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NAWC WARMINSTER
5090.3a

Field Sampling Plan
for
Site 4
Engineering Evaluation/Cost Analysis

Naval Air Warfare Center
Warminster, Pennsylvania

Northern Division
Naval Facilities Engineering Command
Contract Number N62472-90-D-1298
Contract Task Order 0159

January 1995

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CORPORATION

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HNPH/51-1-5-84

January 18, 1995

Project Number 1412

Mr. Lonnie Monaco
Naval Facilities Engineering Command (NAVFACENGCOM)
Northern Division
Environmental Contracts Branch, Mailstop 82
10 Industrial Highway
Lester, Pennsylvania 19113

Reference: CLEAN Contract No. N62472-90-D-1298
Contract Task Order (CTO) No. 159

Subject: Revised Field Sampling Plan - Site 4 Engineering Evaluation/Cost Analysis (EE/CA)
Naval Air Warfare Center (NAWC) Warminster, Pennsylvania

Dear Mr. Monaco:

Please find enclosed two copies of the subject document for continuing Installation Restoration (IR) Program activities at NAWC Warminster. Copies of this revised field sampling plan (FSP) are being sent to those individuals identified on the distribution list. The FSP has been revised in accordance with review comments provided by the United States Environmental Protection Agency.

Please contact me if you have any questions or comments.

Sincerely,

for Neil Teamerson
Jeffrey P. Orient
Project Manager

ANT/jag

Enclosures

cc: Raymond Mannella (NAVFACENGCOM)
Thomas Ames (NAWC Warminster)
David Kennedy (PADER)
Kathyrn Davies (EPA Region III)
Darius Ostrauskas (EPA Region III)
David Fennimore (Earth Data)
Ronald Sloto (USGS)
Anthony Bartolomeo (Pennoni Associates)
Kevin Kilmartin (Halliburton NUS)
Neil Teamerson (Halliburton NUS)
Michael Turco (Halliburton NUS) (without enclosures)

FIELD SAMPLING PLAN
SITE 4 ENGINEERING EVALUATION/COST ANALYSIS (EE/CA)
NAWC WARMINSTER, PENNSYLVANIA

1.0 INTRODUCTION

In response to Contract Task Order No. 159 under Contract No. N62472-90-D-1298, Halliburton NUS Corporation (HNUS) has been tasked to perform an EE/CA for Site 4 (North Landfill Runway) at the Naval Air Warfare Center (NAWC), Warminster, Pennsylvania. The Navy is evaluating remedial or removal options for buried wastes and contaminated soils at Site 4. The goal of the EE/CA is to identify the most appropriate response option to mitigate potential exposures to any contaminants and potential migration of any contaminants into the environment. An EE/CA is required under the National Oil and Hazardous Substances Pollution Contingency Plan [Section 300.415(b)(4)(i)] for all non-time-critical removal actions. The EE/CA will identify the objectives of the removal action and will analyze the various alternatives that may be used to satisfy these objectives.

To support the EE/CA, additional site characterization data will be gathered to determine the locations, nature, and extent of contamination at Site 4. This information will be used in conjunction with data already gathered from previous investigations and studies, including the results of the EPA aerial photograph analysis report (EPIC, 1994) and the environmental baseline survey (EA, 1995). A field investigation will be performed to better characterize the site, to provide information with which to generate volume estimates for landfill materials contained within Site 4, and to perform waste characterization activities to support the evaluation of removal action alternatives. The purpose of this field sampling plan (FSP) is to describe the scope of this work.

The field investigation will consist of the following activities:

- Geophysical survey to establish trench locations or potential subsurface waste disposal locations.
- Soil gas survey to identify the presence of any elevated levels of volatile organic compounds (VOCs) within those locations established by the geophysical surveys.
- Test pits to further identify subsurface wastes within those locations established by the geophysical and soil gas surveys.

- Surface soil and subsurface soil and waste sampling and subsequent analyses to characterize surface and subsurface conditions within Site 4.

1.1 SITE BACKGROUND

Site 4 is a grass-covered area covering 7 acres just north of the main runway along Kirk Road and south of the patrol road. The site is located at approximately the mid-point of the runway. An unnamed tributary of Little Neshaminy Creek is located north of this area, and residential areas and two local parks are also in this direction. The approximate location of Site 4, based on the delineation of waste material, is shown in Figure 1-1.

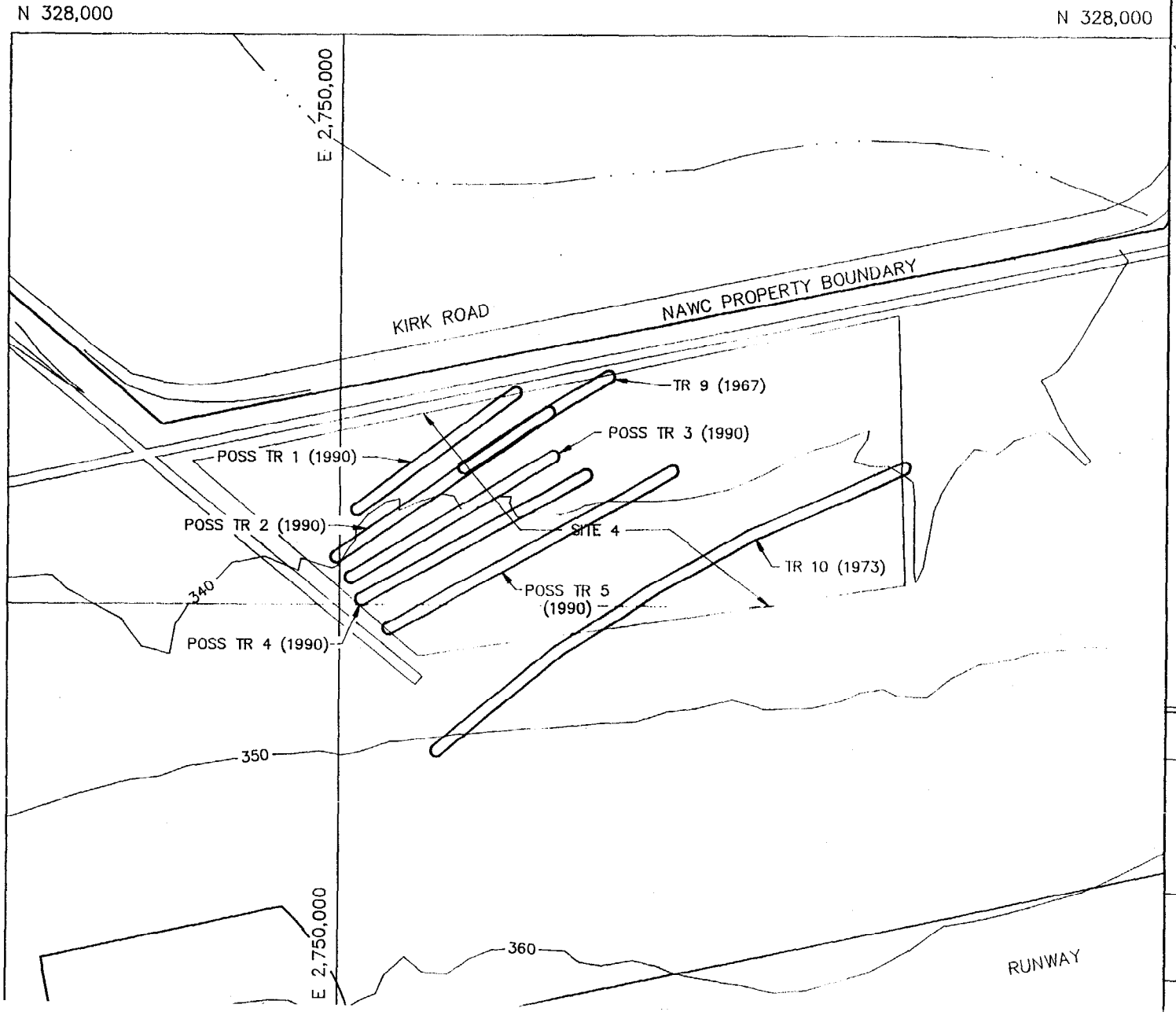
The site is the largest of the NAWC Warminster waste disposal locations; it is less than 100 feet from the edge of the facility boundary. This site reportedly was operated from 1966 to 1970, although historical aerial photographs indicate that Site 4 was active in 1973 (EPIC, 1994). Seven trenches on the site reportedly were used to dispose of non-industrial solid waste, paints, waste oils, waste metals, construction debris, solvents, and sewage sludge from the sewage treatment plant. However, the exact number of trenches has not been confirmed by either aerial photographs or previous source investigations. Differential settling within the landfill trenches has resulted in subsurface expressions that can be identified in the field. Some drainage from this area intersects the unnamed tributary of Little Neshaminy Creek, off base to the north of Kirk Road, near Munro Park. Several off-base residences are present within 200 feet of Site 4.

