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HAZARDOUS WASTE SECTION

February 12, 1987

Mr. Jack Ellvinger, Acting Manager
Hazardous Waste Section
Groundwater and Hazardous Waste Bureau
Environmental Improvement Division
New Mexico Health and Environment Department
P.O. Box 968
Santa Fe, New Mexico 87504-0968

Dear Mr. Ellvinger:

Enclosed is a copy of the final Resource Conservation and Recovery Act (RCRA) Groundwater Monitoring Compliance Inspection report for the Cannon Air Force Base facility in New Mexico.

This report was prepared by the Environmental Protection Agency's Contractor.

If you have any questions, please contact Ms. Linda Thompson at (214) 767-2850.

Sincerely,

Linda Thompson
for William H. Taylor, Chief
Enforcement Section

Enclosure

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FINAL REPORT

WORK ASSIGNMENT 223

RCRA GROUND-WATER MONITORING COMPLIANCE INSPECTION FOR THE CANNON AIR FORCE BASE FACILITY NEW MEXICO

Prepared for:

U.S. Environmental Protection Agency
Office of Waste Programs Enforcement
Washington, D.C. 20460

By

PRC ENVIRONMENTAL MANAGEMENT, INC.
VERSAR, INC.

JANUARY 1987

RCRA GROUND-WATER MONITORING COMPLIANCE INSPECTION FOR THE CANNON AIR FORCE BASE FACILITY NEW MEXICO

FINAL REPORT

Prepared For

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Waste Programs Enforcement
Washington, D.C. 20460

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Prepared By	:	PRC Environmental Management, Inc. and Versar, Inc.
Telephone No.	:	(312) 938-0300
EPA Primary Contact	:	Linda Thompson
Telephone No.	:	(214) 767-2949

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1.0 INTRODUCTION

The U.S. Environmental Protection Agency, Region 6, authorized PRC Environmental Management, Inc. to conduct a series of RCRA ground-water monitoring compliance inspections in the State of New Mexico. PRC subcontracted with Versar, Inc. to participate in these inspections and to give technical support throughout the project.

The inspection of the Cannon Air Force Base, Clovis, New Mexico facility was conducted on September 24 through 26, 1985.

1.1 Inspection Objectives

The purpose of this inspection was to evaluate the compliance of Cannon Air Force Base with the requirements of 40 CFR, Part 265, Subpart F.

1.2 Scope of Activities

Prior to performing the site inspection at Cannon Air Force Base (AFB), PRC visited the New Mexico Environmental Improvement Division (NMEID) offices in Santa Fe, New Mexico to review and collect documents pertinent to the site's RCRA-regulated facilities and ground-water monitoring system. Documents reviewed include:

- All communications between NMEID and Cannon AFB concerning RCRA regulatory status and the RCRA ground-water monitoring system
- State RCRA inspection forms
- All completed phases of the Cannon AFB Installation Restoration Program (IRP)

- Closure plans concerning the site's RCRA-regulated landfill
- Parts A and B hazardous waste applications
- Site analytical data
- Other site-related hazardous waste and geological studies

Following the visit to state offices and an initial review of existing data, information gaps were identified. A site briefing was conducted on September 24 with the base commander and facility environmental personnel. Following this briefing, site personnel were interviewed to address information gaps in the existing data. On September 25 and 26, the inspection team accompanied the site sampling team during sampling activities, witnessed all phases of well purging and sample collection, and obtained split "replicate" samples from the facility sampling team at the time of sample collection. The analytical results of samples obtained by the inspection team are included as Appendix I.

1.3 Inspection Personnel

Name	Title	Organization
Tom Hahne	Hydrogeologist	Versar
Shin Ahn	Environmental Engineer	PRC
Ann Claassen	Water Resources Specialist	NMEID

2.0 SITE HISTORY AND OPERATIONS

2.1 Site Operations

2.1.1 Site Name and Location

Cannon AFB is located approximately 7 miles west of the City of Clovis, New Mexico in Curry County (See Figure 1). The current mailing address, contact telephone number, and EPA facility identification number are:

Address:	Cannon AFB, New Mexico 88103
Telephone:	2nd Lt. Bob Walton, (505) 784-4064
EPA Identification No.:	NM7572124454

2.1.2 Facility Description

The Cannon AFB is the headquarters for the 27th Tactical Fighter Wing. The facility covers approximately 4,320 acres of land and houses approximately 4,100 employees. The site has been an active military base since 1942. Figure 2 depicts the facility as it currently appears.

2.1.3 Waste Materials Generated

In response to a request by EPA Region 6 on November 17, 1984, Cannon AFB initiated a hazardous waste management survey (Hazardous Materials Technical Center, 1985b) to characterize hazardous and potentially hazardous waste streams at the main facility. The purpose of this investigation was to determine which waste streams were ultimately disposed of in the active sewage lagoon. However, the investigation characterized hazardous waste on a facility-wide basis. The results of this investigation were used to compile data presented in Table 1.

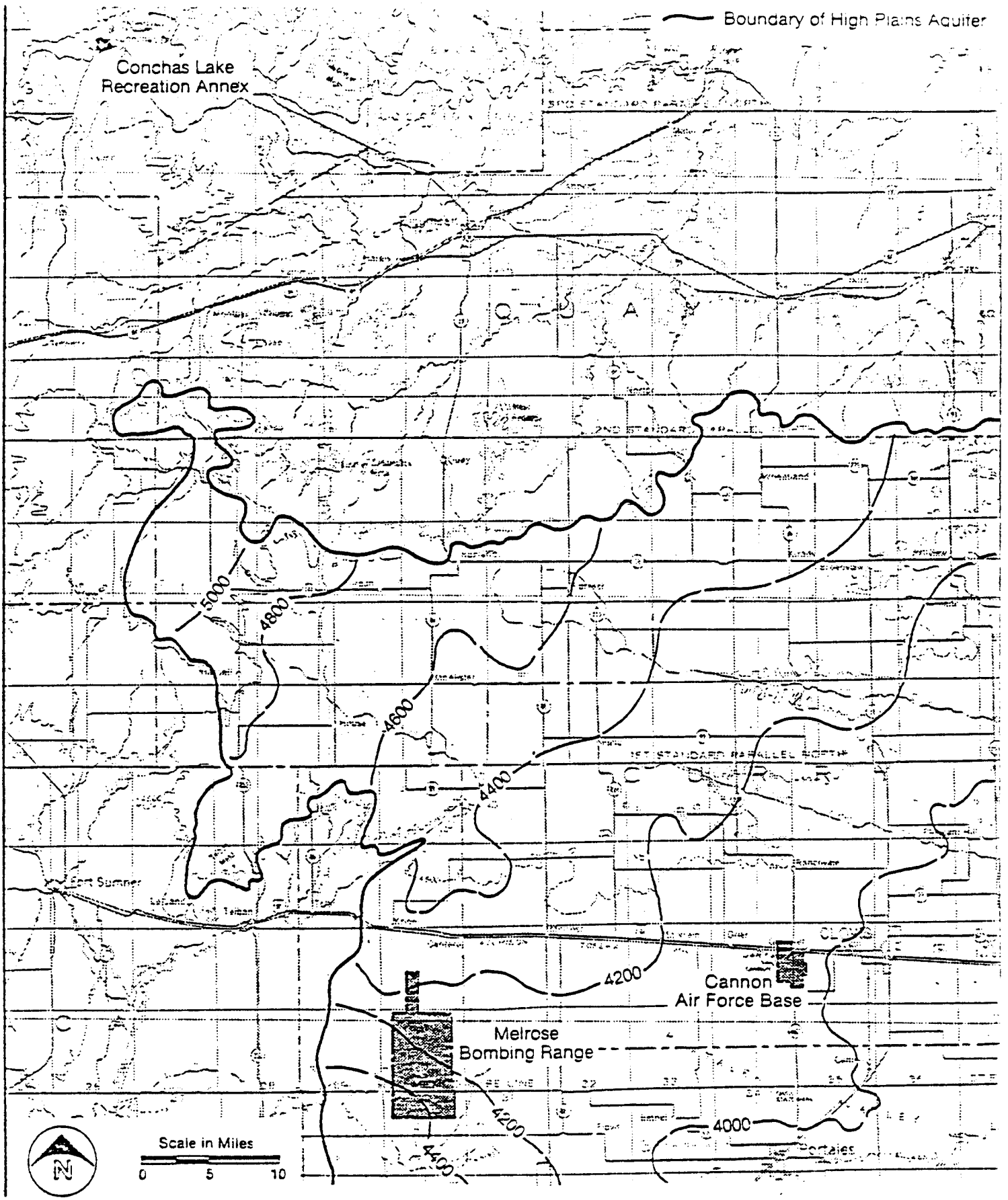

Figure 1: The general location of the Cannon AFB Facility (Regional potentiometric surface of the High Plains acquifer is also shown, modified after CH2M HILL, 1983)

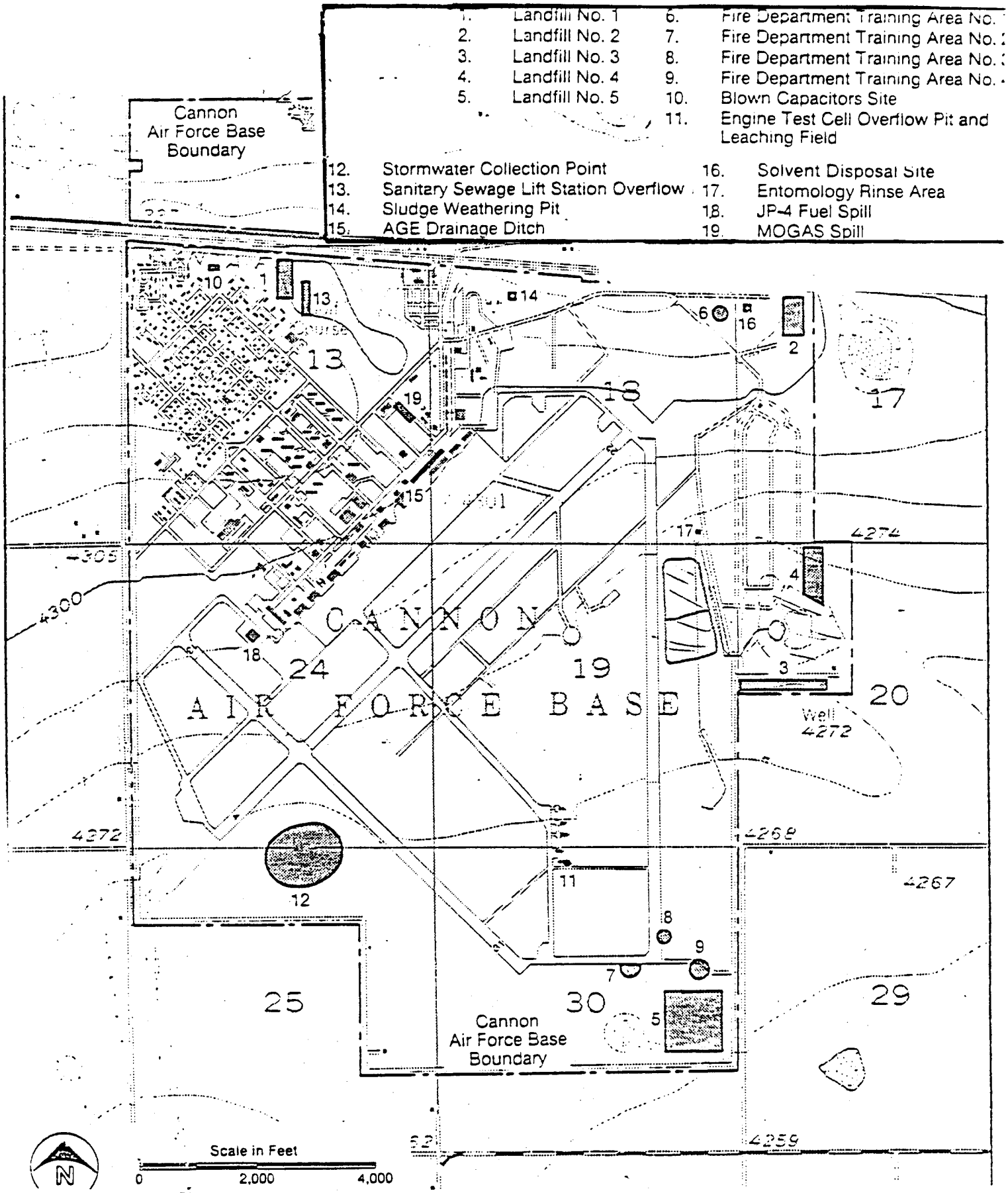

Figure 2: The Site Layout and Areas Studied in IRP records search (Modified after CH2M HILL, 1983)

TABLE 1: HAZARDOUS WASTE MATERIALS GENERATED

Descriptions	Hazardous Waste No.	Annual Amount*	
Carbon Remover	D002	5	gallons
Electrolyte	D002, D006	12	gallons
Mercury	D009	20	pounds
Sulfuric Acid	D002, D008	912	gallons
Paint Waste	D001, D007	1500	gallons
Paint Thinner	D001, D007	300	gallons
Methyl Ethyl Ketone	U159	500	gallons
Toluene	U220	50	gallons
Turco 6542	F001	1320	gallons
Spent fixer	D011	900	gallons

Notes:

Compiled from data presented in "Hazardous Waste Management Survey, Cannon Air Force Base," (Hazardous Material Technical Center, 1986b.)

* Estimates are based on 1984 inventories by Cannon AFB officials (Hazardous Materials Technical Center, 1985b).

2.2 Waste Disposal Practices

2.2.1 Past Waste Disposal

The facility has been operational since 1942, and hazardous wastes were generated and disposed of on-site until approximately 1982. As a result of this extended period of disposal, both disposal methodologies and disposal locations have varied. The facility has been the focus of extensive IRP activities to identify past disposal methods and impacted areas. The scope of this report is limited to those areas currently considered as RCRA regulated or potentially RCRA regulated. Figure 2 illustrates the sites identified in the IRP study.

Landfill No. 5 operated as a multi-purpose landfill, receiving both industrial waste and domestic waste, during the period from 1968 to 1983 (Hazardous Materials Technical Center, 1985c). Landfill No. 5 is shown in Figure 3. Disposal practices from 1968 to 1972 involved burning of wastes and subsequent burial. Since 1972, waste has been directly buried in trenches. Boring data indicate that wastes were not containerized at the time of burial (Hazardous Materials Technical Center, 1985c). Trench No. 3 received waste during 1981, and it is likely that the waste types received approximate those listed in Table 2. An inventory of hazardous waste likely to have been disposed of at the site (Hazardous Materials Technical Center, 1985c) supports this assumption.

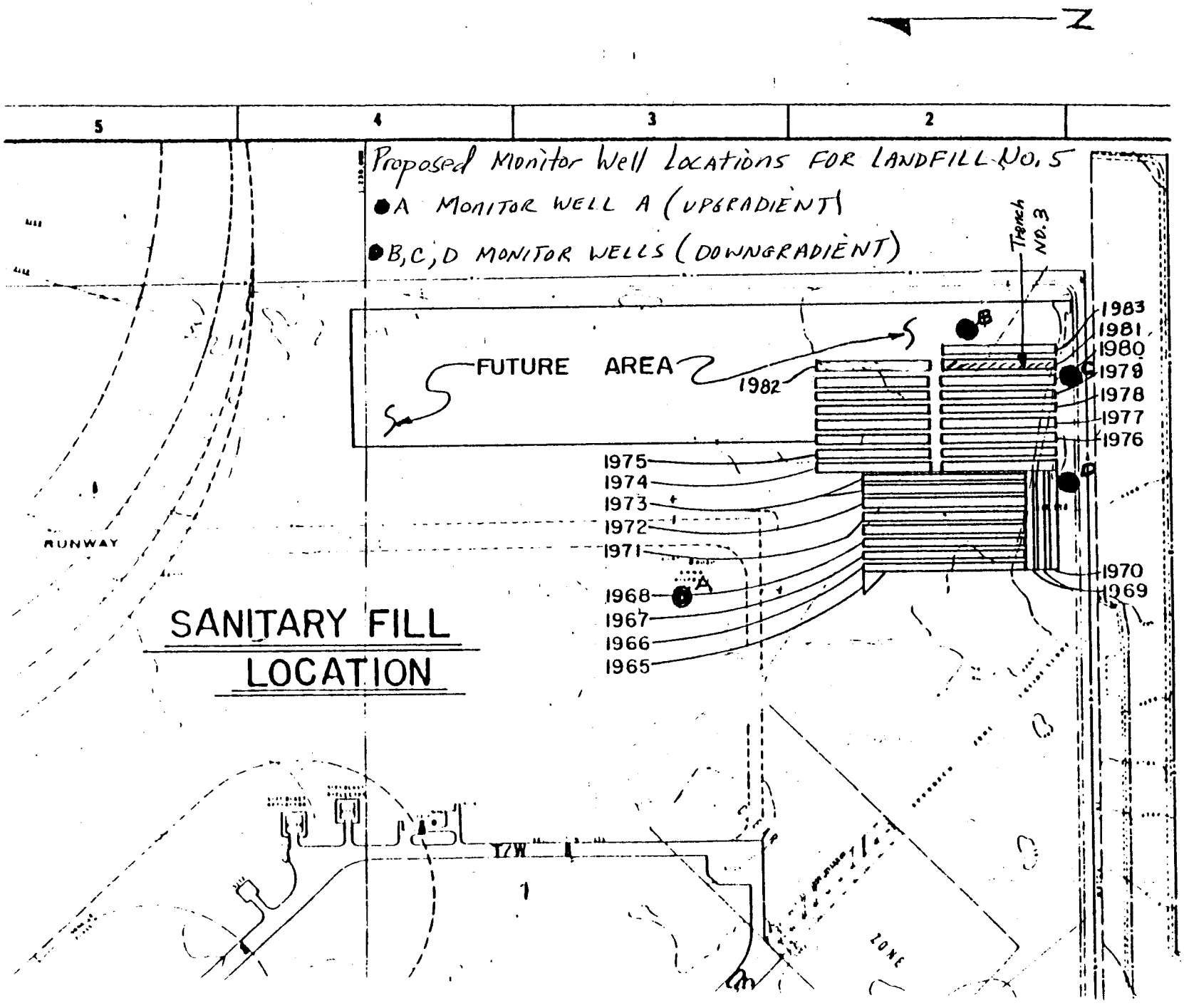

Figure 3: The Trench Locations within Landfill No. 5 and the Approximate Date of Use (After Lyndick Engineering Service, 1971)

TABLE 2: ESTIMATED INVENTORY OF HAZARDOUS WASTE DISPOSED OF IN TRENCH NUMBER 3

Hazardous Waste	Amount (in Pounds)
Methyl Ethyl Ketone	3,565
Toluene	3,906
Methyl Isobutyl Ketone	936
Cyclohexanone	216
Xylene	144
Ethylene Glycol Monobutyl Ether	144
Lead	54
Chromate	36

Source: Hazardous Materials Technical Center, 1985c. Closure and Post-Closure Plans for Landfill Trench at Cannon Air Force Base.

