pace laboratories, inc.
PROFESSIONAL ANALYTICAL CHEMISTRY & ENGINEERING

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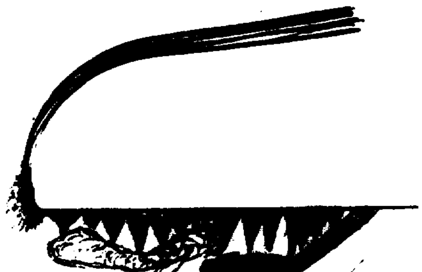
WORK PLAN
FOR
REMOVAL OF DRUMS AND CONTAMINATED SOILS
FROM
SOUTH ANDOVER HAZARDOUS WASTE SITE

Prepared By: PACE Laboratories, Inc.
Minneapolis, MN

September 14, 1984



(p. I P_3)

1) I P_3 visually describe drums to identify potential generator
2) II search for unidentified areas? — method of search?
3) IIA check on fire equipment when drum penetrating, especially [illegible] (p. IV P_4)
4) p. 7 P_2 pH procedure – give me a break!
— P_3 sounds real professional!
5) p. 5 II soil removal? – sub on mixing
— FENCE DRUM AREAS – [illegible] REMOVAL
6) p. 10 P_6 "Personnel sampling" specify
7) p. 11 P_1 Safety factor?
— P_4 ? required by who? how areas defined?

[illegible], [illegible]

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I. Introduction

This work plan provides for the sampling, repackaging, transportation, and disposal of drummed hazardous waste and visibly contaminated soils at the South Andover Site. This work plan has been prepared for a consortium of companies which includes the following: Bemis Company; Color-Ad Packaging, Inc.; Standard Solvents, Inc. and Acme Tag Company. The site consists of three properties as shown in Figure I identified as C & M Heidelberger (Parmak), S & D Heidelberger and Pumpkin City Enterprises. From 1968 through 1974 this site was used for recycling and open burning of solvent wastes. In 1976 the solvent recycling and open burning practices at the site were terminated by the Minnesota Pollution Control Agency. The site has also been used for storage of drums containing waste. In July of 1981, Cecil Heidelberger removed many of the drums from the site.

Several inventories have been conducted over the years to identify the location and number of drums currently stored at the South Andover Site. The first drum inventory was conducted by PACE Laboratories, Inc. for Bemis Company, Inc. dated September 28, 1981 entitled "Andover Drum Inventory". The latest drum inventory performed at the site was conducted by Environmental Engineering and Management, Ltd., dated July, 1983 and entitled "Andover Sites Remedial Plan". The latest drum inventory performed in 1983 identified a total of 214 drums on site. The location of these drums is provided in Figure I.

The types of wastes which may be contained in these drums include wash-up inks and sludges, solvent based adhesives, water adhesives, printing wastes, paint thinners and paint sludges. Substances found in the drums by the Minnesota Pollution Control Agency include benzene, toluene, methlyene chloride, isopropyl alcohol, 1,1,1 trichloroethane, trichloroethylene, N-butyl alcohol and tetrachloroethylene. Based upon the above information PACE Laboratories, Inc. will conduct an inventory to identify all drums of waste and visually contaminated soil immediately adjacent to one or more of the drums, and to properly characterize these wastes for packaging, labeling, transportation and disposal. The remainder of this work plan describes in detail the steps which will be taken to achieve these goals.

II. Drum Inventory and Sample Collection

The purpose of the inventory will be to identify the location of all drums on site which either contain waste or may potentially contain waste. Due to the large number of tires, refuse and rubbish on the site, immediate accessibility to the drums to verify the presence of waste will not be possible. However, the inventory will identify the location of these inaccessible drums so that at a later time heavy equipment can be used to properly prepare the drums for inventory and sampling. The 1983 inventory described earlier in this work plan will be used to locate the drums during the inventory, see Figure I. The results of this drum inventory will be summarized and provided in a report, to give a current assessment of the number and location of the drums located on the South Andover Site.

A. Preparation of the Drums for Sampling

Many of the drums on site are readily accessible for sampling, which will be performed by PACE Laboratories, Inc. in accordance with the procedures described later in this work plan. However, several drums will not be readily accessible for sampling as they may be buried under tires or other refuse, may appear to be damaged or unsound for movement, or are buldging due to internal pressures. PACE Laboratories, Inc. will subcontract with Bay West, Inc. to provide safe access to these drums for sampling. Some of these drums are corroded and rusted while others are leaking. Some drums which are badly rusted or buldging will have to be punctured. In order to accomplish this, a variety of heavy equipment will be required. To avoid loss of life, injury, or health hazards to investigators and the environment, a comprehensive safety program will be implemented as described later in this section.

B. Sample Collection

The following general procedures will be followed by PACE Laboratories, Inc. and Bay West, Inc. to prepare the drums for sampling:

1) Work with each grouping of barrels where they are currently located.

2) When necessary, create additional space by moving unrelated trash and tires.

3) Drums not requiring remote opening will be opened by PACE Laboratories, Inc. using non-sparking tools or drum deheaders.

4) All drums will be grounded during opening.

After the drums are made accessible for sampling PACE Laboratories, Inc. personnel will proceed with sample collection and field characterization. The technique, equipment and procedures used for sampling shall be in accordance with the United States Environmental Protection Agency publication entitled "Samplers and Sampling Procedures for Hazardous Waste Streams" (EPA 600/2-80-018, January 1980). The remainder of this section will provide a brief overview of the sampling equipment and the procedures to be used. The sampling team will consist of chemists, industrial hygienists, and trained environmental technicians. A minimum of two people will be involved in sample collection at any given time. For safety reasons, no one will be allowed to work on sample collection alone.

In performing a comprehensive sampling inventory of the drums at the South Andover Site, it will be important to label each drum as it is sampled. Each individual drum, whether it is empty or full and regardless of its condition, will be labeled. A simple alphanumeric labeling system will be used. Each drum will be numbered consecutively from 1 through 1,000. Following the numeric identification will be a letter code indicating the general area in which the drum is located. Letter codes for the general areas will conform to those reported in our drum inventory.

Each drum will be labeled by painting large easily identifiable numbers and letters, both black and white paint will be available. This will allow a clear identification of dark colored and light colored drums.

Safety is an important consideration in the collection of hazardous waste samples from the drums. The person collecting the sample will be aware that the waste could be corrosive, flammable, explosive, toxic or capable of releasing poisonous gases. The use of safety equipment and the availability of such equipment is, therefore, very important. Table I of this proposal provides a list of the equipment which will be used on the site. This list includes safety equipment and sampling equipment.

Drums containing liquid and or solid wastes can be under pressure causing buldging. Some buldging drums were apparent at the Andover Site. These drums will not be sampled until the pressure can be safely relieved. Handling and opening these drums will be performed using remote devices from a safe distance. Special care will also be taken when dealing with heavily corroded or rusted drums. These drums may contain strong acids and could rupture if not handled carefully. Steps will be taken to reduce the chances of producing sparks in the opening of the drums. Sparks could detonate explosive gases in the drums. Drums will be opened using a selection of non-sparking tools or air operated tools.

It is anticipated that several drums as the South Andover Site will contain liquid solvent material, a coliwasa or glass tube sampler will be used for sampling liquids. The coliwasa sampler was designed by the U.S. Environmental Protection Agency and allows for the collection of a sample representing a vertical cross section from a drum of liquid waste, see Figure II. If a wide variety of liquid wastes types are encountered the glass tube samplers will be used because they are inexpensive. There are, however, numerous drums on the site which contain solid wastes, such as paint sludges. For these wastes, a sample will be collected with a sampling trier or trowel, see Figures III and IV.

Following collection, the samples will be immediately transferred to a sample container (pint glass container). This will be a new glass container with a foil lining in the lid.

Each sample container shall have a label containing the following information:

Project
Client
Sample Identification
Date Sampled
Time Sampled
Sampler Identification

In addition to this, a bound sample log book will be retained. A sample log sheet will be filled out for each drum on site. The log sheet will contain the following information:

Project
Client
Sample Identification
Date Collected
Time Collected
Sampler Identification
General Description and Condition of the Drum
Type of Drum
General Description of the Sample (color, texture, consistency, odor, etc.)
Approximation of Drum Contents

An example log sheet is shown in Figure V.

A sample chain-of-custody form will be filled out for each sample collected. An example of this chain-of-custody form is shown in Figure VI. The form shall be filled out following collection of each sample and will be signed by the individual receiving the sample each time the custody is transferred. General procedures used by PACE Laboratories, Inc. for the collection of samples at hazardous waste sites are provided in Attachment I, in our manual entitled, "Procedure Manual of Cleanup of Hazardous Waste Dump and Storage Sites".

C. Repackaging

Bay West, Inc. will be primarily responsible for repackaging the drums of hazardous wastes. Based upon site inspections at the South Andover Site it is assumed that the majority if not all of the drums containing wastes will have to be repackaged, because they will not meet Department of Transporation requirements for shipment. Where possible, wastes will be consolidated during repackaging, if they are compatible and similar in their chemical and physical properties. Laboratory testing to be performed on each drum will provide information relative to the compatibility of wastes for consolidation during packaging. The laboratory prescreening tests are described later in this work plan.

The drummed wastes will be repackaged into either DOT approved 17H 55 gallon drums or drum overpacks.

III. Sample Analysis

Analytical data will need to be generated on the wastes for two purposes:

1) To adequately characterize the waste for packaging and transporation.

2) To characterize the wastes to meet the requirements of a permitted hazardous waste treatment/disposal facility. Some preliminary tests will be made relative to compatibility. We will determine if the wastes are flammable or corrosive, so that it can be properly labeled and packaged according the Department of Transporation regulations. However, we also need to characterize the waste to be sure that incompatible wastes are not mixed together which may cause an explosion or violent reaction. Additionally, the wastes need to be characterized to minimize mixing waste types which may be compatible but as a result of mixing they render the two waste types incompatible for resource recovery. An example would be mixing a chlorinated and a non-chlorinated solvent wastestream together. Individually, theses two wastestreams could be used for resource recovery, however, when mixed they are not amenable to resource recovery and reclamation. The following prescreening tests will be performed on each waste sampled from the South Andover Site.

The pH of the waste will be taken to determine its corrositivity and its compatibility with other wastes. A barrel of acidic waste coming into contact with a barrel or sulfide or cyanide bearing waste could evolve poisonous hydrogen sulfide or hydrogen cyanide gas. To guard against these possibilities caustic and acid wastes must be segregated.

Due to the interferences caused with hazardous waste samples containing organic layers, sludges or concentrated solutions, the method of determination for pH in the field will utilize a multi-blank pH paper strip which contains a reaction zone and a range of indicator colors for reference. The entire strip will be dipped into the wastes and the color reaction will be allowed to occur. The strip will then be withdrawn and any excess sludge, organic or water, wiped off, squeezing it between the thumb and forefinger of the rubber gloved hand.

Another prescreening test which may be used to segregate chlorinated from non-chlorinated solvents would be specific gravity. The method used would be as described in "Standard Methods for the Examination of Water and Wastewater," 15th Edition. Chlorinated solvents have a specific gravity greater than 1, while most non-chlorinated solvents have a specific gravity less than 1. Other physical characteristics which might be used to segregate waste types would be color, viscosity and odor, water solubility and utilization of a copper wire and flame to detect chlorinated solvents. This data should provide adequate information for the segregation of the wastes sampled, relative to compatibility for transporation and segregation to optimize treatment or disposal of the waste.

Once all prescreening tests have been completed the wastes will be characterized for ultimate treatment or disposal. This will be accomplished by first reviewing all field notes, including comments about physical description of the wastes and prescreening test results. Based upon this information, the wastes will be broken-up into various groups or waste types. There may be anywhere from a few to several drums in each waste type.

