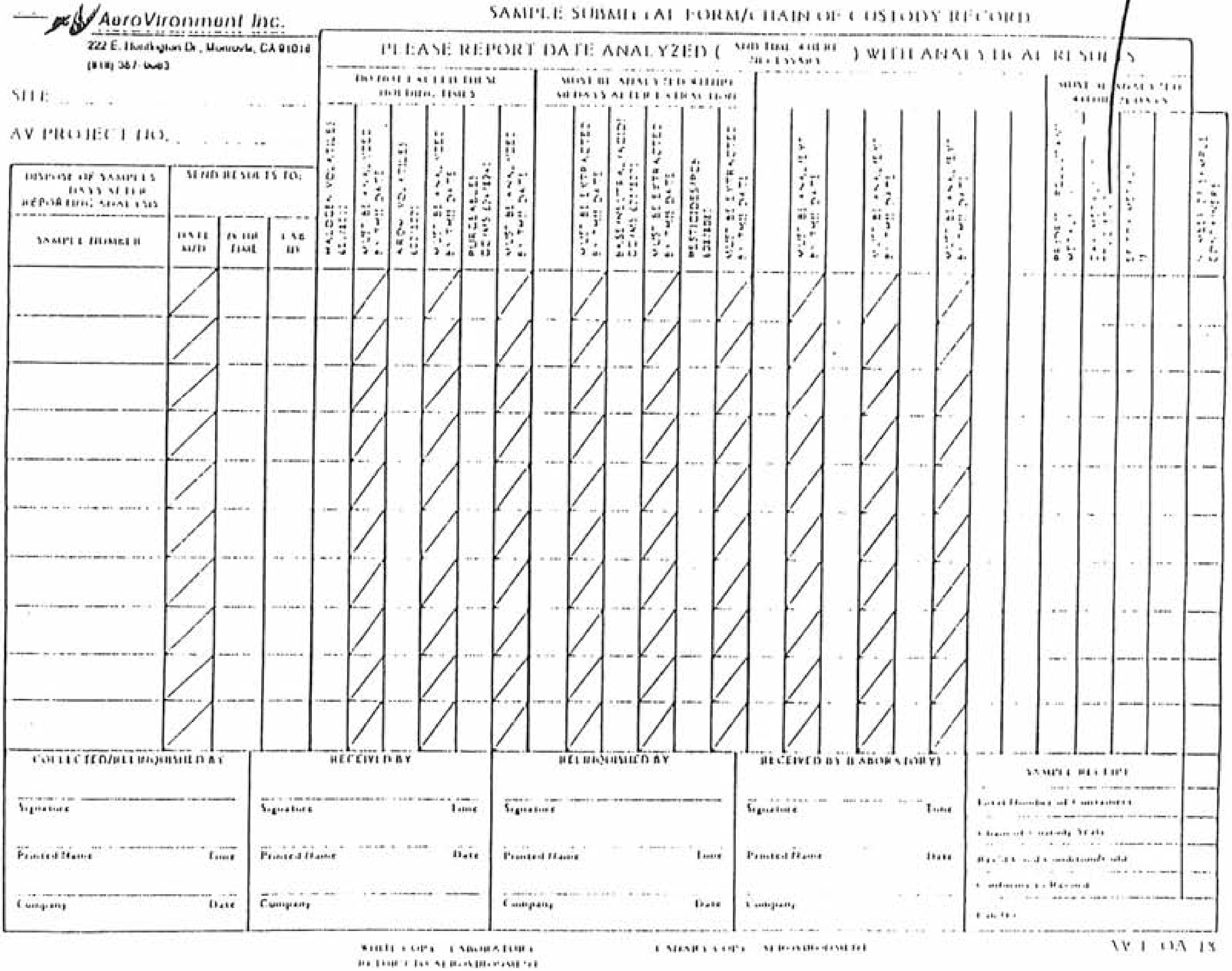
Nº 3464

Nº 3464

Nº 3464

FIGURE 5–7. Sample label and sample number tags.

90-283



AeroVironment Inc.
222 E. Huntington Dr., Monrovia, CA 91016
(818) 357-[illegible]

SITE

AV PROJECT NO.

SAMPLE SUBMITTAL FORM/CHAIN OF CUSTODY RECORD

PLEASE REPORT DATE ANALYZED ( ) WITH ANALYTICAL RESULTS

DO NOT EXCEED THESE HOLDING TIMES

DISPOSE OF SAMPLES ___ DAYS AFTER REPORTING ANALYSES

SEND RESULTS TO:

SAMPLE NUMBER

COLLECTED/RELINQUISHED BY

Signature
Printed Name Time
Company Date

RECEIVED BY

Signature Time
Printed Name Date
Company

RELINQUISHED BY

Signature
Printed Name Time
Company Date

RECEIVED BY (LABORATORY)

Signature Time
Printed Name Date
Company

SAMPLE RECEIPT

WHITE COPY - LABORATORY
RETURN TO AEROVIRONMENT

CANARY COPY - AEROVIRONMENT

FIGURE 5-8. Chain of custody record.

- The field team leader is responsible for all samples collected for laboratory analysis and will keep the samples under custody seals or personal observation until they are turned over to the designated carrier in sealed containers.

- The AV project manager is responsible for ensuring that custody procedures are followed and will investigate any indication of tampering. The analytical laboratory maintains standard operating procedures for sample custody and security.

5.5.8.2 Sample Identification and Recordkeeping

Unique, sequential sample identification numbers will be assigned to all samples. An index of sample numbers will be kept in the field log book. The sample numbers are preprinted on the sample labels, along with spaces for recording the following:

- project name and number
- sample location
- date and time of sampling
- type of analysis to be performed
- preservatives used
- number of containers per sample

The sample label will be filled out and affixed to one of the sample containers and covered with clear vinyl tape to protect the label. Corresponding sample number tags will be affixed to any additional containers for this sample. Thus the sample numbers assigned are also the numbers that will be used on the chain-of-custody records for each sample. Figure 5-7 shows an example of a sample label and sample number tags.

Any information appearing on the sample labels and in the sample log notebook will be recorded in the field log book, along with a list of personnel present, a description of any unusual sample characteristics, records of decontamination and calibration procedures, and any other specific considerations pertaining to sample acquisition. Whenever the responsibility of maintaining field logs passes from one person to another, the transfer will be noted in the log book.

5.5.8.3 Sample Transfer Procedure/Chain-of-Custody Records

Once a sample is collected, an adhesive custody seal (Figure 5-6) will be affixed to each sample container in such a way that the container cannot be opened without breaking the seal. The individual collecting the sample will sign and date the seal before affixing it to the container. An intact seal indicates to the laboratory that the sample was not tampered with during transport.

Chain of custody will be maintained on all samples submitted for laboratory analysis. The field team leader will fill out and sign the chain-of-custody form (Figure 5-8), relinquishing control of the sample to the laboratory employee picking up the samples at the site or receiving the samples at the laboratory. The chain-of-custody form will also serve as a sample analysis request form. Information that will be noted on this form includes

- project number
- four-digit sample identification number (as preprinted on label)
- date and time of sampling
- preservatives used
- holding times
- type of analysis to be performed
- transfer of samples from one party to another

All labels and data recorded in the field will be written legibly in waterproof ink. Errors will be crossed out with a single line, initialed, and dated: they will not be obliterated.

The samples will be placed in chilled coolers, packed with inert packing material, secured, and placed under custody seals for transport to the laboratory. They will be accompanied by the original copy of the chain-of-custody form that has been filled out and signed by the relinquisher. The carbon of this form will be retained by the field team leader.

5.5.9 Analytical Procedures

Table 5-2 gives a summary of the samples to be analyzed, the parameters, and the test methods to be used.

5.5.10 Validation of Laboratory Data

The analysis, validation, and reporting of data received from the laboratory is the responsibility of AV's quality assurance coordinator. Data validation, which consists of data editing, screening, checking, auditing, verification, and review, determines whether data are adequate for their intended use.

Data validation will be accomplished by checking field and laboratory calibration procedures and frequency and by comparing multiple measurements. If measurement data exhibit large variations from these reference data (greater than 20 percent) that cannot be explained by field conditions, then the measurement data will be considered an outlier and will be either rejected as unusable or restricted to limited use. Data validity will be similarly affected if calibration procedures or frequency of calibration checking deviates from standards set in this quality assurance plan.

The data from the laboratory will be reviewed for the following components to evaluate the validity of the analyses:

- analytical results for laboratory blanks and field blanks
- comparison of samples and duplicates/replicates
- surrogate and spike recovery data

The validity of outliers will be determined by reviewing

- field documentation for notations about unusual occurrences that may explain data points outside the expected range

- instrument documentation to identify performance trends and operational quality

- associated data for trends similar to those shown by the outliers

- audit reports for procedural problems

Laboratory data will be invalidated if any of the following occur:

- the sample is not analyzed within its holding time

- the laboratory instrument blank level is too high, causing the detection limit to be in the quantitative area of interest, and the sample cannot be reanalyzed

- the laboratory quality assurance objectives for accuracy and precision are not met

Levels of contaminants in the blanks are expected to be low enough to have little impact on the overall validity of the data. If any contaminants are found above detection limits in the field blank, all of the sample data will be reviewed to determine whether comparable levels are present in some or all samples.

