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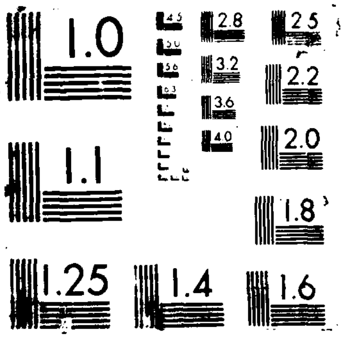
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STEP 2 REPORT
INVESTIGATION OF BURIED PESTICIDE CONTAINERS
STEWART AIR NATIONAL GUARD BASE
NEWBURGH, NY 12550

Stewart Air National Guard Base
Newburgh, NY 12550

Dames & Moore
1550 Northwest Highway
Park Ridge, IL 60068

May 30, 1986

Final Report August 23, 1984 to October 21, 1985

APPROVED FOR PUBLIC RELEASE;
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PREPARED FOR

AIR NATIONAL GUARD SUPPORT CENTER (ANGSC/DEV)
ANDREWS AIR FORCE BASE, MARYLAND 20331-6008

UNITED STATES AIR FORCE
OCCUPATIONAL & ENVIRONMENTAL HEALTH LABORATORY (USAFOEHL)
BROOKS AIR FORCE BASE, TEXAS 78235-5501

STEP 2 REPORT

INVESTIGATION OF BURIED PESTICIDE CONTAINERS

STEWART AIR NATIONAL GUARD BASE

NEWBURGH, NEW YORK

FINAL REPORT

FOR

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USAFOEHL TECHNICAL PROGRAM MANAGER

Captain Maria R. LaMagna

USAF OCCUPATIONAL & ENVIRONMENTAL HEALTH LABORATORY (USAFOEHL)
TECHNICAL SERVICES DIVISION (TS)
BROOKS AIR FORCE BASE, TEXAS 78235-5501

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This report has been prepared for the United States Air Force by DAMES & MOORE, for the purpose of aiding in the investigation of a pesticide burial site at Stewart Air National Guard Base, Newburgh, New York. It is not an endorsement of any product. The views expressed herein are those of the contractor and do not necessarily reflect the official views of the publishing agency, the United States Air Force, nor the Department of Defense.

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Geophysical surveys using a metal detector and magnetometer revealed a large metallic anomaly in the area of the investigation. Subsequent test pit sampling of soils and liquid wastes in the area of this anomaly confirmed the presence of buried 5-gallon pails of pesticides occupying an area approximately 15X25 feet in plan. Groundwater sampling showed evidence of pesticide contamination at least 30 feet downslope of the burial area. The hydraulic gradient on the site is complex and additional monitoring wells are necessary on-site before a groundwater remediation plan can be properly evaluated. As an interim remedial action, Dames & Moore has proposed that the active source of contamination be removed, even before additional field studies proceed.

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PREFACE

Dames & Moore was retained by the United States Air Force (USAF) under Contract No. F33615-83-D-4002 to provide environmental consulting services at the Stewart Air National Guard Base in Newburgh, New York.

This report presents the results of investigations to: 1) confirm and quantify the existence of buried pails of pesticides on the site; and 2) assess the migration of pesticides through soils and groundwater. An interim remedial action alternative for cleaning up the active source of contamination is proposed.

This project was staffed from Dames & Moore offices in Chicago, Illinois, Syracuse, New York, and White Plains, New York. The investigation was directed by Dr. Kenneth J. Stimpfl. Dr. Eileen D. Gilligan, Project Geologist, supervised field activities. Mr. Andre Ivancui, Field Technician conducted the test pit sampling activities and Mr. David B. Chason, Staff Hydrogeologist, supervised the soil sampling and monitoring well installations. Mr. Eric S. Nye, Assistant Geotechnical Engineer, performed soil analyses in the laboratory. Data compilation, analysis and report writing were done by Mr. David B. Chason and Dr. Eileen D. Gilligan.

The work on the project was accomplished between August 1984 and October 1985. Captain Maria R. LaMagna, Technical Services Division, USAF Occuptational and Environmental Health Laboratory (USAFOEHL) was the Technical Monitor.

APPROVED: George W. Nicholas
George W. Nicholas
Program Manager

TABLE OF CONTENTS

STEP 2 INVESTIGATION OF BURIED PESTICIDES CONTAINERS

LIST OF TABLES

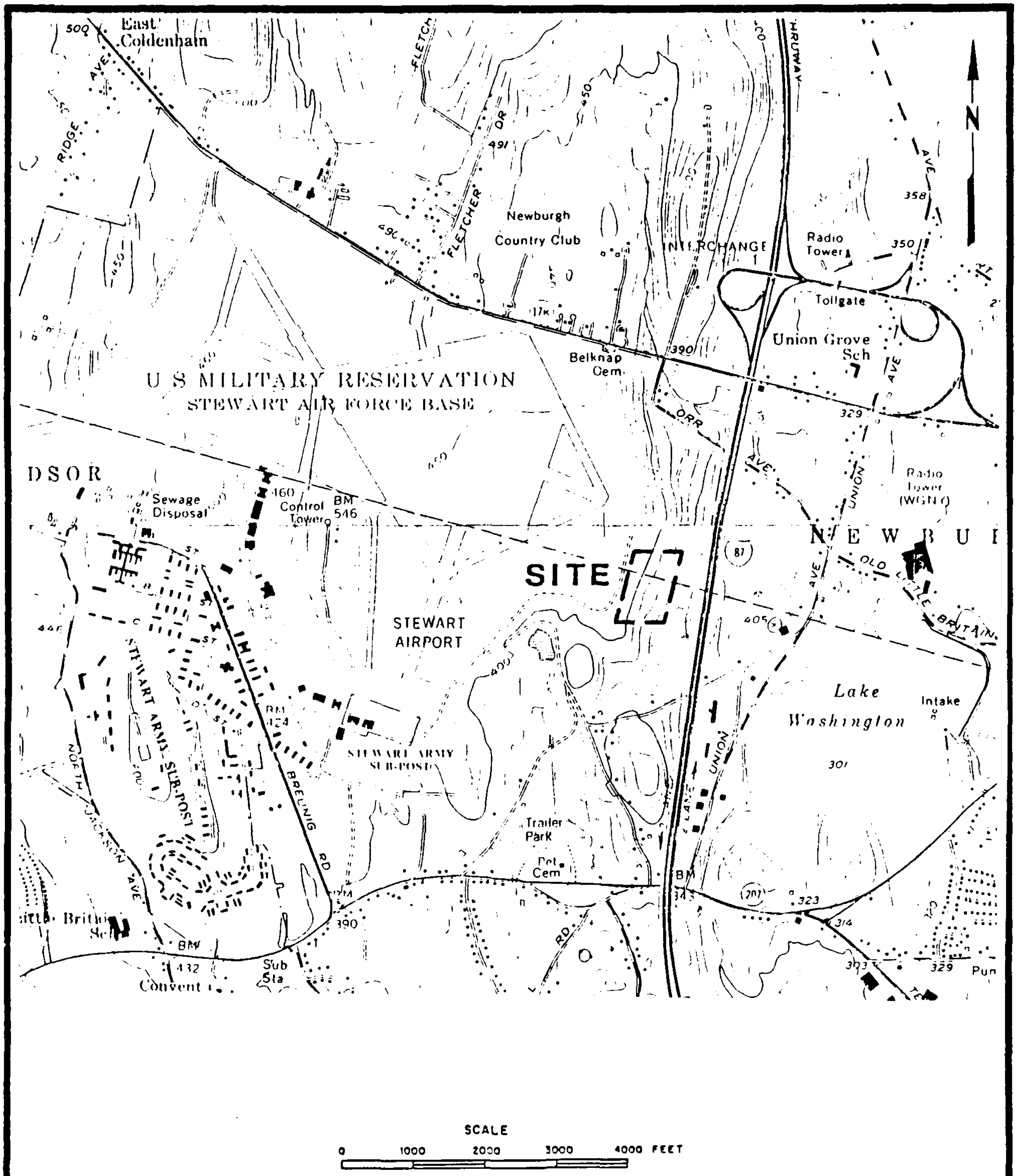
LIST OF FIGURES

SUMMARY

The Stewart Air National Guard Base is part of the Stewart Airport complex, which occupies 875 acres in Orange County New York. The Stewart Airport is located 2.5 miles west of the city of Newburgh in the Hudson River Valley region of New York State (Figure 1).

Two inactive waste management facilities were located during a presurvey of the site (Work Order 0006); a known sanitary landfill located in the eastern portion of theStewart Airport complex, and a suspected area of buried pesticide containers located to the west of the sanitary landfill.

Geophysical surveys using a metal detector and magnetometer (Work Order 0008) were used to locate a magnetic anomaly, which was assumed to be indicative of the buried pesticide containers. A series of test pit excavations (Work Orders 0022 and 0008) in the area of the magnetic anomaly confirmed the presence of crushed metal 5-gallon containers and crushed plastic 1-gallon containers of liquid waste. Chemical analyses of liquids from the containers and soils saturated with the waste indicated high concentrations of DDT in a solvent carrier. The pesticide burial area, approximately 15 by 25 feet in plan as defined by four test pits, was staked for future reference.



SITE LOCATION MAP

REFERENCE: U.S.G.S. 7.5' Topographic Map
Cornwall, NY (1981) and Newburgh, NY
(1957) Quadrangles

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FIGURE 1

Three groundwater monitoring wells were installed on the site (Work Order 0022); one well upslope of the pesticide disposal area as a control well, and two wells between the pesticide disposal area and the sanitary landfill as near-field downgradient wells. Field access problems precluded the installation of a fourth well downslope of the sanitary landfill.

Three possible modes of groundwater transport through two hydrogeologic units have been identified on-site, based on the results of the monitoring well program:

1) Perched water moving horizontally along the top of bedrock, primarily through a weathered rock zone at a rate of about 1.6 ft. per year.

2) Vertical and horizontal movement through pores in the sandier zones of a glacial till unit overlying the bedrock, at a rate of approximately 13 feet per year.

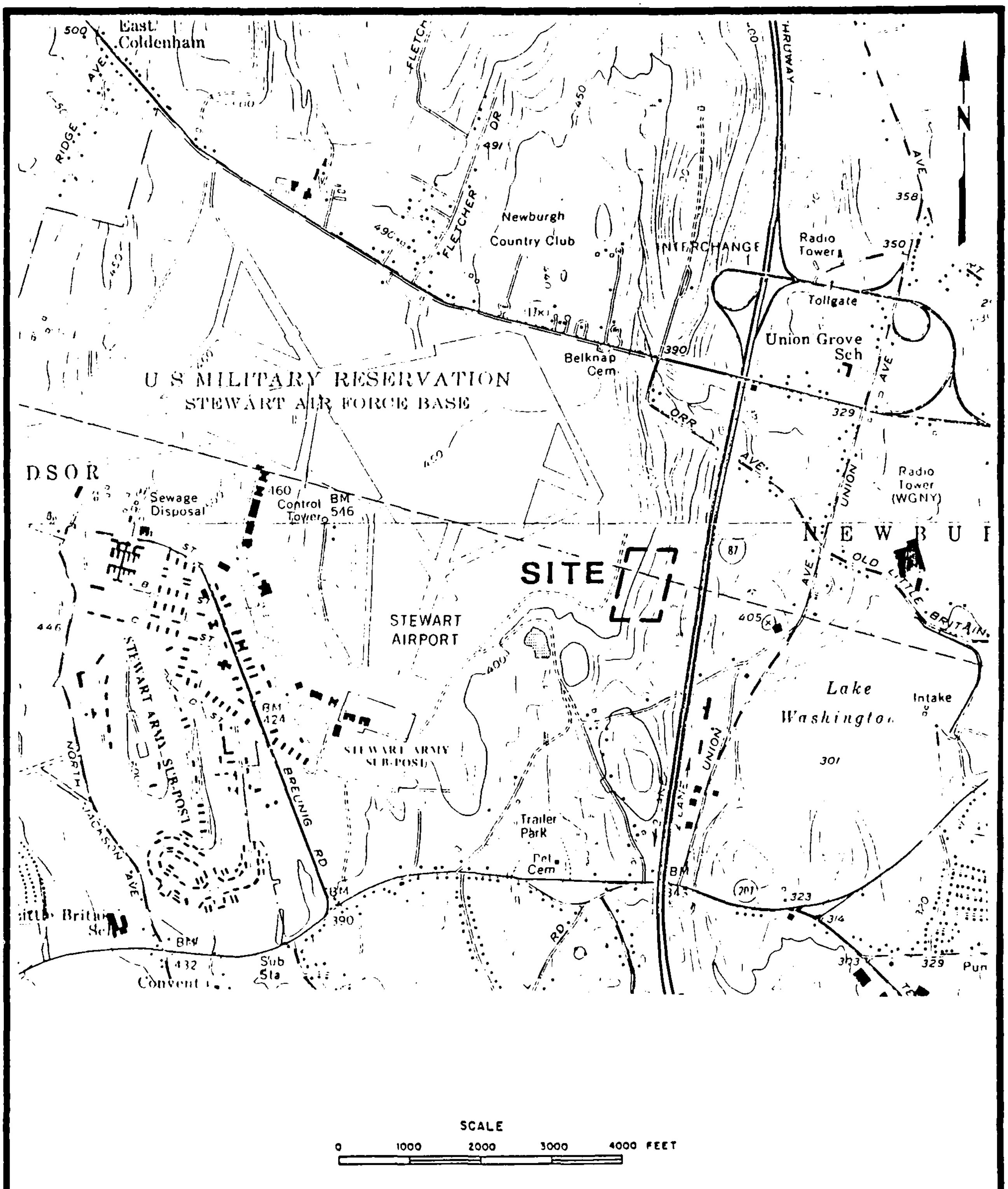
3) Vertical and horizontal movement along fractures in the till unit.

Pesticide contamination was detected in soils and groundwater at a depth of 45 feet at a monitoring location SW-2, approximately 35 feet downslope of the burial area (Figure 3). This suggests that pesticides have migrated vertically downward and horizontally away from the disposal area in an east to southeast direction. However, the hydraulic gradient on the site appears to be complex and the direction of groundwater flow cannot be estimated properly with only three monitoring wells. Additional piezometers are necessary on-site before groundwater and soil remediation alternatives can be evaluated.

In the interim, Dames & Moore has proposed that the active source of pesticide contamination be removed, even before the additional field studies proceed. Preliminary costs for this interim remedial action have been proposed (Appendix F).

1.0 INTRODUCTION

Dames & Moore was retained by the United States Air Force (USAF) under Contract No. F33615-83-D-4002 to provide environmental consulting services at the Stewart Air National Guard Base in Newburgh, New York (Figure 1). The services to be performed by Dames & Moore, as outlined in our original proposal of May 22, 1984, (see Statement of Work in Appendix G) were divided into three discrete steps. The purpose of Step 1 was to confirm the presence of suspected pails of pesticides buried on-site and to identify and quantify the contents of these pails. The purpose of Step 2 was to obtain further site specific hydrogeologic data in order to assess site stratigraphy, groundwater gradients, and to identify whether additional contamination exists in the soil and groundwater. The purpose of Step 3 was to use the data obtained in Steps 1 and 2 to develop a remediation plan to remove the waste and clean up contaminated soils and groundwater. The following report presents the results of Step 2 of this investigation. Although submitted in earlier reports (August, 1985), a brief summary of the results of Step 1 are given in Section 2.3.



SITE LOCATION MAP

REFERENCE: U.S.G.S. 7.5' Topographic Map
Cornwall, NY (1981) and Newburgh, NY
(1957) Quadrangles

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FIGURE 1

2.0 BACKGROUND INFORMATION

2.1 AIRPORT FACILITIES

The Stewart Air National Guard Base is part of the Stewart Airport complex, which occupies 875 acres in Orange County, New York. The Stewart Airport is located 2.5 miles west of the city of Newburgh in the Hudson River Valley region of New York State.

A major milestone in the history of Stewart Airport occurred recently when the site was selected for development as an Air National Guard Base. The site was selected because of its proximity to the New York metropolitan area, yet is beyond the limit of New York air traffic control. The plans for Air National Guard Base development include the construction of all necessary facilities to service aircraft.

2.2 WASTE MANAGEMENT FACILITIES

Two inactive waste management facilities were located during this study. The first was a sanitary landfill located in the eastern portion of the Stewart Airport complex. This landfill was operated by the USAF from approximately 1960 to 1970 and was used for the disposal of domestic refuse from base housing, wastes from food dispensing facilities on the base, and waste from aircraft maintenance operations.

Little information regarding the second waste management facility was available, although it was believed to consist of a burial trench, allegedly used to dispose of approximately 2000 gallons of pesticide/herbicide material in metal containers sometime between 1960 and 1970. Information about this facility was obtained from independent verbal accounts provided by former base employees. The type and nature of the pesticide/herbicide was unknown. According to the verbal accounts, the burial trench was located to the west of the sanitary landfill. The backhoe operator who originally excavated the trench could not recall its precise location but did recall that the excavation penetrated dense "hardpan" material.

The New York State Department of Environmental Conservation (NYSDEC) received an anonymous account of the pesticide disposal and based on this information performed a ground penetrating radar survey and test trench exploration program. The results of this program were negative. However, it should be noted that the program was performed in an area approximately 100 by 100 feet at a location more than 1000 feet away from the location where the backhoe operator thought the disposal might have taken place.

2.3 CONFIRMATION OF BURIED PESTICIDE CONTAINERS

Under Work Order No. 0006, a presurvey of the site was undertaken for the purpose of developing a scope of work for confirmation and quantification of contamination due to the two waste management facilities. One of the tasks of the presurvey was a visit/briefing of the site on September 23, 1983. During the site inspection Dames & Moore examined maps and aerial photographs of the site as well as the reports of an earlier site investigation performed by NYSDEC. Dames & Moore also conducted a field inspection of the landfill site and the approximate area where the pesticides were allegedly buried. The results of this presurvey, submitted to the USAF in a report dated October 4, 1983, included recommendations and cost estimates for additional work needed to confirm and quantify the presence of pesticide contamination at the site.

Under Work Order No. 0008, geophysical surveys using a metal detector and magnetometer were undertaken on March 13 - 15, 1984 to locate the pesticide burial trench. A large anomaly in the target area was identified that corresponded to a depression visible in the aerial photographs, along with several smaller anomalies. The results of this geophysical survey were presented to the USAF in a report dated July 23, 1984. A series of test pit excavations were performed on September 21 - 24, 1984 under Work Order No. 0022. The large anomaly was discovered to contain domestic refuse with no evidence of containers. One test pit, located at the western edge of the area surveyed, revealed buried containers, some of which were labelled "Caution-Acid". Analyses of samples from that test pit indicated the presence of high concentrations of DDT in an apparent oil carrier. Because the burial zone appeared to be largely outside the original survey area, Work Order No. 0008 was reopened to facilitate additional geophysical surveys over an expanded area.

A second series of metal detector and magnetometer surveys were undertaken on November 8 - 10, 1984 to investigate adjacent areas north and west of the original survey areas. As part of the scope of the modified Work Order No. 0008, additional test pits were excavated on April 29 thru May 1, 1985, on the north, south and west margins of the newly defined target area. These test pits confirmed the presence of buried containers of DDT in an oil carrier, as well as small concentrations of sulfuric acid. The burial area, approximately 15 by 25 feet in size as defined by four test pits, was staked for future reference.

A summary of the soil sampling and liquid waste sampling data collected during both phases of the test pit work (September 1984, April/May 1985) are presented in Tables 1a and 1b, respectively. The chemical analyses of soil and liquid waste samples found to be contaminated with pesticides and/or acids are summarized in Tables 2a and 2 b, respectively. The locations of each test pit relative to the geophysical grid are presented in Table 3.

On August 29, 1985, Dames & Moore submitted a draft report to the USAF summarizing the results of the geophysical survey and test pit investigations performed under Work Order No. 0008. This report presented the results of Step 1 of the three step program outlined in our proposal of May 22, 1984, and included an estimate of the quantity of containers, the vertical and horizontal limits of the disposal area, and recommendations regarding Step 2 of the investigation.

TABLE 1a

SOILS FROM TEST PITS

TEST PIT NO	EXCAVATED TO A DEPTH OF:	SAMPLE NO	SAMPLE DEPTH	COMMENTS
TP-1	15 feet	TP1-2	8 feet	taken from under domestic refuse
TP-2	15 feet	TP2-2	7-8 feet	taken from under domestic refuse
TP-3	6 feet	TP3-13	6 feet	floor of test pit;muddy slurry of soil saturated with waste
TP-4	15 feet	TP4-2	10 feet	floor of test pit
TP-5	6 1/2 feet	TP5-1	6 1/2 feet	floor of test pit
TP-6	6 1/2 feet	TP6-1	6 feet	soil saturated with waste on wall of test pit
TP-7	6 feet	TP7-1	6 feet	waste saturated soil from floor of test pit ; derived from liquid draining from black metal container
TP-8	4 1/2 feet on North end; 6 feet on South end	TP8-1	~4 feet	floor of test pit

TABLE 1b

LIQUID WASTES FROM TEST PITS

TEST PIT NO	SAMPLE NO	DEPTH OF SAMPLE (depth of containers)	COMMENTS
TP-3	TP3-1	5 feet	from 5-gallon metal container
	TP3-2	5 feet	from 5-gallon metal container
TP-6	TP6-2	5 feet	milky color, from 5-gallon metal container labelled "STC"
TP-7	TP7-3	6 feet	floor of test pit, milky color
	TP7-2	6 feet	from black metal 5-gallon container
TP-8	TP8-2	~4 feet	from backhoe bucket, oily liquid containing a lot of silt

TABLE 2a

SUMMARY OF ANALYTICAL RESULTS ABOVE DETECTION LIMITS SOIL SAMPLES FROM TEST PITS[a]

PARAMETER	UNIT	TP-3[b]	TP-5	TP-6	TP-7	TP-8
Parathion	µg/g	--	--	2.2	0.59	3.9
DDE	µg/g	--	--	130.	6.1	7.2
DDD	µg/g	3,900.	--	950.	140.	370.
o,p'-DDT	µg/g	3,900.	0.06	600.	25.	49.
p,p'-DDT	µg/g	13,000.	0.17	1,700.	73.	122.
2,4-D	µg/g	0.42	--	--	--	--
2,4,5-T	µg/g	--	--	--	0.37	0.61

Note: -- = Less than detection limit.

[a] Complete laboratory report presented in Appendix B of Order 008 draft report entitled, "Results of Investigation to Locate Buried Pesticide Containers" (August 29, 1985)

[b] Sample number TP3-13

TABLE 2b

SUMMARY OF ANALYTICAL RESULTS ABOVE DETECTION LIMITS LIQUIDS FROM TEST PITS[a]

PARAMETER	UNIT	TP3-I[b]	TP3-II[b]	TP-6	TP-7	TP-8
Sulfuric acid	mg/L	N/A	N/A	N/A	490.	480.
Hydrochloric acid	mg/L	N/A	N/A	N/A	7.	32.
Hydrofluoric acid	mg/L	N/A	N/A	N/A	0.3	2.
Heptachlor	µg/L	3.2	--	--	--	--
Parathion	µg/L	--	--	--	--	3.8
DDE	µg/L	--	--	1,500.	4,000,000.	37.
DDD	µg/L	7100.	159,000.	23,000.	28,000,000.	430.
o,p'-DDT	µg/L	950.	100,000.	16,000.	38,000,000.	360.
p,p'-DDT	µg/L	3040.	370,000.	20,000.	120,000,000.	440.
2,4-D	µg/L	--	130.	6.6	2.2	3.0
2,4,5-T	µg/L	--	31.0	47.0	5.4	6.6

Notes: N/A = not analyzed.

-- = Less than detection limit.

[a] Complete laboratory report presented in Appendix B of Order 0008 draft report entitled, "Results of Investigation to Locate Buried Pesticide Containers" (August 29, 1985)

[b] Two samples from TP-3 taken September 1984 under Task Order 0022.

Table 3

LOCATIONS OF TEST PITS IN RELATION TO GEOPHYSICAL GRID

TP-1	1+34S, 0+60E
TP-2	1+90S, 0+40E
TP-3	1+00S, 0+00E
TP-4	2+40S, 0+30E
TP-5	1+55S, 0+15W
TP-6	0+86S, 0+00E
TP-7	1+20S, 0+11W
TP-8	1+33S, 0+ 3E

NOTE: In the field, excavation of test pits TP-6, TP-7 and TP-8 proceeeded from the above coordinates in a direction toward TP-3 in order to define the limits of the burial area.

3.0 SCOPE OF WORK

Based on the results of Step 1 a field program was designed in which the following tasks would be performed:

1) Drill and install three or four wells in the soil; one well upgradient of the pesticide disposal area, as a control well, one or two wells in the near-field downgradient area between the pesticide disposal area and the domestic landfill to define contamination migrating from the pesticide disposal area; and one well in the far-field downgradient area to the east of the domestic landfill, to define contamination migrating from the landfill. Wells were to be constructed of Schedule 40 PVC and screened just below the water table.

2) Collect and analyze soil samples taken from just below the water table in each boring to assess existing soil contamination.

3) Collect and analyze groundwater samples from each well to assess existing groundwater contamination.

4) Perform in situ permeability tests in each well to evaluate the hydraulic characteristics of the geologic medium in which the wells are screened.

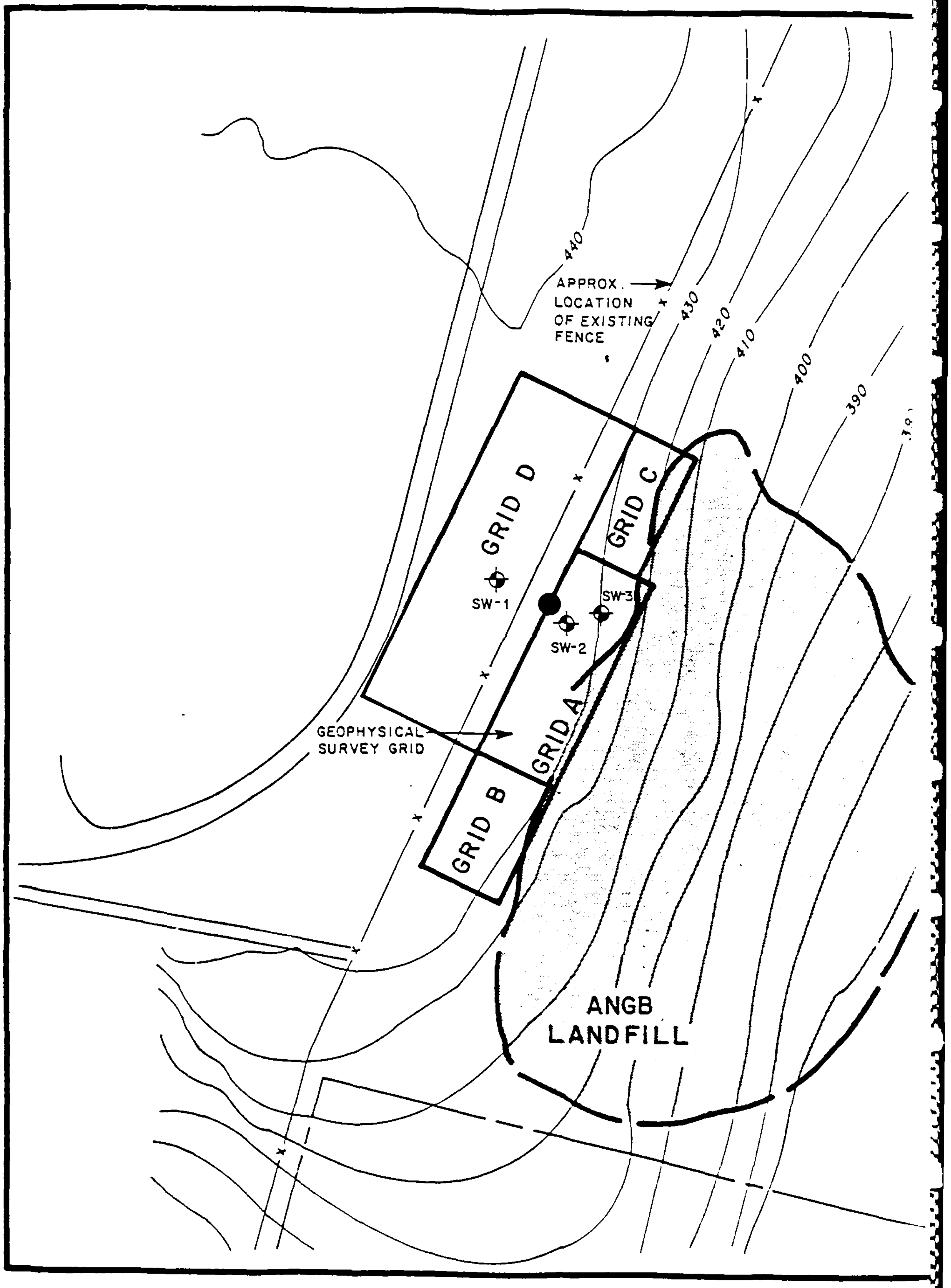
Certain modifications to the original scope of the field investigation were made as field work progressed. Any changes in scope were discussed with the USAF technical board before implementation. A summary of the tasks performed in the field including some modifications, is presented in the following section. Well schematics, boring logs, permeability calculations, grain-size curves and the detailed field procedures employed in the study are presented in Appendix A.

4.0 SUMMARY OF FIELD INVESTIGATION, SEPTEMBER 11 THROUGH OCTOBER 1, 1985

The approximate area of the buried pesticide and acid containers as defined by the earlier geophysical grid surveys and test pit work is shown in Figure 2. The disposal area, roughly rectangular, is located between geophysical grids A and C and is bounded by grid coordinates 0+91S, 1+15S, 0+11W and 0+06E (Figure 3).

The approximate boundaries of the domestic landfill are also shown in Figure 2. Based on visual observations of surface litter and the total magnetic intensities found within grid A (Figure 4), it appears that the domestic landfill is larger in aerial extent than realized from air photographs and previously outlined in our earlier report (August 29, 1985).