Four other areas were identified during the site visit and/or records review that may warrant RCRA status. These include: site No. 11, the test engine overflow pit and leachate field; site No. 12, the stormwater collection point; site No. 9, the fire department training area No. 4; and the sewage treatment lagoon. All of these sites received waste after the RCRA regulatory "interim status" effective date of November 19, 1980.

Site No. 11 has been operational since 1965. Oils and solvents from an oily water separator were released as uncontained overflow on a frequent basis until 1982. In 1982, an overflow pit (engine test cell overflow pit) was installed to contain overflow from the separator. This pit was recently rebuilt and equipped with a concrete liner. At the time of the inspection, oily residue was observed on the ground surface near the oily water separator. Review of analytical data from corings drilled in the immediate area of site No. 11 (from the unreleased draft IRP, Phase II report) indicates that soils may be contaminated with lead.

Site No. 12 is a naturally occurring Playa Lake that has been receiving stormwater discharge throughout the operational history of the facility. This site receives waste solvents from the aircraft washrack and runoff from the runway. Analytical data for shallow corings drilled in the Playa Lake area (from the unreleased draft IRP, Phase II report) indicate that sediments may be contaminated with arsenic, chromium, lead, cadmium, zinc, and silver. Observations at the time of the inspection did not reveal any visual evidence of contamination.

The above information concerning sites No. 11 and 12 was based on a brief on-site review of an unreleased draft report. The inspection team contacted Jim Henderson of

NMEID on January 20, 1987 to try to verify and quantify this information. Mr. Henderson stated that the report was released in final form in September 1986. The report is titled "Installation Restoration Program, Phase 2, Confirmation, Quantification, Stage 1" and was written by Radian Corporation. Mr. Henderson indicated that he could not verify or quantify the information due to the abundance of analytical information and the final report format. It is our understanding that the results were not tabulated, that results were reported as total metals values, and that extraction procedure toxicity measurements were not run.

Site No. 9 is the current fire department training area No 4. This site has been in use since 1961. From 1961 to 1974, this area was used to drain waste fuels from trucks and to drain runoff from fuel truck cleaning operations. From 1974 to 1975, mixed solvents, waste, oils, and jet fuel were burned at the site. Since 1975, this area has been used to burn only recovered jet fuel. The IRP records search (CH2M HILL, 1983) indicates that this facility was actively used at the time of the study and that visual contamination was evident at that time.

The operational history of the sewage treatment lagoon is not known. A study was performed in 1985 (Hazardous Materials Technical Center, 1985b) to determine whether hazardous waste was entering the lagoon. This study concluded that some minor amounts of potentially hazardous waste have entered the sanitary sewage system. The lagoon was originally unlined; Cannon is in the process of installing a liner (Henderson, 1987).

According to Mr. Henderson, NMEID, this unit is currently included as a RCRA unit; the facility installed four monitoring wells in late 1985 (one upgradient and three downgradient) to monitor this unit (Henderson, 1987).

This report is based on information that the inspection team obtained prior to the site visit in September 1985. It does not include a discussion of RCRA-regulated units added to the ground-water monitoring program areas (or their respective ground-water monitoring systems) subsequent to the CME inspection.

2.2.2 Current Disposal Practices

Cannon AFB is currently disposing of all hazardous waste off-site through the Defense Property Disposal Office. Trench No. 3 of landfill No. 5 has recently been covered with dirt and is no longer used. Sites No. 11 and 9 are currently active, although at the time of the inspection, site No. 9 had not been used within the last year (Walton, 1985). Cannon AFB is attempting to delist the sewage treatment lagoon with respect to RCRA regulations (Claassen, 1985).

2.2.3 Regulatory History

A Notice of Violation (NOV) was issued by the NMEID to Cannon AFB on November 13, 1984. The primary focus of this NOV was the lack of ground-water monitoring at trench No. 3 of landfill No. 5. Under this notice, Cannon AFB was required to comply with the provisions of 40 CFR, Part 265, Subpart F (or state interim status regulatory equivalent). A second NOV was issued on December 21, 1984, which addressed the issue of closure and post-closure plans for landfill No. 5. In addition, inquiries were issued concerning treatment of hazardous waste in the on-site sewage lagoon and storage of hazardous waste in a surface impoundment.

A ground-water monitoring plan has been instituted at the site, and a closure and post-closure plan for trench No. 3 of landfill No. 5 has been submitted. In addition, Cannon AFB is currently attempting to delist the sewage treatment lagoon on the basis that it currently receives no hazardous waste.

Cannon AFB has attempted to comply with the requirements issued in the first NOV. According to U.S. EPA, a final compliance order was issued by NMEID in 1985; this compliance order addressed the issues of both NOVs and was closed in the spring of 1985 (U.S. EPA, 1987).

3.0 SITE HYDROGEOLOGY

3.1 Geologic Setting

The Cannon AFB facility is located in the Southern High Plains of the Great Plains physiographic province. Locally, this region is relatively featureless with topography sloping in a northwest to southeast direction across the site. Surface drainage is generally channeled into two naturally occurring playa lakes (site No. 12 on Figure 2 and the playa adjacent to the sewage lagoon).

The stratigraphic section for the site area is illustrated in Figure 4. The Ogallala formation of Tertiary age lies as an uncomformity over the "redbeds" of Triassic age. In the site area, the depth to the Tertiary/Triassic interface is estimated to be at approximately 390 feet (CH2M HILL, 1983). A caliche bed of variable thickness occurs within the upper Ogallala formation.

Boring logs from the installation of the four monitoring wells, A, B, C, and D, represent the bulk of the site-specific data accumulated to characterize the subsurface below a depth of 50 feet. Boring logs are included in Appendix II. These borings indicate that the Ogallala formation exhibits some variability both near the surface and at the depth of saturation. Near the surface, a series of silt, silty sand, and sand layers have been modified by the formation of a continuous caliche layer. The top of the caliche is present at a depth of about 5 feet below the surface. It extends to a minimum depth of about 10 feet at Well B and a maximum depth of about 34 feet at Well D. In this unit, silt and silty sand is dissected by laterally transgressive sandy layers. The silt/silty sand/sand layer reaches a maximum depth of about 65 feet at Well B and a minimum depth of about 25 feet at Well D. Below this layer, the Ogallala is predominantly composed of sand, but it does contain some minor silt and clay units and some consistent gravel layers.

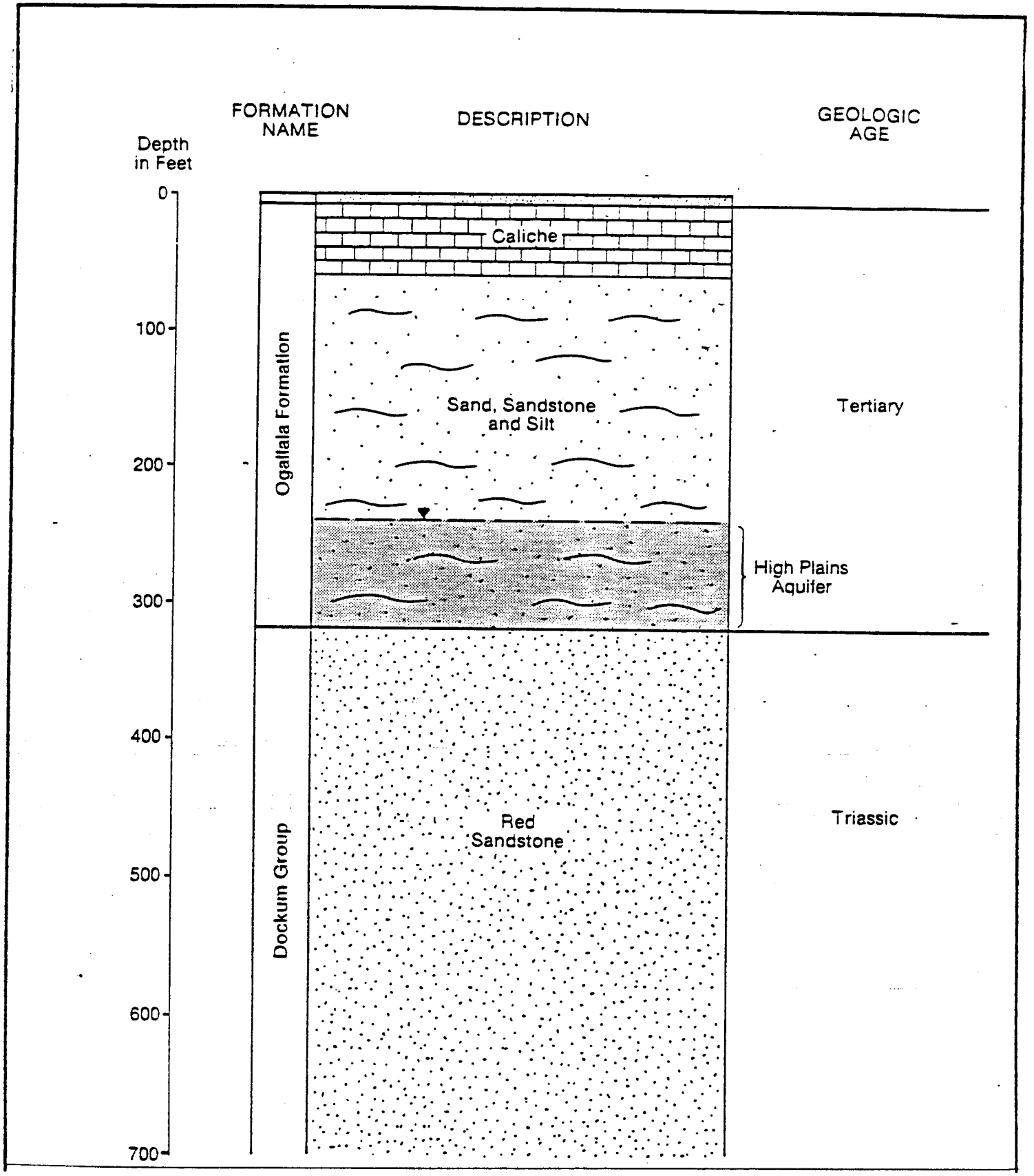

Figure 4: Stratigraphic Section of the Ogallala Formation and Underlying Triassic "Redbeds" (After CH2M HILL, 1983)

These deposits are generally unconsolidated, with a variable degree of calcite cementation evident in most borings, predominantly in the sand and gravel units. Lateral correlation is inconsistent, with some silt and gravel layers pinching out between borings. This is typical of the Ogallala formation, which was deposited as a regional alluvial fan at the base of the Rocky Mountains. Structurally, the Ogallalla pinches out against the underlying "redbeds" to the north and west of the site and thickens to the east of the site.

3.2 Hydrogeology

The site is underlain by the Ogallala formation which contains the High Plains aquifer of the High Plains regional ground-water system. The High Plains ground-water system extends from New Mexico to South Dakota and is mostly contained in the Ogallala formation.

As stated earlier, the Ogallala structurally thins to the north and west of the site and thickens to the east. The Ogallala pinches out to the west and north of the site, within the plateau region. The upper portion of the Ogallala regionally contains a resistant layer of caliche in its upper extent. As a result of Ogallala's termination within the High Plains plateau, recharge to the Ogallala occurs almost entirely within the High Plains region wherever the caliche unit is thinned, eroded, or non-existent. The recharge to the Ogallala in the site area is estimated at 0.5 to 0.8 inch per year (CH2M HILL, 1983).

Well installation boring logs indicate that the aquifer system was first breached in the borings at a depth of 327 to 345 feet below ground surface. After well implacement

and stabilization, water levels were recorded at depths of generally 260 to 265 feet below ground surface. This indicates that the Ogallala in the southern site area is under confined conditions. The overlying confining layer appears to be a well cemented layer of variable sand or gravel. The underlying confining layer is assumed to be the "redbeds" but none of the wells were drilled to this depth.

At the time of the inspection, site sampling team members were not able to access the wells to obtain water level measurements. Versar constructed potentiometric surface maps from data for the four quarters of 1985. The quarterly potentiometric surfaces are depicted in Figures 5, 6, 7, and 8. Well measurements obtained by facility personnel for the four quarter in late September 1985 were obtained from U.S. EPA after the sampling was completed (U.S. EPA, 1987).

The potentiometric surface maps from the four 1985 quarterly sampling events indicate that the direction of ground-water flow is relatively uniform to the southeast. This result supports the facility's assumption of flow direction used to place the monitoring wells. There does not appear to be any seasonal fluctuation in the direction of ground-water flow. The ground-water levels for September are depressed when compared to the other quarters; this is expected due to seasonal agricultural evapotranspiration and recharge patterns.

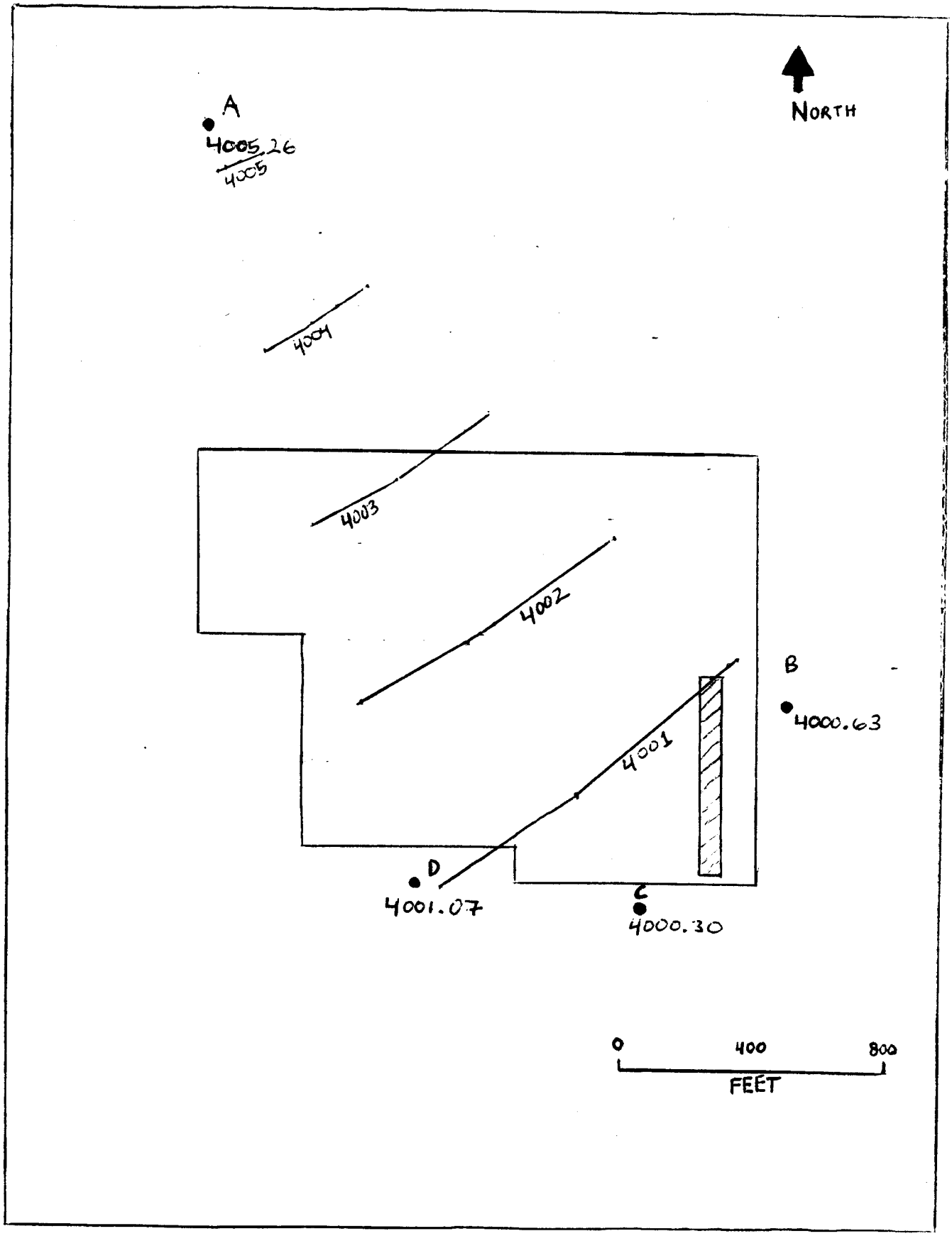

Figure 5: Potentiometric Surface of the High Plains Aquifer in the Landfill No. 5 Area, Constructed from First Quarter 1985 Data (Modified after Radian, 1985)