At this point several permitted hazardous waste treatment/disposal facilities will be contacted. The physical properties and prescreening test results will be reviewed with each of the permitted facilities. Our recommendations for consolidating drums into individual waste types, such as paint sludges, will also require approval from the permitted disposal facility. Once approval has been obtained an equal volume composite sample from all drums in a particual waste type will be obtained. This composite sample for an individual waste type will then be analytically profiled to meet the requirements of the permitted hazardous waste facility.

IV. Contaminated Soil

Contaminated soil to be removed from the site for disposal will only include visually contaminated soil immediately adjacent to one or more of the drums to be sampled. This contaminated soil will be consolidated and taken to a central location where it will be piled on top of a plastic tarp or placed into a roll-off. Once all contaminated soil has been moved to this central storage site the contaminated soil pile will be sampled. Depending upon the amount of material in the pile a statistically representative number of borings from the pile will be obtained and composited for analyses to meet the requirement of a permitted hazardous waste disposal facility. Depending upon the results of these analyses the soil waste will either be packaged into DOT approved drums or shipped off site in bulk. Again, only visually contaminated soil adjacent to one or more of the drums to be sampled will be removed for ultimate disposal.

V. Security and Safety Plan

The field supervisor will be responsible for insuring that all aspects of the safety plan are adhered to by the by employees. The health and safety officer will have this responsibility when he is on site.

Field Supervisor: Robert Elliott, PACE Laboratories, Inc.
Jan Williams, Bay West, Inc.

Health and Safety Officer: Tim Johnson, Bay West, Inc.

The types of wastes anticipated to be found include ink-waste, solvents, paint sludges and jel-adhesives. Health hazards associated with work on site from exposure to the above materials by inhalation and dermal contact will be reviewed. Some of these chemicals are flammable and the hazards from explosion of a buldged drum are possible. Other chemicals may be present among the wastes.

Work will take place out of doors in a rural area. No environmental monitoring of organic chemical vapors will be done since only small sources exist and vapors will be well dispersed by wind. Care will be taken to avoid spillage of liquid onto soil.

The major types of emergencies that may occur are medical and fire. Personnel shall keep fire extinquishers, first aid kits and a supply of water in the immediate vacinity of each work area.

In case of a fire or medical emergency dial 911 from a phone (access to which will be established prior to commencement of work activities) on the Andover Site. Appropriate response personnel will then be dispatched by the Anoka County Emergency Dispatcher. First aid shall be provided to injured personnel on site, as needed, by personnel certified under CPR and first aid.

In case of a spill of chemical substances every effort will be made to limit the amount of spillage and to quickly containerize the spill material and contaminated soils.

When necessary appropriate barricades and warning signs will be placed to prevent unauthorized personnel from entering the work area. Opening of sealed drums will be performed by a working party of at least two people. Sparkless tools and work practices to minimize the chances of sparking will be employed. Buldged drums (that may be under pressure) will be opened using a remote bung opener or piercer. This device can be attached to the drum to be opened (or pierced to relieve pressure) and open operated remotely.

Personnel will not eat, smoke, chew gum or tobacco in the work area until they have thoroughly washed their hands and face. No food will be stored in the work area.

The employees working in conditions that may result in heat stress will be monitored for early signs of heat stress (body temperature and pulse rate). Rest/work schedules will be arranged accordingly. An adequate supply of drinking water will be supplied for all employees.

Employees shall report to the field supervisor anything that may result in an increased hazard potential. The field supervisors will assess the hazard potential and arrange to provide more adequate protection of workers and/or minimize the hazard.

All workers involved in drum opening, sampling and repackaging shall use one-half mask or full-face air-purifying respirators with organic vapor/acid gas cartridges. Gross vapor levels in the worker's breathing zones will be monitored with a photoionization organic vapor analyzer and some field characterization of vapor done through use of a portable gas chomatograph. Personnel sampling will be performed at least once to characterize chemicals and concentration of chemicals to which workers may be exposed.

Self-contained breathing apparatus will be employed if it is established that chemical exposures exceed the protection factor (10) associated with APR or the TLV is exceeded for chemicals against which APR's are not recommended for protection.

Workers shall wear disposable coveralls to prevent dermal/clothing contact. Handling of liquid wastes requires PVC or PVC tyvec. Dry operations and sampling may be performed in plain tyvec. Workers shall wear impervious gloves (double-layed) taped at the wrist to prevent exposure in that area. Steel toed and steel shanked boots will be worn by all workers in the work area.

Hard hats and eye protection shall be utilized by all personnel in the working area.

Disposable personal protective equipment will be disposed of in the proper manner to prevent environmental and personnel contamination. Each time an employee leaves the work area boots (tools and other equipment required in decontamination) will be washed with soap and water and rinsed with water prior to removal from the job site, if required.

VI. Transportation and Disposal

The Minnesota Pollution Control Agency will be notified of the selection of a permitted hazardous waste transporter and permitted hazardous waste treatment/disposal facility for ultimate disposition of the waste on the South Andover Site. This selection will not be made until all prescreening tests have been completed and a number of permitted hazardous waste treatment/disposal facilities interviewed. Once permits have been executed with the hazardous waste disposal facility arrangements will be made for the ultimate transportation of the waste to the disposal facility. Where applicable, EPA I.D. numbers will be obtained and hazardous waste manifests will be properly executed for the shipments. Additionally, all containers will be properly labeled and marked in accordance with both EPA and Department of Transportation regulations.

VII. Time Schedule

Work can commence within two weeks upon approval of this work plan. Barring unforeseen weather conditions all samples should be collected and all wastes properly repackaged within six weeks after the project has been initiated. It is estimated that wastes will be shipped off site to permitted hazardous waste treatment/disposal facilities within eight to twelve weeks from initiation of the project.

This work plan has been prepared by myself or under my direct supervision.

William A. O'Connor
Certified Professional Chemist

WAO/lw

TABLE I

SAFETY AND SAMPLING EQUIPMENT
FOR
ANDOVER DRUM SURVEY

PACE Laboratories, Inc.

Equipment List

Safety and Protective

- Respirators
- Self-contained breathing apparatus
- Chemical resistant neoprene suits
- Steel-toed rubber boots
- Protective gloves
- Goggles
- Hard hats
- Fire extinguisher
- First Aid Kit
- Emergency eye wash

Sampling

- Colliwassa Samplers
- Sampling Trier
- Trowel
- Sample Bottles
- Spray Paint

Tools

- Bung opener
- Long-range bung opener
- Rubber mallet
- Miscellaneous small tools (wrenches, pliers, etc.)

Vehicle

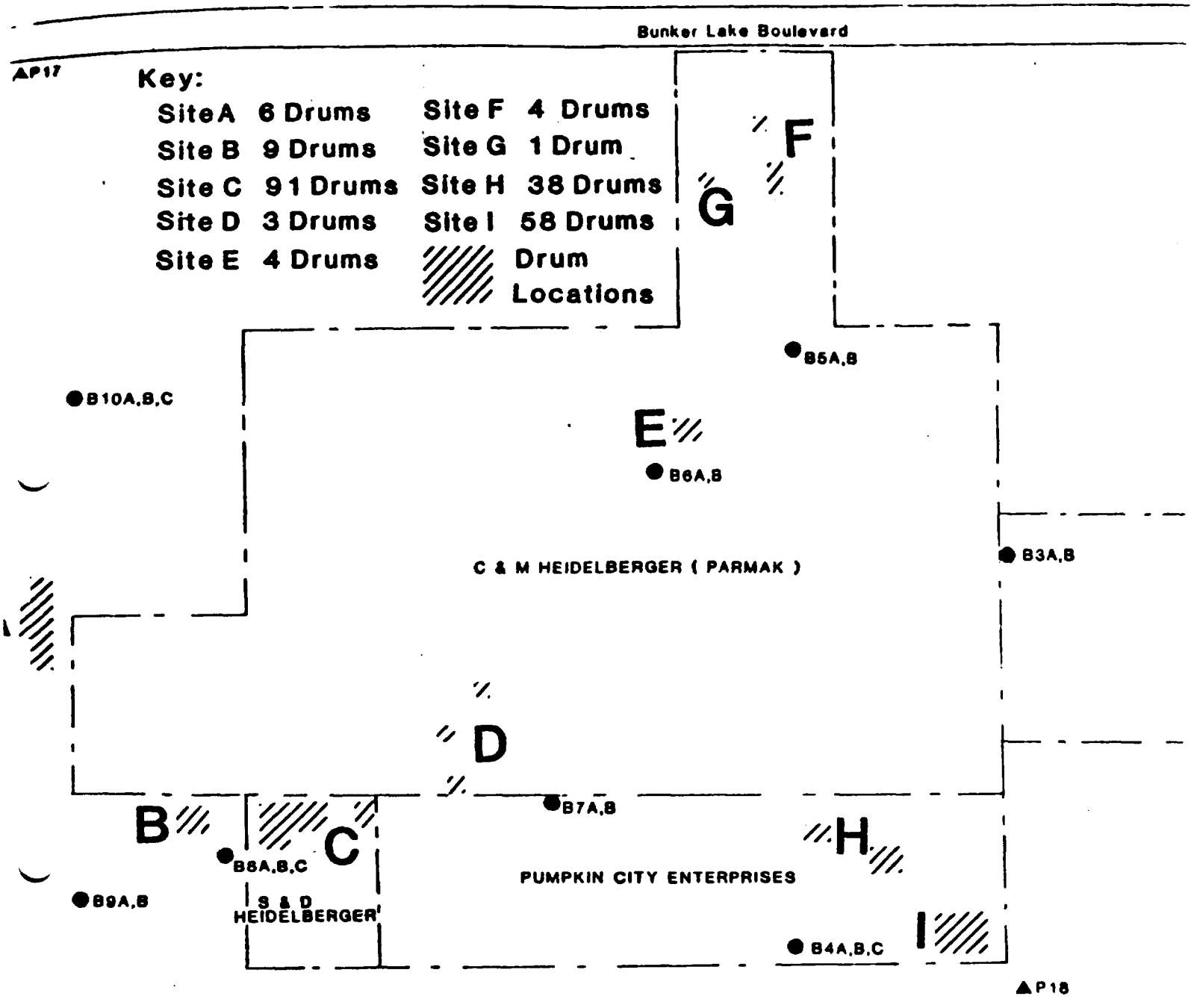
- Van or 4-wheel drive pickup available

Andover Site

FIGURE 1

APPROXIMATE LOCATIONS OF DRUMS CONTAINING WASTE

6/3/83



EXCERPTED FROM "ANDOVER SITES REMEDIAL PLAN,"
ENVIRONMENTAL ENGINEERING AND MANAGEMENT, LTD., JULY 6, 1982

FIGURE 11

COMPOSITE LIQUID WASTE SAMPLER (COLIWASA)

PACE Laboratories, Inc.