Before the drilling program began, a Dames & Moore geologist performed a thorough walk-through of the site with the drilling subcontractor downgradient of the domestic landfill. It was realized from this inspection that placing a well downgradient of the landfill was unfeasible due to problems with access. Based upon conversations with Lt. Maria LaMagna (USAF) it was decided that two wells would be placed between the pesticide disposal


440
APPROX. LOCATION OF EXISTING FENCE
430
420
410
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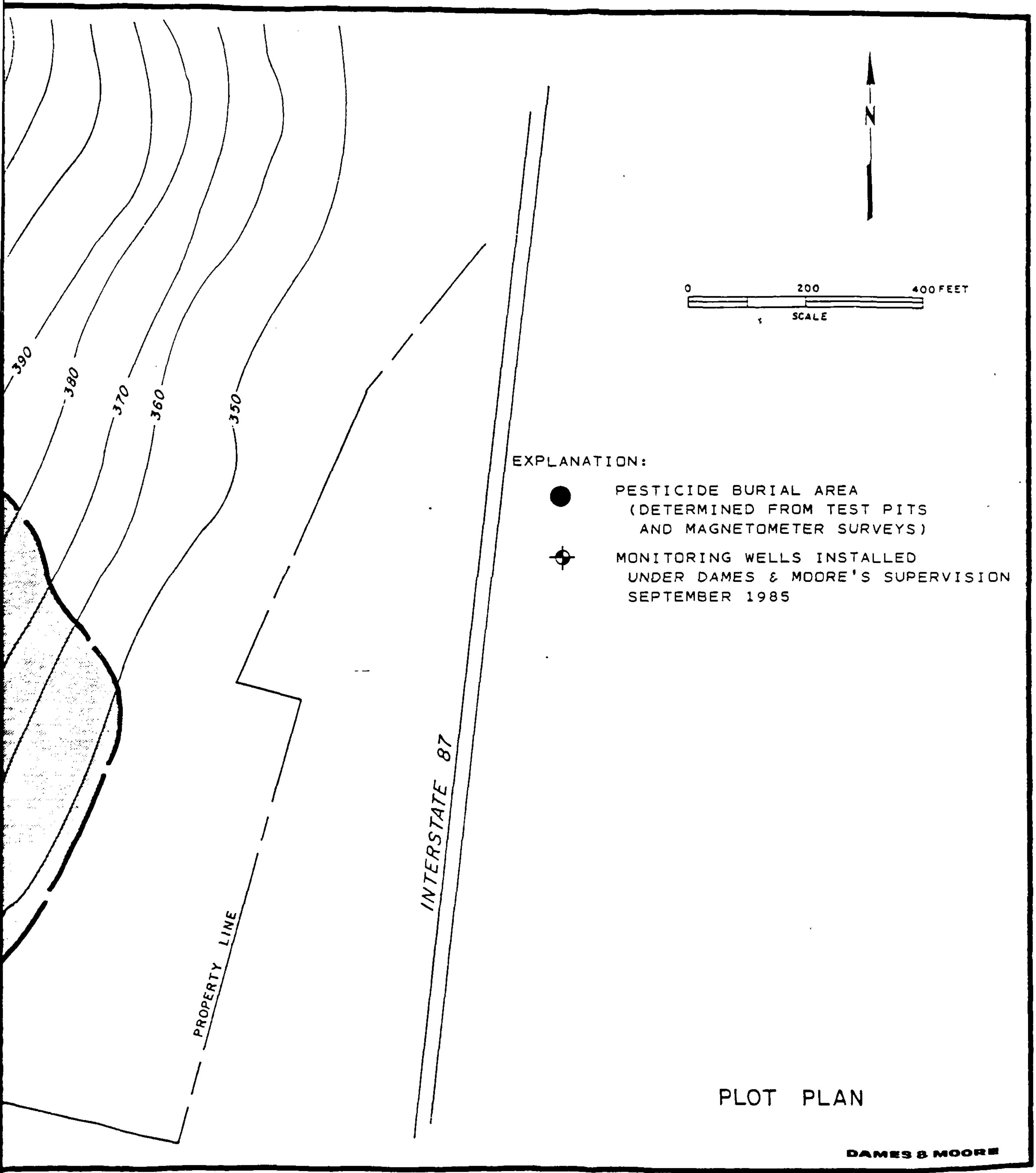
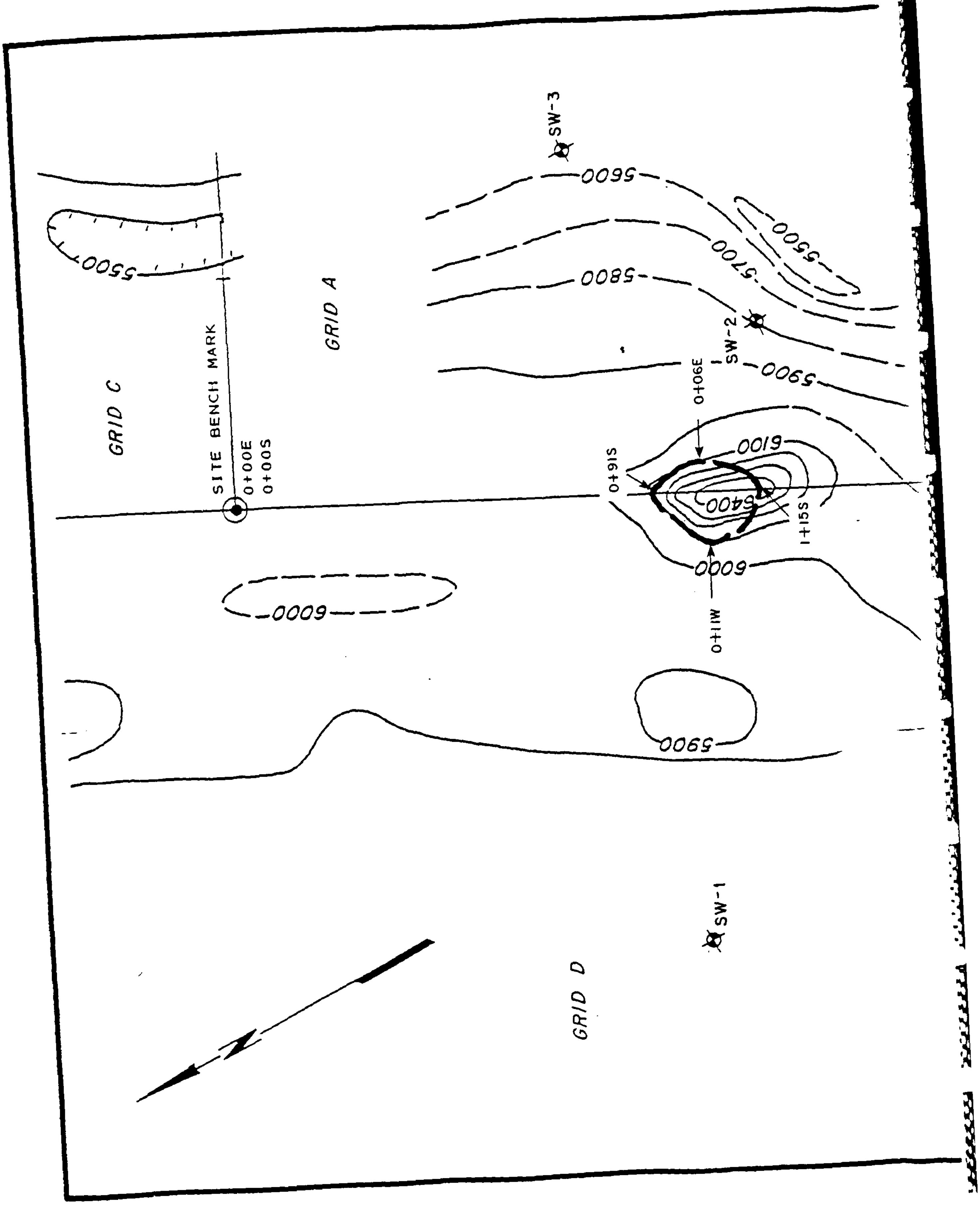
390
GRID D
GRID C
SW-1
SW-3
SW-2
GRID A
GEOPHYSICAL SURVEY GRID
GRID B
ANGB LANDFILL



PLOT PLAN

FIGURE 2

2


GRID C
GRID A
GRID D
SITE BENCH MARK
0+00E
0+00S
SW-1
SW-2
SW-3
5500
5500
5600
5700
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6000
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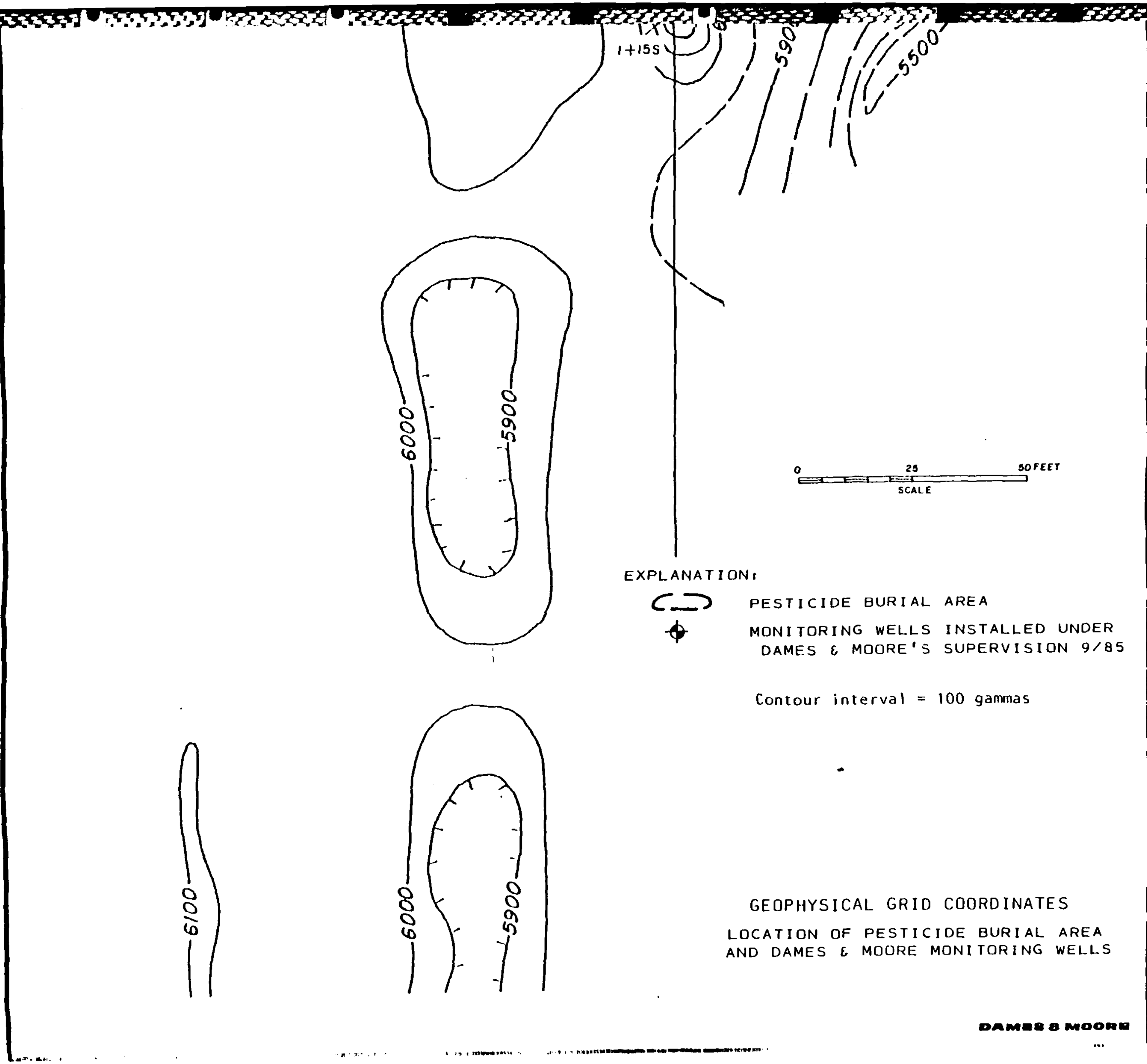
6400
0+06E
0+91S
1+15S
0+11W

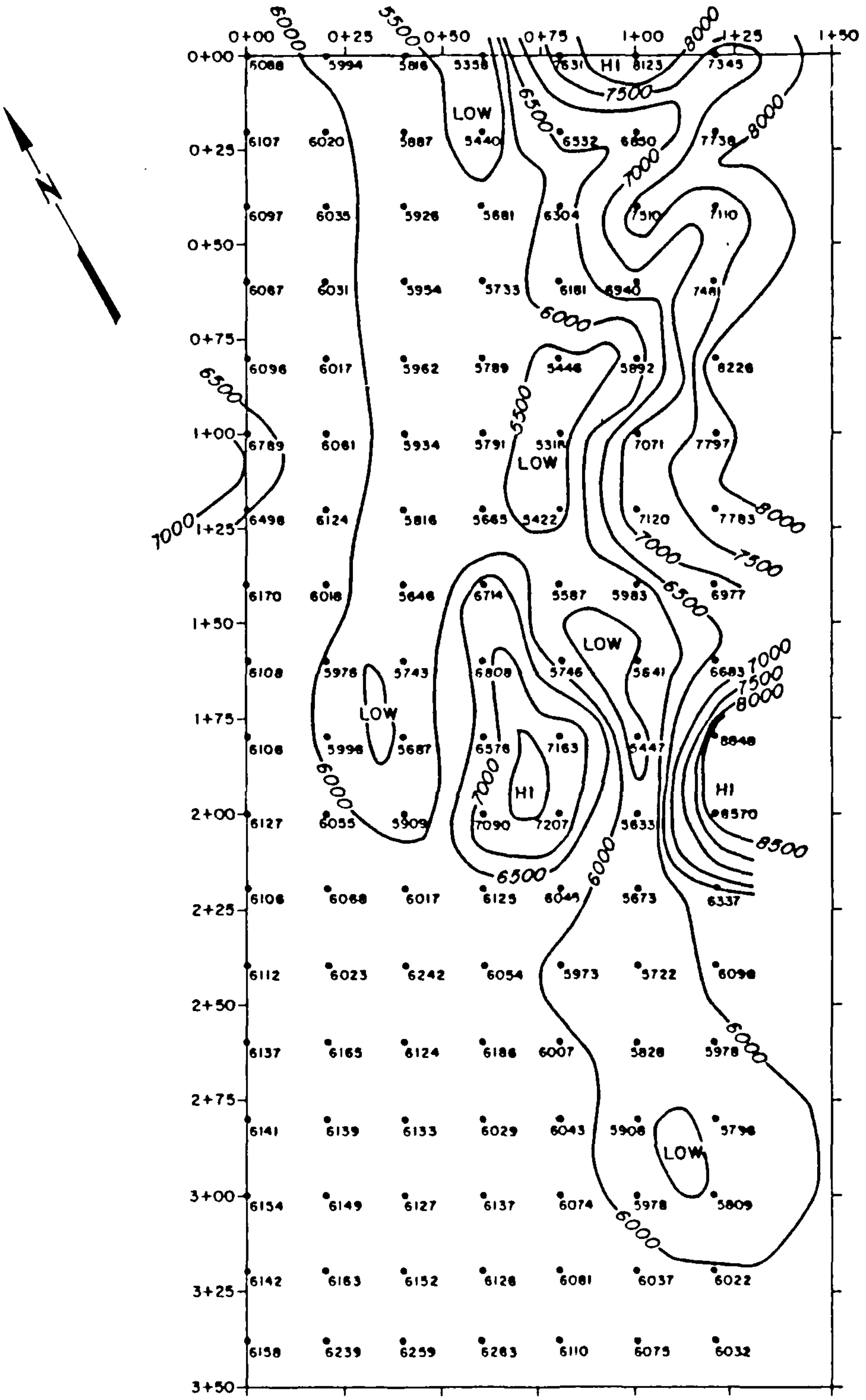
2



GEOPHYSICAL GRID COORDINATES

LOCATION OF PESTICIDE BURIAL AREA
AND DAMES & MOORE MONITORING WELLS

FIGURE 3



NOTE: READINGS ARE HIGHEST IN AREA OF TOPOGRAPHIC DEPRESSION AND IN AREA THOUGHT TO BE FORMER LANDFILL. CONTOUR INTERVAL IS 500 GAMMAS.

TOTAL MAGNETIC INTENSITY - GRID A
MARCH 1984

DAMES & MOORE

FIGURE 4

area and the ANGB landfill and one well would be placed upgradient (to the west) of the pesticide disposal area. Well SW-1, the control well, was placed upgradient of the center of the disposal area at grid coordinates 0+100S, 0+98W. Well SW-2 was placed at coordinates 1+16S, 0+36E to monitor possible contaminant movement directly downgradient of the southern limit of the pesticide disposal area. Well SW-3, placed at 0 + 78S, 0 + 76.5E was located to monitor possible contaminant movement from the northern edge of the disposal area (Figures 2 and 3). The sequence of drilling was SW-1, followed by SW-2, and then SW-3. During drilling, split-spoon samples were taken at 5-foot intervals. Each sample was monitored with a photoionization detector (PID) immediately after the sample was removed from the borehole. It was originally intended that boreholes would not extend beyond the top of bedrock, however none of the soil samples above bedrock exhibited a water saturated condition. After a discussion with USAF personnel concerning the importance of obtaining groundwater samples for this study, the boreholes were extended into the weathered bedrock zone just below the soil (LaMagna, 1985). In the weathered bedrock zone abundant groundwater was encountered. One soil sample from below the elevation of the static water level in each borehole was retained for chemical analyses of pesticides and herbicides. Representative soil samples were also selected for grain-size analyses. Well screens were placed opposite the zones where groundwater was first encountered. Wells SW-1 and SW-2 are screened in the zone of weathered shale bedrock. Well SW-3 is screened partially in the weathered rock zone and partially in glacial till above the bedrock (see Section 5.1, "Site Geology"). During the drilling of SW-2, high concentrations of organic vapor were detected with the PID in both the cuttings around the borehole and in split-spoon samples from depths of 25 to 35 feet. These organic vapors were assumed to be indicative of the organic solvent carrier of the pesticides. After discussing the high levels of organics detected with the USAF, a decision was made to install stainless steel wells in SW-2 and SW-3 instead of PVC, which is incompatible with high concentrations of most organic solvents (LaMagna, 1985). Also, an additional soil sample from borehole SW-2 was sent to the lab for chemical analyses. After each well was installed, the wells were developed and groundwater samples were taken for chemical analyses of pesticides and herbicides. In situ recovery tests were subsequently performed in each well to evaluate the permeability (hydraulic conductivity) of the zone opposite the well screens.

5.0 RESULTS

5.1 SITE GEOLOGY

A site specific assessment of geologic units has been developed from the three recent test borings by D&M to depths of 50 feet, by earlier D&M test pit work which provided shallow subsurface exposure, from a review of selected borings done by Empire Soils, Inc. (1983) to a depth of 30 feet, and from a review of regional geologic data compiled during the D&M presurvey investigation.

Bedrock beneath the site is predominantly thinly bedded and fractured Martinsburg shale. In the vicinity of the pesticide disposal area it occurs at depths between 45 and 50 feet. Downslope of the disposal area, beneath the ANGB landfill, the shale occurs at shallower depths between 15 and 25 feet suggesting that the unit is relatively flat-lying. Overlying the shale is a weathered shale-rock zone ranging between 2.5 and 10 feet thick. The unconsolidated deposit overlying the weathered rock zone is primarily a dense, gray, fine sand and silty glacial till which contains numerous pebbles, cobbles, and boulders. Overlying the undisturbed till is a disturbed till of variable thickness, emplaced either during construction of roadways, during the burial activities of the pesticides or during operation of the ANGB landfill. In the vicinity of the pesticide disposal area this upper till unit is particularly sandy. Upslope of the disposal area the till is more similar in texture to the undisturbed till described above. Downslope of the disposal area in the ANGB landfill, the till is intermixed with domestic refuse (i.e., wood, paper, etc.).

5.2 SITE HYDROLOGY

There is no surface water evident on the disposal site. Rainwater drains off the disposal site to the east into a swamp. The swamp drains in two directions: to the northeast via a stream into Brookside Pond and eventually into the Hudson River, and to the north via a stream along Orr Avenue into another swamp (U.S.G.S. 7 1/2 topo. quads.; Cornwall, N.Y., 1981, Newburgh, NY, 1957).

Numerous borings and excavations on the Stewart ANGB as deep as 60 to 70 feet have not indicated the presence of a water table (Steene, 1985). However, during drilling of the three recent test borings by Dames & Moore, abundant groundwater was encountered under pressure in the zone of weathered bedrock. This water appears to be perched on top of bedrock. The hydraulic gradient in the weathered rock zone is apparently complex. This viewpoint is based upon observations of the static water level (head) in wells SW-1, SW-2 and SW-3. Well SW-1, which is topographically upgradient of SW-2 and SW-3, exhibits a head of approximately four feet lower than SW-2 and SW-3. This anomaly may be due to local heterogeneities in the subsurface geology or may, in fact, suggest that the local hydraulic gradient in the weathered rock zone is toward the west; nearly opposite of the topographic gradient. The hydraulic gradient between wells SW-2 and SW-3 is approximately .007 in an easterly direction, suggesting that the groundwater flow direction in the weathered rock zone is in conformance with the topographic gradient. Unfortunately, there are no other monitoring wells on-site to lend direct supportive evidence to the actual configuration of the potentiometric surface in the weathered rock zone.

For the purpose of computing potential groundwater seepage velocities, we have presently assumed that the hydraulic gradient in the weathered rock zone mimicks the overlying topography (Toth, 1962, 1963) and that the representative magnitude of hydraulic gradient is that which exists between SW-2 and SW-3. Estimates of the horizontal hydraulic conductivity (Kh) of the weathered rock zone were made by performing in situ variable head recovery tests on wells SW-1, SW-2, and SW-3. The average value for the three wells using the time-lag method of Hvorslev (1951) is 5.6 x 10-5 cm/s.

The actual seepage velocity of groundwater in the weathered rock zone can be evaluated from the relationship:

$$v = \frac{KI}{n}$$

WHERE:

K = hydraulic conductivity

I = hydraulic gradient

n = effective porosity

v = seepage velocity

For K = 5.6 x 10-5 cm/s, I = 0.007 and assuming a conservative porosity estimate of 0.25 for fractured shale, (Fetter, 1980, p.65, Freeze and Cherry, 1979, p.37) v in the weathered rock zone is 1.6 x 10-6 cm/s (1.6 ft/yr).

Split-spoon soil samples taken in sandy zones above the dense silty till were moist compared to the very dry nature of the silty till itself. This suggests a potential for perched groundwater movement in sandier zones of the till. Hydraulic conductivity of the sandy till and the silty till are estimated as 2.5 x 10-5 cm/s and 4.9 x 10-6 cm/s, respectively, based on grain-size analyses (see Appendix A.9). The topographic gradient in the local vicinity of the pesticide disposal area is almost negligible, making the potential for porous groundwater flow limited. However, approximately 75 feet downslope, the topographic gradient of the domestic landfill becomes 0.15. Assuming saturated porous flow, a porosity of .30 (Fetter, 1980, p.64, Freeze and Cherry, 1979, p.37) and the above estimate of 2.5 x 10-5 cm/s for K, a conservative estimate of seepage velocity through the sandy till would be 1.25 x 10-5 cm/s (12.9 ft/yr). Another possible mode of groundwater flow on-site is through fractures in the entire till unit. Orange coated surfaces were visible in the gray till during the test-pit work. These surfaces could be attributed to oxygen enriched rainwater percolating through fractures and subsequently oxidizing the iron minerals in the till. A deep water table, such as present on this site, could cause fractures to extend deeply within the till, creating conduits for groundwater migration into the underlying bedrock.

In summary, 3 possible modes of groundwater transport through two hydrogeologic units have been identified on-site:

1) Perched water moving horizontally along the top of bedrock, primarily through a weathered rock zone at a rate of about 1.6 ft/yr.
2) Vertical and horizontal movement through pores in the sandier parts of the glacial till at a rate of approximately 13 ft/yr.
3) Vertical and horizontal movement along fractures in the till unit.

5.3 SITE CONTAMINATION

Tables 4a and 4b present a summary of the compounds detected in soil and groundwater at well locations SW-1, SW-2, and SW-3. A more detailed report of the chemical results is given in Appendix D. As evident during drilling and well installation, the soils and groundwater at location SW-2 are contaminated with pesticides. Only trace amounts of a few compounds were detected at locations SW-1 and SW-3 and for the most part the soils and groundwater at these locations can be considered presently uncontaminated. These results indicate that the pesticides have migrated vertically downward and horizontally away from the disposal area in an east to southeast direction. These chemical results lend support to the idea that local groundwater flow on the site is toward the east in conformance with the topographic gradient.

TABLE 4a

CHEMICALS DETECTED IN SOIL SAMPLES FROM BORINGS

			SAMPLE NO.			
PARAMETER	UNITS	DETECTION LIMIT	SW-1	SW-2-1	SW-2-2	SW-3
Depth	Ft.	*	31	25	35	25
Moisture	%	0.1	6	5	14	9
Malathion	ppm	0.01	*	0.01	*	*
Parathion	ppm	0.01	*	0.08	*	*
P,P'-DDT	ppm	0.001	0.001	1.5	8.2	*
O,P'-DDT	ppm	0.005	*	0.42	1.9	*
DDD	ppm	0.001	*	0.47	2.5	*
DDE	ppm	0.001	*	0.026	0.058	*
2,4-D	ppm	0.005	*	0.067	0.35	0.022
2,4,5-T	ppm	0.005	*	0.006	0.040	*

*denotes value less than limit of detection

TABLE 4b

CHEMICALS DETECTED IN GROUNDWATER SAMPLES

PARAMETER	UNITS	LIMIT	WELL NUMBER SW-1	SW-2	SW-3
Depth	Ft.	*	39.35-49.5	35.1-45.1	36.4-46.4
Dieldrin	ppb	0.01	0.04	*	*
Lindane	ppb	0.01	*	0.03	*
P,P'-DDT	ppb	0.02	*	15.0	*
O,P'-DDT	ppb	0.02	*	4.4	*
DDD	ppb	0.02	*	8.5	*
DDE	ppb	0.02	*	0.15	*
2,4-D	ppb	0.1	*	20.0	0.1
2,4,5-T	ppb	0.05	*	0.45	*

*denotes value less than limit of detection

6.0 CONCLUSIONS

The chemical data gathered to date provide evidence that soils and groundwater are contaminated with pesticides to depths of at least 45 feet and at a distance of at least 30 feet away from the known disposal area. The plume of contamination may in fact be very narrow and localized. However, with the limited number of soil and groundwater samples taken to date, the limits of the plume have not been sufficiently identified. Dames & Moore submitted a draft letter report to the USAF ("Recommendation for Interim Remedial Action and Supplemental Field Investigation, Stewart Air National Guard Base", November 15, 1985) that proposes the drilling of five supplemental test borings around the disposal area, the installation of another groundwater monitoring well downslope of well SW-2 and the sampling of surface water bodies that drain off the disposal site. Temporary PVC wells placed in the test borings will provide the necessary water level data to more clearly define the magnitude and direction of the hydraulic gradient in the weathered bedrock zone. Chemical analyses of groundwater from the newly installed monitoring well, soil samples from the five test borings, and surface water samples will provide the necessary chemical data to more clearly delineate the contamination plume. Once these data are available, and a final analysis of the hydrologic and chemical data is complete, Dames & Moore could submit another report to the USAF concerning the clean-up of existing soil and groundwater contamination on-site. This report would include a listing of the potential remedial alternatives, the criteria necessary for evaluation of each of the alternatives, preliminary cost data for each feasible alternative, and the selection of a preferred alternative. Once that report has been reviewed by the USAF a remedial action work plan could be submitted which would identify the equipment, cost, schedule and logistics to implement the preferred remedial alternative. A bid document would also be prepared at that time for submission to suitable subcontractors.

In the interim, Dames & Moore has proposed that the active source of pesticide contamination be removed, even before the additional field studies proceed (see draft letter report, November 15, 1985 presented in Appendix F). Preliminary costs for this interim remedial action have also been proposed.

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APPENDIX A

APPENDIX A
PROCEDURES

A.1 Drilling and Soil Sampling

Three wells were installed between September 12 and September 26, 1985 for use in conducting in situ variable head hydraulic conductivity tests and for groundwater and soil sampling. All drilling and well installation activities were performed by Parratt-Wolff, Inc. of Syracuse, New York under the supervision of a Dames & Moore geologist. The boreholes were drilled using 3 1/4" I.D. hollow-stem augers driven by a truck mounted CME 55 drill rig.

A 3 1/4" I.D. hollow-stem auger was used to drill through all materials encountered, including unconsolidated deposits, the weathered shale bedrock and the more competent shale bedrock. Because of the difficulty in drilling soft bedrock with a hollow-stem auger the cutting teeth on the auger bit had to be replaced several times.

Soil samples were obtained at five-foot intervals using a 2" O.D. standard split-spoon sampler. Blow counts were obtained by driving the sampler 18 inches using a 140 lb. hammer falling 30 inches. To prevent cross contamination, the split-spoon was cleaned with hexane, then methanol, and rinsed with distilled water between samples. The soils were classified by visual examination in the field using the Unified Soil Classification System (Figure A.1). A complete log of each borehole was maintained by the field geologist. Soil samples were stored in glass containers and labelled. One soil sample from just below the elevation of groundwater potential in each borehole was placed in a mason jar with a teflon-lined lid. An additional soil sample was taken from borehole SW-2 for chemical anaysis because of the high readings detected on the photoionization detector during drilling. These samples were placed in a plastic ice chest, the proper chain-of-custody forms were signed off and the samples sent to UBTL, Inc. in Salt Lake City, Utah for chemical analysis. Dames & Moore soil sampling records and chain-of-custody forms are presented in Appendix E.

Graphical representations of the soils and bedrock encountered in the three boreholes are shown in Figures A.2 through A.4.

A.2 Well Construction

Well SW-1 was installed through the hollow-stem augers. For installation of wells SW-2 and SW-3, the hollow-stem augers were withdrawn and replaced by 4 1/4" I.D. flush-joint casing; the wells were then installed through the casing.

Wells SW-2 and SW-3 were constructed of two-inch diameter stainless steel screens (0.010 inch slot size) with stainless steel riser pipe. Well SW-1 was constructed of a two-inch diameter schedule-40 PVC slotted screen (0.010 inch slot size) with PVC riser pipe. SW-1 and SW-2 were screened in the zone of weathered bedrock; SW-3 was screened partially in glacial till and partially in the weathered bedrock. All three wells were designed to be utilized for groundwater level monitoring and groundwater sampling. A schematic drawing of each well installation is presented in Figures A.5 through A.7.

General step-by-step well construction procedures are listed below:

- o Advance borehole to saturated zone using CME-55 rig with a 3 1/4" hollow-stem auger.
- o Install screen and riser pipe.
- o Place Q-rock filter sand in the annular space betweenwell and borehole to a minimum height of two feet above the well screen.
- o Place bentonite pellets above filter sand for minimum thickness of two feet.
- o Pump cement/bentonite grout into remainder of annular space above bentonite sand.
- o Place four-inch diameter protective casing with lockable steel cap over the two-inch riser pipe and cement in place.

A.3 Well Development

On September 26 - 27, 1985, wells SW-1, SW-2 and SW-3 were developed until they produced sand-free, relatively clear groundwater. This was accomplished by surging with a stainless steel bailer and then evacuating with the same bailer.

A.4 Surveying

The location of each well, ground elevation, top of well casing (uncapped), top of protective casing and static water level were surveyed on October 21, 1985. Surveying work was performed by J.D. Plumley Engineering, P.C. of Baldwinsville, New York. A summary of the survey data is presented in Table A.1.

A.5 Groundwater Samples

Groundwater samples were collected from SW-1, SW-2 and SW-3 on September 30 - October 1, 1985. Laboratory analysis was performed by UBTL, Inc. of Salt Lake City, Utah for trace levels of pesticides and herbicides. Quality Assurance procedures used by the laboratory are presented in Appendix C.

In order to minimize the possibility for cross-contamination, groundwater samples were collected beginning with the well least likely to be contaminated (SW-1) and ending with the well most likely to be contaminated (SW-2). Sampling order was determined from the levels of organics detected during drilling, proximity to the pesticide disposal area and the hydrogeologic conditions present at the site. To prevent cross-contamination sampling equipment was washed with hexane and methanol followed by a rinse of distilled water between wells.

Dames & Moore Field Sampling Records used during the well sampling activities are found in Appendix E. In order to obtain a representative groundwater sample, the water within the well casing and in close proximity to the well screen was removed. At least two well volumes of water were removed prior to sampling the well. Well water was evacuated using a stainless steel bailer.

After removal of the required volumes of water from the wells, groundwater samples were collected using stainless steel bailers. Field measurements of pH, specific conductance and temperature were made with calibrated equipment. All sample bottles were clearly labelled in permanent ink. Handling of the water from the bailer was minimized by immediate transfer to the sample bottles. A duplicate set of samples were taken from SW-2 for quality control purposes. As each full set of samples were collected from each well, they were stored in an ice chest. The samples were maintained in the cooler until sampling of all wells was complete. At that time, the appropriate Chain-of-Custody documents were completed and signed and the samples shipped to the laboratory for analyses. Chain-of-Custody documents are found in Appendix E.

A.6 In-Situ Permeability Testing (Recovery Tests)

In order to evaluate the velocity and extent of groundwater contamination at the site, a knowledge of the aquifer properties must be known. With this goal in mind, in-situ permeability tests (also referred to as slug or bail recovery tests) were conducted at the monitoring wells.

Prior to evacuating water from the wells in preparation for groundwater sampling, the static water level in each well was measured relative to the top of the well casing with a SIMCO audible electric contact probe, accurate to the nearest 0.01 feet. After groundwater sampling, the water level in the well was lowered by bailing. Recovery of the water level was then monitored over a period of time by means of a stopwatch and the electric contact probe. The hydrostatic time-lag method of Hvorslev (1951) was used to calculate permeability (K). This is in part a graphical method whereby recovery data are normalized to the initial drop in head (water level) and plotted on a logarithmic scale versus time on an arithmetic scale. A value for T_o, defined as the basic time lag, is read from the graph and substituted into an appropriate equation to determine K. For this study, the formula used was:

$K = r^2 \ln (L/R)/2 LT_o$ where:

K = permeability

r = radius of the well intake

R = radius of the riser pipe

L = length of effective well intake

T_o = basic time lag.

Theoretically the data should plot as a straight-line passing through 1.0 on the logarithmic scale. If neither of these two conditions are met, there may be other physical parameters affecting the recovery such as air blocked pores or consolidation and swelling of the soil. If two distinct slopes are apparent on the plot of $h-H/H-H_o$ vs. t, it is best to be conservative and extrapolate the steeper slope. By doing so, one would tend to overestimate the permeability; a valuable contingency in a study on the spread of groundwater contamination. Figures A-8 through A-10 are graphs of the data for wells SW-1, SW-2 and SW-3.

A.7 Health and Safety Procedures

As part of Dames & Moore's policy to protect its employees and subcontractors on hazardous waste sites, a detailed Health and Safety Plan was prepared before implementing the field program. Any personnel working on-site were required to sign-off on a form indicating that he/she read and fully understood the contents of the plan.

A.8 Grain-Size Analyses

Grain-size analyses were done on selected soil samples in accordance with ASTM D422-63 entitled, "Standard Method for Particle-Size Analysis of Soils". For the coarse grained fraction the wet sieve method was employed and for the fine grained fraction (passing the No. 200 sieve), the hydrometer method was used. Gradation curves are presented as Figures A.11 through A.13.

A.9 Hydraulic Conductivity Evaluation Based on Grain-Size Analyses

An estimation of the hydraulic conductivity of a soil based on soil texture requires the choice of a representative grain-size. One empirical relationship which can provide useful estimates for most soils relies on the effective grain-size d_{10} and predicts the following relationship with hydraulic conductivity (see Freeze and Cherry p. 350):

$$K = A\, d_{10}$$

where K = hydraulic conductivity in cm/s, d_{10} is the grain size diameter of a soil of which 10% by weight of the particles are finer, and A=1.0 for K in cm/s and d_{10} in mm. Referring to Figure A.11, d_{10} for the sandy glacial till is .005 mm and K = 2.5 x 10^{-5} cm/s. The corresponding d_{10} values for the silty glacial till obtained from Figures A.12 and A.13 are .003 mm and .0009 mm which makes an average K for the silty glacial till equal to 4.9 x 10^{-6} cm/s. (Note that the value obtained for d_{10} in Figure A.13 is extrapolated beyond the gradation curve.)

TABLE A-1
SUMMARY OF SURVEY DATA

WELL NO.	DATE COMPLETED	DATE SURVEYED	GROUND SURFACE ELEVATION (FT.)	ELEVATION OF TOP OF WELL (FT.)	ELEVATION OF TOP OF PROTECTIVE CASING (FT.)	ELEVATION OF STATIC WATER LEVEL (FT. (10-21-85)
SW-1	9-17-85	10-21-85	436.0	438.31	438.56	406.36
SW-2	9-24-85	10-21-85	433.5	435.72	435.99	410.49
SW-3	9-26-85	10-21-85	432.6	434.33	434.58	410.19

DATUM: 6-INCH SQUARE CONCRETE POST 500 FEET ± N OF WELLS AND 75 FEET ± E OF "B" ROAD; ELEVATION = 442.07 FEET U.S.G.S.

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)	▨	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			▨	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	▨	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			▨	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN SAND (LITTLE OR NO FINES)	▨	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			▨	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	▨	SM	SILTY SANDS, SAND-SILT MIXTURES
			▨	SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50	▨	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			▨	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			▨	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50	▨	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
			▨	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			▨	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			▨	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS.

SOIL CLASSIFICATION CHART

UNIFIED SOIL CLASSIFICATION SYSTEM

DAMES & MOORE

FIGURE A-1

DAMES & MOORE
BORING LOG

CLIENT: STEWART AIR NATIONAL GUARD BASE
LOCATION: NEWBURGH, NY

BORING NO.: SW-1
SURFACE ELEV: 436.0

DRILLING METHOD: Hollow stem auger

SAMPLING METHOD: Split spoon

DATE STARTED: 9/12/85

DATE FINISHED: 9/16/85

SAMPLE NO.	BLOWS/FT	SAMPLE TYPE	DEPTH IN FT.	SOIL GRAPH	MATERIAL DESCRIPTION
1	40	SS	0		Brown moist silt and fine to medium sand, little medium gravel
			1	SM --	grading to brownish-gray, silt, dry, some fine gravel and coarse sand, little coarse to medium gravel Hnu=0ppm
			2	ML	
			3		
			4		Gray dry silt, litle fine to medium gravel, little sand Hnu=0ppm
2	103	SS	5		
			6		
			7		
			8		boulder drilled at 8.0'
			9		
3	88	SS	10		grades to some sand, little fine to coarse gravel Hnu=0ppm
			11		
			12	ML	
			13		
			14		
4	128	SS	15		cobble at 15.0'
			16		
			17		
			18		
			19		
5	77	SS	20		

FIGURE A-2A

DAMES & MOORE
BORING LOG

CLIENT: STEWART AIR NATIONAL GUARD BASE
LOCATION: NEWBURGH, NY

BORING NO.: SW-1

SAMPLE NO.	BLOWS/FT	SAMPLE TYPE	DEPTH IN FT.	SOIL GRAPH	MATERIAL DESCRIPTION
			20		
			21		
			22		
			23		boulder at 23.0'
			24		
6	108	SS	25		grades to little sand Hnu=0ppm
			26		
			27		
			28	ML	
			29		
7	146	SS	30		Hnu=<1ppm
			31		
			32		
			33		
			34		
8	80/2"	SS	35		Hnu=<1ppm
			36		
			37		
			38		Brown with iron staining, fissile, weathered shale, dry to moist, wet zone from 40'1" to 40'2", some silt
			39		
9	100/3"	SS	40		

FIGURE A-2B

DAMES & MOORE
BORING LOG

CLIENT: STEWART AIR NATIONAL GUARD BASE
LOCATION: NEWBURGH, NY

BORING NO.: SW-1

SAMPLE NO.	BLOWS/FT	SAMPLE TYPE	DEPTH IN FT.	SOIL GRAPH	MATERIAL DESCRIPTION
			40	WEATHERED ROCK	
			41		
			42		
			43		
			44		
10	100/5"	SS	45		grades to gray, dry with iron staining
			46		
			47		
			48		Bedrock, spoon refusal, no sample Hnu=0ppm
			49		
	100/0"		50		Boring terminated at a depth of 50.0 feet on 9/16/85

NOTE: Hnu readings are field detections of organic vapors given off by soil samples; measured with an Hnu photoionization meter set to a 9.8 span.