The nature and extent of contamination as well as the results of previous investigations at Site 4 are presented in the Phase III RI/FS work plan (HNUS, 1995a), the RI Report for Operable Unit 3 (OU-3) (HNUS, 1994), and the Draft Phase II RI Report for NAWC Warminster (HNUS, 1992b).

1.3 POTENTIAL MIGRATION ROUTES

The major potential contaminant transport pathways for Site 4 contaminants include

- Contaminants leaching from wastes to groundwater. The shallow depth to water and bedrock (i.e., less than 20 feet) promotes migration to groundwater. VOCs are most amenable to such transport.



LEGEND

SITE 4 — ESTIMATED SITE BOUNDARY

STREAM

340 — TOPOGRAPHIC CONTOUR LINE

TRENCH (TR) FEATURES IDENTIFIED BY EPIC (1994 AND 1995)

SOURCES:
ENVIRONMENTAL PHOTOGRAPHIC INTERPRETATION CENTER (EPIC), 1994. AERIAL PHOTOGRAPHIC SITE ANALYSIS, NAWC WARMINSTER, PENNSYLVANIA, REPORT 93053 WARRENTON, VA.

EPIC, 1995. AERIAL PHOTOGRAPHIC SUPPORT, NAWC WARMINSTER, PENNSYLVANIA, TS--PIC--95009. WARRENTON, VA.

N

SCALE

0 50 100 200 (FT)

NAWC
WARMINSTER, PA

FIGURE 1-1

SITE 4
LOCATION

(CONTOUR INTERVAL 10 FEET)

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DATE: 1/16/95

- Erosion of contaminated soils with overland runoff transport to nearby surface water bodies (unnamed tributaries).

- Airborne transport of particulates.

Another potential transport pathway for Site 4 contaminants includes groundwater discharge to nearby surface water bodies. Potential human and environmental receptors include nearby groundwater users, residents exposed to fugitive dusts, and on-base employees that may come in contact with buried wastes or contaminated soils.

1.4 CURRENT STATUS

Additional investigation should be performed as necessary to characterize the nature and extent of soil contamination and associated hazardous substances in the vicinity of Site 4. Based on previous work, the only significant risks identified for subsurface soil at Site 4 were for potential leaching of PCBs to groundwater and erosion to surface water (HNUS, 1992b). However, additional soil sampling should be conducted in the vicinity of Site 4 to better characterize these and any other potential risks.

2.0 FIELD PROCEDURES

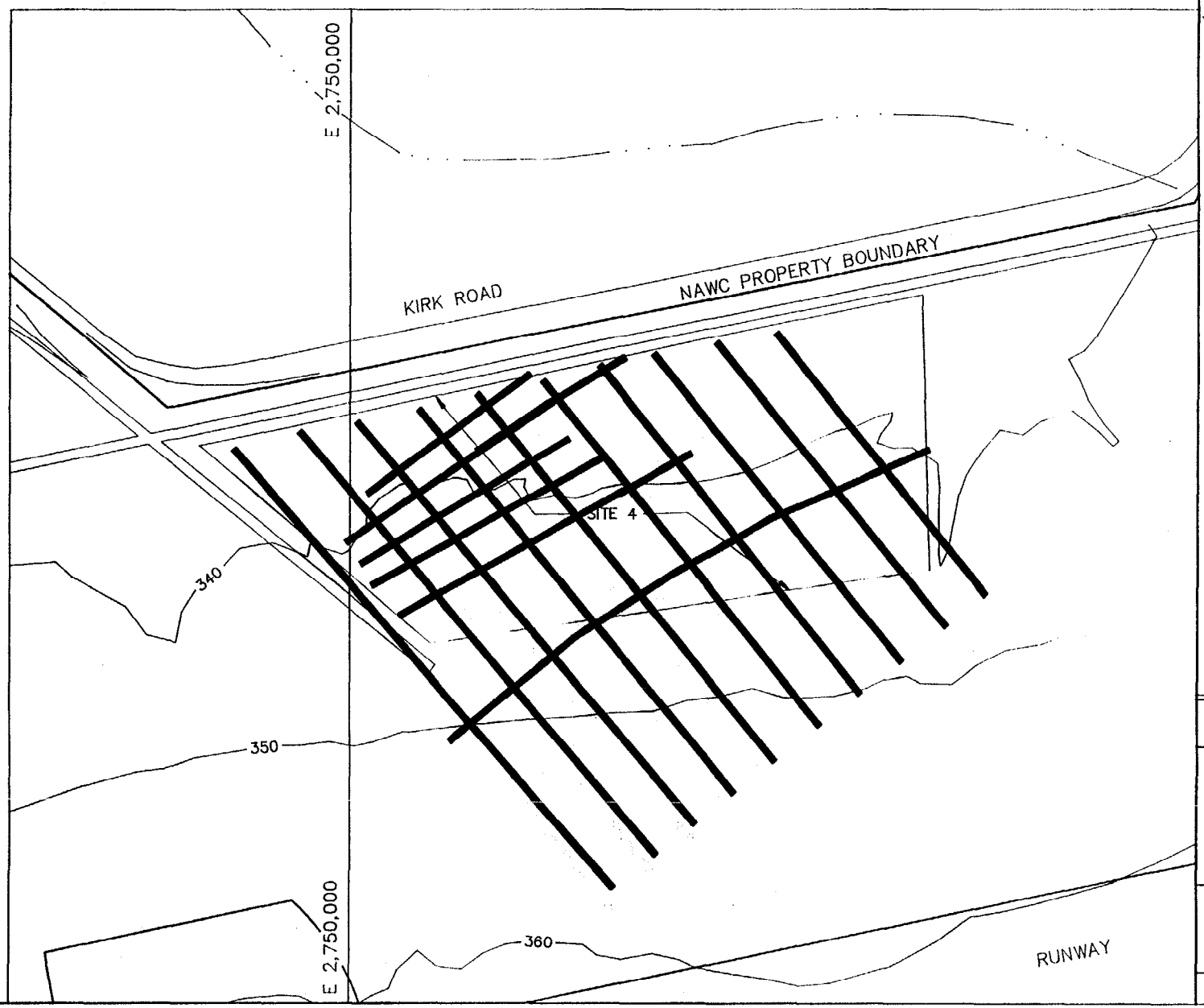
The field procedures outlined in this section assume that the following information will be available before these tasks are initiated:

