

**MALCOLM
PIRNIE**



ARCS II

SDMS Document



111570

Contract No. 68-W9-0051

FIELD SAMPLING PLAN

Action Anodizing Plating & Polishing Copiague, Suffolk County, New York

**Remedial Planning Activities at Selected
Uncontrolled Hazardous Substance Disposal Sites
USEPA Region II (NY, NJ, PR, VI)**

**Malcolm Pirnie, Inc.
2 Corporate Park Drive
White Plains, New York 10602**

March 1990

ACT 001 0493 F

ARCS II CONTRACT NO. 68-W9-0051

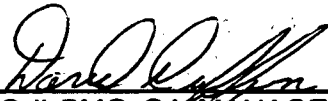
WORK ASSIGNMENT # 001-2L3M

SITE NAME: ACTION ANODIZING PLATING AND POLISHING
FIELD SAMPLING PLAN

CONTRACTOR QA/QC SIGN-OFF

Malcolm Pirnie, Inc. has reviewed this draft document in accordance with the contractor's ARCS II QAPP and is submitting it to USEPA, Region II in compliance with the requirements under Work Assignment No. 001-2L3M and Contract No. 68-W9-0051.

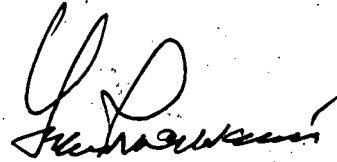
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ARCS II PMO QA MANAGER

Date:

3/13/90



ARCS II PMO OPERATIONS MANAGER

Date:

3/19/90

ACTION ANODIZING - FIELD SAMPLING PLAN

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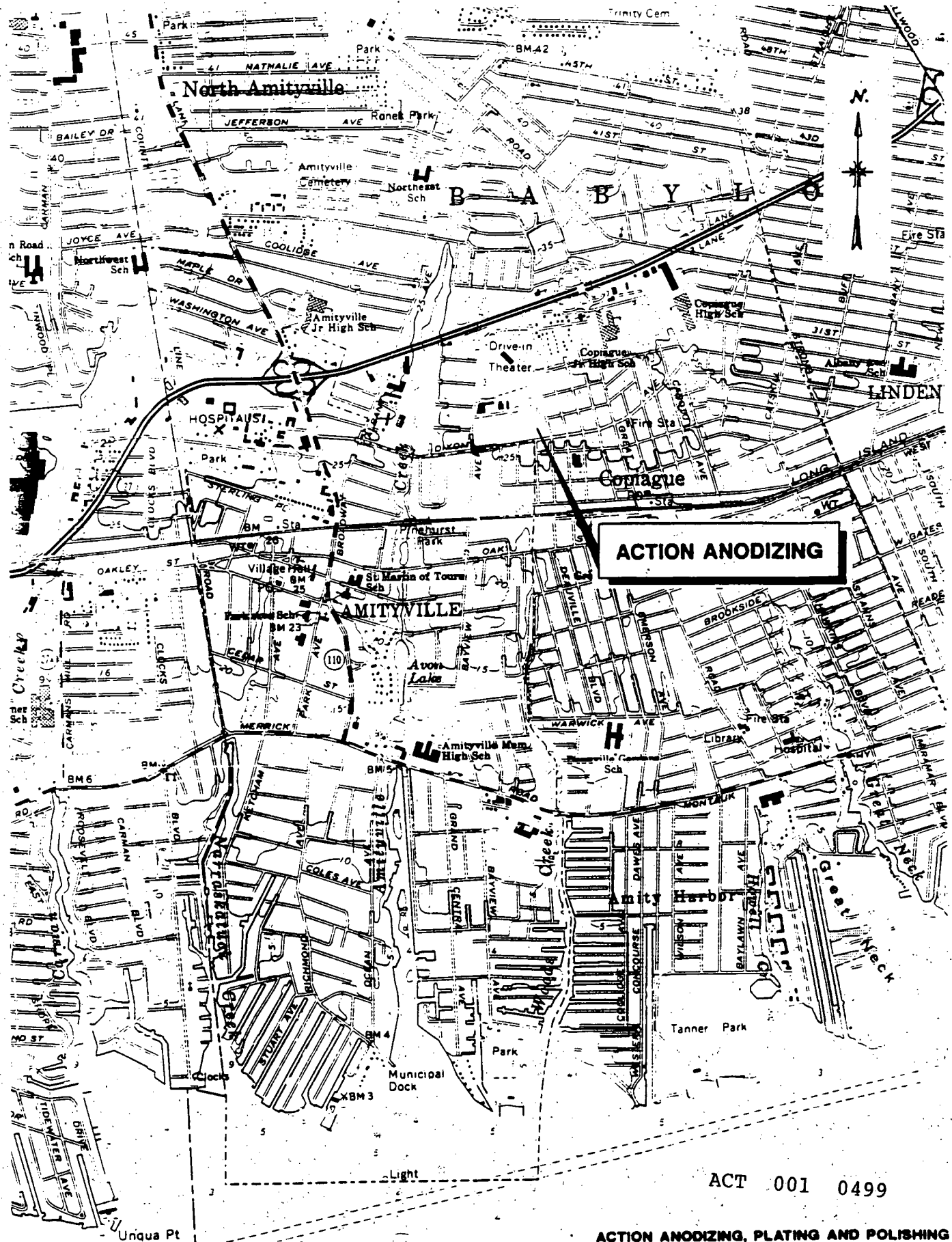
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1.0 INTRODUCTION

This Field Sampling Plan (FSP) describes in detail the procedures that will be followed to conduct field activities at the Action Anodizing Plating and Polishing, Inc. Site in Copiague, New York. The purpose of the FSP is to assure that samples are collected and handled properly until the samples reach the laboratory and sampling and handling procedures are fully documented. This will assure that samples are representative of the media sampled, cross-contamination of samples does not occur, samples are properly preserved and samples are analyzed for the appropriate constituents. The sampling and data gathering methods described in the FSP are consistent with the U.S. Environmental Protection Agency's (EPA) "Compendium of Superfund Field Operations Methods" (EPA/540/P-87/001, OSWER Direction 9355.0-14, December 1987), and Malcolm Pirnie's Standard Operating Procedures.

Each field member will be required to read this document and to fully understand the procedures that are to be followed in the field, before beginning work at the site. In addition, each field member will be required to read the Health and Safety Plan (HASP) that has been prepared for the project, before initiating field activities.

It is recognized that once sampling activities begin, field conditions may be different from conditions expected. As a result, it may be necessary to change some of the procedures described in the FSP. The Malcolm Pirnie Quality Assurance/Quality Control (QA/QC) Officer and the EPA will be advised of the need to change procedures in the FSP. After the changes have been agreed to, the revised procedures will be fully documented and attached to the FSP as an addendum. Copies of the FSP, and the HASP will be maintained at the field office at all times.



ACTION ANODIZING

ACT 001 0499

**ACTION ANODIZING, PLATING AND POLISHING
SITE LOCATION MAP
SCALE: 1" = 2000'**

**MALCOLM
PIRNIE**

SOURCE: USGS AMITYVILLE QUADRANGLE

2.0 SITE BACKGROUND

2.1 SITE DESCRIPTION

The Action Anodizing, Plating and Polishing, Inc. (AAPP) Site is a one-acre site located at 33 Dixon Avenue in the Hamlet of Copiague, Town of Babylon, in Suffolk County, New York (Figure 2-1 and 2-2). The site is approximately one mile east of the Nassau-Suffolk County line and one-half mile south of the Sunrise Highway. A retail/wholesale business is located immediately west of the site. Undeveloped land is located to the north of the site, and single family residences are located along much of the eastern and southern property boundaries.

The site consists of a multi-level building with associated paved areas. The surface elevation of the site is approximately 30 feet above mean sea level (MSL). The ground surface of the site slopes down approximately one-half foot from north to south.

2.2 GEOLOGIC AND HYDROGEOLOGIC SETTING

The site is located in the Coastal Plain Physiographic Province, which is characterized by unconsolidated sedimentary deposits of Cretaceous and Quaternary age which overlie older crystalline bedrock of Pre-Cambrian to Paleozoic Age. The uppermost unconsolidated unit, which is upper Pleistocene in age, consists chiefly of outwash sediments deposited by meltwater streams flowing from stagnant or retreating glaciers. The sediments generally dip to the southeast, and are well stratified, moderately-to-well sorted sand and gravel.

The upper Pleistocene sediments are underlain in some areas by the Gardiners Clay, a marine interglacial fossiliferous clay which occurs only in a limited area in the vicinity of the site at thickness ranging from 20 to 40 feet (Pluhowski and Kantrowitz, 1964).

The Gardiners clay is underlain by the Magothy-Matawan Group which ranges from 1,000 to 2,000 feet in thickness in southern Suffolk County (Pluhowski and Kantrowitz, 1964). This is the major water-bearing unit in the area and is known as the Magothy Aquifer.

2.3 SITE HISTORY

AAPP has occupied the facilities at 33 Dixon Avenue since 1968. The operating facility is a small job shop with most jobs being anodizing, plating, polishing and painting jobs. The operating facility includes approximately 3000 sq. ft. of floor area and about 2000 sq. ft. of office space. Attached to the operating facility is an approximate 7500 sq. ft. addition which was built in 1984. The addition is used for equipment storage. See Figure 2-2.

Prior to 1968, the facility was operated by Unqua Fabricare, a commercial laundry service.

From 1968 to date, AAPP has been involved primarily with sulfuric acid anodizing of aluminum parts for the electronics industry, cadmium plating, chromate conversion coatings, metal dyeing and vapor degreasing.

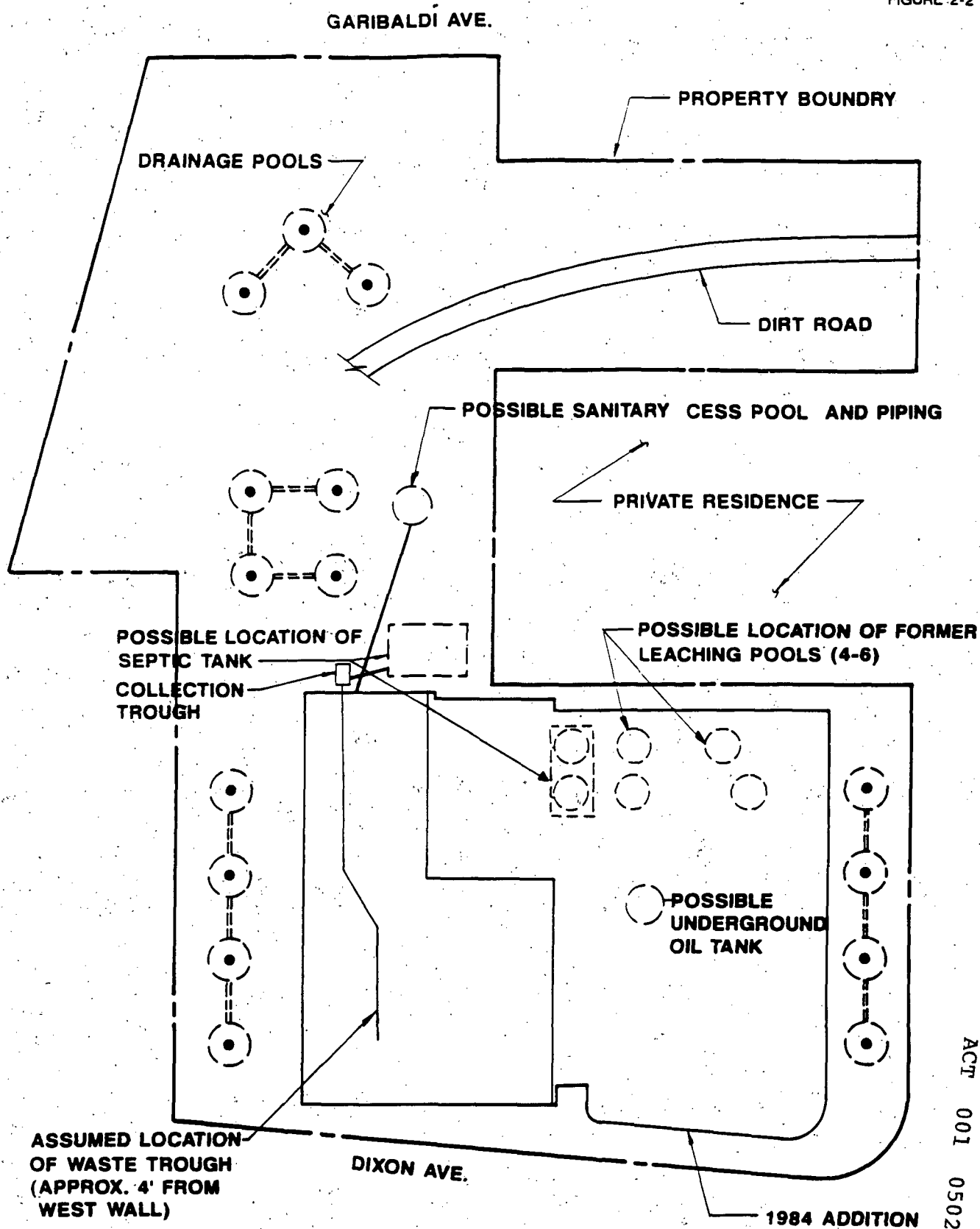
Liquid wastes from the processes included rinses of spent caustic and acidic solutions contaminated with cadmium, chromium, zinc and sodium cyanide. The rinses were stored in a concrete trough from which they were pumped into a low pressure steam boiler. The steam was condensed and reused as process make-up water. The solids from the rinse water were allowed to build up in the boiler tubes until the tubes became plugged (i.e., tubes plugged in about 5 years). Thereafter, the boiler was replaced with a new boiler.

The concrete rinse holding trough had been used by the commercial laundry as part of its drainage system. The trough was connected to a septic tank on the north side of the building. Tank overflow fed into a series of six leaching pits on the east side of the building. The bottom of pits were reportedly several feet above the ground water table.

AAPP has stated that in January 1980, a pipe connecting the holding trough to the leaching system was accidentally broken, allowing the rinse water to discharge to the leaching pits.

On January 11, 1980, AAPP was ordered by the Suffolk County Department of Health Services (SCDHS) to cease discharge immediately and pump out and remove the contents of the entire leaching system.

In the Spring of 1980, AAPP contracted with the Paterson Chemical Company for the cleanup and closing of their leaching system. This work was supervised and approved by SCDHS. On September 30, 1980, SCDHS



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notified AAPP that their leaching pits could be back-filled with clean sand and gravel.

Since 1980, AAPP reports that it has had its industrial waste hauled off site for disposal. In January 1986, New York State Department of Environment Conservation (NYSDEC) issued a Phase 1 Investigation Report on AAPP.

ACT 001 0503

3.0 SAMPLING OBJECTIVES

The purpose of the field activities proposed for the site is to fully assess the extent of waste disposal areas, if any, and to determine the chemical quality of soil, sediment and ground water on the site. The procedures to conduct the proposed field activities are discussed in this document. If the results of the initial investigation indicate that contamination has migrated past the most downgradient wells, additional monitoring points will be necessary to assess the extent of the contamination. If this additional monitoring program is implemented, it is likely to involve the use of existing Suffolk County Water authority monitoring wells and the installation of approximately ten additional wells.

The results of the investigation will be used to assess the potential risks that contamination presents to human health and the environment and to evaluate feasible remedial alternatives to mitigate any risks that are identified. As a result, the data generated during field activities and by the laboratory must be carefully collected and analyzed. The purpose of the Field Sampling Plan is to outline a protocol so that samples are properly collected and handled until they reach the laboratory, and results are representative of actual field conditions.

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4.0 SAMPLE LOCATIONS, FREQUENCY AND DESIGNATION

4.1 INTRODUCTION

Field activities are proposed at the AAPP Site to define the existence, nature, depth and lateral extent of any contamination resulting from the operation of AAPP. Collection of soil, sediment, surface water and ground water samples for chemical analysis will be conducted. The following sections identify each sample matrix to be collected and the constituents to be analyzed. In addition, quality assurance/quality control (QA/QC) samples will be collected for each matrix to assure that the data meet the quality objectives described in the Work Plan. In the following sections, each type of QA/QC sample is described, and the number of QA/QC samples to be collected is described. The numbering system to be used to identify each sample is also presented. Detailed sampling procedures are provided in Section 5.0.

4.2 SAMPLE LOCATIONS AND FREQUENCY

4.2.1 Magnetometer Survey

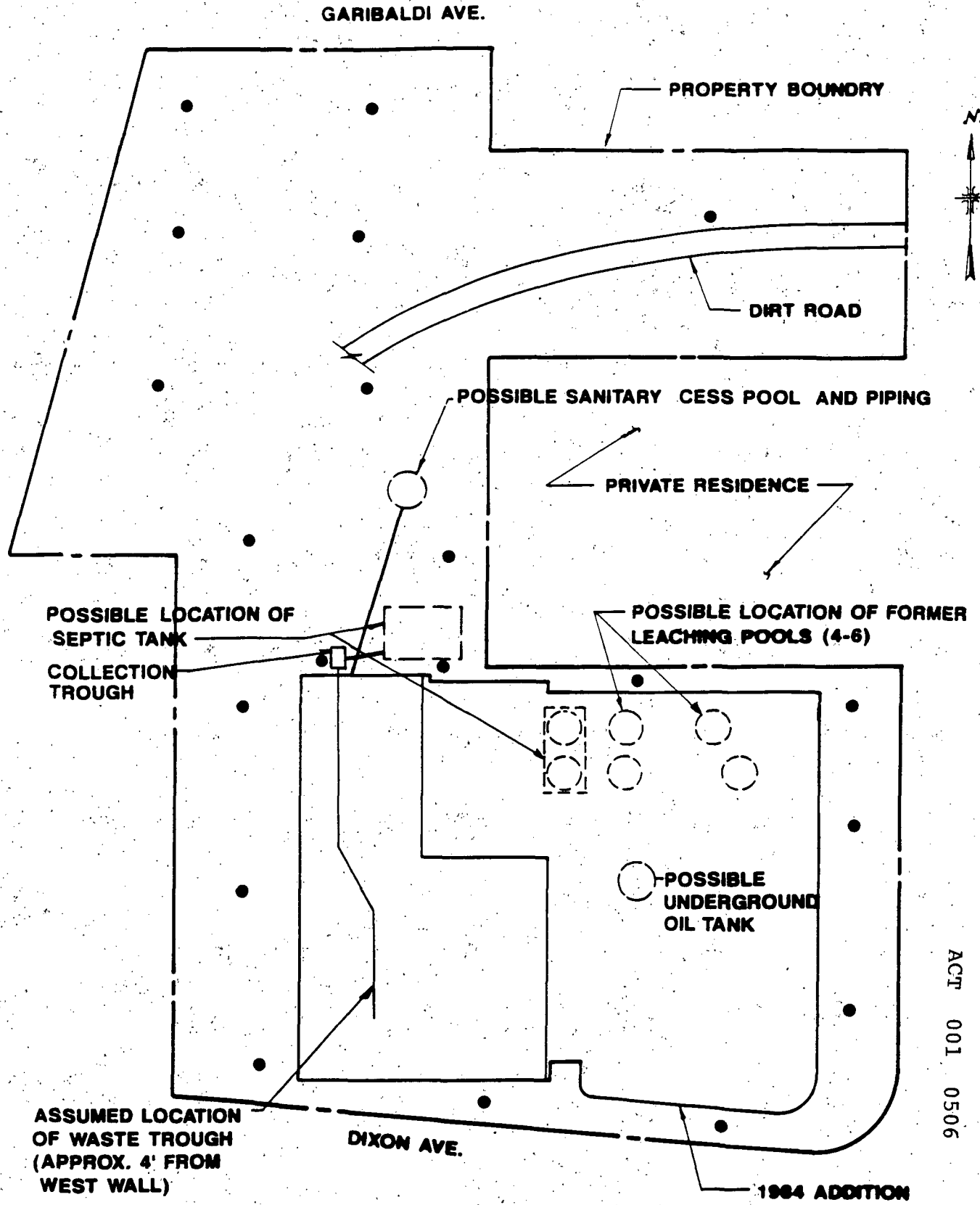
A magnetometer survey will be conducted to determine the presence of buried metallic objects such as pipes or containment vessels. Measurements will be taken in accessible areas on the property outside of the building. Magnetometer measurements will be evaluated and the data plotted on site maps.