FIGURE A-2C

DAMES & MOORE
BORING LOG

Page 1 of 3

CLIENT: STEWART AIR NATIONAL GUARD BASE
LOCATION: NEWBURGH, NY

BORING NO.: SW-2
SURFACE ELEV: 433.5'

DRILLING METHOD: Hollow stem auger

SAMPLING METHOD: Split spoon

DATE STARTED: 9/18/85

DATE FINISHED: 9/19/85

SAMPLE NO.	BLOWS/FT	SAMPLE TYPE	DEPTH IN FT.	SOIL GRAPH	MATERIAL DESCRIPTION
1	32	SS	0	SP	Brown, mottled, dry to moist, fine sand and silt, little fine gravel Hnu=0ppm
			1		
			2		
			3		
			4		
2	100	SS	5	SM	Brown, dry fine sand, little fine to medium gravel Hnu=0ppm
			6	SP	Brown, moist, fine sand, little medium to coarse sand and fine gravel, trace silt Hnu=0ppm
			7		
			8		
			9		
3	92	SS	10		grades to dry, less gravel
			11		
			12		
			13	ML	Gray, moist, silt, little fine to medium gravel, little fine sand Hnu=0ppm
			14		
4	75	SS	15		
			16		
			17		
			18		
			19		
			20		

FIGURE A-3A

CLIENT: STEWART AIR NATIONAL GUARD BASE
LOCATION: NEWBURGH, NY
BORING NO.: SW-2

SAMPLE NO.	BLOWS/FT	SAMPLE TYPE	DEPTH IN FT.	SOIL GRAPH	MATERIAL DESCRIPTION
			20	ML	no soil sample; cuttings are gray silt drilled boulder at 21 feet
	100/5"		21		
			22		
			23		
			24		
5	80	SS	25		grades to dry to slightly moist, little fine to medium sand, little fine to coarse gravel Hnu=10ppm
			26		
			27		
			28		
			29		
6	20/1"	SS	30		no soil sample; cuttings are gray silt
			31		
			32		
			33		
			34		
7	100/1"	SS	35	ROCK	Brown-gray with iron stains, weathered, slightly, metamorphosed shale Hnu=200ppm
			36		
			37		
			38		
			39		
8	100/1/2"	SS	40		Hnu=8ppm

FIGURE A-3B

DAMES & MOORE
BORING LOG

Page 3 of 3

CLIENT: STEWART AIR NATIONAL GUARD BASE
LOCATION: NEWBURGH, NY

BORING NO.: SW-2

SAMPLE NO.	BLOWS/FT	SAMPLE TYPE	DEPTH IN FT.	SOIL GRAPH	MATERIAL DESCRIPTION
			40		
			41		
			42		
			43		
			44		
	100/0"	SS	45	BEDROCK	Spoon bounces; bedrock
			46		
			47		
			48		
			49		
	50/0"		50		Boring terminated at a depth of 50.0 feet on 9/19/85

NOTE: Hnu readings are field detections of organic vapors given off by soil samples; measured with an Hnu photoionozation meter set to a 9.8 span.

FIGURE A-3C

DAMES & MOORE
BORING LOG

Page 1 of 3

CLIENT: STEWART AIR NATIONAL GUARD BASE
LOCATION: NEWBURGH, NY

BORING NO.: SW-3
SURFACE ELEV: 432.6'

DRILLING METHOD: Hollow stem auger

SAMPLING METHOD: Split sploon

DATE STARTED: 9/24/85

DATE FINISHED: 9/26/85

SAMPLE NO.	BLOWS/FT	SAMPLE TYPE	DEPTH IN FT.	SOIL GRAPH	MATERIAL DESCRIPTION
1	46	SS	0	SM	Gray-brown, dry to slightly moist, mottled fine sand, some fine to medium gravel, little silt Hnu=0ppm
			1		
			2		
			3		boulder at 3.0'
			4		
2	31	SS	5		grades to mottled, tan-light brown, moist Hnu=0ppm
			6		
			7		
			8		boulder at 8.0'
			9		
3	74	SS	10		Hnu=0ppm
			11		
			12		boulder at 12.0'
			13		
			14		
4	52	SS	15	SP	Tan to light brown, moist, fine sand, some fine to coarse gravel, trace silt Hnu=0ppm
			16		
			17		
			18		
			19		
5	86	SS	20	SM	Yellow-tan, dry to slightly moist, fine

FIGURE A-4A

DAMES & MOORE
BORING LOG

Page 2 of 3

CLIENT: STEWART AIR NATIONAL GUARD BASE
LOCATION: NEWBURGH, NY

BORING NO.: SW-3

SAMPLE NO.	BLOWS/FT	SAMPLE TYPE	DEPTH IN FT.	SOIL GRAPH	MATERIAL DESCRIPTION
			20	SM	sand and silt, little fine to medium gravel
			21	-----	grades to brown, dry, no gravel grades to gray slightly moist
			22		Gray, slightly moist silt, some fine to medium gravel, some fine sand
			23		Hnu=0ppm
			24		
6	50/6"	SS	25		
			26		
			27		
			28		
			29		cobble at 30.0'
7	50/3"	SS	30		grades to dry, little fine to coarse gravel
			31	ML	Hnu=0ppm
			32		
			33		
			34		
8	70/1/2"	SS	35		grades to no gravel Hnu=0ppm
			36		
			37		
			38		
			39		
	50/1/2"		40		grades to light gray silt and gravel

FIGURE A-4B

DAMES & MOORE
BORING LOG

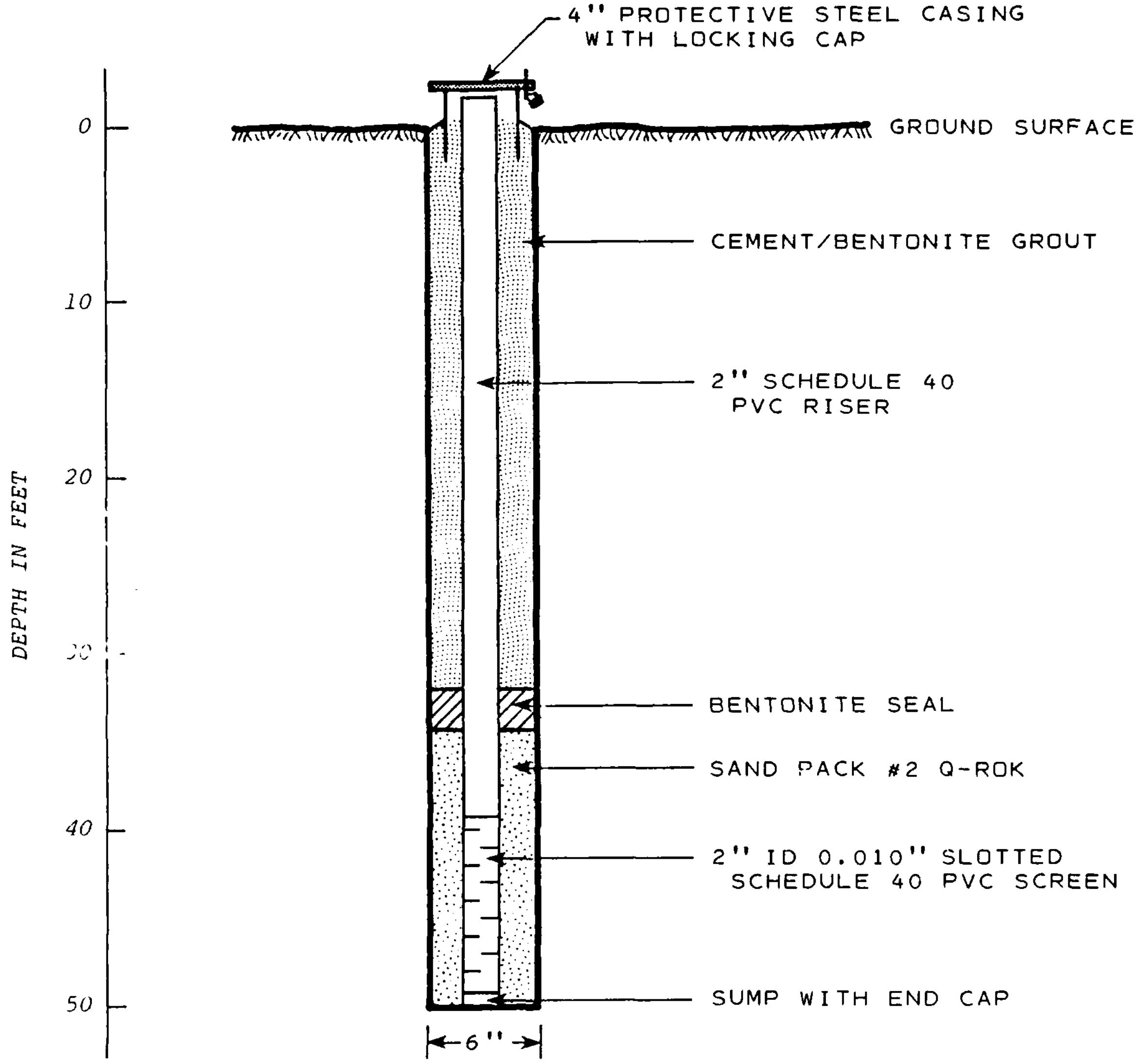
CLIENT: STEWART AIR NATIONAL GUARD BASE
LOCATION: NEWBURGH, NY

BORING NO.: SW-3

SAMPLE NO.	BLOWS/FT	SAMPLE TYPE	DEPTH IN FT.	SOIL GRAPH	MATERIAL DESCRIPTION
			40		Hnu=0ppm
			41	ML	
			42		
			43		Weathered rock Hnu=0ppm
			44		drilled easy from 44 1/2 to 45 feet
9	70/1"	SS	45		Shale bedrock Hnu=0ppm
			46		
			47		
			48		
			49		Boring terminated at a depth of 49.5 feet on 9/26/85
			50		

NOTE: Hnu readings are field detections of organic vapors given off by soil samples; meadured with an Hnu photoionozation meter set to a 9.8 span.

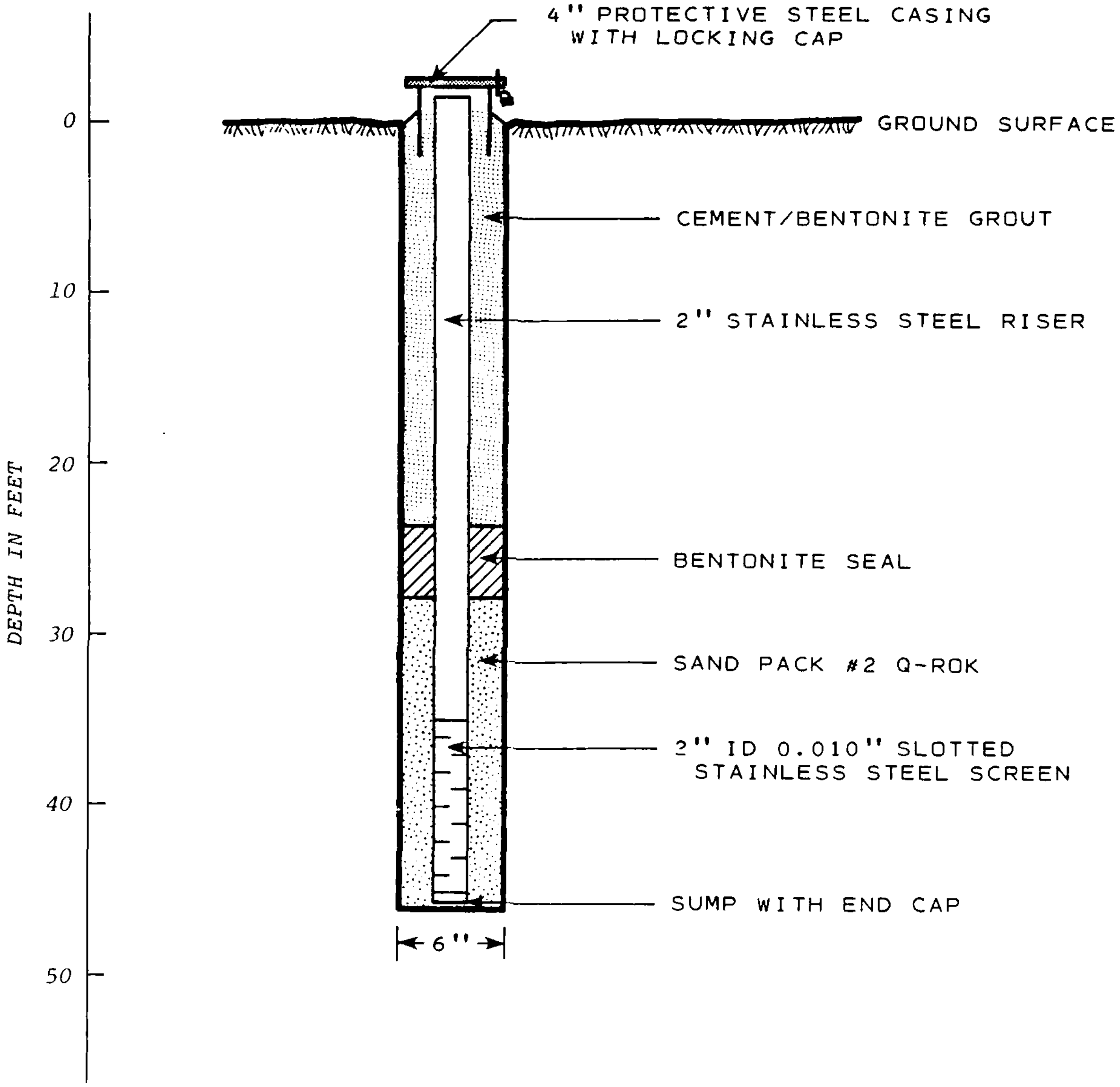
FIGURE A-4C



WELL SCHEMATIC
SW-1

DAMES & MOORE

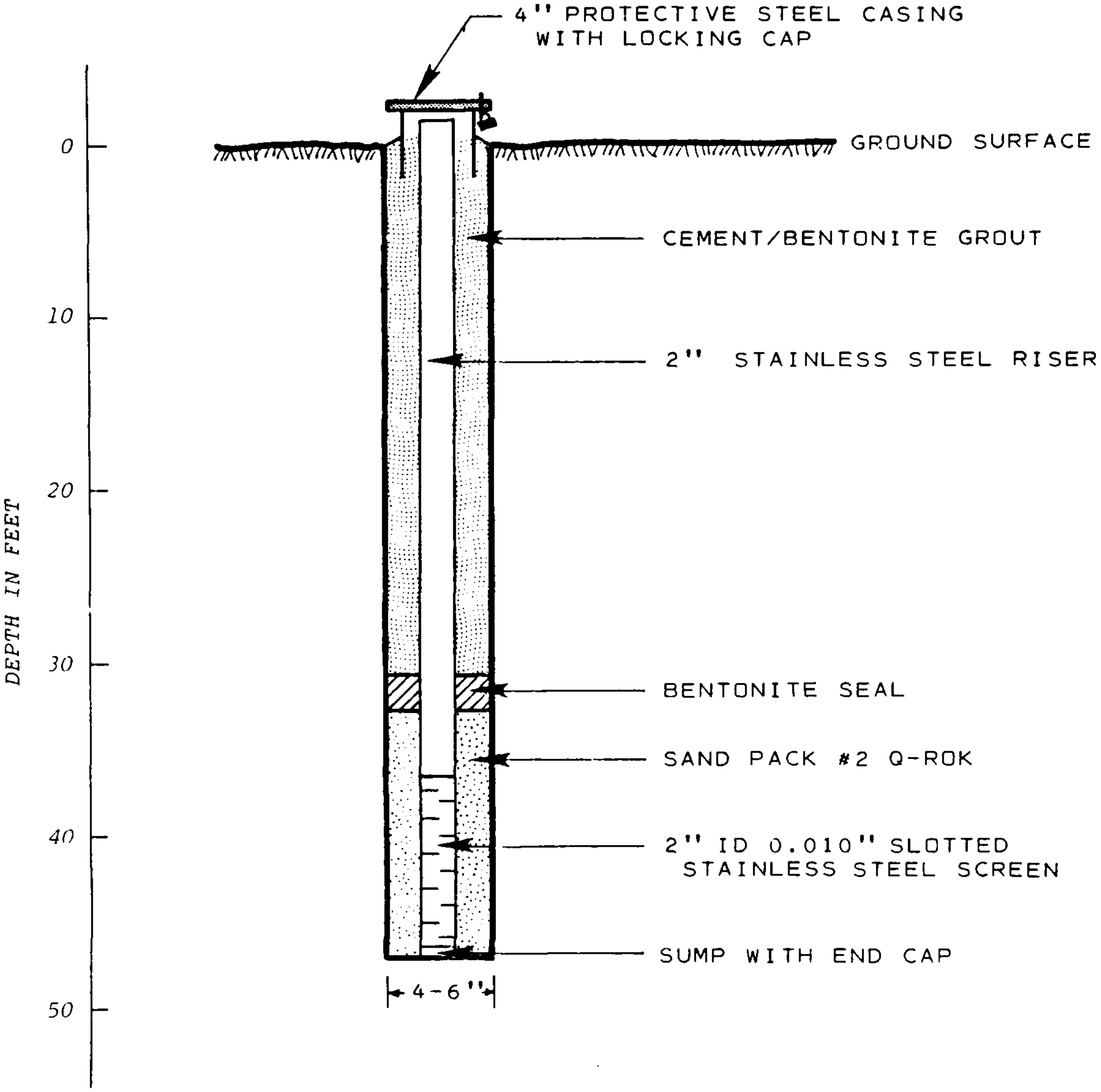
FIGURE A-5



WELL SCHEMATIC
SW-2

DAMES & MOORE

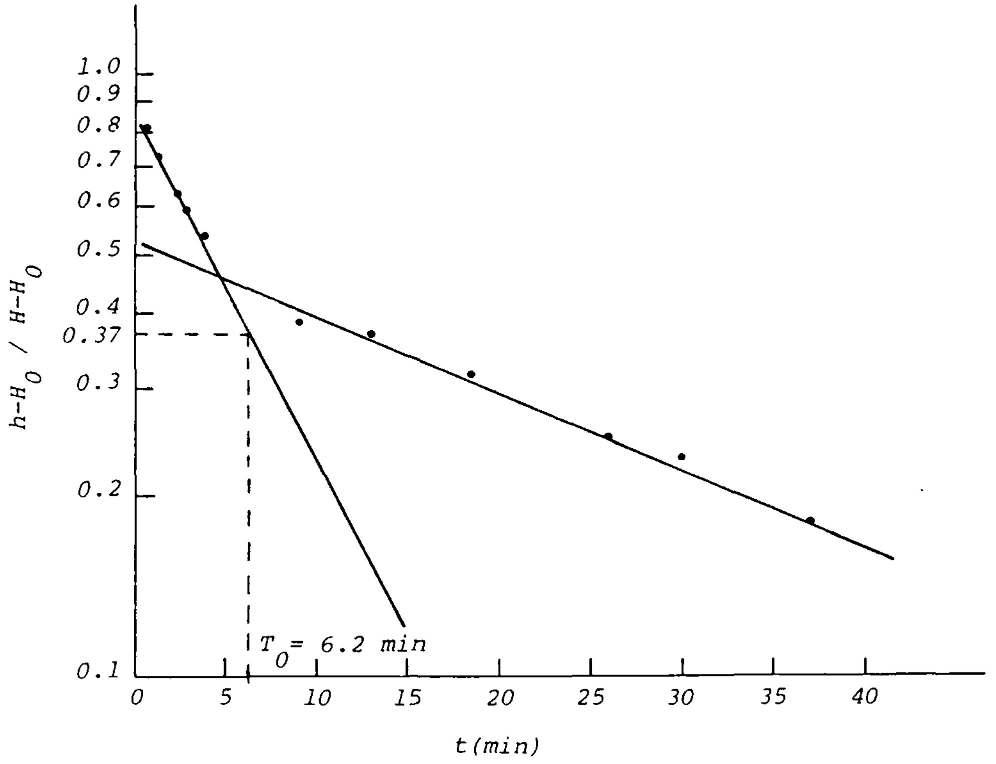
FIGURE A-6



WELL SCHEMATIC
SW-3

DAMES & MOORE

FIGURE A-7



$L = 10'$ $\quad R = 0.25'$

$r = 0.083'$ $\quad H_0 =$ Static water level at $t < 0$ and $t > \infty = 32.83'$

$H =$ head at $t = 0 = 33.75'$

$H - H_0 = 0.92'$ $\quad T_0 = 6.2$ min

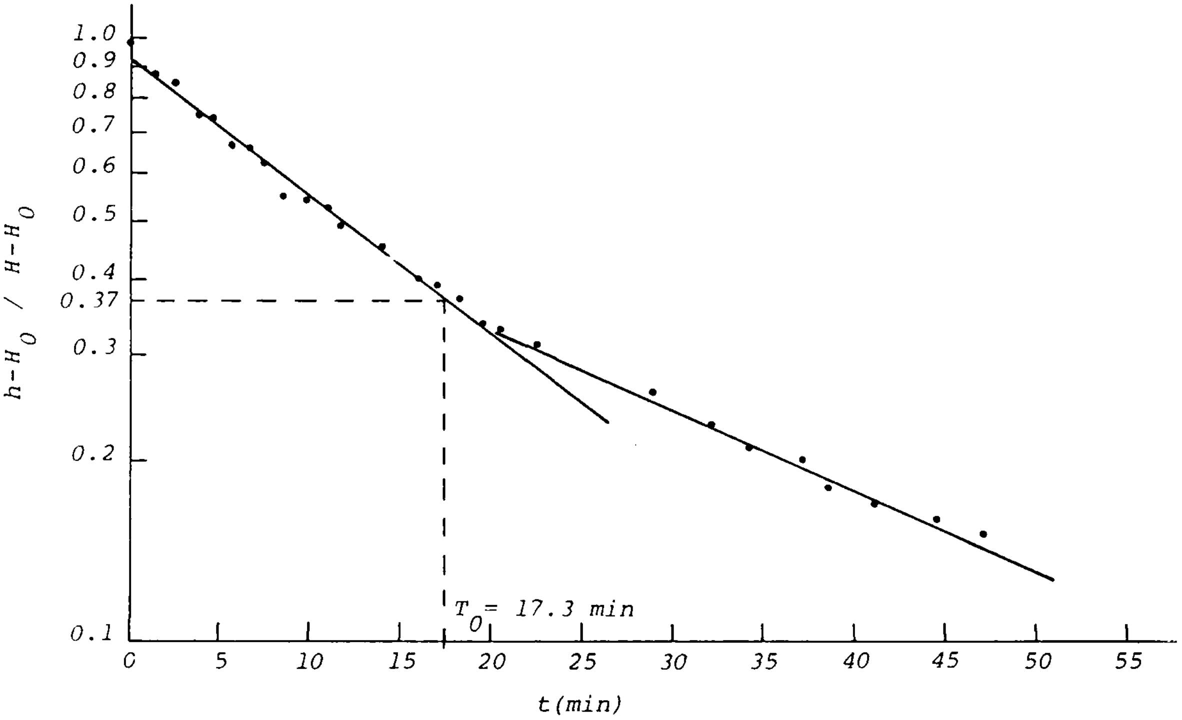
$$K_h = \frac{r^2 \ln(L/R)}{2 L T_0} = \frac{(0.083)^2 \ln(10/0.25)}{(20)\ (6.2)} = 2.05 \times 10^{-4} \text{ ft/min}$$

$$= 1.04 \times 10^{-4} \text{ cm/sec}$$

IN-SITU PERMEABILITY CALCULATIONS FOR SW-1

DAMES & MOORE

FIGURE A-8



$L = 10'$ $R = 0.25'$

$r = 0.083'$ $H_0 =$ Static water level at $t < 0$ and $t \to \infty = 26.67'$

$H =$ head at $t = 0 = 35.0'$

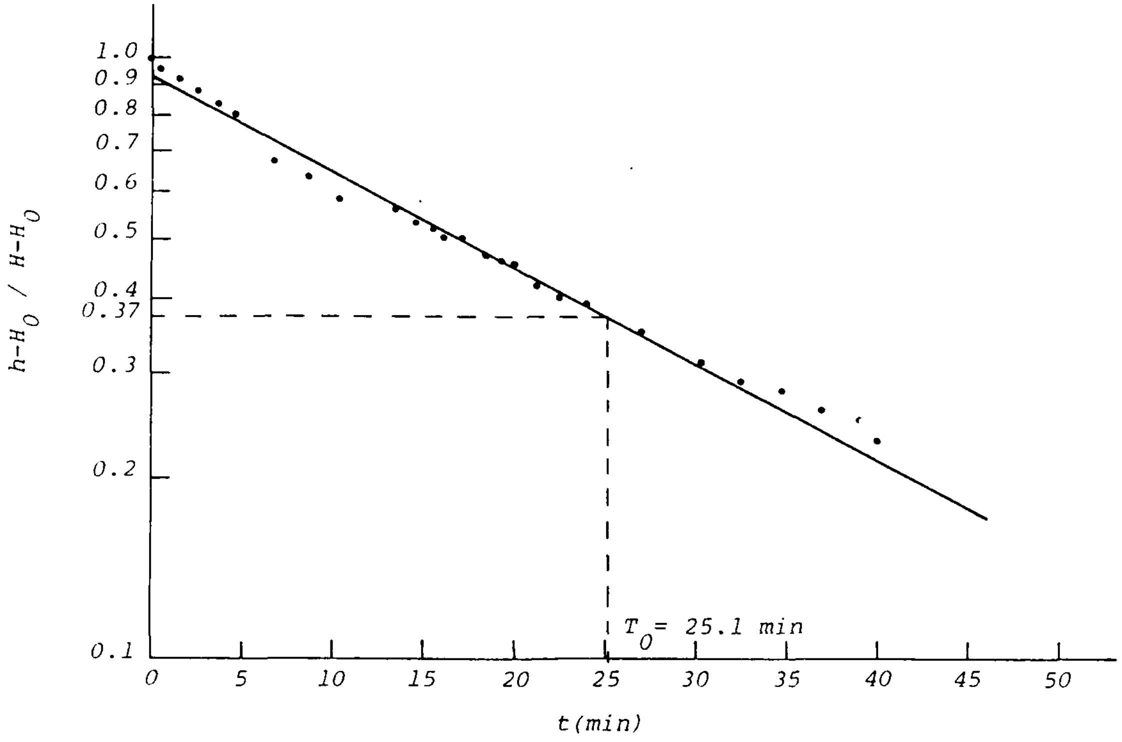
$H - H_0 = 8.33'$ $T_0 = 17.3$ min

$$K_h = \frac{r^2 \ln(L/R)}{2\ L\ T_0} = \frac{(0.083)^2 \ \ln(10/0.25)}{(20)\ (17.3)} = 7.34 \times 10^{-5} \text{ ft/min}$$

$$= 3.70 \times 10^{-5} \text{ cm/sec}$$

IN-SITU PERMEABILITY CALCULATIONS FOR SW-2

FIGURE A-9



$L = 10'$ $R = 0.25'$

$r = 0.083'$ $H_0 =$ Static water level at $t < 0$ and $t > \infty = 25.83'$

$H =$ head at $t = 0 = 38.0'$

$H-H_0 = 12.17'$ $T_0 = 25.1$ min

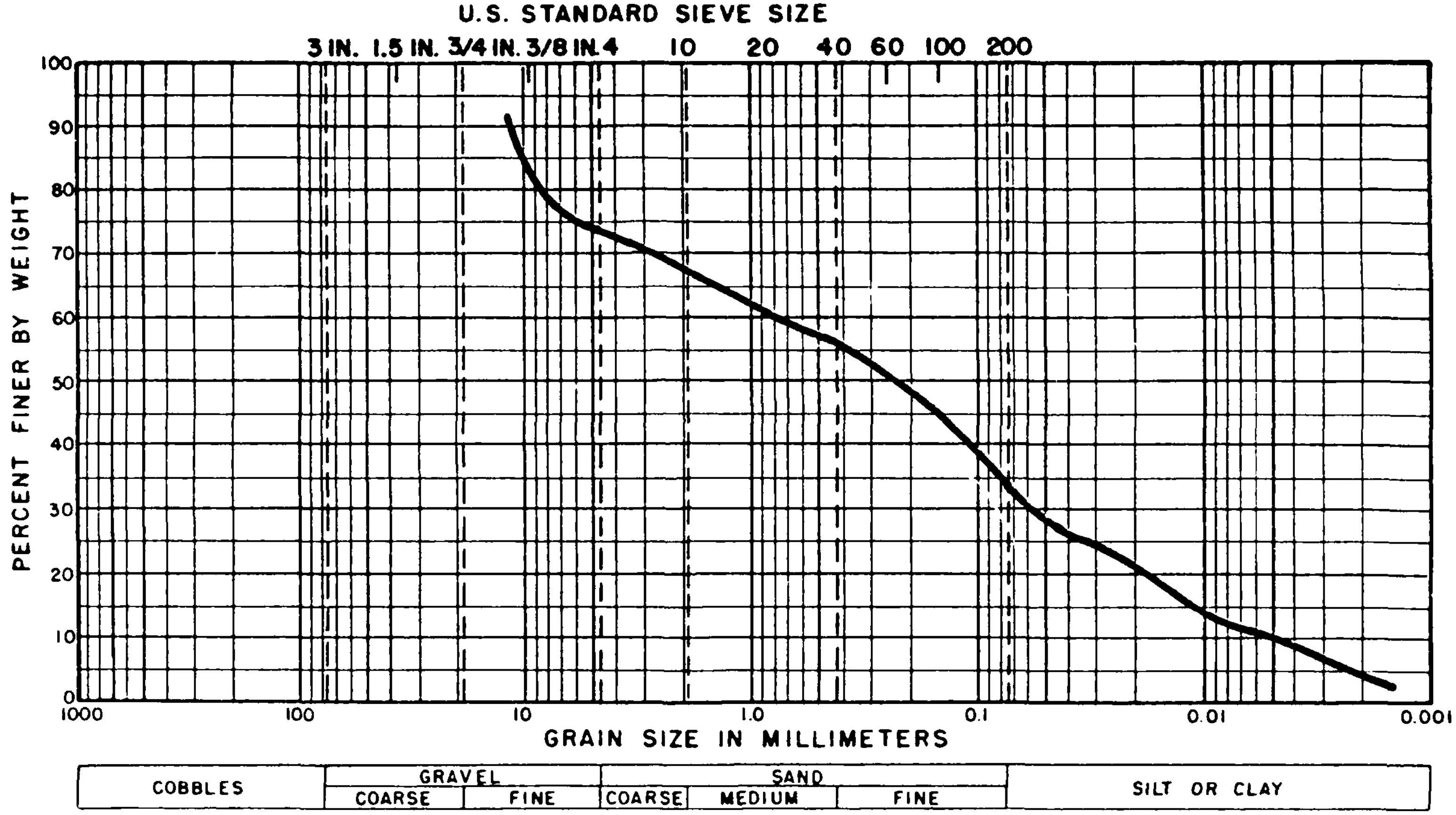
$$K_h = \frac{r^2 \ln(L/R)}{2 L T_0} = \frac{(0.083)^2 \ln(10/0.25)}{(20)\ (25.1)} = 5.06 \times 10^{-5} \text{ ft/min}$$