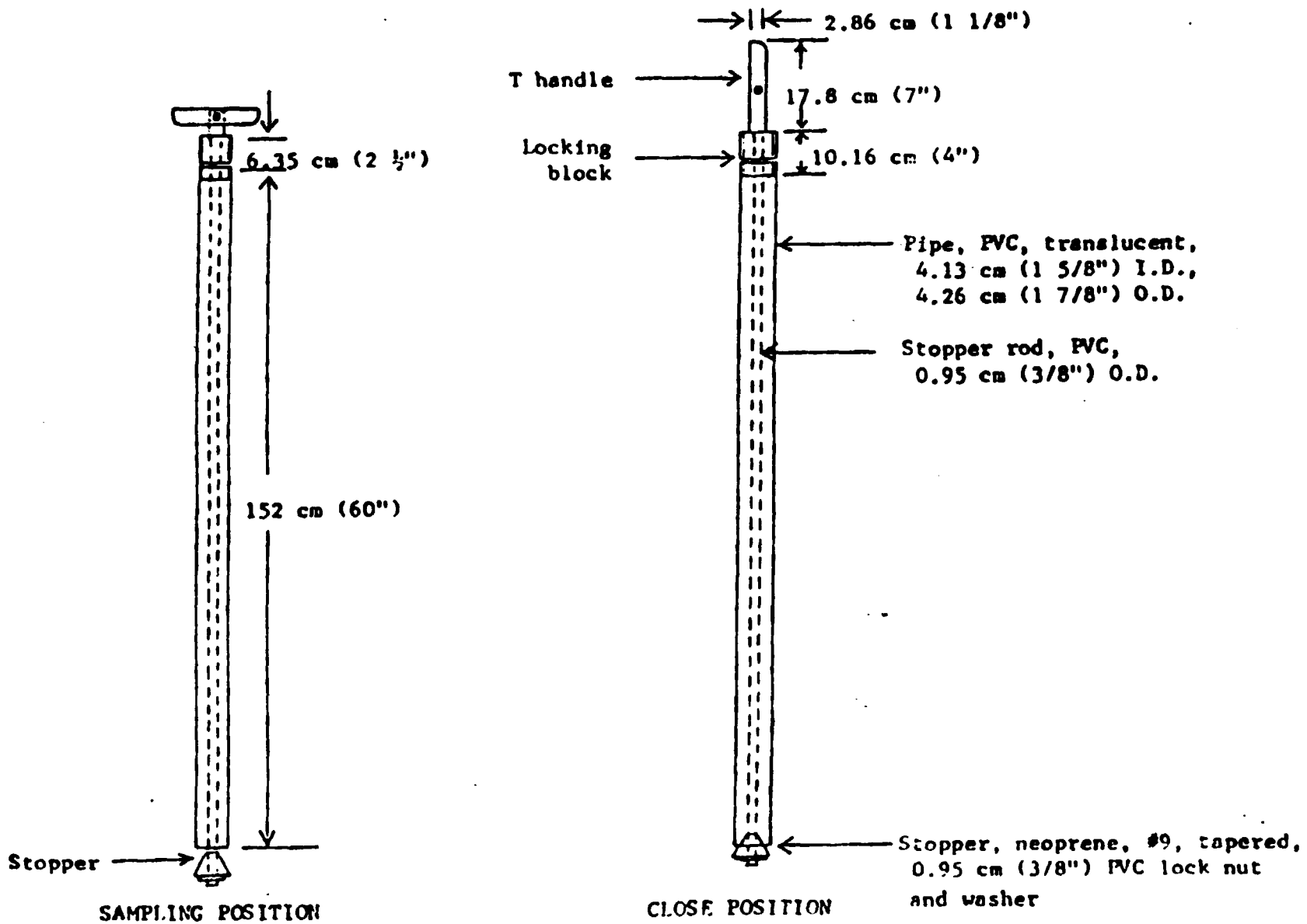


FIGURE III

SAMPLING TRIER

PACE Laboratories, Inc.

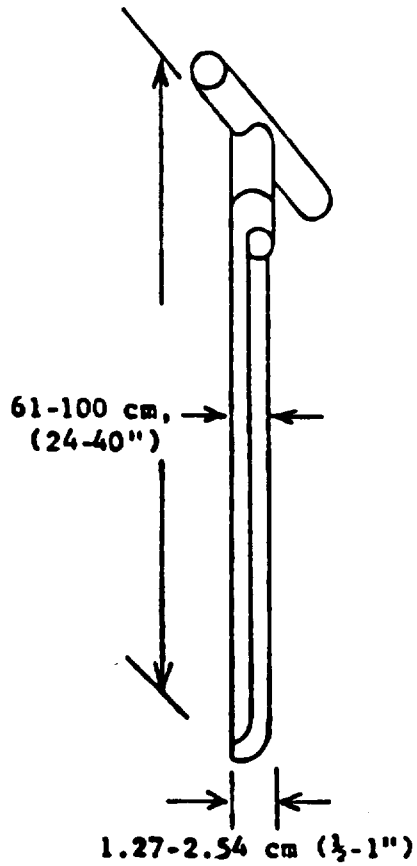


FIGURE IV

TROWEL OR SCOOP WITH CALIBRATIONS

PACE Laboratories, Inc.

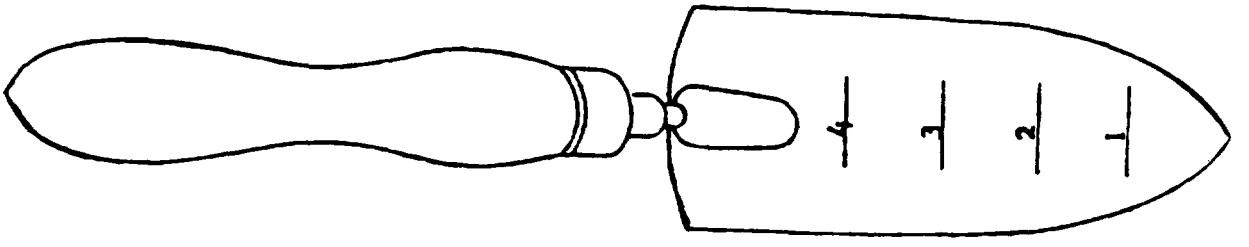


FIGURE V

HAZARDOUS WASTE
SAMPLE LOG SHEET

PROJECT:_____ PROJECT #:_____
CLIENT: _____

Sample Number:_____ Date Collected:_____Time:_____Collector: _____
Sample Description:_____
_____
Waste Type:_____ Drum Description: _____
Volume in Drum: Full/ 3/4/ 1/2/ 1/4/ Empty DOT: Yes/No Why:_____
Head: Open/Closed Sampling Point: Bung/Other: _____
Field Observations: _____
_____

Sample Number: _____ Date Collected:_____Time: _____Collector: _____
Sample Description:_____
_____
Waste Type:_____ Drum Description:_____
Volume in Drum: Full/ 3/4/ 1/2/ 1/4/ Empty DOT: Yes/No Why:_____
Head: Open/Closed Sampling Point: Bung/Other: _____
Field Observations: _____
_____

Sample Number:_____ Date Collected: _____Time:_____Collector:_____
Sample Description:_____
_____
Waste Type: _____ Drum Description:_____
Volume in Drum: Full/ 3/4/ 1/2/ 1/4/ Empty DOT: Yes/No Why:_____
Head: Open/Closed Sampling Point: Bung/Other: _____
Field Observations: _____
_____

Page_____

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FIGURE VI

CHAIN-OF-CUSTODY RECORD

NO. 716

PROJECT LOCATION	NAME OF CLIENT	PROJECT TELEPHONE NO.	PROJECT NUMBER

ITEM NO.	SAMPLE NO.	TIME	NO. OF CONTAINERS	GENERAL	METALS	NITROGEN	CYANIDE	VOLATILES			SAMPLE DESCRIPTION	TRANSFER NO. & CHECK 1	2	3	4	5	6	7
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		

PERSON RESPONSIBLE FOR SAMPLE COLLECTION	AFFILIATION
DATE	TIME

PURPOSE OF ANALYSIS (use back of front sheet if needed)

TRANSFER NUMBER	ITEM NUMBER	TRANSFERS RELINQUISHED BY	ACCEPTED BY	DATE	TIME
1					
2					
3					
4					
5					
6					
7					

ORIGINAL

ATTACHMENT I

PROCEDURE MANUAL
FOR
CLEANUP OF HAZARDOUS WASTE
DUMP AND STORAGE SITES

pace laboratories, inc.
PROFESSIONAL ANALYTICAL CHEMISTRY & ENGINEERING

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PACE LABORATORIES, INC.
PROCEDURE MANUAL
FOR
CLEANUP OF HAZARDOUS WASTE
DUMP AND STORAGE SITES

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I. INTRODUCTION

With the passage of the Resource Conservation and Recovery Act in 1976, and the Comprehensive Environmental Response, Compensation and Liability Act of 1980, (Superfund), Congress has given the EPA tools to manage and clean up the nation's hazardous waste. As a consulting, engineering and analytical testing laboratory, PACE Laboratories, Inc. has been involved in the clean up of hazardous wastes which have been stored both above and below ground.

This manual represents a state of the art approach in conducting these clean up operations. Each site has it's own unique characteristics and problems. This manual only represents our approach to the proper collection of the waste, categorization and grouping of waste types, selection of treatment/disposal options, analytical characterization of waste types and safety considerations.

PACE relies on subcontractors for the excavation of buried waste, repackaging, transportation and ultimate disposal of the hazardous waste. However, based upon our knowledge of the hazardous waste and Department of Transportation rules and the hazardous waste disposal industry, we are able to make recommendations for the selection of these subcontrators which will provide our clients with the most effective option for disposal, yet minimize liability.

Based upon our past experience we believe that the approach outlined in this manual will produce the maximum amount of information at the minimum cost. This information is needed in order to make rational and economically sound decisions regarding the disposal of the wastes at the site. At most sites, the type of wastes which are to be cleaned up are unknown. Therefore, a critical part of our approach is to maintain maximum flexibility in evaluating options for disposal. First determine the type of waste you are dealing with, then select the best option for disposal from a cost and liability standpoint.

It should be emphasized that the approach outlined in this manual is subject to change, dependent upon site specific conditions. However, the procedures outlined in the manual have been utilized on many occasions by PACE Laboratories, Inc. and have been found to be the best way to approach clean up at an abandoned hazardous waste dump site.

II. SITE ASSESSMENT

Prior to beginning cleanup of a hazardous waste site it is essential that all available information relative to the wastes at the site be obtained. This information should include:

1. The source of the wastes. That is, the type of industries which generated the wastes and if available, the industrial processes.

2. The type of container holding the waste.

3. The length of time that the wastes have been at the site.

4. An estimate of the number of containers or amount of waste at the site.

5. An interview should be conducted with individuals familiar with the site operational practices.

This information can be used for planning purposes related to safety concerns, sampling equipment needs and assessing the scope and duration of the project. It is recommended that a tour of the site be conducted prior to cleanup, to familiarize personnel with the environmental and working conditions and restraints.

III. SAMPLE COLLECTION

A. Sampling a Drum

The drums at the site may be heavily corroded or rusted and could readily rupture and spill their contents when disturbed, also drums containing liquid wastes could be under pressure or vacuum. Therefore, it is extremely important that proper safety measures and caution be taken during sampling. PACE Laboratories, Inc. has the technical expertise relative to obtaining a representative sample from each drum and maintaining the integrity of the sample until analysis.

Samples must be representative so that viable data can be generated in making decisions, to determine if the wastes are hazardous or non-hazardous, compatibility of different wastes found at the site, procedures for handling

transportation of the wastes and finally how the wastes should be treated/disposed.

Where possible, sampling procuedures and equipment for taking representative samples will follow the EPA protocols outlined in the EPA Manual entitled "Samplers and Sampling Procedures for Hazardous Waste Streams", January, 1980, EPA-600-2-80-918. Depending upon the physical characteristics of the waste, the container, and the waste types, variation to the sampling methods or different sampling methods may have to be used. General protocols for sampling a 55 gallon drum would include the following:

1. Position the drum so that the bung is up, drums with bungs on the side should be laid on a side with the bungs up. In some cases the bungs may be so badly corroded and rusted that the whole top of the container will have to be removed.

2. Allow the contents of the drum to settle.

3. Slowly loosen the bung with a bung wrench, allowing any gas pressure to release. Drums which are badly bulged may have to be opened remotely due to the danger of explosion.