4.2.2 Soil Sampling

Surface soil samples will be collected to a depth of six inches. Samples will be taken on a grid pattern as shown on Figure 4-1. A total of twenty soil samples will be collected.

4.2.3 Soil Borings

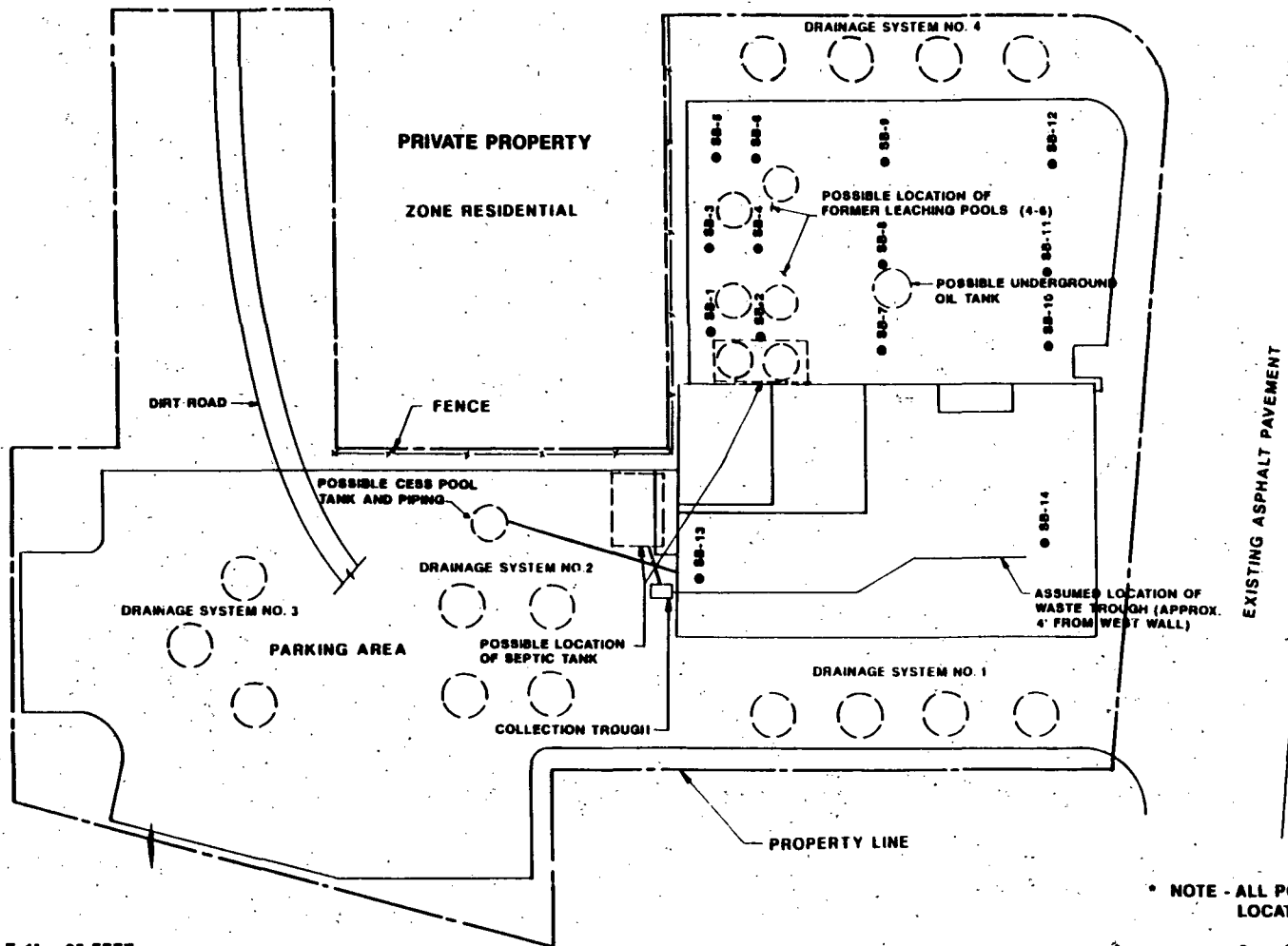
Soil borings will be drilled to collect soil samples for chemical analysis. Fourteen borings will be advanced beneath the slab of the existing building at locations shown on Figure 4-2. In borings SB-1, SB-3, and SB-6, two samples will be sent to the laboratory for analysis. In addition, one soil sample from each of the well borings will be sent for



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**ACTION ANODIZING, PLATING AND POLISHING
PROPOSED SURFACE
SOIL SAMPLING POINTS
APPROXIMATE SCALE: 1"=33'**



APPROXIMATE SCALE 1" = 25 FEET

• NOTE - ALL POSSIBLE AND ASSUMED LOCATIONS/OBJECTS ARE NOT TO SCALE

● SOIL BORING LOCATIONS

**MALCOLM
PIRNIE**

COPAIGUE, NEW YORK
ACTION ANODIZING
PROPOSED INDOOR SOIL BORING LOCATIONS

MALCOLM PIRNIE, INC.

FIGURE 4-2

ACT 001 0507

laboratory analysis. All samples will be analyzed for the parameters indicated in Table 4-1.

4.2.4 Sediment and Surface Water Samples

Four sediment and four water samples will be collected for chemical analysis from the four drainage pool systems installed when the addition was built in 1984 (Figure 4-2). The samples will be analyzed for the parameters indicated in Table 4-1.

4.2.5 Ground Water Monitoring Wells

Ten monitoring wells will be installed at the locations shown on Figures 4-3 and 4-4. Two rounds of ground water samples will be collected from each well for analysis of the parameters indicated in Table 4-1.

4.3 QUALITY CONTROL SAMPLES

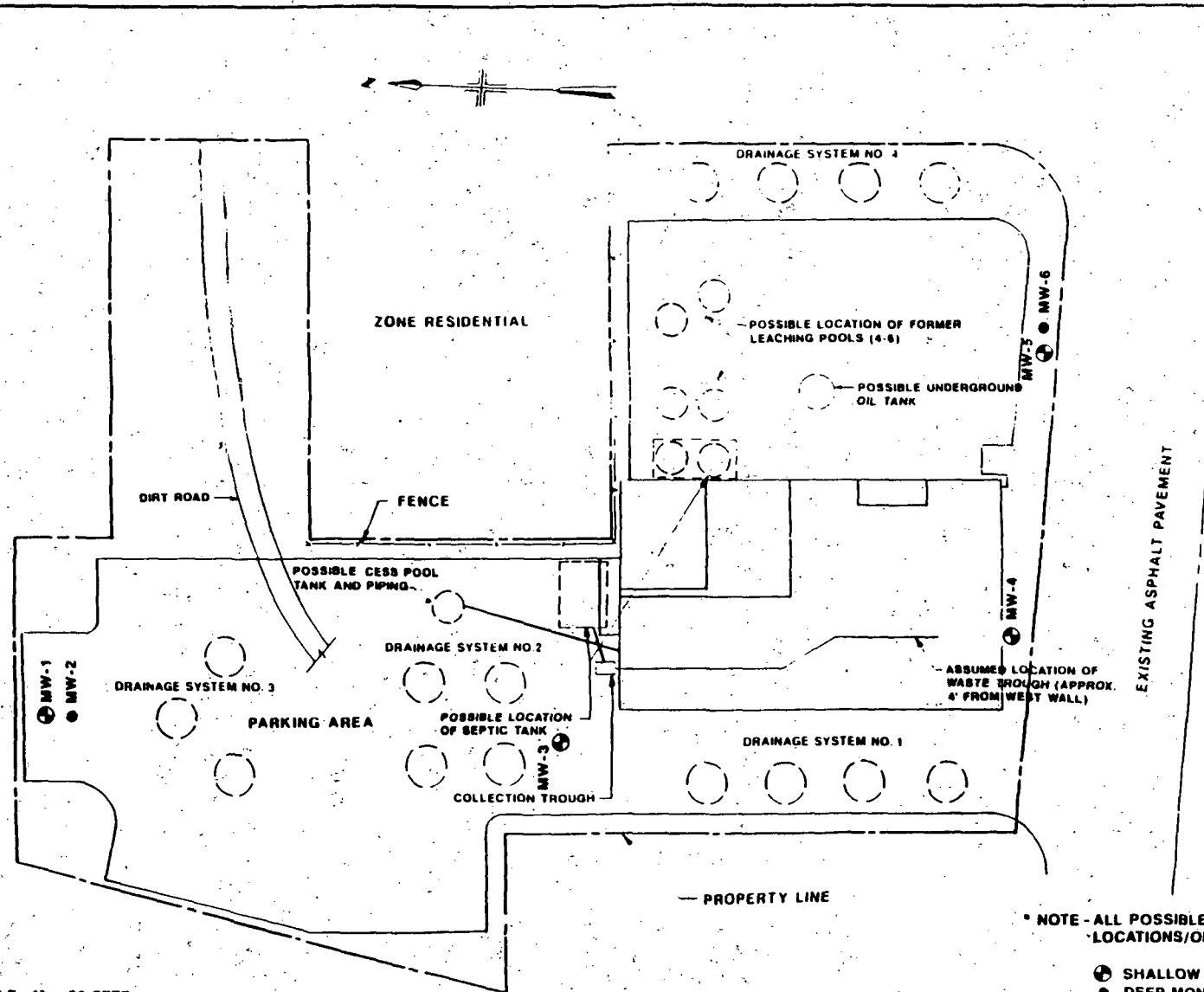
Quality control procedures will be employed to check that sampling, transportation and laboratory activities do not bias sample chemical quality. Trip blanks, field blanks, duplicate samples, matrix spike samples and matrix spike duplicates will provide a quantitative basis for validating the analytical data.

4.3.1 Blank Water

Blank water generated for use in this project will be demonstrated analyte-free prior to the start of sample collection, through analytical testing performed. For the sampling at the AAPP site, the blank water will be deionized water obtained from a commercial chemical supplier. The supplier will provide analytical results for each lot of deionized water demonstrating that the water meets USEPA Region II requirements. The results, including copies of all documentation, will be submitted to the USEPA Region II QAO for this site prior to the start of field sampling. In addition, the results will be kept on-site on file for review. The USEPA Region II criteria for analyte-free is as follows:

Purgeable Organics	<10 ppb
Semi-Volatile Organics	<CRQL
Pesticides	<CRQL
PCBs	<CRQL
Inorganics	<CRDL

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APPROXIMATE SCALE 1" = 25 FEET

NOTE - ALL POSSIBLE AND ASSUMED LOCATIONS/OBJECTS ARE NOT TO SCALE

- ⊕ SHALLOW MONITORING WELL LOCATIONS
- DEEP MONITORING WELL LOCATIONS

LEGEND

- ⊕ SHALLOW WELL
- DEEP WELL

APPROXIMATE SCALE : 1" = 100'



GARIBALDI ST.

GALVANI ST.

VOLTA ST.

SITE

DIXON

AVENUE

ACT 001 0510

MW-7 ⊕

MW-10 ● ⊕ MW-8

⊕ MW-9

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COPAIGUE, NEW YORK

**ACTION ANODIZING SITE
LOCATIONS OF PROPOSED OFF-SITE WELLS**

MALCOLM PIRNIE, INC.

FIGURE 4-4

TABLE 4-1

SAMPLE FREQUENCY AND ANALYTICAL PARAMETERS
ACTION ANODIZING, PLATING AND POLISHING INC. SITE

<u>Sample Matrix</u>	<u>Sample Frequency</u>				<u>Total and Amenable Cyanide⁽²⁾</u>	<u>Hexavalent Chromium</u>	<u>EPTOX⁽³⁾</u>
	<u>TCL⁽¹⁾ VOC</u>	<u>TCL⁽¹⁾ BNAs</u>	<u>TCL⁽¹⁾ Pest/PCBs</u>	<u>TAL⁽¹⁾ Inorganics</u>			
<u>Soil Borings</u>							
a) Soil Samples	30	30	30	30	30	30	6
Trip Blanks ⁽⁴⁾	-	-	-	-	-	-	-
Field Blanks ⁽⁴⁾	2	2	2	2	2	2	2
Lab MS/MSD Samples ⁽⁵⁾	2	2	2	2	2	2	1
Field Duplicates	2	2	2	2	2	2	1
<u>Drainage Pool Systems</u>							
a) Sediment Samples	4	4	4	4	4	4	
Trip Blanks ⁽⁴⁾	-	-	-	-	-	-	-
Field Blanks ⁽⁴⁾	1	1	1	1	1	1	1
Lab MS/MSD Samples ⁽⁵⁾	1	1	1	1	1	1	1
Field Duplicates	1	1	1	1	1	1	1
b) Water Samples	4	4	4	4	4	4	
Trip Blanks ⁽⁴⁾	1	-	-	-	-	-	-
Field Blanks ⁽⁴⁾	1	1	1	1	1	1	1
Lab MS/MSD Samples ⁽⁵⁾	1	1	1	-	1	-	-
Field Duplicates	1	1	1	1	1	1	1
<u>Septic Tank⁽⁶⁾</u>							
a) Sediment/Sludge Samples	2	2	2	2	2	2	
b) Water Samples	2	2	2	2	2	2	

TABLE 4-1 (Continued)

SAMPLE FREQUENCY AND ANALYTICAL PARAMETERS
ACTION ANODIZING, PLATING AND POLISHING INC. SITE

<u>Sample Matrix</u>	<u>Sample Frequency</u>				<u>Total and Amenable Cyanide⁽²⁾</u>	<u>Hexavalent Chromium</u>	<u>EPTOX⁽³⁾</u>
	<u>TCL⁽¹⁾ VOC</u>	<u>TCL⁽¹⁾ BNAs</u>	<u>TCL⁽¹⁾ Pest/PCBs</u>	<u>TAL⁽¹⁾ Inorganics</u>			
<u>Monitoring Wells</u>							
a) Ground Water Samples	20	20	20	20	20	20	
Trip Blanks ⁽⁴⁾	2	-	-	-	-	-	
Field Blanks ⁽⁴⁾	2	2	2	2	2	2	
Lab MS/MSD Samples ⁽⁵⁾	1	1	1	1	1	1	
Field Duplicates	1	1	1	1	1	1	
<u>Surface Soil</u>							
a) Soil Samples	20	20	20	20	20	20	-
Trip Blanks ⁽⁴⁾	-	-	-	-	-	-	-
Field Blanks ⁽⁴⁾	1	1	1	1	1	1	-
Lab MS/MSD Samples ⁽⁵⁾	1	1	1	1	1	1	-
Field Duplicates	1	1	1	1	1	1	-
<u>Air Samples</u>							
a) Air - VOC Samples	12	-	-	-	-	-	-
Trip Blanks ⁽⁴⁾	2	-	-	-	-	-	-
Field Blanks ⁽⁴⁾	-	-	-	-	-	-	-
Lab MS/MSD Samples ⁽⁵⁾	-	-	-	-	-	-	-
Field Duplicates	6	-	-	-	-	-	-

ACT 001 0512

TABLE 4-1 (Continued)

SAMPLE FREQUENCY AND ANALYTICAL PARAMETERS
ACTION ANODIZING, PLATING AND POLISHING INC. SITE

Notes:

1. Target Compound List (TCL), Volatile Organic Compounds (VOCs), Base/Neutral, Acid Extractables (BNAs), Pesticides/PCBs, and Inorganics are the NYSDEC CLP List as given in the most recent protocol.
2. Total and Amenable Cyanide, EPASW-846, Method 9010
3. EP Tox - Extraction Procedure (EP) Toxicity Test Method; include As, Ba, Cd, Cr, Pb, Hg, Se, Ag, endin, Lindane, methoxychlor, toxaphene, 2,4,0, 2,4,5 - TP Silvex by EPA SW-846 Method 1310.
4. The blank water used must be demonstrated analyte-free prior to the start of field sampling. The number of trip and field blanks given is estimated. The actual number will depend on the number of sampling days. See test for further information.
5. For each Lab MS/MSD sample required for aqueous samples, three times the volume of the chosen sample is required. Lab MS/MSD samples required for soil/sediment samples do not require that any extra volume be collected.
6. There are not QC samples proposed for the septic tank samples.

ACT 001 0513

8001-02-1101

4.3.2 Trip Blank

Trip blanks will be taken for each aqueous medium being sampled for volatile analysis, at a rate of one per cooler shipment of volatile samples. The trip blank is prepared by the laboratory by filling a 40 ml vial with distilled/deionized, analyte free water. The vial is shipped to the site with the sample containers and accompanies the sample containers at all times. One trip blank will be returned to the laboratory with each day's shipment of samples scheduled for analysis. The trip blank will be analyzed for volatile organic compounds, to detect possible contamination during shipment.

4.3.3 Field Blanks

A field blank consists of an empty set of laboratory-cleaned sample containers. At the field location, distilled/deionized, analyte free water is passed through decontaminated sampling equipment and placed in the empty set of sample containers for analysis of the parameters indicated in Table 4-1. One field blank for each matrix will be collected for every twenty environmental samples.