$$= 2.57 \times 10^{-5} \text{ cm/sec}$$

IN-SITU PERMEABILITY CALCULATIONS FOR SW-3

DAMES & MOORE

FIGURE A-10



SAMPLE	DEPTH	CLASSIFICATION		NAT. WC	LL	PL	PI	
NO. 2	5-7'	SM	SILTY SAND					

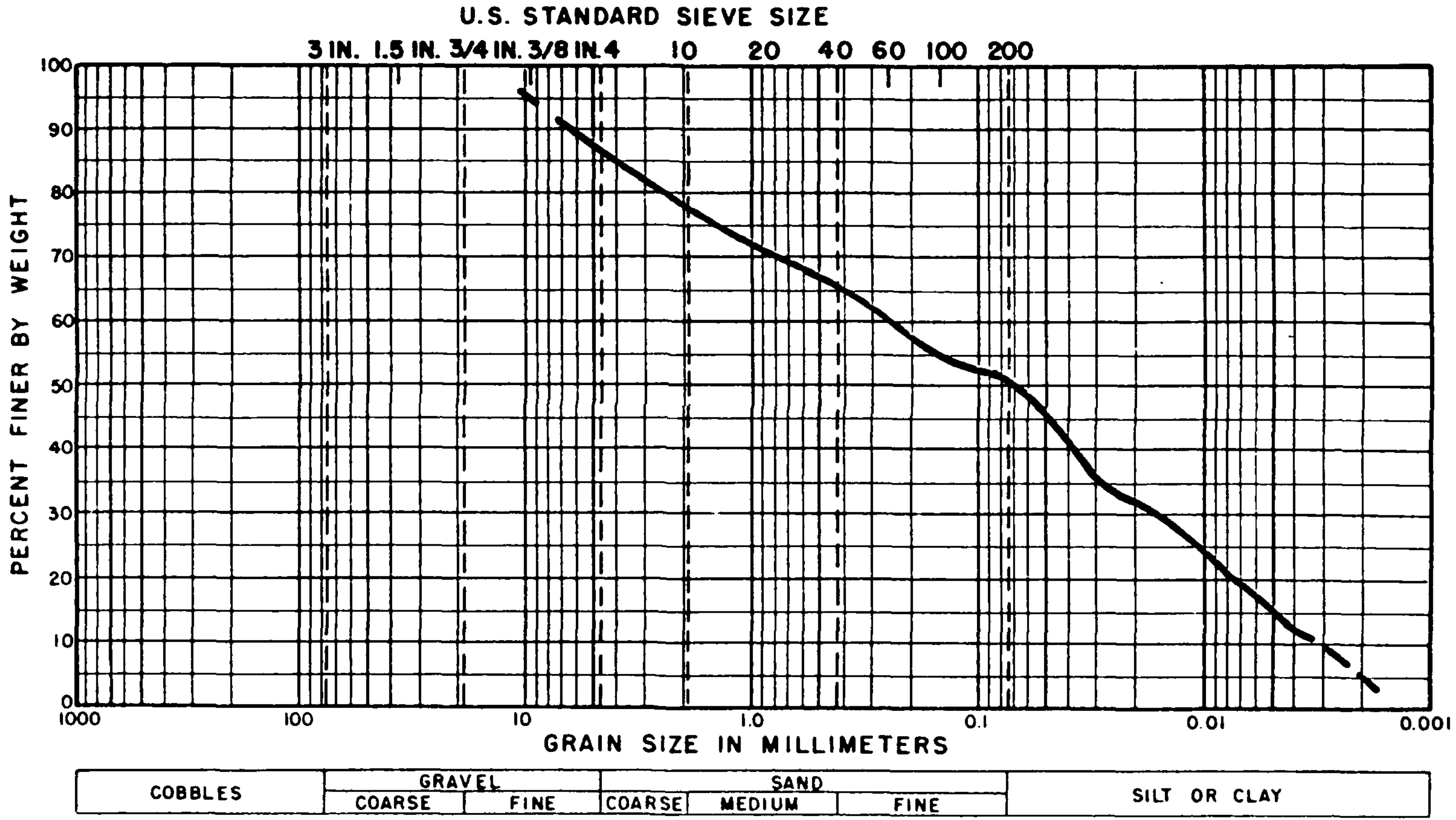
STEWART

GRADATION CURVE

BORING SW-2

DAMES & MOORE

FIGURE A-11



SAMPLE	DEPTH	CLASSIFICATION		NAT. WC	LL	PL	PI	
NO. 3	10-12'	ML	SANDY SILT					

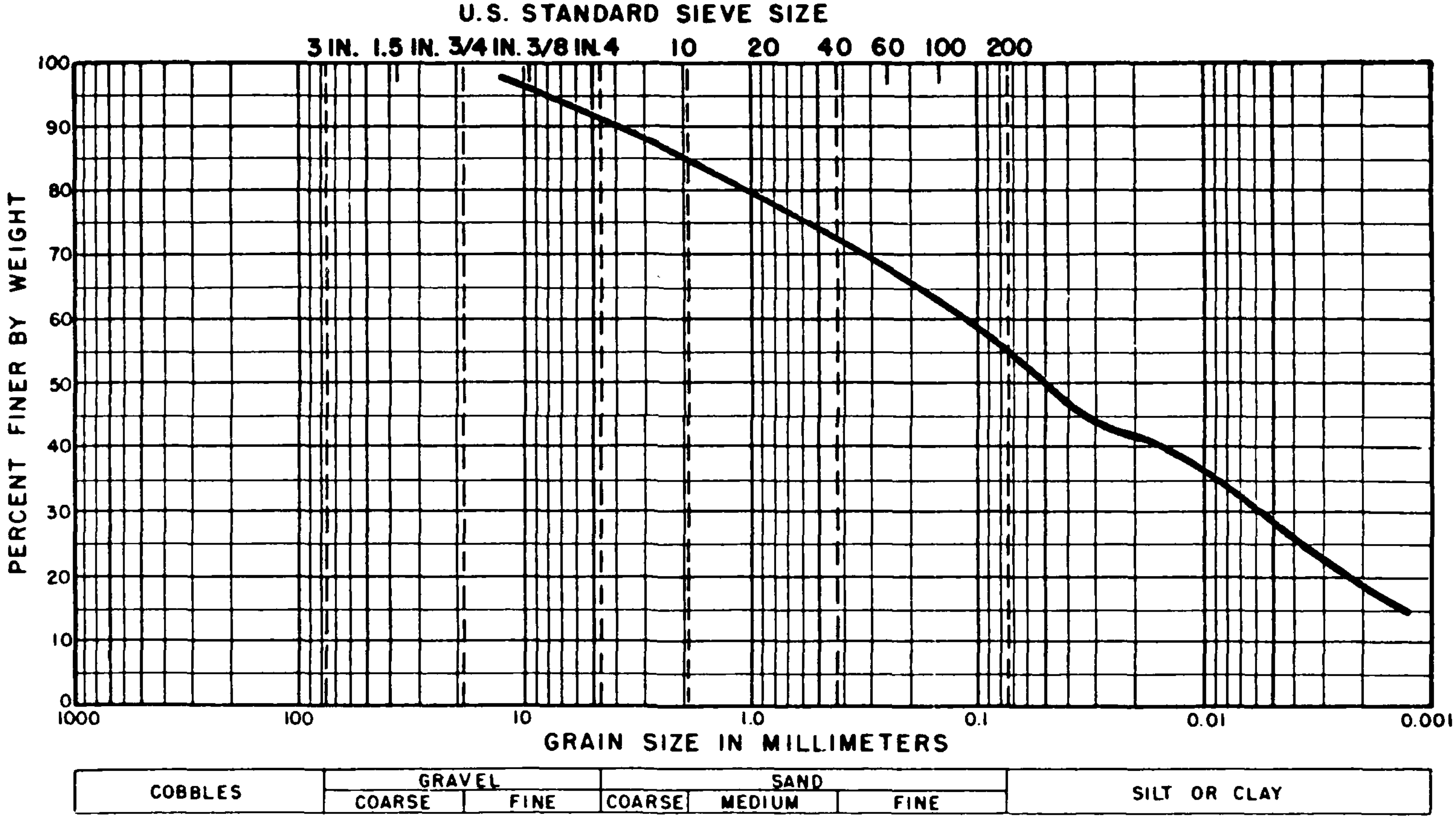
STEWART

GRADATION CURVE

BORING SW-3

DAMES & MOORE

FIGURE A-12



SAMPLE	DEPTH	CLASSIFICATION		NAT. WC	LL	PL	PI	
NO. 5	20-22'	ML	SANDY SILT					

STEWART

GRADATION CURVE

BORING SW-1

DAMES & MOORE

FIGURE A-13

APPENDIX B

DAMES & MOORE
HEALTH AND SAFETY PLAN

Project Name: Stewart Airport, Revision #4

Project Site Location: Newburgh, N.Y.

Project Manager: Arthur Seanor

On-Site Safety Officer: David Chason

Plan Preparer: David Chason

Plan Reviewer: Leslie Birnbaum

Preparation Date: 7/18/85

Plan Approvals:

Office Safety Coordinator

Anna L. Pisano 9/9/85
(Date)

Managing Prinicipal-in-Charge

Arthur Seanor
(Date)

Project Manager

Arthur Seanor
(Date)

Revision 4

Contents   Page

I. PURPOSE

The purpose of this Plan is to assign responsibilities, establish personnel protection standards and mandatory safety practices and procedures, and provide for contingencies that may arise while operations are being conducted at the site.

II. APPLICABILITY

The provisions of the Plan are mandatory for all on-site Dames & Moore employees and subcontractors engaged in hazardous material management activities including but not limited to initial site reconnaissance, preliminary field investigations, mobilization, project operations, and demobilization.

III. RESPONSIBILITIES

A. Project Manager

The PM shall direct on-site investigation and operational efforts. At the site, the PM*, assisted by the On-Site Safety Officer, has the primary responsibility for:

1. Assuring that appropriate personnel protective equipment is available and properly utilized by all on-site personnel.
2. Assuring that personnel are aware of the provisions of this plan, are instructed in the work practices necessary to ensure safety, and in planned procedures for dealing with emergencies.
3. Assuring that personnel are aware of the potential hazards associated with site operations (see Tables 1 and 2).
4. Monitoring the safety performance of all personnel to ensure that the required work practices are employed.
5. Correcting any work practices or conditions that may result in injury or exposure to hazardous substances.
6. Preparing any accident/incident reports (see attached Accident Report Form).
7. Assuring the completion of Plan Acceptance and Feedback for attached herein.

B. Project Personnel

Project personnel involved in on-site investigations and operation are responsible for:

1. Taking all reasonable precautions to prevent injury to themselves and to their fellow employees.

---

* If the PM is not present on-site, the primary responsibility for site safety reverts to the On-Site Safety Officer.

2. Implementing Project Health and Safety Plan, and reporting to the PM for action any deviations from the anticipated conditions described in the Plan.

3. Performing only those tasks that they believe they can do safely, and immediately reporting any accidents and/or unsafe conditions to the PM.

IV. BACKGROUND

Site History

The disposal area at Stewart Air Force Base was utilized for disposal of pesticides. A groundwater contamination investigation study will be performed in order to determine the effects (if any) of the "non-secure" disposal area on the groundwater.

Dames & Moore Activity

Dames & Moore initially conducted a geophysical survey of the suspected area in order to locate a potential pesticide waste under Work Order 022. Based on the results of the survey, test pits were dug, containers unearthed, and their contents sent to a laboratory for analysis.

These initial efforts to locate and sample the waste were not entirely successful. Therefore, D & M performed a second geophysical survey to determine the extent of the newly-identified disposal area. This additional work was completed under Work Order 008. Based on the results of the survey, four (4) new test pits were excavated from which waste containers were unearthed and their contents sampled and analyzed.

Now that the location and extent of the disposal area has been identified, D & M intends to: 1) conduct drilling and soil sampling around the disposal area perimeter, 2) install monitoring wells and sample groundwater, and 3) conduct in-situ permeability tests. This final phase of field investigative activities is being performed under the original Work Order 022.

Suspected and Known Hazards

There are no records of what was actually disposed of in the area of concern; however, there was an unconfirmed report of burial of pesticides in the vicinity of the landfill. Thus, at the onset of field work the major types of commonly used pesticides and herbicides were postulated as being present and therefore presenting potential health hazards. These compounds are: aldrin, chlordane, diazinon, dieldrin, 2,4-D, DDT isomers, endrin, heptachlor, lidane, malathion, methoxychlor, parathion, 2,4,5-T and 2,4,5-TP. Each of these presents a health hazard via skin absorption and inhalation/igestion. There was also the possibility of dioxin, which is not water soluble, binds tightly to soil particles. Thus, exposure to dioxin may occur via skin contact or inhalation of contaminated soil particles.

Sampling activities during the first round of test pit work revealed the presence of acids of an unknown nature, possibly used as carriers for the pesticides. Therefore, the commonly utilized acids (e.g., hydrochloric, hydroflouric and sulfuric acids) became included in the listing of suspected hazards during the second round of test pit work. The major hazards to field personnel who are exposed to acids are the severe irritation and burning to eyes and skin caused by acid vapors.

Also detected in analyses of the first round of test pit samples were the presence of DDT isomers and other constituents of commerical grade DDT, as well as minor amounts of heptachlor. Additional testing of the samples also revealed the presence of benzoic acid, aromatic naptha compounds and chlorinated aromatic compounds (e.g., 2-chloro-analine, 2-methyl napthalene, napthalene, 2,4,6- and 2,4,5-trichlorophenol) with total concentrations of each group in the ppm range.

In response to the detection of these known hazards a revised Health and Safety Plan was prepared for the second round of test pit sampling. Under the new plan, field personnel performing the excavation and sampling were required to donn full level B protection, as specified by the EPA. In addition, air sampling pumps were in operation upwind, downwind and within the exclusion zone during the sampling, to monitor possible release of airborn contamination.

Analyses of the subsequent test pit samples indicate the presence of sulfuric acid with minor amounts of hydrochloric acid and hydroflouric acid. Herbicides and pesticides found include compounds such as DDD; O,Pl-DDT; P,Pl-DDT; 2,4-D; 2,4,5-T. The carrier for the herbicides and pesticides appears to be a hydrocarbon mixture of C5 through C10 aliphatics with a large amount of xylene. Again, each of these compounds present a health hazard via skin absorption and inhalation/ingestion.

V. EMERGENCY CONTACTS AND PROCEDURES

Should any situation or unplanned occurence require outside or support services, the appropriate contact from the following list should be made:

Agency	Person to Contact	Telephone
Police[1]	MSGT. Nuessel (ANG)	564-7000 x3416
Fire	SMSGT. Cinquemani (ANG)	564-7000 x3578
Ambulance	TSGT. Flanagan (ANG)	564-7000 x3434
Hospital	" "	564-7000 x3434
Client Safety Officer[2]	Major Mitchell (ANG)	564-7000 x3301
D&M Project Manager	Arthur M. Seanor	315-638-2572
D&M FH&SPO Director	Leslie Birnbaum (Office) (Home)	914-735-1200 914-783-0026

[1] Radio communications are maintained between security policy office located at entry control point near site, and security police desk Bldg. 1918.

[2] Major Mitchell will be responsible for contacting the 24-hour National Response Center should the situation warrant.

In the event that an emergency develops on site, the procedures delineated herein are to be immediately followed. Emergency conditions are considered to exist if:

- Any member to the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure while on scene.
- A condition is discovered that suggests the existence of a situation more hazardous than anticipated.

The following emergency procedures should be follows:

a) Personnel on-site should use the "buddy" system (pairs). Buddies should pre-arrange hand signals or other means of emergency signals.

b) In emergencies, the following hand signals are suggested:

1. Hand gripping throat: out of air, cannot breath.
2. Grip partner's wrist or place both hands around waist: leave areas immediately, no debate!
3. Hands on top of head: need assistance.
4. Thumbs up: OK, I'm alright, I understand.
5. Thumbs down: No, negative.

c) Site work area entrance and exit routes should be planned, and emergency escape routes delineated by the Project Manager.

d) Visual contact should be maintained between "pairs" on-site with the team remaining in close proximity in order to assist each other in case of emergencies.

e) In the event that any member of the field crew experiences any adverse effects or symptoms of exposure while on scene, the entire field crew should immediately halt work and act according to the instructions provided by the Project Manager.

f) Wind indicators visible to all on-site personnel should be provided by the Project Manager to indicate possible routes for upwind escape.

g) The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated, should result in the evacuation of the field team and re-evaluation of the hazard and the level of protection required.

h) In the event that an accident occurs, the PM is to complete an Accident Report Form for submittal to the MPIC of the office, with a copy to the health and safety program office. The MPIC should assure that follow-up action is taken to correct the situation that caused the accident.

VI. HAZARD CHARACTERISTICS AND PROTECTION REQUIRED

Exposure Limits and Recognition Qualities

Information concerning exposure limits and recognition qualities of the contaminats that are suspected to be on site is presented in Table 1.

Symptoms of Overexposure Potential Chronic Effects and First Aid Treatment

Symptoms of overexposure to the suspected contaminants, potential chronic effects of these substances and first aid treatment information is presented in Table 2.

Protective Equipment Required for On-Site Activities

The protective equipment required for drilling and sampling activities is as follows:

- Hard hat w/splash shield
- Gloves
- Rubber Boots (steel-toed)
- Acid Resistant Tyvek Suits (taped down)
- Full face respirator with organic vapor/acid gas cartridges and high efficiency dust filters.

No personnel will be allowed within 25 feet of the drilling and sampling activities unless they are wearing the above protective equipment. Outside of a 25 feet radius of the work zone it is recommended that on-lookers have at their disposal, at a minimum, a half-face respirator with organic vapor/acid gas cartridges and high efficiency dust filters.

A photo-ionization detector should be on hand and operated as near to the drilling and sampling operation as possible.

Additional equipment to be kept on hand:

- First aid kit
- Emergency eye wash kit

VII. STANDARD SAFE WORK PRACTICES

General

1) Eating, drinking, chewing tobacco, smoking and carrying matches or lighters is prohibited in the contaminated or potentially contaminated area or where the possibility for the transfer of contamination exists.

2) Avoid contact with potentially contaminated substances. Do not walk through puddles, pools, mud, etc. Avoid, whenever possible, kneeling on the ground, leaning or sitting on equipment or ground. Do not place monitoring equipment on potentially contaminated surface (i.e., ground, etc.).

3) In addition to the site monitoring conducted using appropriate instrumentatioin, all field crew members should make use of their senses (all senses) to alert them to potentially dangerous situations in which they should not become involved, (i.e., presence of strong and irritating or nauseating odors).

4) Prevent, to the extent possible, spillages. In the event that a spillage occurs, contain liquid, if possible.

5) Prevent splashing of the contaminated materials.

6) Field crew members shall be familiar with the physical characteristics of investigations, including:

   - wind driection in relation to the ground zero area
   - accessibility to associates, equipment, vehicles
   - communication
   - hot zone (areas of known or suspected contamination)
   - site access
   - nearest water sources

7) The number of personnel and equipment in the contaminated area should be minimized consistent with site operations.

8) All wastes generated during D & M and/or subcontractor activities on-site should be disposed of as directed by the Project Manager.

9) All subcontractors will have a respiratory protection program meeting Dames & Moore standards or their equilvalent.

Drilling and Sampling Practices

For all drilling and sampling activities, the following standard safety procedures shall be employed.

1) All drilling and sampling equipment should be cleaned before proceeding to the drill site.

2) At the drill or sampling site, sampling equipment should be cleaned after each use.

3) Work in "cleaner" areas should be conducted first where practical.

4) The minimum number of personnel necessary to achieve the objectives shall be within 25 feet of the drilling or sampling activity.

5) Appropriate emergency and backup subcontracted personnel should remain 25 feet from the drilling or sampling activity where practical.

VIII. RESPIRATOR INSTRUCTION

Full-face Respirators

Inspection Procedure

1. Look at the shape of the facepiece for possible distortion that may occur if it is not protected during strorage.

2. Check the facepiece for dirt, cracks, tears, or holes. The rubber should be flexible not stiff. Also check the lens for cracks.

3. All straps and buckles must be attached. Check straps for elasticity and worn serrations.

4. Check the exhalation valve located near the chin between the cartridge by the following:

   - unsnap the cover
   - lift the valve and inspect the seat and valve for cracks, tears, dirt and distortion.
   - replace the cover, it should spin freely.

5. Check both inhalation valves (inside the cartridge holders). Look for same signs as above.

6. Make sure the cartridge holders are clean. Make sure the gaskets are in place and threads are not worn. Also look for cracks and other damage.

7. Check the cartridge for dents or other damage, especially in the threaded part.

Donning Procedure

1. Screw the cartridge into the holder hand tight so there is a good seal with the gasket in the bottom of the holder....but don't force it. If the cartridge won't go in easily back it out and try again.

   Always use cartridges made by the same manufacturer who made the respirator.

2. Fold the straps back over the window piece.

3. Hold the facepiece with one hand and the strap piece (in front of the window) with the other.

4. Put your chin in first. Lift the strap piece out and over your head.

5. To tighten the straps, use both hands one on each side and pull straight back - not out. Tighten top side straps, side bottom straps and side top straps.

6. All site personnel will have been fit-tested in accordance with regulatory requirements (e.g., irritant smoke tes). Additionally each time the respirator is to be worn personnel will test the fit by:

   - lightly covering the exhalation valve with the palm of your hand. Exhale...if there is a leak, you will feel the air on your face.

   and

   - covering the cartridges with the palms of your hands. Again don't press too hard. Inhale...the face piece should collapse against your face.

   - If there is a leak with either test adjust the headbands or reposition the facepiece and test until no leakage is detected.

Sanitizing Procedures

1. Remove all cartridges plus or seals not affixed to their seats.

2. Remove elastic headbands.

3. Remove exhalation cover.

4. Remove speaking diaphragm or speaking diaphragm-exhalation valve assembly.

5. Remove inhalation valves.

6. Wash facepiece and breathing tube in cleaner/sanitizer powder mixed with warm water, preferably at 120 degrees to 140 degrees. Wash components separately from the facemask, as necessary. Remove heavy soil from surfaces with a hand brush.

7. Remove all parts from the wash water and rinse twice in clean warm water.

8. Air dry parts in a designated clean area.

9. Wipe facepieces, valves, and seats with a damp lint-free cloth to remove any remaining soap or other foreign materials.

IX. MONITORING EQUIPMENT INSTRUCTIONS

Photoionization Analyzer (HNU)

1. Before attaching the probe, check the function switch on the control panel to make sure it is in the off position.

2. Attach the probe by plugging in the 12 pin plug to the interface on the readout module.

3. Turn the six postion function switch to the battery check position. The needle on the meter should read within or above the green battery arc on the scale. If not, recharge the battery. If the red indicator comes on, the battery should be recharged.

4. Turn the function switch to any range setting. Look into the end of the probe briefly to see if the lamp is on. If it is on, it will give a purple glow. Do not stare into the probe for any length of time as UV light can damage your eyes. The instrument is now ready for operation.

5. To zero the instrument, turn the function switch to the standby position and rotate the zero potentiometer until the meter reads zero.

6. Turn function switch to the 0-20, 0-200, or 0-2000 position.

7. Place probe in the atmosphere to be monitored if the needle moves to the upper limit of the scale change the function switch to the next position.

X. DECONTAMINATION PROCEDURES

1) Locate a decontamination area.

2) Establish a personnel decontamination station consisting of a basin with soapy water, a rinse basin with plain water and a can with a plastic bag.

3) Wash and rinse boots.

4) Remove outside gloves and discard in plastic bag.

5) Remove disposable suit and discard in plastic bag.

6) Remove inside gloves and discard in plastic bag.

7) Upon leaving the contamination area, all personnel will proceed through the appropriate Contamination Reduction Sequence as described above.

8) All protection gear should be left on-site during lunch break following decontamination procedures.

9) At the end of the day all plastic bags filled with contaminated disposable clothing and trash should be removed to an approved disposal facility.

10) All wash tubs, pail containers, etc. should be thoroughly washed, rinsed and dried prior to removal from the site. Decon and rinse solutions could be discarded on-site or removed to approved disposal facility.

XI. SAMPLE SHIPPING

Samples collected should be classified as either environmental or hazardous material (or waste) samples. In general, environmental samples are collected off-site from streams, ponds, or wells and are not expected to be grossly contaminated with high levels of hazardous materials. On-site samples (i.e., soil, water, and materials from drums or bulk storage tanks, obviously contaminated ponds, lagoons, pools, and leachates from hazardous waste sites) are considered hazardous material samples. A distinction must be made between the two types of samples in order to :

- Determine appropriate procedures for transportation of samples. If there is any doubt, a sample should be considered hazardous and shipped accordingly.
- Protect the health and safety of laboratory personnel receiving the samples. Special precautions are used at laboratories when samples other than environmental samples are received.

The sample tag should be legibly written and completed with an indelible pencil or waterproof ink. The information should also be recorded in a log book. At a minimum, it should include:

- Exact location of sample.
- Time and date sample was collected.
- Name of sampler and witnesses (if necessary).
- Project codes, sample station number, and identifying code (if applicable).
- Type of sample (if known).
- Tag number (if sequential tag system is used).
- Laboratory number (if applicable).
- Any other pertinent information.

Environmental Samples

Evironmental samples must be packaged and shipped according to the following procedure:

Packaging

1. Place sample container, properly identified and with a sealed lid, in a polyethylene bag, and seal bag.
2. Place sample in a fiberboard container or metal cooler which has been lined with a large polyethylene bag.
3. Pack with enough noncombustible, absorbent, cushioning material to minimize the possibility of the container breaking.
4. Seal large bag.
5. Seal or close outside container.

Environmental samples may also be packaged following the procedures outlined later for samples classified as "flammable liquids" or "flammable solids". Requirements for marking, labeling, and shipping papers do not apply.

Marking/Labeling

Sample containers must have a completed sample identification tag and the outside container must be marked "Environmental Sample". The appropriate side of the container must be marked "This End Up" and arrows should be drawn accordingly. No DOT marking and labeling is required.

Shipping Papers

No DOT shipping papers are required.

Transportation

There are no DOT restrictions on mode of transportation.

XI. FORMS

The following forms are enclosed in this section:

Plan Acceptance Form

Plan Feedback Form

Accident Report Form

The Plan Acceptance Form should be filled out by all employees working on the site and all D & M subcontractors. The Plan Feedback Form should be filled out by the on-site safety officer and any other on-site employee who wishes to fill one out. The Accident Report Form should be filled out by the Project Manager in the event that an accident occurs.

ALL COMPLETED FORMS SHOULD BE RETURNED TO THE FIRMWIDE HEALTH AND SAFETY PROGRAM OFFICE.

ACCEPTANCE FORM

PROJECT HEALTH AND SAFETY PLAN

Instructions: This form is to be completed by each person to work on the subject project work site and returned to the Program Director-Firmwide Health and Safety Program Office in White Plains.

Job No. 01016-213

Client

Project Stewart Airport, Revision #4

Date ____________

I represent that I have read and understand the contents of the above plan and agree to perform my work in accordance with it.

I also understand that the contents of this plan are confidential, and agree not to release any of the information contained herein, without the consent of the client.

____
Signed

____
Date

PLAN FEEDBACK FORM

Job No. 01016-213

Project Stewart Airport, Revision #4

Problems with plan requirements:

Unexpected situations encountered:

Recommendations for future revisions:

PLEASE RETURN TO THE FIRMWIDE HEALTH AND SAFETY OFFICE-WP

ACCIDENT REPORT FORM

SUPERVISOR'S REPORT OF ACCIDENT	DO NOT USE FOR MOTOR VEHICLE OR AIRCRAFT ACCIDENTS
TO	FROM TELEPHONE (include area code)

NAME OF INJURED OR ILL EMPLOYEE

DATE OF ACCIDENT	TIME OF ACCIDENT	EXACT LOCATION OF ACCIDENT

NARRATIVE DESCRIPTION OF ACCIDENT

NATURE OF ILLNESS OR INJURY AND PART OF BODY INVOLVED	LOST TIME Yes ☐ No ☐

PROBABLE DISABILITY (Check One)

FATAL	LOST WORK DAY WITH__ DAYS AWAY FROM WORK	LOST WORK DAY WITH__ DAYS OF RESTRICTED ACTIVITY	NO LOST WORK DAY	FIRST AID ONLY
☐	☐	☐	☐	☐

CORRECTIVE ACTION WHICH REMAINS TO BE TAKEN (By whom and by when)

NAME OF SUPERVISOR	TITLE
SIGNATURE	DATE

TABLE 1

Exposure Limits and Recognition Qualities

Compound	Exposure Standard (mg/m^3)	IDLH Level (mg/m^3)	Recognition Qualities Color	Odor	State
Aldrin	.25	100	Tan to Dk. Brown	Mild Chemical	Solid
Chlordane	.5	500	Amber	Chlorine	Thick Liquid
Diazinon	.10	N.A.	None to Brown	Faint	Liquid
Dieldrin	.25	450	None to Lt. Tan	Mild Chemical	Solid
Dioxin	None Established EPA - 50 ppt		None	--------	Needles
2,4-D	---	500	None	None	Solid
DDT	.10	N.A.	None	Weak Chemical	Solid
Endrin	1.0	200	None to Tan	Mild Chemical	Solid
Heptachlor	.10	100	Lt. Tan	Camphor	Waxy Solid
Lindane	.5	1000	None	Musty	Solid
Malathion	10.0	5000	None to Brown	Mild Skunk	Liquid

TABLE 1

Exposure Limits and Recognition Qualities

Compound	Exposure Standard (mg/m^3)	IDLH Level (mg/m^3)	Recognition Qualities		
			Color	Odor	State
Methoxychlor	10.0	7500	None to Tan	Fruity	Solid
Parathion	.10	20	Yellow to Dk. Brown	Garlic	Liquid
2,4, 5-T	10^1	5000	None to Tan	None	Solid
Hydrochloric Acid	5 ppm	----	None to Yellow	Pungent, Sharp	Liquid
Sulfuric Acid	1 ppm	----	None to Dk. Brown	None	Oily Liquid
Hydrofluoric Acid	3 ppm	----	None to Yellow	Pungent, Irritating	Liquid
Benzoic Acid	*N.S.	----	White	Aromatic	Powder
Anthracene	0.2		Pale Green	Armatic	Solid
Acenapthalene	----	No Data Available	----	----	----
Acenapthene	*N.S.	----	White	--------	Crystals
Benzyl Alcohol	*N.S.	----	None	Faint Aromatic	Liquid
2-Chlorophenol	*N.S.	----	Light Amber	Medicinal	Liquid

* No Standard

TABLE 1

Exposure Limits and Recognition Qualities

Compound	Exposure Standard (mg/m^3)	IDLH Level (mg/m^3)	Recognition Qualities Color	Odor	State
Chloroaniline	*N.S.	----	None to White	Amine	Liquid
1,2-Dichlorobenzene	50	----	None to Pale Yellow	Aromatic	Liquid
1,4-Dichlorobenzene	C300 ppm	----	None	Moth Ball	Solid
2,4-Dimethylphenol	N.S.	----	White	Tarry	Crystal
2,4-Dichlorophenol	N.S.	----	White	Medicinal	Crystal
Dinitrotoluene	1.5	----	Orange-Yellow	Characteristic	Solid
Isophorone	4 ppm	800 ppm	None	Camphor	Liquid
Methyl phenol		No Data Available			
Methyl Nathalene		No Data Available			
Napthalene	10 ppm	500	None to Brown	Moth Ball	Solid
3-Nitroaniline	3 ppm	300	Yellow	Ammonia	Crystals
n-Nitrosodiphenylamine	N.S.	N.S.	Yellow to Brown	None	Powder or Flakes
Phenol	5 ppm	100 ppm	None to pink	Sweet, Tarry	Solid or Thick Liquid

* No Standard

TABLE 1

Exposure Limits and Recognition Qualities

Compound	Exposure Standard (mg/m^3)	IDLH Level (mg/m^3)	Recognition Qualities		
			Color	Odor	State
Pentachlorophenol	0.5	150	Light Brown	Pungent (Hot)	Solid
Phenanthrene	0.2	----	None	Aromatic	Solid
Trichlorophenol	N.S.	N.S.	None	Phenolic	Needles
Xylene	100 ppm	10^4 ppm	None	Aromatic	Liquid
DDD	N.S.	N.S.	None	---------	Crystal

---

* ACGIH'S Recommended Threshold Limit Values

[1] OSHA's Permissable Exposure Limit

IDLH Immediately Dangerous to Life or Health

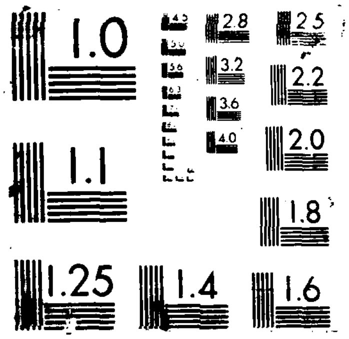
TABLE 2

Symptoms of Overexposure, Potential Chronic Effects
and First Aid Treatment

Compound	Symptoms of Overexposure Eye	Skin	Inhalation/Ingestion	Potential Chronic Effects
Aldrin	---	Minor reddening	Convulsions, headache, nausea, dizziness	Cancer of liver
Chlordane	---	Irritation	Shaking, blurred vision, irritability, confusion, delerium, staggering, nausea vomiting	Liver and kidney damage
Diazinon	Blurred vision	---	Weakness, headache, tightness in chest, salivation, sweating, nausea	---
Dieldrin	---	---	Convulsions, headache, dizziness, nausea, sweating, malaise	Liver and kidney damage
Dioxin	Irritation	Irritation	Fatigue, respiratory distress, depression	May have long term effects: carcinogen teratogen, mutagen
2,4-D	---	Rash	Weakness, stupor, muscle twitching	Liver and kidney damage
DDT	Irritation	Irritation	Convulsions, tremors, dizziness, confusion, headache, fatigue	Liver and kidney damage
DDD	Irritation	Irritation	Vomiting, convulsions, fatigue, irritation to nose and throat	Liver and kidney

AD-A195 011 INVESTIGATION OF BURIED PESTICIDE CONTAINERS (STEP 2) 2/3
STEWART AIR NATIONA..(U) DAMES AND MOORE PARK RIDGE IL
30 MAY 86 F33615-83-D-4002

UNCLASSIFIED F/G 24/5 NL


1.0
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3.2
2.2
3.6
4.0
2.0
1.1
1.8
1.25
1.4
1.6

TABLE 2

Symptoms of Overexposure, Potential Chronic Effects
and First Aid Treatment

	Symptoms of Overexposure			Potential
Compound	Eye	Skin	Inhalation/Ingestion	Chronic Effects
Endrin	---	---	Headache, dizziness, abdominal discomfort, nauseau, confusion confusions	Liver damage
Heptachlor	---	---	Tremors, convulsions	Liver and kidney damage
Lindane	Irritation	Rash	Vomiting, restlessness, muscle spasms, headache, nose and throat irritation	Blood disorders
Malathion	---	Sweating, twitching	Tightness in chest, wheezing, aching eyes, blurred vision, runny nose, headache	Nervous system effects
Methoxychlor	---	---	Possibly convulsions	---
Parathion	---	Sweating, twitching	Tightness in chest, wheezing, aching eyes, blurred vision, runny nose, headache	Nervous system effects
2,4, 5-T	---	Irritation	Abdominal pain, nausea, vomiting, diarrhea, blood in the stool.	Liver damage
Hydrochloric Acid	Irritation, burning	Burning	Cough, choking, nausea vomiting	Ulceration of respiratory tract, circulatory collapse

TABLE 2

Symptoms of Overexposure, Potential Chronic Effects
and First Aid Treatment

Compound	Symptoms of Overexposure Eye	Skin	Inhalation/Ingestion	Potential Chronic Effects
Sulfuric Acid	Burning	Burning	Lung damage	---
Hydrofluoric Acid	Irritation,	Burning	Respiratory tract irritation, nausea vomiting	Fluorosis
Benzoic Acid	Irritation	Irritation	Nausea, gastroenteric disturbances	---
Anthracene	---	Rash	---	Bronchitis; lung, skin, kidney and bladder cancer
Acenapthene	Irritation	Irritation	Mucous membrane irritation, vomiting	Cancer
Benzyl Alcohol	---	Irritation	Mucous membrane irritation, headache, vertigo, nausea, vomiting, diarrhea	---
2-Chlorophenol	Irritation	Irritation	Headache, dizziness, weak pulse, mouth and and throat irritation	---
Chloroaniline	Irritation	Dermatitis	Headache, drowsiness, nausea	---
1,4-Dichlorobenzene	Irritation	Irritation	Throat irritation, headache, swelling around eyes, runny nose, loss of appetite, nausea, vomiting	---

TABLE 2

Symptoms of Overexposure, Potential Chronic Effects
and First Aid Treatment

	Symptoms of Overexposure			Potential
Compound	Eye	Skin	Inhalation/Ingestion	Chronic Effects
1,2-Dichlorobenzene	Irritation	Burning	Respiratory tract irritation, drowsiness	Liver, kidney injury
2,4-Dichlorophenol	Irritation	Irritation	Tremors, convulsions, shortness of breath	---
2,4-Dimethylphenol	Irritation	Whitening	Vomiting, difficult swallowing, diarrhea, lack of appetite, headache, dizziness, dark urine	Liver damage
Dinitrololuene	---	Bluish discoloration	Headache, irritability, dizziness, weakness, nausea, vomiting	Anemia jaundice
Isophorone	Irritation	Irritation	Headache, dizziness, fatigue, malaise	Liver and kidney damage
Methyl Phenols	---	No Data Available	---	---
Methyl Napthalene	---	No Data Available	---	---
Nathalene	Irritation	Irritation	Abdominal cramps, nausea, vomiting, diarrhea, headache, dark or bloody urine	Cataracts
Xylene	Irritation	Dermatitis	Dizziness, incoordination nausea	Central nervous system, liver and kidney damage

TABLE 2

Symptoms of Overexposure, Potential Chronic Effects and First Aid Treatment

Compound	Symptoms of Overexposure Eye	Skin	Inhalation/Ingestion	Potential Chronic Effects
3-Nitroaniline	---	Blue	Nose, throat irritation, headache, nausea, dizziness, shortness of breath	Blue lips and skin, difficulty breathing
n-Nitrosodiphenylamine	Irritation	Irritation	---	Bladder, skin cancer
Phenol	Irritation	Whitening	Vomiting, difficulty swallowing, diarrhea, lack of appetite, headache, dizziness, dark urine	Liver damage, skin dicoloration
Pentachlorophenol	Irritation	---	Respiratory irritation, weakness, nausea, chest pain, sweating, headache, dizziness	Liver damage
Trichlorophenol	Irritation	Irritation	Nausea, vomiting, diarrhea, mucous-membrane irritation, respiratory tract irritation	Liver and kidney damage

General First Aid Treatment

Eye -Irrigate immediately
Skin -Soap wash promptly
Inhalation -Move to fresh air
Ingestion -Get medical attention

APPENDIX C

UBTL Environmental Chemistry
Quality Assurance Manual

QA-2/83

UBTL, Inc.
520 Wakara Way
Salt Lake City, UT 84108

James H. Nelson, Ph.D.
Laboratory Director

Lance M. Eggenberger, M.S.
Quality Assurance Specialist

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF EXHIBITS

1.0 Quality Assurance Program Plan Identification Form

Document Title: UBTL Environmental Chemistry Quality Assurance Manual

Document Control Number: QA-2/83

Organization Title: UBTL, Inc.