4. After the bung or top of the drum has been removed, collect the sample, using the appropriate piece of sampling equipment. During sampling, the following plan of action will be monitored by PACE Laboratories, Inc. personnel.

   a. At least one sample will be drawn from each drum.

   b. Select proper sampler. The type of sampler used will be dependent upon the waste type and the condition of the container. Table I provides a listing of the types of samplers which we use during the course of a project.

   c. Select proper sample container and closure. Table II provides a list of the types of containers and closures which we use based upon available information with regard to the waste buried at the site. Depending upon the parameters to be analyzed, other bottle types and perservatives may be required. PACE Laboratories, Inc. Quality Assurance Manual is provided as Attachment I to this

manual has a comprehensive listing of sample preservation procedures and bottle types which would be used upon the analytical parameter to be analyzed. The selection of the appropriate bottle type and perservative will be made by PACE Laboratories, Inc.'s Field Laboratory Supervisor, on site. All bottles and perservatives required will be supplied by PACE Laboratories, Inc.

d. Select proper sampling points. The sampling point for the drums will be highly dependent upon the condition of the drum at the time it is excavated. However, general recommendation for the selection of these sampling points are provided in Table III.

e. Determine the number of samples to be taken from each individual drum. As mentioned previously, a minimum of one sample will be collected from each drum. It is possible that additional samples will be collected depending upon the physical characteristics of the material in the drum.

f. Determine the volume of waste to be sampled. The volume of waste will be dependent upon the types of analyses which will be performed and the accessibility of obtaining the waste from the drum. Safety precautions or the physical condition of the waste may limit the amount of the sample which can be obtained.

g. Identify samples and protect them from tampering. All samples collected will be labeled to prevent misidentification. The label will include at least the following information:

    Name of collector
    Date and time of collection
    Place of collection
    Collectors sample number, which uniquely identifies the sample.

An example of the label is provided in Figure I. The samples will also be sealed to preserve their integrity from the time of collection until the sample is opened in the laboratory. Gummed paper seals will be used as official sample seals. The paper seal will carry the following information:

    Collectors name
    Date and time of sampling
    Collectors sample number (this number will be identical with the number on the sample label).

The seal will be attached in such a way that it will be necessary to break it in order to open the sample container. An example of the sample seal is provided in Figure I.

h. Record sample information in field notebook. A field notebook will be maintained at the site. This will be a bound book with consecutively numbered pages that are 8½ inches X 11 inches. Entries in the log book will at minimum include the following:

Location of sampling and address
Name and address of field contact
Type of waste in each drum
Waste physical characteristic (color, odor, physical state, etc.)
Volume of waste in drums
Description of sampling point
Date and time of collection
Collectors sample identificaion number
Drum sample identification number
Field observations
Field measurements made on waste, such as pH or flammability.

The log book will be protected and kept in a safe place.

i. Fill out chain of custody records. Procedures should be taken during the collection and analysis of the samples to be sure that the data is acceptable to the State in the event of an enforcement case in litigation. The first step in this document control procedure is the completion of the Chain of Custody record provided in Attachment III. In the Field Supervisor and signed off by the assigned laboratory custodian upon arrival of the samples at the laboratory.

j. Deliver or ship samples to laboratory for analysis.

The ten points outlined above should be followed irrespective of the type of container the waste is contained in.

B. Sampling a Vacuum Truck

Sampling a vacuum truck requires the person collecting the sample to climb onto the truck and walk along a narrow catwalk. In some trucks, it requires climbing access rungs to the tank hatch. These situations present accessability problems to the sample collector, who most usually will wear full protective

sampling gear. Preferabley, two persons should perform the sampling: One person should do the actual sampling and the other should hand the sampling device, stand ready with the sample container, and help deal with any problems. The sample collector should position himself to collect samples only after the truck driver has opened the tank hatch. The tank is usually under pressure or vacuum. The driver should open the hatch slowly to release pressure or to break the vacuum.

1. Let the truck driver open the tank hatch.

2. Using protective sampling gear, assume a stable stance on the tank catwalk or access rung to the hatch.

3. Collect a sample through the hatch opening with a Coliwassa.

4. If the tank truck is not horizontal, take one additional sample each from the rear and front clean out hatches and combine all three samples in one sample container.

5. When necessary, carefully take sediment sample from the tank through the drain spigot.

C. Sampling a Barrel, Fiberdrum, Can, Bags, or Sacks Containing Powder or Granular Waste

The proper protective respirator, in addition to the other protective gear, must be worn when sampling dry powdered or granular wastes in these containers. These wastes tend to generate airborne particles when the containers are disturbed. The containers must be opened slowly. The barrels, fiberdrums, and cans must be positioned upright. If possible, sample sacks or bags in the position you find them, since standing them upright might rupture the bags or sacks.

1. Collect a composite sample from the container with a grain sampler or sampler trier.

2. When there is more than one container of waste at a site, segregate and sample the containers according to project managers directions.

D. Sampling a Pond

Storage or evaporation ponds for hazardous wastes vary greatly in size from a few to a hundred meters. It is difficult to collect representative samples from the large ponds without incurring huge expense and assuming excessive risks. Any samples desired beyound 3.5 m (11½ ft) from the bank may require the use of a boat, which is very risky, or the use of a crane or helicopter, which is very expensive. The information sought must be weighed against the risk and expense of collecting the samples. The pond sampler can be used to collect samples as far as 3.5 m (11½ ft) from the bank. Collect a composite sample with pond sampler, as directed by project manager.

E. Sampling Soil

The techinques of soil sampling are numerous. The procedures outlined below are adopted from ASTM methods. The procedures are consistent with the hazardous waste management objective of collecting soil samples which is usually to determine the amount of hazardous material deposited on a particular area of land or to determine the leaching rate of the material and/or determine the residue level on the soil. Elaborate statistically designed patterns have been designed for sampling soils. The proper pattern and techniques will be determined by the project management.

F. Sampling a Waste Pile

Waste piles can range from small heaps to a large aggregates of wastes. The wastes are predominantly solid and can be a mixture of powders, granules, and chunks as large as or greater than 2.45 cm (1 inch) average diameter. A number of core samples have to be taken at different angles and composited to obtain a sample that, on analysis, will give average values for the hazardous components in the waste pile.

G. Sampling a Storage Tank

The collection of liquid samples in storage tanks is extensively discussed in the ASTM methods. The procedure used here is adopted from one of those methods.

Sampling a storage tank requires a great deal of manual dexterity. Usually it requires climbing to the top of the tank through a narrow vertical or spiral stairway while wearing protective sampling equipment and carry sampling paraphernalia. At least two persons must always perform the sampling: One should collect the actual samples and the other should stand back, usually at the head of the stairway, and observe, ready to assist or call for help. The sample collectors must be accompanied by a representative of the company, who must open the sampling hole, usually on the tank roof.

1. Collect one sample each from the upper, middle, and lower sections of the tank contents with a weighted bottle sampler.

2. Combine the samples in one container and submit it as a composite sample.

H. Sampling Equipment

Sampling of hazardous wastes requires different types of samplers. Some of these samplers are commercially available, but the others have to be fabricated. This section lists and describes suitable samplers. Their uses and commercial availability as well as directions for their use are reported.

Composite Liquid Waste Sampler (Coliwassa)

The Coliwassa is the single most important hazardous waste sampler discussed in this report. It was chosen from a number of other liquid samplers, based on laboratory an field tests, as the most practical. It permits the representative sampling of multiphase wastes of a wide range of viscosity, corrosivity, volatility, and solids content. Its simple design makes it easy to use and allow the rapid collection of samples, thus minimizing the exposure of the sample collector to potential hazards from the wastes. The sampler is not commercially available, but is relatively easy and inexpensive to fabricate. The cost of fabrication is low enough that the contaminated parts may be discarded after a single use when they cannot be easily cleaned.

The recommended model of the Coliwas shown in Figure II. The main parts of the Coliwasa consist of the sampling tube, the closure-locking mechanism, and the closure system.

The sampling tube consists of a 1.53 m (5 ft) plastic pipe, usually polyvinyl chloride (PVC) or borosilicate glass plumbing tube. The closure-locking mechanism consists of a short-length, channeled alumnium bar attached to the sampler's stopper rod by an adjustable swivel. The alumnium bar serves both as a T-handle and lock for the sampler's closure system. When the sampler is in the open position, the handle is placed in the T-position and pushed down against the locking block. The manipulation pushes out the neoprene stopper and opens the sampling tube. In the close position, the handle is rotated until on leg of the T is squarely perpendicular against the locking block. This rightly seats the neoprene stopper against the bottom opening of the sampling tube and positively locks the sampler in the close position. The closure tension can be adjusted by shortening or lengthening the stopper rod by screwing it in or out of the T-handle swivel. The closure system of the sampler consists of a sharply taped neoprene stopper attached to a 0.95 cm (3/8 in.) O.D. rod, usually PVC. The upper end of the stopper rod is connected to the swivel of the alumnium T-handle.

Two types of Coliwassa samplers are made, namely plastic or glass. The plastic type consists of a plastic (usually PVC) sampling tube. The glass Coliwassa uses borosilicate glass plumbing pipe as the sampling tube and Teflon plastic stopper rod.

The complete list of parts for constructing the two types of Coliwasa samplers is given in Appendix B. The suppliers and approximate costs of the parts as well as the directions for fabricating the commercially unavailable parts are also given.

The sampler is assembled as shown in Figure II as follows:

1. Attach the swivel to the T-handle with the 3.18 cm (1¼ inch) long bolt and secure with the 0.48 cm (3/16 inch) National Coarse (NC) washer and lock nut.

2. Attach the neoprene stopper to one end of the stopper rod and secure with the 0.95 cm (3/8 inch) washer and lock nut.

3. Install the stopper and stopper rod assembly in the sampling tube.

4. Secure the locking block sleeve on the block with glue or screws. This block can also be fashioned by shaping a solid plastic rod on a lathe to the required dimensions.

5. Position the locking block on top of the sampling tube such that the sleeveless portion of the block fits inside the tube, the sleeve sits against the top end of the tube, and the upper end of the stopper rod slips through the center hole of the block.

6. Attach the upper end of the stopper rod to the swivel of the T-handle.

7. Place the sampler in the close position and adjust the tension on the stopper by screwing the T-handle in our out.

Uses

The plastic Coliwassa is used to sample most containerized liquid wastes except wastes that contain ketones, nitrogenzene, dimethylforamide, mesityl oxide, and tetrahydrofuran.

The glass Coliwassa is used to sample all other containerized liquid wastes that cannot be sampled with the plastic Coliwassa except strong alkali and hydrofluoric acid solutions.

Procedure for Use

1. Put the sampler in the open position by placing the stopper rod handle in the T-position and pushing the rod down until the handle sits against the sampler's locking block.

2. Slowly lower the sampler into the liquid waste. (Lower the sampler at a rate that permits the levels of the liquid inside and outside the sampler tube to be about the same. If the level of the liquid

in the sampler tube is lower than that outside the sampler, the sampling rate is too fast and ill result in a non representative sample).

3. When the sampler stopper hits the bottom of the waste container, push the sampler tube downward against the stopper to close the sampler. Lock the sampler in the close position by turning the T handle until it is upright and one end rests tightly on the locking block.

4. Slowly withdraw the sampler from the waste container with one hand while iping the sampler tube with a disposable cloth or rag with the other hand.

5. Carefully discharge the sample into a suitable sample container by slowly opening the sampler. This is done by slowly pulling the lower end of the T handle away from the locking block while the lower end of the sampler is positioned in a sample container.

6. Cap the sample container; attach label and seal; record in field log book; and complete sample analysis request sheet and chain of custody record.

7. Unscrew the T handle of the sampler and disengage the locking block. Clean sampler on site or store the contaminated parts of the sampler in a plastic storage tube for subsequent cleaning. Store used rags in plastic bags for subsequent disposal.

8. Deliver the sample to the laboratory for analysis.

Grain Sampler

The grain sampler (Figure III) consists of two slotted telescoping tubes, usually made of brass or stainless steel. The outer tube has a conical, pointed tip on one end that permits the sampler to penetrate the material being sampled. The sampler is opened and closed by rotating the inner tube. Grain samplers are generally 61 to 100 cm (24 to 40 inch) long by 1.27 to 2.54 cm (½ to 1 inch) in diameter, and they are commercially available at laboratory supply houses.

Uses

The grain sampler is used for sampling powdered or granular wastes or materials in bags, fiberdrums, sacks or similar containers. This sampler is most useful when the solids are no greater than 0.6 cm (¼ inch) in diameter.