4.3.4 Laboratory Matrix Spike/Matrix Spike Duplicates

Matrix spike and matrix spike duplicate sample pairs are analyzed by the laboratory to provide a quantitative measure of the laboratories precision and accuracy. CLP laboratories are required to analyze a minimum of one MS/MSD pair for each twenty samples of the same concentration and matrix for each case. Non-CLP laboratories and SAS analyses will perform MS/MSDs at an equal rate.

Aqueous samples require that three times the volume of the sample selected for each MS/MSD sample be collected and submitted to the laboratory for organics analysis. No extra volume of aqueous sample is required for inorganics (TAL, Total and Amenable Cyanide, hexavalent chromium) MS/MSD pairs. Non-aqueous samples (soils/sediment) do not require that any extra volume of sample be submitted to the laboratory for MS/MSD samples.

ACT 001 0514

4.3.5 Field Duplicate Samples

For each sample matrix, a field duplicate sample will be collected at a rate of one sample per 20 environmental samples. The duplicate sample is collected at the same location as the environmental sample. The field duplicate sample is identified, using the sample designation system described in Section 4.4. The identity of the field duplicate is not revealed to the laboratory. The analytical results of the environmental sample will be compared to the field duplicate sample, to evaluate the field sampling precision.

4.4 SAMPLE DESIGNATION

A sample numbering system will be used to identify each sample. This system will provide a tracking procedure to allow retrieval of information about a particular sample, and will assure that each sample is uniquely numbered. The sample identification will consist of at least three components as described below. Identification numbers for soil boring samples will also have a fourth component, and each matrix spike and matrix spike duplicate will be identified with the suffix MS or MSD.

- Project Identification: The first component consists of a three letter designation which identifies the project site. for this project, the three letter designation will be AAP.
- Sample type: The second component, which identifies the sample type, will consist of a two letter code as follows:
 - SB - Soil Boring
 - MW - Monitoring Well (ground water sample)
 - SD - Sediment Sample
 - SW - Surface Water
- Sample Location: The third component identifies the sample location, or identifies if the sample is a trip blank or field blank. A two digit number will be used to identify each sampling location. TB will be used to identify a trip blank and FB will be used to identify a field blank.
- Sample Identification: The fourth component will only be used for soil boring samples, as described below:
- Soil Borings: A two digit number will be used to indicate the interval from which the sample was collected.

ACT 001 0515

- Quality Assurance/Quality Control Samples will be labelled with the following suffixes:

MS - Matrix Spike
MSD - Matrix Spike Duplicate

Duplicate samples will be numbered uniquely as if they were samples.
A record of identification for duplicate samples will be maintained.

Examples of identification numbers are given below:

AAP-SB-02-10: Soil boring, boring location number 2, 10 feet below ground surface.

AAP-SD-03-MSD: Sediment sample, sediment sample location 3, matrix spike duplicate.

AAP-MW-TB: Trip blank for ground water sample.

5.0 SAMPLING PROCEDURES AND EQUIPMENT

5.1 INTRODUCTION

The following sections provide step-by-step instructions for each type of field activity that is to be conducted at the site. These procedures will be followed by the field team in order to maintain the data quality objectives outlined in the Work Plan.

5.2 MOBILIZATION

The following facilities will be provided prior to the start of the field work:

- Temporary decontamination pad;
- Staging area for equipment, supplies, and drums to temporarily store drill cuttings, disposable clothing, and other contaminated materials.
- Wind Socks - Wind Socks will be installed at three locations. Two wind socks will be set up at each location. One sock will be located 5 feet above ground surface and the second will be located 10 feet above ground surface. These will be used to determine the prevailing wind direction during the air monitoring program.

5.3 MAGNETOMETER SURVEY

5.3.1 Survey Objectives

A magnetometer survey will be conducted by Malcolm Pirnie to determine the presence of buried metallic objects such as pipes or containment vessels.

5.3.2 Survey Equipment

The following equipment will be needed to perform the magnetometer survey:

- Transit
- Tripod
- Surveying stakes
- Permanent markers

- Flagging
- 100-foot tape measure
- Field notebook
- EG&G Model G-856 Proton Precision Magnetometer

5.3.3 Survey Procedures

A 50-foot on center grid will be surveyed using a transit, tripod, and 100-foot tape measure (Figure 5-1). Magnetic measurements will be collected at 25-foot intervals using a EG&G Model G-846 Proton Precision Magnetometer.

The magnetometer will be placed at each grid location, with the sensor oriented properly to the north, and a magnetic reading collected. The instrument operator will be free of any magnetic material. To identify possible magnetic drift (diurnal variation) the looping method will be used. This involves collecting a base station reading at the same location after each completed transect. Because these readings are repeated at the same location, the magnetic readings should be relatively consistent over time. If the diurnal does not vary more than 15 to 20 gammas over a one hour period, magnetic correction may not be necessary.

Interferences from surface metals, fences, powerlines, and other background sources will be noted in the field notebook and taken into consideration during data reduction and interpretation.

Magnetometer results will be reduced, corrected for diurnal variations (if necessary), plotted on a site map, and contoured. The contour map will be interpreted by a geologist and a map will be generated showing locations of target areas (areas possibly having buried metallic material).

5.4 COLLECTION OF SOIL SAMPLES

5.4.1 Sampling Objectives

Twenty surface soil samples will be collected to determine the existence, nature, and areal extent of surface soil contamination. As with the magnetometer survey, a grid will be set up and sampling will be conducted at the surveyed points (See Figure 4-1).

5.4.2 Sampling Equipment

- Stainless steel trowels
- Field notebook
- Roll of plastic
- Camera
- Laboratory prepared bottles

5.4.3 Sampling Procedures

At each grid location, the surface debris (e.g., rocks, twigs, grass) will be cleared. An adequate portion of soil from a depth of 0-6 inches will be collected using a stainless steel trowel. The sample will be directly transferred into the sample container. The stainless steel trowel will be decontaminated prior to sample collection. Decontamination procedures are described in detail in Appendix B. Sample integrity will be maintained to as great an extent as possible. The volatile soil sample will be transferred into the wide-mouth sample bottle immediately, with no mixing, to assure that the volatile fraction is not lost. Use of the wide-mouth bottle will reduce disturbance of the sample and help prevent the loss of volatiles. All soil samples collected for fractions other than volatile will be homogenized in order to minimize bias of sample representativeness. The procedure for homogenization of soil samples is described as follows.

Soil Sample Homogenization

First, rocks, twigs, leaves and other debris should be removed if they are not considered part of the sample. The soil is then removed from the sampling device and placed in a stainless steel pan, then thoroughly mixed using a stainless steel spoon. The sediment in the pan should be scraped from the sides, corners and bottom of the pan, rolled to the middle of the pan and initially mixed. The sample should then be quartered and moved to the four corners of the pan. Each quarter of the pan sample should be mixed individually and then rolled to the center of the container and the entire sample mixed again.

At each grid location, the following information will be recorded in the field by book.

- Name and location of job
- Sample identification numbers
- Date of sampling
- Method of sample acquisition

- Soil description
- Photograph numbers, if any

5.5 AIR MONITORING

5.5.1 Sampling Objectives

Air monitoring will be conducted during field operations to measure volatile organic contaminant levels, combustible gas levels and respirable dust and radiation levels. The purpose of the air monitoring is to evaluate contaminant levels in the workers' breathing zone in order to select appropriate personal protective equipment, and to measure any exposure of workers to radiation, as described in the HSP prepared for the Phase I investigation. In addition, monitoring will be conducted along the perimeter of the site during drilling operations, in order to determine if field activities are creating conditions which may pose a health risk to nearby residents. If contaminant levels along the perimeter exceed the action limits given in the HSP, field activities will be terminated, and if necessary a contingency plan may be implemented to alert nearby residents.

5.5.2 Sampling Equipment

- HNu Systems, Inc., PI-101 photoionization Detector (HNu)
- Foxboro Organic Vapor Analyzer (OVA)
- MSA Model 2A Explosimeter
- MIE, Inc., Miniram Model PDM-3 (Miniram)
- MIE, Inc., Minirad Monitor 4 (Minirad)
- Field Notebook.

5.5.3 Sampling Procedures

Before drilling operations begin, air monitoring will be conducted on the site to evaluate background levels. For a period of one day, background conditions will be monitored along the perimeter of the site and in the interior of the site. The purpose of the background monitoring will be to assess if car exhaust or fumes from nearby businesses are affecting atmospheric conditions at the site. The HNu or OVA will be used to measure levels of volatile organic vapors, the explosimeter will be used to measure explosive gas levels, the Miniram will be used to measure dust levels and the Minirad will be used to measure radiation levels

possibly emanating from buried waste. Readings will be recorded approximately every 15 minutes at different locations around the perimeter. In addition, the direction of wind movement will be recorded by observing the wind socks located on the site. The date, time, location, instrument readings, and direction of wind will be recorded in a field notebook.

During drilling operations, air monitoring will be conducted using the instruments described above at the following locations and time intervals:

- Workers' Breathing Zone (every 15 minutes)
- At the boring (every 15 minutes)
- At various points along the site perimeter (every 20 minutes)

For each measurement, the date, time, location, and instrument reading will be recorded in the field notebook. When readings are made along the perimeter, the wind direction, and the location of the active trench or boring will also be noted.

The calibration procedures for each instrument are provided in Appendix A. Each instrument will be calibrated at the start of each day. In addition, each instrument will be recalibrated before use, if it is turned off during the day.

5.5.4 Air Sampling - Optional

Metal finish and plating operations involve metal cleaning and degreasing steps in their processes. Usually these degreasing agents are volatile organic compounds or chlorinated hydrocarbons. This air sampling program is optional. Table 5-1 lists soil gas data on the site. These values are low and it is not anticipated volatiles in air will be an issue on this site. If soil sampling data indicates the presence of volatiles, the EPA at its option can initiate this air sampling program. To the extent possible within the framework of the project schedule, air sampling will be conducted on relatively warm weather days.

METHODOLOGY

The following summarizes the methodologies and describes the equipment and procedures to be utilized during the planned air sampling program at AAPP.

EQUIPMENT

Adsorbent Tubes

Adsorbent tubes will be used for the sampling program to identify potential airborne contaminants emitted by AAPP. The adsorbent tubes contain an adsorbent resin (i.e., Tenax, CMS) that traps certain VOC compounds.

Sampling Pumps

Portable air sampling pumps (SKC, Gilian) with combined high/low flow pump system will be utilized to provide a means of sampling the ambient air at AAPP. These pumps are portable battery powered units that draw air at a fixed rate either by maintaining constant flow for high flow (i.e., >500 cc/min) or through constant pressure, regulated by a variable orifice, for low flow (1 cc to 500 cc/min). The pump system includes a programmable timer that can be used to start and stop the pump at preset intervals and that can indicate the accumulated time the pump has operated. The pumps will be calibrated (against a bubblemeter/calibrated flowmeter) by adjusting the flow indicated by a calibrated flowmeter until the desired flow rate is obtained.

Portable Meteorological System

A portable meteorological system is planned to record continuous measurements of wind speed, direction and temperature during the sampling periods. Measurements will be taken at a height of approximately 6 feet above the system will be accomplished with a sighting compass.

PROCEDURES

Number of Samples

Six sample locations are planned for the study to collect concurrent upwind, downwind and on-site samples. The objective of this configuration will be to isolate and identify potential emissions from the site and any potential off-site, upwind sources. Typically, the six sampling locations

will consist of two upwind, two downwind, and two onsite. Primary samples and one duplicate will be taken at each of the six locations. Two rounds of sampling (each round on a different day) are planned. It is anticipated that half the duplicates will be analyzed. A total of 12 samples and 12 duplicates will be taken, approximately 18 (12 samples, 6 duplicates) will be analyzed.

Sampling Locations

The six sampling locations selected will be based on the prevailing wind direction expected during the sampling period and on an upwind/downwind orientation. The forecasted wind direction will be obtained from the National Weather Service office prior to the start of each sampling period.

The site will be surveyed with a direct reading Photoionization Detector (HNU PI101) to screen for any areas with organic vapors elevated above ambient conditions. Areas with organic vapor levels above ambient conditions will be selected as on-site sampling locations.

Laboratory Analysis

The air samples collected will be analyzed for the specific volatile organic compounds based on the compounds of concern. These include:

- perchloroethylene
- trichloroethylene
- 1,2 dichloroethene
- toluene

The analytical procedures to be used by the laboratory will be consistent with the EPA Methods T01/T02. These methods employ thermal desorption followed by the GC/MS analysis.

Documentation

Sampling Flow Rates. Sampling flow rates will be checked periodically during the sampling periods as part of the quality assurance procedures. This ensures the correct flow rate is maintained throughout the test and the correct sample volume is collected. Flow rate check sheets will be used to document the sample location sample time, adsorbent media, pump number, and observed flow rate. Flow rates will be checked in the

field with the adsorbent tube in place. If the flow drifts from the calibrated flow the pump will be adjusted to the correct value and the correction documented on the flow rate check sheets.

Chain of Custody. A chain of custody form will be used to document the handling of the air samples from the time the sampling is completed until the time the analytical laboratory receives the samples. These forms will contain the sample number, date, sampling time, sampling location and person(s) relinquishing or receiving the samples.

5.6 INSTALLATION OF MONITORING WELLS

5.6.1 Objectives

Ten monitoring wells will be installed at the locations shown on Figures 4-3 and 4-4. The purpose of the wells is to collect ground water samples for chemical quality analysis. The groundwater sample is a physical sample collected from a monitoring well that is sent to the laboratory for chemical analysis. In addition, ground water elevations will be recorded to evaluate the direction of ground water movement and to determine the vertical hydraulic gradient beneath the site. The groundwater elevation is a measure of depth of the groundwater table from the soil surface that is recorded in the field logbook. This is fully described in Section 5.8.

At 3 locations a cluster of two monitoring wells will be installed. One well in each cluster will be screened across the water table, and the second well will be drilled to the bottom of the Upper Pleistocene Deposits, approximately 75 feet below grade.

The remaining 4 locations will have a single well which will be screened across the water table.

At each monitoring well location, one soil sample will be collected and submitted for TCL, TAL, hexavalent chromium and amenable cyanide analysis. The samples for chemical analysis will be collected as described in Section 5.7 on soil borings, and selected based on the criteria in that section.

5.6.2 Equipment

The following equipment will be needed for the drilling and installation of the monitoring wells:

- Truck-mounted hollow stem auger drilling rig
- 4-inch diameter stainless steel threaded pipe, with threaded cap
- 4-inch diameter stainless steel, wire wrapped screen with 0.02 inch slots (ten feet long), with base plate
- No. 2 sand
- Bentonite pellets
- Bentonite-cement grout
- 6-inch diameter protective steel flush mounted casing with locking cap
- HNu Systems, Inc., PI-101 photoionization detector
- MSA Model 2A explosimeter
- Field notebook
- Camera
- Roll of plastic
- Laboratory prepared wide mouth sample bottles

5.6.3 Installation Procedures

Each monitoring well will be drilled and installed using a truck-mounted hollow stem auger drill rig. Each well will be completed with 10 feet of 4-inch diameter stainless steel wire wrapped screen, with 0.020 inch slots, and 4-inch diameter stainless steel threaded casing. At each of the 3 locations where clusters of two monitoring wells are to be installed, the deeper well will be installed first. Continuous split-spoon samples will be collected from the ground surface to the water table. Below the water table, split-spoon samples will be collected every five feet. Each split spoon sample will be collected in accordance with a standard penetration test (ASTM D1586). The split-spoon sampler will be driven by dropping a 140-lb hammer from a height of 30 inches. The number of blows required to advance the sampler over each 6 inches will be recorded. Before drilling each boring, the auger flights, drill rods and any other equipment that will enter the hole will be decontaminated by steam cleaning. The split spoon samplers will be decontaminated before each use by following the procedures outlined in Appendix B. The drill cuttings will be placed into labelled drums and stored on-site. Figure 5-2 illustrates typical monitoring well construction.

The split-spoon sampling tool will be opened and will be laid on a piece of clean polyethylene sheeting. The hydrogeologist will examine the

contents, and will screen the sample for organic vapors by passing the probe of an HNu over the length of the sample. Photograph, with a scale for comparison, will be taken of selected samples. The photographs will include a card showing the site name, sample identification number, date and initials of the sampling team. The samples will be transferred to glass jars which will be labelled with the job name, date, and boring and sample identification number. The jars will be sealed and allowed to stand for one-half hour in order to allow time for the organic vapors to off-gas and accumulate in the jar. One-half hour after the soil samples have been collected, the head space in the jar will be measured for organic vapors with the HNu.

All volatile samples that are sent to the laboratory for chemical analysis will be transferred immediately to a wide mouth sample bottle, with no mixing, to assure that the volatile fraction is not lost. Use of wide-mouth bottles will reduce disturbance of the sample and help prevent the loss of volatiles. Volatile sample fractions are not homogenized. All soil samples collected for analysis except the volatile fraction volatile will be homogenized in order to minimize bias of sample representativeness. The procedure for soil sample homogenization is described in Section 5.4.3. Data to be recorded in the field logbook will include the following:

- Name and location of job
- Well and sample identification numbers
- Date of drilling
- Method of drilling and sample acquisition
- Blow counts
- Soil description
- Photograph numbers
- Organic gas levels
- Vapor Concentrations (HNu calibration units)

The sample jars and spatula will be handled with new surgical gloves to prevent contamination. Surgical gloves will be changed between each sample.

All sample containers will be pre-cleaned containers obtained from I-Chem which has been the USEPA Region II supplier, or another vendor with comparable containers and quality assurance procedures, obtained through ARCS II procurement procedures. I-Chem, or other vendors will supply QC

documentation certifying that the containers are clean and contaminant free. Cleanliness and QC documentation of I-Chem containers or comparable source will be reviewed and submitted to USEPA Region II prior to their use. When the bottles are received at Malcolm Pirnie, they will be held in a specially designated bottle room, that contains only clean sample bottles, until the time they are used.

One foot of No. 2 sand will be tremied to the bottom of each boring, after which the well screen, base plate and casing will be assembled and lowered inside the hollow stem auger. In the shallow wells, the well screen will bridge the water table with eight feet set below the water table and the remaining two feet set in the vadose zone. The auger flights will then be slowly raised and No. 2 sand will be tremied to one foot above the top of the screen. A two foot bentonite seal will be placed above the sand pack. The remaining annular space will be filled with a cement-bentonite slurry which will be hydraulically tremied into place. Each well will be completed with a 9-inch diameter protective steel flush mounted casing and locking cap.

5.6.4 Well Development

Each monitoring well will be developed using a centrifugal pump to open the screen to formation water, and to minimize turbidity. Development will remove clay and other fine particles, and will proceed until the turbidity is less than 50 NTU's, unless development for three hours or more cannot achieve these levels. Development water will be recharged into the ground within 50 feet of the well being developed.