- Corrected grid coordinates of significant aerial photograph features identified by EPA in the vicinity of Site 4.

- Staked or marked field locations identifying significant aerial photograph features in the vicinity of Site 4. It is assumed that the Navy will mark these locations.

2.1 GEOPHYSICAL SURVEY

An EM conductivity survey will be performed in the vicinity of Site 4 to check for buried wastes and materials. The proposed area for the survey is shown in Figure 2-1. A Geonics EM-31 conductivity meter will be used to measure the earth's response to an induced EM signal. Both in-phase and quadrature-



LEGEND

SITE 4 — ESTIMATED SITE BOUNDARY

STREAM

340 — TOPOGRAPHIC CONTOUR LINE

PROFILE LINES

N

SCALE:

0 50 100 200 (FT)

NAWC
WARMINSTER, PA

FIGURE 2-1

PROPOSED GEOPHYSICAL SURVEY AREA
SITE 4
(CONTOUR INTERVAL 10 FEET)

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phase data will be collected at each data point. Based on the Phase I RI geophysical survey results, it appears that there is not enough magnetic interference at the site to make a gradiometer/total field magnetometer survey useful. However, a magnetometer will be considered in order to provide higher resolution for locating ferrous magnetic anomalies. If the EM survey is unsuccessful in delineating potential waste locations, a ground-penetrating radar survey may be performed instead.

Based on previous site reconnaissance activities, it appears that the approximate locations of the disposal trenches can be tentatively located based on visual observations. The ground surface overlying the trenches has settled, resulting in obvious linear ground scars The EM survey will first be run along a series of profile lines laid out perpendicular to the long axis of each suspected trench or buried waste disposal location to better establish trench locations. Based on these results, profile lines will be laid out along the trenches. As indicated in Section 2.0, the exact location of the profile lines will not be selected until significant aerial photograph features are marked in the field by the Navy. However, at least 10 profile lines (running in the general direction of northwest to southeast, perpendicular to the known trench layouts) will be established across Site 4 at 50-foot spacing. These profile lines will extend from the Patrol Road bordering the northern portion of the site to within 100 feet of the inactive main runway. Additional profile lines will be run along the axis of each trench identified, as well as on 50-foot centers in areas where no trenches are identified with the first set of profiles. Because the width of the trenches at Site 4 is estimated to be 12 feet, data stations will be spaced approximately 5 feet apart along each profile line. All geophysical station numbers and results will be recorded in the field notebook and on each pin flag used to mark the locations of each station. At least two corners of the geophysical survey grid will be surveyed to provide information to accurately plot the survey results.

The data generated from the EM survey will be evaluated to identify potential areas of buried magnetic/electrical anomalies. Contour maps will be generated for both the quadrature and inphase data sets. The anomaly shapes will be evaluated to determine the probable anomaly type (e.g., buried drum, scrap metal). Subsurface anomalies will be further investigated through the excavation of test pits. Appropriate technical personnel will be involved in the decision-making process regarding the general locations and scope of the geophysical survey.

2.2 SOIL GAS SURVEY

A soil gas survey will be performed across Site 4 to identify potential areas of elevated VOC concentrations. These areas may be continuing sources of groundwater contamination or may pose

threats to humans through dermal contact. Results of the soil gas survey will be used to identify test pit and subsurface soil sampling locations as needed to investigate any areas of anomalously high soil gas readings. Particular areas of emphasis will be those locations that have shown elevated VOC readings. The geophysical survey results will be used to select soil gas survey locations, and these locations will be adjusted as necessary to avoid buried subsurface objects. The soil gas survey will be run along the long axis of each suspected trench or buried waste disposal location (Figure 2-2). In addition, discrete areas of EM anomalies outside of any identified trench boundaries will be investigated with soil gas points.