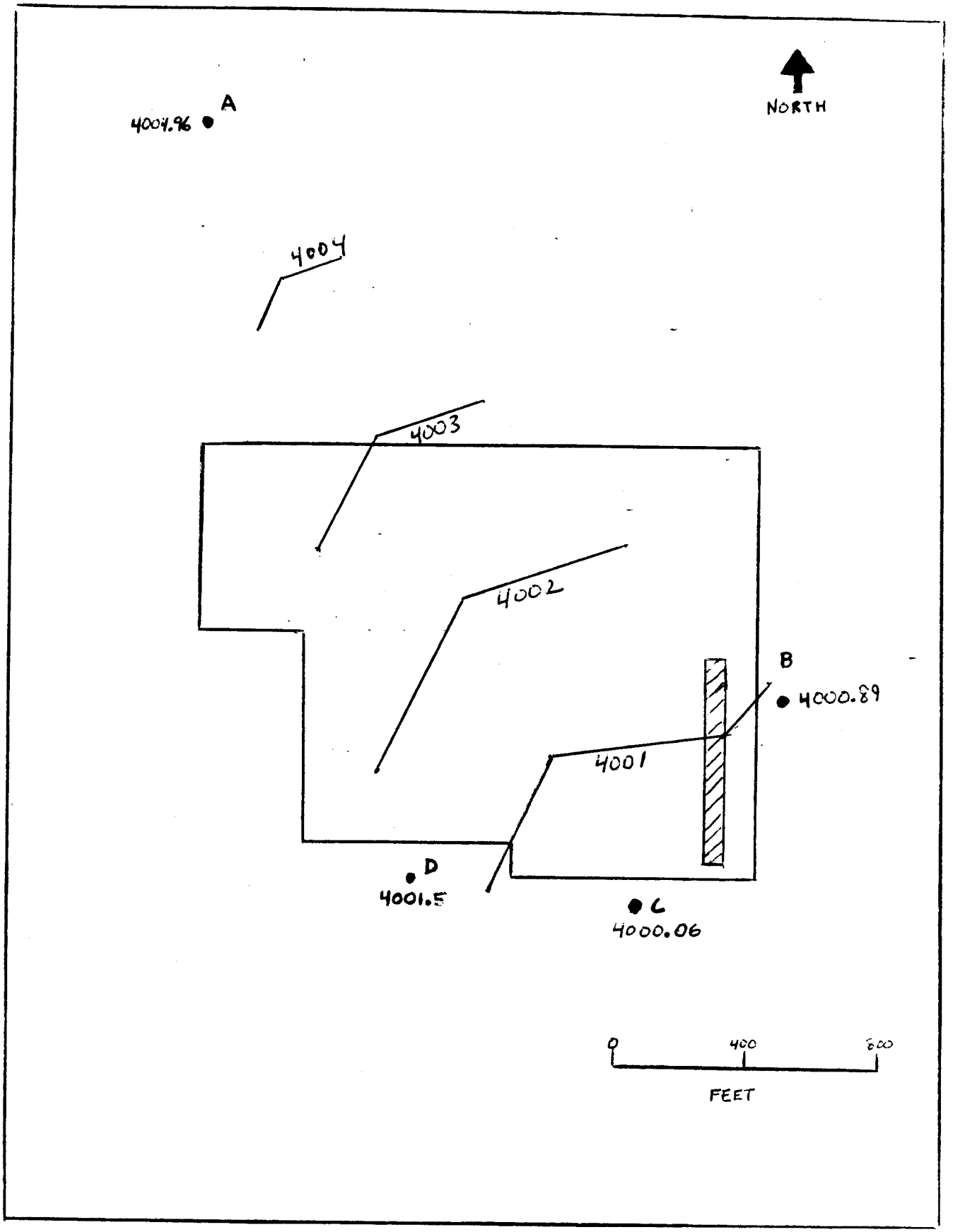

Figure 6: Potentiometric Surface of the High Plains Aquifer in the Landfill No. 5 Area, Constructed from Second Quarter 1985 Data (Modified after Radian, 1985)

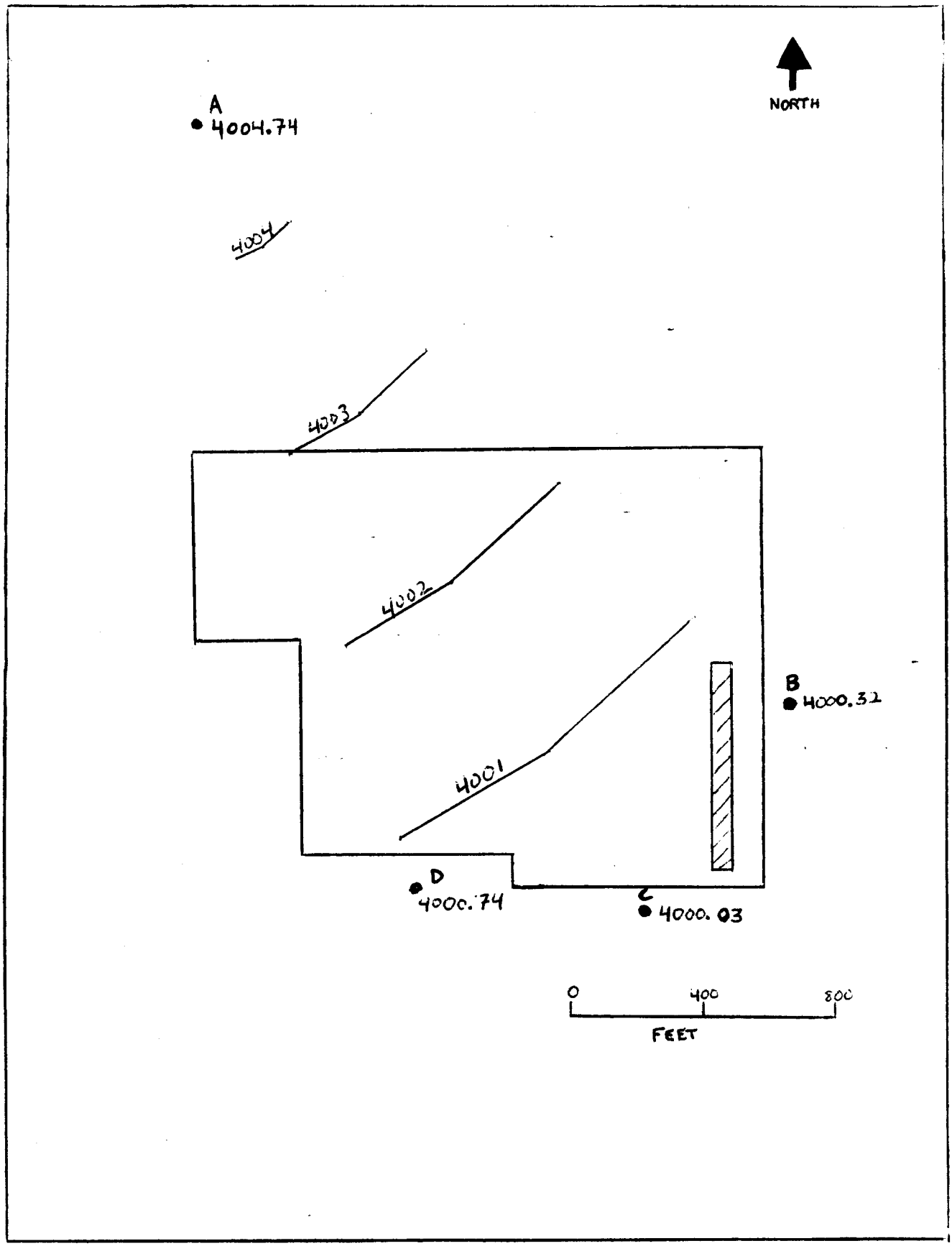

Figure 7: Potentiometric Surface of the High Plains Aquifer in the Landfill No. 5 Area, Constructed from Third Quarter 1985 Data (Modified after Radian, 1985)

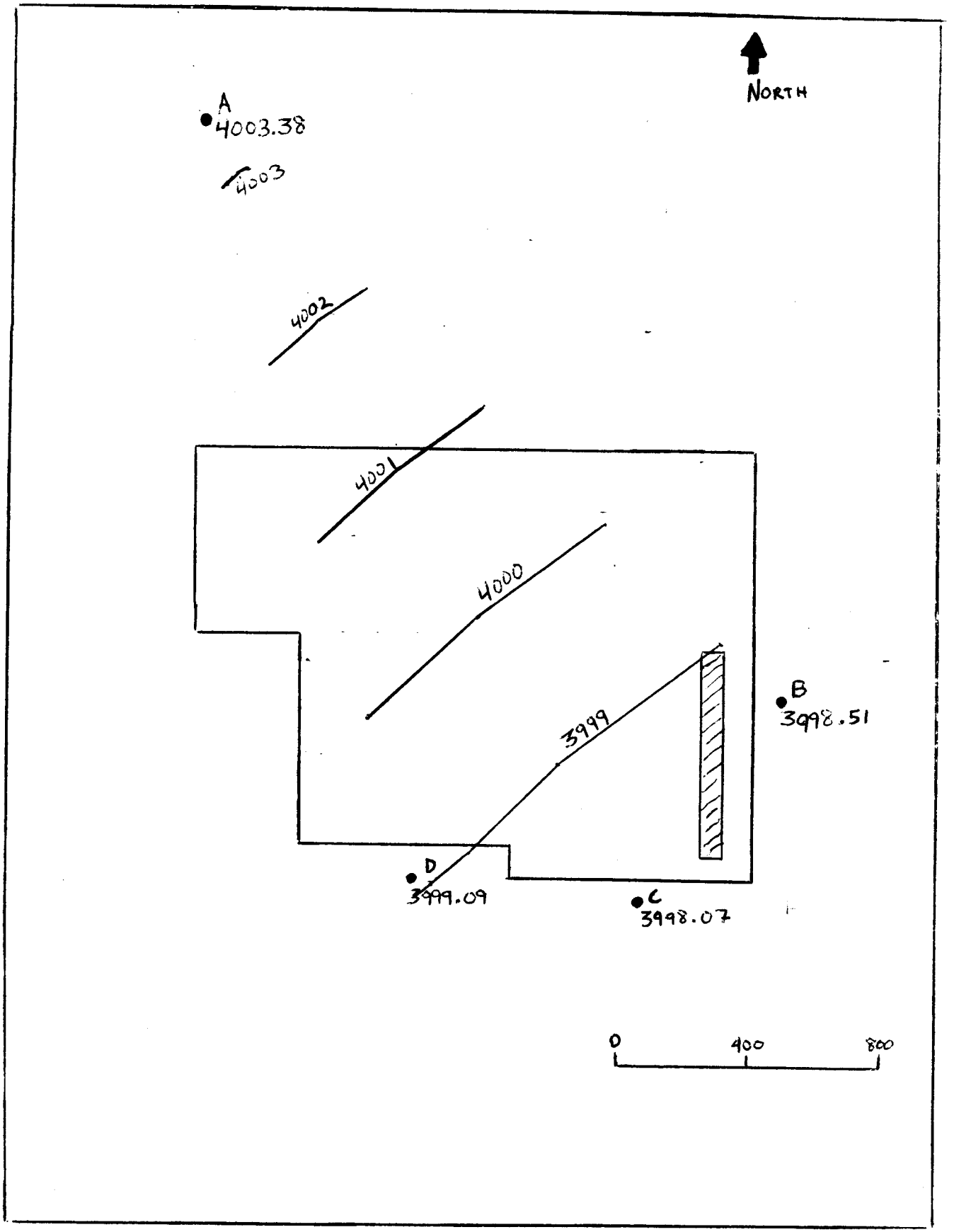

Figure 8: Potentiometric Surface of the High Plains Aquifer in the Landfill No. 5 Area, Constructed from Fourth Quarter 1985 Data (Modified after Radian, 1985)

Boring data from the site indicate that the caliche layer is persistent across the site. However, boring data also indicate that the layer is thinned and discontinuous (Boring Nos. 3I and 3E) at some locations on the site. Considering the recharge characteristics of the High Plains ground-water system, it is possible that in areas where a persistent hydraulic driving force (that is, a surface body of water or persistent drainage course) exists, a potential for recharge to the aquifer within the site area exists. Potential areas of infiltration include the landfill areas, site No. 11, site No. 12, and site No. 9. However, it should be noted that the ground-water system in the south site area is under confined conditions. This fact somewhat lessens the potential for recharge where the confining unit is present.

3.3 Surface Water

The site area receives an estimated 14 inches of precipitation per year. Most of the precipitation that falls in the site area drains naturally into two on-site playas. Due to the high evapotranspiration rate and low precipitation, the site area has a net water balance of approximately -55 inches. Under natural conditions, the playas do not contain impounded water in the site area. However, site No. 12 obtains additional runoff from the storm sewer system, and the playa located at the east side of the facility obtains treated sewage effluent. As a result, the playas may contain impounded surface water for much of the year. At the time of the inspection, site No. 12 (the western site playa) was observed to contain standing water and supported typical marshland flora.

Two surface impoundments also contain standing water on a regular basis. These include the engine test cell overflow pit and the sanitary sewage treatment system. No other perennial surface water bodies were observed in or near the site area during the inspection.

4.0 GROUND-WATER MONITORING SYSTEM EVALUATION

4.1 Monitoring Well Location and Construction

4.1.1 Monitoring Well Location

Four monitoring wells were installed by Cannon AFB during the period from December 1984 through January 1985. The locations of these four wells were indicated on Figure 3. These wells were installed to assess ground-water contamination from the RCRA-regulated trench No. 3 of landfill No. 5.

Ground water flows to the southeast (see Section 3.2) in the landfill No. 5 area. Four monitoring wells have been installed around the perimeter of landfill No. 5. The site ground-water monitoring system uses well A as the upgradient well and wells B, C, and D as downgradient wells for the regulated unit.

The initial objectives of the well installation were primarily "to determine the nature, extent and rate of migration of possible ground-water contaminants emanating from the site . . . ," and secondly, "to potentially satisfy the requirements of RCRA 40 CFR 265" (RADIAN Corporation, 1984). Considering the indicated direction of ground-water movement, it appears that the second objective may not have been met.

Under strict interpretation of 40 CFR, Part 265, Subpart F regulations, one well must be placed upgradient of the management area and must be unaffected by the facility (40 CFR 265.91 (a) (1) (ii)) and three wells must be located downgradient of the waste management area. The RCRA-regulated waste management unit considered in the

closure plan is trench No. 3. Trench No. 3 occupies a position at the southeast corner of landfill No. 5 (see Figure 3). Currently two problems exist with respect to monitoring well location; first, only well B may be hydraulically downgradient from the regulated unit, and second, the upgradient well is in a location that may be downgradient from other on-site units identified in the Phase II (IRP) presurvey (Sites No. 11 and No. 12 on Figure 2). It should be noted that the September 1986 final IRP, Phase II, Confirmation, Quantification, Stage I study report may provide valuable information concerning any contamination at these units.

If the owner/operator decides to consider the entire landfill No. 5 as the waste management area, then the facility still may be in compliance with the second point. However, considering the indicated hydraulic gradient from the second quarter (see Figure 6), well D may be of questionable downgradient status on a seasonal basis (during the spring quarter) with respect to landfill No. 5.

It should be noted that waste disposal practices were not uniform in the trenches within landfill No. 5. Specifically, "burn and cover" practices were in operation in the trenches filled prior to 1972 and landfilling of liquid waste was practiced between 1972 and 1981. Downgradient well placement should be sensitive to these previous practices and monitor areas of the unit that received liquid waste. For instance, the trenches in the southeast corner of the landfill area were operated during a period when they may have received liquid waste (see Figure 3). Well D is not truly downgradient of this area of the landfill during all quarters (see Figures 5, 6, 7, and 8). Installing a well to the east of Well D or south of Well B may improve the adequacy of the monitoring system. Well C is truly downgradient, based on ground-water elevations during the period of interest.

Two borings were drilled through trench No. 3 at landfill No. 5 in an attempt to characterize the landfill contents; samples from these borings were analyzed for selected total metals and halogenated volatile compounds (Hazardous Materials Technical Center, 1985c). The results indicate hazardous constituent levels of less than one part per million in the landfill. If this sampling is representative of the entire trench area, it suggests that the RCRA-monitored unit is an unlikely source for waste migration. However, it is not known whether the landfilled area received waste in a uniform manner.

4.1.2 Monitoring Well Construction

Installation records indicate that wells were constructed in the following manner. Wells were drilled using an air rotary rig. Wells were completed to a depth 10 to 15 feet below the confining layer. A 15-foot long, 4-inch diameter, schedule 80 PVC casing with threaded joints and 0.01-inch mill slotted screens was used to construct the inner casing. The screened sections were set 15 feet below the water table in a pea gravel pack. The gravel pack was poured to a level 5 feet above the screen. One foot of fine-grained sand was poured into the annular space above the pack, and 3 feet of bentonite pellets were placed above the sand. The bentonite was wetted and the annulus was cement grouted to the surface. A protective steel outer casing was installed at the surface, and wells were equipped with submersible, dedicated pumps (type not known). Inspection of the surface seal and casings at the time of the site visit indicated good well integrity.

4.2 Monitoring Data

At the time of the inspection, the site was in its first year of monitoring. Background data had been accumulated for four quarterly sampling events, but statistical analysis of the data was not applicable at the time of the inspection.

Review of the first three quarterly sampling analytical results indicates that ground-water quality results are below EPA current interim primary drinking water standards with the exception of fluoride levels for wells A, B, and C in the first quarter analyses and fecal coliform bacteria levels for wells B, C, and D in the first quarter analyses. Elevated fluoride levels may be attributed to natural background levels due to the age of the ground water and the Ogallala provenance and considering the lack of any identified fluoride-rich waste stream at the site. The cause for elevated fecal coliform levels is not known; however, site personnel indicate that test methods may be at fault. Analytical data from subsequent reporting periods do not establish a trend for either parameter.

Versar obtained split samples during the fourth quarter (1985) sampling event. The results are included as Appendix I of this report. Data from the facility's first three quarters (1985) are included as Appendix IV. Comparison of the facility's fourth quarter analytical data and Versar's data was not possible because the facility's data was not available for review at the time of this report.

Comparison of Versar's data with the facility's first three quarters (1985) show good correlation. In some instances, the facility's detection limits are different than Versar's and comparison is difficult. For instance for chromium the facility's level of detection

is at or above the maximum contaminant limits for drinking water supplies. However, Cannon AFB's and Versar's data indicate that the monitored ground-water quality is good with respect to interim primary drinking water standards, indicators of ground-water contamination parameters, and drinking water suitability parameters.