5.7 DRILLING OF INDOOR SOIL BORINGS

5.7.1 Sampling Objectives

Soil borings will be drilled beneath the slab of the existing building to determine the nature and extent of soil contamination in the vadose zone.

The borings will be advanced to the ground water table. One sample will be collected for laboratory analysis. In borings SB-1 through SB-6, two samples will be collected for laboratory analysis. One sample will

be collected at the 4-6 foot depth, the second will be collected at the 8-10 foot depth. Both will be submitted to the laboratory for complete RAS analysis, hexavalent chromium and amenable cyanide. In addition, an additional sample will be collected and submitted for EP Tox and TCLP analysis.

As described in the QAPP in section 3.4 on data quality objectives one sample of SB-1 through SB-6 shall be selected by the samplers as a critical sample. This should be noted in the field logbook. The selection of the critical sample from this group will be based on two things. First, the sample should be beneath a former leaching pit. Second, the sample should be determined by visual observation or field instruments to be contaminated. If no sample is found meeting these criteria, then one will be selected at random from SB-1 through SB-6. The sample selected as the critical sample will be collected in duplicate and both will be submitted to the laboratory for CLP-RAS analysis.

5.7.2 Sampling Equipment

The following equipment will be needed to drill soil borings and to collect soil samples for analysis:

- Small skid-mounted drilling rig with hollow stem augers
- Decontaminated 2-inch diameter, 2-foot long split spoons
- Decontaminated stainless steel spatulas
- Camera
- Roll of plastic
- HNu PI-101 photoionization detector (HNu)
- MSA Model 2A explosimeter
- Field notebook and field logs
- Laboratory prepared wide-mouth sample bottles
- Glass bottles for archiving soil samples

5.7.3 Sampling Procedures

Each drilling location will first be located and a mark will be made on the floor of the building labelled with the boring identification number. A small skid-mounted drilling rig, equipped with hollow stem augers, will be used to drill the borings. The drilling rig platform, auger flights, drill rods, split spoon samplers, and any other equipment that will enter the hole, will be decontaminated before the drilling rig enters the site.

At each boring location, continuous split spoon samples will be collected from the ground surface to the water table. Collection and analysis of these samples will be the same as that described in Section 5.6.3. The drill cuttings will be placed into labelled drums, and stored on the site.

The sample for chemical analysis will be selected based on its response to the HNu, or other signs of visible contamination. These samples will be transferred from the sampling spoon to clear sample jars using a stainless steel spatula. The jars will be sealed and allowed to stand for on-half hour in order to allow time for the organic vapors to off-gas and accumulate in the jar. Approximately one half hour after the soil samples have been collected, the head space in the jars of the archived samples will be measured for organic vapors with the HNu. All volatile samples that are sent to the laboratory for chemical analysis will be transferred immediately to a wide mouth sample bottle, with no mixing, to assure that the volatile fraction is not lost. Use of wide-mouth bottles will reduce disturbance of the sample and help prevent the loss of volatiles. Volatile sample fractions are not homogenized. All samples collected for fractions other than volatile will be homogenized in order to minimize bias of sample representativeness. The proceeding for soil sample homogenization is described in Section 5.4.3. The samples will then be sent to a USEPA CLP laboratory for analysis. The spatula will be decontaminated between each use by following the procedures outlined in Appendix B. The samples that are not selected for chemical analysis will be transferred to glass jars for archiving, which will be labelled with the job name, date, boring number and sample identification number. The jars will be sealed and allowed to stand for one-half hour in order to allow time for the organic vapors to off-gas and accumulate in the jar.

Data to be recorded in the field logbook will include the following:

- Name and location of job
- Boring and sample identification numbers
- Date of drilling
- Method of drilling and sample acquisition
- Blow counts
- Soil Description
- Photograph numbers
- Organic gas and methane levels

The sample jars and spatula will be handled with new surgical gloves to prevent contamination. Surgical gloves will be changed between each sample.

Section 5.6.3 gives the source of all containers used in this project.

5.8 COLLECTION OF WATER LEVEL MEASUREMENTS

5.8.1 Objectives

Three rounds of synoptic water level measurements will be collected in the wells that will be installed during the RI. The purpose of collecting the water level measurements is to evaluate the direction of ground water movement and to evaluate the vertical hydraulic gradient.

5.8.2 Equipment

The following equipment will be used to collect ground water level measurements:

- Electronic water level indicator
- Field Notebook
- HNu Systems, Inc., PI-101 Photoionization Detector (HNu)
- MSA Model 2A Explosimeter

5.8.3 Procedures

Depth to Water Level Measurements

At each location, the locking steel cap and internal stainless steel well cap will be removed. The headspace and breathing zone's air quality will be monitored for air quality with an HNu and explosimeter. The battery of the electronic water level indicator will be checked by pushing the battery check button, and waiting for the audial signal to sound, or the instrument to come on. The instrument will then be turned on and the probe will be slowly lowered into the well, until the audial signal is heard, and the instrument light goes on, indicating that the sensor in the probe has made contact with the water surface in the well.

The depth of water will be recorded to the nearest one-hundredth of a foot, from the top of the stainless steel casing. The date, time, well number and depth to water will be recorded. The water level indicator

will be decontaminated before collecting a measurement in each well by following the procedures outlined in Appendix B.

5.9 PUMP TESTING (OPTIONAL)

5.9.1 Testing Objectives

A 48 hour pumping test is proposed for MW-5. The pump test for MW-5 will be utilized if the RI/FS determines that the nature and extent of contamination at the site warrants remedial action. If it is decided then that pumping the aquifer is a possible remedial alternative to be tested, then the pump test will be performed on MW-5 as described.

The pumping test will be used to obtain data on aquifer characteristics in order to assess contaminant movement and determine a remedial design. During this test, water levels will be continuously monitored in wells MW-5, MW-4, MW-6, MW-2, and MW-7.

5.9.2 Equipment

- 5 electronic data loggers
- 5 pressure transducers
- Electronic water level indicator
- Field notebook
- Roll of plastic
- Duct tape
- Submersible pump
- Generator
- Stevens Type F Recorders

5.9.3 Testing Procedures

A controlled pumping test will be conducted on MW-5 provided the data from the drilling and developing of the other eight monitoring wells indicate a continuous water-bearing zone and MW-5 has sufficient capacity to warrant this type of aquifer test.

Pretest water-level measurements will be collected from all ten wells prior to the start of the test. At least two of the wells will be equipped with Steven Type F water-level recorders. The continuous record from the recorders will provide information on the type and magnitude of short term water-level fluctuations that occur on site. Water-level measurements in Monitoring Well 5 (the pumping well), will also be made.

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Manual water-level measurements for static readings will be made using either a chalked tape or an electric probe (M-scope). All measurements will be accurate to 0.05 foot or better.

The pumping rate in Monitoring Well 5 will be controlled using a valve on the discharge line. Adjustments of the pumping rate will not be made by changing the rpm of the pump. The flow rate will be continuously monitored by at least one of three methods. If the flow is 40 gpm or more, the discharge will be measured with an orifice and manometer. If the discharge rate of the well is less than 40 gpm, the flow rate will be checked by diverting the water into a container of known capacity, such as a 5 gallon pail or a 55 gallon drum and measuring the time it takes to fill it. The pumping rate can then be accurately calculated. If possible, the valve will be set at the desired pumping rate the day before the start of the controlled pumping test, and the accuracy of the orifice and manometer (if used) can be verified.

The pumping test will be started at either high tide or low tide, as determined from the recorder charts. At these points in the tidal cycle, the water level changes in the aquifer are minimal for a period of approximately 4 hours. Consequently, tidal changes in the water levels will be negligible during the early part of the test when frequent water-level measurements are being made. The discharge rate will be maintained at a constant rate throughout the test, which will be conducted for a period of 48 hours.

During the test, water levels in the pumping well will be monitored at sufficient frequency so that at least 15 evenly spaced measurements are made within each log cycle of time of the water level plots. In other words, at the start of the test, water-level measurements will be made in the pumping well at the following times after the start of pumping: 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 5, 6, 7, 8, 9 and 10 minutes. In the second log cycle, the measurements will be made at 15, 20, 25, 30, 35, 40, 50, 60, 70, 80, 90 and 100 minutes. After 100 minutes, measurements will be made at 30-minute intervals until the test is shutdown at 2880 minutes (48 hours). The pumping rate will be continuously monitored and adjusted by the well driller for the first 10 minutes and the water-level measurements will be made by the hydrogeologist in charge of the test. After 10

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minutes, the hydrogeologist in charge of the test will measure each water level twice to assure accuracy.

Water levels in the monitoring wells 2, 4, 6, and 7 will be measured with an electronic data logger and transducer and checked with either a chalked tape or an electric probe. The frequency will be the same as measured in the pumping well after 10 minutes. It is anticipated that during the first two hours of the test, one person will monitor the pumping well, a second person will measure water levels in Monitoring Wells 2 and 4, and a third person in Monitoring Wells 5 and 7. Once the time between measurements increases to 10 minutes, one person will monitor the entire test.

At the end of 48 hours, the pump will be shut down and recovery measurements will be made in the wells in a similar manner to the measurements made during the drawdown portion of the test. The recovery data are useful as a check on the drawdown data.

As the test progresses, plots of the drawdown of the monitored wells will be plotted on semilogarithmic paper, and initial values of transmissivity and storage will be calculated from the data. Using the Jacob straightline approximation method, transmissivity is calculated by:

$$T = \frac{264Q}{s}$$

Where T = Coefficient of Transmissivity, in gpd/ft

Q = Pumping rate, gpm

s = Drawdown difference per log cycle of time, in feet

The coefficient of storage can be calculated from the plots of the record from the monitoring wells used as observation wells by the formula:

$$S = \frac{Tt_0}{4790r^2}$$

Where S = Coefficient of Storage (dimensionless)

T = Coefficient of Transmissivity, in gpd/ft

t₀ = Intersection of straightline slope with zero-drawdown axis, in minutes.

r = Distance from pumping well to observation well, in feet.

It should be noted that the Jacob method is applicable in the observation well only after sufficient time has elapsed for the plot to

reach a straightline. The minimum time for the method to apply can be calculated by the formula:

$$T_{s1} = \frac{1.35 \times 10^5 r^2 s}{T}$$

Where T_{s1} = Time for plot to reach a straight line, in minutes
 r = Distance from pumping well to observation well, in feet
 S = Coefficient for Storage (dimensionless)
 T = Coefficient of Transmissivity, in gpd/ft

Once the test is completed, the drawdown in each of the observation wells will be plotted on log paper and analyzed using an appropriate curve fitting method.

The method that will be used to analyze the log-log plots of the drawdown data will depend upon whether the aquifer is considered to be under water table or under artesian conditions based on the aquifer geometry and the shape of the drawdown plots. In all cases, once the method of solution is selected, the field data will be fitted to type curves and the transmissivity and storage calculated from the appropriate equations.

If the data indicate that the aquifer is artesian with vertical leakage taking place, analysis will be by means of leaky artesian formula derived by Hantush and Jacob in a paper entitled, "Non-steady radial flow in an infinite leaky aquifer" (Transactions of the American Geophysical Union, Vol. 36, No. 1, 1955)

If leakage through the confining bed into the aquifer is not measurable or the confining bed is missing, the Theis non-equilibrium formula will be used. This formula is referred to as the non-leaky artesian formula and is described in a paper entitled, "The relation between the lowering of piezometric surface and the rate and duration of a well using ground water storage" (Transactions of the American Geophysical Union, 16th Annual Meeting, Vol. 2, 1955).

If analysis of the aquifer indicates that the aquifer is under water table conditions where the water pumped is derived largely from storage by gravity drainage, a method of Bolton will be used. This method is described in a paper entitled, "The drawdown of the water table under non-steady conditions near a pumped well in a unconfined formation" (In Proceedings [British] Institute of Civil Engineers, Vol 3, Part 3, 1954).

Once the pumping test data have been collected and the proper method selected for the analysis, the USEPA will be informed of the selection. A description of the method will also be appended to the final report.

Every possible precaution will be taken to obtain useful data during the pumping test. If stabilization takes place, the test may be terminated before 48 hours has elapsed. Care will be taken, however, to insure that the test has run long enough so that gravity drainage from dewatered sediments in the cone of depression is not mistaken for leakage.

5.10 COLLECTION OF GROUND WATER SAMPLES

5.10.1 Sampling Objectives

Two rounds of ground water samples will be collected from the wells that will be installed during the RI, for analysis of TCL parameters, cyanide, and hexavalent chromium. Samples will be collected when, based on the technical expertise of the drilling contractor, the aquifer has returned to stability.

5.10.2 Equipment

The following equipment will be needed to collect ground water samples for analysis:

- Electronic water level indicator
- Submersible pump
- Polyethylene tubing
- Laboratory cleaned stainless steel bailer
- Teflon-coated leader cord
- Bailer cord
- pH meter
- Temperature, and specific conductivity meter
- HNu Systems, Inc., PI-101 Photoionization Detector (HNu)
- MSA Model 2A Explosimeter
- Field Notebook and field logs
- Laboratory prepared sample containers
- Roll of plastic

The submersible pump will be water cooled and constructed of stainless steel. Neoprene, PVC, Tygon silicon rubber or viton will not be used in the pump construction.

5.10.3 Sampling Procedures

A piece of polyethylene sheeting will be laid on the ground beside each well, and the sampling equipment, water level indicator, sample bottles and sample notebook will be placed on the polyethylene sheeting. The well cap will be removed, and the concentration of volatile organic vapors and combustible gases will be measured by placing the HNu photoionization detector and explosimeter above the well casing. The HNu and explosimeter will be calibrated before the start of each day by following the procedures described in Appendix A. If the instruments are turned off during the day, they will be recalibrated before being reused.

The depth to water will be measured with an electronic water level indicator. The cable and probe of the water level indicator will be decontaminated between use at each well by washing with Alconox and rinsing with tap water as outlined in Appendix B. This will be followed by a rinse with deionized water.

The water volume in the casing will be calculated using the following equation:

$$V = r^2h \quad \text{Note 1 cu. ft.} = 7.48 \text{ gal}$$

where:

V = standing water volume (gallons)

r = well casing radius (feet)

h = height of water column (feet)

Clean, new polyethylene tubing will be attached to the submersible pump, which will be decontaminated between well locations, as described in Appendix B. The pump will be lowered into the well. During evacuation, the pump intake will not be set greater than six feet below the dynamic water level. This requires that the pump be lowered as purging continues and the water level drops.

Initially, each well will be purged until three to five volumes of standing water are evacuated or until the well is pumped dry. The volume of water removed from each well that is not pumped dry, is dependent upon field measurements of pH, temperature and specific conductivity. When each of these parameters has stabilized, the volume of water will be recorded, and the well will be sampled. If the parameters do not stabi-

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lize, purging will continue until 3 to 5 volumes of water are removed. The purge water will be discharged into drums and stored on site.

The ground water sample will be collected by gently lowering a laboratory cleaned stainless steel bailer into the well. Teflon coated cord will be used for bailer cord which contacts the ground water. The bailer will be retrieved, and the sample will be transferred to the appropriate sample containers. The vial provided for volatile organics will be filled first, without leaving any head space or air bubbles. All other sample bottles will be filled to the shoulder. The head space will allow for expansion/contraction of the sample.

The sample bottles will be placed into coolers and will be sent to a USEPA CLP laboratory for analysis of TCL and TAL parameters, and cyanide.

Field measurements of pH, specific conductance, and temperature will be made in each well. Both the pH and the specific conductivity meters will be calibrated for water temperature before they are used and the pH meter will be calibrated prior to each use. The calibration procedures are provided in Appendix A.

The bailer and any equipment entering the well will be handled with new surgical gloves to prevent contamination. Surgical gloves will be changed between each sample location.

Data to be recorded in the field logbook will include the following:

- Name and location of job
- Well and sample identification numbers
- Date of sample collection
- Method of purging and sample acquisition
- Depth to water
- Volume of water removed during purging
- pH, temperature and specific conductivity
- Organic gas and methane levels

5.11 COLLECTION OF SEDIMENT & SURFACE WATER SAMPLES FROM DRAINAGE POOLS AND SEPTIC TANK

5.11.1 Sampling Objectives

One surface water and one sediment sample will be collected for chemical analysis from each of the four drainage pool systems to characterize the chemical quality of the water and sediment. In addition two

water samples and two sediment samples will be collected from the septic tank, if possible.

5.11.2 Sampling Equipment

- HNu and CGI
- Van Dorn water sampler
- WILDCO gravity core sampler
- Field notebook
- Roll of plastic
- Camera
- Laboratory prepared wide-mouth bottles

Section 5.6.3 gives the source of all containers used in this project.

5.11.3 Sampling Procedures - Water Samples

The water samples will be collected in approximately the same locations as the sediment samples collected as described in Section 5.11.4. The water samples will be taken first, followed by the sediment samples described in Section 5.11.4. As the water in each pool is less than 3 feet deep, stratification is not expected. Therefore, the samples will be collected at mid-depth.

The samples will be collected with a Van Dorn Sampler, which will be decontaminated before use following the procedures described in Appendix B. The sample will be slowly transferred to laboratory prepared bottles and will be sent to a USEPA certified laboratory for analysis of TCL parameters, TAL, cyanide, and amenable cyanide.

Data to be recorded in the field logbook will include the following:

- Name and location of job
- Sample identification number
- Method of sample collection
- Weather conditions

The Van Dorn sampler and sample jars will be handled with new surgical gloves to prevent contamination. Surgical gloves will be changed between each sample location.

Section 5.6.3 gives the source of all containers used in this project.

5.11.4 Sampling Procedures - Sediment Samples

Before sampling, an HNu and CGI with extension probes will be used to monitor the air in the drainage pools. A bottom sediment sample will be collected in each of the pools. The samples to be collected in the pools will be collected as close as possible to the center of the pool.

At each sampling location, a precleaned, dedicated 24-inch long polystyrene core liner and core catcher will be used to collect the samples. Before sampling at each location, the outer surface will be decontaminated as described in Appendix B.

After the sample is collected, the sampler will be laid on a piece of polyethylene sheeting, and will be opened. The physical characteristics of each core will be described in the field logbook. At least one photograph, with a scale for comparison, will be taken of the core. The photograph will include a card showing the site name, sample identification number, date and initials of the sampling team. The core will be transferred to certified clean jars and will be sent to a USEPA-CLP laboratory for analysis of TCL parameters, TAL, cyanide, and cyanide amenable. All volatile samples that are sent to the laboratory for chemical analysis will be transferred immediately to a wide mouth sample bottle, with no mixing, to assure that the volatile fraction is not lost. Use of wide-mouth bottles will reduce disturbance of the sample and help prevent the loss of volatiles. Volatile sample fractions are not homogenized. All samples collected for fractions other than volatile will be homogenized in order to minimize bias of sample representativeness. The proceeding for soil sample homogenization is described in Section 5.4.3.