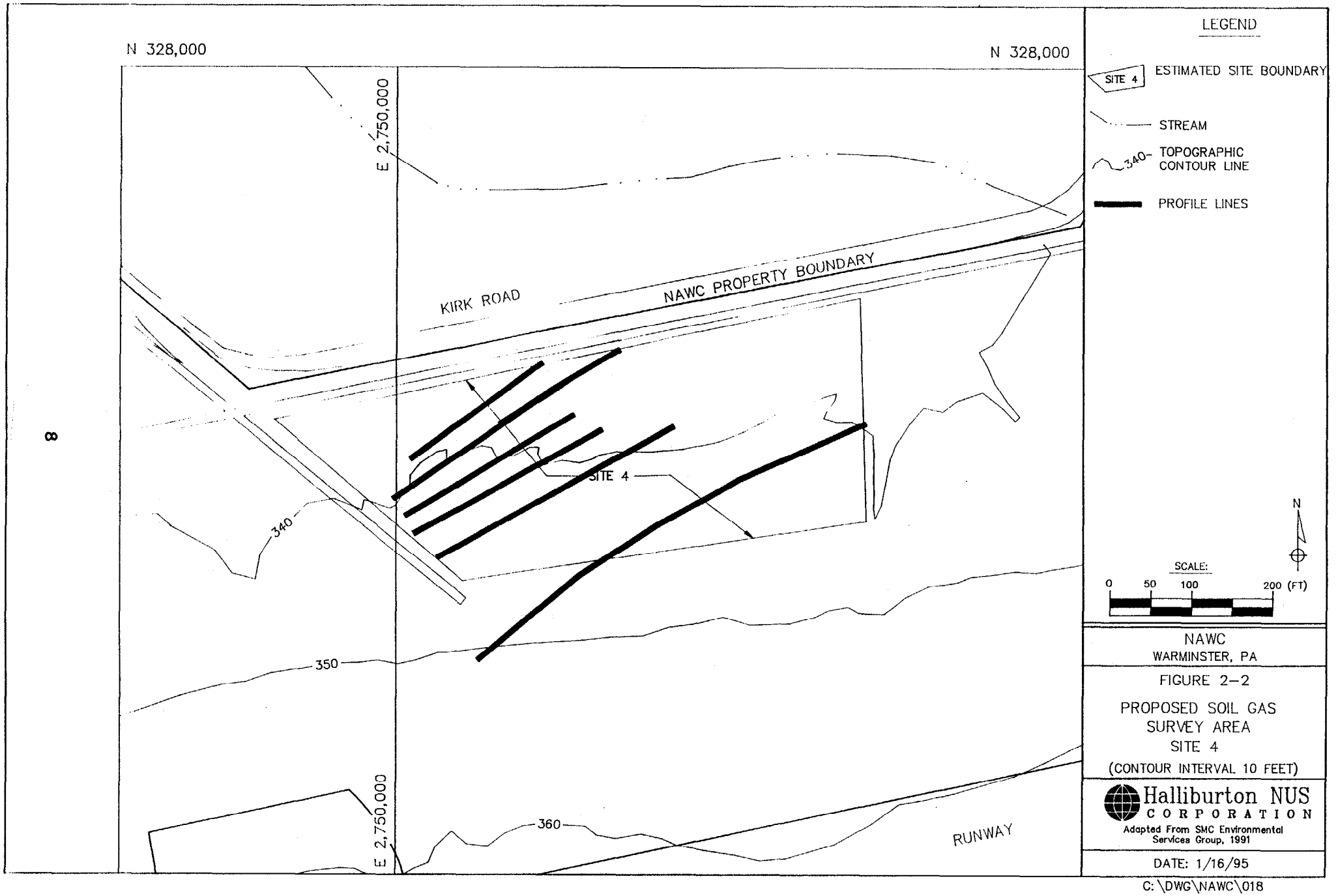
Data stations for profile lines along the length of suspected trenches will be spaced approximately 50 feet apart along each profile line, with additional soil gas points installed in areas of elevated readings to more precisely define the locations of any anomalies encountered.

All soil gas station numbers, depths, and locations will be recorded in the field notebook. Pin flags will be used to mark the locations of each station. To the extent practicable, the soil gas survey will use the existing grid laid out for the geophysical survey. The soil gas survey will not be performed during or immediately after periods of significant precipitation.

All soil gas survey locations will be cleared for known or suspected buried metallic objects based on the results of the geophysical survey. Each soil gas sample location will be completed by using the hollow probe method (Geoprobe PRT or equivalent), which involves a probe assembly that retracts from a disposable shield or drive point. An electric-powered hammer drill will be used to drive the hollow probe and probe tip into the ground. This technique will create a hole approximately 0.5 inch in diameter.

Upon reaching the required depth for a soil gas sample, the hollow probe will be pulled up to retract the probe adapter from the probe tip, exposing the lowest two to four inches of soil at the bottom of the hole. A short length of polyethylene (PE) tubing with a threaded endpiece will then be lowered into the hollow probe, tightened to the disposable drive point adapter, and connected at the surface to a peristaltic pump. New tubing will be used for each soil gas sample. The PE tubing will be firmly tightened to the adapter attachment to prevent the escape of soil gas in the hollow probe.

In the event that low-permeability soils are encountered during the soil gas survey, sampling will be performed using the same technique, with allowances made for a slower rate of sampling.


N 328,000
N 328,000
E 2,750,000
E 2,750,000
KIRK ROAD
NAWC PROPERTY BOUNDARY
SITE 4
340
350
360
RUNWAY
LEGEND
SITE 4
ESTIMATED SITE BOUNDARY
STREAM
340
TOPOGRAPHIC CONTOUR LINE
PROFILE LINES
N
SCALE:
0
50
100
200 (FT)
NAWC
WARMINSTER, PA
FIGURE 2-2
PROPOSED SOIL GAS SURVEY AREA
SITE 4
(CONTOUR INTERVAL 10 FEET)
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Adapted From SMC Environmental Services Group, 1991
DATE: 1/16/95
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At the time of soil gas sample collection, the PE tubing will be inserted into a short length (about 6 inches) of silicon tubing that passes through the peristaltic pump. Using the pump, the PE tubing, silicon tubing, and probe will be purged of three void volumes to remove any atmospheric vapor and to extract VOCs from the interstitial soil pore space. A new or decontaminated Tedlar bag will be connected to the pump, filled with soil vapor, sealed, and labeled until analysis. Care will be taken to minimize the sample's exposure to light and to prevent degradation of VOCs present in the sample.

Two soil gas samples will be collected at each survey location. One sample will be taken from a depth of 2 to 3 feet below the ground surface; the second sample will be obtained from a depth of 4 to 6 feet (or until refusal) below the surface. After each soil gas sample is collected, the hollow probe and adapter assembly will be removed with a mechanical jack and thoroughly decontaminated. The Tedlar bags will be purged with three volumes of purified gas between use or disposed, in the case of any highly contaminated samples.

The sample will be transferred to the on-base trailer for analysis. A temperature-programmable gas chromatograph (GC) (e.g., Hewlett Packard HP 5890 or equivalent) will be used for sample analysis, along with a detachable portable computer. The GC will be equipped with both a photoionization detector (PID) and an electron capture detector (ECD). The PID will be sensitive to compounds with an ionization potential at or below 10.2 eV. The PID and ECD will be calibrated to detect specific soil gas target compounds, although they can be used to detect most Target Compound List (TCL) volatile organics. The PID will be used to detect unsaturated, non-halogenated VOCs, including acetone, 2-butanone, benzene, toluene, ethyl benzene, xylenes, and styrene. The ECD will be used to detect saturated, chlorinated hydrocarbons, including TCE, PCE, 1,1,1-TCA, and related degradation products (i.e., 1,1,-DCE, 1,2-DCE, 1,1-DCA, and 1,2-DCA). If necessary, soil gas target compounds will be modified based on the initial soil gas analysis results.

The soil gas survey results will be plotted on a site map in the field, while the survey is in progress, to evaluate and modify the survey as it proceeds. Areas of relative high soil gas readings will be investigated in greater detail by locally reducing the grid size to further delineate the extent of the soil gas contamination pattern. The initial grid size reduction will be at 25-foot spacing with further spacing reductions considered based on field results. The soil gas survey will provide qualitative data regarding the presence of VOCs. Test pit sampling and analysis will provide quantitative data regarding subsurface contamination. Appropriate technical personnel will be involved in the decision-making process regarding the general locations and scope of test pit excavation activities.