Procedure for Use

1. While the sampler is in the close position, insert it into the granular or powdered material or waste being sampled from a point near a top edge or corner, through the center, and to a point diagonally opposite the point of entry.

2. Rotate the inner tube of the sampler in the open position.

3. Wiggle the sampler a few times to allow materials to enter the open slots.

4. Place the sampler in the close position and withdraw from the material being sampled.

5. Place the sampler in a horizontal position with the slots facing upward.

6. Rotate and slide out the outer tube from the inner tube.

7. Transfer the collected sample in the inner tube into a suitable sample container.

8. Collect two or more core samples at different points and combine the samples in the same container.

9. Cap the sample container; attach label and seal; record in field log book; and complete sample analysis request sheet and chain of custody record.

10. Clean or store the sampler in plastic bag for subsequent cleaning.

11. Deliver the sample to the laboratory for analysis.

Sampling Trier

A typical sampling trier (Figure IV) is a long tube with a slot that extends almost its entire length. The tip and edges of the tube slot are sharpened to allow the trier to cut a core of the material to be sampled when rotated after insertion into the material. Sampling triers are usually made of stainless steel with wooden handles. They are about 61 to 100 cm (24 to 40 inches) long and 1.27 cm (½ to 1 inch) in diameter. They can be purchased readily from laboratory supply houses.

Uses

The use of the trier is similar to that of the grain sampler discussed above. It is preferred over the grain sampler when the powdered or granular material to be sampled is moist or sticky,

In addition, the sampling trier can be used to obtain soft or loosened soil samples up to a depth of 61 cm (24 inches) as outlined below.

Procdure for Use

1. Insert the trier into the waste material at a 0 to 45° angle from horizontal. This orientation minimizes the spillage of sample from the sampler. Extraction of samples might require tilting of the contianers.

2. Rotate the trier once or twice to cut a core of material.

3. Slowly withdraw the trier, making sure that the slot is facing upward.

4. Transfer the sample into a suitable container with the aid of a spatula and/or brush.

5. Repeat the sampling at different points, two or more times and combine the samples in the same sample container.

6. Cap the sample container; attach the label and seal; record in field log book; and complete sample analysis request sheet and chain of custody record.

7. Wipe the sampler clean, or store it in a plastic bag for subsequent cleaning.

8. Deliver the sample to the laboratory for analysis.

Trowel or Scoop

A garden-variety trowel looks like a small shovel (Figure V). The blade is usually about 7 by 13 cm (3 by 5 inches) with a sharp tip. A laboratory scoop is similar to the trowel, but the blade is usually more curved and has a closed upper end to permit the containment of material. Scoops come in different sizes and makes. Stainless steel or polypropylene scoops with 7 by 15 cm (2 3/4 by 6 inch) blades are preferred. A trowel can be bought from hardware stores; the scoop can be bought from laboratory supply houses.

Uses

An ordinary zinc-plated garden trowel can be used in some cases for sampling dry granular or powdered materials in bins or other shallow containers. The laboratory scoop, however, is a superior choice. It is usually made of materials less subject to corrosion or chemical reactions, thus lessening the probabilitiy of sample contamination.

The trowel or scoop can also be used in collecting top surface soil samples.

Procedure for Use

1. At regular intervals take small, equal portions of sample from the surface or near the surface of the material to be sampled.

2. Combine the samples in a suitable container.

3. Cap the container; attach the label and seal; record in field log book; and complete sample analysis request sheet and chain of custody record.

4. Deliver the sample to the laboratory for analysis.

Soil Auger

This tool consists of a hard metal central shaft and sharpened spiral blades (Figure VI). When the tool is rotated clockwise by its wooden T handle, it cuts the soil as it moves forward and discharges most of the loose soil upward. The cutting diameter is about 5 cm (2 inches). The length is about 1 m (40 inches), with graduations every 15.2 cm (6 inches). The length can be increased up to 2 m (80 inches). This tool can be bought from stores and, in some cases, from laboratory supply houses.

Uses

The auger is particularly useful in collecting soil samples at depths greater than 8 cm (3 inches). This sampler destroys the structure of cohesive soil and does not distinguish between samples collected near the surface or toward the bottom. It is not recommended, therefore, when an undisturbed soil sample is desired.

Procedure for Use

1. Select the sampling point and remove unnecessary rocks, twigs, and other non-soil materials.

2. Install the sampler's wooden T handle in its socket.

3. Bore a hole through the middle of an alumnium pie pan large enough to allow the blades of the auger to pass through. The pan will be used to catch the sample brought to the surface by the auger.

4. Spot the pan against the selected sampling point.

5. Start augering through the hole in the pan until the desired sampling depth is reached.

6. Back off the auger and transfer the sample collected in the catch pan and the sample adhering to the auger to a suitable container. Spoon out the rest of the loosened sample with a sampling trier.

7. Repeat the sampling at different sampling points and combine the samples in the same container.

8. Cap the sample container; attach label and seal; record in field log book; and comlete sample analysis request sheet and chain of custody record.

9. Brush off and wipe the sampler clean, or store it in a plastic bag for subsequent cleaning.

10. Deliver the sample to the laboratory for analysis.

Waste Pile Sampler

A waste pile sampler (Figure VII) is essentially a large sampling trier. It is commericàlly available, but it can be easily fabricated from sheet metal plastic pipe. A polyvinyl chloride plumbing pipe 1.52 m (5 ft) long by 3.2 cm (1¼ inch) I.D. by 0.32 cm (1/8 inch) all thickness is adequate. The pipe is sawed lengthwise (about 60/40 split) until the last 10 cm (4 inches) the narrower piece is sawn off and hence forms a slot in the pipe. The edges of the flow and the tip of the pipe are sharpened to permit the sampler to cut into the waste material being sampled. The unsplit length of the pipe serves as the handle. The plastic pipe can be purchased from hardware stores.

Uses

The waste pile sampler is used for sampling wastes in large heaps with cross-sectional diameters greater than 1 m (39.4 inches). It can also be used for sampling granular or powdered wastes or materials in large bins, barges, or silos where the grain sampler or sampling trier is not long enough. This sampler does not collect representative samples when the diameters of the solid particles are greater than half of the diameter of the tube.

Procedure for Use

1. Insert the sampler into the waste material being sampled at 0 to 45° from horizontal.

2. Rotate the sampler two or three times in order to cut a core of the material.

3. Slowly withdraw the sampler, making sure that the slot is facing upward.

4. Transfer the samle into a suitable container with the aid of a spatula and/or brush.

5. Repeat the sampling at different sampling points two or more times and combine the samples in the same sample container in step 4.

6. Cap the container; attach label and seal; record in field log book; and complete sample analysis request sheet and chain of custody record.

7. Wipe the sampler clean or store it in a plastic bag for subsequent cleaning.

8. Deliver the sample to the laboratory for analysis.

Pond Sampler

The pond sampler (Figure VIII) consists of and adjustable clamp attached to the end of a two to three piece telescoping alumnium tube that serves as the handle. The clamp is used to secure a sampling beaker. The sampler is not commercially available, but it is easily and inexpensively fabricated. The tubes can be readily purchased from most hardware or swimming pool supply sotes. The adjustable clamp and sampling beaker can be obtained from most laboratory supply houses.

Uses

The pond samler is used to collect liquid waste samples from disposal ponds, pits, lagoons, and simliar reservoirs. Grab samples can be obtained at distances as far as 3.5 m (11½ ft) from the edge of the ponds. The tubular alumnium handle may bow when sampling very viscous liquids if sampling is not done slowly.

Procedure for Use

1. Assemble the pond sampler. Make sure that the sampling beaker and the bolts and nuts that secure the clamp to the pole are tightened properly.

2. With proper protective garment and gear take grab samples from the pond at different distances and depths.

3. Combine the samples in one suitable continer.

4. Cap the contianer; label and affix the seal; record in field log book; and complete sample analysis request sheet and chain of custody record.

5. Dismantle the sampler; wipe the parts with terry towels or rags and store them in plastic bags for subsequent cleaning. Store used towels or rags in garbage bags for subsequent disposal.

6. Deliver the sample to the laboratory for analysis.

Weighted Bottle Sampler

This sampler (Figure IX) consists of a bottle, usually glass, a weight sinker a bottle stopper, and a line that is used to open the bottle and to lower and raise the sampler during sampling. There are a few variations of this sampler, as illustrated in the ASTM MEthods D 270[8] and E 300[9]. The ASTM sampler, which uses a metallic bottle basket that also serves as weight sinker, is prefered. The weighted bottle sampler can either be fabricated or purchased.

Uses

The weighted bottle sampler can be used to sample liquids in storage tanks, wells, sumps, or other containers that cannot be adequately sampled with a Coliwassa. The sampler cannot be used to collect liquids that are incompatible or that react chemically with the weight sinker and line.

Procedure for Use

1. Assemble the weighted bottle sampler as shown in Figure IX.

2. Using protective sampling equipment, in turn, lower the sampler to proper depths to collect the following samples:
   a. Upper sample - middle of upper third of tank contents.
   b. Middle sample - middle of tank contents.
   c. Lower sample - near bottom of tank contents.

3. Pull out the bottle stopper with a sharp jerk of the sampler line.

4. Allow the bottle to fill complete, as evidence by the cessation of air bubbles.

5. Raise the samplerand retrieve and cap the bottle. Wipe off the outside of the bottle with a terry towel or rag. The bottle can serve as the sample container.

6. Label each of the three samples collected; affix seal; fill out sample analysis request sheet and chain of custody record; record in the field log book.

7. Clean onsite or store contaminated sampler in a plastic bag for subsequent cleaning.

8. Deliver the sample to the laboratory for analysis. Instruct the laboratory to perform analsis on each sample or a composite of the samples.

Hollow Tube Sampler

This sampler consists of a PVC tube with a sharp point cut on the bottom for penatrating the waste. On the top of the pipe there is a threaded "Tee". This sampler can be constructed from materials bought from a plastic supply house.

Uses

The tube sampler is particularly useful in collecting solid, semi-solid wastes from 55 gallon drums.

Procedure for Use

1. Select sampling point.

2. Slowly lower sampler into waste. If necessary use a slow cork-screw turning action for sampler to penetrate waste.

3. When sampler hits bottom, stop and wiggle sampler to make sure sample is loose from bottom of container.

4. Slowly withdraw the sampler from the waste container with one hand while wiping the sampler tube with a disposable cloth with the other hand.

5. Carefully allow waste to discharge into suitable container if sample does not discharge by tapping side of rube, remove "Tee" on top and insert 3/8" ram to push sample out.

6. Cap the sample container; attach label and seal; record in field log book; and complete sample chain of custody sheet.

7. Deliver sample to laboratory for analysis.

IV. SAFETY CONSIDERATIONS

The chemicals at any given site may carry a risk for fire, explosion and health that must be met by a specific set of safety and health precautions. The minimum level of precautions is outlined below. The supervisor may alter and add to these precautions to meet changing conditions in the field.

1. Access must be controlled to the work area.

2. No smoking will be allowed withing the restricted area.

3. Hand tools should be non sparking.

4. Adequate fire extinguishers should be available at the work site.

5. The local fire department should be briefed on scope of work and potential fire and toxic exposures, if the size of projects warrants.

6. A medical consultant reasonably near the work site should be briefed on potential worker exposures, if the size of the project warrants.

7. Chemical eyewash should be available on site along with a fully equipped first aid kit and first aid trained personnel.

Several levels of dermal and respiratory protection will be kept at the jobsite and be available to workers. The election of level of protection will be made by the project manager and supervisor on site, based on worker task and jobsite conditions.

The risk to personnel entering an area must be evaluated against the need for entering. Although this assessment is largely a value judgement, a conscientious deliberation of the variables involved and the risk to personnel must be balanced against this need for site entry.

The knowledge that carcinogens or other highly toxic substances are involved or suspected requires that gross levels not be the sole factor in determining

the level of protection. Other factors which must be taken into consideration are exposure, chemical characteristics of known/suspected materials, weather conditions, etc.