Data to be recorded in the field log book will include the following:

- Name and location of job
- Time and date of collection
- Sample identification number
- Method of sample collection
- Length of core
- Description of material
- Weather conditions
- Photograph numbers

The sample jars will be handled with new surgical gloves to prevent contamination. Surgical gloves will be changed between each sample location.

6.0 SAMPLE HANDLING

6.1 GENERAL

Representative sampling of environmental matrices for chemical analysis depends on proper collection, preservation, shipping, custody and preparation techniques. Unpreserved or improperly shipped samples may jeopardize sample integrity and reduce data quality. To assure that sampling data are reliable, Malcolm Pirnie will adhere to procedures described in the following sections and in the Quality Assurance Project Plan prepared for the investigation.

6.2 PROCUREMENT AND PREPARATION OF SAMPLE CONTAINERS

The analytical laboratory will provide the sample containers indicated in Table 6-1. Container closures will be screw-on type and made of inert materials. Sample containers will be cleaned and prepared by the laboratory prior to being sent to the field. Trip blanks will be used to check any false positives due to laboratory cleaning procedures or cross contamination during sample shipment.

6.3 LABELING OF SAMPLES

All samples collected at the site will be identified with a Malcolm Pirnie sample label (Figure 6-1) and a Malcolm Pirnie sample tag. The sample label will be attached to each bottle that contains a sample, and the label will be covered with clean plastic tape to assure that it does not peel off or become damaged. A unique sample number will be assigned to each sampling location which will be marked on the label. The sample tag will be attached to the sample bottle with wire.

The sample label and tag will be checked by the laboratory to be sure that they are identical, and they will be cross-referenced to the chain-of-custody form. Any inconsistencies will be noted on the chain-of-custody form. All identifying tags, data sheets, and laboratory records will be retained as part of the permanent record.

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TABLE 6-1

SAMPLE CONTAINER, PRESERVATION AND HOLDING TIME REQUIREMENTS

<u>Matrix</u>	<u>Analysis</u>	<u>Procedure</u>	<u>Container</u>	<u>Preservation</u>	<u>Holding Time</u>
Ground Water/ Surface Water	Volatiles	CLP(1)	2-40 ml glass	HCl to pH<2, Cool to 4 C	10 days, preserved
	Semi-Volatiles	CLP(1)	2 L amber glass	Cool to 4 C	5 days to extraction 40 days to analysis
	Pesticides/PCBs	CLP(1)	1 L amber glass	Cool to 4 C	5 days to extraction 40 days to analysis
	Inorganics (Metal only)	CLP(2)	1 L Polyethylene	HNO ₃ to pH<2, 4°C	180 days
	Mercury	CLP(2)	1 L Polyethylene	HNO ₃ to pH<2	26 days
	Alkalinity	USEPA 310.1	1 L Polyethylene	Cool to 4 C	14 days
	Ammonia	USEPA 350.2	1 L Polyethylene	H ₂ SO ₄ to pH<2	28 days
	BOD	USEPA 405.1	1 L Polyethylene	Cool to 4 C	48 hours
	COD	USEPA 410.4	1 L Polyethylene	H ₂ SO ₄ to pH<2	28 days
	Chloride	USEPA 325.1	1 L Polyethylene	None required	28 days
	Chromium VI	USEPA 218.5	1 L Polyethylene	Cool to 4 C	24 hours
	Color	USEPA 110.2	1 L Polyethylene	Cool to 4 C	48 hours
	Cyanide	CLP(2)	1 L Polyethylene	NaOH to pH<12, 4°C	12 days ²
	Amenable Cyanide	USEPA 335.1	1 L Polyethylene	0.6 g ascorbic acid, 4°C	14 days
	Hardness	USEPA 130.2	1 L Polyethylene	HNO ₃ to pH<2 H ₂ SO ₄ to pH<2	6 months
	Phenols	USEPA 420.1	1 L Glass	H ₂ SO ₄ to pH<2 Cool to 4 C	28 days
	MBA	USEPA 425.1	1 L Glass	Cool to 4 C	48 hours
	Nitrate	USEPA 353.2	1 L Polyethylene	Cool to 4 C	48 hours
	Odor	USEPA 140.1	1 L Glass	Cool to 4 C	24 hours
	Sulfate	USEPA 375.4	1 L Polyethylene	Cool to 4 C	28 days
	TDS	USEPA 160.1	1 L Polyethylene	Cool to 4 C	7 days
	Total Kjeldahl-N	USEPA 351.2	1 L Polyethylene	H ₂ SO ₄ to pH<2 Cool to 4 C	28 days
TOC	USEPA 415.2	1 L Polyethylene	H ₂ SO ₄ to pH<2 Cool to 4 C	28 days	

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TABLE 6-1 (Continued)

<u>Matrix</u>	<u>Analysis</u>	<u>Procedure</u>	<u>Container</u>	<u>Preservation</u>	<u>Holding Time</u>
Soil/Sediment	Volatiles	CLP(1)	40 ml VOA vial	None	10 days
	Semi-Volatiles	CLP(1)	8 oz jar	None	10 days to extraction
					40 days to analysis
	Pesticides/PCBs	CLP(1)	8 oz jar	None	10 days to extraction
					40 days to analysis
	Inorganics (Metal only)	CLP(2)	8 oz jar	None	180 days
	Cyanide	CLP(2)	8 oz jar	None	12 days
	Mercury	CLP(2)	8 oz jar	None	28 days
	Amenable Cyanide	USEPA 9010	8 oz jar	4°C	14 days
	Chromium VI	USEPA 7196	8 oz jar	4°C	24 hours
	EPTOX-metals	SW-846-1310(5)	32 oz jar	None	7 days to extraction
					40 days to analysis
	Reactivity	SW-846(5)	8 oz jar	None	14 days
	Ignitibility	SW-846(5)-1010	8 oz jar	None	14 days
	Corrosivity	SW-846(5)-1110	8 oz jar	None	14 days
TCLP-metals	SW-846-1311(5)	32 oz jar	None	7 days to extract, 40 days to analysis	

Notes:

1. USEPA Contract Laboratory Program, statement of Work for Organic Analysis, 2/88.
2. USEPA Contract Laboratory Program Statement for Work for Inorganic Analysis 7/88.
3. Should only be used in the presence of residual chlorine.
4. Maximum holding time is 24 hours when sulfide is present. Optionally all samples may be tested with lead acetate paper before pH adjustments in order to determine if sulfide is present.
5. 40 CFR, 1987, Part 261, App. 111

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Malcolm Pirnie, Inc
2 Corporate Park Dr.
White Plains, NY 10602

Pirnie Job Number : _____

Sample Description : _____

Sampled By : _____ Method : _____

Date : _____ Time : _____

Preservative Added : _____ By : _____

Date : _____ Time : _____
=====

For Lab use
Sample ID Number _____

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SAMPLE LABEL

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FIGURE 6-1

6.4 SAMPLE PRESERVATION/HOLDING TIMES

The analytical laboratory will analyze samples for the constituents given in Table 4-1. The samples will be analyzed by following EPA CLP methodologies. Information on sample containers, preservation techniques, and holding time limits is presented in Table 6-1.

6.5 SAMPLE SHIPPING AND CHAIN-OF-CUSTODY

The sample handling and sample custody procedures described below will be followed during the remedial investigation. A chain-of-custody form (Figure 6-2) will be initiated at the laboratory that will accompany the sample bottles from the laboratory into the field. Upon receipt of the bottles and cooler, the sampler will sign and date the first "received" blank space. After each sample is collected and appropriately identified, entries will be made on the chain-of-custody form which will include: sampler names and signatures, sampling station identification, date, time, type of sample and the required analysis.

After sampling has been completed, the sample containers will be wiped with a clean cloth. Sample tags will be attached and the containers will be placed into coolers. Ice packs will be placed in the coolers to keep the samples cold. Packing materials will also be placed in the coolers to keep the sample containers from moving and possibly breaking. The sampler will sign and date the next "relinquished" blank space on the chain-of-custody form.

The samples will be transported to the laboratory under custody of Malcolm Pirnie personnel, or they will be shipped by an air express service. If the samples are shipped by an air express service, the name of the carrier will be entered under the next "received" blank and the air bill number will be entered on the form. The chain-of-custody form will be placed in the cooler. Two or more custody seals will be signed and dated, and placed on each shipping container, located in a manner that would indicate if the container were opened in transit. Wide, clean tape will be placed over the seals, to ensure that seals are not accidentally broken during shipment.

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CHAIN OF CUSTODY RECORD/SAMPLE REQUEST FORMS

MALCOLM PIRNIE JOB NO.		PROJECT NAME			FACILITY NAME		FACILITY LOCATION	
SAMPLERS: (Signature)					NO OF CON- TAINERS	REMARKS		
SPLIT SAMPLER: OFFERED		() ACCEPTED () DECLINED						
STA. NO.	DATE	TIME	LOG	TIME	STATION LOCATION			
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		

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

0602

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**MALCOLM
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CHAIN-OF-CUSTODY FORM

MALCOLM PIRNIE, INC.

FIGURE 6-2

All samples will be received by the laboratory within 24 hours of collection. Samples will be received by laboratory personnel, who will assume custody of the samples, and sign and date the next "received" blank.

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Amendment #1 to the FSP

As stated in the AAPP Work Plan and QAPjP, an additional sediment sample will be collected from the storm drain in front of AAPP on Dixon Ave. The sampling procedures for this sample will be the same as described for the sediment samples collected from the drainage pools on the AAPP site described in section 5.11.4 of the FSP. The sample will be analyzed for the following parameters according to data quality objective Level IV-CLPRAS:

TCL
TAL
Hexavalent Chromium
Cyanide
Cyanide Amersibles

Equipment decontamination, sample handling and chain of custody requirements will be the same as described in the FSP.

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APPENDIX A
EQUIPMENT CALIBRATION PROCEDURES

ACT 001 0548

0738-02-1113

CALIBRATION PROCEDURES AND FREQUENCY

Calibration procedures for field instrumentation that will be used during the project are discussed in the following sections.

Frequency

The calibration of each instrument will be checked prior to each day's use. Dates and times of the calibration check, serial numbers and procedures as well as the signature of the technician will be entered into the field log book. If the instrument readings are incorrect, the instrument will either be calibrated by the technician or returned to the manufacturer for calibration.

Procedures

Photoionization Detector

With the probe attached to the instrument, the instrument switch will be turned to the battery check position. Check to see that the Span Potentiometer is set at the appropriate setting for the probe being used (5.0 for 9.5 eV probe, 9.8 for 10.2 eV and 5.0 for 11.7 eV.) The needle on the meter should read within or above the green battery area on the scale plate. If the needle is in the lower position of the battery arc, the instrument should be recharged prior to any calibration. If the red LED turns on, the battery should be recharged. Next, the function switch will be turned to the on position. In this position the UV light source will be on.

To zero the instrument, the function switch will be turned to the standby position and the zero potentiometer will be rotated until the meter reads zero. Clockwise rotation of the zero potentiometer produces an upscale deflection while the counterclockwise rotation yields a downscale deflection. If the span adjustment setting is changed after zero is set, the zero will be rechecked and adjusted if necessary. The operator will wait 15-20 seconds to ensure that the zero reading is stable. If necessary, the zero will be readjusted.

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After the instrument has been zeroed, it will be calibrated using nontoxic gas mixtures available from the manufacturer. The instrument probe will be attached to the gas cylinder with a piece of tubing. The valve of the pressurized container will then be opened until a slight flow is indicated and the instrument draws in the volume of sample required for detection. The span potentiometer will be adjusted so that the instrument is reading the stated concentration of the calibration gas.

This procedure will be followed only until the span potentiometer reaches the following limits:

<u>Probe</u>	<u>Initial Span Potentiometer Setting</u>	<u>Maximum Acceptance Span Potentiometer Setting</u>
9.5 eV	5.0	1.0
10.2 eV	9.8	8.5
11.7 eV	5.0	2.0

If these limits are exceeded, the instrument will be returned for maintenance and recalibration. This maintenance will be done only by qualified individuals.

The following information will be recorded in the field notebook.

- Date inspected
- Person who calibrated instrument
- The instrument number (serial number or other identification number)
- The results of the calibration (ppm, probe eV, span potentiometric setting)
- Identification of the calibration gas (source, type, concentration)

Flame Ionization Detector/Organic Vapor Analyzer (OVA)

The OVA is designed to detect, measure, characterize, and identify organic gases and vapors found in the ambient air. Its application is broad, since it has a chemically resistant sampling system and it can be calibrated to quantitatively respond to many different organic compounds. It is extremely sensitive, and in the "survey mode" it provides an accurate indication of organic gas and vapor concentrations in three

ranges: 0 to 10 ppm, 0 to 100 ppm, and 0 to 1,000 ppm. While designed as a lightweight, portable instrument, it can be readily adapted to remote monitoring applications. In addition, the OVA can function as a gas chromatograph ("GC mode") and can thus be used to characterize and identify organic material.

Primary calibration of the OVA is accomplished at the factory by using methane in air samples of known concentration and making adjustments to four potentiometers located on the circuit board inside the instrument. This primary adjustment is relatively stable over time and should not concern field operators. The primary calibration may be checked during factory maintenance procedures which will be required for each unit. Maintenance schedules will be established by the Project Manager.

All OVAs will be calibrated to methane, and records kept on file to document the procedure. A 5 liter (l) gas sampling bag is filled with "clean" air. One cubic centimeter (cc) of a pure methane gas from a calibration cylinder is injected through the septum of the gas sampling bag. The sampling bag is then agitated to ensure complete diffusion of the sample. The concentration in parts per million (ppm) (volume/volume) will be equal to the sample size in cubic centimeters, divided by the volume of the bag in cubic centimeters, times 1,000,000. Therefore,

$$\frac{1 \text{ cc}}{5,000 \text{ cc}} \times 1,000,000 = 200 \text{ ppm}$$

Note: 1 liter = 1,000 cc

The outlet of the sampling bag is connected to the air sampling line of the OVA. The GAS SELECT knob is then adjusted until the meter reading on the OVA is 200 ppm.

Since the instrument is calibrated to methane, the concentration read for other compounds must be expressed as "methane equivalent" concentrations. It is possible to calibrate the instrument to other vapors by adjusting the GAS SELECT knob on the Sidepack control panel. However, this requires a supply of the gas of interest at a known concentration. Cylinders of various gases are commercially available and should be requested with the gas of interest and the balance as air. The

calibration gas should be withdrawn from the cylinder and placed in a sample bag of known volume from which it may be drawn into the OVA. By making the appropriate calculations, samples of known concentration can be prepared. As the OVA draws in the sample, the GAS SELECT knob is turned until the calculated concentration of sample is read on the meter. The instrument is now calibrated to directly read the concentration of the compound of interest.

pH Meter

The pH meter is calibrated before each measurement. To calibrate the instrument, the temperature compensator is first adjusted to the temperature of the water sample. The tip of the probe is then rinsed with deionized water and immersed into a buffer solution with a pH of 7. The meter is then adjusted to read 7.0 and the probe is removed and again rinsed with deionized water. The instrument is checked by immersing the probe into a buffer solution of pH 4.0 (if the sample is expected to have a low pH) or a buffer solution of pH 10 (if the sample is expected to have a high pH). The pH probe is rinsed again, and then immersed into the sample for a measurement. When storing the probe, the tip is immersed in deionized water.

Specific Conductance Meter

Before each measurement of specific conductance, the meter is calibrated by turning the function switch to "red line" and turning the adjustment knob until the needle is aligned with the red line on the meter dial. The function switch is then turned to read conductivity measurements and the instrument readings are checked by immersing the electrode into two buffer solutions with known conductivities. If the readings are not correct, the electrode will be cleaned and then reimmersed into the buffer solutions. If the readings are still incorrect, the instrument will be returned to the manufacturer for repair.

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Temperature Probe

To check the temperature instrument, both the probe and a thermometer that is approved by the National Bureau of Standards is immersed into the same beaker of water. Any differences in temperature are noted and recorded in the field log.

Combustible Gas Indicator

To verify that the combustible gas indicator is operating properly and retaining factory calibration, the following procedure is followed at the beginning of each day, in an atmosphere free of combustible gases.

1. Open cover and set RANGE switch to 0-5.
2. Set ON/OFF switch to ON. Ready indicator should turn on within approximately 4 seconds. BATT indicator pointer should be at least halfway into the white zone.
3. Squeeze aspirator bulb 8 to 10 times to purge instrument with fresh air. Permit bulb to inflate completely after each squeeze.
4. Lift and adjust 0-5 ZERO control to obtain zero indication on meter. (NOTE: to make zero adjustments, lift and turn the outer sleeve of the ZERO controls).
5. Set RANGE switch to 0-100. READY indicator should momentarily turn off and then turn on within approximately 4 seconds.
6. Lift and adjust 0-100 ZERO control to obtain zero indication on meter.
7. Connect source of 100% methane to inlet fitting of instrument. Pass gas through instrument and then shut off flow. Meter should indicate at least 95.

8. Repeat step 3 and set RANGE switch to LEL.
9. Connect flow control of Calibration Check Kit, Model R, to Calibration Check Gas Cylinder (2% methane) and connect adapter hose between flow control and inlet fitting of instrument.
10. Turn flow control valve counterclockwise to pass gas through instrument. Turn valve clockwise and, when needle stabilizes, meter should indicate 1.9 to 2.1.
11. Disconnect hose from inlet fitting and remove flow control from gas cylinder. Squeeze aspirator bulb 8 to 10 times to purge instrument with fresh air.

If the instrument is not accurately reading the concentrations of the calibration gases, the following calibration procedure will be followed in an atmosphere free of combustible gases.

1. Open cover and loosen clasps securing top and bottom sections of case.
2. Remove bottom section of case and place instrument on rubber bumpers, so that meter can be read.
3. Set RANGE switch to 0-5 and ON/OFF switch to ON. Needle should come to rest near 0 and READY indicator should turn on.
4. Squeeze aspirator bulb 8 to 10 times to purge instrument with fresh air. Permit bulb to inflate completely after each squeeze.
5. Lift and adjust 0-5 ZERO control to obtain zero indication on meter.