All data, whether validated or not, will be reported. Invalidated data will be footnoted. When possible, the data point may be resampled to verify or correct the original result.

5.5.11 Specific Procedures to Assess Quality Assurance Goals

AV personnel will review all data received from the laboratories and will compare them to previously collected data for reproducibility. Inconsistencies and unusual results will be examined further to determine whether they reflect actual site conditions or are the result of field and/or laboratory procedural errors.

Comparison of results between sampling rounds will indicate the total precision of the measurement system including such factors as sample collection, containerization, preservation, shipping, and analysis.

Reproducibility, together with several other factors, is integral in determining whether a result is significant. For this investigation, the criteria for establishing the significance of analytical finds will take into account the following factors:

- laboratory or field-induced background contamination, identified using laboratory and field blank samples

- the limit of quantitation (LOQ) for the analyte of interest, defined as the lower limit of concentration or amount of substance that must be present before a method is considered to provide quantitative results. The LOQ is equal to two times the standard deviation at the lowest level of measurement (40 CFR, Part 53).

- the reproducibility of the measurements, both within sampling rounds and between rounds

- applicable air and water quality criteria

Results that are not repeatable for at least two sampling rounds are not considered significant unless the criteria are exceeded. Results that are not above the LOQ will be reported and footnoted. Results that are below the detection limit will be reported as not detected (ND). Analytes that are identified as background contaminants based on their presence in the laboratory blanks and/or field blanks are not considered significant if detected in a sample at levels comparable to those in the blanks. Analytes that are not naturally occurring but that are repeatable and quantifiable (above the LOQ for all sampling rounds) will be considered significant.

Routine assessments of data precision, accuracy, and completeness will be made by the laboratories during the analyses of all samples. Each measurement procedure, system, or instrument has predetermined limits to indicate when corrective action is required. The laboratories will monitor their QC data to ensure that they are within established control limits for the methods, as published by the U.S. EPA.

When analytical data are received from a laboratory, they will be reviewed, and the accuracy and precision achieved will be compared to the control limits established.

Procedures that will contribute to the assessment of field sampling accuracy and precision are the inclusion of one trip blank and one equipment blank (air and water only), one replicate (split) soil sample, and one duplicate sample per water or air sampling round. The blanks will be used to check for compounds inadvertently introduced into the samples during collection, shipment or analysis. The replicate and duplicate samples can be used to measure precision achieved in the field and the laboratory.

5.5.12 Document Control

The purpose of document control is to ensure that all project documents will be accounted for when the project is complete. The project number issued for this project will be recorded on all sample labels, field logbooks, data sheets, chain-of-custody forms, calculation worksheets, and other project records. These documents (except the sample labels) will be retained at AV's Monrovia office in the project files. The project manager will maintain control of all documents passing through project operations.

The field team leader will also function as document control officer for field-generated data and will be responsible for issuing, controlling, and maintaining records of controlled documents. At the conclusion of field activity, all controlled documents and records will be delivered to the project manager for inclusion in an overall project document inventory, which will be maintained and archived in AV's project files.

5.5.13 Quality Assurance Reports to Management

During the sampling, the quality assurance coordinator will confer frequently with the project manager and/or the field team leader to forestall any quality assurance problems. Significant quality assurance problems that arise will be discussed with the project manager immediately.

Upon receipt of data from the laboratory, the quality assurance coordinator or his/her designee will prepare an assessment of data accuracy, precision, and completeness.

Section 6

DATA MANAGEMENT

The data management procedures below will document and track data generated during the characterization study. These data will include information generated in the field, meteorological data, and chemical analysis results.

6.1 FIELD DATA

A daily log will be kept of all field work performed for this project. Field logs will be maintained whenever any matrix is sampled at the surface impoundments, the landfills, or the hazardous waste treatment units. The field team leader will be responsible for recording all pertinent information in the field logbook, including

- names of personnel on site
- the exact locations at which samples are collected
- sample numbers
- sampling dates and times
- duration of air sampling
- wind directions during air sampling
- air sampler flow rates
- observations of other site activities or field conditions that might affect the samples

The chain-of-custody form will also serve as a sampling record. Ultimately, the chain-of-custody form will include AV's sample number and the laboratory's own unique sampling number. The laboratory will include the completed form with its report of analysis results.

Unit-specific maps that include information such as sampling and monitoring locations and ISS sampling grid layouts will be generated. These maps will be part of the characterization report describing the study and its findings.

6.2 METEOROLOGICAL DATA

Data generated by meteorological monitoring will be automatically logged on electronic data recorders connected to the field equipment. Data associated with overall site meteorology will be reported as hourly averages. Data associated with ambient sampling in the vicinity of hazardous waste treatment units will be reported with sufficient time resolution to permit evaluation of the effectiveness of the directional and wind speed sensitive sampling.

Meteorological data, such as hourly average values of temperature, wind speed, wind direction, sigma-theta, and stability class, will be summarized in tabular form. (Stability class will be determined using the approach specified by the EPA (1987a).) In addition to the hourly data collected during sampling, daily, monthly, and annual historical data summaries will be generated. Summarized data include average, high, and low temperatures, average wind speeds, and maximum instantaneous wind speeds (i.e., gusts).

Frequency distributions of winds by speed and direction classes will be presented in a wind-rose format on a monthly and annual basis. The annual distribution will also be segregated by stability class and a separate wind rose produced for each stability class.

6.3 CHEMICAL ANALYSIS DATA

Separate data tables will be compiled for analysis results from

- surface impoundment liquids
- ambient air downwind from surface impoundments
- evaporative tank liquids
- landfill surface soils
- landfill gases
- ambient air downwind from hazardous waste treatment units

The tables will be used in the development of a proposed list of compounds for subsequent ambient air sampling.

Section 7

SCHEDULE

The work described herein will begin 30 days following award of the contract to conduct the work set forth in the work plan. Contract award will be made after approval of the work plan by the DTSC.

It is estimated that the field work will be completed within 90 days after it begins, with that schedule somewhat flexible due to variable meteorological conditions and the need to schedule sampling operations around site activities.

The surface impoundments, evaporative tanks, and landfills will be sampled concurrently. Impoundment and tank sampling will be conducted over a six-week period, in accordance with permit requirements. The ambient air samples from the hazardous waste treatment units will be collected during acceptable meteorological conditions and during periods of minimal interference from other site activities.

Laboratory results are expected within four weeks of submission of the last samples. Evaluation of the test results will take about 30 days, and composition of a report on site topography, meteorology, and monitoring results is expected to take another 60 days. Therefore, the entire program is expected to take about seven months.

The overall schedule timeline is illustrated in Figure 7-1.