2.3 TEST PITS

The results of the geophysical and soil gas surveys will be used to select test pit locations. Locations will be adjusted as necessary to avoid puncturing subsurface objects or releasing previously immobile hazardous substances to groundwater.

Before test pit excavation activities are begun, potential test pit locations will be staked and checked for the presence of underground utilities and highly contaminated subsurface materials. Based on previous hydrogeologic investigations, there are no confining layers in the vicinity of Site 4 that would be disrupted by excavation activities and that would subsequently increase the potential for contaminant transport into shallow groundwater if breached.

As discussed in Section 2.1, it appears that the approximate locations of the disposal trenches can be reasonably located based on visual observations. Based on these visual observations along with the EM and soil gas survey results, three test pit locations will be staked within each of the trenches, near both ends and in the middle. Test pits will be located within the trenches, and approximately seven test pits will be excavated outside the apparent limits of the trenches, to confirm the absence of wastes in areas with no noticeable ground scars. Four test pits will be excavated outside but within 20 feet of the presumed ends of the test pits. Three test pits will be excavated in random areas within Site 4 that are not near any ground scars in order to evaluate the potential for hidden trenches.

The test pits excavated within the disposal trenches will be extended across each trench to natural soils/clean fill on either side of the trench and will be extended vertically to the bottom of the trench (or bedrock or maximum reach of the backhoe, whichever is encountered first). Each test pit will be photographed and logged to provide a description of the wastes and a cross-section of the trench. Test pit excavation and logging procedures will be in accordance with HNUS Standard Operating Procedure GH-1.8 (Attachment A).

The waste materials encountered will be screened with an organic vapor detector. If potentially contaminated wastes are encountered, based on organic vapor detector readings and/or visual observations, representative samples of the wastes will be obtained for laboratory analysis. Samples will be obtained directly from the pit, if the excavation is less than 4 feet deep, or from the backhoe bucket, using dedicated stainless-steel trowels. The samples will be placed in the appropriate containers, labeled, and preserved as described in the Phase III RI Quality Assurance Project Plan (QAPP) (HNUS, 1995b).

In addition, one soil sample will be collected from the side wall of any test pit that shows the presence of potentially contaminated wastes. These soil samples will be representative of subsurface soils that might be contaminated as the result of waste migration (e.g., leaching, infiltration) within or adjacent to the disposal trenches.

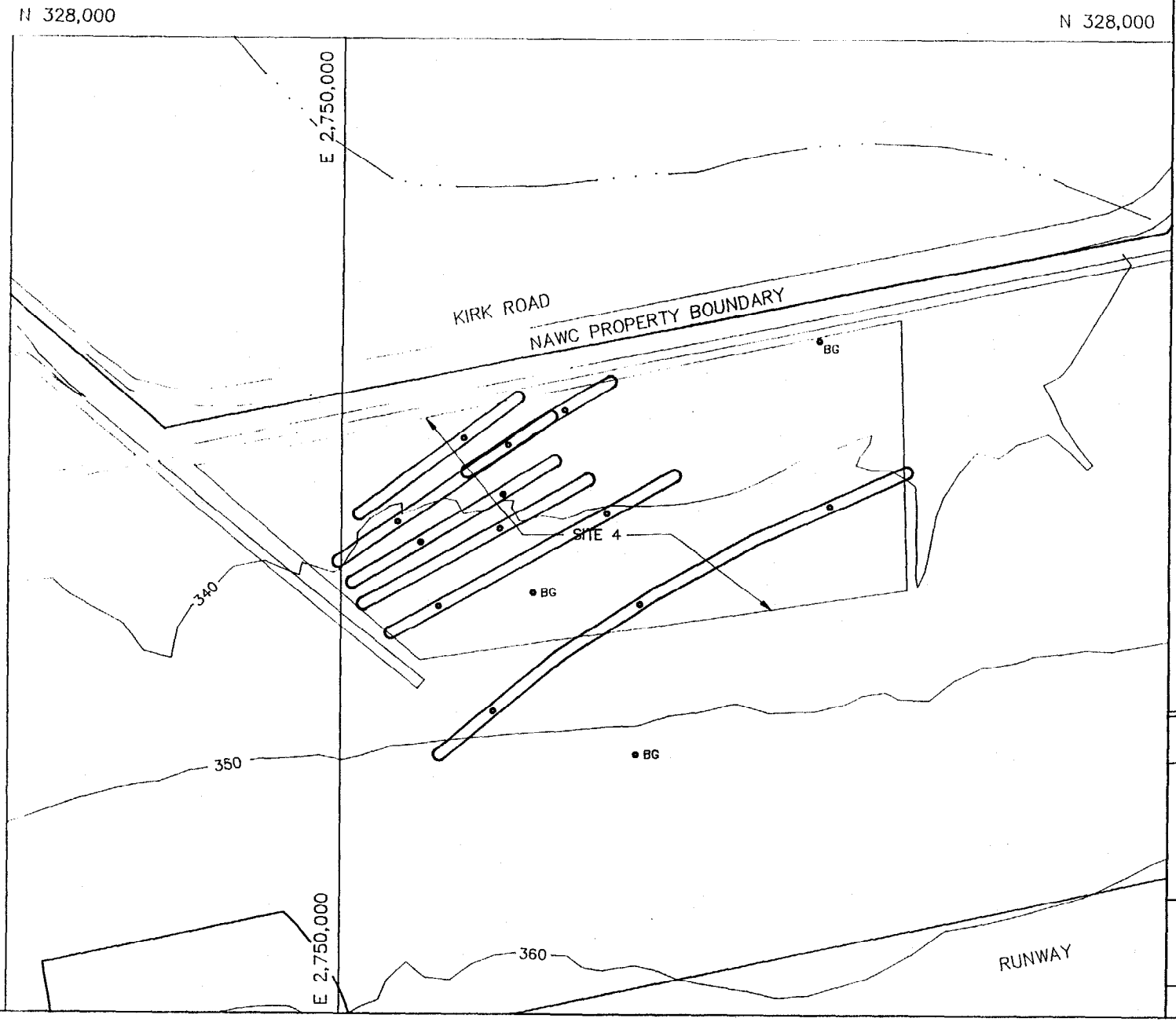
Upon completion of each test pit, the pit will be backfilled with the same materials that were excavated. No segregation of materials or stockpiling of excavated materials will be performed unless containerized wastes (i.e., intact drums) are encountered. In the event that such wastes are encountered, the Navy will be notified regarding handling/disposal concerns. The backhoe bucket will be decontaminated by steam cleaning after excavation of each test pit.