Some items of concern to the inspection team were noted; first is the current lack of analytical data for the first and third quarters of RCRA Appendix III pesticide constituents. This problem was addressed during the site visit. Due to a contract oversight, the first quarter analyses for these constituents were not obtained. It is the intent of the Cannon AFB personnel to have an additional sampling event to obtain the necessary analytes and to include this information in the first year's data base. Cannon AFB has agreed to conduct additional monitoring events to obtain the requisite number of data points for all parameters (U.S. EPA, 1987). Other problems with analytical data are summarized in Table 2. Additionally, Cannon AFB did not measure the well water levels at the time of the fourth quarter (1985) sampling event. According to site personnel, the probe used during the previous two sampling events was not available at that time. Well elevations were, however, obtained 2 weeks after the completion of the fourth quarter sampling event.

From the data from the first two sampling events, it is apparent that Cannon AFB collected and analyzed samples for the required first year RCRA interim status parameters, with the exceptions noted in Table 3.

There are problems with the current acquisition of monitoring data. These problems may be associated with oversight during collection, laboratory oversight, or coordination between the sampling supervisor and the laboratory. Due to the

TABLE 3: MONITORING DATA GAPS OR PROBLEMS

Parameter	Problem
Pesticide/Herbicides	No data for first quarter and incomplete data for third quarter.
Radiation	No data for radium or gross beta.
Phenols	No data for second quarter.
TOH	No indication that four replicates for upgradient well A were analyzed in the first quarter. Only three replicates in second quarter. Not analyzed in third quarter.
TOC	No indication that four replicates for well A were analyzed in the first quarter.
Specific Conductance	No indication that four replicates for well A were analyzed in the first quarter.
pH	No indication that four replicates for well A were analyzed in the first or second quarters.
Fluoride	Not analyzed in third quarter.

Note: This table was compiled from review of facility analytical data forms.

importance of data acquisition for developing the background statistical norms for indicator parameters, it is recommended that current information gaps be filled by collection of additional data. Additionally, the development of protocol or standard operating procedures that will result in more complete data acquisition is suggested.

4.3 Ground-Water Quality Assessment Plan Outline

At the time of this inspection, the facility had not yet completed its first year of background ground-water monitoring. The facility contact stated that a ground-water quality assessment outline was not required until after completion of the first year of data accumulation. However, the facility provided a draft version of its Ground-Water Quality Assessment Plan Outline. This is included as Appendix III of this report. This plan roughly outlines steps to be taken in the event a statistical triggering of the RCRA indicator parameters occurs. Upon detecting an initial increase, the following steps will be taken:

- Wells will be immediately resampled to evaluate and confirm the initial analytical results.
- Sampling-event frequency will be increased to quarterly.
- TOC and TOH analyses will be replaced with TOC and TOH screens to quantify contaminants.
- Rates and direction of contaminant movement will be evaluated.
- Evaluation of the plume should consider listed factors and both heavy immiscible and lighter fractionates.
- At the time of the initial confirmation, a specific plan for a ground-water quality assessment program will be prepared by the Occupational and Environmental Health Laboratory Consultant Services Division.

The draft outline appears to describe an assessment program that is more comprehensive than the existing program. It allows for determining hazardous waste or hazardous constituents in the ground water and the rate and extent of migration. It is, however, vague in specifying the means necessary to achieve these milestones. In determination of hazardous constituents, the reference to TOC and TOH "screens" should be clarified, and the facility should specifically state whether its means of determining the rate and extent will be based on direct or indirect methods of data accumulation.

5.0 FIELD SAMPLING EVALUATION

5.1 Sampling and Analysis Plan

Cannon AFB's sampling and analysis plan is included as Appendix V. In general, this appears to meet the requirements set forth in 40 CFR, Part 265, Subpart F. However, two problems were noted: (1) the analytical method for radium, gross alpha, and beta radiation is not listed, and (2) the method of measuring temperature is not listed. This may be important because the method currently used for measuring specific conductivity uses a probe that is not temperature compensating.

5.2 Sampling Methods and Equipment

The fourth quarter sampling event was observed by the inspection team. The observed sampling protocol was as follows:

- Wells were purged of approximately five well volumes of water immediately prior to sampling.
- Well water levels were not obtained due to a lack of adequate equipment.
- TOX samples were collected in three 40-ML VOA bottles and were not preserved.
- TOC, phenols, metals, radiation, and TOX samples were collected in quart volume "cubitainers." Pesticides were collected in amber glass containers with Teflon lids.
- Samples were preserved in the following manner immediately following collection:
  - Sample bottles were lined up on the pickup tailgate and preservative was pipetted into samples as follows:
    - -- Nitrates, TOC, and phenols were preserved with sulfuric acid to pH < 2.
    - -- Metals and radiation samples were preserved with nitric acid to pH < 2.

- Pesticides and TOX samples were unpreserved.

- o pH was determined in the field with a colormetric device. However, the facility usually uses a Hach mini meter that was not working at the time of the CME inspection (U.S. EPA, 1987).

- o Specific conductivity was obtained at all wells using a Hach kit.

- o Samples were preserved by refrigeration after transport to Cannon AFB's Bioenvironmental Engineering facility between well sampling events.

5.3 Field Quality Assurance Deficiencies

5.3.1 Sample Handling and Contamination

Some problems were noted with the field procedure for sample handling and for prevention of contamination. Significant problems noted were:

- o During the initial stage of sample collection at well A, a base operation interrupted sample collection. As a result, samples were left in the open, unattended and unpreserved, for a period of approximately 2 hours. All log books and sampling equipment were also left at the sampling point during this interruption.

- o Field personnel were observed to exhale into cubitainers to inflate them. This process should be discontinued due to potential contamination of the sampling container.

- o Field personnel were observed ~~to~~ smoke cigarettes in close proximity to samples and sample equipment.

- o Field personnel used pH paper to verify acidification of preserved samples to pH $\leq$ 2. As part of this procedure, pH paper was dipped into the sample container. This procedure may lead to contamination of samples.

5.3.2 Sample Preservation and Documentation

In general, sample preservation was observed to conform to the requirements of the regulations. However, two potential problems were observed:

- Sample preservation methods observed were potentially excessive and present the possibility of contaminant introduction. During preservation, aliquots of nitric and sulfuric acid were handled in close proximity to open samples that were either unpreserved or already preserved. The possibility of introducing nitric acid (for example) into a nitrate sample or other similar contamination is possible during such handling.
- Considerable amounts of preservative were added to some samples. Introduction of excessive amounts of preservative should be avoided.

Documentation problems were observed in the field. The field crew mistakenly identified monitoring well C as well D and vice versa during the sampling event. The wells are not currently labeled and, although samples were later re-labeled correctly in the staging area, this constitutes a system problem which should be addressed by permanently labeling monitoring wells.

5.3.3 Chain-of-Custody Documentation

All samples were pre-labeled. The inspection team did not observe that chain-of-custody documents were filled out during the sampling event. According to 2nd Lt. Walton, these forms are filled out in the Bioenvironmental Engineering area following collection and prior to shipment. This may not present a problem at this point due to the small number of wells and parameters; however, it is suggested that chain-of-custody forms be filled out immediately after sample collection to assure the integrity of the custody and to aid in subsequent tracking of samples.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The purpose of this inspection was to determine the compliance of Cannon AFB with the requirements of 40 CFR, Part 265, Subpart F.

The facility installed four wells to monitor trench No. 3 of landfill No. 5, which was the waste management area defined by the closure and post-closure plan submitted by Cannon AFB in 1985. Currently, the ground-water monitoring system has three monitoring wells that have been installed downgradient of landfill No. 5. Of these, only well B may be truly downgradient of the regulated No. 3 trench. Additionally, upgradient well A is potentially downgradient of other potential solid waste management units (sites No. 11 and No. 12). It is recommended that the site either expand the waste management area to include all of landfill No. 5 (which will require a change in the scope of the closure and post-closure plan) or install two additional wells that are truly downgradient of the regulated unit. An alternative would be to monitor that area of landfill No. 5 that received liquid waste (trenches operated between 1972 and 1981). This would require the installation of a replacement well for well D. It is also suggested that data from the upgradient position of well A be closely scrutinized in terms of potential contamination from upgradient sources.

Currently, the analytical data do not indicate that the site has impacted water quality in the landfill No. 5 area. The confined nature of the ground-water system appears to lessen the potential for contamination from surface sources in the landfill area, and subsurface soil samples in the landfill do not indicate the presence of volatile organic constituents above one part per million. However, due to the unconsolidated nature of much of the Ogallala formation, the confining unit may represent an aquitard and not

an aquaclude in the site area. Due to the depth of the ground-water system, it is also possible that subsurface infiltration of contaminants may not be vertical but may migrate some distance laterally before reaching the aquifer system. The present placement of the downgradient wells may provide, in this case, valuable data relating to the regulated unit. It is suggested that if additional wells are placed downgradient of the regulated unit to meet RCRA regulatory requirements, that the existing wells should be retained in the monitoring system.

Some problems were found with both the sample handling techniques and the documentation of samples. The latter relates to the need to identify wells with permanent labels. The former requires some modification in the handling and preservation procedures for samples as identified in Section 5.3.

There are gaps in the site's analytical data. These gaps appear to have resulted from miscommunication between the laboratory and facility personnel. SOPs should be developed for site-lab coordination, and additional sampling events should be conducted to fill existing data gaps. It should be noted that when any samples are obtained, RCRA regulations require that well water level measurements also be obtained.

The RCRA status of the sites No. 11, No. 12, and No. 9 is not ascertainable without further investigation. If any of these sites, active since November 19, 1980, have received hazardous waste since this date of implementation, then these sites are not in compliance with the requirements of 40 CFR, Part 265, Subpart F. Due to the impact of the 1984 amendments to RCRA (3008 and 3004), these units may be considered SWMUs and fall under the regulatory requirements of 40 CFR, Part 265, Subpart F.

The facility should obtain the equipment necessary to measure the well depths at each sampling event. Additionally, the facility should allocate the time necessary for the sampling crew to collect and preserve the samples in an uninterrupted manner for the duration of each sampling event.

Technical deficiencies and regulatory violations found at the Cannon AFB facility are provided below:

(For purpose of this report, the term violation is used for practices which are not in accordance with the regulations set forth in 40 CFR, 265, Subpart F. Violations can be directly connected to specific requirements in these regulations. Practices or procedures not specifically prohibited by regulations set forth in 40 CFR, 265, Subpart F, but not meeting the spirit or intent of the regulations are termed deficiencies. Additionally, practices are termed deficient if they are not equivalent to preferred methods recommended in guidance documents referenced in 40 CFR, 265, Subpart F. Deficiencies, if left unattended, may lead to violations of 40 CFR, 265, Subpart F.)

Technical Deficiences

1. During the inspection it become apparent that the facility does not provide the time necessary for an uninterrupted sampling event.

2. Monitoring wells are not currently labeled.

3. The sampling protocol does not include temperature as a parameter at each well.

4. Current sample handling techniques should be modified to assure that the potential for contamination during sample handling is lessened.

5. Pesticide parameters were not analyzed during the first quarter sampling event (this is not listed as a violation due to the explanation and expected corrective procedure outined in Section 4.2).

6. The facility located upgradient well A in a position where it may potentially be affected by other facility contaminant sources.

7. The ground-water elevation was not determined at the time of the fourth quarter sampling event. 40 CFR 265.92 (e) requires that the elevation of the ground-water surface be obtained each time a sample is collected. Well elevations were, however, obtained 2 weeks after the completion of the fourth quarter sampling event.

8. Analytical methods for radiation parameters are not included in the sampling and analysis plan.

Regulatory Violations

1. The site does not currently have a sufficient number of wells downgradient of the regulated unit (trench No. 3 of landfill No. 5) . Three monitoring wells are required downgradient of the regulated unit (40 CFR, 265.91 (a)(2)).

2. Four replicates were not obtained for all "parameters to be used as indicators of ground-water contamination," as required by 40 CFR 265.92 (c)(2).

3. The facility has not analyzed for all required EPA primary interim drinking water standards or parameters establishing ground-water quality on a quarterly basis, as required by 40 CFR 265.92 (c)(1).

REFERENCES

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(2) Claassen, Anne, 1985, Water Resources specialist, New Mexico Department of Environmental Quality. Personal communication wth Tom Hahne, Versar Inc. (September 1985).

(3) Hazardous Materials Technical Center, 1985a. RCRA Part B Permit Application, Cannon Air Force Base DPDO-Cannon.

(4) Hazardous Materials Technical Center, 1985b. Hazardous Waste Management Survey, Cannon Air Force Base.

(5) Hazardous Materials Technical Center, 1985c. Closure and Post Closure Plans for Landfill Trench at Cannon Air Force Base.

(6) Henderson, Jim, Environmental Scientist, New Mexico Environmental Improvement Division. Personal communication with Tom Hahne, Versar, Inc. (January 1987).

(7) Lyndick Engineering Services, 1971. Sanitary Fill Location Plan, Cannon Air Force Base.

(8) Radian Corporation, 1983. Presurvey for Phase II Installation Restoration Program, Cannon AFB, New Mexico.

(9) Radian Corporation, 1984. Installation Restoration Program Phase II, Stage I, Task Description, Cannon AFB NM.

(10) Radian Corporation, 1985. Draft Installation Restoration Program Phase II, Stage II.

(11) Walton, Robert, 1985, 2nd lieutenant, 27th Tactical Fight Wing, United States Air Force. Personnel communication with Tom Hahne, Versar Inc. (September 1985).

(12) U.S. EPA, 1987. Letter from Sam Becker, Chief, Hazardous Waste Compliance Branch, to Dr. Thomas D. Brisbin, Planning Research Corporation, dated January 2, 1987.

Appendix I

Versar Laboratory Analytical Data

PRC Engineering
Suite 600
303 East Wacker Drive
Chicago, IL 60601
312-938-0300
TWX 910-2215112
Cable CONTOWENG

prc
Planning Research Corporation

To: Linda Thompson, U.S. EPA Region 6

From: Shin Ahn, PRC Environmental Management, Inc.

Subject: Cannon AFB, New Mexico, Sampling-Field Quality Control

Date: December 9, 1985

Sampling was conducted on September 25, 1985. Sample replicates were obtained from Cannon AFB sampling personnel for all facility sampling parameters. Additionally, volatile organics samples were collected. Specific conductance, pH, and temperature were analyzed by Versar personnel in the field. Following the collection of samples, Versar standard operating procedures were conducted for proper sample collection, preservation, handling, and shipment. Chain of custody was maintained and chain of custody forms were completed prior to shipment of samples to Versar laboratories.

In order to gauge potential sources of field and laboratory error, two types of quality control samples were collected in two field.

* A field blank was poured at the sampling location at well A. This field blank was subsequently analyzed for all parameters.

* A triplicate sample was collected at well D. The triplicate sample was submitted as a blind sample to the Versar laboratory. The triplicate was analyzed for all parameters.

In addition to the above quality control samples, a trip blank prepared at the Versar Laboratory was brought to the site. The trip blank was analyzed for only volatile organics.

The results of the analyses have been tabulated and are included as an attachment to this memorandum. This table was prepared from the analytical data (attached in Appendix I) submitted to PRC from the Versar Inc. Laboratory.

Review of the analytical results indicates that flouride levels for all wells exceeded the maximum contaminant level (2.4 mg/L) of the National Interim Primary Drinking Water Regulations (40 CFR 141). Manganese concentration (0.198 mg/L) for well B also exceeded the maximum contaminant level of the National Secondary Drinking Water Regulations (0.05 mg/L) (40 CFR 143.3).

SUMMARY OF ANALYTICAL RESULTS

Parameter	Well A	Well B	Well C	Well D	Well D	Well D	Field Blank
Arsenic (ug/L)	<10	<10	<10	<10	<10	<10	<10
Barium (ug/L)	35	58	30	38	38	44	1.7
Cadmium (ug/L)	<10	<10	<10	<10	<10	<10	<10
Chromium (ug/L)	<3	<3	<3	<3	<3	<3	<3
Fluoride (mg/L)	2.7	2.5	2.6	2.6	2.6	2.6	0.01
Lead (ug/L)	<5	<5	<5	86 [1]	<5	<5	<5
Mercury (ug/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nitrate (mg/L as N)	1.2	0.9	1.2	1.3	1.3	1.1	<0.1
Selenium (ug/L)	5.5	5.4	7.1	8.3	5.3	5.4	<5
Silver (ug/L)	<3	<3	<3	<3	<3	<3	<3
Endrin (ug/L)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Lindane (ug/L)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Methoxychlor (ug/L)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Toxaphene (ug/L)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,4-D (ug/L)	<1	<1	<1	<1	<1	<1	<1
2,4,5-TP Silvex (ug/L)	<1	<1	<1	<1	<1	<1	<1
Gross Alpha (pCi/L)	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<1.5
Gross Beta (pC/L)	16	5.2	8	6.1	6.2	9.0	4.7
Radium 226 (PC/L)	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Radium 228 (pc/L)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloride (mg/L)	53	51	54	53	52	52	<1
Iron (ug/L)	21	68	12	5.6	9.3	7.9	<3
Manganese (ug/L)	2	198	2.5	12	12	12	12

Parameter	Well A	Well B	Well C	Well D	Well D	Well D	Field Blank
Phenols (mg/L)	0.01	0.009	0.016	0.007	<0.005	<0.005	0.016 (0.008)[2]
Sodium (mg/L)	57.5	61.5	49.3	44.9	43.9	51.3	0.26
Sulfate (mg/L)	110	180	99	100	94	93	<1
pH (pH units)	7.48	7.55	7.51	7.42			
Specific Conductance[3] (umhos)	760	780	780	705			
Temperature (°c)	19.8	15.5	19.5	19.8			
Total Organic Carbon (mg/L)	2.8	1.8	1.5	1.5	1.2	1.2	1.1
Total Organic Halogen (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Volatile Organics[4] (ug/L)	ND[5]	ND	ND	ND	ND	ND	See Footnote 6

Note:

1) The high value is almost certainly due to spurious sample concentraction.

2) Duplicate Value.

3) Specific conductance values reported are average values determined by Cannon AFB personnel. Versar YSI meter was mulfunctioning at the time of sample collection.