Functions which need to be performed on-site must be evaluated. The work functions to be performed such as moving drums, opening containers, bulking of materials, and other operations that increase the probability of exposure may require a higher level of protection.

Level A Protection

Level A protection provides the highest degree of protection against hazards due to inhalation, skin and eye irritation, if the inherent limitations of the personnel protective equipment are not exceeded. Yet Level A protection does present the highest potential for heat stress. Cooling vests/suits have demonstrated some degree of relief to body temperature build-up.

1. Since Level A will provide protection against air concentrations greater that 1000 ppm for most substances, an operational restriction of 1000 ppm is established as a warning flag to:
   a. Evaluate the need to enter environments greater that 1000 ppm.
   b. Identify the specific constituents contributing to the total concentration and their associated toxic properties.
   c. More precisely determine the concentration of the individual constituents that make up the total concentration.

2. A lower limit of 500 ppm (for Level A) total gas/vapor concentration in air is selected as the value to upgrade from Level B to Level A in order to fully protect the skin and/or eyes until qualitative and quantitative determinations can be made of the constituent products, and skin and/or eye hazards excluded.

3. The range of 500-1000 ppm total concentration is sufficiently conservative to provide a safe margin of protection due to unanticipated transient concentrations, and protection against highly hazardous substances that could account for the total concentrations.

High concentrations have only been encountered in closed buildings, at openings to containers, or working in the spilled contaminants.
NOTE: A decision for requiring Level A protection should also consider the negative aspects: high probability for accidents due to combersomeness of equipment, increased resources needed, and the physical stress caused by heat build-up in fully encapsulating suits. These factors need to be evaluated and balanced against the reasons for utilizing Level A.

Level B Protection

Level B protection is the minimum level of protection required for initially entering an open site where the type(s), concentration(s) and presence of airborne gas/vapors are unknown. This level or protection provides a high degree of inhalation, skin and eye irritation or absorption protection. Although a small portion of the body (neck and head) are exposed, primarily liquid/solid materials have the highest potential of causing acute or chronic effects due to exposure of this area. The use of a hooded chemical resistant jacket would further reduce potential for exposure to this area of the body. Although the potential for heat stress is not has high as Level A, it is a major problem and should not be taken lightly. Cooling vests/suits have demonstrated some degree of relief to body temperature build-up.

Although Level B personnel protection would provide adequate protection against most substances at concentratios higher than 500 ppm, an upper limit of 500 ppm is selected as the decision point for a careful evaluation of the risks associated with higher concentrations. Considerations:

1. The probability that substance(s) present are cutaneous or percutaneous.

2. The necessity for entering higher concentrations in Level B.

3. The work function to be done and the increased probability for exposure.

4. Qualitative and quantative identification of the specific components.

Level C Protection

This level provides the same high degree of skin protection as Level B, but a lesser inhalation and/or eye protection. An upper limit of total vapor concentration of 5 ppm (above background) has been selected primarily based on the use of a full-face air purifying gas mask with canisters, and requirements as to its constraints and limitations. These are:

1. MSHA/NIOSH approved air-purfying devices should only be work in atmospheres where the substances have been identified or the potential of exposure is highly unlikely.

2. Substances must have good warning properties.

3. Continuous air monitoring must occur for the atmospheric contaminant identified.

4. Appropriate, approved canisters must be used.

5. Sufficient oxygen (at lease 19.5 % of air at sea level) must be present.

Full-face, air purifying devices will provide respiratory protection against most environmental vapors greater than 5 ppm; however, until qualitative and quantitative information is abailable about the substances, concentrations greater than 5 ppm indicate a higher level of respiratory protection should be used.

Protective Equipment

Since exposure factors vary from one situation to another, it is impossible to develop a specific safety procedure that will be appropriate for situations; ERT limited the selection of protective equipment to three general categories. Although total gas/vapor monitoring is the primary screening mechanism used, the protection levels indirectly address protection against three possible routes of exposure (inhalation, skin absorption/irritation, and ingestions).

Level A - Personal Protection Equipment

Positive Pressure SCBA (MSHA/NIOSH approved) operated in the positive pressure mode.

Totally Encapsulating Suite (boots and gloves attached, cooling vest when applicable).
Golves - Inner (tight fitting and chemical-resistant).
Boots - Chemical-protective, steel toes and shank. Depending on suit boot construction, work over suit boots.
Gloves - Outer, chemical-resistant. Depending on suit construction, work over suit gloves. May be replaced with tight fitting, chemical-resistant gloves worn inside suite gloves.
Underwear - cotton, long-john type.
Hard Hat - (under suit).*
Disposable protective suit, gloves, and boots. (Worn under or over encapsulating suit).
Coveralls (under suit).*
Two-way radio communicatings.
*Optional.

Level B - Personnel Protective Equipment

Positive Pressure SCBA (MSHA/NIOSH approved), operated in the positive pressure mode.
Hooded, two-piece chemical-resistant suit (cooling vest when applicable).
Gloves - Inner, tight fitting, chemical-resistant.
Boots - Outer (chemical-resistant, heavy rubber disposables).
Boots, Inner (chemical-resistant, steel toe and shank).
Two-way radio communications.
Hard Hats*
Face Shield*
*Optional

Level C - Personnel Protective Equipment

Full-face gas mask, air-purifying respirator (MSHA/NIOSH approved).
Chemical-resistant clothing.
Overalls and long-sleeved jacket or coveralls; hooded two-piece chemical splash suit (when applicable - hooded disposable coveralls).
Gloves - Other (chemical-protective)
Gloves - Inner (tight fitting, chemical-resistant type).
Cloth or disposal coveralls - inside chemical protective clothing, cooling vest when applicable.*

Escape pack
Hard Hat* (face-shield, optional)
Boots - Outer (chemical-protective heavy rubber throw-aways)
Boots - Inner (chemical-protective, steel toe and chank)
Two-way radio communications.

V. SAMPLE ANALYSIS

Analytical data will need to be generated on the waste for two purposes:
1) To adequately characterize the waste for packaging and transportation.
2) To characterize the waste to meet the requirements of a permitted hazardous waste treatment/disposal facility.

Some preliminary field tests and laboratory tests will have to be made relative to compatibility. In other words, we need to determine if the waste is flammable or corrosive, so that it can be properly labeled and packaged according to the Deparmtnet of Transportation Regulations for transportation. However, we also need to characterize the waste to be sure that incompatible wastes are not mixed together which may cause an explosion or violent reaction. Additionally, the wastes need to be characterized to minimize mixing waste types which may be compatible but as a result of the mixing may render the two waste types incompatible for resource recovery. An example would be mixing a chlorinated and a non-chlorinated solvent waste stream together. Individually, these two waste streams could be used for resource recovery, however, when mixed they are not amenable to resource recovery or reclamation. PACE uses a series of field compatability tests.

The pH of the waste would be taken in the field to determine its corrossitivity and its compatibility with other wastes. A barrel of acidic wastes coming into contact with a barrel of a sulfide or cyanide bearing waste could evolve poisonous hydrogen sulfide or hydrogen cyanide gas. To guard against these possibilities caustic and acid wastes must be segregated. Both sulfide and cyanide ions must be kept above a pH of 9 in order to maintain stability, therefore, caustic wastes (Categories A and B) are defined as those with a pH above 9, and acidic wastes (Categories C and D) are defined with a pH below 9.

Due to the interferences caused with hazardous waste samples containing organic layers, sludges or concentrated solutions, the method of determination for pH in the field will utilize a multi-bank pH paper

strip which contains a reaction zone in a range of indicator colors for reference. The entire strip will be dipped into the waste and the color reaction will be allowed to occur. The strip will then be withdrawn and any excess sludge, organic or water, wiped off, squeezing it between thumb and forefinger of the rubber gloved band of the samples.

The oxidation reduction (REDOX) potential field kit is used as a screening procedure for analyzing and classifying drums which may contain oxidizing or reducing agent. The segregation of drums which have strong oxidizing or reducing chemical waste is necessary due to the danger of explosion. The REDOX test kit permits measurement of the REDOX potential of drum samples through use of a portable battery operated instrument, electrodes and electrolyte solution. The REDOX test kit has the ability to perform REDOX measurement not only in aqueous but also in organic matrices such as are found in hazardous waste sites. The test kit consists of a portable pH meter capable of EMF measurements(Fisher Scientific Acument Model No. 150), a platinum fencing combination electrode with a silver silver chloride reference electrode. In addition, the kit contains 0.001 normal ferrous ammonium sulfate and 0.001 normal potassium chromate standard tests solutions, measuring flasks, disposable 50 ml volume beakers, and dipsosable containers for taking sample measurements.

The test procedure in the field involves the addition of a chemical waste sample to standard test solution and then measuring the change in millivolts as measured in the pH meter and electrodes. Changes in those reading either in the negative or positive direction upon addition of sample, indicates the presence of an oxidizing or reducing agent. A threshold change of 50 millivolts in the positive direction indicates the presence of oxidizing agents and 50 millivolts in the negative direction, the presence of reducing agents. The electrode probes tend to clog at sub zero degrees C temperature. Therefore, these measurements should be made in a small heated shed, located at the site. We do not anticipate based upon information provided to date, to find any significant quantities of oxidizing or reducing agents in the waste excavated, however, this kit will be available for spot checks.

The standard flash point test will supply significant information relative to characterizing the waste for transportation and for segregation in light of resource recovery. However, the standard flash point test method becomes impractical when dealing with a large number of drums on an emergency operation. For example, typical tests will usually require from 20 minutes to one hour to obtain a result. If one had to sample 750 drums, this could take up to 19 man weeks. The method recommended by the EPA is a field measure for flammability and the preocedure which will be used on-stie follows: Place two to five mls of a representative hazardous waste sample in a disposable beaker. The beaker is placed in a large sandbox and a propane torch is slowly passed over the unidentified waste. This determination should be made in a building or room at ambient summertime temperatures. If a flame is observed, then the sample is classified as flammable. A non-flammable classification is assigned to the waste after the torch has been passed over the waste several times.

Another field test which may be used to segregate chlorinated from non-chlorinated solvents would be specific gravity. The method used would be as described in the Standards Methods for the Examination of Water and Wastewater, Fifteenth Edition. Chlorinated solvents have a specific gravity greater than 1, while most non-chlorinated solvents have a specific gravity less than 1. Other physical characteristics which might be used to segregate waste types would be color, viscosity and odor, water solubility and utilizing a copper wire and flame to detect chlorinated solvents. Some statistically significant number of the samples test in the field would be verified in the laboratory by running flash point according to the standard closed cup method, confirming solvent composition by gas-liquid chromatography with flame ionization detector, and performing any other parameters which may be of significance to the waste found at the site. This data should provide adequate information for the segregation of the waste excavated, relative to compatibility identification for trasportation and segregation to optimize treatment or disposal of the wastes.

Once the wastes have been excavated, they will then be characterized for ultimate treatment or disposal. This will be accomplished by first reviewing all field notes, including comments on physical description of the wastes and field tests conducted on-site. Based upon this information, the wastes would initially be broken up into various grouns of waste types. There may be anywhere from a few to several hundred drums in each waste type. In order to obtain a representative sampling of the drums in each waste type, we would use the random sampling procedure outlined on page 67 of the EPA publication, "Samplers and Sampling Procedures for Hazardous Waste Streams", January, 1980. A copy of this procedure is included as Attachment II. These samples would then be characterized for parameters required by the permitted hazardous waste treatment or disposal facility where that waste type would be sent. The type of analyses performed would be highly dependent upon the type of hazardous waste facility. For example, a resource recovery facilit would be interested in knowing the solvent composition of the waste where an incinerator would not have the need for this information. Similarily, a permitted hazardous waste landfill may be interested in the EP toxicity leachate test, but again, an incineratory or resource recovery facility would not. PACE Laboratories, Inc. has great familiarity with characterizing hazardous waste for a wide vareity of permitted hazardous waste facilities. The list of parameters and detection limits provided in the Quality Assurance Section of this proposal encompasses all of these parameters. Additional analytical work may have to be performed, such as PCB analysis or other carcinogens suspected of being in the waste.