Upon delineation of the areal limits of the disposal trenches, the ends of the trenches will be marked with wooden stakes. Test pit locations will also be marked with stakes. The stake locations will be surveyed and the trench/test pit locations placed on the site map. The trench lengths will be measured to provide information regarding the sizes of the trenches. Cross-sectional profiles of the trenches will be generated and combined with the trench lengths to determine waste/fill volumes.

Appropriate technical personnel will be involved in the decision-making process regarding the results of test pit excavation activities, including analytical results.

2.5 SURFACE SOIL SAMPLING AND ANALYSIS

Analytical results are not available for Site 4 surface soils, and previous investigations (HNUS, 1992b, HNUS, 1994; SMC, 1991) indicate that Site 4 has not affected groundwater quality in this area. However, the potential risks posed by dermal contact with soils and airborne particulates cannot be evaluated unless surface soil samples are collected and analyzed for Site 4. To address this data gap, samples will be obtained from the 1.0- to 3.0-foot depth interval at 15 locations in the vicinity of Site 4 (Figure 2-3). The actual sample depth interval will be determined in the field. Care will be taken to avoid collecting samples from the topsoil layer. Three locations will be used to collect background samples. These samples will be analyzed for Target Analyte List (TAL) metals, cyanide, and TCL semivolatile organics. One-third of these samples will be analyzed for TCL pesticides and PCBs, including at least one background sample. TCL volatile organic analysis is not recommended for shallow soil samples (e.g., those collected from less than or equal to the 2.0-foot depth interval) since any VOCs present during the period that Site 4 was active are expected to have volatilized from surface soils. However, the deeper surficial soil samples



LEGEND

- SURFACE SOIL SAMPLE LOCATION
- BG — BACKGROUND SAMPLE
- SITE 4 — SITE
- STREAM
- 340 — TOPOGRAPHIC CONTOUR LINE
- TRENCH FEATURES IDENTIFIED BY EPIC (1994 AND 1995)

SOURCES:
ENVIRONMENTAL PHOTOGRAPHIC INTERPRETATION CENTER (EPIC), 1994. AERIAL PHOTOGRAPHIC SITE ANALYSIS, NAWC WARMINSTER, PENNSYLVANIA. REPORT 93053 WARRENTON, VA.

EPIC, 1995. AERIAL PHOTOGRAPHIC SUPPORT, NAWC WARMINSTER, PENNSYLVANIA. TS-PIC-95009. WARRENTON, VA.

N

SCALE:
0 50 100 200 (FT)

NAWC
WARMINSTER, PA

FIGURE 2-3
SURFACE SOIL
SAMPLE LOCATIONS
SITE 4
(CONTOUR INTERVAL 10 FEET)

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Environmental Corporation
Adapted From SMC Environmental Services Group, 1991

DATE: 1/16/95

(e.g., those collected from depths greater than 2.0 foot) will be analyzed for TCL volatile organic analysis. Approximately half of the surface soil samples will be analyzed for this parameter. Note that Site 4 has reportedly been capped with 2 feet of clean soil. Analytical results will be reported by the laboratory within 21 days of sample receipt. Table 2-1 lists the sampling and analysis requirements for the soil samples.

The surface soil analytical results will be used to assess the risks posed by surficial soils and, if necessary, to establish clean-up goals or acceptable contaminant concentrations specific to this medium.

TABLE 2-1
SAMPLING AND ANALYSIS REQUIREMENTS FOR SITE 4 SOIL AND WASTE SAMPLES

SURFACE SOIL

NUMBER OF SAMPLES	FIELD DUPLICATES	RINSATE BLANKS	FIELD BLANKS	TRIP BLANKS	ANALYSES	SOURCE OF 'ANALYSIS
15	2	2	0	0	TAL Metals/Cyanide	SW846 6010/7471/9010
15	2	2	0	0	TCL Semivolatile Organics	SW846 8270
5	1	1	0	0	TCL Pesticides/PCBs	SW846 8080
8	1	1	0	1	TCL Volatile Organics	SW846 8240

SUBSURFACE SOIL AND WASTE

NUMBER OF SAMPLES	FIELD DUPLICATES	RINSATE BLANKS	FIELD BLANKS	TRIP BLANKS	ANALYSES	SOURCE OF ANALYSIS
24 (a)	3	3	1	1	TCL Volatile Organics	SW846 8240
24 (a)	3	3	1	0	TAL Metals/Cyanide	SW846 6010/7471/9010
3 (b)	1	1	1	0	TCLP (all parameters)(c)	SW846 1311/ 40 CFR Pt. 261
24 (a)	3	3	2	0	TCL Semivolatile Organics	SW846 8270
24 (a)	3	3	2	0	TCL Pesticides/PCBs	SW846 8080

Notes:

(a) Includes 12 waste samples and 12 subsurface soil samples.
(b) Waste samples only.
(c) Includes ignitability (SW846 1010/1020), corrosivity (SW846 1110), and reactivity (SW846 Chapters 7.3.3.2 through 7.3.4.2) testing for the same samples.

2.6 SUBSURFACE SAMPLING AND ANALYSIS

Approximately 12 test pit samples (i.e., waste materials) will be obtained for analysis. Analytes will include TCL volatiles and semivolatiles, TAL metals, pesticides/PCBs, and cyanide. In addition, the three most contaminated samples will undergo a full toxicity characteristic leaching procedure (TCLP) waste characterization, including TCLP, ignitability, corrosivity, and reactivity. Also, approximately 12 subsurface soil samples will be obtained for analysis from the side wall of those test pits showing the presence of potentially contaminated wastes. It is assumed that subsurface soil samples will be collected from the same test pit as the waste samples. Analytes will include TCL volatiles and semivolatiles, TAL metals, pesticides/PCBs, and cyanide. Analytical results for the subsurface soil and waste samples will be reported by the laboratory within 21 days of sample receipt. Table 2-1 lists the sampling and analysis requirements for the test pit excavation program at Site 4.

The subsurface soil analytical results will be used to characterize the buried wastes and associated soils and if necessary, to establish clean-up goals or acceptable contaminant concentrations specific to this medium. These results will also be used to evaluate potential removal action alternatives and to generate volume estimates for buried materials contained within Site 4.

3.0 QUALITY ASSURANCE DOCUMENTATION

Quality assurance/quality control (QA/QC) guidelines and procedures for sample handling and documentation will be consistent with those presented in the QAPP for Phase III RI activities (HNUS, 1995b), and in the Final Phase II Work Plan, Part II, Sampling Plan Addendum (HNUS, 1992a).