6. Connect flow control of Calibration Check Kit, Model R, to Calibration Check Gas Cylinder (2% methane) and connect adapter hose between flow control and inlet fitting of instrument.
7. Turn flow control valve counterclockwise. When needle stabilizes, meter should indicate 2. If it does not, turn LEL span adjustment to obtain 2 on meter.
8. Disconnect adapter hose from inlet fitting.
9. Squeeze aspirator bulb 8 to 10 times to purge instrument with fresh air. Meter should indicate 0. If it does not, lift and adjust 0-5 ZERO control to obtain zero indication on meter; then connect adapter hose to inlet fitting and repeat steps 7 and 8. Remove flow control from gas cylinder.
10. Set RANGE switch to 0-100 and, when READY indicator turns on, lift and adjust 0-100 ZERO control to obtain zero indication on meter.
11. Connect source of 100% methane to inlet fitting. Pass gas through instrument and then shut off flow. Meter should indicate 100. If it does not, turn GAS span adjustment to obtain 100 on meter.
12. Disconnect source of methane and squeeze aspirator bulb 8 to 10 times to purge instrument with fresh air. Meter should indicate 0. If it does not, adjust 0-100 ZERO control to obtain zero indication on meter; then repeat steps 11 and 12.
13. Place instrument in bottom section of case and clasp top and bottom sections together. Close cover.

APPENDIX B

DECONTAMINATION PROCEDURES

ACT 001 0556

DECONTAMINATION PROCEDURES

Sampling Equipment

Any equipment that will be used to collect samples, such as stainless steel trowels, stainless steel spatulas, split-spoon samplers Van Dorn water samplers and WILDCO gravity samplers will be contaminated at an upwind location on the site, following the procedures described below:

The required decontamination procedure for all sampling equipment is as follows:

- a. wash and scrub with low phosphate detergent
- b. tap water rinse (from Suffolk County Public Supply)
- c. rinse with 10% HNO₃, ultrapure
- d. tap water rinse (from Suffolk County Public Supply)
- e. acetone only rinse of methanol followed by hexane (pesticide grade or better)
- f. thoroughly rinse with deionized demonstrated analyte free water (volume used during this rinse must be 3-5 times the volume of solvent used in Step e.)
- g. air dry
- h. wrap in aluminum foil for transport

When using a split-spoon sampler which is composed of carbon steel instead of stainless steel, the nitric acid rinse may be lowered to a concentration of 1% instead of 10% so as to reduce the possibility of leaching metals from the spoon itself.

This procedure applies to all sampling equipment including stainless steel bailers.

At the end of each day, the wash and rinse water will be drained into drums for proper disposal. The drums will be labelled with the project site name, date and drum contents. Non-interfering containers such as those made of glass, Teflon or stainless steel will be used to transport the hexane.

Electronic Water Level Indicator

The electronic water level indicator will be decontaminated before being used in each well by following the procedures described below.

1. Wash probe and cable with Alconox detergent and tap water.
2. Rinse with distilled water. Allow water to drain into tub.
3. Allow instrument to air dry.
4. Place instrument into plastic bag.

The wash and rinse water will be disposed of, as described above.

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Submersible Pump

The submersible pump will be decontaminated between each use by first cleaning the outside of the pump with a 20-gallon flush of Alconox detergent and a tap water rinse. This will be followed with a 20-gallon flush of tap water through the pump. The flushing will be accomplished by filling a clean plastic overpack drum with tap water. The pump will run long enough to flush 20 gallons through the pump housing. The water will be discharged into a 55-gallon drum and stored on-site.

Decontamination of Stainless Steel Bailers

The bailers used to collect ground water samples will be laboratory cleaned, autoclaved, packaged and dedicated for use at one sample location for each day of sampling. Extra bailers will be available on site in the event problems occur which prohibit the use of a particular instrument. After autoclaving is completed, the bailer will be wrapped in clean and autoclaved aluminum foil or equivalent material.

Decontamination of Drilling Equipment

All down-hole drilling equipment will be decontaminated prior to the start of drilling operations, between each soil boring, and between each monitoring well installation. Decontamination will be accomplished with a steam cleaner and will consist of spraying the equipment with high pressure steam. Additionally, the drill rig will be decontaminated both before beginning work and prior to leaving the site.

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OPERATION PROCEDURES
MINIRAM MODEL PDM-3

ACT 001 0559

1.0 DESCRIPTION

1.1 Sensing Method

The MINIRAM (for Miniature Real-time Aerosol Monitor) Model EDM-3 is an ultra-compact personal-size airborne particulate monitor whose operating principle is based on the detection of scattered electromagnetic radiation in the near infrared. The MINIRAM uses a pulsed GaAlAs light emitting source, which generates a narrow-band emission (half-power width of 80 nm) centered at 880 nm. This source is operated at an average output power of about 2 mW. The radiation scattered by airborne particles is sensed over an angular range of approximately 45° to 95° from the forward direction by means of a silicon-photovoltaic hybrid detector with internal low-noise preamplifier. An optical interference-type filter is incorporated to screen out any light whose wavelength differs from that of the pulsed source.

The MINIRAM is a light scattering aerosol monitor of the nephelometric type, i.e., the instrument continuously senses the combined scattering from the population of particles present within its sensing volume (approximately 1 cm³) whose dimensions are large compared with the average separation between the individual airborne particles.

1.2 Open Sensing Chamber Sampling Method

Air surrounding the MINIRAM passes freely through the open aerosol sensing chamber as a result of air transport caused by convection, circulation, ventilation, and personnel motion. The MINIRAM requires no pump for its operation, and the scattering sensing parameters have been designed for preferential response to the particle size range of 0.1 to 10 micrometers, ensuring high correlation with standard gravimetric measurements of both the respirable and thoracic deposition fractions. Optional flow accessories are available for applications requiring specific inertial particle precollection, extractive sampling, concurrent filter collection, etc.

It should be noted that one of the advantages of direct light scattering aerosol sensing is that the rate at which air passes through the sensor does not influence the indicated concentration because the detection is performed directly on every parcel of air traversing the fixed sensing volume.

Therefore, flow velocity through a real-time sensor such as the MINIRAM influences only the response time. So it should not surprise the first-time user when, upon pressing the MEAS key of the MINIRAM, no pump noise is heard, and this silence will be accompanied by a readout message of "GO" on the liquid-crystal display indicating that the MINIRAM has, indeed, been activated.

1.3 MINIRAM Electronics

The MIE MINIRAM is a very advanced aerosol monitor which incorporates a custom-designed single-chip CMOS microprocessor whose functions are to: process the signal from the light scattering detection circuit, control the measurement sequence program, compute concentration averages, keep record of elapsed time, perform automatic zero correction, control auto-ranging, drive the liquid-crystal-display, store average concentration values as well as timing and identification information, sense battery and overload conditions, sequence playback of stored information, and provide alarm signals.

The MINIRAM derives its power from a set of internal rechargeable Ni-Cd batteries which can provide continuous monitoring operation for over 8 1/2 hours, or retain stored information for up to approximately 6 months. The battery set is packaged as a separable module which allows easy field replacement when recharging is not feasible. The MINIRAM can be run without time limit from an A.C. line using the charger provided with the instrument.

The MINIRAM has two output connectors. One provides a continuous, real-time analog signal output proportional to the aerosol concentration. This signal can be used for continuous recording (e.g., on a strip chart recorder), telemetry, or control purposes, etc. The other connector provides, during the measurement mode, either an ASCII digital output which is updated every 10 seconds, or a switched output for alarm purposes (depending on the user-selected function). Stored information playback can be accomplished either by means of the MINIRAM's own display or through the digital output jack. During the normal monitoring operation, the liquid-crystal-display indicates the aerosol concentration in the units of milligrams per cubic meter, and the displayed reading is updated every 10 seconds. When operating in the measurement or monitoring mode, other functions can be displayed

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momentarily, i.e., as long as a corresponding touch switch is pressed. All external controls are performed by pressing one or more of 8 sealed touch switches on the MINIRAM panel.

1. Modes of Use and Application

The MINIRAM measures the concentration of any airborne particles, both solid and liquid, and the display indicates this level in the units of milligrams per cubic meter, based on its factory calibration, against a filter-gravimetric reference, using a standard test dust (Arizona road dust). The MINIRAM can be used to measure the concentration of all forms of aerosol: dusts, fumes, smokes, fogs, etc.

Its small size and weight, and concentration averaging features permit its use as a personal exposure monitor, attached to a belt, shoulder strap, hard hat, etc. Alternatively, it can be used as an area monitor for both indoor and ambient air situations. Test chamber monitoring, visibility measurements, cloud detection (e.g., radio/drop sonde), aerosol dispersion studies, etc. are additional applications of the MINIRAM.

2.0 WHEN YOU RECEIVE THE MINIRAM ...

Follow these steps when first receiving your MINIRAM:

- 2.1 Remove the instrument from shipping case.
- 2.2 Observe display. It should be blank indicating that the MINIRAM is in the minimum power mode.
- 2.3 Plug charger into A.C. line (standard charger is for 120V, 60 Hz; optional version available for 220V, 50 Hz).
- 2.4 Connect charger plug into corresponding MINIRAM receptacle.
- 2.5 Leave charger connected to MINIRAM for a minimum of 8 hours before using instrument without the charger.

2.5 You can operate the MINIRAM immediately after the charger has been connected. Follow operating instructions described in the next section of this manual.

3.0 OPERATING INSTRUCTIONS

Refer to Figure 1 for the location of control switches, display, and connector jacks. Refer to Figure 2 for the display timing sequences.

3.1 Initial Condition

Assuming that the batteries of the MINIRAM have been recharged (see section 2.0), the display may indicate one of the following conditions:

- Blank display: Means the MINIRAM had not been in the measurement mode for 48 hours or more, and is in the minimum power off mode.
- "OFF" display: MINIRAM has been in the off mode for less than 48 hours.
- Concentration display that changes or "blinks" once every 10 seconds: the MINIRAM is in the measurement mode.

3.2 To start Measurement Cycle

- If the MINIRAM shows a blanked display (see above), press OFF and wait until the display reads "OFF" (approximately 5 seconds after pressing OFF), before pressing MEAS to initiate measurement cycle.
- If the MINIRAM shows "OFF" (see above), press MEAS directly to initiate measurement cycle (there is no need to press OFF first, in this case).

The functions performed by pressing each MINIRAM touch switch are as follows:

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3.2 MEAS

To start the monitoring operation of the MINIRAM, Press MEAS (see automatic timing sequence of Figure 2). The first readout displayed is either "00" or "CGO" (if TIME is also pressed, section 3.4), followed by the last concentration reading or ".00". Approximately 30 seconds after pressing MEAS the first new 10-second-averaged concentration reading is displayed. All subsequent readings are concentration values in milligrams per cubic meter, updated every 10 seconds. Figure 3 shows a typical digital printout of a sequence of 10-second measurements (second data block).

The MINIRAM will now run in the measurement mode for 500 minutes (8 hours and 20 minutes), after which it will stop, displaying the OFF reading, retaining in storage the concentration average and elapsed time information. Once the MEAS mode has been entered this sequence can only be interrupted by pressing OFF; pressing ZERO, TWA, SA, TIME or ID# only affects the display during the time these keys are pressed, without affecting the measurement cycle. Pressing PBK during this cycle has no effect.

The instrument normally operates in the .00 to 9.99 mg/m³ range. Whenever a 10-second concentration exceeds 9.99 mg/m³ the MINIRAM display automatically switches to the .0 to 99.9 mg/m³ range and remains in that range as long as the measured 10-second concentration exceeds 9.99 mg/m³, otherwise the MINIRAM reverts to its lower range display.

3.3 MEAS and TIME

If both MEAS and TIME are pressed at the same time (press TIME first and while depressing it actuate MEAS) the MINIRAM will display "CGO" (for Continuous "GO"), and will then operate as above (i.e., pressing MEAS only), except that after the first 8.3 hour run it will restart automatically and continue to measure for an indefinite number of 8.3 hour runs, (with the battery charger) until the OFF key is pressed, or until the batteries are exhausted. Concentration averages and timing information for the last seven 8.3 hour runs will remain in storage at any given time.

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OFF

When this key is pressed the MINIRAM will discontinue whatever mode is underway displaying "OCA" * followed by the display segments check ("3.3.3=") and finally "OFF" (see timing diagram of Figure 2). The MINIRAM will then remain in this reduced power condition (displaying "OFF") for a minimum of 10 minutes or a maximum of 48 hours or until the MEAS key is pressed to resume the measurement cycle.

If OFF is pressed during a measurement run the display will read "OFF" for 48 hours (unless another key is pressed during that period), after which the display will be blanked. Thereafter, if OFF is pressed the MINIRAM will display the "OFF" reading for only 10 minutes, after which the display will be blanked again unless another key is pressed during that period.

Every time the OFF key is pressed, during a measurement cycle, the MINIRAM will store the concentration average and elapsed monitoring time up to the time of that OFF command. The duration of the off period (up to 48 hours), i.e., between two consecutive measurement cycles, is also stored for each of up to 7 cycles.

If the MINIRAM is not reactivated (i.e., pressing MEAS) within 48 hours of the OFF Command, it automatically switches to a minimum power level, with blanked display; however, all data remains stored in memory for up to approximately 6 months without battery recharging (indefinitely, with charger).

OFF must be keyed before any other operating mode can be entered: setting ID#, zero referencing, playing back stored data, or changing the program code. Display functions, however, can be activated during the measurement mode.

"OCA" is displayed and printed out by the PDM-3 although the instrument is manufactured by MIE, Inc.

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3.5 TIME

During the measurement mode, if TIME is pressed the display will show the elapsed time, in minutes, to three significant figures, from the start of the last measurement run. The MINIRAM will automatically return to concentration display after the TIME key is released.

3.7 TWA

This key stands for Time-weighted-Average. During the measurement mode, if TWA is pressed the display will indicate the average concentration in milligrams/m³ up to that instant, from the start of the last run. This average is computed by the MINIRAM applying the equation:

$$TWA = \frac{1}{t} \int_0^t C dt$$

where t is the elapsed run time and C is the instantaneous concentration at time t. The value of TWA is updated every 10 seconds. After releasing the TWA key the MINIRAM display returns to the 10-second concentration display.

3.8 SA

This key stands for Shift-Average. During the measurement mode, pressing SA will provide a display of the aerosol concentration, up to that moment, averaged over an 8-hour shift period. This average is computed by the MINIRAM applying the equation:

$$TWA = \frac{1}{80 \text{ Min.}} \int_0^t C dt$$

The shift-average value corresponds to the exposure from the start of the measurement cycle. Thus, for example, if the MINIRAM has been measuring for 3 hours, and the time-weighted average over that period has been 6 mg/m³

(TWA reading), the shift average value at that time. SA reading would be 1 mg/m^3 , which is equivalent to an 8-hour exposure to an average concentration of 1 mg/m^3 .

The value of SA is updated every 10 seconds. When releasing the SA key the MINIRAM display returns to the 10-second concentration display.

3.9. PBK

With the MINIRAM in the off mode (i.e., not in the measurement mode), the stored information can be played back by pressing PBK. If the PBK key is initially pressed the display will indicate "P" for one second. If PBK continues to be pressed for more than 1 second, then the stored data is automatically played back through the MINIRAM display. First, the identification number is displayed with the ID indicator bar on; next the shift or run number (7 through 1, i.e., starting with the last run) is shown (with the OVR indicator bar on as identification); followed by the sampling (i.e., measurement) time in minutes, for that run; followed by the off-time between the last and next run (in tens of minutes); finally, the average in mg/m^3 *. This sequence is repeated seven times. An average reading of 9.99 indicates that a significant overload condition occurred during that run. The total time required for the complete automatic playback on the MINIRAM display is approximately 70 seconds.

If PBK is pressed for less than one second "PA" will be displayed, and the stored data will be fed out through the digital output jack of the MINIRAM for printout, magnetic storage, telemetry, etc. A printout consists of 8 lines of data. Figure 3 shows a typical stored data printout (see data block labeled "Playback of Stored Data"). The first 7 lines show the data for the last 7 measurement periods, and the last line shows the identification number (I), the programmable selection code (F), and the zero value for that data block (Z). In addition a check sum is printed out on a 9th line for

*Either the TWA or the SA values, depending on selected user-programmable code (see Section 4.2).

modem/computer data transfer purposes. The first 7 data lines are subdivided into 4 columns. The first column identifies the measurement period (starting with the last of 5 min); the next column lists the corresponding duration of each measurement period, in minutes; the third column lists the off time between consecutive measurement periods, in minutes divided by 100; and the last column lists the average concentration values for each period in mg/m^3 .*

Either time-weighted, or shift average values can be printed, depending on the selected programmable code (see section 4.2). The example shown on Figure 3 (F=0012) indicates that the TWA values are listed. Although the printout heading will indicate "PDM-2 LISTING" (as shown in Figure 3), this format applies equally to the MINIRAM model PDM-3.

The speed of the digital transfer to a printer or other digital device can be user selected through the programmable selection code (see section 4.2). For a 300 baud rate the transfer time for the stored data block is approximately 45 seconds. See sections 10.0 and 11.0 for instructions on how to connect the MINIRAM to a printer or other digital recording/processing device.

3.10 ZERO

The interior walls of the MINIRAM sampling chamber reflect a small amount of the light from the infrared source into the detector. This background level is referred to as the "zero value", and is automatically subtracted from all aerosol concentration readings during the measurement mode. The result is that the displayed readings depend only on the actual dust concentration present within the sensing chamber.

The zero value varies from instrument to instrument as well as with different sensing chambers. It will increase somewhat as the chamber inner walls and windows become contaminated with dust. A zero update should be performed after cleaning the sensing chamber (see section 12.0).

*Either the TWA or the SA values, depending on selected user-programmable code (see Section 4.2).

Pressing ZERO during a measurement period provides momentary display of the stored zero concentration value used by the MINIRAM to correct all digital concentration readings (the analog output signal is not zero-corrected). To update the ZERO value the MINIRAM must be in its off condition (press OFF in case of doubt). Then, press ZERO and wait until the display again indicates "OFF".

The average of 4 consecutive 10-second zero level measurements will then be stored by the MINIRAM as the new ZERO reference value. (See timing diagram in Figure 2 and digital printout obtained during a typical zero check on Figure 3). When operating the MINIRAM in high particle concentration environments ($>5 \text{ mg/m}^3$) the zero value update should be performed approximately every 8 hours. At aerosol concentrations below approximately 1 mg/m^3 this update may only be required once a week, or even less frequently. The zero update should be performed either within a clean-air environment (ideally, a clean room or clean-bench) for dust measurements in the concentration range below 0.5 mg/m^3 , approximately, or by flowing clean air through the sensing chamber of the MINIRAM (e.g., by means of an optional clean-air adaptor, MIE model PDM-1FZ Zero Check Module) (see section 17.2) for use at dust concentrations above 0.5 mg/m^3 , approximately. Air conditioned offices (without smokers) usually have concentrations below approximately 0.05 mg/m^3 and can thus be used for zeroing purposes. When measurements are performed under essentially clean air conditions, e.g., in the same environment where the zero check was performed, the MINIRAM readings will indicate 0.00 mg/m^3 with small random fluctuations around that value. Positive values (e.g., 0.02) will thus be indicated on the LCD display. Negative values (e.g., -0.02) are suppressed and are also indicated as 0.00. The digital output, however, does include such negative values and these will be printed out by a digital printer (see sections 10.0 and 11.0)

3.11 ID#

Pressing ID# during a measurement period provides momentary display of the identification number stored within the MINIRAM memory.