4) Volatile organics were also not detected in the trip blank.

5) ND = Not Detected.

6) Methyl Cyclopentane and Hexane were detected at 0.005 mg/L and 0.024 mg/L, respectively. These two hydrocarbons tentatively identified in the field blank are almost certainly due to spurious contamination of the blank during preparation in the laboratory.

Versar INC.

December 4, 1985

Shin Ahn
PRC Engineering
303 East Wacker Drive
Suite 600
Chicago, Illinois 60601

Reference: EPA Contract No. 68-01-7037, WA 223

Dear Shin:

Enclosed are results of chemical analyses of well water samples collected at Cannon Air Force Base, New Mexico. This transmittal completes the analyses requested. Results of some analyses are presented in summary tables; results of pesticide, herbicide, and volatile organic compound determinations are provided in the laboratory report data sheets as follows:

1. Common parameters are presented in summary form in Attachment 1. Results of duplicate, spike, certified standard, field blank, and reagent blank analyses are shown as well.

2. Radiochemical parameters are presented in Attachment 2.

3. EP metals concentrations are summarized in the lead table of Attachment 3. The laboratory reports data sheets, including results of quality assurance analyses, are included with the attachment. Please note the anomalously high lead concentration in the Well D sample. That value is almost certainly due to spurious sample contamination because it was not observed in either of the duplicate samples (Well E and Well F). The value should be ignored.

4. Volatile organic compound analyses are presented in Attachment 4. Two hydrocarbons tentatively identified in the field blank are almost certainly due to spurious contamination of the blank during preparation in the laboratory. No volatiles were detected in any samples.

5. Pesticide analyses are presented in Attachment 5. No pesticides were detected in any of the samples.

6. Herbicide analyses are presented in Attachment 6. No herbicides were detected in any of the samples at a detection limit of 1 ug/l.

If you have any questions about the analyses, please call Wesley Bradford at (703) 642-6744.

Sincerely,

Robert Murphy
Program Manager

RM:mar
Enclosures

6850 VERSAR CENTER • P.O. BOX 1549 • SPRINGFIELD, VIRGINIA 22151 • TELEPHONE: (703) 750-3000 • TELEX: 901125

ATTACHMENT 1

RESULTS OF ANALYSES OF WELL WATER SAMPLES
(Concentrations in milligrams/liter)

CANNON AIR FORCE BASE, NEW MEXICO
PROJECT: EPA 68-01-7037, WA 223

Field Sample Nos.	Sample	TOX	TOC	Phenols	Sulfate	Chloride	Fluoride	Nitrate (N)
10907-10911	Well A	<0.01	2.8	0.010	110	53	2.7	1.2
	Duplicates		2.8					1.2
	Spike*		10.9					
10943-10947	Well B	<0.01	1.8	0.009	180	51	2.5	0.9
	Spike Recovery	96%						
10952-10956	Well C	<0.01	1.5	0.016	99	54	2.6	1.2
10916-10920	Well D	<0.01	1.5	0.007	100	53	2.6	1.3
10925-10929	Well E[1]	<0.01	1.2	<0.005	94	52	2.6	1.3
10934-10938	Well F[1]	<0.01	1.2	<0.005	93	52	2.6	1.1
	Duplicates	<0.01					2.6	
	Spike*						12.4	
10898-10902	Field Blank	<0.01	1.1	0.016	<1	<1	0.01	<0.1
	Duplicate			0.008				
ERA Standard			29	0.15		308	4.2	4.0
(Certified concentration)			(33)	(0.119)		(323)	(4.2)	(4.4)
*Concentration of Spike			10.0				10.0	
Reagent Blank				0.007			0.02	0.0

[1]Wells E and F are blind triplicates of Well D sample.

ATTACHMENT 2

RADIOCHEMICAL DATA
CANNON AIR FORCE BASE, NEW MEXICO, WELLS
PROJECT: EPA 68-01-7037, WA 223

Parameter	Method[1]	Well A	Well B	Well C	Well D	Well E[2]	Well F[2]	Field Blank
		Field Sample Number						
		10912	10948	10957	10921	10930	10939	10903
Alpha, Gross (pC/L)	900.0	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<1.5
Alpha, Gross; Counting Error (pC/L)		NA[3]	NA	NA	NA	NA	NA	NA
Beta, Gross (pC/L)	900.0	16	5.2	8.0	6.1	6.2	9.0	4.7
Beta, Gross; Counting Error (pC/L)		2.8	2.0	1.7	2.1	2.4	2.0	1.9
Radium 226 (pC/L)	903.1	0.1	0.1	0.1	0.3	0.2	0.2	0.1
Radium 226; Counting Error (pC/L)		0.1	0.1	0.1	0.1	0.1	0.1	0.1
Radium 228, (pC/L)	Footnote 4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Radium 228; Counting Error (pC/L)		NA[3]	NA	NA	NA	NA	NA	NA

[1]US EPA 600/4-80-032, August 1980, except as noted.
[2]Blind triplicates of Well D sample.
[3]NA = Counting error not applicable when counts are below detection limit of the method.
[4]Percibel, D.R. and Martin, D.B. 1974. Sequential Determination of Radium 226 and 228, Actinium 227 and Thorium Isotopes in Environmental and Process Waste Samples. Analytical Chemistry, 46.1742. (Method approved by EPA for analysis of drinking water)

ATTACHMENT 3

SUMMARY OF EP METALS CONCENTRATIONS IN WELL WATER
CANNON AIR FORCE BASE, NEW MEXICO, WELLS
PROJECT: EPA 68-01-7037, WA 223

Parameter	Well A	Well B	Well C	Well D	Well E[1]	Well F[1]	Field Blank
	Field Sample Number						
	10906	10942	10951	10915	10924	10933	10897
Arsenic (ug/l)	<10	<10	<10	<10	<10	<10	<10
Barium (ug/l)	35	58	30	38	38	44	1.7
Cadmium (ug/l)	<10	<10	<10	<10	<10	<10	<10
Chromium (ug/l)	<3	<3	<3	<3	<3	<3	<3
Iron (ug/l)	21	68	12	5.6	9.3	7.9	<3
Lead (ug/l)	<5	<5	<5	86	<5	<5	<5
Manganese (ug/l)	2.0	198	2.5	12	12	12	12
Mercury (ug/l)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Silver (ug/l)	<3	<3	<3	<3	<3	<3	<3
Selenium (ug/l)	5.5	5.4	7.1	8.3	5.3	5.4	<5
Sodium (mg/l)	57.5	61.5	49.3	44.9	43.9	51.3	0.26

[1]Blind triplicates of Well D sample.

VERSAR INC.

Date: 19-Nov-85
Project#: 914.031.03-1
Lab#: 1457
Sample#: 10906
Well A

Laboratory Operations
Trace Metals Section
Metals Results

(Conc. in: ug/l)

Parameter	Sample Concentration	Parameter	Sample Concentration
Barium	35.	Arsenic	<10.
Cadmium	<10.	Lead	<5.
Chromium	<3.	Mercury	<0.2
Iron	21.	Selenium	5.5
Manganese	2.0		
Silver	<3.		
Sodium	57500.		

Comments:

Robert Maxfield,
Lab Manager

Procedure in accordance with:
Test Methods for Evaluating
Solid Waste, SW-846, Second Edition
USEPA, Washington D.C., 1982

6850 VERSAR CENTER • P.O. BOX 1549 • SPRINGFIELD, VIRGINIA 22151 • TELEPHONE: (703) 750-3000 • TELEX: 901125

Versar INC.

Date: 19-Nov-85
Project#: 914.031.03-1
Lab#: 1461
Sample#: 10942
Well B

Laboratory Operations
Trace Metals Section
Metals Results

(Conc. in: ug/l)

Parameter	Sample Concentration	Parameter	Sample Concentration
Barium	58.	Arsenic	<10.
Cadmium	<10.	Lead	<5.
Chromium	<3.	Mercury	<0.2
Iron	68.	Selenium	5.4
Manganese	198.		
Silver	<3.		
Sodium	61500.		

Comments:

Robert Maxfield,
Lab Manager

Procedure in accordance with:
Test Methods for Evaluating
Solid Waste, SW-846, Second Edition
USEPA, Washington D.C., 1982

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Versar INC.

Date: 19-Nov-85
Project#: 914.031.03-1
Lab#: 1462
Sample#: 10951
Well C

Laboratory Operations
Trace Metals Section
Metals Results

(Conc. in: ug/l)

Parameter	Sample Concentration	Parameter	Sample Concentration
Barium	30.	Arsenic	<10.
Cadmium	<10.	Lead	<5.
Chromium	<3.	Mercury	<0.2
Iron	12.	Selenium	7.1
Manganese	2.5		
Silver	<3.		
Sodium	49300.		

Comments:

Robert Maxfield,
Lab Manager

Procedure in accordance with:
Test Methods for Evaluating
Solid Waste, SW-846, Second Edition
USEPA, Washington D.C., 1982

Versar INC.

Date: 19-Nov-85
Project#: 914.031.03-1
Lab#: 1458
Sample#: 10915
Well D

Laboratory Operations
Trace Metals Section
Metals Results

(Conc. in: ug/l)

Parameter	Sample Concentration	Parameter	Sample Concentration
Barium	38.	Arsenic	<10.
Cadmium	<10.	Lead	86.
Chromium	<3.	Mercury	<0.2
Iron	5.6	Selenium	8.3
Manganese	12.		
Silver	<3.		
Sodium	44900.		

Comments:

Robert Maxfield,
Lab Manager

Procedure in accordance with:
Test Methods for Evaluating
Solid Waste, SW-846, Second Edition
USEPA, Washington D.C., 1982

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Versar INC.

Date: 19-Nov-85
Project#: 914.031.03-1
Lab#: 1459
Sample#: 10924
Well E

Laboratory Operations
Trace Metals Section
Metals Results

(Conc. in: ug/l)

Parameter	Sample Concentration	Parameter	Sample Concentration
Barium	38.	Arsenic	<10.
Cadmium	<10.	Lead	<5.
Chromium	<3.	Mercury	<0.2
Iron	9.3	Selenium	5.3
Manganese	12.		
Silver	<3.		
Sodium	43900.		

Comments:

Robert Maxfield,
Lab Manager

Procedure in accordance with:
Test Methods for Evaluating
Solid Waste, SW-846, Second Edition
USEPA, Washington D.C., 1982

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Versar INC.

Date: 19-Nov-85
Project#: 914.031.03-1
Lab#: 1460
Sample#: 10933
Well F

Laboratory Operations
Trace Metals Section
Metals Results

(Conc. in: ug/l)

Parameter	Sample Concentration	Parameter	Sample Concentration
Barium	44.	Arsenic	<10.
Cadmium	<10.	Lead	<5.
Chromium	<3.	Mercury	<0.2
Iron	7.9	Selenium	5.4
Manganese	12.		
Silver	<3.		
Sodium	51300.		

Comments:

Procedure in accordance with:
Test Methods for Evaluating
Solid Waste, SW-846, Second Edition
USEPA, Washington D.C., 1982

Robert Maxfield,
Lab Manager

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Versar INC.

Date: 19-Nov-85
Project#: 914.031.03-1
Lab#: 1456
Sample#: 10897
Field Blank

Laboratory Operations
Trace Metals Section
Metals Results

(Conc. in: ug/l)

Parameter	Sample Concentration	Parameter	Sample Concentration
Barium	1.7	Arsenic	<10.
Cadmium	<10.	Lead	<5.
Chromium	<3.	Mercury	0.2
Iron	<3.	Selenium	<5.
Manganese	<2.		
Silver	<3.		
Sodium	259.		

Comments:

Robert Maxfield,
Lab Manager

Procedure in accordance with:
Test Methods for Evaluating
Solid Waste, SW-846, Second Edition
USEPA, Washington D.C., 1982

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VERSAR, INC.

LABORATORY OPERATIONS
TRACE METALS SECTION
QUALITY ASSURANCE DATA

Date: 19-Nov-85
Batch: 914.031.03-1

ICP Analysis
(Conc. in: ug/l)

		Ba	Cd	Cr	Fe	Mn	Ag	Na
Reference Standard	Found	427.00	254.00	303.00	791.00	351.00	67.00	47900.00
	True	437.00	235.00	311.00	796.00	346.00	68.00	46500.00
	Rel. % Err.	-2.29	8.09	-2.57	-0.63	1.45	-1.47	3.01
CALB. BLK.	Results	<1.	<10.	<3.	<3.	<2.	<3.	<34.
REG. BLK.1	Results	<1.	<10.	<3.	<3.	<2.	<3.	<34.
REG. BLK.2	Results							
Check Standard	Found	430.00	259.00	309.00	804.00	357.00	68.00	48500.00
	True	437.00	235.00	311.00	796.00	346.00	68.00	46500.00
	Rel. % Err.	-1.60	10.21	-0.64	1.01	3.18	0.00	4.30
DUPLICATE 1								
Sample #: 10897	Samp. Result	1.70	<10.	<3.	<3.	<2.	<3.	259.00
	Dup. Result	1.90	27.	<3.	<3.	<2.	<3.	290.00
	RPD	11.11	-	-	-	-	-	11.29
DUPLICATE 2								
Sample #:	Samp. Result							
	Dup. Result							
	RPD							
SPIKE 1	Samp. Result	1.70	<10.	<3.	<3.	<2.	<3.	259.00
Sample #: 10897	Spike Result	182.00	176.00	183.00	172.00	182.00	172.00	2060.00
	Spike added	200.00	200.00	200.00	200.00	200.00	200.00	2000.00
	% Recovery	90.15	88.00	91.50	86.00	91.00	86.00	90.05
SPIKE 2	Samp. Result							
Sample #:	Spike Result							
	Spike added							
	% Recovery							

VERSAR, INC.

LABORATORY OPERATIONS
TRACE METALS SECTION
QUALITY ASSURANCE DATA

Date: 19-Nov-85
Batch: 914.031.03-1

AA Analysis
(Conc. in: ug/l)

		As	Hg	Pb	Se				
Reference Standard	Found	57.00	3.70	46.00	49.00				
	True	53.40	3.60	45.00	50.20				
	Rel. % Err.	6.74	2.78	2.22	-2.39				
CALB. BLK.	Results	<10.	<0.2	<5.	<5.				
REG. BLK.1	Results	<10.	<0.2	<5.	<5.				
REG. BLK.2	Results								
Check Standard	Found	60.00	2.30	71.00	47.00				
	True	53.40	2.50	70.00	50.20				
	Rel. % Err.	12.36	-8.00	1.43	-6.37				
DUPLICATE 1 Sample #: 10897	Samp. Result	<10.		<5.	<5.				
	Dup. Result	<10.		<5.	<5.				
	RPD	-		-	-				
DUPLICATE 2 Sample #: 10915	Samp. Result		<0.2						
	Dup. Result		<0.2						
	RPD		-						
SPIKE 1 Sample #: 10897	Samp. Result	<10.		<5.	<5.				
	Spike Result	44.00		74.00	40.00				
	Spike added	50.00		50.00	50.00				
	% Recovery	88.00		148.00	80.00				
SPIKE 2 Sample #: 10915	Samp. Result		<0.2						
	Spike Result		0.80						
	Spike added		1.00						
	% Recovery		80.00						

ATTACHMENT 4
RESULTS OF VOLATILE ORGANIC COMPOUND ANALYSES
CANNON AIR FORCE BASE, NEW MEXICO
PROJECT: EPA 68-01-7037, WA 223

Versar INC.

October 16, 1985

To: Bob Murphy
From: Scott Powers
Subject: Analytical Report for 914.031.03

The attached analytical report is for the GCMS analysis of eight samples for volatiles organics received in the lab on 9/27/85. There were no detectable levels of volatile organics in seven of the samples. One sample had two tentatively identified hydrocarbon peaks at low part per billion levels. The samples were analyzed using the USEPA-CLP methods. Should you have any questions, give me a call.

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Sample Number
10904
Well A

Organics Analysis Data Sheet
(Page 1)

Laboratory Name: VERSAR, INC.
Case No: 914 0313
Lab Sample ID No: 1442A
QC Report No: 914 0313
Sample Matrix: LOW LEVEL AQUEOUS
Contract No:
Data Release Authorized By:
Date Sample Received: 9-27-85

Volatile Compounds

Concentration: Low Medium (Circle One)
Date Extracted/Prepared: 9/30/85
Date Analyzed: 9/30/85
Conc/Dil Factor: 1.0 pH —
Percent Moisture: 100%
Percent Moisture (Decanted): —

CAS Number		ug/l or ug/Kg (Circle One)
74-87-3	Chloromethane	10u
74-83-9	Bromomethane	10u
75-01-4	Vinyl Chloride	10u
75-00-3	Chloroethane	10u
75-09-2	Methylene Chloride	5u
67-64-1	Acetone	10u
75-15-0	Carbon Disulfide	5u
75-35-4	1, 1-Dichloroethene	5u
75-34-3	1, 1-Dichloroethane	5u
156-60-5	Trans-1, 2-Dichloroethene	5u
67-66-3	Chloroform	5u
107-06-2	1, 2-Dichloroethane	5u
78-93-3	2-Butanone	10u
71-55-6	1, 1, 1-Trichloroethane	5u
56-23-5	Carbon Tetrachloride	5u
108-05-4	Vinyl Acetate	10u
75-27-4	Bromodichloromethane	5u

CAS Number		ug/l or ug/Kg (Circle One)
79-34-5	1, 1, 2, 2-Tetrachloroethane	5u
78-87-5	1, 2-Dichloropropane	5u
10061-02-6	Trans-1, 3-Dichloropropene	5u
79-01-6	Trichloroethene	5u
124-48-1	Dibromochloromethane	5u
79-00-5	1, 1, 2-Trichloroethane	5u
71-43-2	Benzene	5u
10061-01-5	cis-1, 3-Dichloropropene	5u
110-75-8	2-Chloroethylvinylether	10u
75-25-2	Bromoform	5u
591-78-6	2-Hexanone	10u
108-10-1	4-Methyl-2-Pentanone	10u
127-18-4	Tetrachloroethene	5u
108-88-3	Toluene	5u
108-90-7	Chlorobenzene	5u
100-41-4	Ethylbenzene	5u
100-42-5	Styrene	5u
	Total Xylenes	5u

Data Reporting Qualifiers

For reporting results to EPA, the following results qualifiers are used. Additional flags or footnotes explaining results are encouraged. However, the definition of each flag must be explicit.