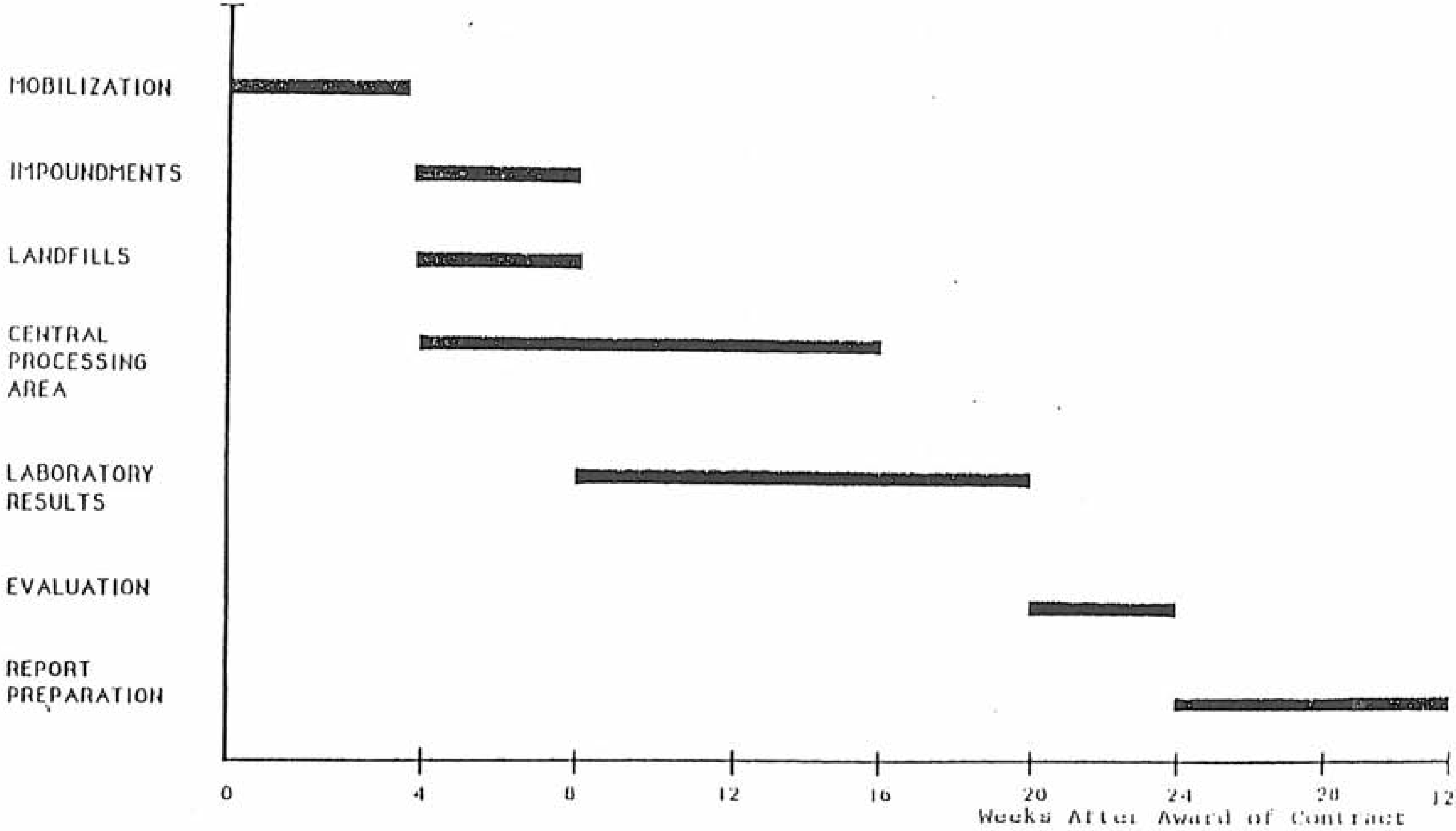


FIGURE 7-1. Schedule for characterization study
Kettleman Hills Facility, Kings County, California

Prepared for Chemical Waste Mana. nt, Inc. by AeroVironment Inc.

Section 8

REFERENCES

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Appendix B
Target Compound List

APPENDIX B
TARGET COMPOUND LIST (TCL)
ANALYSIS METHODS AND DETECTION LIMITS

	CAS[a] No.	Air Analysis Method	Targeted Detection Limit (ppbv)[b]	Water Analysis Method	Targeted Detection Limit (ug/L)[c]	Soil Analysis Method	Targeted Detection Limit (mg/kg)[d]
SEMIVOLATILES							
PESTICIDES							
Aldrin	309-00-2	TO-13[e]	1	608	0.050	8080	0.010
Chlordane	57-74-9	TO-13[e]	1	608	0.50	8080	0.10
4,4'-DDD	72-54-8	TO-13[e]	1	608	0.10	8080	0.025
4,4'-DDE	72-55-9	TO-13[e]	1	608	0.10	8080	0.010
4,4'-DDT	50-29-3	TO-13[e]	1	608	0.10	8080	0.025
SVOCs							
Acenaphthylene	208-96-8	TO-13	1	625	10	8270	1
Anthracene	120-12-7	TO-13	1	625	10	8270	1
Benzo(a)anthracene	56-55-3	TO-13	1	625	10	8270	1
Benzo(b)fluoranthene	205-99-2	TO-13	1	625	10	8270	1
Benzo(k)fluoranthene	207-08-9	TO-13	1	625	10	8270	1
Benzo(g,h,i)perylene	191-24-2	TO-13	1	625	10	8270	1
Benzo(a)pyrene	50-32-8	TO-13	1	625	10	8270	1
2-Chloronaphthalene	91-58-7	TO-13	1	625	10	8270	1
Chrysene	218-01-9	TO-13	1	625	10	8270	1
o-Cresol	95-48-7	TO-13[e]	1	625	10	8270	NR[f]
p-Cresol	106-14-5	TO-13[e]	1	625	10	8270	NR
Cumene	98-82-8	TO-13	1	625	10	8270	NR
Dibenzo(a,h)anthracene	53-70-3	TO-13	1	625	10	8270	1
Fluoranthene	206-44-0	TO-13	1	625	10	8270	1
Fluorene	86-73-7	TO-13	1	625	10	8270	1
Indeno(1,2,3-c,d)pyrene	193-39-5	TO-13	1	625	10	8270	1
Naphthalene	91-20-3	TO-13	1	625	10	8270	1
Nitrobenzene	98-95-3	TO-13	1	625	10	8270	1

APPENDIX B (continued)
TARGET COMPOUND LIST (TCL)
ANALYSIS METHODS AND DETECTION LIMITS

	CAS[a] No.	Air Analysis Method	Targeted Detection Limit (ppbv)[b]	Water Analysis Method	Targeted Detection Limit (ug/L)[c]	Soil Analysis Method	Targeted Detection Limit (mg/kg)[d]
N-Nitrosodimethylamine	62-75-9	TO-13[e]	1	625	10	8270	1
N-Nitrosodiphenylamine	86-30-9	TO-13[e]	1	625	10	8270	1
N-Nitroso-di-n-propylamine	621-64-7	TO-13[e]	1	625	10	8270	1
Phenanthrene	85-01-8	TO-13	1	625	10	8270	1
Pyrene	129-00-0	TO-13	1	625	10	8270	1
Phenol	108-95-2	TO-13[e]	1	625	10	8270	1
PCBs (Total)		TO-13[e]	1	8080	0.5	8080	0.010
DIOXINS/FURANS							
Polychlorinated dibenzo-p-dioxins	1746-01-6	TO-13[e]	1	8280	<0.002	8280	<0.2 mg/kg
VOCs							
Acetaldehyde	75-07-0	TO-11	1	8315	0.010	NA	NA
Acetone	67-64-1	TO-14	1	624	100	NA	NA
Acrolein	107-02-8	TO-11	1	624	2000	NA	NA
extra! Acrylonitrile	107-13-1	TO-14	0.20	624	20	NA	NA
Allyl chloride	107-05-1	TO-14	0.20	624	5.0	NA	NA
Benzaldehyde	100-52-7	TO-11	1	8315	0.010	NA	NA
Benzene	71-43-2	TO-14	0.20	624	5.0	NA	NA
Bromoform	75-25-2	TO-14	0.20	624	5.0	NA	NA
2-Butanal	123-72-8	TO-11	1	624	50	NA	NA
Carbon tetrachloride	56-23-5	TO-14	0.20	624	5.0	NA	NA
Carbonyl chloride (Phosgene)	75-44-5	OSHA Method 61	1	NA	NA	NA	NA
Chlorobenzene	108-90-7	TO-14	0.20	624	5.0	NA	NA
Chloroform	67-66-3	TO-14	0.20	624	5.0	NA	NA
1,2-Dibromoethane	106-93-4	TO-14	0.20	624	5.0	NA	NA
1,4-Dichlorobenzene = p-Dichlorobenzene	106-46-7	TO-14	0.20	624	5.0	NA	NA
1,1-Dichloroethane	75-34-3	TO-14	0.20	624	5.0	NA	NA
1,2-Dichloroethane	107-06-2	TO-14	0.20	624	5.0	NA	NA
1,1-Dichloroethene	75-35-4	TO-14	0.20	624	5.0	NA	NA
1,2-Dichloropropane	78-87-5	TO-14	0.20	624	5.0	NA	NA

APPENDIX B (continued)
TARGET COMPOUND LIST (TCL)
ANALYSIS METHODS AND DETECTION LIMITS

	CAS' No.	Air Analysis Method	Targeted Detection Limit (ppbv)[a]	Water Analysis Method	Targeted Detection Limit (ug/L)[c]	Soil Analysis Method	Targeted Detection Limit (mg/kg)[d]
cis-1,3-Dichloropropene	10061-01-5	TO-14	0.20	624	5.0	NA	NA
trans-1,3-Dichloropropene	10061-02-6	TO-14	0.20	624	5.0	NA	NA
Ethylbenzene	100-41-4	TO-14	0.20	624	5.0	NA	NA
Formaldehyde	50-00-0	TO-11	1	8315	0.050	NA	NA
n-Heptane	142-82-5	TO-14	0.20	624	5.0	NA	NA
Hexanal	66-25-1	TO-11	1	624	50	NA	NA
extra Hexane	110-54-3	TO-14	0.20	624	5.0	NA	NA
Bromomethane = methyl bromide	74-83-9	TO-14	0.20	624	10	NA	NA
Methylene chloride	75-09-2	TO-14	1.50	624	5.0	NA	NA
2-Butanone (MEK)	78-93-3	TO-14	1	624	100	NA	NA
Pentanal	110-62-3	TO-11	1	624	50	NA	NA
Propanal	123-38-6	TO-11	1	624	50	NA	NA
Tetrachloroethene	127-18-4	TO-14	0.20	624	5.0	NA	NA
Toluene	108-88-3	TO-14	0.20	624	5.0	NA	NA
1,1,1-Trichloroethane	71-55-6	TO-14	0.20	624	5.0	NA	NA
Trichloroethene	79-01-6	TO-14	0.20	624	5.0	NA	NA
Vinyl chloride	75-01-4	TO-14	0.20	624	10	NA	NA
Xylenes, total	1330-20-7	TO-14	0.20	624	10	NA	NA
Total Volatile Hydrocarbons	—	EPA Method 25	—	624	—	NA	NA
INORGANICS							
METALS							
Antimony	7440-36-0	PF/6010	1	NA	NA	6010	10
Arsenic	7440-38-2	PF/6010	1	NA	NA	7060	0.50
Barium	7440-39-3	PF/6010	1	NA	NA	6010	5.0
Berylium	7440-41-7	PF/6010	1	NA	NA	6010	0.50
Cadmium	7440-43-9	PF/6010	1	NA	NA	6010	1.0
Chromium	7440-47-3	PF/6010	1	NA	NA	6010	5..0
Cobalt	7440-48-4	PF/6010	1	NA	NA	6010	5.0
Copper	7440-50-8	PF/6010	1	NA	NA	6010	5.0