The ID# key, in combination with other keys, is used for several additional programming functions described in the next section (4.0).

4.0 PROGRAMMABLE FUNCTIONS

4.1 ID# Selection

In order to change the instrument identification number the MINIRAM must first be in the off mode (i.e., press OFF). Then press the ID# key, and the presently stored number (between 1 and 999) will be displayed, as well as the ID indicator bar. To increment the identification number press the ▲ key (same key as TWA), and to decrement the number press the ▼ key (same key as SA). Any number between 1 and 999 can thus be selected and will remain in storage until the batteries are disconnected, or if the MINIRAM is not recharged over a 6-month period.

Pressing the OFF key after the above identification number selection will remove the MINIRAM from the ID# selection routine and lock-in that number until a new number is selected. A complete ID# lock-out (i.e., a routine to preclude panel-control change of that number) can be accomplished by a separate programmable code selection (see section 4.2).

4.2 Programmable Selection Code

The programmable code allows the user to panel-select several alternate functions and operating modes.

The program codes to select specific alternate operating modes are:

- 1 selects the alarm instead of ASCII digital output
- 2 selects the ID# lock-out
- 4 selects the TWA instead of the SA to be stored for playback
- 8 selects a 1-second pause after each printer carriage return (for slow printers)
- 32 selects 110 baud digital output rate instead of 300 baud
- 64 selects 600 baud digital output rate instead of 300 baud

These numbers are entered as a sum, e.g., to implement ID# lock out, TWA storage, and 1-second carriage return delay, the code number would be 14 (2+4+8).

To enter the desired code (e.g., 14) follow these steps:

- Press OFF key and wait until "OFF" is displayed.
- Press ID# key and set program code to desired number (e.g., 14) by means of the ▲ and ▼ keys.
- Press TIME key (this will show previously entered code).
- Press ID# key again to lock in the new program code which will then be displayed.
- The preceding steps will cause the ID# to become equal to the programmable selection code. To restore the desired ID# (without affecting the selected code number which is now locked in), use the ▲ and ▼ keys again to select the ID# for the instrument as described in section 4.1.
- Press OFF to exit the ID# selection routine.
- To look at the programmed code number, at any time, start from the off condition; press ID#, then press TIME ("F" will then be displayed momentarily), after which the code number will be displayed. Press OFF to exit the code number routine.

If no specific alternate code is entered the MINIRAM will operate in its standard mode (equivalent to code 12) consisting of the following:

- ASCII digital output
- Panel-selectable ID number (preset to 999)
- Time-weighted Average (TWA) values in memory storage
- 7-bit ASCII resolution
- 300 baud digital output
- Printer carriage return followed by a 1 second delay

4.3 ID# Lock-out

If the ID# lock-out code has been selected (i.e., a 2 as part of the sum, as described in section 4.2) then both the ID# and the programmable code can only be displayed (and printed out), but neither of the two can then be

changed by means of the panel keys. In this case, in order to change the ID# or the lock-out code has been selected, or too alter the programmable code, the battery must be unplugged momentarily. Disconnecting the battery, however, causes the MINIRAM to lose all stored data, and cancels all alternate program codes which may then be restored following the procedure described in section 4.2.

4.2 Alarm Level Adjustment

If the selected program code includes a 1, the MINIRAM will not provide an ASCII digital output but instead a switched output (at the digital output connector) which will close every time the measured 10-second concentration value exceeds a presettable threshold concentration level. If a 1 has been included in the code, then the ID# divided by 10 becomes the alarm level in milligrams/m³. This level can be adjusted following the ID# selection procedure of section 4.1, that is using the ▲ and ▼ keys to increment or decrement the number. For example, if an alarm level of 12.5 mg/m³ is desired (and starting from the off mode), press ID#, adjust displayed number to 125 with the ▲ and ▼ keys, and press OFF. This number (e.g., 125) then becomes the ID# as well. It is not possible to enter a separate alarm level and ID# number.

5.0 OVERLOAD AND ERROR CODE INDICATORS

5.1 Bar Displays

There are three bar indicators on the MINIRAM display, identified as OVR, ID, and BAT. If the OVR bar is displayed at any time during operation in the measurement mode the MINIRAM detection circuit has been overloaded. A momentary overload can be caused by the insertion of an object into the sensing chamber, sudden exposure to sunlight, etc. If the cause of overload is eliminated, the OVR bar will disappear during the next 10-second display period, unless the overload persists for more than a total of 1 1/2 minutes over an 8 1/3 hour measurement cycle.

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The ID bar display is activated only for display identification purposes and not for error conditions.

The BAT bar is displayed when the battery voltage becomes insufficient, indicating that the charger should be plugged into the MINIRAM.

4.2 Error Codes

The MINIRAM will display and output (at the digital output jack) error code numbers along with the corresponding overload indicator bars on the LCD readout. These codes will appear only if the problem persists for more than about 30 seconds.

The error code numbers are as follows:

- .01: low battery condition
- .02: RAM (digital processing)
- .03: A/D (signal) overload

If an overload condition persists for more than approximately 1 1/2 minutes the selected concentration average value (SA or TWA) automatically registers 9.99 and that number will be indicated (or digitally transmitted) upon data playback, signifying an invalid measurement cycle. The OVR bar will then remain on for the rest of that run.

4.3 SENSING CHAMBER REMOVAL AND INSERTION

During normal operation of the MINIRAM the removable sensing chamber (see Figure 1) must be properly inserted, i.e., pushed all the way into the MINIRAM towards the display/control panel end of the instrument. When this chamber is properly positioned the surface on the opposite end from the display/control panel will be approximately flush with the body of the MINIRAM.

To remove the sensing chamber, gently push it away from the display/control panel end, using both thumbs, sliding it out of its channel. This will expose the shouldered metal button with its small spring-loaded plunger, and the two lenses (illumination and detection lenses). Touching of

8.0 CALIBRATION ADJUSTMENT

Although every MINIRAM has been factory-calibrated using a representative dust (see section 7.0), the user may wish to change the calibration constant of the instrument for a specific type of aerosol. Such a calibration should be performed by obtaining a concurrent filter collection (e.g., by means of a personal filter sampler), sampling from the same environment within which the MINIRAM is placed. The average concentration obtained by the MINIRAM (i.e. TWA reading) at the end of the test should be compared with the filter-gravimetric-determined concentration. The ratio of the two concentration values can then be used to correct the MINIRAM calibration. The comparison run should be replicated several times (to minimize errors) to obtain an average ratio.

To change the MINIRAM calibration proceed as follows:

- 8.1 Place MINIRAM in a clean environment (e.g. air conditioned office).
- 8.2 Remove battery pack (follow procedure of section 7.0).
- 8.3 Disconnect battery connector (remember that all stored data will thus be lost/erased from MINIRAM memory).
- 8.4 While leaving battery pack lying next to MINIRAM, re-connect the two units (i.e. plug in connector).
- 8.5 Immediately observe MINIRAM display. It will be performing a slow segment-by-segment display checkout. As soon as it displays ".00", press OFF, thus interrupting the initial automatic zero check (see section 7.0). Wait until the display indicates "OFF" and then press MEAS and wait approximately 36 seconds.
- 8.6 Observe 10-second readings (typically in the range of 1 to 3 mg/m^3) and record manually a few consecutive readings. Calculate the average of these values.

8.7 Identify small potentiometer screw visible through an opening in the foil shield of the open MINIRAM) opposite the digital output jack. Adjust this potentiometer, using a fine screw driver, until the average MINIRAM reading is increased or decreased (with respect to the average obtained in 8.6) by the desired ratio (e.g. as determined by previous gravimetric comparison runs).

8.8 Shut off MINIRAM, reposition and secure battery pack, and re-zero instrument as usual. All subsequent concentration readings are now corrected by the desired ratio.

If an optional Reference Scatterer is available, insert in the MINIRAM instead of the normal sensing chamber and follow the same procedure (i.e., follow steps 8.1 through 8.8).

9.0 ANALOG RECORDER CONNECTION

The analog output of the MINIRAM is a negative voltage of 0 to 1.5 V. A high input impedance recorder ($>100K\Omega$), or other signal processing device can be connected to that output. The 0 to -1.5V range corresponds approximately to 0 to 100 mg/m^3 as displayed by the MINIRAM.

This analog output (as opposed to the digital output and readings) is not zero-corrected, and thus a zero concentration results in a bias level of the order of several millivolts.

It is advisable to connect a capacitor in parallel with (i.e. across) the analog output (e.g. 100 microfarads or larger) in order to obtain a steady output signal. The internal time constant of the analog output of the MINIRAM is only 0.2 seconds which, in the absence of an external capacitor, results in excessive signal fluctuations.

Two miniature plugs are provided with the instrument to connect to the analog and/or digital output jacks (both can be used concurrently).

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To use the check sum the host computer must add the ASCII value of all digits, spaces, carriage returns, and line feeds except for the first two carriage returns and line feeds which are sent immediately after pressing the PBK switch. The last eight bits of this sum should then be expressed as a decimal number (0-255) and should agree with the decimal value of the MINIRAM check sum.

12.0 ROUTINE MAINTENANCE

When the MINIRAM is not being operated it should be placed in its snipping case which should then be closed. This will minimize the amount of particle contamination of the inner surfaces of the sensing chamber.

After prolonged operation within, and exposure to particulate-laden air, the interior walls and the two glass windows of the sensing chamber may have become contaminated with particles. Although repeated updating of the zero reference following the procedure of section 3.10 will correct errors resulting from such particle accumulations, eventually this contamination could affect the accuracy of the measurements as a result of excessive spurious scattering, and significant attenuation to the radiation passing through the glass windows of the sensing chamber.

An indication of excessive chamber contamination is provided by the zero level reading (section 3.10), which should not exceed 3 mg/m^3 , approximately.

In order to clean a soiled sensing chamber remove that chamber as described in section 7.0 and wash it with soap and water, rinsing thoroughly to remove any residues from the glass windows and interior of the chamber. Do not use solvents of any type. Do not rub interior surfaces of the chamber (coated version). Allow the sensing chamber to dry completely and re-insert into the MINIRAM as indicated in section 7.0

13.0 PRECAUTIONS AND OPERATING POSITIONS

The interior of the MINIRAM sensing chamber should not be exposed to fluctuations of intense light; flashes of sunlight or bright daylight especially, are to be avoided. Such excessive variable illumination of the

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scattering detector can result in significant measurement errors that may persist over several 10-second display cycles. In order to operate the MINIRAM under those conditions it is advisable to use the Sunshield accessory MIE model PDM-SNS, see section 17.37.

Another potential source of error is the presence of reflecting surfaces in close proximity to the sensing chamber openings. Such objects should be kept at least 2 cm (3/4 inch) from the chamber openings.

The removable sensing chamber should not be used as a carrying handle, especially not while operating the MINIRAM; holding this chamber may affect the measurements.

When using the MINIRAM for personal monitoring it should be positioned vertically, i.e., with the display/control panel facing upwards, by either clipping the MINIRAM to the belt, shoulder strap, etc.

In general, an approximate vertical position is to be preferred for any long-term monitoring purposes, in that this position minimizes potential particle deposition within the removable sensing chamber.

Other monitoring positions are:

- a) horizontal, resting on belt clip
- b) hand held (while ensuring that hand and fingers are away from edges of sensing chamber)
- c) Using the optional MINIRAM table stand
- d) Wall mounted using belt clip, or the four battery pack attachment screws on the back of the MINIRAM.

14.0 INTRINSIC SAFETY

The MINIRAM has been designed to satisfy the requirements for intrinsically safe operation in methane-air mixtures. The sealed battery pack incorporates a current-limiting resistor that limits the battery short circuit current to less than 14A. MSHA 2G-3532-0 approval has been granted to the PDM-S.

3.0 SPECIFICATIONS

- Measurement ranges: 0.01 to 10 mg/m³ and 0.1 to 100 mg/m³
- Precision and stability (for 10 sec. readings)*: ± 0.03 mg/m³ (-sigma)
- Precision and stability of time-averaged measurements*:
 - 0.02 mg/m³ (for 1 minute averaging)
 - 0.006 mg/m³ (for 10 minute averaging)
 - 0.003 mg/m³ (for 1 hour averaging)
 - 0.001 mg/m³ (for 8 hour averaging)
- Temperature coefficient: 0.005 mg/m³ per °C (typical)
- Readout resolution: 0.02 mg/m³ or 0.1 mg/m³ depending on automatically selected range (3 digit LCD)
- Digital readout updating time: 10 seconds
- Analog output time constant: 0.2 seconds
- Total measurement period: 8 1/3 hours, or indefinite 8 1/3 hour cycles
- Particle size range of maximum response: 0.1 to 10 μ m in diameter
- Measurement display: normally 10 second real time measurement; or momentarily: time-weighted average, or 8-hour equivalent shift average, or elapsed sample time (in minutes), or zero value, or identification number, or programmable code
- Data storage: seven concentration averages, sampling periods in minutes (3 significant figure resolution), off time (10 minute resolution), identification number, zero value, programmable code, and check sum
- Real time outputs: analog (0 to 1.5V full scale), and digital ASCII
- Memory playback: either by own LCD display, or by 110, 300 or 600 baud, ASCII digital output (20 mA current loop, or RS232 terminals may be connected with appropriate interface)
- Nominal battery voltage: 7.5V
- Average battery current drain: 40 mA

*At constant temperature (typ. 25°C)

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- Continuous operating time with full battery charge: 10 hours, approximately
- Operating temperature: 0° to 50°C (32 to 120°F) Storage: -10 to 50°C
- Outside dimensions: main body: 10 x 10 x 4 cm (4 x 4 x 1.6 inches); sensing chamber cover: 7.7 x 3.8 x 1.5 cm (3 x 1.5 x 0.6 inches)
- Weight: 0.5 kg. (1.1 lb. oz.)

16.0 STANDARD ACCESSORIES

Accessories provided with each MINIRAM are detailed in the following subsections.

16.1 Battery Charger

The battery charger (MIE model PDM-1-157-1) serves the following functions: recharge or maintain the charge of the nickel-cadmium batteries within the MINIRAM, permit continuous a.c. power line operation, and provide power for the operation of pump of the optional MIE model PDM-1FZ Zero Check Module (see section 17.2). The charger cannot be used to power the MINIRAM without its batteries, however, it can be used to charge a separate or spare battery pack (MIE model PDM-3B, see section 7.0).

The standard battery charger is designed for a 120V/60 Hz input, however, it can be obtained for 220V/50 Hz if so specified.

16.2 Other Standard Accessories

Other accessories supplied with the MINIRAM are:

- Output connectors (can be used for the analog, and/or the digital output jacks);
- Snipping Case;
- Instruction Manual.

List of Figures

- 1 Main View of MINIRAM
- 2 Timing diagram of MINIRAM model PDM-3 when pressing OFF, MEAS or ZERO (typical times)
- 3 Typical MINIRAM Model PDM-3 Digital Printout Format
- 4 10 mA Loop Connection
- 5 RS-232 Connection

ACCESSORY ATTACHMENT
INSERTS (6-32 THREAD)

REMOVABLE SENSING
CHAMBER

LCD READOUT

BATTERY
PACK

ANALOG
OUTPUT

CHARGE
8VDC

DIGITAL
OUTPUT

BELT CLIP

TOUCH SWITCH
PANEL

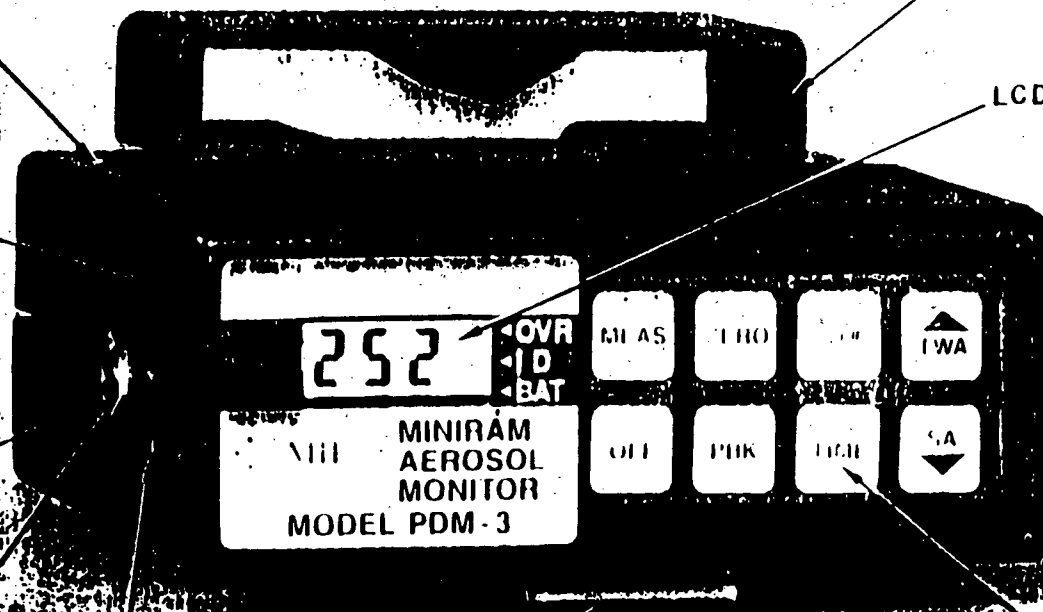


Figure 1. Main view of MINIRAM.