Value If the result is a value greater than or equal to the detection limit, report the value.

U Indicates compound was analyzed for but not detected. Report the minimum detection limit for the sample with the U (e.g., 10U) based on necessary concentration/dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read: U-Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero. (e.g., 10J)

C This flag applies to pesticide parameters where the identification has been confirmed by GC/MS. Single component pesticides≥10 ng/ul in the final extract should be confirmed by GC/MS.

B This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

Other Other specific flags and footnotes may be required to properly define the results. If used, they must be fully described and such description attached to the data summary report.

Sample Number
10904

Organics Analysis Data Sheet

Tentatively Identified Compounds

CAS Number	Compound Name	Fraction	RT or Scan Number	Estimated Concentration (ug/l or ug/kg)
1. —	No Volatiles Detected	VOA	—	—
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
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20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				

Sample Number
10940
well B

Organics Analysis Data Sheet
(Page 1)

Laboratory Name: VERSAR, INC.
Case No: 914 0313
Lab Sample ID No: 1446 A
QC Report No: 914 0313
Sample Matrix: LOW LEVEL AQUEOUS
Contract No:
Data Release Authorized By:
Date Sample Received: 9-27-85

Volatile Compounds

Concentration: Low Medium (Circle One)
Date Extracted/Prepared: 9/30/85
Date Analyzed: 9/30/85
Conc/Dil Factor: 1.0 pH —
Percent Moisture: 100 %
Percent Moisture (Decanted): —

CAS Number		ug/l or ug/Kg (Circle One)
74-87-3	Chloromethane	10u
74-83-9	Bromomethane	10u
75-01-4	Vinyl Chloride	10u
75-00-3	Chloroethane	10u
75-09-2	Methylene Chloride	5u
67-64-1	Acetone	10u
75-15-0	Carbon Disulfide	5u
75-35-4	1, 1-Dichloroethene	5u
75-34-3	1, 1-Dichloroethane	5u
156-60-5	Trans-1, 2-Dichloroethene	5u
67-66-3	Chloroform	5u
107-06-2	1, 2-Dichloroethane	5u
78-93-3	2-Butanone	10u
71-55-6	1, 1, 1-Trichloroethane	5u
56-23-5	Carbon Tetrachloride	5u
108-05-4	Vinyl Acetate	10u
75-27-4	Bromodichloromethane	5u

CAS Number		ug/l or ug/Kg (Circle One)
79-34-5	1, 1, 2, 2-Tetrachloroethane	5u
78-87-5	1, 2-Dichloropropane	5u
10061-02-6	Trans-1, 3-Dichloropropene	5u
79-01-6	Trichloroethene	5u
124-48-1	Dibromochloromethane	5u
79-00-5	1, 1, 2-Trichloroethane	5u
71-43-2	Benzene	5u
10061-01-5	cis-1, 3-Dichloropropene	5u
110-75-8	2-Chloroethylvinylether	10u
75-25-2	Bromoform	5u
591-78-6	2-Hexanone	10u
108-10-1	4-Methyl-2-Pentanone	10u
127-18-4	Tetrachloroethene	5u
108-88-3	Toluene	5u
108-90-7	Chlorobenzene	5u
100-41-4	Ethylbenzene	5u
100-42-5	Styrene	5u
	Total Xylenes	5u

Data Reporting Qualifiers

For reporting results to EPA, the following results qualifiers are used. Additional flags or footnotes explaining results are encouraged. However, the definition of each flag must be explicit.

Value If the result is a value greater than or equal to the detection limit, report the value.

U Indicates compound was analyzed for but not detected. Report the minimum detection limit for the sample with the U (e.g., 10U) based on necessary concentration/dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read: U-Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero. (e.g., 10J)

C This flag applies to pesticide parameters where the identification has been confirmed by GC/MS. Single component pesticides ≥10 ng/ul in the final extract should be confirmed by GC/MS.

B This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

Other Other specific flags and footnotes may be required to properly define the results. If used, they must be fully described and such description attached to the data summary report.

Sample Number
10940

Organics Analysis Data Sheet

Tentatively Identified Compounds

CAS Number	Compound Name	Fraction	RT or Scan Number	Estimated Concentration (ug/l or ug/kg)
1. —	No Volatiles Detected	VOA	—	—
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
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27.				
28.				
29.				
30.				

Sample Number
10949
well C

Organics Analysis Data Sheet
(Page 1)

Laboratory Name: VERSAR, INC.
Case No: 914 0313
Lab Sample ID No: 1447 A
QC Report No: 914 0313
Sample Matrix: LOW LEVEL AQUEOUS
Contract No:
Data Release Authorized By:
Date Sample Received: 9-27-85

Volatile Compounds

Concentration: Low Medium (Circle One)
Date Extracted/Prepared: 9/30/85
Date Analyzed: 9/30/85
Conc/Dil Factor: 1.0 pH —
Percent Moisture: 100%
Percent Moisture (Decanted): —

CAS Number		ug/l or ug/Kg (Circle One)
74-87-3	Chloromethane	10u
74-83-9	Bromomethane	10u
75-01-4	Vinyl Chloride	10u
75-00-3	Chloroethane	10u
75-09-2	Methylene Chloride	5u
67-64-1	Acetone	10u
75-15-0	Carbon Disulfide	5u
75-35-4	1, 1-Dichloroethene	5u
75-34-3	1, 1-Dichloroethane	5u
156-60-5	Trans-1, 2-Dichloroethene	5u
67-66-3	Chloroform	5u
107-06-2	1, 2-Dichloroethane	5u
78-93-3	2-Butanone	10u
71-55-6	1, 1, 1-Trichloroethane	5u
56-23-5	Carbon Tetrachloride	5u
108-05-4	Vinyl Acetate	10u
75-27-4	Bromodichloromethane	5u

CAS Number		ug/l or ug/Kg (Circle One)
79-34-5	1, 1, 2, 2-Tetrachloroethane	5u
78-87-5	1, 2-Dichloropropane	5u
10061-02-6	Trans-1, 3-Dichloropropene	5u
79-01-6	Trichloroethene	5u
124-48-1	Dibromochloromethane	5u
79-00-5	1, 1, 2-Trichloroethane	5u
71-43-2	Benzene	5u
10061-01-5	cis-1, 3-Dichloropropene	5u
110-75-8	2-Chloroethylvinylether	10u
75-25-2	Bromoform	5u
591-78-6	2-Hexanone	10u
108-10-1	4-Methyl-2-Pentanone	10u
127-18-4	Tetrachloroethene	5u
108-88-3	Toluene	5u
108-90-7	Chlorobenzene	5u
100-41-4	Ethylbenzene	5u
100-42-5	Styrene	5u
	Total Xylenes	5u

Data Reporting Qualifiers

For reporting results to EPA, the following results qualifiers are used. Additional flags or footnotes explaining results are encouraged. However, the definition of each flag must be explicit.

Value If the result is a value greater than or equal to the detection limit, report the value.

U Indicates compound was analyzed for but not detected. Report the minimum detection limit for the sample with the U (e.g., 10U) based on necessary concentration/dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read: U-Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero. (e.g., 10J)

C This flag applies to pesticide parameters where the identification has been confirmed by GC/MS. Single component pesticides≥10 ng/ul in the final extract should be confirmed by GC/MS.

B This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

Other Other specific flags and footnotes may be required to properly define the results. If used, they must be fully described and such description attached to the data summary report.

Environmental Protection Agency. CLP Sample Management Office.
P. O. Box 818. Alexandria, Virginia 22313 703/557-2490

Sample Number
10949

Organics Analysis Data Sheet
(Page 4)

Tentatively Identified Compounds

CAS Number	Compound Name	Fraction	RT or Scan Number	Estimated Concentration (ug/l or ug/kg)
1. —	No Volatiles Detected	VOA	—	—
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
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26.				
27.				
28.				
29.				
30.				

Sample Number
10913
Well D

Organics Analysis Data Sheet
(Page 1)

Laboratory Name: VERSAR, INC.
Case No: 914 C313
Lab Sample ID No: 1443 A
QC Report No: 914-C313
Sample Matrix: LOW LEVEL AQUEOUS
Contract No:
Data Release Authorized By:
Date Sample Received: 9-27-85

Volatile Compounds

Concentration: Low Medium (Circle One)
Date Extracted/Prepared: 9/30/85
Date Analyzed: 9/30/85
Conc/Dil Factor: 1.0 pH —
Percent Moisture: 100%
Percent Moisture (Decanted): —

CAS Number		ug/l or ug/Kg (Circle One)
74-87-3	Chloromethane	10u
74-83-9	Bromomethane	10u
75-01-4	Vinyl Chloride	10u
75-00-3	Chloroethane	10u
75-09-2	Methylene Chloride	5u
67-64-1	Acetone	10u
75-15-0	Carbon Disulfide	5u
75-35-4	1, 1-Dichloroethene	5u
75-34-3	1, 1-Dichloroethane	5u
156-60-5	Trans-1, 2-Dichloroethene	5u
67-66-3	Chloroform	5u
107-06-2	1, 2-Dichloroethane	5u
78-93-3	2-Butanone	10u
71-55-6	1, 1, 1-Trichloroethane	5u
56-23-5	Carbon Tetrachloride	5u
108-05-4	Vinyl Acetate	10u
75-27-4	Bromodichloromethane	5u

CAS Number		ug/l or ug/Kg (Circle One)
79-34-5	1, 1, 2, 2-Tetrachloroethane	5u
78-87-5	1, 2-Dichloropropane	5u
10061-02-6	Trans-1, 3-Dichloropropene	5u
79-01-6	Trichloroethene	5u
124-48-1	Dibromochloromethane	5u
79-00-5	1, 1, 2-Trichloroethane	5u
71-43-2	Benzene	5u
10061-01-5	cis-1, 3-Dichloropropene	5u
110-75-8	2-Chloroethylvinylether	10u
75-25-2	Bromoform	5u
591-78-6	2-Hexanone	10u
108-10-1	4-Methyl-2-Pentanone	10u
127-18-4	Tetrachloroethene	5u
108-88-3	Toluene	5u
108-90-7	Chlorobenzene	5u
100-41-4	Ethylbenzene	5u
100-42-5	Styrene	5u
	Total Xylenes	5u

Data Reporting Qualifiers

For reporting results to EPA, the following results qualifiers are used. Additional flags or footnotes explaining results are encouraged. However, the definition of each flag must be explicit.

Value If the result is a value greater than or equal to the detection limit, report the value.

U Indicates compound was analyzed for but not detected. Report the minimum detection limit for the sample with the U (e.g., 10U) based on necessary concentration/dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read: U-Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero. (e.g., 10J)

C This flag applies to pesticide parameters where the identification has been confirmed by GC/MS. Single component pesticides ≥10 ng/ul in the final extract should be confirmed by GC/MS.

B This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

Other Other specific flags and footnotes may be required to properly define the results. If used, they must be fully described and such description attached to the data summary report.

Sample Number
10913

Organics Analysis Data Sheet

Tentatively Identified Compounds

CAS Number	Compound Name	Fraction	RT or Scan Number	Estimated Concentration (ug/l or ug/kg)
1. —	No Volatiles Detected	VOA	—	—
2.				
3.				
4.				
5.				
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8.				
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29.				
30.				

Sample Number
10922
Well E

Organics Analysis Data Sheet
(Page 1)

Laboratory Name: VERSAR, INC.
Case No: 914 0313
Lab Sample ID No: 1444 A
QC Report No: 914-0313
Sample Matrix: LOW LEVEL AQUEOUS
Contract No:
Data Release Authorized By:
Date Sample Received: 9-27-85

Volatile Compounds

Concentration: Low Medium (Circle One)
Date Extracted/Prepared: 9/30/85
Date Analyzed: 9/30/85
Conc/Dil Factor: 1-0 pH —
Percent Moisture: 100%
Percent Moisture (Decanted): —

CAS Number		ug/l or ug/Kg (Circle One)
74-87-3	Chloromethane	10u
74-83-9	Bromomethane	10u
75-01-4	Vinyl Chloride	10u
75-00-3	Chloroethane	10u
75-09-2	Methylene Chloride	5u
'-64-1	Acetone	10u
75-15-0	Carbon Disulfide	5u
75-35-4	1, 1-Dichloroethene	5u
75-34-3	1, 1-Dichloroethane	5u
156-60-5	Trans-1, 2-Dichloroethene	5u
67-66-3	Chloroform	5u
107-06-2	1, 2-Dichloroethane	5u
78-93-3	2-Butanone	10u
71-55-6	1, 1, 1-Trichloroethane	5u
56-23-5	Carbon Tetrachloride	5u
108-05-4	Vinyl Acetate	10u
75-27-4	Bromodichloromethane	5u

CAS Number		ug/l or ug/Kg (Circle One)
79-34-5	1, 1, 2, 2-Tetrachloroethane	5u
78-87-5	1, 2-Dichloropropane	5u
10061-02-6	Trans-1, 3-Dichloropropene	5u
79-01-6	Trichloroethene	5u
124-48-1	Dibromochloromethane	5u
79-00-5	1, 1, 2-Trichloroethane	5u
71-43-2	Benzene	5u
10061-01-5	cis-1, 3-Dichloropropene	5u
110-75-8	2-Chloroethylvinylether	10u
75-25-2	Bromoform	5u
591-78-6	2-Hexanone	10u
108-10-1	4-Methyl-2-Pentanone	10u
127-18-4	Tetrachloroethene	5u
108-88-3	Toluene	5u
108-90-7	Chlorobenzene	5u
100-41-4	Ethylbenzene	5u
100-42-5	Styrene	5u
	Total Xylenes	5u

Data Reporting Qualifiers

For reporting results to EPA, the following results qualifiers are used. Additional flags or footnotes explaining results are encouraged. However, the definition of each flag must be explicit.

Value If the result is a value greater than or equal to the detection limit, report the value.

U Indicates compound was analyzed for but not detected. Report the minimum detection limit for the sample with the U (e.g., 10U) based on necessary concentration/dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read: U-Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero. (e.g., 10J)

C This flag applies to pesticide parameters where the identification has been confirmed by GC/MS. Single component pesticides≥10 ng/ul in the final extract should be confirmed by GC/MS.

B This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

Other Other specific flags and footnotes may be required to properly define the results. If used, they must be fully described and such description attached to the data summary report.

Sample Number
10932

Organics Analysis Data Sheet

Tentatively Identified Compounds

CAS Number	Compound Name	Fraction	RT or Scan Number	Estimated Concentration (ug/l or ug/kg)
1. —	No Volatiles Detected	VOA	—	—
2.				
3.				
4.				
5.				
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30.				

Sample Number
10931
Well F

Organics Analysis Data Sheet
(Page 1)

Laboratory Name: VERSAR, INC.
Case No: 914031 3
Lab Sample ID No: 1445A
QC Report No: 914-031 3
Sample Matrix: LOW LEVEL AQUEOUS
Contract No:
Data Release Authorized By:
Date Sample Received: 9-27-85

Volatile Compounds

Concentration: (Low) Medium (Circle One)
Date Extracted/Prepared: 9/30/85
Date Analyzed: 9/30/85
Conc/Dil Factor: 1.0 pH —
Percent Moisture: 100%
Percent Moisture (Decanted): —

CAS Number		(ug/l) or ug/Kg (Circle One)
74-87-3	Chloromethane	10u
74-83-9	Bromomethane	10u
75-01-4	Vinyl Chloride	10u
75-00-3	Chloroethane	10u
75-09-2	Methylene Chloride	5u
'-64-1	Acetone	10u
75-15-0	Carbon Disulfide	5u
75-35-4	1, 1-Dichloroethene	5u
75-34-3	1, 1-Dichloroethane	5u
156-60-5	Trans-1, 2-Dichloroethene	5u
67-66-3	Chloroform	5u
107-06-2	1, 2-Dichloroethane	5u
78-93-3	2-Butanone	10u
71-55-6	1, 1, 1-Trichloroethane	5u
56-23-5	Carbon Tetrachloride	5u
108-05-4	Vinyl Acetate	10u
75-27-4	Bromodichloromethane	5u

CAS Number		(ug/l) or ug/Kg (Circle One)
79-34-5	1, 1, 2, 2-Tetrachloroethane	5u
78-87-5	1, 2-Dichloropropane	5u
10061-02-6	Trans-1, 3-Dichloropropene	5u
79-01-6	Trichloroethene	5u
124-48-1	Dibromochloromethane	5u
79-00-5	1, 1, 2-Trichloroethane	5u
71-43-2	Benzene	5u
10061-01-5	cis-1, 3-Dichloropropene	5u
110-75-8	2-Chloroethylvinylether	10u
75-25-2	Bromoform	5u
591-78-6	2-Hexanone	10u
108-10-1	4-Methyl-2-Pentanone	10u
127-18-4	Tetrachloroethene	5u
108-88-3	Toluene	5u
108-90-7	Chlorobenzene	5u
100-41-4	Ethylbenzene	5u
100-42-5	Styrene	5u
	Total Xylenes	5u

Data Reporting Qualifiers

For reporting results to EPA, the following results qualifiers are used. Additional flags or footnotes explaining results are encouraged. However, the definition of each flag must be explicit.

Value If the result is a value greater than or equal to the detection limit, report the value.

U Indicates compound was analyzed for but not detected. Report the minimum detection limit for the sample with the U (e.g., 10U) based on necessary concentration/dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read: U-Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero. (e.g., 10J)

C This flag applies to pesticide parameters where the identification has been confirmed by GC/MS. Single component pesticides ≥10 ng/ul in the final extract should be confirmed by GC/MS.

B This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

Other Other specific flags and footnotes may be required to properly define the results. If used, they must be fully described and such description attached to the data summary report.