Address:
UBTL
Chemistry Department
520 Wakara Way
Salt Lake City, UT 84108

Director: James H. Nelson, Ph.D.
Phone Number: 801-581-8239

Quality Assurance Specialist: Lance M. Eggenberger, M.S.
Phone Number: 801-581-8945

Plan Coverage: This document describes UBTL, Inc.'s Quality Assurance Program Plan. The Plan addresses environmental data generated and processed by UBTL from the analysis of environmental samples. The Plan applies to data derived from Air, Drinking Water, Water Quality, Solid and Hazardous Wastes, Toxic Substances, and Pesticides Programs.

Concurrences

By: Lance M. Eggenberger
Lance M. Eggenberger, M.S.
Quality Assurance Specialist
Date: 9 Feb 1984

By:
James B. Perkins
Laboratory Supervisor
Date: [illegible]

By: Edward H. Sanders
Edward H. Sanders, Ph.D.
Section Head, Organic Chemistry
Date: 9 February 1984

By: Sim D Lessley
Sim D. Lessley, Ph.D.
Section Head, Inorganic Chemistry
Date: Feb 9, 1984

By: John C. Holt
John C. Holt
Section Head, Chromatography
Date: 9 Feb, 1984

Approval for Implementation

By: James H. Nelson
James H. Nelson, Ph.D.
Laboratory Director
Date: February 9, 1984

2.0 Introduction

The U.S. Environmental Protection Agency (EPA) considers quality assurance (QA) of the highest priority with respect to environmental monitoring. EPA policy requires, in part, that laboratories performing analyses for environmental monitoring programs, develop and implement QA program plans which cover all laboratory activities related to the analysis of environmental samples. Accordingly, the Chemistry Department of UBTL, Inc. has developed and implemented a QA program plan pertinent to the analysis of environmental samples and in accordance with EPA guidelines. Environmental data, generated and processed under this QA program plan, are derived from the analysis of environmental samples for air, drinking water, water quality, solid and hazardous wastes, toxic substances, and pesticides.

The quality assurance program plan presented in this document is applicable to environmental data generated and processed at UBTL and serves to assure that such data meets users' requirements in terms of accuracy, precision, completeness, and comparability.

Generally, UBTL is responsible only for the analysis of environmental samples and not for sample collection. Therefore, this quality assurance program plan does not address sample representativeness. When applicable, sample representativeness will be addressed in individual QA project plans.

3.0 Quality Assurance Policy

3.1 Goals

The goal of the UBTL QA program is to ensure that all available data generated and processed subject to EPA guidelines and requirements is scientifically valid, defensible, and of known and acceptable accuracy and precision.

3.2 Policy

It is the policy of UBTL that the analytical aspects of all environmental data generated and processed, subject to EPA guidelines and requirements, be of known and acceptable quality. This quality will meet the requirements of the intended use(s) of the data. Quality assurance data will be documented and available.

The level of effort of required QA activities will meet the requirements of the intended use(s) of the data.

Specific QA activities needed to meet data quality requirements of precision, accuracy, and completeness will be described in appropriate QA project plans. As required by EPA regulations, subject data will be reported with applicable calculations of precision and accuracy.

4.0 Quality Assurance Management

4.1 Introduction

Responsibility for the management of QA activities required in the generation and processing of environmental data is delegated by the Laboratory Director to the Quality Assurance Specialist (QAS). Arbitrament with respect to QA policy and protocol resides with the Laboratory Director. The QAS will function independently with respect to technical problems and in implementing required QA activities.

Illustrated in Figure 1 is an organization chart for the management of quality assurance practices at UBTL. The QAS is organizationally independent of all programs involved in the data generation process.

4.2 Assignment of Responsiblities

The Labortory Director has overall responsibility for the implementation of EPA's quality assurance requirements and for directing UBTL QA policy. The authority and responsibility for the daily management of QA activities is delegated to the QAS.

The QAS:

1) Is responsible for the implementation of QA project plans and ensuring that environmental data generated and processed meets the quality requirements of its use(s) as specified in applicable QA project plans.
2) Is responsible for identifying and responding to QA needs, problems, and requests from within UBTL.
3) Coordinates all laboratory QA activities with appropriate laboratory management personnel.
4) Provides technical QA assistance or obtains technical assistance from specialized sources, such as the EPA Region VIII Quality Assurance Office, as necessary. This activity includes assistance in preparing detailed QA plans, contract or other extramural proposal presentations requiring QA, and in designing QA programs for new studies.
5) Reviews and approves all QA Project Plans and the QA programs of all proposals which require QA.
6) Identifies QA problems requiring corrective action and works with laboratory management to implement appropriate corrective action when, where, and however needed.

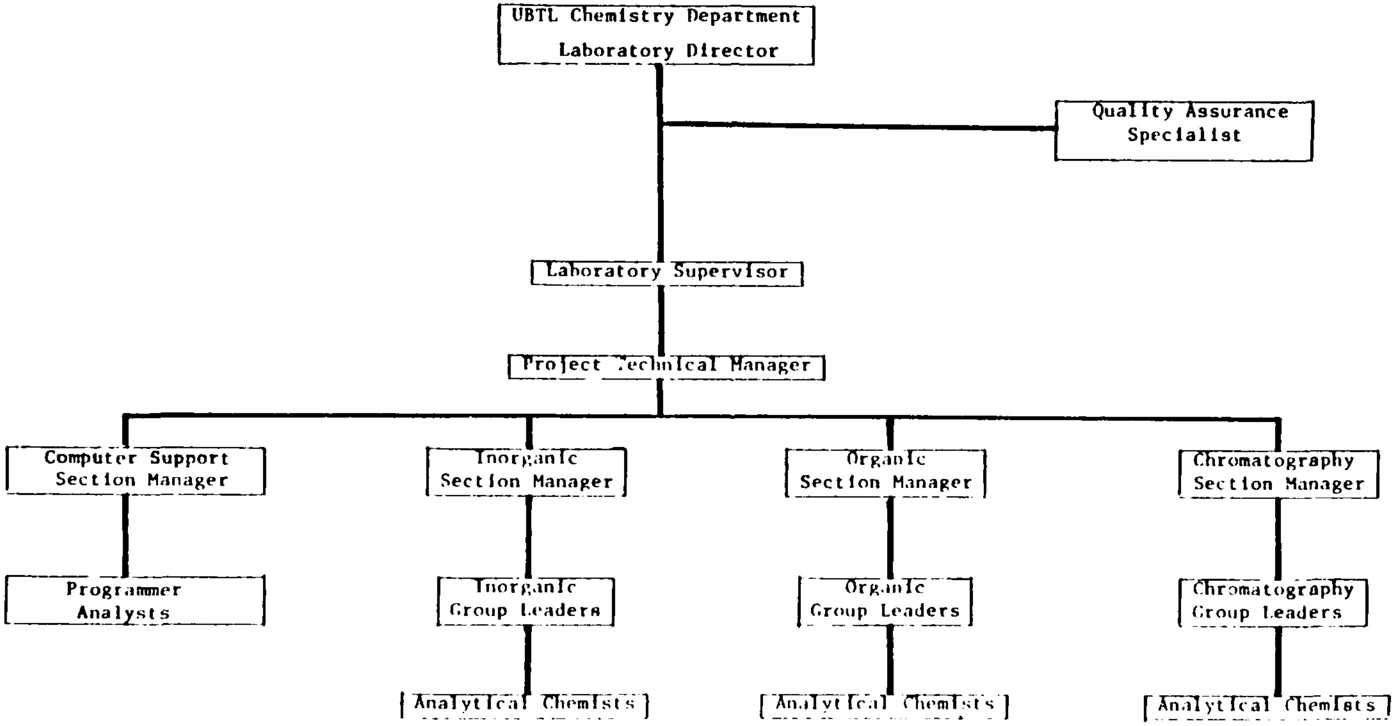


Figure 1. ORGANIZATION CHART FOR UBTL CHEMISTRY DEPARTMENT QUALITY ASSURANCE

4.3 Communication

Effective communication is necessary for a responsive, efficient QA program. UBTL employs a system of routine communications to ensure the efficacy of the QA program. This system includes daily, weekly, and monthly communications as described in the following.

4.3.1 Daily

Environmental samples received at UBTL are evaluated on a daily basis to assess QA requirements. Both management and analytical personnel are consulted by the QAS to ascertain QA program status and current needs or problems.

Environmental samples and the associated analytical work requests are reviewed by the QAS before analytical procedures are initiated. This ensures adherence to the requirements of applicable QA project plans during analysis.

The QAS evaluates all analytical data reports for precision, accuracy, completeness and adherence to EPA and project plan QA requirements.

4.3.2 Weekly

The QAS meets weekly with the Laboratory Director, Laboratory Supervisor, and Laboratory Section Managers. Specific QA project information is exchanged and QA needs evaluated. Specific items of activity are identified and implemented.

4.3.3 Monthly

The QAS submits a monthly summary report of QA activity to the Laboratory Director. The report includes:

1) Data relevant to specific QA activities in the laboratory.
2) A summary of significant problems and the corrective actions implemented.
3) A summary of special achievements.
4) A short-range projection of activities or anticipated projects.
5) A description of specific items (e.g., equipment, supplies, services) required by QA personnel.
6) A list of updated QA control charts.

4.3.4 Annually

The QAS submits an annual QA summary report to the Laboratory Director. The report includes:

1) The status of, or changes to, existing QA Program Plans.
2) The status of QA Project Plans.
3) A Data quality assessment, to include:
    - accuracy
    - precision
    - completeness
    - comparability
4) A summary of significant QA problems, corrective actions, accomplishments, and recommendations.
5) The results of performance audits.
6) The results of systems audits.
7) A summary of OA training.
8) Other information specifically requested by the Laboratory Director.

4.4 Sample Custody

Methods and procedures to be used for sample custody and processing are described here.

4.4.1 Sample Receiving and Logging

UBTL utilizes well established and controlled procedures for sample handling including receiving, logging and tracking. Samples are examined upon receipt by the authorized UBTL personnel to assure that all required conditions are met. Any problems are resolved by consultation with appropriate personnel and the sample set is cleared for logging. Samples are logged in a special computerized log book (established for individual projects) by the UBTL sample clerk. The clerk assigns each individual sample a specific laboratory number for logging and accounting purposes. The following information is entered into the log for each set of samples: a UBTL reference number; UBTL laboratory numbers; number of samples; analyses requested; sample type; date of receipt; date of analytical report; turnaround time; any delay in initiation of analytical work; date of assignment of samples to the analyst; name of analyst; source of samples; and EPA identification numbers. An example of a page from a typical UBTL log book is presented in Exhibit 1. Following logging procedures, the samples are assigned to the appropriate Section Manager for processing.

4.4.2 Sample Security, Storage, and Disposal

The laboratory is locked except during the regular working hours of 7:30 a.m. to 5:30 p.m. Admittance to the building during non-working hours is available only through the security agent on duty. Non-employees are required to sign the visitor register upon admittance and are escorted at all times both during regular working hours and non-working hours.

It is occasionally necessary to store samples after receipt and prior to the initiation of analysis. Samples are analyzed within the time period(s) established regarding the preservation of sample integrity. UBTL maintains secured walk-in refrigerators as well as freezers and other secured sample storage areas. All samples requiring special storage conditions (e.g., cold, frozen) are stored in accordance with specifications.

Samples are properly disposed of after appropriate designated holding periods.

4.4.3 Sample Tracking

Samples are received at the laboratory by the designated Sample Receipt Officer or (in the absence of the Sample Receipt Officer) the specific individual serving as alternate. At the time of sample receipt at the laboratory, the individual accepting the samples signs the Chain-of-Custody Record. Ideally, the Chain-of-Custody Record is initiated by appropriate EPA personnel. The laboratory provides blank Chain-of-Custody Records if another Chain-of-Custody Record is not specified for use.

After sample receipt and the accompanying required documentation of the Chain-of-Custody Record is completed, the Sample Receipt Officer implements one of the two following procedures:

(1) If samples are to be logged immediately, they are placed in the custody of the appropriate laboratory Section Manager who signs the Chain-of-Custody Record, completes the laboratory Work Order, and assures that

Exhibit 1. Example of Sample Log Book

RefNo	LabNo	No	Analyte	Ans	Type	Rec	Rep	TAT	Res	Assg	Chem	TO	Itm	Accnt	Cost	Inv
AF1541	AF14622	01	Endrin, Lindane, Methoxychlor, Toxaphene, 2,4-D, 2,4,5-T,	NA	BULK	11/08/83	NA	NA	NA	NA	NA	21	8	03631	310.20	NA
AF1542	AF14623	01	Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, Silver,	NA	SOLID	11/08/83	NA	NA	NA	12/01/83	CLM	21	8	03631	206.80	NA
AF1543	AF14624	01	Nickel,	01	FILT	11/10/83	11/28/83	10	18	11/16/83	KPB	21	7	03631	14.96	NA
AF1544	AF14625	01	Cadium,	01	FILT	11/10/83	11/28/83	10	18	11/16/83	KPB	21	7	03631	14.96	NA
AF1545	AF14626	01	Nickel, Cadmium,	02	FILT	11/10/83	11/28/83	10	18	11/16/83	KPB	21	7	03631	23.76	NA
AF1546	AF14627-14629	03	Iron,	03	FILT	11/10/83	11/28/83	10	18	11/16/83	KPB	21	7	03631	44.88	NA
AF1547	AF14630-14631	02	Lead, Cadmium, Nickel, Chromium,	08	FILT	11/10/83	11/28/83	10	18	11/16/83	KPB	21	7	03631	82.72	NA
AF1548	AF14632	01	Lead,	01	BULK	11/10/83	12/02/83	14	22	11/28/83	CLM	21	A	03631	22.00	NA
AF1549	AF14633-14639	07	Cadmium, Silver,	14	FILT	11/10/83	11/28/83	10	18	11/16/83	KPB	21	7	03631	166.32	NA
AF1550	AF14640-14644	05	Silver, Cadmium, Lead,	15	FILT	11/10/83	11/28/83	10	18	11/16/83	KPB	21	7	03631	162.80	NA
AF1551	AF14645	01	Chromium, Iron, Manganese, Nickel, Zinc,	05	FILT	11/10/83	11/28/83	10	18	11/16/83	KPB	21	7	03631	50.16	NA
AF1552	AF14646-14647	02	Chromium VI,	02	FILT	11/10/83	12/13/83	21	33	12/05/83	DPC	21	7	03631	26.40	NA
AF1553	AF14648	01	Silver, Gold,	02	FILT	11/10/83	12/02/83	14	22	11/28/83	CLM	21	7	03631	32.00	NA
AF1554	AF14649	01	Beryllium,	01	BULK	11/10/83	12/02/83	14	22	11/28/83	CLM	21	A	03631	22.00	NA
AF1555	AF14660-14665	06	Lead,	06	FILT	11/10/83	11/28/83	10	18	11/16/83	KPB	21	7	03631	89.76	NA
AF1556	AF14666-14668	03	Zinc,	03	FILT	11/10/83	11/28/83	10	18	11/16/83	KPB	21	7	03631	44.88	NA
AF1557	AF14670-14678	20	Chromium, Iron, Manganese, Nickel,	80	FILT	11/10/83	11/28/83	10	18	11/16/83	KPB	21	7	03631	877.20	NA
AF1558	AF14679-14730	52	PCB'S,	52	OIL	11/10/83	11/28/83	10	18	11/10/83	JRB	21	6	03631	2236.00	NA
AF1559	AF14731-14733	03	Malathion,	03	CHEM	11/10/83	11/21/83	07	11	11/10/83	EEJ	21	1	03631	105.00	NA
AF1560	AF14734-14737	04	Baygon, Pyrethrum,	08	CHEM	11/10/83	11/30/83	12	20	11/29/83	RMI	22	A	03631	440.00	NA
AF1561	AF14738-14777	40	Asbestos,	40	FILT	11/14/83	12/08/83	16	24	11/14/83	BS	21	4	03631	704.00	NA
AF1562	AF14778-14783	06	Diazinon, Malathion, 2,4-D	NA	WATER	11/14/83	NA	NA	NA	NA	NA	21	2	03631	592.20	NA

all required sample logging procedures are completed. Following the completion of sample logging, the Section Manager either assigns the samples to an appropriate analyst, or secures the samples in either a locked refrigerated sample storage area or in the locked sample storage room and notes the location of the samples on the Work Order and the Chain-of-Custody Record. The Chain-of-Custody Record remains with the samples. The laboratory Work Order is retained by the Section Manager. At a later time, the Section Manager assigns stored samples to the analyst, who documents the receipt of such on the Chain-of-Custody Record. The analyst receives the Chain-of-Custody Record and the laboratory Work Order with the samples. The established policy of the laboratory is that samples are in the immediate possession (or in view) of the individual who has most recently signed the Chain-of-Custody Record or they are secured in a locked area. Therefore, if it is necessary for the analyst to store samples or materials derived from the samples during processing (e.g., extracts, residues, solutions), it is the responsibility of the analyst to secure such in a designated locked storge area. In the event that samples or materials derived from the samples during processing are split, the split is noted on the Chain-of-Custody Record and the individual receiving the split signs for such on the Record. An independent laboratory Work Order is issued for the split by the Section Manager.

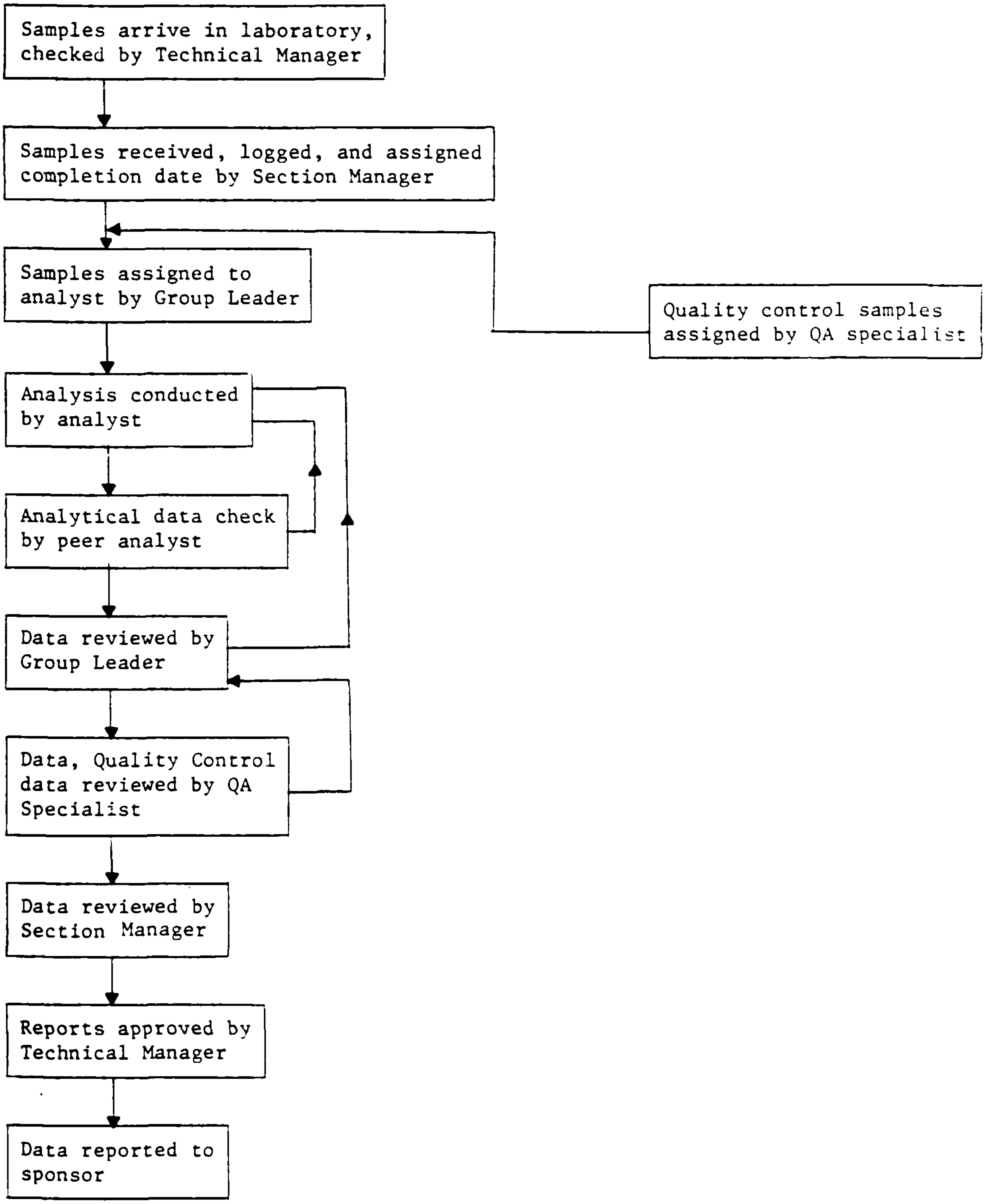
(2) If current laboratory assignments do not permit immediate sample logging, the Sample Receipt Officer, or his alternate, secures the samples in the appropriate sample storge area. When required personnel are available for the initiation of sample logging procedures, the Sample Receipt Officer initiates sample logging and the procedures summarized in (1) above are followed.

Figure 2 summarizes the sample flow through the laboratory.

A copy of the current laboratory Chain-of-Custody Record is provided as Exhibit 2.

A laboratory tracking report form (Exhibit 3) is used to provide a record of each of the major analytical and/or reporting steps completed

Figure 2. UBTL Sample Processing System



LABORATORY CHAIN-OF-CUSTODY RECORD

Sample Source (Client Identification)		Field Personnel (Signature)
Project Title	Field Project ID No.	Laboratory Project ID No.

Date	Time	Sample Number(s)	Sample Type	No. of Containers	Sampling Site	Remarks

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

Exhibit 2. Chain-of-Custody Record

Exhibit 3

LABORATORY TRACKING REPORT

Sample Source (Client Identification) ____________________
Field Sample Set ID Number ____________________
Laboratory Sample Set ID Number ____________________
Inclusive Laboratory Sample Numbers ____________________

Processing Step Required	Responsible Individual	Date Received by Responsible Individual	Date Step Completed	Signature of Individual Completing Step

Description of Problems:

Remarks:

for a specific set of samples, each sample in the set requiring the same analytical protocol. The appropriate Section Manager initiates all requisite laboratory tracking report forms.

4.5 Document Control

QA reports, procedure documents, plans, and directives are maintained under document control procedures described in Section 1.4.1 of the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume I (EPA-600/9-76-005).

The standard laboratory operating procedures address the organization, assembly, dissemination, and filing of all documents pertinent to the analysis of each set of samples. The goal of the Document Control Program is to assure that all required documents for a specific sample set are appropriately completed, distributed, and filed. Document control addresses, but is not limited to: sample tags, Chain-of-Custody records, sample tracking records, information recorded in analysts' notebooks and in instrumentation logbooks, hardcopy output from instrumentation (e.g., chromatograms, tapes of absorbance values, recorder output), computer printouts, raw data summaries, analytical request documentation and accompanying correspondence, analytical reports, methodology reports, and quality assurance reports.

The Project Manager prepares a complete list (inventory) of all required documentation and the specific individual responsible for the collection and completion of each type of documentation after the samples of a set are received, logged, and a Work Order is completed. At this point, the analytical work is well defined and the documentation required has been identified. Each responsible individual is provided with a copy of the documentation inventory sheet. The Project Manager reviews the development of documentation as the project proceeds, and collects and organizes all essential documents at the conclusion of the work. It is the current policy of the laboratory to file all documentation packages indefinitely. A copy of the laboratory Document Control form is provided as Exhibit 4.

Exhibit 4

DOCUMENT CONTROL FORM

Sample Source (Client Identification) ____________
Field Sample Set ID Number ____________
Laboratory Sample Set ID Number ____________
Inclusive Laboratory Sample Numbers ____________

Document Items Required	Document ID Number	Individual Responsible for Completion	Date Received by Technical Manager
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			

Remarks:

4.6 Calibration Procedures, References & Frequency

It is standard operating procedure at UBTL to analyze a series of appropriate standards with each set of samples. EPA Standard Reference Materials (SRM) are used as standards for all parameters for which these are available. For those parameters for which an EPA SRM is not available, a commercially available product of the highest available purity is used. The purity of commercial products is verified by analysis before acceptance by the laboratory. High purity inorganic SRMs and selected organic-mixture SRMs available from the National Bureau of Standards are also used. When appropriate, commercial products are analyzed for purity against EPA or NBS reference materials.

The calibration procedures followed for selected instrumental methods of analysis are presented in Table 1.

Table 1.
Calibration Procedures

Instrument	Standards	Frequency
GC	5-7 Analytical Standards plus one mid-range check sample	Double inject all standards at beginning and end of analytical run. Inject check standard every 10th analysis
GC/MS	Performance check (i.e., Grob test mixture for polar compounds)	Before analysis of each set of samples
	5 Analytical Standards plus one mid-range check sample	Single inject all standards at beginning of analytical run. Inject check standard every 10th analysis
	Mass calibration with PFTBA (tuning) and DFTPP (check)	Daily, once each
HPLC	5 Analytical Standards	One standard between every two samples
ICP	4 Analytical Standards 1 Blank Mid-range standard	Analysis of standards at beginning and end of analytical run Mid-range standard run once every 20 samples

4.7 Program Assessment

The QA Program is monitored continually for quality through utilization of computerized data collection, reduction, storage, and retrieval. Assessment of data precision is available on a continuing basis to the analysts through automated data processing procedures. Computerized evaluation of quality assurance sample data provides to the analyst, management personnel, and the QAS, a timely appraisal of both accuracy and precision.

Utilizing sample data stored in computer files, acceptance/rejection criteria are periodically updated, as the volume of data allows.

Internal quality assurance samples are analyzed on a routine basis for environmental samples not addressed by specific Project Plans. Otherwise, the analysis of quality assurance samples is in accordance with the QA requirements of applicable Project Plans.

4.8 Performance Audits, System Audits, and Frequency

4.8.1 Performance Audits

The UBTL Quality Assurance Specialist (QAS) is not directly involved in measurement or production processes. The QAS administers a continuous internal performance audit in the laboratory. Quality control (QC) samples are prepared by the QAS from either standard reference materials (EPA or NBS) or from QC samples provided by EPA for this purpose. These audit samples are analyzed routinely within the laboratory as part of the internal quality control program. The data are evaluated by the QAS. Any required corrective measures are initiated by the QAS.

Extramural performance audit programs include those administered by the State of Utah Department of Health (annually) and by the EPA (quarterly). These programs include EPA's Water Supply Laboratory Performance Evaluation Study and the Water Pollution Performance Evaluation Study. UBTL participates in three additional extramural performance audit programs. Two programs address blood lead determinations. Both are administered by the Centers for Disease Control (CDC). One program requires monthly participation and the other quarterly participation. The third program, administered quarterly by NIOSH, is a Proficiency Analytical Testing (PAT) round robin which addresses organic solvents, asbestos, free silica, lead, cadmium, and zinc.

4.8.2 System Audits

System audits are performed for all EPA measurement related systems at UBTL by the State of Utah, Department of Health, on at least a biannual schedule. In alternate years, only a performance audit is conducted.

Triannually, UBTL participates in a system audit for accreditation by the American Industrial Hygiene Association.

5.0 Personnel Qualifications

All UBTL personnel assigned to perform tasks related to environmental sample data quality will have education, training, and experience commensurate with responsibilities and duties.

The QAS will assist the Laboratory Supervisor in the assessment of personnel training needs and in the accomplishment of such training.

6.0 Facilities, Equipment and Services

UBTL ensures that the following are maintained in the laboratory:

- Adequate and acceptable facilities (e.g., lighting, ventilation, temperature, humidity, etc.).
- Adequate and acceptable utility services (e.g., voltage control, air, water, vacuum, gas, etc.).
- Adequate and acceptable general laboratory facilities and equipment (e.g., refrigerators, laboratory fume hoods, sinks, bench area, etc.).

Each item of major analytical equipment is maintained under a program of regularly scheduled preventative maintenance, performed by a trained engineer. Equipment performance checks are performed by each analyst prior to the analysis of each batch of environmental samples through the use of standard and control samples.

Records of equipment maintenance and standards checks are maintained.

7.0 Data Generation

QA Project Plans are developed and implemented for all environmentally related measurement activities addressed by UBTL, so that all data generated and processed by UBTL are scientifically valid, defensible, of known accuracy and precision, and of acceptable completeness, representativeness, and comparability.

7.1 Quality Assurance Project Plans

UBTL does not routinely participate in field sample collection procedures; these are primarily extramural activities. In fulfillment of some specific Project Plan requirements, however, UBTL provides acceptable field sample containers and preservatives prepared in accordance with applicable EPA guidelines.

QA Project Plans are prepared for each specific project or continuing operation to ensure that data generated and processed are of known quality and integrity. Each QA Project Plan contains the following, as applicable:

1) Title Page, with provision for approval signatures
2) Table of Contents
3) Project Description, including objectives, goals, data usage, etc.
4) Project Organization and Responsibilities
5) QA Objectives for Measurement Data, in terms of precision, accuracy, completeness, comparability, and representativeness
6) Sampling Procedures
7) Calibration Procedures and References
8) Analytical Procedures
9) Data Reduction, Validation, and Reporting
10) Internal Quality Control Checks
11) Performance and Systems Audits
12) Preventive Maintenance Procedures and Schedules
13) Specific procedures to be used to assess routinely data precision, acccuracy, and completeness of the specific measurement parameters involved
14) Corrective Action
15) Quality Assurance Reports to Management

QA Project Plans also address the following activities, as applicable:

1) General network design, objectives, limitations, etc.
2) Specific sampling-site selection criteria
3) Sampling and analytical methodology
4) Probes, collection devices, storage containers, sample additives and preservatives, temperature, pH, etc.
5) Federal reference, equivalent, and alternate test procedures
6) Instrumentation selection and use
7) Calibration and standardization
8) Preventive and remedial maintenance and service contracts
9) Replicate sampling and analysis
10) Blind and spiked samples
11) Quality control procedures such as inter- and intra-field and laboratory activities
12) Sample custody and handling procedures, including special precautions such as holding times, protection from heat and light, reactivity, combustibility, packaging, etc.
13) Sample labeling, package marking, and placarding in accordance with Department of Transportation Regulations prior to shipment or transportation
14) Safety
15) Data handling evaluation procedures
16) Precision, accuracy, completeness, representativeness and comparability
17) Document control

7.2 Standard Operating Procedures

Standard Operating Procedures, detailed documents describing who does what, when, where, how, and why in a stepwise manner, are prepared for routine tasks which do not vary with different environmental studies. They are included in QA Project Plans by reference. They are sufficiently complete and detailed to ensure:

1) Data of known quality and integrity are collected to meet the project objectives.

2) A minimum loss of data due to out-of-control conditions.

7.3 Analytical Procedures

Generally, analytical procedures are selected from a multitude of published sources. Procedures often vary according to the character of the individual environmental sample being analyzed. Representative procedures have been compiled in Appendix A. The compilation is neither all inclusive, nor exclusive, and is subject to revision.

8.0 Data Processing

Data processing includes collection, validation, storage, transfer, and reduction. UBTL employs extensive automated data processing procedures, including:

- The generation of standard calibration curves
- Mathematical modeling of standard curves
- Statistical analysis
- Calculations
- Data storage and retrieval
- The generation of hard copy output

UBTL uses a computer-based data processing system for all pertinent areas of data processing.

8.1 Collection

UBTL utilizs a sophisticated data collection and reduction system consisting of the following automated data handling systems:

(1) A Hewlett-Packard Laboratory Data System (Model 3357, Series E) is a dedicated turn key system for the collection, reduction and processing of data derived from gas chromatographic, and high performance liquid chromatographic instrumentation. All chromatographic data collected by the Hewlett-Packard Laboratory Data System are transferred to the UBTL central computing system (HP-1000). This central system has been programmed to store and sort data into separate files for each sample set. Further, it allows the analyst to review automatically the results from standard runs and to select (from an array of possibilities) an appropriate mathematical model to calculate sample results from the calibration curve corresponding to the model selected. The system provides (automatically) hardcopy output of results for each analyte in tabular format with pre-selected units.

The Hewlett-Packard Laboratory Data System also controls and operates a total of eleven autosamplers attached to the UBTL chromatographic instrumentation.

(2) UBTL has three modern gas chromatography/mass spectrometry/data systems (GC/MS/DS): a Hewlett-Packard Model 5985B GC/MS/Data System (including a 50 megabyte disc for data storage), a Hewlett-Packard Model 5992B GC/MS/Data System and a Finnigan Model 1020 GC/MS/Data System. Each of these systems has powerful data collection and reduction capability for processing mass spectral data.

(3) A PDP 11/05 computer with DECwriter console is used to collect and process data derived from the analysis of selected elements by inductively coupled argon plasma emission spectrophotometry.

(4) UBTL employs the Hewlett-Packard 1000 Minicomputer for the storage and manipulation of quality assurance (QA) data.

8.2 Validation

Analytical data generated at UBTL are validated using several procedures, the most important of which involves the established quality assurance system.

At the completion of an analysis of a sample set, each chemist calculates his/her results and reports such on the Sample Data and Laboratory Report sheet. Results for replicated samples and internal QA samples are calculated and tabulated automatically by computer on a real time basis. Thus, the chemist may determine immediately if his QA samples are in control. The QA data are then held in file within the computer. Before the results are submitted to the Section Manager, a peer scientist other than the analyst is assigned to check the results for possible errors in calculations or data processing. The checker must approve results reported on both the quality assurance sheet and the sample report sheet. Should the QA data be out of control (Section 9.0), the chemist and his supervisor are required to assess possible problems. They must notify the Quality Assurance Specialist (QAS) of the problem and its solution before the QAS releases the data from the computer. The Section

Manager, after his evaluation of the data, gives the report sheets and quality control sheet to the QAS for evaluation and implementation of any required action. Upon approval by the QAS, the completed report is routed through to the Project Manager for final review and reporting. (Refer to Figure 2, Section 4.4.3.)