APPENDIX B (continued)
TARGET COMPOUND LIST (TCL)
ANALYSIS METHODS AND DETECTION LIMITS

	CAS[a] No.	Air Analysis Method	Targeted Detection Limit (ppbv)	Water Analysis Method	Targeted Detection Limit (ug/L)[c]	Soil Analysis Method	Targeted Detection Limit (mg/kg)[d]
Lead	7439-92-1	PF/6010	1	NA	NA	6010	10
Mercury	7439-97-6	PF/6010	1	NA	NA	7471	0.050
Molybdenum	7439-98-7	PF/6010	1	NA	NA	6010	5.0
Nickel	7440-02-0	PF/6010	1	NA	NA	6010	10
Selenium	7783-00-8	PF/6010	1	NA	NA	7740	0.50
Silver	7440-22-4	PF/6010	1	NA	NA	6010	2.5
Thallium	7440-28-0	PF/6010	1	NA	NA	6010	25
Vanadium	7440-62-2	PF/6010	1	NA	NA	6010	5.0
extra Zinc	7440-66-6	PF/6010	1	NA	NA	6010	5.0

a CAS = Chemical Abstracts Service
b ppbv = Parts per Billion by Volume
c ug/L = Micrograms per Liter
d mg/kg = Milligrams per Kilogram
e Sampling method followed procedure outlined in TO-13. Analytical method utilized modified 8270 procedures (see Section 3.2.3.4 describing approved methoc modifications).
f NA = Not Applicable
g NR = Not Reported

Appendix C
Landfill Soil Sampling Location Maps

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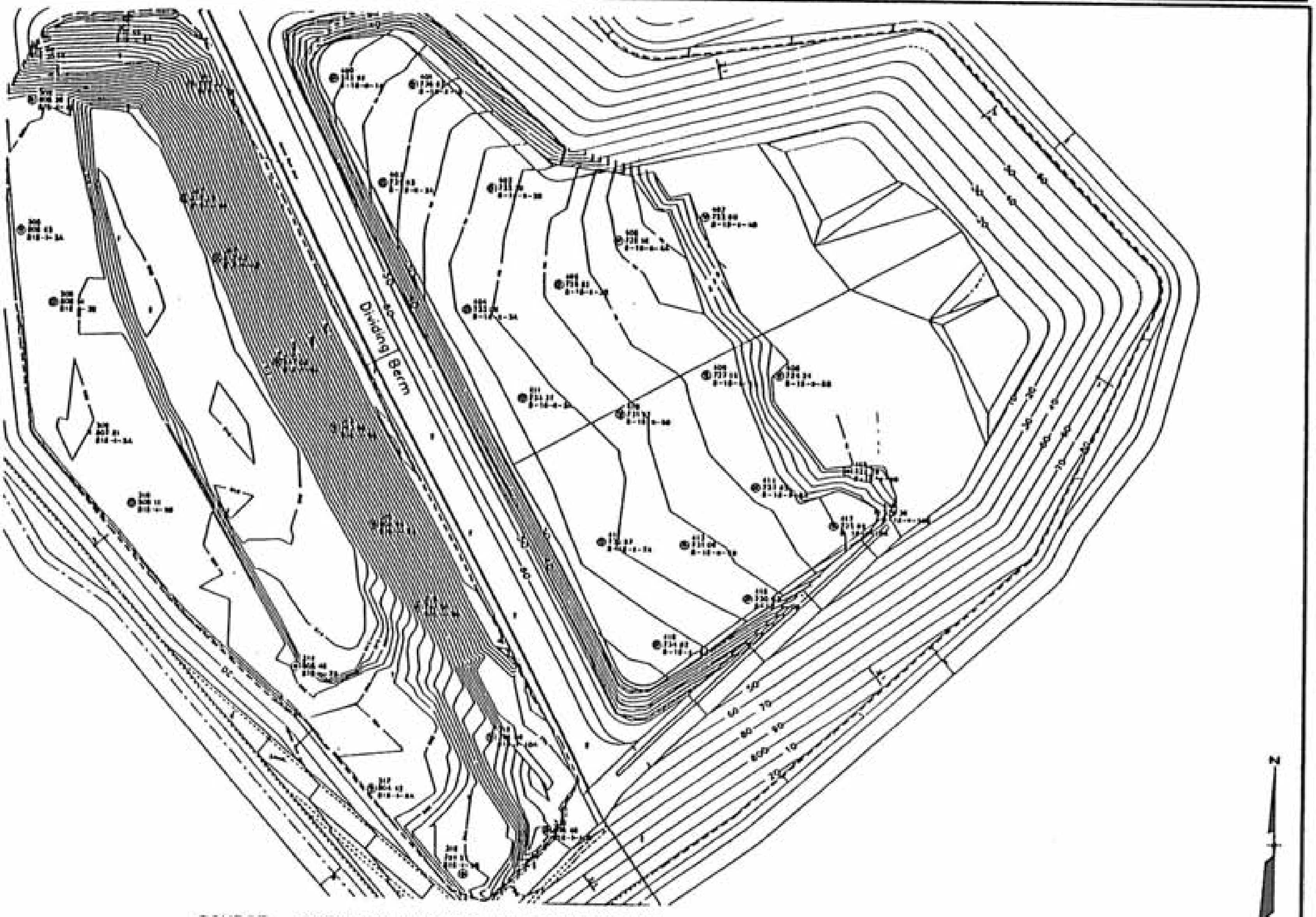

SOURCE: CHEMICAL WASTE MANAGEMENT INC.

NOT TO SCALE

RUST ENVIRONMENT & INFRASTRUCTURE
Minneapolis, MN 55441

B-18 PHASE I & II
SOIL SAMPLING LOCATIONS

1994 KETTLEMAN HILLS FACILITY (KHF)
TOPOGRAPHICAL, METEOLOGICAL AND AIRBORNE
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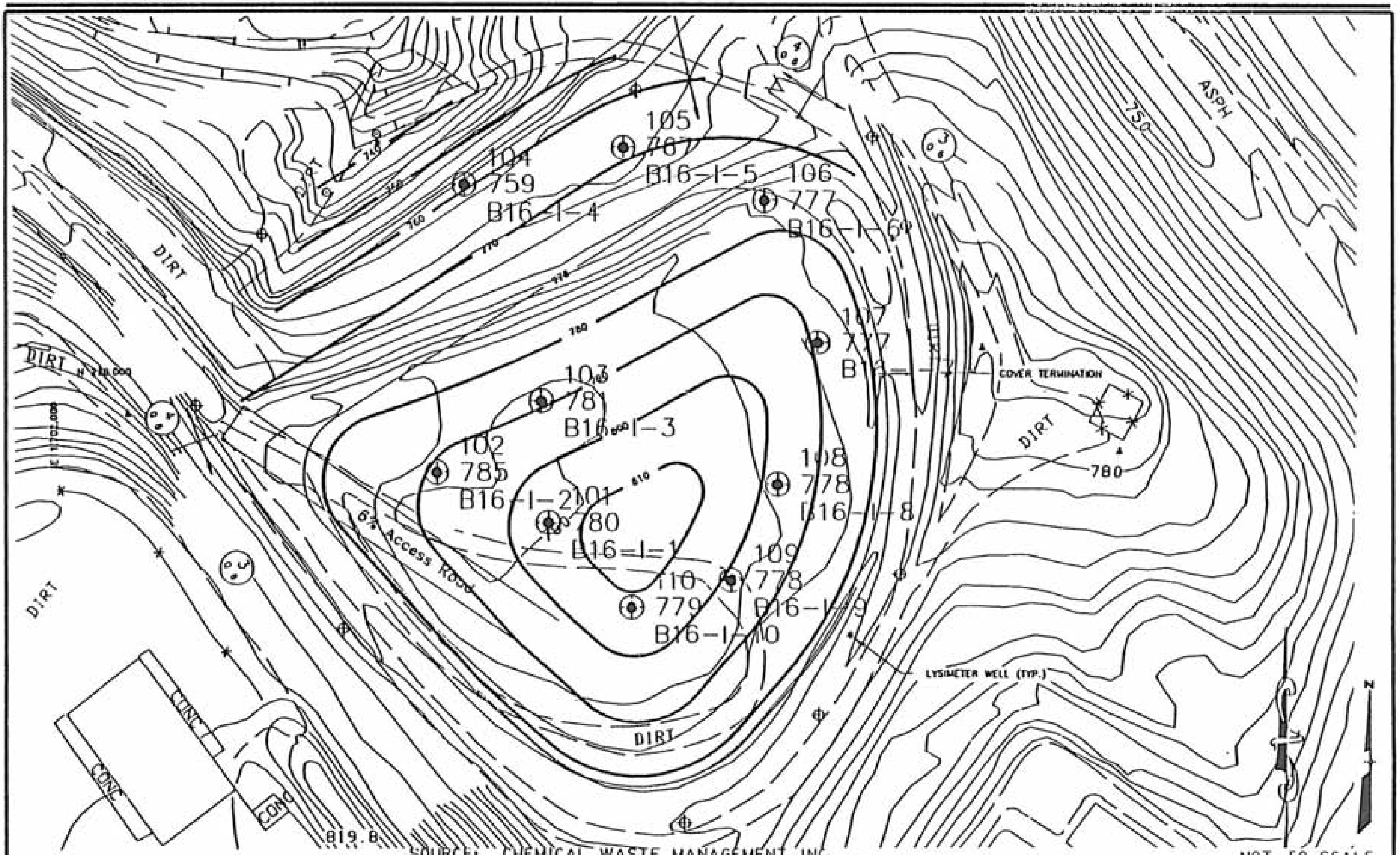

SOURCE: CHEMICAL WASTE MANAGEMENT INC.