Environmental Protection Agency. CLP Sample Management Office.
P. O. Box 818. Alexandria, Virginia 22313 703/557-2490

Sample Number
10931

Organics Analysis Data Sheet
(Page 4)

Tentatively Identified Compounds

CAS Number	Compound Name	Fraction	RT or Scan Number	Estimated Concentration (ug/l or ug/kg)
1. —	No Volatiles Detected	VOA	—	—
2.				
3.				
4.				
5.				
6.				
7.				
8.				
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27.				
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29.				
30.				

Sample Number
10895
Field Blank

Organics Analysis Data Sheet
(Page 1)

Laboratory Name: VERSAR, INC.
Case No: 914 031 3
Lab Sample ID No: 1441A
QC Report No: 914 031 3
Sample Matrix: LOW LEVEL AQUEOUS
Contract No:
Data Release Authorized By:
Date Sample Received: 9-27-85

Volatile Compounds

Concentration: (Low) Medium (Circle One) MS
Date Extracted/Prepared: 10/1/85
Date Analyzed: 10/1/85
Conc/Dil Factor: 1.0 pH —
Percent Moisture: 100%
Percent Moisture (Decanted): —

CAS Number		(ug/l) or ug/Kg (Circle One)
74-87-3	Chloromethane	10u
74-83-9	Bromomethane	10u
75-01-4	Vinyl Chloride	10u
75-00-3	Chloroethane	10u
75-09-2	Methylene Chloride	5u
7-64-1	Acetone	10u
75-15-0	Carbon Disulfide	5u
75-35-4	1, 1-Dichloroethene	5u
75-34-3	1, 1-Dichloroethane	5u
156-60-5	Trans-1, 2-Dichloroethene	5u
67-66-3	Chloroform	5u
107-06-2	1, 2-Dichloroethane	5u
78-93-3	2-Butanone	10u
71-55-6	1, 1, 1-Trichloroethane	5u
56-23-5	Carbon Tetrachloride	5u
108-05-4	Vinyl Acetate	10u
75-27-4	Bromodichloromethane	5u

CAS Number		(ug/l) or ug/Kg (Circle One)
79-34-5	1, 1, 2, 2-Tetrachloroethane	5u
78-87-5	1, 2-Dichloropropane	5u
10061-02-6	Trans-1, 3-Dichloropropene	5u
79-01-6	Trichloroethene	5u
124-48-1	Dibromochloromethane	5u
79-00-5	1, 1, 2-Trichloroethane	5u
71-43-2	Benzene	5u
10061-01-5	cis-1, 3-Dichloropropene	5u
110-75-8	2-Chloroethylvinylether	10u
75-25-2	Bromoform	5u
591-78-6	2-Hexanone	10u
108-10-1	4-Methyl-2-Pentanone	10u
127-18-4	Tetrachloroethene	5u
108-88-3	Toluene	5u
108-90-7	Chlorobenzene	5u
100-41-4	Ethylbenzene	5u
100-42-5	Styrene	5u
	Total Xylenes	5u

Data Reporting Qualifiers

For reporting results to EPA, the following results qualifiers are used. Additional flags or footnotes explaining results are encouraged. However, the definition of each flag must be explicit.

Value If the result is a value greater than or equal to the detection limit, report the value.

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J Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero. (e.g., 10J)

C This flag applies to pesticide parameters where the identification has been confirmed by GC/MS. Single component pesticides≥10 ng/ul in the final extract should be confirmed by GC/MS.

B This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

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Environmental Protection Agency. CLP Sample Management Office.
P O Box 818. Alexandria, Virginia 22313 703/557-2490

Sample Number
10895

Organics Analysis Data Sheet
(Page 4)

Tentatively Identified Compounds

CAS Number	Compound Name	Fraction	RT or Scan Number	Estimated Concentration (ug/l) ~~or ug/kg~~
1. 96377	METHYL CYCLOPENTANE	VOA	340	5
2. 110543	HEXANE	VOA	423	24
3.				
4.				
5.				
6.				
7.				
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26.				
27.				
28.				
29.				
30.				

Sample Number
10958
Trip Blank

Organics Analysis Data Sheet
(Page 1)

Laboratory Name: VERSAR, INC.
Case No: 914 031 3
Lab Sample ID No: 1448 A
QC Report No: 914-031-3
Sample Matrix: LOW LEVEL AQUEOUS
Contract No:
Data Release Authorized By:
Date Sample Received: 9-27-85

Volatile Compounds

Concentration: (Low) Medium (Circle One)
Date Extracted/Prepared: 9/30/85
Date Analyzed: 9/30/85
Conc/Dil Factor: 1.0 pH —
Percent Moisture: 100%
Percent Moisture (Decanted): —

CAS Number		(ug/l) or ug/Kg (Circle One)
74-87-3	Chloromethane	10u
74-83-9	Bromomethane	10u
75-01-4	Vinyl Chloride	10u
75-00-3	Chloroethane	10u
75-09-2	Methylene Chloride	5u
67-64-1	Acetone	10u
75-15-0	Carbon Disulfide	5u
75-35-4	1, 1-Dichloroethene	5u
75-34-3	1, 1-Dichloroethane	5u
156-60-5	Trans-1, 2-Dichloroethene	5u
67-66-3	Chloroform	5u
107-06-2	1, 2-Dichloroethane	5u
78-93-3	2-Butanone	10u
71-55-6	1, 1, 1-Trichloroethane	5u
56-23-5	Carbon Tetrachloride	5u
108-05-4	Vinyl Acetate	10u
75-27-4	Bromodichloromethane	5u

CAS Number		(ug/l) or ug/Kg (Circle One)
79-34-5	1, 1, 2, 2-Tetrachloroethane	5u
78-87-5	1, 2-Dichloropropane	5u
10061-02-6	Trans-1, 3-Dichloropropene	5u
79-01-6	Trichloroethene	5u
124-48-1	Dibromochloromethane	5u
79-00-5	1, 1, 2-Trichloroethane	5u
71-43-2	Benzene	5u
10061-01-5	cis-1, 3-Dichloropropene	5u
110-75-8	2-Chloroethylvinylether	10u
75-25-2	Bromoform	5u
591-78-6	2-Hexanone	10u
108-10-1	4-Methyl-2-Pentanone	10u
127-18-4	Tetrachloroethene	5u
108-88-3	Toluene	5u
108-90-7	Chlorobenzene	5u
100-41-4	Ethylbenzene	5u
100-42-5	Styrene	5u
	Total Xylenes	5u

Data Reporting Qualifiers

For reporting results to EPA, the following results qualifiers are used. Additional flags or footnotes explaining results are encouraged. However, the definition of each flag must be explicit.

Value If the result is a value greater than or equal to the detection limit, report the value.

U Indicates compound was analyzed for but not detected. Report the minimum detection limit for the sample with the U (e.g., 10U) based on necessary concentration/dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read: U-Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero. (e.g., 10J)

C This flag applies to pesticide parameters where the identification has been confirmed by GC/MS. Single component pesticides ≥10 ng/ul in the final extract should be confirmed by GC/MS.

B This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

Other Other specific flags and footnotes may be required to properly define the results. If used, they must be fully described and such description attached to the data summary report.

Sample Number
10958

Organics Analysis Data Sheet

Tentatively Identified Compounds

CAS Number	Compound Name	Fraction	RT or Scan Number	Estimated Concentration (ug/l or ug/kg)
1. —	No Volatiles Detected	VOA	—	—
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
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ATTACHMENT 5
RESULTS OF PESTICIDE ANALYSES ON WELL WATER SAMPLES
CANNON AIR FORCE BASE, NEW MEXICO
PROJECT: EPA 68-01-7037, WA 223

CASE NO: 914.31.3

SUMMARY DATA PACKAGE
FOR SMO

PESTICIDE
RESULTS

WATER SURROGATE PERCENT RECOVERY SUMMARY

Case No. 914031-3 Contract Laboratory VERSAR, INC. Contract No. 68-01-6756 68-01-6757

	VOLATILE			SEMI-VOLATILE								PESTICIDE
SMO TRAFFIC NO.	TOLUENE-D8 (88-110)	BFB (86-121)	1,2 DICHLORO-ETHANE-D4 (77-120)	NITRO-BENZENE-D5 (41-120)	2-FLUORO-BIPHENYL (44-110)	TERPHENYL-D14 (33-120)			PHENOL-D5 (15-103)	2-FLUORO-PHENOL (23-121)	2,4,6 TRIBROMO-PHENOL (10-130)	** DIBUTYL-CHLORENDATE (40-136)
1449												90
1450												102
1451												101
1452						NR						110
1453												104
1454												101
1455												102
RB I												106
RB II												99
1455MS												103
1455MSD												105

* VALUES ARE OUTSIDE OF CONTRACT REQUIRED QC LIMITS

** ADVISORY LIMITS ONLY

Volatiles: — out of — ; outside of QC limits

Semi-Volatiles: — out of — ; outside of QC limits

Pesticides: 0 out of 11 ; outside of QC limits

Comments: NR- not required

WATER MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Case No: 914.31.3 Contractor_____ Versar_____ Contract No._____

FRACTION	COMPOUND	CONC. SPIKE ADDED (ug)	SAMPLE RESULT	CONC. MS	% REC.	CONC. MSD	% REC.	RPD	QC LIMITS RPD	QC LIMITS RECOVERY
VOA	1,1-Dichloroethene	0			NA *		NA *	NA *	14	61 -145
SMO	Trichloroethene	0			NA *		NA *	NA *	14	71 -120
SAMPLE NO	Chlorobenzene	0			NA *		NA *	NA *	13	75 -130
	Toluene	0			NA *		NA *	NA *	13	76 -125
———	Benzene	0			NA *		NA *	NA *	11	76 -127
	1,2,4-Trichlorobenzene				NA *		NA *	NA *	28	39 - 98
B/N	Acenaphthene	0			NA *		NA *	NA *	31	46 -118
SMO	2,4-Dinitrotoluene	0			NA *		NA *	NA *	38	24 - 96
SAMPLE NO	Di-n-Butylphthalate	0			NA *		NA *	NA *	40	11 -117
	Pyrene	0			NA *		NA *	NA *	31	26 -127
———	N-Nitroso-Di-N-Propylamine	0			NA *		NA *	NA *	38	41 -116
	1,4-Dichlorobenzene	0			NA *		NA *	NA *	28	36 - 97
ACID	Pentachlorophenol	0			NA *		NA *	NA *	50	9 -103
SMO	Phenol				NA *		NA *	NA *	42	12 - 89
SAMPLE NO	2-Chlorophenol	0			NA *		NA *	NA *	40	27 -123
	4-Chloro-3-Methylphenol	0			NA *		NA *	NA *	42	23 - 97
———	4-Nitrophenol	0			NA *		NA *	NA *	50	10 - 80
	Lindane	0.2	0	0.25	125 *	0.27	135 *	8	15	56 -123
PEST	Heptachlor	0.2	0	0.23	115	0.24	120	4	20	40 -131
SMO	Aldrin	0.2	0	0.26	130 *	0.27	135 *	4	22	40 -120
SAMPLE NO	Dieldrin	0.5	0	0.47	94	0.48	96	2	18	52 -126
1455	Endrin	0.5	0	0.54	108	0.55	110	2	21	56 -121
———	4,4'-DDT	0.5	0	0.68	136 *	0.71	142 *	4	27	38 -127

*ASTERISKED VALUES ARE OUTSIDE QC LIMITS

RPD: VOAs _ NA out of 5 : outside QC limits
B/N _ NA out of 7 : outside QC limits
ACID _ NA out of 5 : outside QC limits
PEST _ 0 out of 6 : outside QC limits

RECOVERY
VOA _ NA out of 10 outside QC limits
B/N _ NA out of 14 outside QC limits
ACID _ NA out of 10 outside QC limits
PEST _ 6 out of 12 outside QC limits

Comments:_____

REAGENT BLANK SUMMARY

Case No. 914-0313 Contractor VERSAR, INC. Contract No. 68-01-6756 68-01-6757

FILE ID	DATE OF ANALYSIS	FRACTION	MATRIX	CONC. LEVEL	INST. ID	CAS NUMBER	COMPOUND (HSL, TIC OR UNKNOWN)	CONC.	UNITS	CRDL
RBI&RBII	10-23-85	Pest	Water	L	7A	—	No Pesticides Detected	—	—	—

Comments:

Environmental Protection Agency, CLP Sample Management Office
P.O. Box 818, Alexandria, Virginia 22313 703/557-2490

Sample Number
1450

10905
Well A

ORGANICS ANALYSIS DATA SHEET
(Page 3)

Pesticides/PCBs

Concentration: Low | Medium (circle one)

Date Extracted/Prepared: 10/15/85

Date Analyzed: 10/23/85

Conc/Dil Factor 1

CAS Number		ug/l or ug/Kg (circle one)
319-84-6	alpha-BHC	0.05 u
319-85-7	beta-BHC	0.05 u
319-86-8	delta-BHC	0.05 u
58-89-9	gamma-BHC (Lindane)	0.05 u
76-44-8	Heptachlor	0.05 u
309-00-2	Aldrin	0.05 u
1024-57-3	Heptachlor Epoxide	0.05 u
959-98-8	Endosulfan I	0.05 u
60-57-1	Dieldrin	0.10 u
72-55-9	4,4'-DDE	0.10 u
72-20-8	Endrin	0.10 u
33213-65-	Endosulfan II	0.10 u
72-54-8	4,4'-DDD	0.10 u
7421-93-4	Endrin Aldehyde	0.10 u
1031-07-8	Endosulfan Sulfate	0.10 u
50-29-3	4,4'-DDT	0.10 u
72-43-5	Methoxychlor	0.10 u
53494-70-	Endrin Ketone	0.10 u
57-74-9	Chlordane	0.5 u
8001-35-2	Toxaphene	1.0 u
12674-11-	Aroclor-1016	0.5 u
11104-28-	Aroclor-1221	0.5 u
11141-16-	Aroclor-1232	0.5 u
53469-21-	Aroclor-1242	0.5 u
12672-29-	Aroclor-1248	0.5 u
11097-69-	Aroclor-1254	1.0 u
11096-82-	Aroclor-1260	1.0 u

Vi = Volume of extract injected (ul)
Vs = Volume of Water Extracted (ml)
Ws = Weight of sample extracted (g)
Vt = Volume of total extract (ul)

D.L. 11/4/85

Vs 1000.00 or Ws _____ Vt 10000 Vi 2.00

Environmental Protection Agency, CLP Sample Management Office
P.O. Box 818, Alexandria, Virginia 22313 703/557-2490

Sample Number
1454

10941
Well B

ORGANICS ANALYSIS DATA SHEET
(Page 3)

Pesticides/PCBs

Concentration: Low Medium (circle one)

Date Extracted/Prepared: 10/15/85

Date Analyzed: 10/24/85

Conc/Dil Factor 1

CAS Number		ug/l or ug/Kg (circle one)
319-84-6	alpha-BHC	0.05 u
319-85-7	beta-BHC	0.05 u
319-86-8	delta-BHC	0.05 u
58-89-9	gamma-BHC (Lindane)	0.05 u
76-44-8	Heptachlor	0.05 u
309-00-2	Aldrin	0.05 u
1024-57-3	Heptachlor Epoxide	0.05 u
959-98-8	Endosulfan I	0.05 u
60-57-1	Dieldrin	0.10 u
72-55-9	4,4'-DDE	0.10 u
72-20-8	Endrin	0.10 u
33213-65-	Endosulfan II	0.10 u
72-54-8	4,4'-DDD	0.10 u
7421-93-4	Endrin Aldehyde	0.10 u
1031-07-8	Endosulfan Sulfate	0.10 u
50-29-3	4,4'-DDT	0.10 u
72-43-5	Methoxychlor	0.10 u
53494-70-	Endrin Ketone	0.10 u
57-74-9	Chlordane	0.5 u
8001-35-2	Toxaphene	1.0 u
12674-11-	Aroclor-1016	0.5 u
11104-28-	Aroclor-1221	0.5 u
11141-16-	Aroclor-1232	0.5 u
53469-21-	Aroclor-1242	0.5 u
12672-29-	Aroclor-1248	0.5 u
11097-69-	Aroclor-1254	1.0 u
11096-82-	Aroclor-1260	1.0 u

D.L. 11/4/85

Vi = Volume of extract injected (ul)
Vs = Volume of Water Extracted (ml)
Ws = Weight of sample extracted (g)
Vt = Volume of total extract (ul)

Vs 1000.00 or Ws _____ Vt 10000 Vi 2.00

Environmental Protection Agency, CLP Sample Management Office
P.O. Box 818, Alexandria, Virginia 22313 703/557-2490

Sample Number
1455

10950

Well C

ORGANICS ANALYSIS DATA SHEET
(Page 3)

Pesticides/PCBs

Concentration: Low Medium (circle one)

Date Extracted/Prepared: 10/15/85

Date Analyzed: 10/24/85

Conc/Dil Factor 1

CAS Number		ug/l or ug/Kg (circle one)
319-84-6	alpha-BHC	0.05 u
319-85-7	beta-BHC	0.05 u
319-86-8	delta-BHC	0.05 u
58-89-9	gamma-BHC (Lindane)	0.05 u
76-44-8	Heptachlor	0.05 u
309-00-2	Aldrin	0.05 u
1024-57-3	Heptachlor Epoxide	0.05 u
959-98-8	Endosulfan I	0.05 u
60-57-1	Dieldrin	0.10 u
72-55-9	4,4'-DDE	0.10 u
72-20-8	Endrin	0.10 u
33213-65-	Endosulfan II	0.10 u
72-54-8	4,4'-DDD	0.10 u
7421-93-4	Endrin Aldehyde	0.10 u
1031-07-8	Endosulfan Sulfate	0.10 u
50-29-3	4,4'-DDT	0.10 u
72-43-5	Methoxychlor	0.10 u
53494-70-	Endrin Ketone	0.10 u
57-74-9	Chlordane	0.5 u
8001-35-2	Toxaphene	1.0 u
12674-11-	Aroclor-1016	0.5 u
11104-28-	Aroclor-1221	0.5 u
11141-16-	Aroclor-1232	0.5 u
53469-21-	Aroclor-1242	0.5 u
12672-29-	Aroclor-1248	0.5 u
11097-69-	Aroclor-1254	1.0 u
11096-82-	Aroclor-1260	1.0 u