8.3 Storage

The paperwork containing the raw data for a sample set (i.e., chart paper, computer readouts, paper tapes, calibration curves, tables of data, etc.) is collected and placed in a 8 1/2" by 11" envelope which has been labeled with sample numbers, analyst, date, and other pertinent information. Appropriate and complete data along with a description of the samples and analytical method are also entered in the chemist's notebook. The envelopes are filed by laboratory number for possible future reference and data retrieval. Raw data for each sample analysis are therefore readily available, if needed.

Each chemist at UBTL maintains a bound laboratory notebook in which are detailed events related to sample analyses. Completed notebooks are filed by each chemist. At termination of employment, all laboratory notebooks are placed in a permanent file.

8.4 Transfer

QA Project Plans describe procedures to be used to ensure that data transfer is error free and that no information is lost in the transfer. Because of the extensive use of a computerized data processing system, data transfer steps are minimized.

8.5 Reduction

To accomplish data reduction, mathematical models based on analysis of standard solutions or standard samples are generated in order to determine the quantity of analyte present in field samples. Data processing by the computer includes calculations, generation of standard calibration curves, mathematical modeling of standard curves, statistical analyses, and the generation of hard copy output.

Four different computerized mathematical models are available at UBTL to fit data derived from the analysis of standards and to generate calibration curves. The analyst has the option of selecting the model which best fits standard data. UBTL's computer program provides an equation for the calibration curve and the value of the corresponding correlation coefficient. The optional mathematical models are:

Linear	$Y = AX+B$
Quadratic	$Y = AX^2+BX+C$
Exponential	$Y = A+B(1-e^{CX})$
Nernst	$Y = A+B(\log(C+X))$

where Y is the experimental observation and X is the concentration or amount of the analyte of interest.

Data from the analysis of standards are used to determine the coefficients A, B and C, as appropriate. These values define the equation of the standard curve which is used to determine X from the value of Y determined experimentally for each analyte of each field sample.

The data reduction program allows the analyst to generate a printed plot of the standard curve as an aid in selecting the curve of best fit. Although a correlation coeficient is provided, it is not always the best indication of a reasonable data fit.

8.6 Reporting

Analytical reports are submitted immediately following the completion of the analyses and the associated calculations for each work effort. Each analytical report is comprised of three parts: A report listing analytical results and the appropriate units (one example is provided in Exhibit 5); a brief description of the employed methodology, possible interferences, unusual problems and other observations, and the limit(s) of detection (Exhibit 6); and a report of the results of the analysis of quality assurance samples processed with the set of field samples (Exhibit 7). Each of these items is provided to the sample sponsor for each sample set.

Exhibit 5

Report of Analytical Results

2\.
UBTL
520 Wakara Way, SLC, UT 84108

3\. LAB SAMPLE NUMBER
AF-1270
AF-11417
00000

4\. REQUESTOR SAMPLE NUMBER
22965CN830004
00020

SAMPLE COLLECTION INFORMATION

5\. DATE RECEIVED BY
May 27, 1983

6\. DATE ANALYSIS COMPLETED

7\. SITE DESCRIPTION

ON-SITE ANALYTICAL RESULTS

8\. SITE LOCATION NO

9\. FLOWRATE AT SITE 00058 GAL/MIN

10\. WEATHER 00021

16\. WATER TEMP 000 10 °C

17\. PH 00400 UNITS

18\. DISS O2 00300 MG/L

11\. COLLECTION DATE/PERIOD

12\. NAME OF COLLECTOR

19\. RESULTS OF OTHER ON-SITE ANALYSES

13\. SAMPLING TECHNIQUE

14\. PHONE NUMBER

15\. REASON FOR SAMPLE SUBMISSION
NPDES #

ANALYSES REQUESTED AND RESULTS

A. PRIMARY DRINKING WATER STANDARDS (40CFR 141) (Preservation Group H)

PARAMETER	TOTAL	µG/L	MAX LEV ALLWD	PARAMETER	TOTAL	µG/L	MAX LEV ALLWD
ENDRIN	39390	.	0.2 µG/L	2, 4-D	39730	.	100 µ G/L
LINDANE	39782	.	4 µG/L	2,4, 5-TP SILVEX	39760	.	10 µ G/L
METHOXYCHLOR	39480	.	100 µ G/L				
TOXAPHENE	39400	.	5 µ G/L				

B. NON-POTABLE WATER ANALYSIS FOR PESTICIDES (Preservation Group H)

PARAMETER	TOTAL	µG/L	PARAMETER	TOTAL	µG/L	PARAMETERS (SPECIFY)	µG/L
ALDRIN	39330	<0.02	METHOXYCHLOR	39480	<0.2	alpha-BHC	<0.02
CHLORDANE	39350	<0.4	TOXAPHENE	39400	<2.	beta-BHC	<0.04
DDT ISOMERS	39370	.	2,4-D	39730	0.09	delta-BHC	<0.02
DIELDRIN	39380	<0.02	2,4,5-TP SILVEX	39760	<0.05	2,4,5-T	<0.05
ENDRIN	39390	<0.04	DDD		0.20		
HEPTACHLOR	39410	<0.02	DDE		<0.02		
HEPTACHLOR EPOXIDE	39420	<0.02	p,p'-DDT		<0.1		
LINDANE	39782	12.	o,p-DDT		<0.1		

1\. ORGANIZATION REQUESTING ANALYSIS

CHEMIST
Ellen Jenkins

REVIEWED BY
James B. [illegible]

APPROVED BY
Edward A Sander

Exhibit 6

Description of Analytical Methodology

June 14, 1983

UBTL
520 WAKARA WAY
SALT LAKE CITY
UTAH 84108
801 581-826

ANALYTICAL REPORT

SUBMITTED TO:

SUBMITTED BY:	Ellen Jenkins
REFERENCE DATA:	
Analysis of:	Aldrin, Chlordane, DDE, DDD, o,p-DDT, p,p'-DDT, Dieldrin, Endrin, Heptachlor, Heptachlor Epoxide, Lindane, Methoxychlor, Toxaphene, 2,4-D, 2,4,5-TP Silvex, 2,4,5-T, alpha-BHC, beta-BHC, and delta-BHC
Identification No.:	AF-1270
Task Order No.:	19
Sample(s): 6	Analyses: 114
UBTL Laboratory No.:	AF-11414 through AF-11419

The above numbered water samples were prepared for pesticide analysis by EPA Method 608 and for herbicide analysis by EPA Method 615. The butyl ester of the herbicides was used. Both methods call for the extraction of 1 liter but it was necessary to use smaller volumes because of sample availability. The limits of detection were adjusted accordingly.

The pesticides except methoxychlor and endrin were analyzed on a Tracor 222 gas chromatograph equipped with an electron capture detector. A 6' x 2 mm i.d. glass column packed with 3% OV-17 and 3% QF-1 on 100/120 mesh Gas Chrom Q was used isothermally at 195°C and with a gas flow of 75 mL per minute. Methoxychlor and endrin were analyzed on a Tracor 220 gas chromatograph equipped with an electron capture detector. A 6' x 2 mm i.d. glass column packed with 3% OV-101 on 100/120 mesh HP Chrom W was used isothermally at 200°C and with a gas flow of 75 mL/minute. Sample AF-11417 was found to contain lindane and DDD. The rest of the pesticide analytes were not found to be present in amounts greater than the limits of detection.

The herbicide analysis was performed on the Tracor 222 gas chromatograph using the mixed phase isothermally at 170°C. Sample AF-11417 was found to contain 2,4-D. The rest of the herbicides analytes were not found to be present in the samples in amounts greater than the limits of detection.

Exhibit 6 (Continued)

The limits of detection for a 500 mL extraction were 0.02 µg/L for aldrin, DDD, DDE, dieldrin, heptachlor, heptachlor epoxide, alpha-BHC, delta-BHC, and lindane; 0.04 µg/L for endrin and beta-BHC; 0.05 µg/L for 2,4-D, silvex, and 2,4,5-T; 0.2 µg/L for p,p'-DDT, o,p-DDT, and methoxychlor; 0.4 µg/L for chlordane; and 2 µg/L for toxaphene.

The results are tabulated on the following page(s).

Ellen Jenkins
Ellen Jenkins

James H. Nelson, Ph.D.

Exhibit 7

Quality Assurance Data Report

```
                 UBTL Analytical Laboratory

                 Quality Control Data Sheet        ID #   EJ3540


Analyte              ENDRIN

Analyst name         EEJ                  Matrix          WATERS
Analyst number       457                  Instrument      222
Method               ECGC                 Date            11  MAY , 1983

                      Results in UG/L

 Sample      Value1      Value2 Num     Mean      Target     Range  Rng/Mean Status
------------------------------------------------------------------------------------
 QC15393      1.520       1.525 2      1.522      1.690       .005      .003  NA
 SA1636        .195        .194 2       .194                  .000      .002
 SA1806       1.554       1.586 2      1.570                  .032      .020
 SA1807        .454        .428 2       .441                  .026      .058
 SPIKE150     1.836       1.852 2      1.844                  .016      .009

Limit of detection  0.02ug/L       Checked by  JRB
```

5/13

Following the submission of reports to a sponsor, the sample set is logged out on the master log book by the Sample Clerk. A copy of all reports is placed in a master file for storage and retrieval of information as required. This file is organized and maintained according to UBTL sample number. Material filed for each sample set includes reports of (1) analytical results; (2) methodology; and (3) QA results.

10.0 Data Quality Assessment

The quality of all data generated and processed by UBTL is assessed before it is reported, or put into use, to ensure that it satisfies the needs of the user and fulfills QA Project Plan requirements. The data are assessed for accuracy, precision, completeness, representativeness, and comparability.

10.1 Data Sources

There are two primary data parameters which are adaptable to control limit calculations. These parameters are accuracy and precision. Accuracy data are obtained from either separately prepared integral samples or from analyte enriched (spiked) field samples. The data are utilized in the format of percent recovery. Precision data are obtained from either quality control sample analyses or from the analysis of field samples. Since precision is a measure of reproducibility, a selected sample is analyzed at least twice to produce precision data. There are two types of precision data obtainable. Two essentially identical samples processed through the entire analytical method from sample preparation to analysis will produce analytical method precision data. One sample analyzed twice on the same instrument will produce instrumental precision data. The two types of precision data are handled separately. In like manner, accuracy data from separately prepared quality control samples are handled separately from accuracy data obtained from spiked field samples.

10.2 Calculation of Quality Control Limits

Quality control limits and accompanying charts are generated for each analyte from the statistical analysis of QC sample results. To address the entire range of analyte levels expected for field samples, quality control samples are prepared in the laboratory at several different concentrations or levels. These levels are not necessarily duplicated exactly from sample set to sample set. To optimize comparative use of the quality control data, the results are normalized by dividing each analytical result by the corresponding theoretical (target) value so that these standardized results are distributed around 1.00 or 100% recovery. Statistical quality control methods (1,2,3) have been modified and applied to the standardized results to produce accuracy and precision control charts.

For the ith sample result of n_i replicate determinations obtained in the laboratory for a specific quality control sample, two statistics are calculated:

$$X_i = \frac{\text{Calculated Mean}}{\text{Theoretical Value}} \qquad (1)$$

$$R_i = \frac{\text{Range of Values}}{\text{Theoretical Value}} \qquad (2)$$

When a control data set of N sample results has been accumulated for the determination of a specified analyte in a given sample matrix using a specified method, the following summary statistics are computed:

Mean Percent Recovery:

$$\overline{X} = \frac{\sum_{i=1}^{N} n_i X_i}{\sum_{i=1}^{N} n_i} \qquad (3)$$

Average Standard Deviation Among Replicates:

$$\sigma' = \frac{\sum_{i=1}^{N} \frac{(n_i - 1)\, R_i}{d_{2i}}}{\sum_{i=1}^{N} (n_i - 1)} \qquad (4)$$

where d_{2i} is the factor to convert a range to a standard deviation for sample size n_i (Table 2).

The precision component of the quality control program is based on the range of results rather than on the standard deviation because the range is conceptually easier for the chemist to relate to analytical results. The actual standard deviation could be applied with equal facility. Most of the quality control results compiled in the laboratory are comprised of sets of two determinations derived from duplicate analysis of the same sample. For this situation, the range divided by the constant d_2 is equal to the calculated standard deviation.

Accuracy and precision performance criteria of many quality control programs are based only on the repeated analysis of the same sample. Such programs utilize only one standard deviation, that attributable to repeated measurements. This standard deviation corresponds to the standard deviation among replicates σ' applied in the UBTL program and defined by Equation (4). Since the program involves the analysis of different quality control samples (with the same or different analyte levels) for the purpose of establishing performance criteria, sample-to-sample variation must also be considered. Accordingly, quality control criteria for assessing accuracy are based on a consideration of both the replicate standard deviation σ' and the standard deviation among samples σ_s(3).

Using analysis of variance procedures,(4) the standard deviation among samples can be estimated as follows:

$$\sigma_s = \left[\frac{(MS_s - \sigma'^2)\ (N-1)}{\sum_{i=1}^{N} n_i - \left(\sum_{i=1}^{N} n_i^2 \right) / \sum_{i=1}^{N} n_i} \right]^{\frac{1}{2}} \qquad (5)$$

MS_s is the mean square among samples from the analysis of variance and is calculated as follows:

$$MS_s = \frac{\sum_{i=1}^{N} \frac{(n_i X_i)^2}{n_i} - \overline{X}^2 \sum_{i=1}^{N} n_i}{N - 1} \qquad (6)$$

The standard error S_x of our result X_i is then:(3)

$$S_x = \sqrt{\frac{\sigma'^2}{n_i} + \sigma_s^2} \tag{7}$$

Accuracy limits for quality control charts are calculated, establishing control limits and warning limits at three standard errors and two standard errors, respectively, from the mean. It is important to note that the accuracy control limits applied to the analytical results for a given quality control sample are dependent not only on the previously established values of σ' and σ_s, but also on the number of replicate analytical results. For example, for a new quality control sample of n_j replicates with results X_j and R_j, the accuracy limits are:

Accuracy Control Limits for X_j: $$\overline{X} \pm 3\sqrt{\frac{\sigma'^2}{n_j} + \sigma_s^2} \tag{8}$$

Accuracy Warning Limits for X_j: $$\overline{X} \pm 2\sqrt{\frac{\sigma'^2}{n_j} + \sigma_s^2} \tag{9}$$

To calculate quality control limits for precision charts, only the replicate standard deviation σ' is needed. Precision control limits(1, 2) (three standard deviations) for a range are:

Lower Limit = $D_1\sigma'$ Upper Limit = $D_2\sigma'$

Values of D_1 and D_2 are a function of the number of replicates and are given in References (1) and (2). Selected values are also provided in Table 2. Constants similar to D_1 and D_2 are required to calculate warning limits (two standard deviations). These are not commonly tabled, however, they can be derived from a table of the studentized range.(5) These warning limit constants, denoted as D_1' and D_2', are tabulated along with D_1 and D_2 in Table 2. Warning limits are:

Lower Limit = $D_1's'$ Upper Limit = $D_2's'$

TABLE 2

Constants for the Computation of Quality Control Charts

n	d_2	D_1	D_2	D_1'	D_2'
2	1.128	0	3.69	0	2.83
3	1.693	0	4.36	0	3.47
4	2.059	0	4.70	0.30	3.82
5	2.326	0	4.92	0.60	4.05
6	2.534	0	5.08	0.84	4.23
7	2.704	0.20	5.20	1.04	4.37
8	2.847	0.39	5.31	1.21	4.49
9	2.970	0.55	5.39	1.35	4.59
10	3.078	0.69	5.47	1.48	4.67

d_2, D_1 and D_2 were taken directly from standard tables.(1, 2)

D_1' and D_2' correspond to two standard deviation limits for ranges and were calculated from a table of the studentized range.(5)

Although results are standardized (divided by the theoretical value) for purposes of comparability, the normalized replicate standard deviation still tends to decrease slightly with increasing concentration or analyte level(6). The influence of analyte level is reduced by grouping the data into several concentration (level) ranges and calculating limits separately for each range. Data are plotted on a single chart, with the limits changing appropriately for each data point. The number of concentration ranges selected is determined from the nature and characteristics of the data. Data obtained at relatively low analyte levels near the limit of detection, when separated from high concentration level data, often generates expanded control limits.

The control data set is updated after evaluation of 20 successive quality control samples and includes data on the 50 most recent results. Any value X_i or R_i which is out of control is not used in the subsequent determination of new limits. Figures 3 and 4 show sample plots of the accuracy and precision control charts.

10.3 Accuracy

Individual QA Project Plans describe the specific, detailed mechanisms required for that project to demonstrate that reported data are favorably comparable to true values. These mechanisms usually include the analysis of reference or spiked samples, and participation in performance audit programs.

Since the "true" analyte values for field samples are not known, no accuracy measurement can be made using field sample analyses (excepting spikes). Although actual acceptable precision meausrements are indicative of an analytical system that is in control, the accuracy of the data generated for field samples is assessed through the analysis of QC samples processed with the field samples. Unacceptable results for accuracy in the analysis of internal quality control samples analyzed with a field sample set overrides any acceptability based upon field sample precision measurements.

10.4 Precision

Individual QA Project Plans describe the specific, detailed mechanisms required for that project to demonstrate the reproducibility of the measurements performed by UBTL. These mechanisms generally require that the results of replicate analyses of an environmental sample or reference sample be within predetermined acceptance limits.

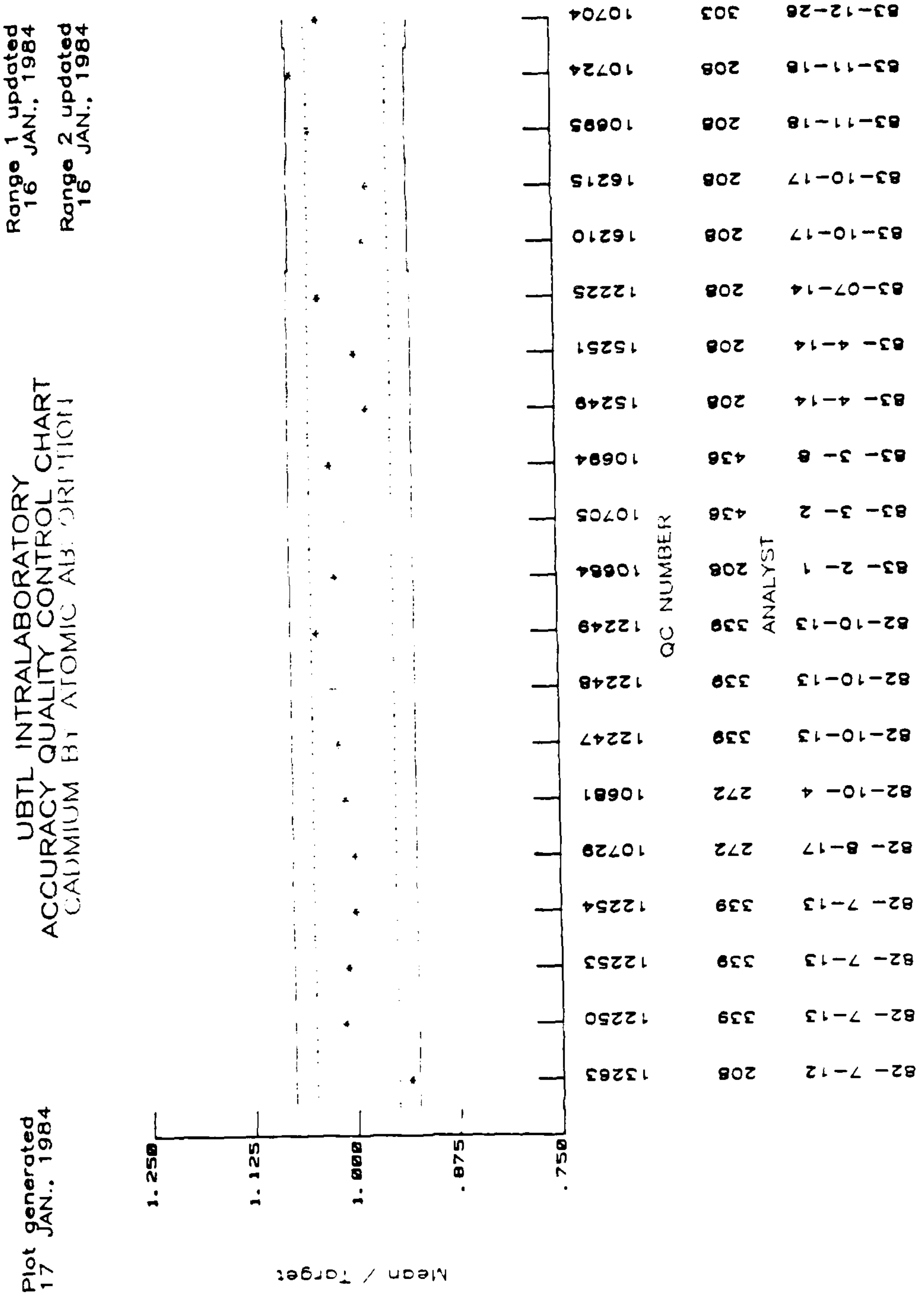


Figure 3. Accuracy Control Chart

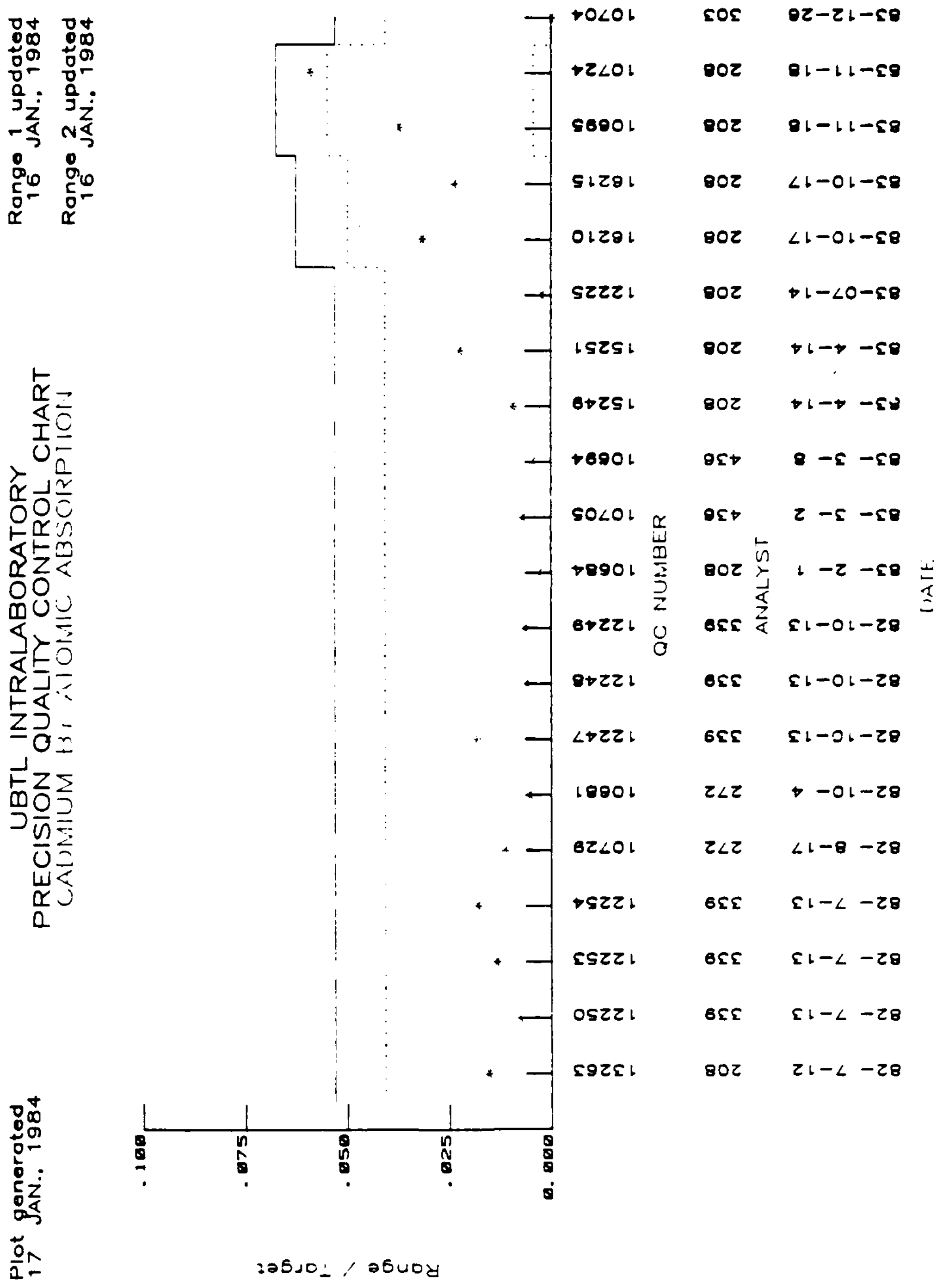


Figure 4. Precision Control Chart

For any single sample, the range of the replicate analytical values is divided by the average of the values, resulting in a measure of the precision of the analysis. This precision value is usually evaluated using precision control limits established previously from the analysis of quality control samples of the same analyte analyzed by the same method. If quality control limits are not available for a particular analyte, an evaluation is made employing control limits established for a similar compound, analyzed by the same method.

10.5 Completeness

The application of QA Project Plans prepared by UBTL is normally limited to the laboratory analysis of environmentally related samples. The Plans normally do not address parameters of field sampling. QA Project Plans address the completeness of sample analysis and data reporting. All samples received by UBTL are accounted for under normal laboratory procedures.

10.6 Representativeness

Representativeness is the degree to which a sample accurately and precisely represents the actual conditions at the sampling location. Field sampling is an extramural activity and normally is not under the auspices of UBTL. To the extent to which UBTL is responsible for field sampling procedures for any specific Project, the QA Project Plan addresses representativeness.

10.7 Comparability

QA Project Plans contain a description of any special procedures required to ensure data comparability. EPA approved methods of analysis and guidelines for data reporting and quality assurance are the primary basis for insuring comparability of measurement data.

11.0 Corrective Action

QA Project Plans provide for establishing and maintaining QA reporting or feedback channels to the appropriate management authority (extramural and intramural) to ensure that early and effective corrective action can be implemented when required. Corrective action is required when the data for a specific sample set or a specific work effort are determined to be unacceptable.

An unacceptable situation is defined as a value outside the established control limits. When UBTL detects an unacceptable situation, analyses are discontinued until the analytical system is demonstrated to be reliable. All data obtained since analysis of the latest acceptable QA samples are considered invalid. Efforts are directed toward the determination of the cause of the problem(s) and corrective actions are implemented to reinstate a reliable analytical system. Once problems are identified and corrected, data considered to be invalid are evaluated. If identified errors can be corrected without the reanalysis of the samples (as, for example, in the case of calculation errors or improper processing of reliable raw analytical data), corrections are effected without additional analytical work. All samples for which reanalysis is the only reasonable corrective measure, are reanalyzed, if sufficient sample is available and if the integrity of the remaining portion of the sample is intact. Resampling and reanalysis are required to correct unacceptable results if the conditions noted in the preceding cannot be satisfied.

The UBTL QAS carefully monitors (on a real-time basis) the results of the control samples analyzed and, in the event that a QA result is unacceptable, implements specific steps to identify and correct the deficiency. A Corrective Action Record (Exhibit 8) is prepared by the QAS and forwarded to the appropriate Section Manager. Action for correcting the problem, pursued jointly by the analyst, the appropriate Group Leader, the appropriate Section Manager, and the Project Manager is recorded on the Corrective Action Record. The steps to be followed are:

Problem Analyte(s)________________________ **UBTL or Agency ID No.**_________

QUALITY ASSURANCE/QUALITY CONTROL
CORRECTIVE ACTION RECORD

Quality Assurance Comments:

QAS: Date:

Management Action:

Signature: Date:

Analyst Response (see back of form):

Analyst: Date:

Quality Assurance Approval:

QAS: Date:

Exhibit 8
Corrective Action Record

1. Check all data processing procedures and calculations.
2. Check blank samples for identification of possible interferences or other problems.
3. Check instrumentation performance (if applicable) by observing the response of the instrument while processing a sample material for which the expected response is known. Operating conditions must be similar to those used for analysis of the samples under consideration.
4. Check the original standard preparation procedures by preparing new standards, obtaining a new standard calibration curve from the new data, and comparing the new standard curve with the original standard calibration curve.
5. Check the integrity of the original QA samples by preparing new QA samples following the same procedures, and analyzing the new QA samples.
6. Carefully review raw data (e.g., recorder output, chromatograms, computer output) in an effort to identify interferences, unusual signals (unusual peak shapes, etc), or other factors which could produce inaccuracies.
7. Reanalyze the samples with new standards and new QA samples if sufficient field sample material is available. The entire analytical process including, for example, extractions, digestions, etc. should be repeated if possible.
8. If QA results are still unacceptable and no reason has been identified after completing Step 7, discuss the problem in detail with personnel from the EPA and determine how results should be reported.

12.0 Implementation Requirements and Schedule

Several milestones and action items are identified and scheduled to implement the UBTL environmental QA program in an efficient, satisfactory manner. These include:

ITEM	STATUS
1. Preparation of the QA Program Plan	completed
2. Designation of QA Officers	completed
3. Preparation of QA Project Plans	ongoing
4. Participation in Annual Performance or System Audits	ongoing

REFERENCES

1. Grant, E.L. and R.S. Leavenworth: Statistical Quality Control 4th Ed., pp. 39-190. McGraw-Hill, New York (1972).

2. Burr, I.W.: Control Charts for Measurements with Varying Sample Sites. J. Qual. Technol. 1:163-167 (1969).

3. Mandel, J. and L.F. Nanni: Measurement Evaluation. In Quality Assurance Practices for Health Laboratories, Inhorn, S.L., ed., pp. 209-272. American Publich Health Association, Washington (1978).

4. Johnson, N.L. and F.C. Leone: Statistics and Experimental Design Vol. II., pp. 1-103. John Wiley and Sons, New York (1964).

5. Pearson, E.S. and H.O Hartley: Biometrika Tables for Statisticians Vol I., p. 164. University Press, Cambridge (1962).

6. Handbook for Analytical Quality Control in Water and Wastewater Laboratories, pp. 6/1 - 6/13. EPA-600/4-79-019, Cincinnati (1979).

APPENDIX D

SOIL SAMPLE HANDLING AND MOISTURE DETERMINATION

Storage

Before analysis, all soil samples will be stored under refrigeration and protected from light.

Unused portions of soil samples will be stored in a freezer.

Safety

At a minimum, gloves, a labcoat and safety glasses will be worn while handling the bulk samples. The working surface will be covered with a plastic-backed absorbent material. Odorous or dusty samples will be handled in a hood. Additional protective equipment will be used as necessary.

Initial Handling

Soil is analyzed "as received" unless otherwise specified.

Containers and implements of glass, aluminum or stainless steel may be used for sample handling.

The soil is mixed well in the container and portions are taken for analysis as follows:

Analyte	Sample Size	Container
Oil & Grease	5-15 g	Scinti-vial
EPA 601	10-25 g	VOA Vial
EPA 602	10-25 g	VOA Vial
Moisture	5-15 g	Tared Container for Analysis
Lead	1-5 g	Acid Rinsed Scinti-vial

Analyte	Sample Size	Container
Phenol	5-10 g	Scinti-vial
Pesticides	50-100 g	Obtain from Ed Sanders

The samples may be placed directly into tared containers for analysis rather than into scinti-vials.

Moisture Determination

The sample for moisture determination is collected in a tared container and weighed. It is then dried to constant weight (±0.005 g) at 110°C ± 5°. Wet and dry weights are recorded and the percent moisture is calculated.

UBTL ANALYTICAL REPORT
Stewart ANGB - Soil Analysis

arameter	Method	Units	Detection Limit	SW-1	SW-2	SW-2-2	SW-3
oisture	160.3 (2)	%	0.1	6.	5.	14.	
ldrin	3550 (3)	µg/g	0.001	*	*	*	*
hlordane	3550 (3)	µg/g	0.01	*	*	*	*
ieldrin	3550 (3)	µg/g	0.001	*	*	*	*
ndrin	3550 (3)	µg/g	0 001	*	*	*	*
eptachlor	3550 (3)	µg/g	0.001	*	*	*	*
eptachlor Epoxide	3550 (3)	µg/g	0.001	*	*	*	*
indane	3550 (3)	µg/g	0.001	*	*	*	*
ethoxychlor	3550 (3)	µg/g	0.01	*	*	*	*
alathion	3550 (3)	µg/g	0.01	*	0.01	*	*
arathion	3550 (3)	µg/g	0.01	*	0.08	*	*
iazinon	3550 (3)	µg/g	0.01	*	*	*	*
,P'-DDT	3550 (3)	µg/g	0.001	0.001	1.5	8.2	*
,P'-DDT	3550 (3)	µg/g	0.005	*	0.42	1.9	*
DD	3550 (3)	µg/g	0.001	*	0.47	2.5	*
DE	3550 (3)	µg/g	0.001	*	0.026	0.058	*
,4-D	8150 (3)	µg/g	0.005	*	0.067	0.35	0.022
,4,5-T	8150 (3)	µg/g	0.005	*	0.006	0.040	*
,4,5-TP (Silvex)	8150 (3)	µg/g	0.005	*	*	*	*

ee soil Q.C. report for footnotes.

UBTL QUALITY CONTROL REPORT
Stewart ANGB - Soil Analysis

Parameter	Method	Units	Detection Limit	Spiked Sample	Initial Value	Spike Conc.	Percent Recovered	Split Sample	First Value	Second Value	Method Blank
oisture	160.3 (2)	%	0.1					SW-1	6.	6.	
ieldrin	3550 (3)	µg/g	0.001	SW-2-2	*	0.05	96.				*
ndrin	3550 (3)	µg/g	0.001	SW-2-2	*	0.05	98.				*
eptachlor	3550 (3)	µg/g	0.001	SW-2-2	*	0.05	94.				*
eptachlor Epoxide	3550 (3)	µg/g	0.001	SW-2-2	*	0.05	104.				*
indane	3550 (3)	µg/g	0.001	SW-2-2	*	0.05	90.	SW-2-1	*	*	*
alathion	3550 (3)	µg/g	0.01					SW-2-1	0.01	0.009	*
arathion	3550 (3)	µg/g	0.01					SW-2-1	0.08	0.08	*
,P'-DDT	3550 (3)	µg/g	0.001					SW-2-1	1.5	1.5	*
,P'-DDT	3550 (3)	µg/g	0.005					SW-2-1	0.42	0.42	*
DD	3550 (3)	µg/g	0.001					SW-2-1	0.47	0.46	*
DE	3550 (3)	µg/g	0.001					SW-2-1	0.025	0.026	*
,4-D	8150 (3)	µg/g	0.005	SW-2-2	0.35	0.50	46.	SW-2-1	0.067	0.067	*
,4,5-T	8150 (3)	µg/g	0.005	SW-2-2	0.040	0.50	100.				*
,4,5-TP(Silvex)	8150 (3)	µg/g	0.005	SW-2-2	*	0.50	89.				*

ee next page for footnotes.