NOT TO SCALE

RUST ENVIRONMENT & INFRASTRUCTURE
Minneapolis, MN 55441

B-16
SOIL SAMPLING LOCATIONS

1994 KETTLEMAN HILLS FACILITY (KHF)
TOPOGRAPHICAL, METEOLOGICAL AND AIRBORNE
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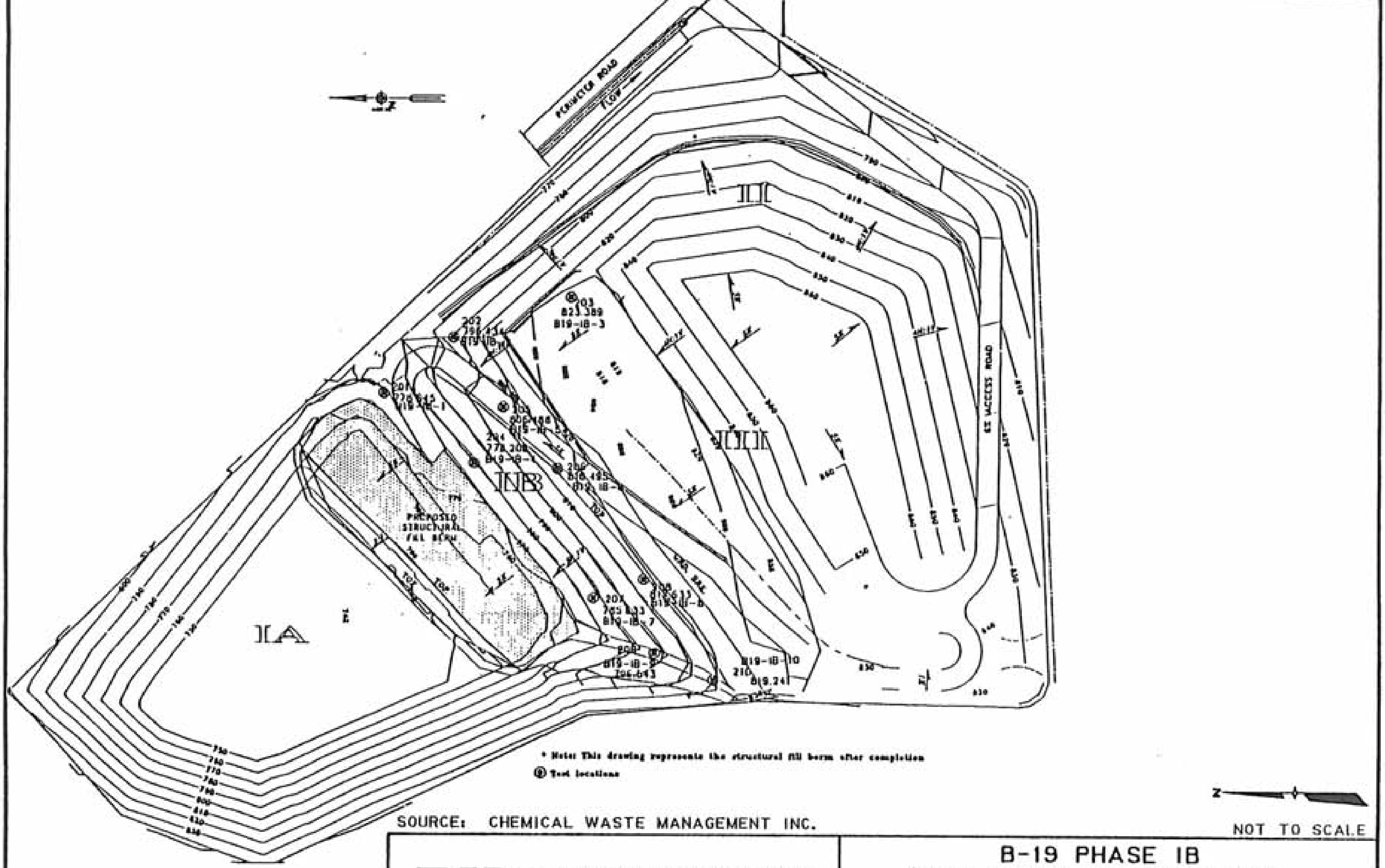


* Note: This drawing represents the structural fill berm after completion

⊗ Test locations

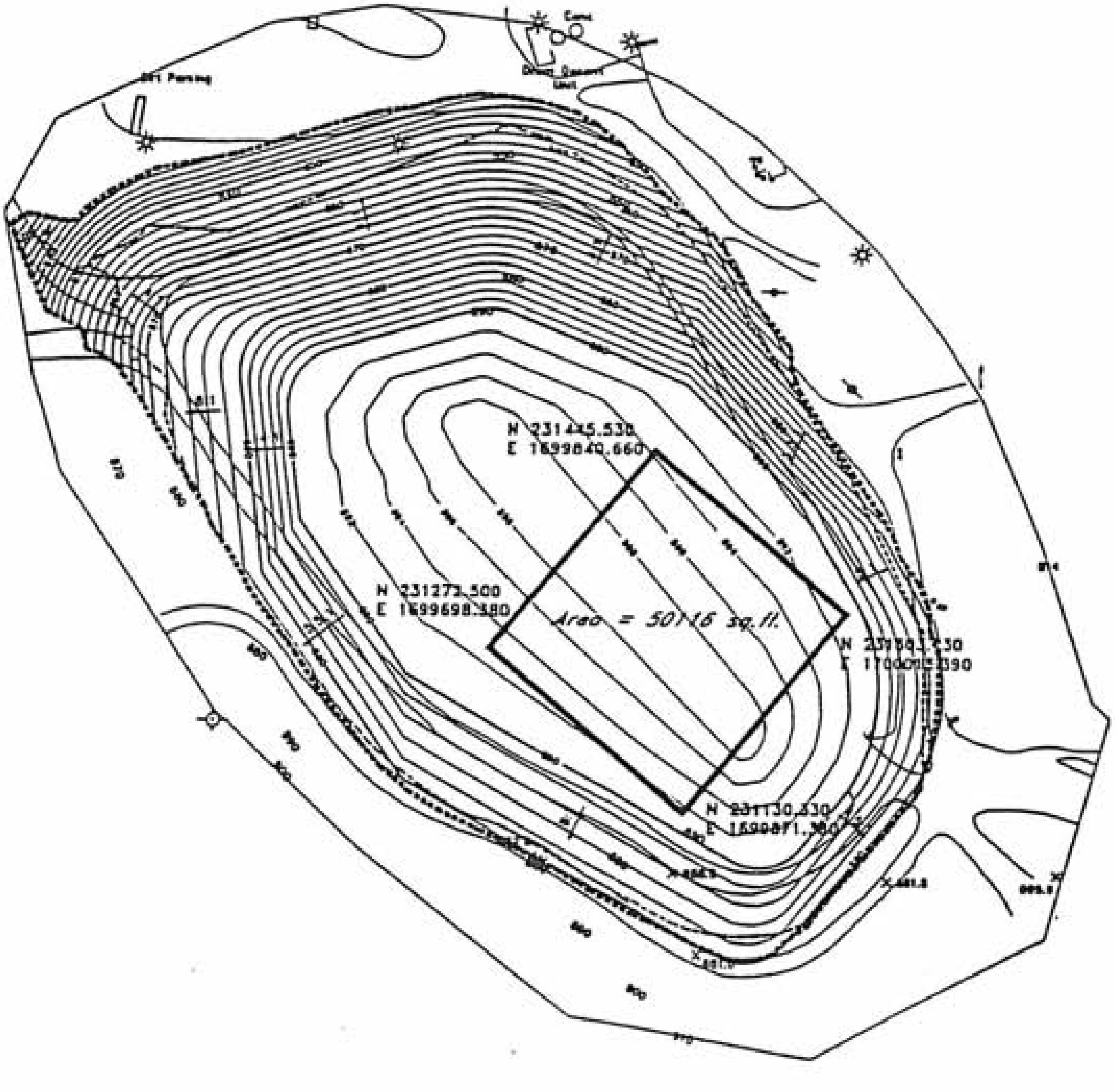
SOURCE: CHEMICAL WASTE MANAGEMENT INC.