Based upon this approach it can be seen that some of the analyses will be conductd on-site as the samples are collected. Other samples will be received at the laboratory and analyzed in phases. For example, the first phase would be to confirm field tests of drummed wastes. The second phase to determine if the waste is hazardous or non-hazardous and the third phase to characterize the waste for ultimate disposal or treatment. Each phase would be conducted independently but yet depend upon the information obtained in a previous phase. PACE Laboratories, Inc. has the capabilities to provide a two week turn around time for the analytical work in each of these phases. However, this turn around timw will be dependent upon the number of samples which must be analyzed at one time and the extent of the analytical characterization. The anlaytical work is complete in a timely fashion.

TABLE I

SAMPLERS RECOMMENDED FOR VARIOUS TYPES OF WASTES

PACE Laboratories, Inc.

Waste Type	Recommended Sampler	Limitations
Liquids, sludges, and slurries in drums, vacuum trucks, barrels, and similar containers	Coliwassa	Not for containers 1.5 m(5 ft) deep.
	a) Plastic	Not for wastes containing ketones, nitrobenzene, dimethylformamide, mesityl oxide, or tetrahydrofuran[3,4].
	b) Glass	Not for wastes containing hydrofluoric acid and concentrated alkali solutions.
Liquids and sludges in ponds, pits or lagoons	Pond	Cannot be used to collect samples beyond 3.5 m(11.5 ft). Dip and retrieve sampler slowly to avoid bending the tubular aluminum handle.
Powdered or granular solids in bags, drums, barrels, and similar containers	a) Grain sampler	Limited application for sampling moist and sticky solids with a diameter 0.6 cm(¼ in.).
	b) Sampling trier	May incur difficulty in retaining core sample of very dry granular materials during sampling.
Dry wastes in shallow containers and surface soil	Trowel or scoop	Not applicable to sampling deeper than 8 cm(3 in.). Difficult to obtain reproducible mass of samples.
Waste piles	Waste pile sampler	Not applicable to sampling solid wastes with dimensions greater than half the diameter of the sampling tube.
Soil deeper than 8 cm(3 in.)	a) Soil auger	Does not collect undisturbed core sample.
	b) Veihmeyer sampler	Difficult to use on stony, rocky, or very wet soil.

TABLE II

SAMPLE CONTAINERS AND CLOSURES RECOMMENDED FOR VARIOUS TYPES OF WASTE

PACE Laboratories, Inc.

Waste Type Item	Recommended Container	Recommended Closure
Oil wastes except pesticides, HC, chlorinated HC, and photosensitive wastes	Linear polyethylene (LPE) bottles,[a] 1000-and 2000-ml(1-qt. and ½-gal.), wide mouth	LPE caps
Pesticides, HC, and chlorinated HC	Glass bottles,[b] wide-mouth, 1000-and 2000-ml (1-qt. and ½-gal.).	Bakelite caps with Teflon liner[c]
Photosensitive wastes	Amber LPE or brown glass[d] bottles, wide-mouth, 1000-and 2000-ml (1-qt. and ½-gal.)	LPE caps for the LPE bottles; Bakelite caps with Teflon liner for the glass bottles

- - - - - - - - - - - - - - - -

[a]Nalgene, Cat. Nos. 2104-0032 and 2120-0005, or equivalent.

[b]Scientific Products, Cat. Nos. 87519-32 and B7519-64, or equivalent.

[c]Available from Scientific Specialities, P. O. Box 352, Randallstown, MD.

[d]Scientific Products, Cat. Nos. B7528-050 and 7528-2L, or equivalent.

TABLE III

SAMPLING POINTS RECOMMENDED FOR MOST WASTE CONTAINERS

PACE Laboratories, Inc.

Container Type	Sampling Point
Drum, bung on one end	Withdraw sample through the bung opening.
Drum, bung on side	Lay drum on side with bung up. Withdraw sample through the bung opening.
Barrel, fiberdrum, buckets, sacks, bags	Withdraw samples through the top of barrels, fiberdrums, buckets, and similar containers. Withdraw samples through fill openings of bags and sacks. Withdraw samples through the center of the containers and to different points diagonally opposite the point of entry.
Vacuum truck and similar containers	Withdraw sample through open hatch. Sample all other hatches.
Pond, pit, lagoons	Divide surface area into an imaginary grid.[a] Take three samples, if possible: one sample near the surface, one sample at mid-depth or at center, and one sample at the bottom. Repeat the sampling at each grid over the entire pond or site.
Waste pile	Withdraw samples through at least three different points near the top of pile to points diagonally opposite the point or entry.
Storage tank	Sample from the top through the sampling hole.
Soil	Divide the surface area into an imaginary grid.[a] Sample each grid.

- - - - - - - - - -

[a]The number of grid is determined by the desired number of samples to be collected, which when combined should give a representative sample of the wastes.

TABLE IV

COMPATIBILITY FIELD TESTS

PACE Laboratories, Inc.

Test	Category	Category Identification
1. pH*	Caustic (NF)	A
	Caustic (F)	B
	Acid (NF)	C
	Acid (F)	D
2. Oxidization/Reduction	Oxidizer (F)	E
	Oxidizer (NF)	G
3. Volatile vapor/gasses		
4. Flammability		F

*pH is the level as to when the release of cyanide and sulfide gases pose a threat.

(F) - Flammable
(NF) - Non-flammable

FIGURE I

EXAMPLE OF SAMPLE LABEL AND SEAL

PACE Laboratories, Inc.

SAMPLE LABEL

Collector_____ Collector's Sample No._____

Place of Collection_____

_____

Date Sampled_____ Time Sampled_____

Field Information_____

_____

SAMPLE SEAL

PACE Laboratories, Inc.
3121 Nicollet Avenue
Minneapolis, MN 55408

Collected by _____ Collector's Sample No._____
(signature)

Date Collected_____ Time Collected_____

Place Collected_____

_____

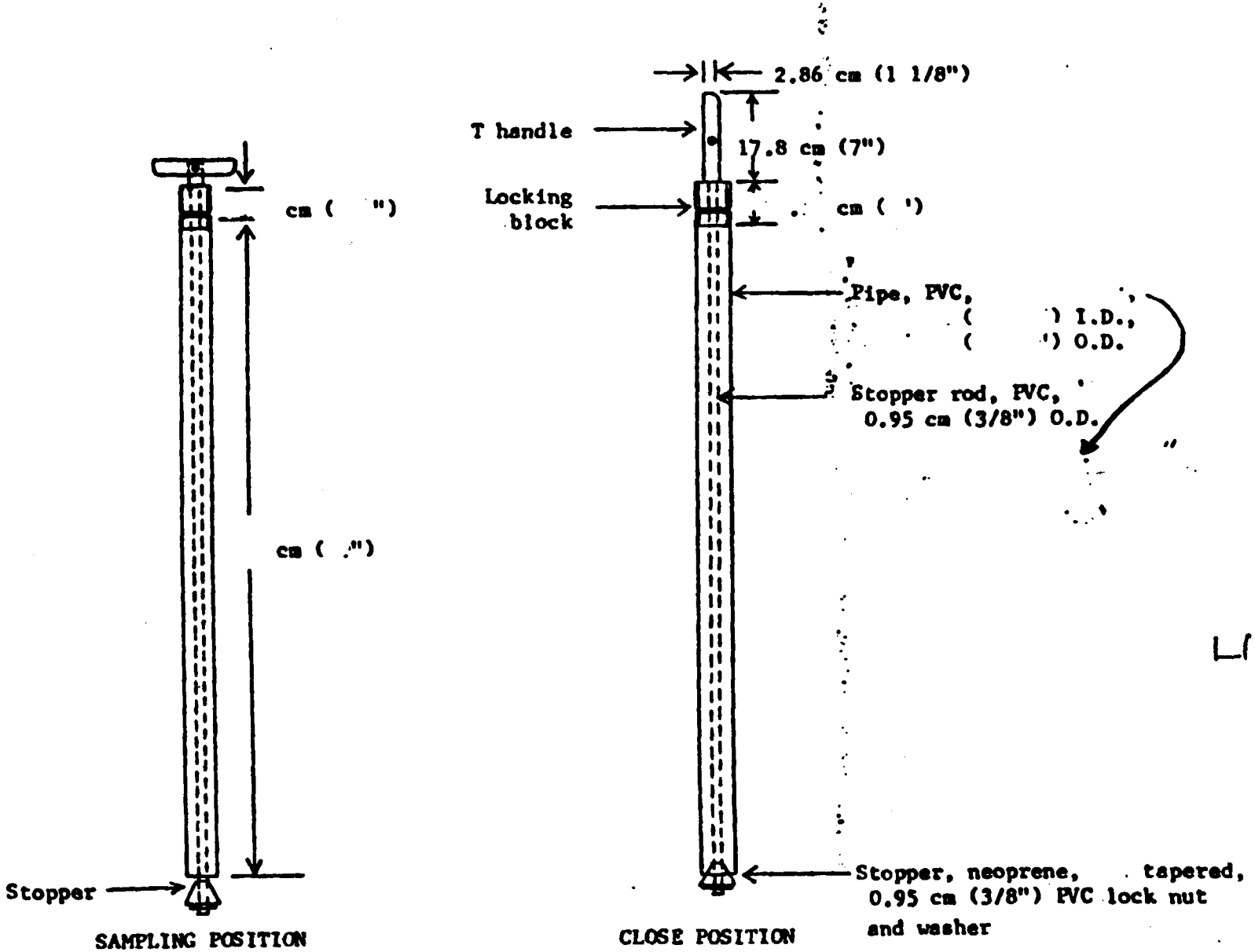

Figure 2. Composite liquid waste sampler (Coliwasa)

PACE Laboratories, Inc.

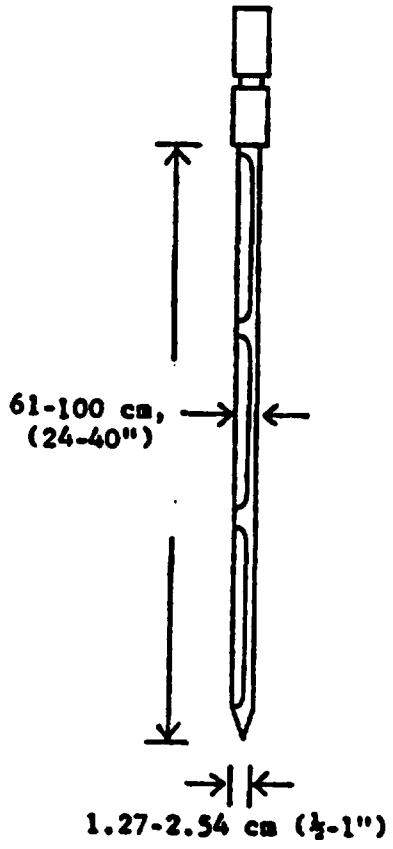

Figure 3, Grain sampler.
PACE Laboratories, Inc.

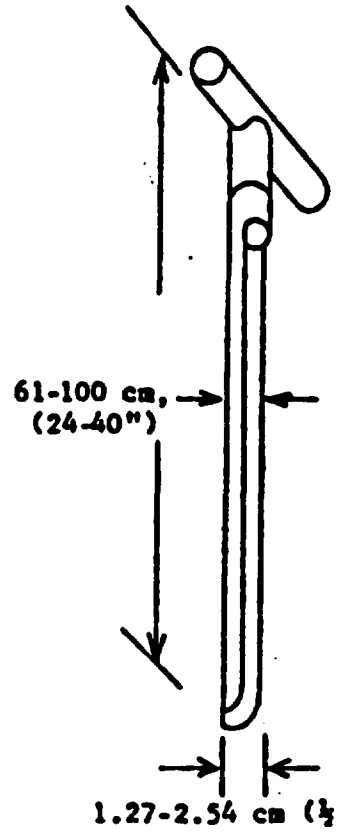

Figure 4. Grain sampler.
PACE Laboratories, Inc.