UBTL QUALITY CONTROL REPORT
Stewart ANGB - Soil Analysis

(1) Results not corrected for Percent Moisture.

(2) Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020, revised in March 1983, modified for use with soil.

(3) Test Methods for Evaluating Solid Waste, EPA/SW-846, 1982.

* Denotes value less than the limit of detection.

Reviewed and approved by:

A Brent Torgensen

A. Brent Torgensen

UBTL ANALYTICAL REPORT

Stewart ANGB - Water Analysis

Parameter	Method	Units	Detection Limit	SW-1	SW-2	SW-3
Aldrin	509A (1)	µg/L	0.01	*	*	*
Dieldrin	509A (1)	µg/L	0.01	0.04	*	*
Chlordane	509A (1)	µg/L	0.2	*	*	*
Endrin	509A (1)	µg/L	0.01	*	*	*
Heptachlor	509A (1)	µg/L	0.01	*	*	*
Heptachlor Epoxide	509A (1)	µg/L	0.01	*	*	*
Lindane	509A (1)	µg/L	0.01	*	0.03	*
Methoxychlor	509A (1)	µg/L	0.1	*	*	*
Malathion	509A (1)	µg/L	0.1	*	*	*
Parathion	509A (1)	µg/L	0.1	*	*	*
Diazinon	509A (1)	µg/L	0.1	*	*	*
P,P'-DDT	509A (1)	µg/L	0.02	*	15.	*
O,P'-DDT	509A (1)	µg/L	0.02	*	4.4	*
DDD	509A (1)	µg/L	0.02	*	8.5	*
DDE	509A (1)	µg/L	0.02	*	0.15	*
2,4-D	509B (1)	µg/L	0.1	*	20.	0.1
2,4,5-T	509B (1)	µg/L	0.05	*	0.45	*
2,4,5-TP (Silvex)	509B (1)	µg/L	0.05	*	*	*

See water QC report for footnotes.

UBTL QUALITY CONTROL REPORT

Stewart ANGB - Water Analysis

Parameter	Method	Units	Detection Limit	Spiked Sample	Initial Value	Spike Conc.	Percent Recovered	Split Sample	First Value	Second Value	Method Blank
Chlordane	509A (1)	µg/L	0.2					SW-2	*	*	*
Dieldrin	509A (1)	µg/L	0.01	SW-2	*	0.50	84.				*
Endrin	509A (1)	µg/L	0.01	SW-2	*	0.50	100.				*
Heptachlor	509A (1)	µg/L	0.01	SW-2	*	0.50	90.				*
Heptachlor Epoxide	509A (1)	µg/L	0.01	SW-2	*	0.50	98.				*
Lindane	509A (1)	µg/L	0.01	SW-2	0.03	0.50	125.	SW-2	0.02	0.03	*
DDE	509A (1)	µg/L	0.02					SW-2	0.03	0.27	*
DDD	509A (1)	µg/L	0.02					SW-2	5.0	12.	*
O,P'-DDT	509A (1)	µg/L	0.02					SW-2	1.1	7.6	*
P,P'-DDT	509A (1)	µg/L	0.02					SW-2	3.4	27.	*
2,4-D	509B (1)	µg/L	0.1					SW-2	20.	20.	*
2,4,5-T	509B (1)	µg/L	0.05	SW-2	0.45	5.0	72.	SW-2	0.47	0.43	*
2,4,5-TP (Silvex)	509B (1)	µg/L	0.05	SW-2	*	5.0	74.	SW-2	*	*	*

(1) Standard Methods for the Examination of Water and Wastewater, 16th ed. 1985.

* Denotes value less than the limit of detection.

Reviewed and approved by:

A. Brent Torgensen

A. Brent Torgensen

APPENDIX E

FIELD SOIL SAMPLING RECORD

JOB# 11016-213-19 JOB ~~NUMBER~~ Stewart ANGB DATE 9/12/85

SAMPLING POINT SW-1

SAMPLERS: D B Chason OF Dames & Moore

OF

SAMPLING: TIME 4 ___ a.m. X p.m.

SAMPLER TYPE Split-spoon

SAMPLE DEPTH 30-32'

DESCRIPTION OF SAMPLING POINT: borehole

SAMPLE DESCRIPTION:

TEXTURE Silt and f-c gravel, little sand, little to trace fine sand.

COLOR Gray.

ODOR no organics

OTHER

ANALYZE FOR: pesticides herbicides

REFRIGERATED: DATE: 9/19/85 TIME 9 a.m. ___ p.m.

FIELD TESTS:

TEMPERATURE (C°/F°) ______ WEATHER Sunny 70°F

pH ______

OTHER (SPECIFY BELOW)

COMMENTS:

FIELD SOIL SAMPLING RECORD

JOB Stewart ANGB JOB NUMBER 01016-213 19 DATE 9/19/85

SAMPLING POINT SW-2-1

SAMPLERS: D.B. Chason OF Dames & Moore

OF

SAMPLING: TIME 9 [✓ a.m.] p.m.

SAMPLER TYPE 2" split-spoon

SAMPLE DEPTH 74.5 - 76 ft

DESCRIPTION OF SAMPLING POINT: Borehole

SAMPLE DESCRIPTION:

TEXTURE Silt, little f-m sand, little f-c gravel, dense

COLOR Gray

ODOR organic

OTHER HNU 10 ppm at 9.8 span

ANALYZE FOR: herbicides + pesticides

REFRIGERATED: DATE: 9/19/85 TIME 9 a.m. p.m.

FIELD TESTS:

TEMPERATURE (C°/F°) WEATHER Sunny 70°F

pH

OTHER (SPECIFY BELOW)

COMMENTS:

FIELD SOIL SAMPLING RECORD

JOB Stewart ANGB JOB NUMBER 01016-213-19 DATE 9/19/85

SAMPLING POINT SW-2-2

SAMPLERS: D.B. Olson OF Dames Moore

_______________ OF _______________

SAMPLING: TIME 10:45 X a.m. ___ p.m.

SAMPLER TYPE 2" split-spoon

SAMPLE DEPTH 35 ft

DESCRIPTION OF SAMPLING POINT: borehole

SAMPLE DESCRIPTION:

TEXTURE Shale cuttings and silt

COLOR brown-gray

ODOR Organic

OTHER HNU 12 ppm at 9.8 span

ANALYZE FOR: herbicide + pesticides

REFRIGERATED: DATE: 9/19/85 TIME 10:45 a.m. ___ p.m.

FIELD TESTS:

TEMPERATURE (C°/F°) ___________ WEATHER Sunny 70°F

pH ___________

OTHER (SPECIFY BELOW)

___________ ___________

COMMENTS: ___________

FIELD SOIL SAMPLING RECORD

JOB# 01611-213-19 JOB ~~NUMBER~~ Stewart ANGB DATE 9/25/85

SAMPLING POINT Sw-3

SAMPLERS: D.B. Chaison OF Dames & Moore

OF

SAMPLING: TIME 8:30 X a.m. / p.m.

SAMPLER TYPE 3" Split-Spoon

SAMPLE DEPTH 25-26.5

DESCRIPTION OF SAMPLING POINT: borehole

SAMPLE DESCRIPTION:

TEXTURE silt, some f-m gravel, little sand

COLOR GRAY

ODOR NONE

OTHER

ANALYZE FOR: pesticides + herbicides

REFRIGERATED: DATE: 9/25/85 TIME 8:30 a.m. / p.m.

FIELD TESTS:

TEMPERATURE (C°/F°) WEATHER

pH

OTHER (SPECIFY BELOW)

COMMENTS:

FIELD SOIL SAMPLING RECORD

JOB Stewart ANGB JOB NUMBER C1016-213-19 DATE 9/19/85

SAMPLING POINT BQC-1

SAMPLERS: D.B. Gibson OF Dames Moore

OF

SAMPLING: TIME 9 x a.m. p.m.

SAMPLER TYPE 2" Split spoon

SAMPLE DEPTH 24.5 - 26 ft

DESCRIPTION OF SAMPLING POINT: borehole

SAMPLE DESCRIPTION:

TEXTURE Silt, little f-m sand, little f-c gravel, clinker

COLOR Gray

ODOR Organic

OTHER HNU 10 ppm at [illegible] spoon

ANALYZE FOR:

REFRIGERATED: DATE: 9/19/85 TIME 9 a.m. p.m.

FIELD TESTS:

TEMPERATURE (C°/F°) WEATHER Sunny 70°

pH

OTHER (SPECIFY BELOW)

COMMENTS: Quality control sample split from SB-2-1

FIELD SAMPLING RECORD

JOB Stewart ANGB JOB NO. C1C16-213.19 DATE 9/30/85

WELL Sw-1

SAMPLERS: DB CHASON OF DEM

OF

INITIAL STATIC WATER LEVEL. . . . . 32'10"
(from top of well ~~casing~~)

PUMPING:

USING: SUBMERSIBLE ___ CENTRIFUGAL ___

NITROGEN ___ POSITIVE DISPLACEMENT ___

BAILED X 5 gallons ~~times~~

DEPTH TO INTAKE FROM TOP OF WELL CASING ________

PUMPED ________ MINUTES AT ________ GPM (> 2 EXCHANGES)

SAMPLING:

TIME 3:30 ___ a.m. X p.m.

BAILER TYPE: KEMMERER

STAINLESS STEEL BUCKET BAILER X

FROM POS. DIS. PUMP DISCHARGE TUBE ___

OTHER ________ ___

TRIP BLANK I.D. 1

NO. CONTAINERS FILLED (PRIMARY LAB) . . . . 2 *

NO. CONTAINERS FILLED (REPLICATE SAMPLES) . . . . ________

PHYSICAL APPEARANCE AND ODOR silty, odorless

REFRIGERATED: DATE 9/30/85 TIME 3:30 PM

FIELD TESTS:	BEFORE PUMPING ___	AFTER PUMPING X
TEMPERATURE (C°/°F)	15°C	
pH	7.4	
SPEC. CONDUC (umhos/cm)	900 umhos/cm.	
DISSOLVED OXYGEN (mg/l)	~ 1	

WEATHER Sunny 70°F

COMMENTS HNU 0 ppm

* SW-1-H Sample to be analyzed for herbicides

SW-1-P " " " for pesticides

FIELD SAMPLING RECORD

JOB Stewart ANGB **JOB NO.** C1C16-213 **DATE** 10/1/85
WELL SW-2

SAMPLERS: D.B. CHASEN **OF** DEM
OF

INITIAL STATIC WATER LEVEL. . . . . 26' 8"
(from top of well ~~casing~~)

PUMPING:
USING: SUBMERSIBLE ___ CENTRIFUGAL ___
NITROGEN ___ POSITIVE DISPLACEMENT ___
BAILED X 6.3 gals ~~times~~

DEPTH TO INTAKE FROM TOP OF WELL CASING ___
PUMPED ___ MINUTES AT ___ GPM (> 2 EXCHANGES)

SAMPLING:
TIME 10:00 X a.m. ___ p.m.

BAILER TYPE: KEMMERER ___
STAINLESS STEEL BUCKET BAILER X
FROM POS. DIS. PUMP DISCHARGE TUBE ___
OTHER ___ ___

TRIP BLANK I.D. . . . .
NO. CONTAINERS FILLED (PRIMARY LAB) . . . . 2 *
NO. CONTAINERS FILLED (REPLICATE SAMPLES) . . . .

PHYSICAL APPEARANCE AND ODOR silty, organic odor

REFRIGERATED: DATE 10/1/85 TIME 10:00 AM

FIELD TESTS: BEFORE PUMPING ___ AFTER PUMPING X

TEMPERATURE (C°/°F)	14°C	
pH	8-9	
SPEC. CONDUC (umhos/cm)	1,310 umhos/cm	
DISSOLVED OXYGEN (mg/l)	2-1	

WEATHER Cloudy, 60°F

COMMENTS HNU E ppm

* SW-2-H Sample to be analyzed for Herbicides
SW-2-P " " " Pesticides

FIELD SAMPLING RECORD

JOB Stewart ANGB **JOB NO.** 01016-213-19 **DATE** 9/30/85
WELL SW-3

SAMPLERS: D.B. CHASON **OF** DEM
OF

INITIAL STATIC WATER LEVEL. . . . . 25' 5'
(from top of well ~~casing~~)

PUMPING:
USING: SUBMERSIBLE ___ CENTRIFUGAL ___
NITROGEN ___ POSITIVE DISPLACEMENT ___
BAILED X 7 gallons ~~times~~

DEPTH TO INTAKE FROM TOP OF WELL CASING ___
PUMPED ___ MINUTES AT ___ GPM (> 2 EXCHANGES)

SAMPLING:
TIME ~~[illegible]~~ 5:30 ☐ a.m. ☒ p.m.

BAILER TYPE: KEMMERER ___
STAINLESS STEEL BUCKET BAILER X
FROM POS. DIS. PUMP DISCHARGE TUBE ___
OTHER ___

TRIP BLANK I.D. . . . . ~~[illegible]~~
NO. CONTAINERS FILLED (PRIMARY LAB) . . . . 2 *
NO. CONTAINERS FILLED (REPLICATE SAMPLES) . . . . ___

PHYSICAL APPEARANCE AND ODOR silty, no odor

REFRIGERATED: DATE 9/30/85 TIME 5 30 PM

FIELD TESTS: BEFORE PUMPING ___ AFTER PUMPING ✓

TEMPERATURE (C°/°F)	15° C	
pH	7-8	
SPEC. CONDUC (umhos/cm)	860 umhos/cm	
DISSOLVED OXYGEN (mg/l)	1	

WEATHER Sunny 76°F

COMMENTS HNU 0 ppm

* SW-3-H sample for herbicide analyses
SW-3-D " " pesticide analyses

FIELD SAMPLING RECORD

JOB Stewart ANGB JOB NO. 01016-213-19 DATE 10/1/85
WELL GC-1

SAMPLERS: D. B. Clkson OF Dames & Moore
OF

INITIAL STATIC WATER LEVEL. . . . . —
(from top of well casing)

PUMPING:
USING: SUBMERSIBLE ___ CENTRIFUGAL ___
NITROGEN ___ POSITIVE DISPLACEMENT ___
BAILED ___ ___ times

DEPTH TO INTAKE FROM TOP OF WELL CASING ___
PUMPED ___ MINUTES AT ___ GPM (> 2 EXCHANGES)

SAMPLING:
TIME 10:00 X a.m. ___ p.m.

BAILER TYPE: KEMMERER ___
STAINLESS STEEL BUCKET BAILER X
FROM POS. DIS. PUMP DISCHARGE TUBE ___
OTHER ___

TRIP BLANK I.D. . . . . ___
NO. CONTAINERS FILLED (PRIMARY LAB) . . . . 2 *
NO. CONTAINERS FILLED (REPLICATE SAMPLES) . . . . ___

PHYSICAL APPEARANCE AND ODOR ___

REFRIGERATED: DATE 10/1/85 TIME 10:00 AM

FIELD TESTS: BEFORE PUMPING ___ AFTER PUMPING ___

TEMPERATURE (C°/°F) ___ ___
pH ___ ___
SPEC. CONDUC (umhos/cm) ___ ___
DISSOLVED OXYGEN (mg/l) ___ ___

WEATHER ___

COMMENTS Quality Control sample from [redacted] SW-2
* GC-1-P Sample to be analyzed for Pesticides
GC-1-H " " " " Herbicides

FIELD SAMPLING RECORD

JOB Stewart ANGB JOB NO. 01016-213 DATE 9/30/85

~~WELL~~ WB-1

SAMPLERS: D.B. CHASON OF D&M

OF ___

INITIAL STATIC WATER LEVEL. . . . . —
(from top of well casing)

PUMPING:

USING: SUBMERSIBLE ___ CENTRIFUGAL ___
NITROGEN ___ POSITIVE DISPLACEMENT ___
BAILED ___ ___ times

DEPTH TO INTAKE FROM TOP OF WELL CASING ___
PUMPED ___ MINUTES AT ___ GPM (> 2 EXCHANGES)

SAMPLING:

TIME 4:30 ___ a.m. X p.m.

BAILER TYPE: KEMMERER ___
STAINLESS STEEL BUCKET BAILER X
FROM POS. DIS. PUMP DISCHARGE TUBE ___
OTHER ___ ___

TRIP BLANK I.D. . . . . ~~[illegible]~~
NO. CONTAINERS FILLED (PRIMARY LAB) . . . . 2 *
NO. CONTAINERS FILLED (REPLICATE SAMPLES) . . . . ___

PHYSICAL APPEARANCE AND ODOR clear, odorless

REFRIGERATED: DATE 9/30/85 TIME 4:30 pm

FIELD TESTS: BEFORE PUMPING ___ AFTER PUMPING ___

	BEFORE PUMPING	AFTER PUMPING
TEMPERATURE (C°/°F)		
pH		
SPEC. CONDUC (umhos/cm)	/	
DISSOLVED OXYGEN (mg/l)	/	

WEATHER ___

COMMENTS Wash blank - sample of Great Bear distilled/deionized water taken from bailer after washing with hexane, methanol & distilled water (Great Bear) between sampling wells SW-1 and SW-3

* WB-1-H sample to be analyzed for metals
WB-1-P " " " particulates

CHAIN OF CUSTODY RECORD

PROJ. NO. 1016-213	**PROJECT NAME** Stewart ANGB
SAMPLERS: *(Signature)*	

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CON-TAINERS	Mason jar glass	1 l. glass jar						REMARKS
W-3	9/25/85	8:30A		X	Newburgh NY	1	1							Soil
W-1	1/30/85	3:30P		X	" "	2		2						groundwater
2	10/1/85	10:00A		X	" "	2		2						groundwater
3	10/1/85	5:30P		X	" "	2		2						groundwater
1	10/1/85	10:00A		X	" "	2		2						groundwater
WB-1	10/3/85	4:30P		X	" "	2		2						groundwater

Relinquished by: *(Signature)*	**Date / Time** 10/4/85 4:30P	**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

CHAIN OF CUSTODY RECORD

PROJ. NO. 01016-213

PROJECT NAME Stewart ANGB

SAMPLERS: *(Signature)* David B. Clason

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	1 pint glass mason jars						REMARKS
SW-1	9/12/85	4 PM		X	Newburgh, N.Y.	1							not refrigerated til 9/19/85 9 AM
SW-2-1	9/19/85	9 AM		X	" "	1							HNU 10 ppm in field
SW-2-2	9/19/85	10:45 AM		X	" "	1							HNU 12 ppm in field
QC-1	9/19/85	4 AM		X	" "	1							HNU 10 ppm in field

DO NOT ANALYZE IF THIS IS TOO LONG A PERIOD OF TIME

Relinquished by: *(Signature)* David B Clason of DEM	**Date / Time** 9/19/85 4PM	**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

CHAIN OF CUSTODY RECORD

PROJ. NO. CICIL-213

PROJECT NAME Stewart ANGB

SAMPLERS: *(Signature)*

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CON-TAINERS							REMARKS
						11							EMPTY

Relinquished by: *(Signature)*	**Date / Time** 10/1/85 4:30P	**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

APPENDIX F

DRAFT
LETTER REPORT
RECOMMENDATIONS FOR INTERIM REMEDIAL ACTION AND SUPPLEMENTAL FIELD INVESTIGATION
STEWART ANGB
NEWBURGH, NEW YORK

01016-23-019
NOVEMBER 1985

November 15, 1985

U.S. Air Force OEHL/TS
Building 754 (Trailers)
Brooks Air Force Base, TX 78235

Attention: 1st Lt. Maria LaMagna

Draft
Letter Report
Recommendations for Interim Remedial Action & Supplemental Field Investigation
Stewart Air National Guard Base
Newburgh, New York
01016-213-L010

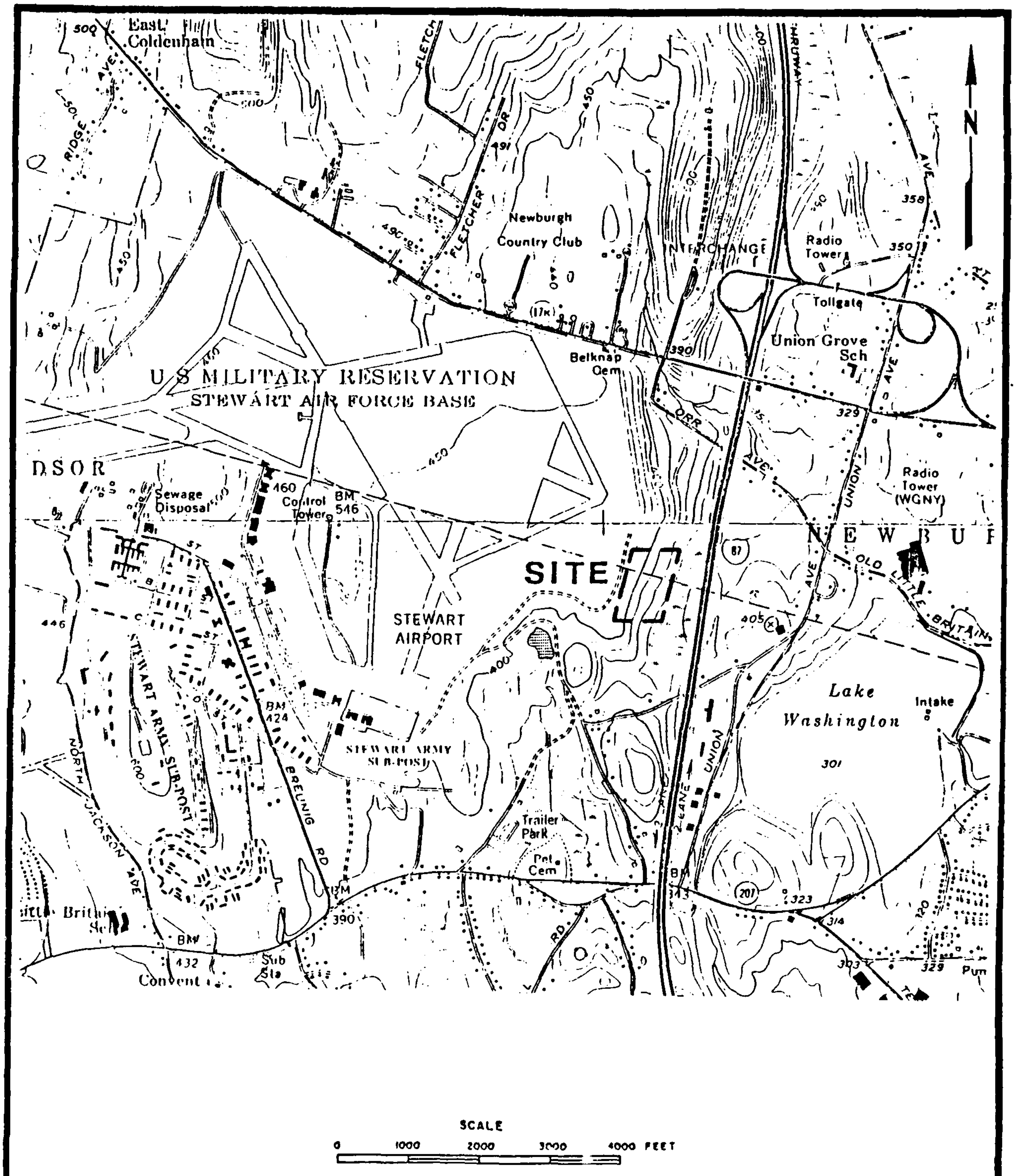
Gentlemen:

The following letter report is submitted to present our recommendations for interim remedial action and supplemental field investigation regarding pesticide contamination at the Stewart Air National Guard Base in Newburgh, New York.

Background

On September 22, 1983, Dames & Moore was retained by the United States Air Force (USAF) under Contract No. F33615-83-D-4002 to provide environmental consulting services at the Stewart ANGB (Figure 1).

Under Work Order No. 0006 a presurvey of the site was undertaken for the purposes of developing a scope of work and cost estimate for confirmation and quantification of contamination due to two



SITE LOCATION MAP

REFERENCE: U.S.G.S. 7.5' Topographic Map
Cornwall, NY (1981) and Newburgh, NY
(1957) Quadrangles

DAMES & MOORE

FIGURE 1

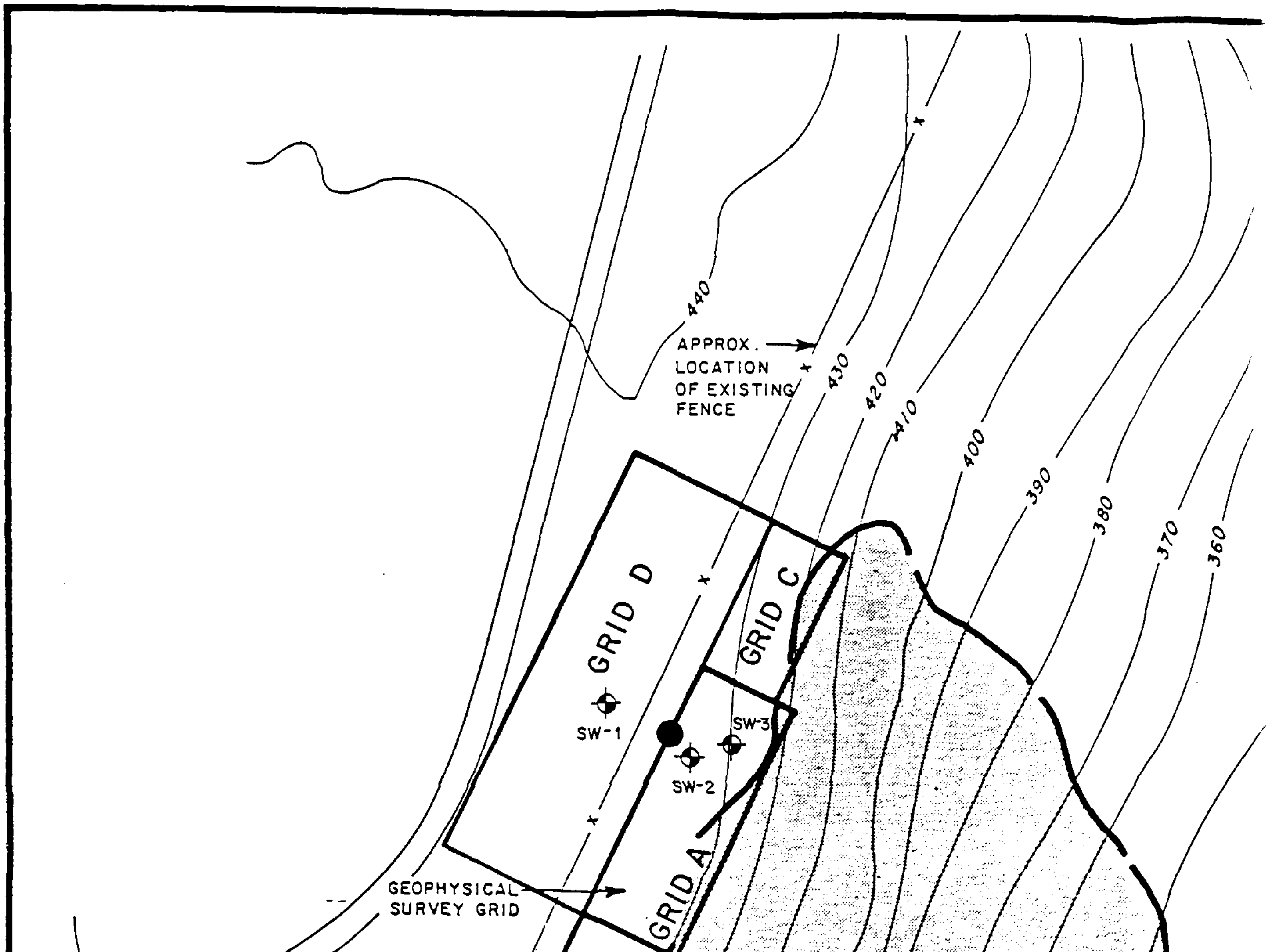
waste management facilitites; a domestic landfill and an alleged waste burial trench. One of the tasks of the presurvey was a visit/briefing of the site on September 23, 1983. During the site inspection Dames & Moore examined maps and aerial photographs of the site, as well as the reports of an earlier site investigation performed by the New York State Department of Environmental Conservation (NYSDEC), and conducted a field inspection of the landfill site and the approximate area where pesticides were allegedly buried in a trench in the late 1960's. The results of the presurvey were submitted to the USAF in a report dated October 4, 1983.

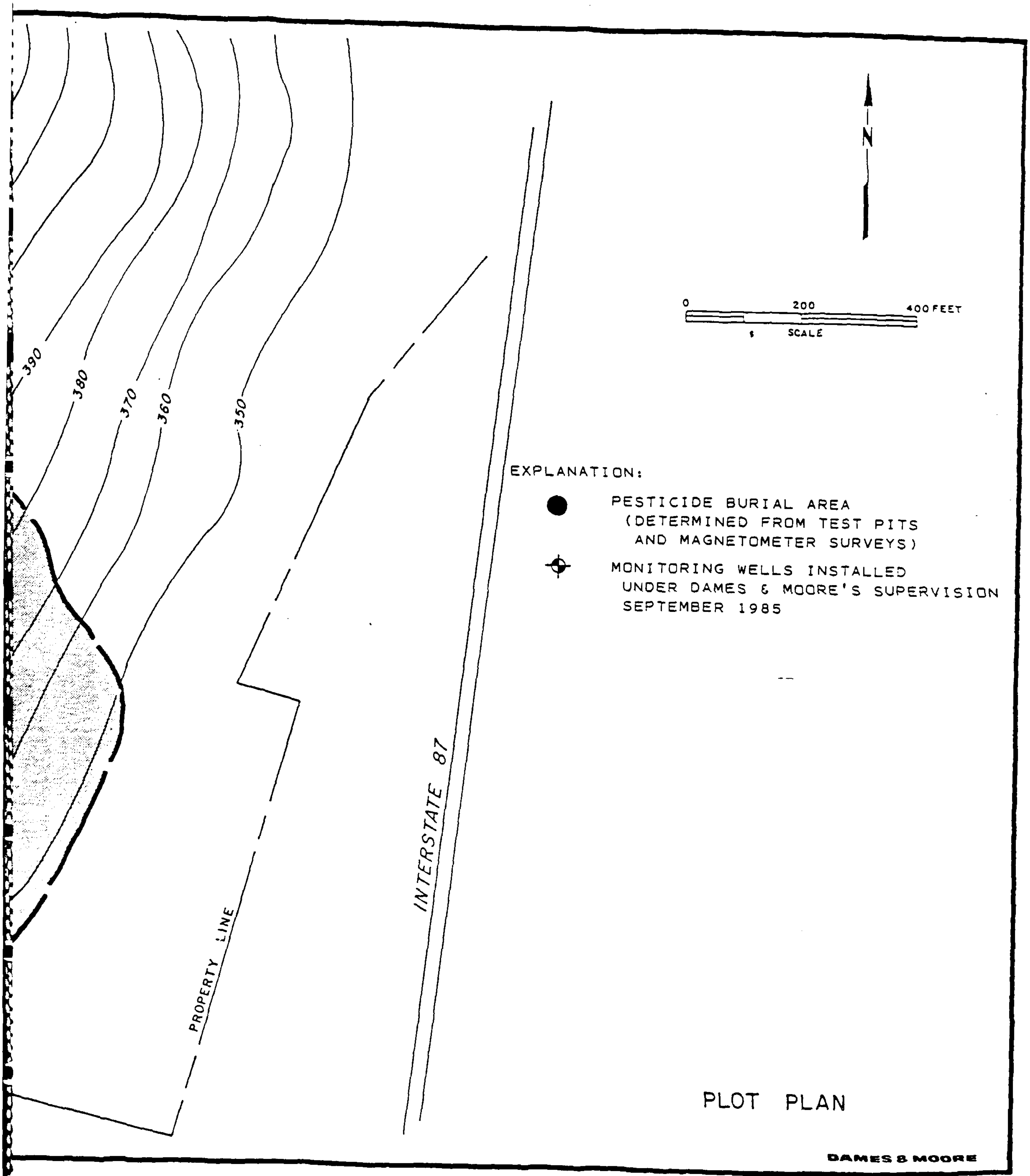
Under Work Order No. 0008, geophysical surveys using a metal detector and magnetometer were undertaken on March 13 through March 15, 1984, to locate the pesticide burial trench. A large anomaly in the target area was identified that corresponded to a depression visible in aerial photographs, along with several smaller anomalies. The results of this geophysical survey were presented to the USAF in a report dated July 24, 1984. A series of test pit excavations were performed on September 21 through September 24, 1984, under Work Order No. 0022. The large anomaly was discovered to contain domestic refuse with no evidence of containers. One test pit, located at the western edge of the area surveyed, revealed buried containers, some of which were labeled "Caution-Acid". Analyses of samples from that test pit indicated the presence of high concentrations of DDT in an apparent oil carrier. Because the burial zone appeared to be largely outside the original survey area, Work Order No. 0008 was reopened to facilitate additional geophysical surveys over an expanded area.

A second series of metal detector and magnetometer surveys were undertaken on November 8 through November 10, 1984, to investigate adjacent areas north and west of the original survey areas. As part of the scope of the modified Work Order No. 0008, additional test pits were excavated on April 29 through May 1, 1985, on the north, south and west margins of the newly defined target area. These test pits confirmed the presence of buried containers of DDT in an oil carrier, as well as small concentrations of sulfuric acid. The burial area, approximately 15 x 25 feet in size as defined by four test pits, was staked for future reference. On August 29, 1985, Dames & Moore submitted a report to the USAF summarizing the results of the geophysical survey and test pit investigation undertaken under Work Order No. 0008. On September 12 through September 26, 1985, under Work Order No. 0022, Dames & Moore installed three groundwater monitoring wells to evaluate groundwater movement and to collect groundwater samples for chemical analyses. Upon receipt of the chemical analyses from the laboratory, Dames & Moore will submit a report to the USAF which will include an assessment of site stratigraphy, groundwater gradient and the extent of existing contamination on-site. It was the intent of this report also to include an evaluation of remedial alternatives to clean up existing surface and groundwater contamination. However, because additional groundwater and soil contamination is suspected in the downgradient wells (Figure 2) it is our opinion that additional test borings and chemical analyses are necessary to more completely define site contamination. Final remedial alternatives regarding soil and groundwater clean-up for the entire site can be evaluated only after additional studies. Sufficient data is available to identify interim remedial action regarding surface soil clean-up.

Basis for Interim Remedial Action

During the test pit investigations of September 21 through September 24, 1984 and April 29 through May 1, 1985 numerous 5-gallon metal containers containing pesticides were unearthed. The containers were for the most part crushed and leaking into the surrounding soils. In one instance, a leaking container actually created a small pool of waste fluid in the excavated pit. Also encountered during the test pit investigation were 1-gallon plastic containers containing sulfuric acid solution. Chemical analyses of the soils saturated with the waste indicated high concentrations of DDT, DDD and DDE. Four test pits have defined the horizontal and vertical distribution of the buried


440
APPROX. LOCATION OF EXISTING FENCE
430
420
410
400
390
380
370
360
GRID D
GRID C
GRID A
GRID B
SW-1
SW-2
SW-3
GEOPHYSICAL SURVEY GRID
ANGB LANDFILL



PLOT PLAN

DAMES & MOORE

FIGURE 2

2

containers. It is estimated that approximately 40, 5-gallon pails of pesticides (200 gallons) and an estimated 10 gallons of sulfuric acid solution were buried in the area delineated as the disposal area in Figure 2.