RUST ENVIRONMENT & INFRASTRUCTURE
Minneapolis, MN 55441

B-19 PHASE IB
SOIL SAMPLING LOCATIONS

1994 KETTLEMAN HILLS FACILITY (KHF)
TOPOGRAPHICAL, METEOLOGICAL AND AIRBORNE
CONTAMINANT CHARACTERIZATION

Appendix D
ISS Sampling Grid Survey Maps



SOURCE: CHEMICAL WASTE MANAGEMENT INC.

NOT TO SCALE

RUST ENVIRONMENT & INFRASTRUCTURE
Minneapolis, MN 55441

B-13 ISS GRID LOCATION AND AREA

1994 KETTLEMAN HILLS FACILITY (KHF)
TOPOGRAPHICAL, METEOLOGICAL AND AIRBORNE
CONTAMINANT CHARACTERIZATION

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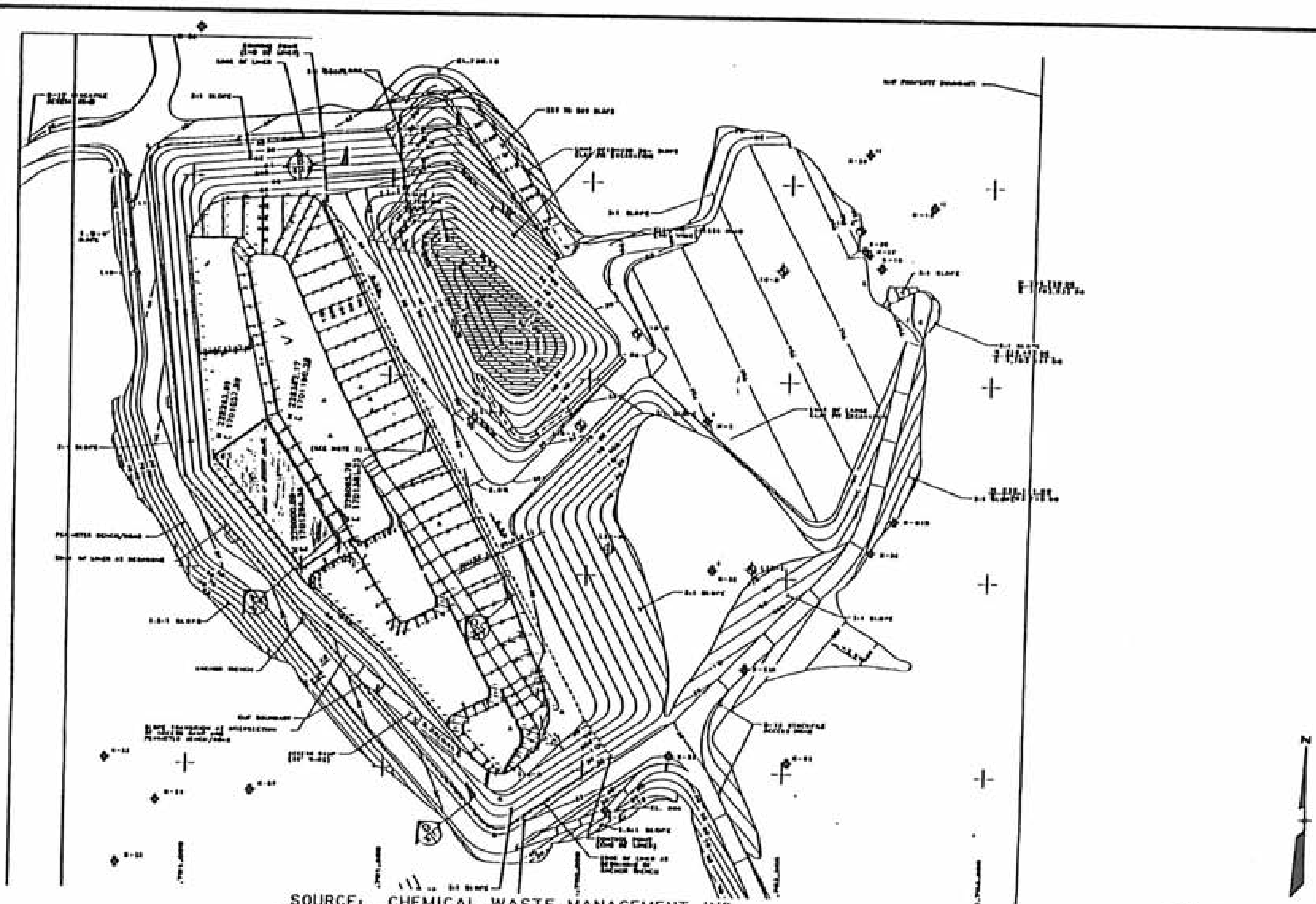

SOURCE: CHEMICAL WASTE MANAGEMENT INC.

NOT TO SCALE

RUST ENVIRONMENT & INFRASTRUCTURE
Minneapolis, MN 55441

B-18 ISS GRID
LOCATION AND AREA

1994 KETTLEMAN HILLS FACILITY (KHF)
TOPOGRAPHICAL, METEOLOGICAL AND AIRBORNE
CONTAMINANT CHARACTERIZATION

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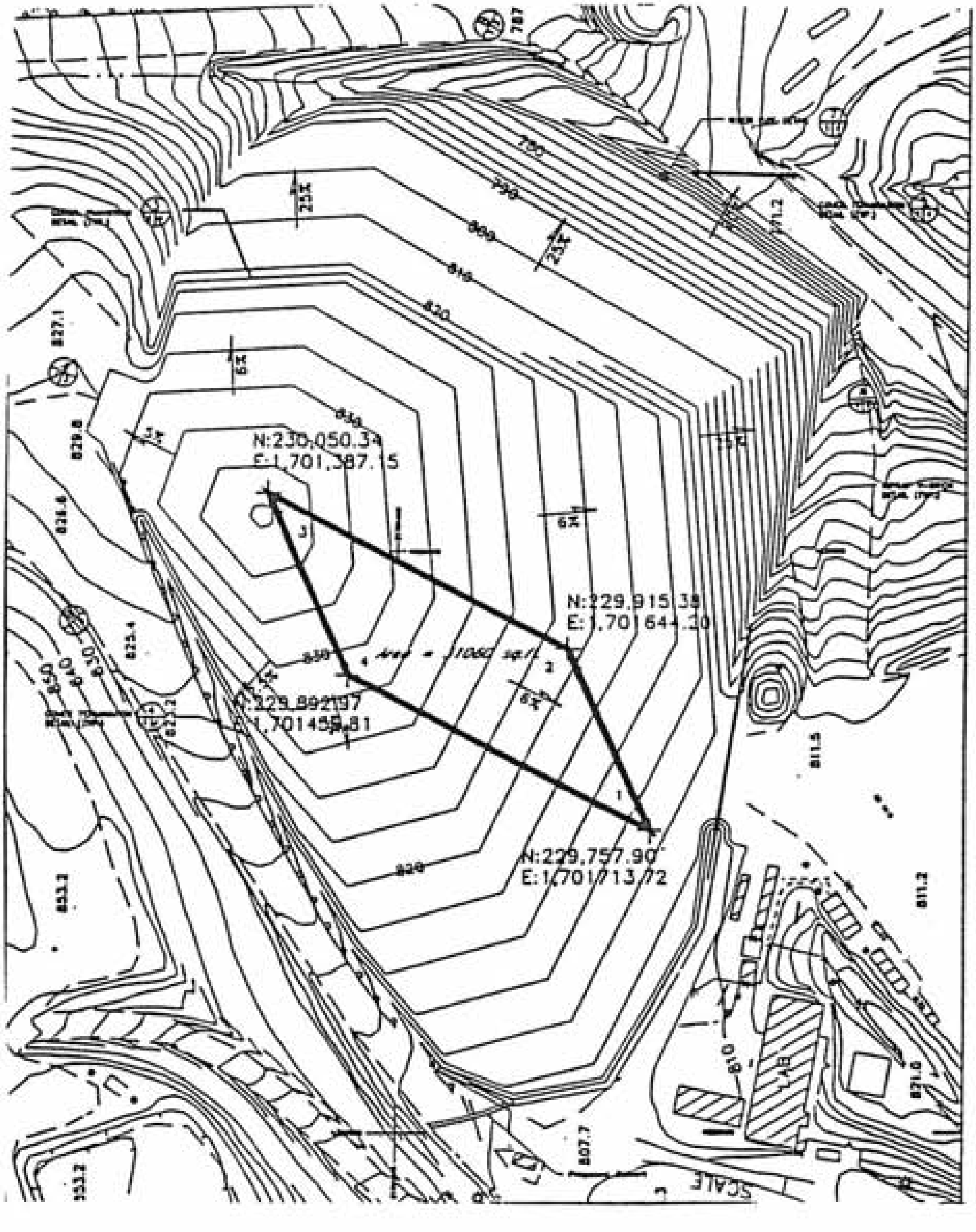

SOURCE: CHEMICAL WASTE MANAGEMENT INC.