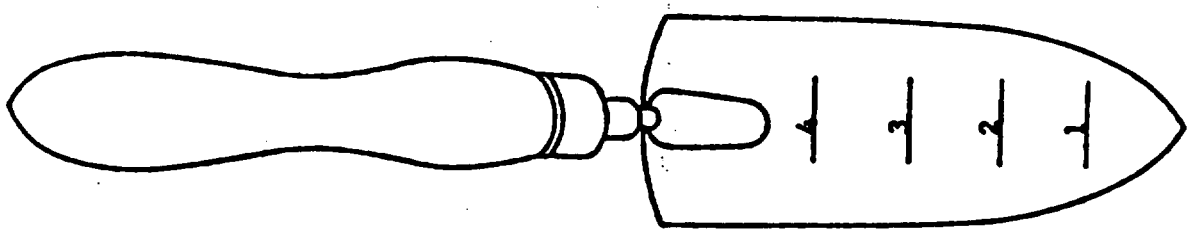

Figure 5. Trowel or scoop with calibrations.
PACE Laboratories, Inc.

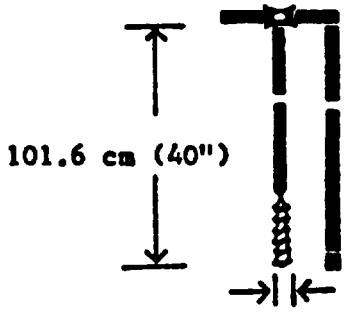

Figure 6. Soil auger.
PACE Laboratories, Inc.

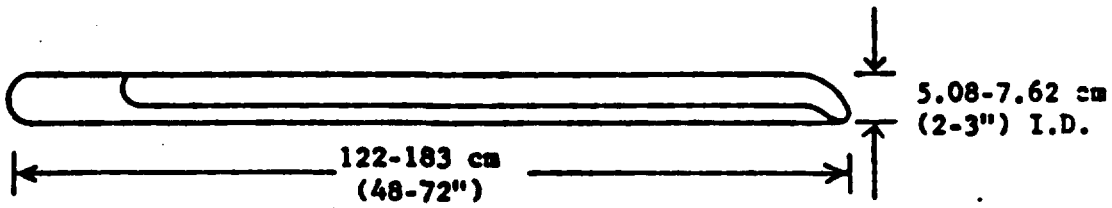

Figure 7. Waste pile sampler.

PACE Laboratories, Inc.

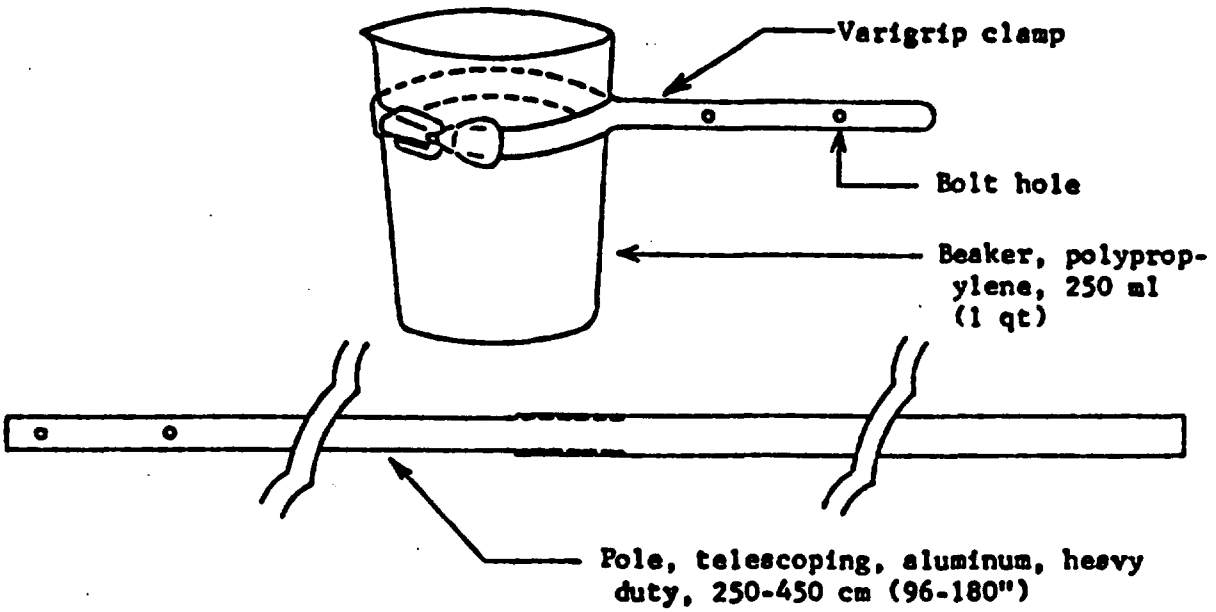

Figure 8. Pond sampler.
PACE Laboratories, Inc.

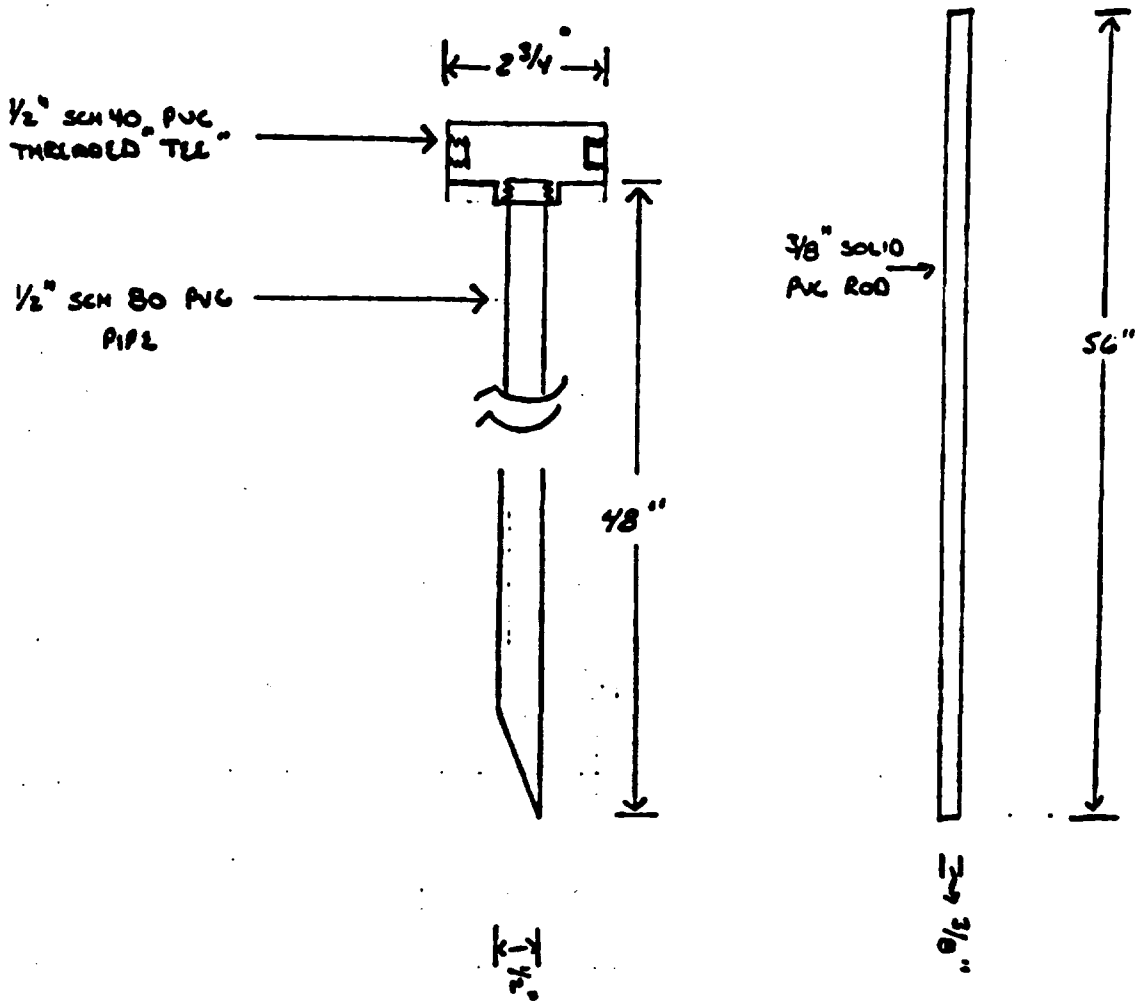

Figure 9. Hollow Tube Sampler.
PACE Laboratories, Inc.

ATTACHMENT II

APPENDIX D. RANDOM SAMPLING

Random Numbers

03	47	43	73	[illegible]	36	96	47	36	61	46	98	63	71	62
97	74	24	67	[illegible]	42	81	14	57	20	42	53	32	37	32
16	76	62	27	[illegible]	56	50	26	71	07	32	90	79	78	53
12	56	85	99	[illegible]	96	96	68	27	31	05	03	72	93	15
55	59	56	35	64	38	54	82	46	22	31	62	43	09	90
16	22	77	94	39	49	54	43	54	82	17	37	93	23	78
84	42	17	53	31	57	24	55	06	88	77	04	74	47	67
63	01	63	78	59	16	95	55	67	19	98	10	50	71	75
33	21	12	34	29	78	64	56	07	82	52	42	07	44	38
57	60	86	32	44	09	47	27	96	54	49	17	46	09	62
18	18	07	92	46	44	17	16	58	09	79	83	86	19	62
26	62	38	97	75	84	16	07	44	99	83	11	46	32	24
23	42	40	64	74	82	97	77	77	81	07	45	32	14	08
52	36	28	19	95	50	92	26	11	97	00	56	76	31	38
37	85	94	35	12	83	39	50	08	30	42	34	07	96	88
70	29	17	12	13	40	33	20	38	26	13	89	51	03	74
56	62	18	37	35	96	83	50	87	75	97	12	25	93	47
99	49	57	22	77	88	42	95	45	72	16	64	36	16	00
16	08	15	04	72	33	27	14	34	09	45	59	34	68	49
31	16	93	32	43	50	27	89	87	19	20	15	37	00	49

HOW TO USE THE TABLE OF RANDOM NUMBERS:

1. Based on available information, segregate the containers (i.e., drums, sacks, etc.) according to waste types.
2. Number the containers containing the same waste types consecutively, starting from 01.
3. Decide on how many samples you wish to take. This number is usually determined by the objective of the sampling. For regular surveillance sampling, the collection of one or two samples is usually adequate. In this case, random sampling is not necessary. But for regulatory or research purposes, more samples (such as one sample for every group of five containers) taken at random will generate more statistically valid data. Hence if there were 20 drums containing the same [illegible] of waste, 5 drums have to be sampled.
4. Using the [illegible] of random numbers above, choose any number as a starting point.
5. From this number, go down the column, then to the next column to the right, or go in any predetermined direction until you have selected five numbers between 01 and 20, with no repetitions. Larger numbers are ineligible.

   Example: If you were to choose 19 as the starting point on column four, the next eligible numbers as you go down this column are 12 and 04. So far you have chosen only three

eligible numbers. Proceed to the next column to the right. Going down and starting from the top of this column, the next eligible numbers are 12 and 13. But 12 is already chosen. Proceeding to the sixth column, the next eligible number is 16. Your five random numbers, therefore, are 19, 12, 04, 13 and 16. Thus the drums with corresponding numbers have to be sampled.

ATTACHMENT III

CHAIN OF CUSTODY RECORD

Minneapolis, Minnesota 55408

PROJECT NAME

SAMPLERS: (Signature)

Sample No.	DATE	TIME			WASTE TYPE	NO. OF Sample CON-TAINERS								REMARKS

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	