Level D Naval Facilities Engineering Service Center (NFESC) [formerly Naval Energy and Environmental Support Activity (NEESA)] guidelines and protocols will be followed, since the data will be used to support the EE/CA site characterization and the streamlined risk assessment. QA/QC samples taken will include equipment rinsate blanks, field duplicates, field blanks, and trip blanks. For test pit sampling, it is anticipated that two rinsate blanks, one field blank, two field duplicates, and one trip blank will be submitted for analysis, in addition to the 12 subsurface waste samples. For subsurface soil samples, one rinsate blank, one field blank, one field duplicate, and one trip blank will be submitted for analysis, in addition to the 12 environmental samples. All QA/QC samples will be analyzed for the same parameters as the related samples.

For surface soil sampling, it is anticipated that QA/QC samples will include two equipment rinsate blanks and two field duplicates in addition to the 15 surface soil samples. Trip blank and field blank samples will not be collected. All QA/QC samples will be analyzed for the same parameters as the related samples.

For all subsurface and surface soil samples, the laboratory will also analyze matrix spikes (MS) and matrix spike duplicates (MSD). The duplicate will be taken from the same sample that will become the laboratory MS/MSD for organics or for the sample used as a duplicate in inorganic analysis.

4.0 PROJECT MILESTONES AND SCHEDULE

The project schedule for the Site 4 EE/CA field investigation, including the due date for deliverables, is under discussion and will be presented as a separate submittal. The field investigation will take about 4 weeks to perform, assuming there are no significant changes to the approach described in this FSP. Laboratory analysis will take about 5 weeks to complete. The draft EE/CA report should be completed about 1 month after all analytical results are received.

REFERENCES

EA Engineering, Science, and Technology, Inc., 1995. Base-Wide Environmental Baseline Survey for NAWC Warminster, Aircraft Division, Warminster, Pennsylvania. Berkely Heights, New Jersey.

Environmental Photographic Interpretation Center, 1994. Aerial Photographic Site Analysis, NAWC Warminster, Pennsylvania. Warrenton, Virginia.

Environmental Photographic Interpretation Center, 1995. Aerial Photographic Support, NAWC Warminster, Pennsylvania. Warrenton, Virginia.

Halliburton NUS Corporation, 1992a. Phase II Remedial Investigation/Feasibility Study Work Plan, Sampling and Analysis Plan. Wayne, Pennsylvania.

Halliburton NUS Corporation, 1992b. Draft Phase II Remedial Investigation Report for NAWC Warminster, Pennsylvania. Wayne, Pennsylvania.

Halliburton NUS Corporation, 1993. Phase II Remedial Investigation Report for Operable Unit 1, NAWC Warminster, Pennsylvania. Wayne, Pennsylvania.

Halliburton NUS Corporation, 1994. Remedial Investigation Report for Operable Unit 3, NAWC Warminster, Pennsylvania. Wayne, Pennsylvania.

Halliburton NUS Corporation, 1995a. Phase III Remedial Investigation Work Plan for NAWC Warminster, Pennsylvania. Wayne, Pennsylvania. Quality Assurance Project Plan, January 1995 (under development).

Halliburton NUS Corporation, 1995b. Phase III Remedial Investigation Work Plan for NAWC Warminster, Pennsylvania, Quality Assurance Project Plan. Wayne, Pennsylvania (under development).

REFERENCES

JRB Associates, 1981. Hydrogeologic Investigation of the Naval Air Development Center Waste Disposal Sites, Warminster, Pennsylvania; Task 1 - Records Search, Preliminary Site Investigation, and Recommendations for Task 2. McLean, Virginia.

Pennsylvania Department of Environmental Resources, 1993. Cleanup Standards for Contaminated Soils. Harrisburg, Pennsylvania.

SMC Environmental Services Group, 1991. Stages I and II - Rough Draft Remedial Investigation Report for NADC Warminster, Pennsylvania. Valley Forge, Pennsylvania.

U.S. Environmental Protection Agency, 1993. Draft Soil Screening Level Guidance. Washington, DC.

ATTACHMENT A

NUS CORPORATION ENVIRONMENTAL MANAGEMENT GROUP	STANDARD OPERATING PROCEDURES	Number GH-1.8	Page 1 of 6
		Effective Date 05/04/90	Revision 2
		Applicability EMG	
		Prepared Earth Sciences	
Subject EXCAVATION OF EXPLORATORY TEST PITS AND TRENCHES		Approved D. Senovich	

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1.0 PURPOSE

This procedure describes methods for proper excavation of test pits and trenches.

2.0 SCOPE

These procedures give overall technical guidance and may be modified by site-specific requirements for field exploratory test pits and trenches. Conditions which would make trench excavation technically difficult (such as shallow water table), potentially dangerous (presence of explosive materials or underground utilities) or likely to cause even greater environmental problems (such as potential rupture of buried containerized wastes) would require modifications to the methods described herein and may prevent implementation of the exploratory excavation program. Furthermore, the costs and difficulties in disposing of potentially hazardous materials removed from test pits may constrain their use to areas where contamination potential is low. Consequently, the techniques described herein may be most applicable in areas of low apparent contamination and where potentially explosive materials are not expected to be present.

3.0 GLOSSARY

Trenches or test pit. - Open shallow excavations, typically longitudinal (if a trench) or rectangular (if a pit), to determine the shallow subsurface conditions for engineering, geological, and soil chemistry exploration and/or sampling purposes. These pits are excavated manually or by a machine, such as a backhoe, clamshell, trencher excavator, or bulldozer.

4.0 RESPONSIBILITIES

Site Manager - is responsible for determining, in consultation with other project personnel (geologist, geochemist, engineer), the need for test pits or trenches, their approximate locations, depths and sampling objectives.

Field Operation Leader (FOL) - is responsible for finalizing the location and depth of test pits/trenches based on site conditions and the site geologist's advice. The FOL is ultimately responsible for the proper construction and backfilling of test pits and trenches, including adherence to OSHA regulations if applicable (see Section 5.0).

Health and Safety Officer - responsible for air quality monitoring during test pit construction and sampling, to ensure that workers and offsite (downwind) individuals are not exposed to hazardous levels of airborne contaminants. He/She may also be required to advise the FOL on other safety-related matters and mitigative measures to address potential physical hazards from unstable trench walls, puncturing of drums, or other hazardous objects, etc.

Site Geologist/Sampler - responsible for recording all information and data pertaining to the test pit excavation. Engineers, field technicians, or other properly trained personnel may also serve in this capacity.

5.0 PROCEDURES

5.1 APPLICABILITY

This subsection presents routine test pit or trench excavation techniques. Specialized techniques that are applicable only under certain conditions are not presented.

During the excavation of trenches or pits at hazardous waste sites, several health and safety concerns arise and control the method of excavation. All excavations that are deeper than 4 feet must be stabilized (before entry into the excavation) by bracing the pit sides using wooden or steel support structures. Personnel entering the excavation may be exposed to toxic or explosive gases and oxygen-deficient environments. In these cases, substantial air monitoring is required before entry, and appropriate respiratory gear and protective clothing is mandatory. There must be at least two persons present at the immediate site before entry by one of the investigators. The reader shall refer to OSHA regulations 29 CFR 1926, 29 CFR 1910.120, and 29 CFR 1910.134.