NOT TO SCALE

RUST ENVIRONMENT & INFRASTRUCTURE
Minneapolis, MN 55441

B-15 ISS GRID LOCATION AND AREA

1994 KETTLEMAN HILLS FACILITY (KHF)
TOPOGRAPHICAL, METEOLOGICAL AND AIRBORNE
CONTAMINANT CHARACTERIZATION

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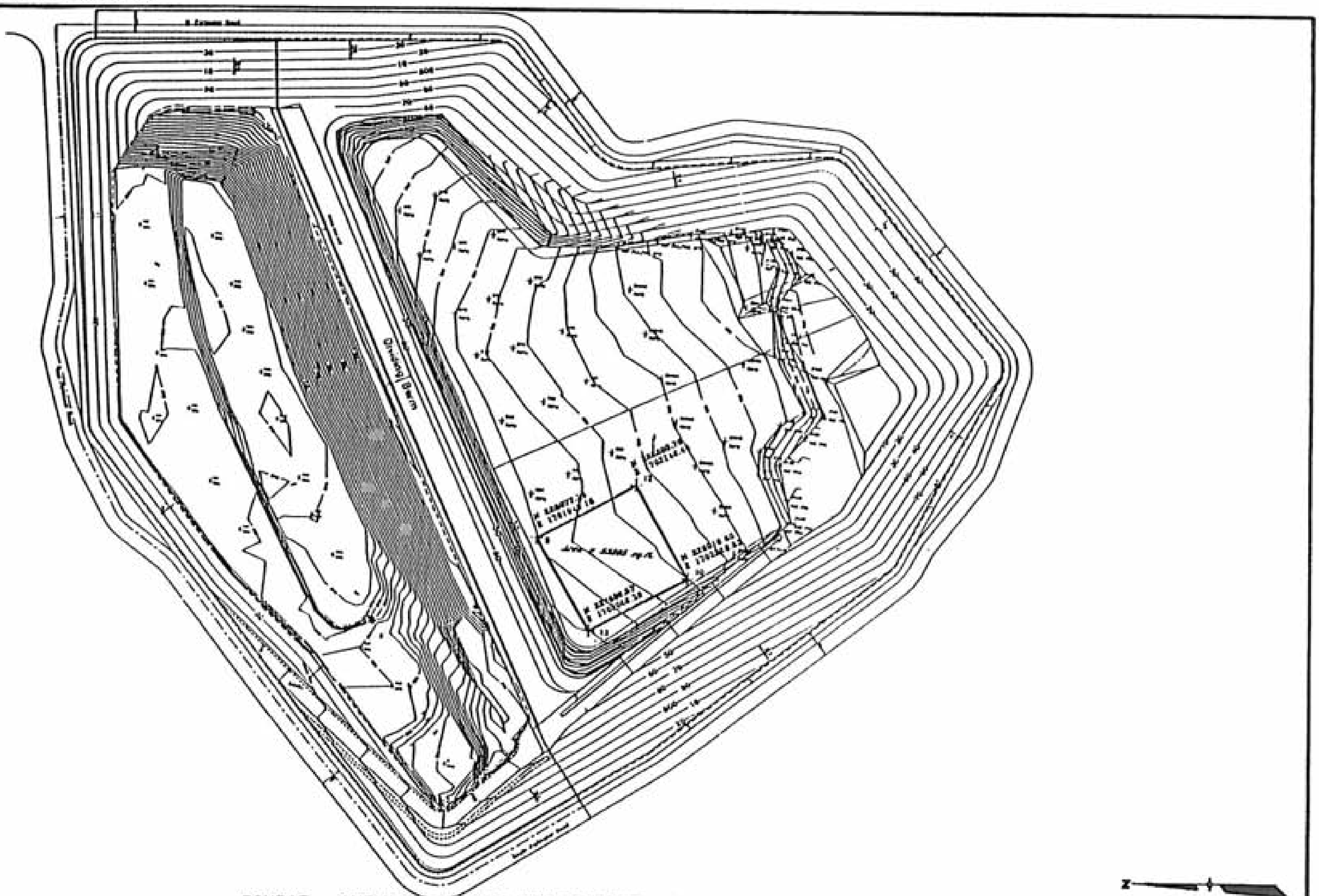

NOT TO SCALE

SOURCE: CHEMICAL WASTE MANAGEMENT INC.

RUST ENVIRONMENT & INFRASTRUCTURE
Minneapolis, MN 55441

B-18 ISS GRID
LOCATION AND AREA

1994 KETTLEMAN HILLS FACILITY (KHF)
TOPOGRAPHICAL, METEOLOGICAL AND AIRBORNE
CONTAMINANT CHARACTERIZATION

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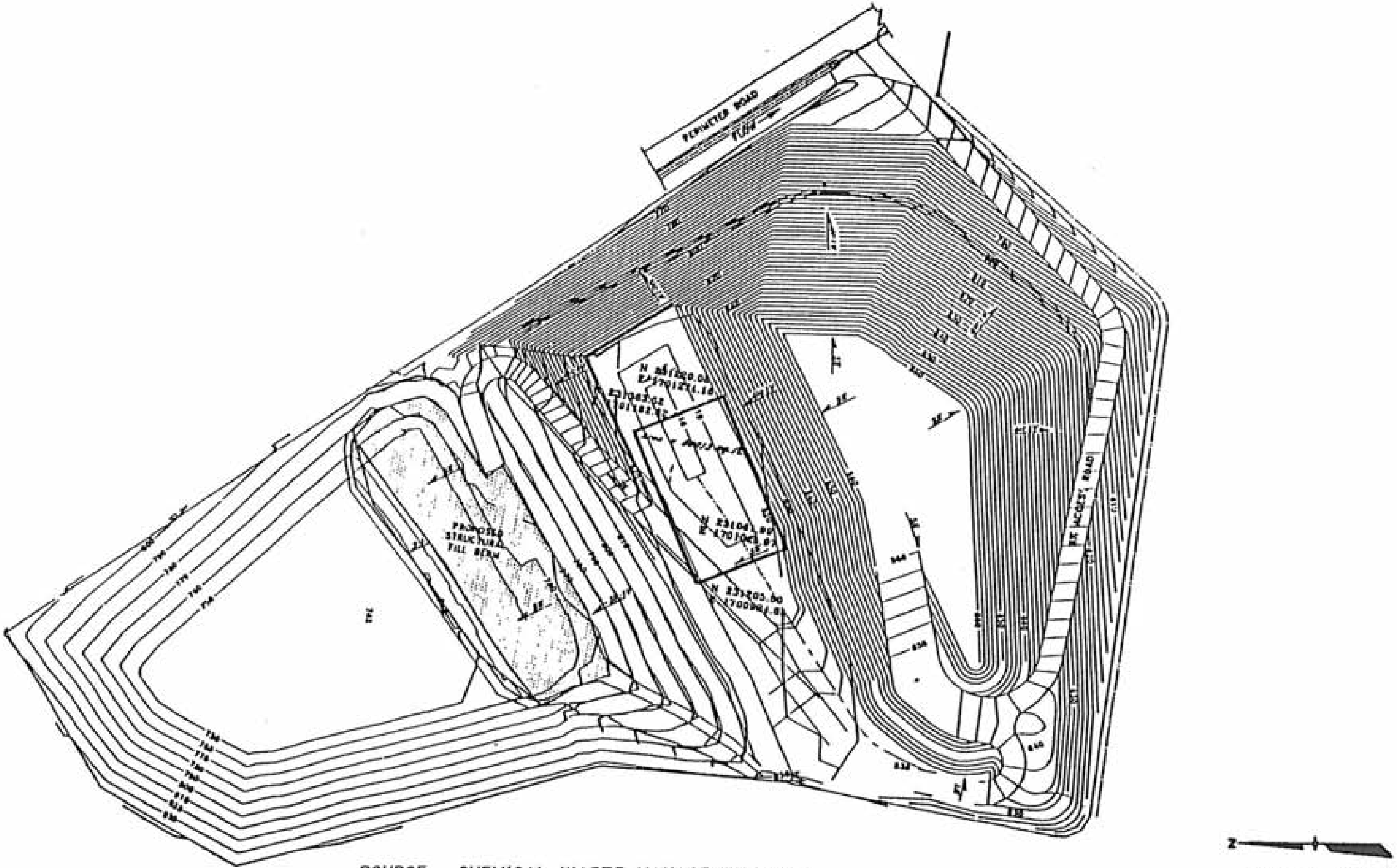

NOT TO SCALE

SOURCE: CHEMICAL WASTE MANAGEMENT INC.

RUST ENVIRONMENT & INFRASTRUCTURE
Minneapolis, MN 55441

B-19 ISS GRID
LOCATION AND AREA

1994 KETTLEMAN HILLS FACILITY (KHF)
TOPOGRAPHICAL, METEOLOGICAL AND AIRBORNE
CONTAMINANT CHARACTERIZATION

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SOURCE: GOLDER ASSOCIATES INC.