Additional evidence of pesticide contamination was provided during the well installation program in September, 1985. During the drilling of monitoring well SW-2, located approximately 30 feet to the east of the disposal area (Figure 2), high concentrations of organic vapors were detected with a photoionization detector (PID), both in the cuttings around the borehole and in individual split-spoon soil samples from depth of 15-25 feet. These detectable readings are assumed to be indicative of the organic solvent carrier for the pesticides. After the installation of well SW-2 into a weathered bedrock zone at depth of 40-50 feet, organic vapors were detected within the well casing, suggesting that groundwater in the bedrock also may be contaminated. No organic vapors were detected during the drilling and installation of monitoring wells SW-1 and SW-3 (Figure 2).

Basis for Further Field Investigation

The hydrologic and geologic data obtained during the recent field investigation suggest that there are three possible modes of groundwater transport on-site:

1) Perched water moving horizontally along the top of bedrock, primarily through a weathered rock zone at depths of 40-50 feet.
2) Unsaturated and saturated vertical and horizontal flow through pores in the sandy zones of a predominantly silty glacial till overlying the bedrock.
3) Vertical and horizontal movement along dessication fractures in the till unit.

However, the magnitude and direction of the hydraulic gradient on-site appears to be complex and estimates of the the hydraulic gradient based upon observations of the static water levels (head) in wells SW-1, SW-2 and SW-3 alone are inconclusive. SW-1, which is topographically upgradient of SW-2 and SW-3 exhibits a head of approximately four feet lower than SW-2 and SW-3, suggesting that groundwater flow is toward the west; nearly opposite of the topographic gradient. On the other hand, the static water level in SW-2 is slightly greater than in SW-3, indicative of a hydraulic gradient toward the east in conformance with the topographic gradient. Additional test borings are necessary to more accurately identify the direction of groundwater flow. These test borings would also provide the opportunity to collect additional soil samples for chemical analyses, allowing for further definition of on-site contamination.

Recommendations

Evidence indicates that soils are contaminated at a distance of at least 30 feet from the known disposal area. However, with the limited number of soil and groundwater samples taken to date, the limits of the plume have not been accurately delineated. Dames & Moore recommends that additional site sampling is necessary to define the extent of contamination, particularly to the east of well SW-2. We also recommend that the active point source be removed immediately.

The technical approach for removal of the source and additional field exploration follow:

Removal of the Active Source

Dames & Moore recommends the removal and safe disposal of an estimated 40, 5-gallon pails of pesticides an estimated 10 gallons of sulfuric acid solution and associated contaminated soils from the area delineated as the disposal area in Figure 2. Dames & Moore will subcontract this work to a qualified waste disposal firm. Based on recent telephone conversations with a number of waste management firms, we have selected five firms to send a formal RFP to regarding the waste removal at Stewart ANGB.

These are:

Chemical Waste Management, Inc. (SCA)
150 West 137th Street
Riverdale, Illinois
Contact: Lee Lawrence
(312) 841-8600

CECOS Environmental
40 Brunswick Avenue
Edison, New Jersey 08818
Contact: Jim Pietracatella
(201) 248-0600

Rollins, Inc.
Bridgeport, New Jersey
Contact: Todd Raba
(609) 467-3105

Round Lake Sanitation Corp.
Box 211
Monroe, New York 10950
Contact: Roger Shadow
(914) 783-1444

O.H. Materials
P. O. Box 551
Findlay, Ohio 45839-0051
Contact: Paul Schaltry
(419) 423-3526

In the RFP, Dames & Moore will request that the following services be accomplished:

1) Remove pails of pesticides existing below the surface on-site and place into suitable disposal packs (overpacks).
2) Remove all containers of acid from below the surface and place into suitable disposal packs separate from the pesticides.
3) Pump all pools of waste fluid created during the excavation into suitable disposal packs.
4) Remove all soils that appear to be highly contaminated on the basis of visual observation and/or photoionization detector readings, and place into suitable containers.
5) Properly transport and dispose of all hazardous waste

removed from the excavation.

6) Perform soil sampling and confirmation testing to assure that all highly contaminated soils have been removed. The excavation shall be temporarily secured until confirmation testing is complete.
7) Regrade the site with clean fill following removal to minimize erosion and runoff.

Dames & Moore will supervise the removal activities, provide accurate documentation of what was performed, and provide an on-site inspector to authorize any adjustments in the program as may be dictated by site conditions.

Before work begins the subcontractor will be required to submit a detailed Work Plan and Health and Safety Plan to Dames & Moore. Dames & Moore will review and comment on these plans before submitting them to the ANG for approval.

A site specific contingency plan for the Stewart ANGB site will be developed jointly with the subcontractor, Dames & Moore, the ANG, the AF and the NYSDEC. This plan will identify potential problem areas that may be encountered during the course of the waste removal. These areas may include:

1) Provisions for off-site and on-site evacuation.

2) Methodology for handling

   a) toxic gas release
   b) fire
   c) explosives
   d) leaking containers
   e) large volumes of acutely dangerous substances
   f) medical emergencies
   g) transportation incidences
   h) spilled substances

3) Transportation routes

4) Other problems such as:

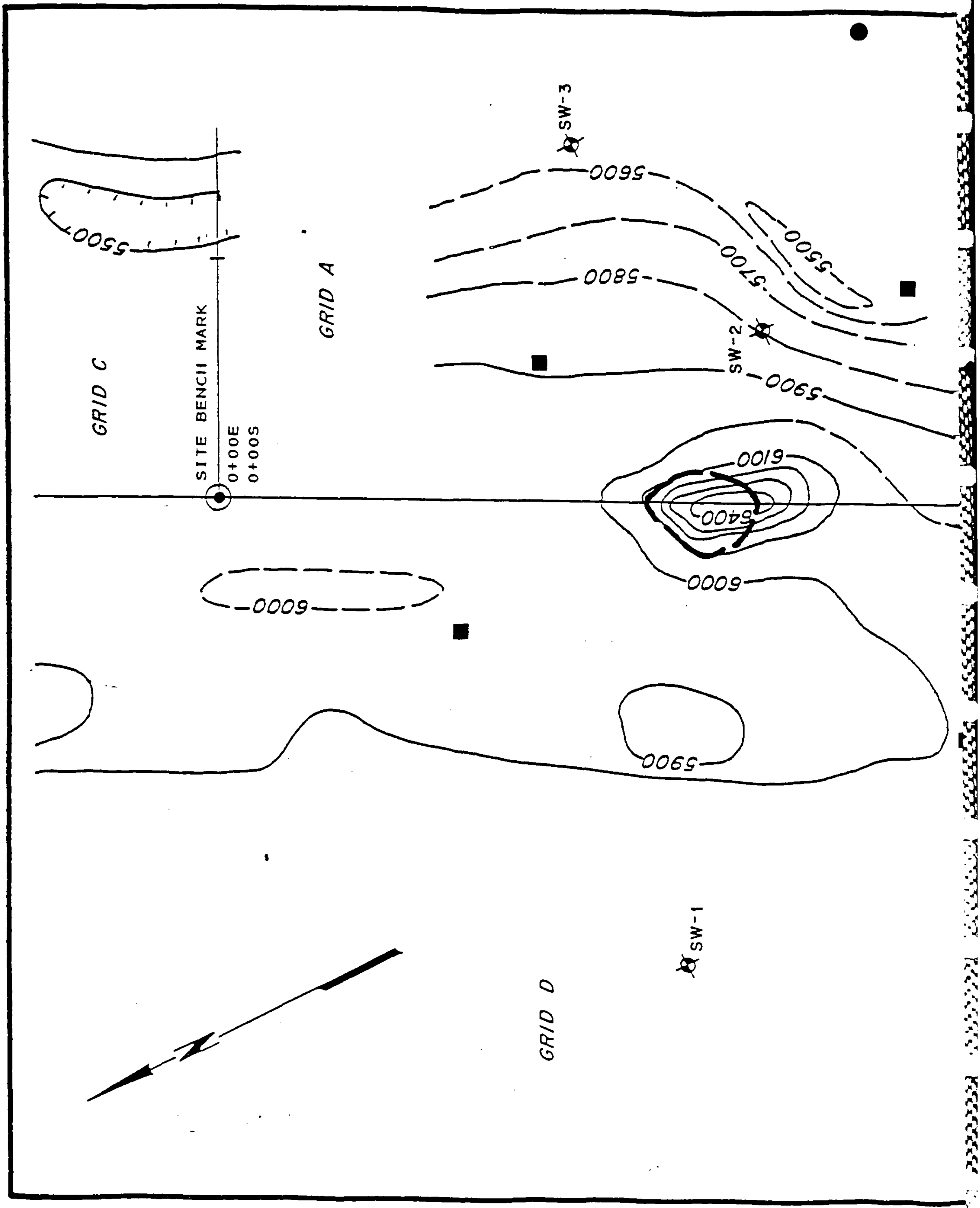
   a) excessive inclement weather
   b) site access
   c) site security
   d) site publicity

<u>Additional Field Exploration:</u>

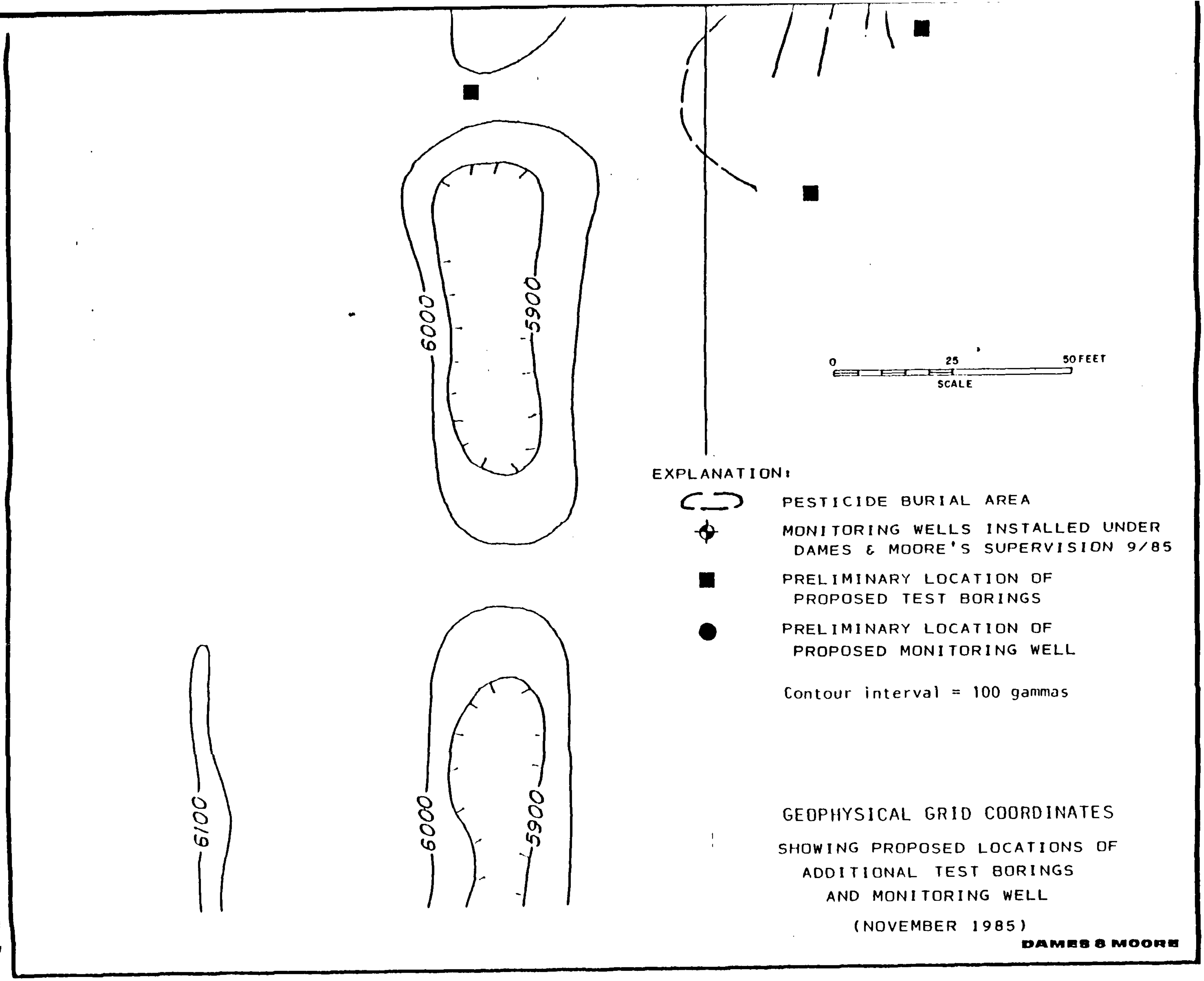
Following successful removal of the active source of contamination, Dames & Moore will immediately implement a field program to obtain further hydrogeologic data on the site. A series of five test borings will be drilled at the approximate locations shown in Figure 3. The final locations of the borings will depend on the results of chemical analysis from SW-1, SW-2, and SW-3. The purpose of these borings is two-fold:

1) To obtain static water level measurements to better evaluate the magnitude and direction of the hydraulic gradient on-site.

2) To obtain additional soil samples for chemical analyses, to



GRID C
GRID A
GRID D
SITE BENCH MARK
0+00E
0+00S
SW-1
SW-2
SW-3
5500
5500
5600
5700
5800
5900
5900
6000
6000
6100
5400
N



EXPLANATION:

⊂⊃	PESTICIDE BURIAL AREA
⌖	MONITORING WELLS INSTALLED UNDER DAMES & MOORE'S SUPERVISION 9/85
■	PRELIMINARY LOCATION OF PROPOSED TEST BORINGS
●	PRELIMINARY LOCATION OF PROPOSED MONITORING WELL

Contour interval = 100 gammas

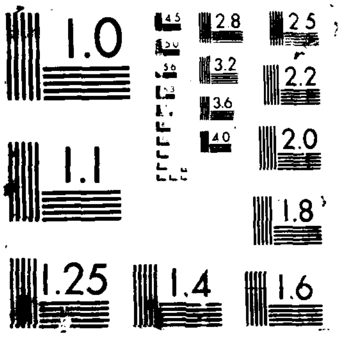
GEOPHYSICAL GRID COORDINATES

SHOWING PROPOSED LOCATIONS OF
ADDITIONAL TEST BORINGS
AND MONITORING WELL
(NOVEMBER 1985)

DAMES & MOORE

FIGURE 3

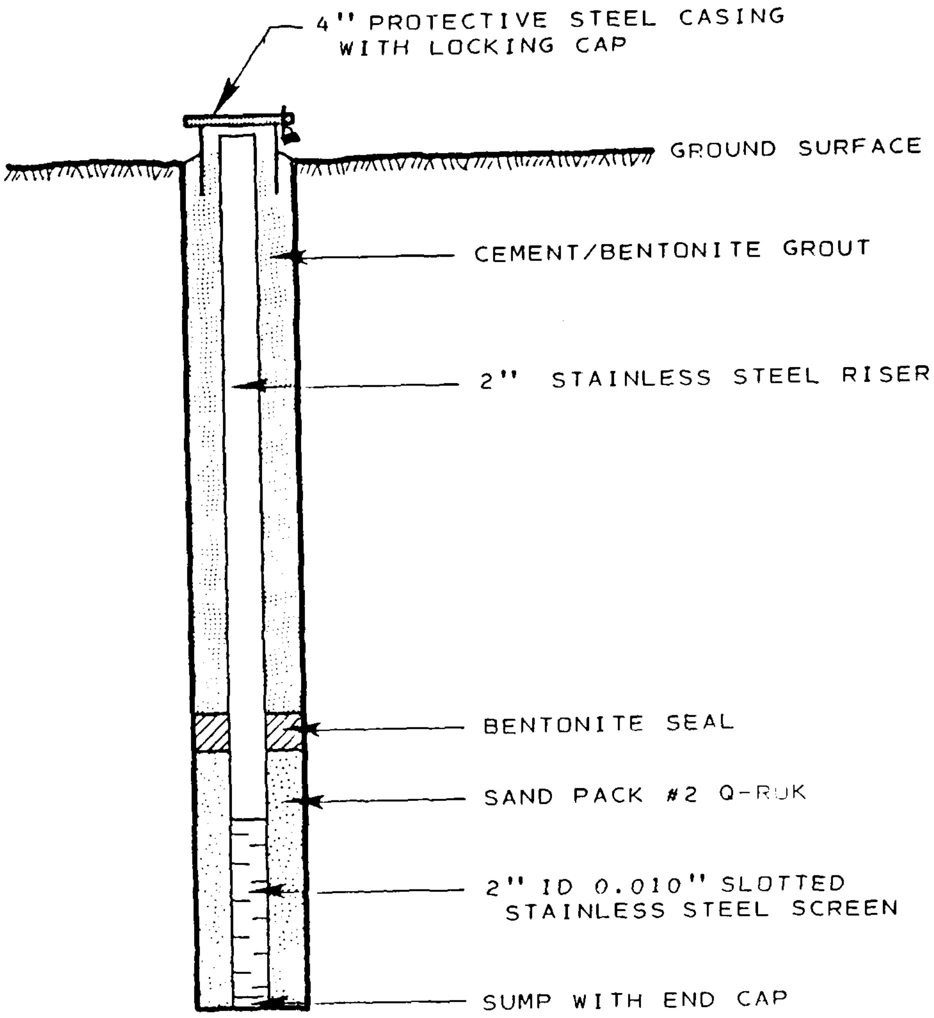
AD-A195 811 INVESTIGATION OF BURIED PESTICIDE CONTAINERS (STEP 2) 3/3
STEWART AIR NATIONA..(U) DAMES AND MOORE PARK RIDGE IL
30 MAY 86 F33615-83-D-4002
UNCLASSIFIED F/G 24/5 NL


1.0
4.5
5.0
5.6
6.3
2.8
3.2
3.6
4.0
2.5
2.2
2.0
1.1
1.8
1.25
1.4
1.6

more accurately identify the extent of existing contamination on-site.

The soil borings will be drilled to depths of approximately 45-50 feet. During drilling, soil samples will be taken at 5-foot intervals or at changes in subsurface soil lithology. During drilling, the position of the water table will be noted on the log. For each boring the soil sample immediately below the water table will be placed in a specially prepared jar (from the chemical lab) and used for chemical analysis. One of these samples will be split to form a QA control sample. Sampling forms will be completed for all soil samples sent to the chemical laboratory. After drilling, the augers will be withdrawn to the zone of transition between the weathered bedrock and the overlying till. A PVC standpipe and screen will be lowered into the boring through the augers and the augers removed. The annular space will then be backfilled with site soils. The screens will be placed so as to receive groundwater from between the weathered bedrock and till, thus providing comparable measurements of static water levels to that of wells SW-1, SW-2 and SW-3.

Although the chemical results from groundwater sampling are not complete it is anticipated that well SW-2 will show high concentrations of contaminants. One additional monitoring well



TYPICAL MONITORING WELL SCHEMATIC

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FIGURE 4

will then be placed to the east of SW-2, to collect groundwater samples. The approximate location of this well is shown in Figure 3. The well will be constructed in the same manner as SW-1, SW-2 and SW-3. (Figure 4.) The groundwater sample collected will be split to form a QA control sample. Specific conductance, pH and temperature will be measured in the field. After sampling the well a recovery test will be performed to evaluate the field permeability.

A final analysis of site hydrogeology and site contamination will be performed after field data and laboratory data are available. From this analysis final remediation alternatives will be evaluated to address the passive source of contamination that will still exist on-site.

COSTS

The man hours required by Dames & Moore personnel for the above described work is shown in Table 1. Dames & Moore's billing rates for 1985 and 1986 are shown in Table 2. Travel and subsistence estimates for Dames & Moore personnel are presented in Table 3. Other direct costs are summarized in Table 4. Subcontractor costs for waste removal/disposal, test borings/well installation, and laboratory analyses are estimated in Tables 5, 6 and 7, respectively. The total estimated cost for work performed by subcontractors and services provided by

Dames & Moore for these interim tasks is $76,876. This total can be subdivided as follows:

Dames & Moore Labor	$14,182
Travel and Subsistence	2,065
Other Direct Costs	2,175
Waste Removal and Disposal Subcontractors	44,548
Drilling and Surveying Subcontractors	10,867
Chemical Laboratory Subcontractor	3,039
TOTAL	$76,876

* * * * *

We look forward to receiving your comments on this draft report. If you have any questions concerning this report or proposed work, please call us.

Very truly yours,

DAMES & MOORE

Arthur M. Seanor
Project Manager

AMS:eml

cc: Major William Steene - NYSANG
Michael Ander - D&M

TABLE 1

DAMES & MOORE MAN HOURS NEEDED TO PERFORM INTERIM SERVICES

CONTAMINANT REMOVAL	SENIOR	JUNIOR	TECHNICIAN	SUPPORT
- Bid Preparation	8	20	24	24
- Surveillance	8	50	20	0
- Reporting	4	20	8	32
HYDROGEOLOGIC FIELD INVESTIGATION				
- Field Tasks	8	40	20	16
- Data Analyses and Site Investigation Report	16	60	20	40

TABLE 2

DAMES & MOORE BILLING RATES

GRADE LEVEL	1985 RATE	1986 RATE
Senior Professional	66.86	71.54
Mid Level Professional	42.34	45.30
Junior Professional	26.50	28.36
Technician	29.67	31.75
Support	22.74	24.33

TABLE 3

TRAVEL AND SUBSISTENCE BREAKDOWN FOR DAMES & MOORE PERSONNEL

Removal/Disposal	One round trip, office to SANGB	$ 540.00
	Subsistence 5 days @ $75.00	375.00
	Vehicle rental	125.00
	Subtotal	$1,040.00
Test Borings/ Well Installation	One round trip, office to SANGB	$ 540.00
	Subsistence 4 days @ $75.00	300.00
	Vehicle rental	125.00
	Subtotal	$ 965.00
	Travel & Subsistence	$2,005.00
	3% Fee	60.15
	TOTAL	$2,065.15

TABLE 4

SUMMARY ESTIMATE OF OTHER DIRECT COSTS (ODC's)

Health & Safety Equipment (respirator cartridges, chemical resistant suits, gloves, wash bins, buckets, brushes, tarps)	$ 260.00
Sampling Equipment (pumps, bailers, pH meter, specific conductance meter)	$ 165.00
Air Monitoring Equipment (photoionization detector, air sampling tubes)	$ 500.00
Miscellaneous Field Supplies (tool cleaning solvent, stakes, flagging, markers, tape, etc.)	$ 250.00
Word Processing Equipment (50 hours x $10.00)	$ 500.00
Reproduction (1500 pages x .10)	$ 150.00
Communications	$ 175.00
Shipping	$ 150.00
Subtotal ODC's	$2,150.00
3% Fee on external costs	25.05
TOTAL	$2,175.05

TABLE 5

SUBCONTRACTOR COST ESTIMATE FOR REMOVAL AND DISPOSAL OF WASTE

Labor (team of 6)	$ 1,620/day
Per Diems	$ 330/day
Equipment (backhoe, loader, vacuum unit, grappler, decontamination trailer, van, fuel truck, PID, SCBA's, full face respirators)	$ 2,500/day
Expendable Items (tyvek suits, chemical resistant suits, respirator cartridges, gloves, fuel, air, etc.)	$ 370/day
Subtotal/Day	$ 4,820
x 5 days	$24,100
<u>Disposal</u>	
10 overpacks x $195/each	$ 1,950
15 ton soil x $100/ton	$ 1,500
500 lbs. bulk solvent (liquid) x 0.20/lb.	$ 100
Subtotal	$ 3,550
Mobilization	$10,200
Project Management	$ 4,000
On-site Mobile Laboratory (optional)	$ 1,400
Subcontractor Cost	$43,250
3% Fee	$ 1,297.50
TOTAL	$44,547.50

TABLE 6

SUBCONTRACTOR COST ESTIMATE FOR TEST BORINGS WELL INSTALLATION AND SURVEYING

	UNIT COST	AMOUNT
Test Boring w/ Standard Sampling (270 ft.)	25.00/ft.	$ 6,750.00
Well Installation		
2" stainless steel screen (10 ft.)	60.00/ft.	$ 600.00
2" stainless steel riser (40 ft.)	25.00/ft.	$ 1,000.00
Installation of Locking Well Cover (1)	125.00 ea.	$ 125.00
Development (3 hrs.)	125.00/hr.	$ 375.00
Standby (2 hrs.)	125.00/hr.	$ 250.00
Standpipe Installation		
1 1/2" Schedule 40 PVC pipe (200 ft.)	5.00/ft.	$ 1,000.00
1 1/2" Schedule 40 PVC screen (50 ft.)	9.00/ft.	$ 450.00
Subcontractor Cost		$10,550.00
3% Fee		$ 316.50
TOTAL		$10,866.50

TABLE 7

LABORATORY ANALYTICAL COST ESTIMATE

	ANALYSIS	UNIT PRICE	AMOUNT
6 Soil Samples	aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor epoxide, lindane, methoxychlor, malathion, parathion, diazinon, DDT isomers, 2,4-D, 2,4,5-T, and 2,4,5-TP (Silvex)	$404.19	$2,425.14
2 Groundwater Samples	Same as above.	$262.79	$ 525.58
	Subcontractor Cost		$2,950.72
	3% Fee		$ 88.52
	TOTAL		$3,039.24

APPENDIX G

2 6 JUN 1984

Pesticide Burial Site
Stewart Air National Guard Base

I. Description of Work:

The purpose of this multiphased project is to confirm the presence of pesticides through identification and quantification of the contents of suspected buried metal containers, to evaluate the vertical and lateral extent of contaminated soils and groundwater, to evaluate cost-effective and technically feasible methods to remove contaminated materials and/or soils, and to implement a clean-up of the area in a reasonable time frame. Phase I, II, and III, Pesticide Confirmation, Migration Analysis, and Remedial Alternative Evaluation will be accomplished herein. The last phase, or Implementation of Remediation Plan, will be accomplished as a discretely separate task to be issued subsequently.

Ambient air monitoring of hazardous and/or toxic material for the protection of contractor and Air Force personnel shall be accomplished when necessary, especially during the drilling operation.

The presurvey report (mailed under separate cover) and Results of Metal Detector Geophysical Survey Report (mailed under separate cover) incorporated background and description of the site for this task. To accomplish this effort, the contractor shall take the following steps:

A. General

1. Locations where soil samples are collected shall be marked with a permanent marker and the location recorded on a site map.

2. A total of four groundwater monitoring wells shall be installed in the vicinity of the pesticide burial site and landfill. The exact location of the wells shall be determined in the field.

3. All wells installed during this effort shall be constructed of schedule 40 PVC casing and screen. Each well shall be completed to a depth of at least 10 feet below the water table surface, and 10 feet of screen shall be set. A sandpack shall be emplaced around the well screen. Bentonite pellets shall be placed on top of the sandpack to seal the screened interval and the seal shall be completed using a bentonite-cement grout to the surface. Each well shall be provided with a surface grout seal and protective steel casing with a locking cap. All wells shall be developed, water levels measured, and locations surveyed and recorded on a site map.

4. Ground-water monitoring wells shall comply with U.S. EPA publication 330/9-81-002 <u>NEIC Manual for Groundwater/Subsurface Investigations at Hazardous Waste Sites</u>, and State of New York requirements for monitoring well installation. All wells will be developed until they produce clear, sand-free water. Only screw type joints shall be used. Glue fittings are not permitted.

5. All water samples shall be analyzed on site by the contractor for pH, temperature, and specific conductance. Sampling, maximum holding time, and preservation of samples shall comply strictly with the following references: Standard Methods for the Examination of Water and Wastewater, 15th Ed. (1980), pp 35-42; ASTM, Part 31, pp 72-82, (1976), Method D-3370; and Methods for Chemical Analysis of Waters and Wastes, EPA Manual 600/4-79-020, pp xiii to xix (1979). All water samples shall be analyzed using minimum detection levels, as specified in Attachment 1.

6. Field data collected from the site shall be plotted and mapped. The nature, magnitude, and potential for contaminant flow within the site to receiving streams and ground waters shall be estimated. Upon completion of the sampling and analysis, the data shall be tabulated in the next R&D Status Report as specified in Item VI below.

B. In addition to items delineated in A above, conduct the following specific actions at the pesticide burial site identified on Stewart ANGB NY:

1. Conduct three test excavations into the pesticide burial site. Excavations shall be performed with a backhoe and conducted near the center and the inferred northern and southern boundaries of the burial area. These excavations shall be performed to confirm that metallic responses from geophysical survey (Task Order 8) were containers, to permit visual inspection of container integrity, and to allow an estimate of the total quantity of buried containers.

2. Collect one container sample from each excavation if it has been determined by visual examination that the containers are intact and "samplable".

3. Each container sample shall be analyzed for the pesticides specified in Attachment 1.

4. In addition, collect one soil sample of the surrounding area soils from each excavation to provide an estimate of the migration potential.

5. Each soil sample shall be analyzed for the pesticides specified in Attachment 1.

6. If the contractor does not encounter containers during the backhoe excavations, field efforts shall cease and no further work will be accomplished. The contractor shall file the corresponding R&D Status Report and await further instructions from the USAF OEHL technical monitor.

7. Install four groundwater monitoring wells, one well placed upgradient of the pesticide burial area and three wells placed downgradient of the site. Two of the downgradient wells shall be located so as to monitor the near-field groundwater gradient. The third downgradient well shall be placed so as to monitor groundwater quality downgradient of the landfill and estimate the far-field groundwater gradient.

8. Collect one water sample from each well.

9. Each groundwater sample shall be analyzed for the pesticides specified in Attachment 1.

10. Using information from the field investigation, the contractor will develop a remediation plan to remove drummed chemicals, contain soils, and remediate any groundwater contamination. The remediation plan shall consist of the formulation of remedial alternatives, assessment of remedial alternatives, identification of the best remedial action, and cost for implementation. Each alternative program shall be conceptually developed to describe how component technologies will be applied, estimated performances, construction requirements, major equipment sizes, design parameters, and concept level capital and operating cost estimates. Each alternative shall be evaluated on the basis of technical feasibility, cost-effectiveness, implementation time frame and environmental effectiveness, and risk assessment.

C. Well Installation and Clean-up

The well area shall be cleaned following the completion of each well. Drill cuttings shall be removed and the general area clean. If hazardous waste is generated in the process of well installation the contractor shall be responsible for proper containerization for eventual government disposal. Disposal of drill cuttings are not the responsibility of the contractor.

D. Results of all sampling and analysis shall be tabulated and incorporated in the Informal Technical Information report (Sequence 3 Atch 1 and Sequence 2 Atch 3 as specified in Item VI below) and forwarded to USAF OEHL/TS for review.

E. Reporting

1. A draft report delineating all findings of this field investigation shall be prepared and forwarded to the USAF OEHL, as specified in Item VI below, for Air Force review and comment. This report shall include a discussion of the regional hydrogeology, well logs of all project wells, data from water level surveys, water quality analysis results, available geohydrologic cross sections, ground-water surface and gradient vector maps, any available vertical and horizontal flow vectors, and laboratory quality assurance information. The report shall follow the USAF OEHL format (mailed under separate cover).

2. Estimates shall be made of the magnitude and direction of movement of contaminants discovered. Potential environmental consequences of discovered contamination shall be identified or estimated. Where survey data are insufficient to properly determine or estimate the magnitude and direction of movement of discovered contaminants, fully justified specific recommendations shall be made for additional efforts required to properly evaluate contamination migration.

3. Specific requirements, if any, for additional soil excavation and/or sampling or for future ground-water monitoring must be identified.

F. Cost Estimates

The contractor shall provide cost estimates for implementation of area clean-up and any additional work recommended to confirm the presence of pesticides and evaluate the lateral and vertical extent of migration of contaminants from pesticide burial area. The recommendations provided shall include viable alternative technologies for restoration of the aquifer and soils along with an estimate of the time required to accomplish the proposed effort. This information shall be provided in a separately bound appendix to the draft final report.

II. Site Location and Dates:

Stewart ANGB NY
Time and Dates
To be established

III. Base Support: None

IV. Government Furnished Property: None

V. Government Points of Contact:

1. 1Lt Maria R. LaMagna
USAF OEHL/TS
Brooks AFB TX 78235
(512) 536-2158
AV 240-2158

2. Mr Harry Lindenhofen
ANGSC/DEV
Andrews AFB MD 20331
(301) 981-6693
AV 858-6693

3. Major William A. Steene
P.O. Box 6148
Stewart Airport NY 12550
(914) 564-7841

4. Lt Col Michael C. Washeleski
ANGSC/SGB
Andrews AFB MD 20331
(301) 981-5926
AV 858-5926

VI. In addition to sequence numbers 1, 5 and 10 which are applicable to all orders, the reference numbers below are applicable to this order. Also shown are data applicable to this order:

Sequence No.	Block 10	Block 11	Block 12	Block 13	Block 14
Atch 1					
4	ONE/R	84NOV15	84NOV30	85FEB28	*
3	ONE/T	**	**		2
Atch 3					
2	ONE/T	**	**		2

*A minimum of two draft reports will be required. After incorporating Air Force comments concerning the first draft report, the contractor shall supply the USAF OEHL with a second draft report. The report will be forwarded to the applicable regulatory agencies for their comments. The contractor shall supply the USAF OEHL with 20 copies of each draft report and 50 copies plus the original camera ready copy of the final report.

**Upon completion of analysis

Attachment 1

Levels of Detection Required

Levels of Detection are for water unless shown otherwise:

Analyte	Analytical Method	Detection Limit
Oil and Grease (IR Method)	EPA 413.2*	100 µg/L (waters) 100 µg/g (soil)
pH	EPA 150.1*	
Specific Conductance	EPA 120.1*	1 µmho/cm
Aldrin	Standard 509 A	.02 µg/L
Chlordane	Standard 509 A	.2 µg/L
Dieldrin	Standard 509 A	.02 µg/L
Endrin (1)	Standard 509 A	.02 µg/L
Heptachlor	Standard 509 A	.02 µg/L
Heptachlor Epoxide	Standard 509 A	.02 µg/L
Lindane (1)	Standard 509 A	.01 µg/L
Methoxychlor (1)	Standard 509 A	.2 µg/L
Malathion	Standard 509 A	.1 µg/L
Parathion	Standard 509 A	.02 µg/L
Diazinon	Standard 509 A	.02 µg/L
2,4-D (1)	Standard 509 B	.06 µg/L
2,4,5-T	Standard 509 B	.06 µg/L
2,4, 5-TP (Silvex) (1)	Standard 509 B	.06 µg/L
DDT Isomers (DDD, DDE)	Standard 509 A	.02 µg/L

For soils, use detection levels shown above, but report values as micrograms pesticide per gram of soil; (1)=Primary Drinking Water Standard, 40 CFR 141.12

Reference: * Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020, Mar 1979, U.S. EPA.

END

DATE

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