Excavations are generally not practical where a depth of more than about 15 feet is desired. They are usually limited to a few feet below the water table. In some cases, a pumping system may be required to control water levels within the pits, providing that pumped water can be adequately stored or disposed. If data on soils at depths greater than 15 feet are required, the data are usually obtained through test borings instead of test pits.

In addition, hazardous wastes may be brought to the surface by excavation equipment. This material, whether removed from the site or returned to the subsurface, must be properly handled according to any and all applicable federal, state, and local regulations.

5.2 TEST PIT AND TRENCH EXCAVATION

These procedures describe the methods for excavating and logging test pits and trenches to determine subsurface soil and rock conditions.

Test pits and trenches may be excavated by hand or by power equipment to permit detailed description of the nature and contamination of the in situ materials. The size of the excavation will depend primarily on the following:

- The purpose and extent of the exploration
- The space required for efficient excavation
- The chemicals of concern
- The economics and efficiency of available equipment

Test pits normally have a cross section that is 4 to 10 feet square; test trenches are usually 3 to 6 feet wide and may be extended for any length required to reveal conditions along a specific line. The following table, which is based on equipment efficiencies, can give a rough guide for design consideration:

Equipment	Typical Widths, in Feet
Trenching machine	2
Backhoe	2-6
Track dozer	10
Track loader	10
Excavator	10
Scraper	20

Fifteen feet is considered to be the economical vertical limit of excavation. However, larger and deeper excavations have been used when special problems justified the expense.

The lateral limits of excavation of trenches and the position of test pits shall be carefully marked on area base maps. If precise positioning is required to indicate the location of highly hazardous waste materials, nearby utilities, or dangerous conditions, the limits of the excavation shall be surveyed. Also, if precise determination of the depth of buried materials is needed for design or environmental assessment purposes, the elevation of the ground surface at the test pit or trench location shall also be determined by survey. It may be necessary to record several elevations for irregular or sloping surfaces. If the test pit/trench will not be surveyed immediately, it shall be backfilled and its position identified with stakes placed in the ground at the margin of the excavation for later surveying. For regional studies test pits and trenches may be located by survey or by using existing topographic maps and plans.

The construction of test pits and trenches shall be planned and designed in advance as much as possible. However, field conditions may necessitate revisions to the initial plans. The final depth and construction method shall be determined by the field geologist. The actual layout of each test pit, temporary staging area and spoils pile will be predicated on site conditions and wind direction at the time the test pit is made. Prior to excavation, the area can be surveyed by magnetometer or metal detector to identify the presence of underground utilities or drums.

The test pits and trenches shall be excavated in compliance with applicable safety regulations as specified by the health and safety officer.

If the depth exceeds 4 feet and people will be entering the pit or trench, Occupational Safety and Health Administration (OSHA) requirements must be met: Walls must be braced with wooden or steel braces, ladders must be in the hole at all times, and a temporary guardrail must be placed along the surface of the hole before entry. It is advisable to stay out of test pits as much as possible; if possible the required data or samples shall be gathered without entering the pit. Samples of leachate, groundwater, or sidewall soils can be taken with telescoping poles, etc.

Stabilization of the sides of test pits and trenches, when required, generally is achieved by sloping the walls at a sufficiently flat angle or by using sheeting. Benching or terracing can be used for deeper holes. Shallow excavations are generally stabilized by sheeting. Test pits excavated into fill are generally much more unstable than pits dug into natural in-place soil.

Sufficient space shall be maintained between trenches or pits to place soil that will be stockpiled for cover, as well as to allow access and free movement by haul vehicles and operating equipment. Excavated soil shall be stockpiled to one side in one location, preferably downwind, away from the edge of the pit to reduce pressure on the pit walls.

Dewatering may be required to assure the stability of the side walls, to prevent the bottom of the pit from heaving, and to keep the excavation dry. This is an important consideration for excavations in cohesionless material below the groundwater table. Liquids removed as a result of dewatering operations must be handled as potentially contaminated materials. Procedures for the collection and disposal of such materials should be discussed in the site-specific Work Plan.

The overland flow of water from excavated saturated soils and the erosion or sedimentation of the stockpiled soil shall be controlled. A temporary detention basin and a drainage system shall be planned to prevent the contaminated wastes from spreading, if necessary.

5.3 BACKFILLING OF TRENCHES AND TEST PITS

Before backfilling, the onsite crew shall photograph all significant features exposed by the test pit and trench and shall include in the photograph a scale to show dimensions. Photographs of test pits shall be marked to include site number, test pit number, depth, description of feature, and date of photograph. In addition, a geologic description of each photograph shall be entered in the logbook. All photographs shall be indexed and maintained for future reference.

After inspection, backfill material shall be returned to the pit under the direciton of the field supervisor.

If a low permeability layer is penetrated (resulting in groundwater flow from an upper contaminated flow zone into a lower uncontaminated flow zone), backfill material must represent original conditions or be impermeable. Backfill could consist of a soil-bentonite mix prepared in a proportion specified by the field supervisor (representing a permeability equal to or less than original conditions). Backfill can be covered by "clean" soil and graded to the original land contour. Revegetation of the disturbed area may also be required.

6.0 REFERENCES

NUS and CH_2MHill, August, 1987. Compendium of Field Operation Methods. Prepared for the U.S. EPA.

OSHA, 1979. Excavation, Trenching and Shoring 29 CFR 1926.650-653.

7.0 RECORDS

Test pits and trenches shall be logged by the field geologist in accordance with Procedure GH-1.5.

Test pit logs shall contain a sketch of pit conditions (see Attachment A, Test Pit Log Form). In addition, at least one photograph with a scale for comparison shall be taken of each pit. Included in the photograph shall be a card showing the test pit number. Test pit locations shall be documented by tying in the location of two or more nearby permanent landmarks (trees, house, fence, etc.) and shall be located on a site map. Surveying may also be required, depending on the requirements of each project. Other data to be recorded in the field logbook include the following:

- Name and location of job.
- Data of excavation.
- Approximate surface elevation.
- Total depth of excavation.
- Dimensions of pit.
- Method of sample acquisition.
- Type and size of samples.
- Soil and rock descriptions.
- Photographs.
- Groundwater levels.
- Organic gas or methane levels.
- Other pertinent information, such as waste material encountered.

ATTACHMENT A

TEST PIT LOG — *NUS CORPORATION*

PROJECT: ..... TEST PIT NO.: .....
PROJECT NO.: ..... DATE: .....
LOCATION: .....
FIELD GEOLOGIST: .....

DEPTH (ft.)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS

Test Pit Cross Section and / or Plan View

REMARKS .....

PHOTO LOG ..... TEST PIT .....

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