NOT TO SCALE

RUST ENVIRONMENT & INFRASTRUCTURE
Minneapolis, MN 55441

B-14 ISS GRID
LOCATION AND AREA

1994 KETTLEMAN HILLS FACILITY (KHF)
TOPOGRAPHICAL, METEOLOGICAL AND AIRBORNE
CONTAMINANT CHARACTERIZATION

Appendix E
Tables of Sampling Dates at Each Source

APPENDIX E

TABLE E-1
LANDFILL COMPOSITE SOIL SAMPLES
SAMPLING DATES AND TARGET ANALYTES

SamplingDate	Field Sample I.D.	Analytes on Target Compound List
3/15/94-3/16/94	B-16	Metals and SVOCs
3/16/94	B-18 PHASE I	Metals and SVOCs
3/16/94	B-18 PHASE II	Metals and SVOCs
3/16/94	B-18 PHASE II COMPOSITE A	Metals and SVOCs
3/16/94	B-18 PHASE II COMPOSITE B	Metals and SVOCs
3/15/94-3/16/94	B-19-PHASE IB	Metals and SVOCs

SVOCs = Semivolatile Organic Compounds

APPENDIX E

TABLE E-2
LANDFILL INTEGRATED SURFACE SAMPLES
SAMPLING DATES AND TARGET ANALYTES

Sampling Date	Field Sample I.D.	Analytes on Target Compound List
4/14/94	B-13	To-14 VOCs, TO-11 VOCs Phosgene, TVH
4/20/94	B-15	To-14 VOCs, TO-11 VOCs Phosgene, TVH
4/20/94	B-16	To-14 VOCs, TO-11 VOCs Phosgene, TVH
4/20/94	B-19	To-14 VOCs, TO-11 VOCs Phosgene, TVH
5/01/94	B-18 PHASE I	To-14 VOCs, TO-11 VOCs Phosgene, TVH
5/01/94	B-18 PHASE I Equipment Blank	To-14 VOCs, TO-11 VOCs Phosgene, TVH
5/01/94	B-18 PHASE II	To-14 VOCs, TO-11 VOCs Phosgene, TVH
5/01/94	B-18 PHASE II Duplicate	To-14 VOCs, TO-11 VOCs Phosgene, TVH
5/02/94	B-13	Phosgene
5/02/94	B-15	Phosgene
5/04/94	B-16	Phosgene
5/04/94	B-19	Phosgene

VOCs = Volatile Organic Compounds
TVH = Total Volatile Hydrocarbons

APPENDIX E

TABLE E-3
SURFACE IMPOUNDMENT LIQUID SAMPLES
SAMPLING DATES AND TARGET ANALYTE GROUPS

Sampling Date	Field Sample I.D.	Analytes on Target Compound List
3/31/94	P-9	VOC's, SVOC's and TVH
3/31/94	P-14, P-14-Equipment Blank	VOC's, SVOC's and TVH
3/31/94	P-16, P-16-Duplicate	VOC's, SVOC's and TVH
4/06/94	P-9, P-9-Duplicate	VOC's, SVOC's and TVH
4/06/94	P-14	VOC's, SVOC's and TVH
4/06/94	P-16, P-16-Equipment Blank	VOC's, SVOC's and TVH
4/12/94	P-9, P-9-Equipment Blank	VOC's, SVOC's and TVH
4/12/94	P-14, P-14-Duplicate	VOC's, SVOC's and TVH
4/12/94	P-16	VOC's, SVOC's and TVH
4/18/94	P-9	VOC's, SVOC's and TVH
4/18/94	P-14, P-14-Equipment Blank	VOC's, SVOC's and TVH
4/18/94	P-16, P-16-Duplicate	VOC's, SVOC's and TVH
4/30/94	P-9, P-9-Duplicate	VOC's, SVOC's and TVH
4/30/94	P-14	VOC's, SVOC's and TVH
4/30/94	P-16, P-16-Equipment Blank	VOC's, SVOC's and TVH
5/03/94	P-9, P-9, Equipment Blank	VOC's, SVOC's and TVH
5/03/94	P-14, P-14-Duplicate	VOC's, SVOC's and TVH
5/03/94	P-16	VOC's, SVOC's and TVH

Notes:

VOC's=Volatile Organic Compounds

TVH=Total Volatile Hydrocarbons

SVOC's=Semivolatile Organic Compounds

APPENDIX E

TABLE E-4

AMBIENT AIR SAMPLES FROM SURFACE IMPOUNDMENTS AND HWTUs SAMPLING DATES AND TARGET ANALYTE GROUPS

Sampling Date	Field Sample I.D.	Analytes on Target Compound List
3/30/94	Equipment Blank	TO-14 VOCs and TVH
3/31/94	P-9	All VOCs and TVH
3/31/94	P-14	TO-14 VOCs and TVH
3/31/94	P-14-Equipment Blank	TO-11 VOCs and Phosgene
3/31/94	P-16	TO-14 VOCs and TVH
3/31/94	P-16-Duplicate	TO-14 VOCs and TVH
4/06/94	P-9	TO-14 VOCs and TVH
4/06/94	P-9-Duplicate	TO-14 VOCs and TVH
4/06/94	P-14	TO-14 VOCs and TVH
4/06/94	P-16	TO-14 VOCs and TVH
4/06/94	P-16-Equipment Blank	TO-14 VOCs and TVH
/12/94	P-9	TO-14 VOCs and TVH
4/12/94	P-9-Equipment Blank	TO-14 VOCs and TVH
4/12/94	P-14	TO-14 VOCs and TVH
4/12/94	P-14-Duplicate	TO-14 VOCs and TVH
4/12/94	P-16	TO-14 VOCs and TVH
4/13/94	FSU	All VOCs, TVH, SVOCs and Metals
4/13/94	FSU-Duplicate	TO-14 VOCs, Phosgene, TVH, Metals, SVOCs
4/13/94	FSU-A	All VOCs, TVH, SVOCs and Metals
4/13/94	FSU-A-Equipment Blank	All VOCs, TVH, SVOCs and Metals
4/13/94	FSU-B	All VOCs, TVH, SVOCs and Metals
4/14/94	DSU	All VOCs, TVH, SVOCs and Metals
4/14/94	CPA	All VOCs, TVH, SVOCs and Metals
4/18/94	P-9	All VOCs and TVH
4/18/94	P-14	All VOCs and TVH
4/18/94	P-14-Equipment Blank	All VOCs and TVH

APPENDIX E

TABLE E-4 (continued)
AMBIENT AIR SAMPLES FROM SURFACE IMPOUNDMENTS AND HWTUs
SAMPLING DATES AND TARGET ANALYTE GROUPS

Sampling Date	Field Sample I.D.	Analytes on Target Compound List
4/18/94	P-16	All VOCs and TVH
4/18/94	P-16-Duplicate	All VOCs and TVH
4/19/94	FSU	All VOCs, TVH, SVOCs and Metals
4/19/94	FSU Equipment Blank	All VOCs and TVH
4/19/94	FSU-A	All VOCs, TVH, SVOCs and Metals
4/19/94	FSU-A Duplicate	SVOCs
4/19/94	FSU-B	All VOCs, TVH, SVOCs and Metals
4/19/94	FSU-B-Duplicate	All VOCs, TVH, and Metals
4/20/94	DSU	All VOCs, TVH, and Metals
4/20/94	DSU-Duplicate	All VOCs, TVH, and Metals
4/20/94	CPA	All VOCs, TVH, SVOCs and Metals
4/20/94	CPA-Duplicate	SVOCs
4/30/94	P-9	All VOCs and TVH
4/30/94	P-9-Duplicate	All VOCs and TVH
4/30/94	P-14	All VOCs and TVH
4/30/94	P-16	All VOCs and TVH
4/30/94	P-16-Equipment Blank	All VOCs and TVH
5/01/94	DSU	All VOCs, TVH, SVOCs and Metals
5/01/94	CPA	All VOCs, TVH, SVOCs and Metals
5/01/94	CPA-Equipment Blank	All VOCs, TVH, SVOCs and Metals
5/02/94	FSU	All VOCs, TVH, SVOCs and Metals
5/02/94	FSU-A	TO-11 VOCs, Phosgene, SVOCs, Metals
5/02/94	FSU-A-Duplicate	Phosgene, Metals
5/02/94	FSU-B	All VOCs, TVH, SVOCs and Metals
5/02/94	FSU-Duplicate	TO-11 VOCs, SVOCs
5/02/94	FSU-Equipment Blank	SVOCs, Metals

APPENDIX E

TABLE E-4 (continued)
AMBIENT AIR SAMPLES FROM SURFACE IMPOUNDMENTS AND HWTUs SAMPLING DATES AND TARGET ANALYTE GROUPS

Sampling Date	Field Sample I.D.	Analytes on Target Compound List
5/03/94	P-9	TO-11 VOCs, Phosgene
5/03/94	P-9-Equipment Blank	All VOCs and TVH
5/03/94	P-14	All VOCs and TVH
5/03/94	P-14-Duplicate	All VOCs and TVH
5/03/94	P-16	All VOCs and TVH
5/04/94	P-9	TO-14 VOCs and TVH
5/04/94	P-9-Equipment Blank	TO-14 VOCs and TVH
5/04/94	FSU-A	TO-14 VOCs and TVH
5/04/94	Air Blank	TO-14 VOCs and TVH

Notes:
VOCs = Volatile Organic Compounds
TVH = Total volatile Hydrocarbons
SVOCs = Semivolatile Organic Compounds