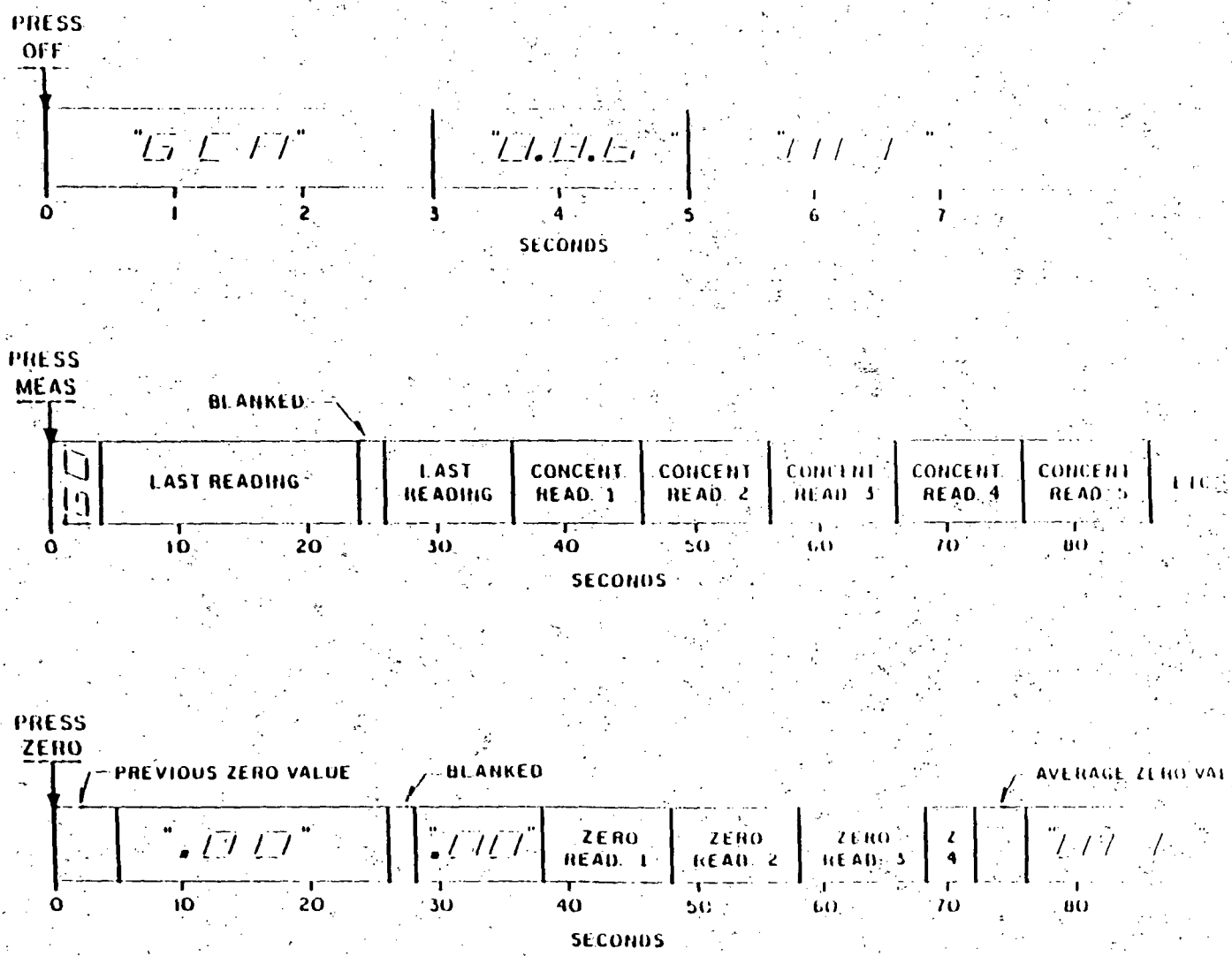


Figure 2. Timing diagram of MINIRAM model PDM-3 when pressing OFF, MEAS, or ZERO (typical times).

Average
Zero Value

00.02 00.01 00.00 00.07 00.01

Zero Check

0000 02.05 02.25 02.04 02.25 02.04
 02.05 02.04 02.05 02.04 02.05
 0001 02.04 02.05 02.05 02.05 02.04
 02.05 02.05 02.25 02.04 02.05
 0002 02.05 02.04 02.05 02.25 02.04
 02.25 02.25 02.25 02.25 02.04

Continuous
10-Second
Printout of
Concentration
(in mg/m³)

Line Number

SCA TECHNOLOGY INC.
 BEDFORD MA USA
 617-275-5444
 PDM-3 LISTING

SHIFT	ON	OFF	CONC
*	MINS	MIN/10	MG/M3
0007	0004	0000	02.04
0006	0012	0000	01.01
0005	0005	0000	01.01
0004	0004	0000	00.01
0003	0006	0000	00.00
0002	0000	0000	00.02
0001	0000	0001	00.00

Playback of
Stored Data

ID Number

I = 0003 F = 0012 Z = 00.01
 0057

Check Sum

Programmable
Selection
Code

Zero Value

Figure 3. Typical MINIRAM Model PDM-3 Digital Printout Format.

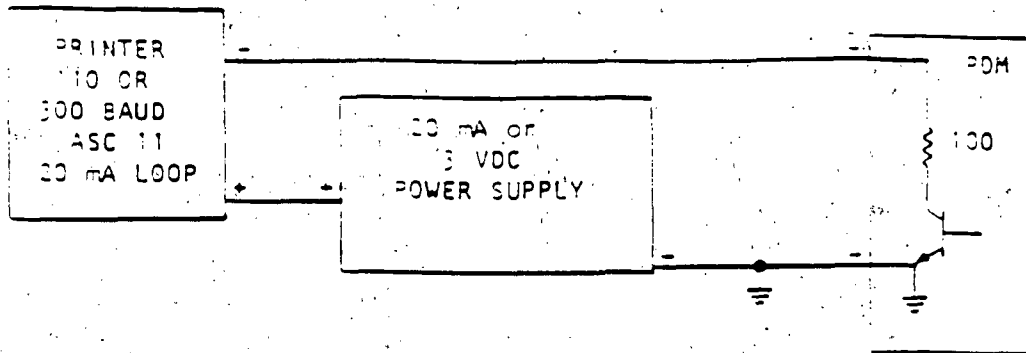


Figure 4. 20 mA loop connection.

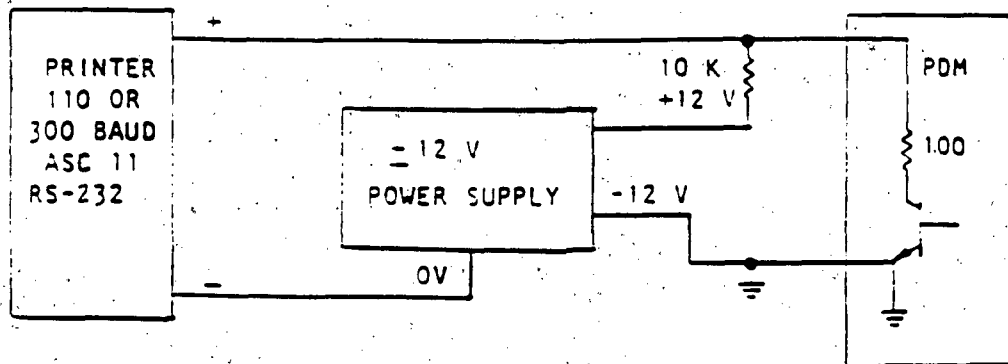


Figure 5. RS-232 connection.

MALCOLM
PIRNIE

OPERATION PROCEDURES
MINIRAD MONITOR 4

ACT 001 0585

OPERATION MANUAL FOR THE RADIATION ALERT MONITOR 4

INSTRUCTIONS

To operate the Monitor 4, first install a fresh 9 volt alkaline battery (NEDA #1604A or equivalent). The battery compartment is located at the bottom of the back of the instrument and is accessible by pushing down on the finger grip provided. Snap in the battery and slide the cover back into position. The battery life is up to 2,000 hours at normal background radiation levels. NOTE: Always turn the Monitor 4 off before installing the battery.

The Monitor 4 senses ionizing radiation by means of a GM (Geiger-Mueller) tube with a thin mica end window. The tube is fully enclosed inside the instrument. When a ray or particle of ionizing radiation strikes the tube, it is sensed electronically and displayed by a flashing count light on the instrument face. About 5 to 25 of these counts, at random intervals, can be expected every minute from naturally occurring background radiation, depending on your location and altitude. When the switch is in the AUDIO position, the instrument will also beep each time a ray or particle of ionizing radiation strikes the tube.

Be sure the range switch is in the appropriate position when using the instrument. When the range switch is in the x1 (times one) position, the meter reads from 0 to .5 mR/hr or 0 to 500 CPM (counts per minute) as indicated on the meter scale. In the x10 position the reading is multiplied by 10, indicating levels up to 5 mR/hr or 5000 CPM. In the x100 position the reading is multiplied by 100, indicating up to 50 mR/hr or 50,000 CPM (approximately 2,500 times background levels).

This model of the Monitor 4 has an anti-saturation circuit good to at least 5R/hr.

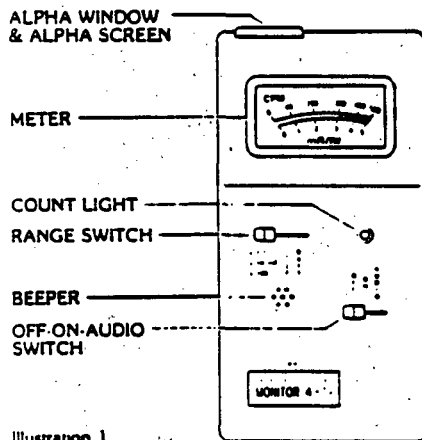


Illustration 1

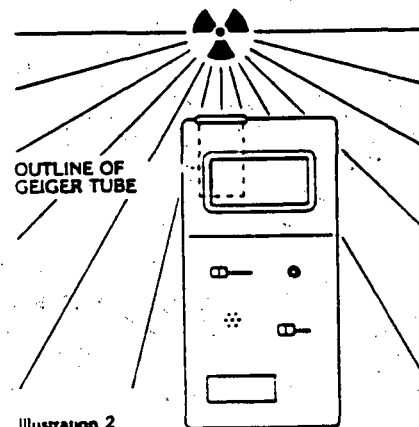


Illustration 2

PRECAUTIONS:

NOTE: Before using this instrument the user must determine the suitability of the product for his or her intended use. The user assumes all risk and liability connected with such use.

1. Handle your Monitor 4 carefully, as you would a camera.
2. Avoid exposing the Monitor 4 to liquids, moisture, and corrosive gases; also avoid extreme temperatures or direct sunlight (i.e. car dashboards) for extended periods.
3. We recommend that you remove the battery to prevent leakage if you don't intend to use the Monitor 4 for a month or more.
4. The mica end window of the Geiger tube can be easily damaged if struck directly. Therefore, do not insert any pointed object through the alpha screen.
5. To avoid contaminating the Monitor 4, do not touch the instrument to the surface being tested.
6. This instrument may be sensitive to radio frequency fields, microwave fields, electrostatic fields, and magnetic fields, and may not operate properly in such fields.

SERVICE AND CALIBRATION:

The Monitor 4 has proven to be a very reliable instrument. Should it ever need servicing outside of our warranty, please contact us for a return authorization number at:

S.E. International, Inc.
P.O. Box 39
156 Drakes Lane
Summertown, TN 38483 USA

Tel. (615) 964-3561
Telex (ITT) 4997468 SOLAR

NOTE: Please do not send us contaminated instruments for repair under any circumstances.

For ANSI standard calibration, contact a certified lab.

SPECIFICATIONS

CALIBRATION: Factory calibration is by pulse generator and is typically plus or minus 10% of full scale relative to Cesium 137. The Monitor 4 is easily calibrated to ANSI standards by a certified lab.

CALIBRATION PROCEDURE: Position the Monitor 4 upright with the back of the instrument facing the source. Adjust the height of the Monitor 4 so that the center of the tube (lengthwise) will be centered with the beam. Measure the appropriate distance from the source to the center of the tube's diameter.

If you need to adjust the calibration, simply remove the two screws from the top of the case and the two screws inside the battery compartment and ease off the back of the case. The trimpot is located above the ON/OFF/AUDIO switch.

SENSOR: LND 712 halogen-quenched uncompensated GM tube with mica end window 1.5-2.0 mg/cm² thick. This tube has 1000 counts per minute per mR/hr for Cesium 137.

ENERGY SENSITIVITY: Detects alpha down to 2.5 MeV; typical detection efficiency at 3.6 MeV is greater than 80%. Detects beta at 50 KeV with typical 35% detection efficiency. Detects beta at 150 KeV with typical 75% detection efficiency. Detects gamma and x-rays down to 10 KeV typical through the end window, 40 KeV minimum through the case.

SATURATION: This instrument has an anti-saturation circuit good to at least 100 times the maximum reading in the highest range.

AUDIO: Built-in piezo electric transducer gives audible indication of each count when switch is in the audio position. Frequency is approximately 3 kHz.

CURRENT DRAIN: Idling current is typically 190 uA.

OPERATING VOLTAGE RANGE: 7-11 volts DC.

VOLTAGE REGULATION: High voltage fully regulated. Less than a 3.0 volt change in output for a 9 volt to 6 volt change in supply voltage.

POWER REQUIREMENT: One 9 volt alkaline battery, NEDA #1604A, or equivalent.

BATTERY LIFE: Up to 2,000 hours at background radiation levels.

TEMPERATURE RANGE: -20 C to +50 C.

WEIGHT: 245 grams (8.8oz.) with battery installed.

SIZE: 145mm x 72mm x 38mm (5.7" x 2.8" x 1.5").

ADDITIONAL INFORMATION FOR THE NEWCOMER TO HEALTH PHYSICS

Since our instruments are sometimes purchased by individuals with no background in Health Physics, we thought it would be helpful if we included this addition to our operational manual. Please be sure to read the entire operation manual thoroughly.

MEASURING RADIATION:

The Monitor 4 detects the four main types of ionizing radiation: alpha, beta, gamma, and x-ray. It is calibrated for Cesium 137, but also serves as an excellent indicator of relative intensities for many other sources of ionizing radiation. The level of radiation for gamma and x-rays is measured in milliRoentgens per hour (mR/hr). Alpha and beta radiation are measured in counts per minute (CPM).

The position of the Geiger tube is shown in Illustration 2. The end of the tube has a thin mica end window built into it. This mica window can be broken if struck directly, and it is protected by the screen on the end of the instrument. This alpha window (see Illustration 1) allows alpha particles to reach the mica end window and be detected. The mica end window will also sense low energy beta, gamma, and x-rays that cannot penetrate the plastic case or the side of the tube, which is stainless steel. (Note: Some very low energy radiation cannot be detected through the mica end window. See SPECIFICATIONS for the Geiger tube sensitivities.)

Always approach a source of radiation carefully. Never touch the Monitor 4 to any suspected radioactive substance in order to avoid contaminating the unit itself. Try to make sure you are not walking through or inhaling any radioactive material. Keep in mind that low energy radiation is hard to detect (see BRIEF OVERVIEW OF RADIATION DETECTION below). We recommend that any contact with radioactive materials be avoided whenever possible.

Unless you expect to be measuring high levels of radiation, always keep the range switch in the x1 position. If you are making a measurement and the meter goes off scale to the right, move the range switch to the next higher setting, x10 or x100 if necessary. (Note: The flashes from the count light and the audible beeps are progressively shorter in the x10 and x100 positions.)

Should you detect radioactivity with your Monitor 4, exercise extreme caution to avoid unnecessary exposure and notify the proper authorities. Depending on where you are, this can be your state emergency management agency, the radiation control division of your state health department, or the NRC regional office. If you think you have an emergency on your hands after regular office hours, you can contact your state or local police department for assistance.

If you stand a risk of contamination, try to protect yourself. Although some beta and most gamma radiation can go through protective gear, you can attempt to avoid skin contamination if the radioactivity is airborne. Wear a respirator and some type of overshoes. A full body protective suit may be necessary. You may have to improvise with whatever is on hand. When you leave the radioactive area, remove your protective outerwear and dispose of properly. If you think you have been contaminated, as an additional precaution shower and consult a physician.

We only mention the above procedure in the event you are faced with some type of unavoidable situation. We recommend that contact with radioactive materials and other sources of radiation be avoided whenever possible.

MAKING MEASUREMENTS WITH THE MONITOR 4:

To measure gamma and x-rays, hold the back of the Monitor 4 toward the source of radiation. Low energy gamma and x-rays (10 - 40 KeV) cannot penetrate the side of the Geiger tube, but may be detected through the alpha window.

To detect alpha radiation, position the Monitor 4 so the suspected source of radiation is next to the alpha window. Alpha radiation will not travel far through air so put the source as close as possible (within 1/4 of an inch) to the alpha screen without touching it. Even a very humid day can limit the already short distance an alpha particle can travel. Most alpha radiation can be shielded with a sheet of paper. However, alpha emitters are especially dangerous when inhaled because they may become lodged in the lungs for months or years.

To detect beta radiation, point the alpha window toward the source of radiation. Beta radiation has a longer range through air than alpha particles but can usually be shielded by a few millimeters of aluminum. High energy betas may be monitored through the back of the case.

To determine whether radiation is alpha, beta, or gamma, hold the back of the Monitor 4 toward the specimen (see Illustration 2 for location of the Geiger tube). If there is an indication of radioactivity, it is most likely gamma or high energy beta. Place a piece of aluminum about 1/8" thick between the case and the specimen. If the indication stops, the radiation is most likely beta. (Keep in mind that to some degree most common isotopes contain both beta and gamma.)

If there is no indication through the back of the case to begin with, position the alpha window close to but not touching the specimen. If there is an indication, it is probably alpha or beta. If a sheet of paper will stop the indication it is most likely alpha. (Note: Do not hold the specimen above the alpha window in order to avoid particles falling into the instrument.)

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BRIEF OVERVIEW OF RADIATION DETECTION

The Monitor 4 does not detect neutron, microwave, RF (radio frequency), laser, infra-red, or ultra-violet radiation.

The Monitor 4 is calibrated for Cesium 137 and is very accurate for it and other isotopes of similar energies. Some of the isotopes that the Monitor 4 will detect relatively well are Cobalt 60, Technetium 99M, Phosphorous 32, Strontium 90, and many forms of Radium, Plutonium, Uranium, and Thorium.

Some forms of radiation are very difficult or impossible for our Geiger tube to detect. Tritium, for instance, might barely be recorded through the thin mica end window, if at all. Tritium has industrial and military uses and is also a by-product of nuclear reactors. The beta emissions from Tritium are so weak that other than taking a test wipe and measuring it in a scintillation counter, there is no practical way to detect it. A liquid scintillation counter might be found in a large university or hospital. Some other examples of when more sophisticated equipment is needed are for the detection of radon gas, X-rays from CRT's and TV's, and environmental samples, such as radioactivity in milk, fruits and vegetables, etc.

On the other hand, the radiation from some isotopes can overexcite a Geiger tube and cause the meter to indicate a higher level of radiation than is actually there. Americium 241 is an example of this phenomenon. Americium 241 is used in some smoke detectors and many different types of industrial density and flow meters.

Although you might have the best intentions, it is possible to draw misleading conclusions from your readings unless you know exactly what you are measuring, which is seldom the case. We tried to design the Monitor 4 to be able to detect the broadest range of ionizing radiation possible and still be in the price range of the average person. It would take a large closet full of very expensive equipment to accurately measure the whole spectrum of ionizing radiation.

Although the Monitor 4 comes with an operation manual geared to people who have no prior knowledge of radiation and/or radiation detection instruments, it does not provide an in-depth understanding of the science of health physics. We encourage you to seek out other sources of information.

There are many books written about radiation, both pro and con. Everyone agrees that radioactive materials can be dangerous. Considering the controversy that surrounds the issue of radiation safety, we suggest that everyone educate themselves as much as possible.