Vi = Volume of extract injected (ul)
Vs = Volume of Water Extracted (ml)
Ws = Weight of sample extracted (g)
Vt = Volume of total extract (ul)

D.L. 11/4/85

Vs 1000.00 or Ws _____ Vt 10000 Vi 2.00

Environmental Protection Agency, CLP Sample Management Office
P.O. Box 818, Alexandria, Virginia 22313 703/557-2490

Sample Number
1451

10914
Well D

ORGANICS ANALYSIS DATA SHEET
(Page 3)

Pesticides/PCBs

Concentration: Low Medium (circle one)

Date Extracted/Prepared: 10/15/85

Date Analyzed: 10/23/85

Conc/Dil Factor 1

CAS Number		ug/l or ug/Kg (circle one)
319-84-6	alpha-BHC	0.05 u
319-85-7	beta-BHC	0.05 u
319-86-8	delta-BHC	0.05 u
58-89-9	gamma-BHC (Lindane)	0.05 u
76-44-8	Heptachlor	0.05 u
309-00-2	Aldrin	0.05 u
1024-57-3	Heptachlor Epoxide	0.05 u
959-98-8	Endosulfan I	0.05 u
60-57-1	Dieldrin	0.10 u
72-55-9	4,4'-DDE	0.10 u
72-20-8	Endrin	0.10 u
33213-65-	Endosulfan II	0.10 u
72-54-8	4,4'-DDD	0.10 u
7421-93-4	Endrin Aldehyde	0.10 u
1031-07-8	Endosulfan Sulfate	0.10 u
50-29-3	4,4'-DDT	0.10 u
72-43-5	Methoxychlor	0.10 u
53494-70-	Endrin Ketone	0.10 u
57-74-9	Chlordane	0.5 u
8001-35-2	Toxaphene	1.0 u
12674-11-	Aroclor-1016	0.5 u
11104-28-	Aroclor-1221	0.5 u
11141-16-	Aroclor-1232	0.5 u
53469-21-	Aroclor-1242	0.5 u
12672-29-	Aroclor-1248	0.5 u
11097-69-	Aroclor-1254	1.0 u
11096-82-	Aroclor-1260	1.0 u

Vi = Volume of extract injected (ul)
Vs = Volume of Water Extracted (ml)
Ws = Weight of sample extracted (g)
Vt = Volume of total extract (ul)

D.L. 11/4/85

Vs 1000.00 or Ws _____ Vt 10000 Vi 2.00

Environmental Protection Agency, CLP Sample Management Office
P.O. Box 818, Alexandria, Virginia 22313 703/557-2490

Sample Number
1452

10923
Well E

ORGANICS ANALYSIS DATA SHEET
(Page 3)

Pesticides/PCBs

Concentration: Low Medium (circle one)

Date Extracted/Prepared: 10/15/85

Date Analyzed: 10/23/85

Conc/Dil Factor 1

CAS Number		ug/l or ug/Kg (circle one)
319-84-6	alpha-BHC	0.05 u
319-85-7	beta-BHC	0.05 u
319-86-8	delta-BHC	0.05 u
58-89-9	gamma-BHC (Lindane)	0.05 u
76-44-8	Heptachlor	0.05 u
309-00-2	Aldrin	0.05 u
1024-57-3	Heptachlor Epoxide	0.05 u
959-98-8	Endosulfan I	0.05 u
60-57-1	Dieldrin	0.10 u
72-55-9	4,4'-DDE	0.10 u
72-20-8	Endrin	0.10 u
33213-65-	Endosulfan II	0.10 u
72-54-8	4,4'-DDD	0.10 u
7421-93-4	Endrin Aldehyde	0.10 u
1031-07-8	Endosulfan Sulfate	0.10 u
50-29-3	4,4'-DDT	0.10 u
72-43-5	Methoxychlor	0.10 u
53494-70-	Endrin Ketone	0.10 u
57-74-9	Chlordane	0.5 u
8001-35-2	Toxaphene	1.0 u
12674-11-	Aroclor-1016	0.5 u
11104-28-	Aroclor-1221	0.5 u
11141-16-	Aroclor-1232	0.5 u
53469-21-	Aroclor-1242	0.5 u
12672-29-	Aroclor-1248	0.5 u
11097-69-	Aroclor-1254	1.0 u
11096-82-	Aroclor-1260	1.0 u

Vi = Volume of extract injected (ul)
Vs = Volume of Water Extracted (ml)
Ws = Weight of sample extracted (g)
Vt = Volume of total extract (ul)

D.L. 11/4/85

Vs 1000.00 or Ws _____ Vt 10000 Vi 2.00

Environmental Protection Agency, CLP Sample Management Office
P.O. Box 818, Alexandria, Virginia 22313 703/557-2490

Sample Number
1453

10932
Well F

ORGANICS ANALYSIS DATA SHEET
(Page 3)

Pesticides/PCBs

Concentration: Low Medium (circle one)

Date Extracted/Prepared: 10/15/85

Date Analyzed: 10/24/85

Conc/Dil Factor 1

CAS Number		ug/l or ug/Kg (circle one)
319-84-6	alpha-BHC	0.05 u
319-85-7	beta-BHC	0.05 u
319-86-8	delta-BHC	0.05 u
58-89-9	gamma-BHC (Lindane)	0.05 u
76-44-8	Heptachlor	0.05 u
309-00-2	Aldrin	0.05 u
1024-57-3	Heptachlor Epoxide	0.05 u
959-98-8	Endosulfan I	0.05 u
60-57-1	Dieldrin	0.10 u
72-55-9	4,4'-DDE	0.10 u
72-20-8	Endrin	0.10 u
33213-65-	Endosulfan II	0.10 u
72-54-8	4,4'-DDD	0.10 u
7421-93-4	Endrin Aldehyde	0.10 u
1031-07-8	Endosulfan Sulfate	0.10 u
50-29-3	4,4'-DDT	0.10 u
72-43-5	Methoxychlor	0.10 u
53494-70-	Endrin Ketone	0.10 u
57-74-9	Chlordane	0.5 u
8001-35-2	Toxaphene	1.0 u
12674-11-	Aroclor-1016	0.5 u
11104-28-	Aroclor-1221	0.5 u
11141-16-	Aroclor-1232	0.5 u
53469-21-	Aroclor-1242	0.5 u
12672-29-	Aroclor-1248	0.5 u
11097-69-	Aroclor-1254	1.0 u
11096-82-	Aroclor-1260	1.0 u

Vi = Volume of extract injected (ul)
Vs = Volume of Water Extracted (ml)
Ws = Weight of sample extracted (g)
Vt = Volume of total extract (ul)

D.L. 11/4/85

Vs 1000.00 or Ws _____ Vt 10000 Vi 2.00

Environmental Protection Agency, CLP Sample Management Office
P.O. Box 818, Alexandria, Virginia 22313 703/557-2490

Sample Number
1449

10896
Field Blank

ORGANICS ANALYSIS DATA SHEET
(Page 3)

Pesticides/PCBs

Concentration: Low Medium (circle one)

Date Extracted/Prepared: 10/15/85

Date Analyzed: 10/23/85

Conc/Dil Factor 1

CAS Number		ug/l or ug/Kg (circle one)
319-84-6	alpha-BHC	0.05 u
319-85-7	beta-BHC	0.05 u
319-86-8	delta-BHC	0.05 u
58-89-9	gamma-BHC (Lindane)	0.05 u
76-44-8	Heptachlor	0.05 u
309-00-2	Aldrin	0.05 u
1024-57-3	Heptachlor Epoxide	0.05 u
959-98-8	Endosulfan I	0.05 u
60-57-1	Dieldrin	0.10 u
72-55-9	4,4'-DDE	0.10 u
72-20-8	Endrin	0.10 u
33213-65-	Endosulfan II	0.10 u
72-54-8	4,4'-DDD	0.10 u
7421-93-4	Endrin Aldehyde	0.10 u
1031-07-8	Endosulfan Sulfate	0.10 u
50-29-3	4,4'-DDT	0.10 u
72-43-5	Methoxychlor	0.10 u
53494-70-	Endrin Ketone	0.10 u
57-74-9	Chlordane	0.5 u
8001-35-2	Toxaphene	1.0 u
12674-11-	Aroclor-1016	0.5 u
11104-28-	Aroclor-1221	0.5 u
11141-16-	Aroclor-1232	0.5 u
53469-21-	Aroclor-1242	0.5 u
12672-29-	Aroclor-1248	0.5 u
11097-69-	Aroclor-1254	1.0 u
11096-82-	Aroclor-1260	1.0 u

Vi = Volume of extract injected (ul)
Vs = Volume of Water Extracted (ml)
Ws = Weight of sample extracted (g)
Vt = Volume of total extract (ul)

D.L. 11/4/85

Vs 1000.00 or Ws _____ Vt 10000 Vi 2.00

Environmental Protection Agency, CLP Sample Management Office
P.O. Box 818, Alexandria, Virginia 22313 703/557-2490

Sample Number
RB I

ORGANICS ANALYSIS DATA SHEET
(Page 3)

Pesticides/PCBs

Concentration: Low | Medium (circle one)

Date Extracted/Prepared: 10/15/85

Date Analyzed: 10/23/85

Conc/Dil Factor 1

CAS Number		ug/l or ug/Kg (circle one)
319-84-6	alpha-BHC	0.05 u
319-85-7	beta-BHC	0.05 u
319-86-8	delta-BHC	0.05 u
58-89-9	gamma-BHC (Lindane)	0.05 u
76-44-8	Heptachlor	0.05 u
309-00-2	Aldrin	0.05 u
1024-57-3	Heptachlor Epoxide	0.05 u
959-98-8	Endosulfan I	0.05 u
60-57-1	Dieldrin	0.10 u
72-55-9	4,4'-DDE	0.10 u
72-20-8	Endrin	0.10 u
33213-65-	Endosulfan II	0.10 u
72-54-8	4,4'-DDD	0.10 u
7421-93-4	Endrin Aldehyde	0.10 u
1031-07-8	Endosulfan Sulfate	0.10 u
50-29-3	4,4'-DDT	0.10 u
72-43-5	Methoxychlor	0.10 u
53494-70-	Endrin Ketone	0.10 u
57-74-9	Chlordane	0.5 u
8001-35-2	Toxaphene	1.0 u
12674-11-	Aroclor-1016	0.5 u
11104-28-	Aroclor-1221	0.5 u
11141-16-	Aroclor-1232	0.5 u
53469-21-	Aroclor-1242	0.5 u
12672-29-	Aroclor-1248	0.5 u
11097-69-	Aroclor-1254	1.0 u
11096-82-	Aroclor-1260	1.0 u

Vi = Volume of extract injected (ul)
Vs = Volume of Water Extracted (ml)
Ws = Weight of sample extracted (g)
Vt = Volume of total extract (ul)

D.L. 11/4/85

Vs 1000.00 or Ws _____ Vt 10000 Vi 2.00

Environmental Protection Agency, CLP Sample Management Office
P.O. Box 818, Alexandria, Virginia 22313 703/557-2490

Sample Number
RB II

ORGANICS ANALYSIS DATA SHEET
(Page 3)

Pesticides/PCBs

Concentration: Low | Medium (circle one)

Date Extracted/Prepared: 10/15/85

Date Analyzed: 10/23/85

Conc/Dil Factor 1

CAS Number		ug/l or ug/Kg (circle one)
319-84-6	alpha-BHC	0.05 u
319-85-7	beta-BHC	0.05 u
319-86-8	delta-BHC	0.05 u
58-89-9	gamma-BHC (Lindane)	0.05 u
76-44-8	Heptachlor	0.05 u
309-00-2	Aldrin	0.05 u
1024-57-3	Heptachlor Epoxide	0.05 u
959-98-8	Endosulfan I	0.05 u
60-57-1	Dieldrin	0.10 u
72-55-9	4,4'-DDE	0.10 u
72-20-8	Endrin	0.10 u
33213-65-	Endosulfan II	0.10 u
72-54-8	4,4'-DDD	0.10 u
7421-93-4	Endrin Aldehyde	0.10 u
1031-07-8	Endosulfan Sulfate	0.10 u
50-29-3	4,4'-DDT	0.10 u
72-43-5	Methoxychlor	0.10 u
53494-70-	Endrin Ketone	0.10 u
57-74-9	Chlordane	0.5 u
8001-35-2	Toxaphene	1.0 u
12674-11-	Aroclor-1016	0.5 u
11104-28-	Aroclor-1221	0.5 u
11141-16-	Aroclor-1232	0.5 u
53469-21-	Aroclor-1242	0.5 u
12672-29-	Aroclor-1248	0.5 u
11097-69-	Aroclor-1254	1.0 u
11096-82-	Aroclor-1260	1.0 u

Vi = Volume of extract injected (ul)
Vs = Volume of Water Extracted (ml)
Ws = Weight of sample extracted (g)
Vt = Volume of total extract (ul)

D.L. 11/4/85

Vs 1000.00 or Ws _____ Vt 10000 Vi 2.00

Environmental Protection Agency, CLP Sample Management Office
P.O. Box 818, Alexandria, Virginia 22313 703/557-2490

Sample Number
1455 MS

Matrix Spike Sample before spike added

ORGANICS ANALYSIS DATA SHEET
(Page 3)

Pesticides/PCBs

Concentration: Low | Medium (circle one)

Date Extracted/Prepared: 10/15/85

Date Analyzed: 10/24/85

Conc/Dil Factor 1

CAS Number		ug/l or ug/Kg (circle one)
319-84-6	alpha-BHC	0.05 u
319-85-7	beta-BHC	0.05 u
319-86-8	delta-BHC	0.05 u
58-89-9	gamma-BHC (Lindane)	0.05 u
76-44-8	Heptachlor	0.05 u
309-00-2	Aldrin	0.05 u
1024-57-3	Heptachlor Epoxide	0.05 u
959-98-8	Endosulfan I	0.05 u
60-57-1	Dieldrin	0.10 u
72-55-9	4,4'-DDE	0.10 u
72-20-8	Endrin	0.10 u
33213-65-	Endosulfan II	0.10 u
72-54-8	4,4'-DDD	0.10 u
7421-93-4	Endrin Aldehyde	0.10 u
1031-07-8	Endosulfan Sulfate	0.10 u
50-29-3	4,4'-DDT	0.10 u
72-43-5	Methoxychlor	0.10 u
53494-70-	Endrin Ketone	0.10 u
57-74-9	Chlordane	0.5 u
8001-35-2	Toxaphene	1.0 u
12674-11-	Aroclor-1016	0.5 u
11104-28-	Aroclor-1221	0.5 u
11141-16-	Aroclor-1232	0.5 u
53469-21-	Aroclor-1242	0.5 u
12672-29-	Aroclor-1248	0.5 u
11097-69-	Aroclor-1254	1.0 u
11096-82-	Aroclor-1260	1.0 u

Vi = Volume of extract injected (ul)
Vs = Volume of Water Extracted (ml)
Ws = Weight of sample extracted (g)
Vt = Volume of total extract (ul)

D.L. 11/4/85

Vs 1000.00 or Ws _____ Vt 10000 Vi 2.00

Environmental Protection Agency, CLP Sample Management Office
P.O. Box 818, Alexandria, Virginia 22313 703/557-2490

Sample Number
1455 MSD

ORGANICS ANALYSIS DATA SHEET
(Page 3)

Pesticides/PCBs

Concentration: Low | Medium (circle one)

Date Extracted/Prepared: 10/15/85

Date Analyzed: 10/24/85

Conc/Dil Factor 1

CAS Number		ug/l or ug/Kg (circle one)
319-84-6	alpha-BHC	0.05 u
319-85-7	beta-BHC	0.05 u
319-86-8	delta-BHC	0.05 u
58-89-9	gamma-BHC (Lindane)	0.05 u
76-44-8	Heptachlor	0.05 u
309-00-2	Aldrin	0.05 u
1024-57-3	Heptachlor Epoxide	0.05 u
959-98-8	Endosulfan I	0.05 u
60-57-1	Dieldrin	0.10 u
72-55-9	4,4'-DDE	0.10 u
72-20-8	Endrin	0.10 u
33213-65-	Endosulfan II	0.10 u
72-54-8	4,4'-DDD	0.10 u
7421-93-4	Endrin Aldehyde	0.10 u
1031-07-8	Endosulfan Sulfate	0.10 u
50-29-3	4,4'-DDT	0.10 u
72-43-5	Methoxychlor	0.10 u
53494-70-	Endrin Ketone	0.10 u
57-74-9	Chlordane	0.5 u
8001-35-2	Toxaphene	1.0 u
12674-11-	Aroclor-1016	0.5 u
11104-28-	Aroclor-1221	0.5 u
11141-16-	Aroclor-1232	0.5 u
53469-21-	Aroclor-1242	0.5 u
12672-29-	Aroclor-1248	0.5 u
11097-69-	Aroclor-1254	1.0 u
11096-82-	Aroclor-1260	1.0 u

Vi = Volume of extract injected (ul)
Vs = Volume of Water Extracted (ml)
Ws = Weight of sample extracted (g)
Vt = Volume of total extract (ul)

D.L. 11/4/85

Vs 1000.00 or Ws _____ Vt 10000 Vi 2.00

Environmental Protection Agency, CLP Sample Management Office
P.O. Box 818, Alexandria, Virginia 22313 703/557-2490

Sample Number
MSTD

ORGANICS ANALYSIS DATA SHEET
(Page 3)

Pesticides/PCBs

Concentration: Low Medium (circle one)

Date Extracted/Prepared: 10/15/85

Date Analyzed: 10/24/85

Conc/Dil Factor 1

CAS Number		ug/l or ug/Kg (circle one)
319-84-6	alpha-BHC	0.05 u
319-85-7	beta-BHC	0.05 u
319-86-8	delta-BHC	0.05 u
58-89-9	gamma-BHC (Lindane)	0.05 u
76-44-8	Heptachlor	0.05 u
309-00-2	Aldrin	0.05 u
1024-57-3	Heptachlor Epoxide	0.05 u
959-98-8	Endosulfan I	0.05 u
60-57-1	Dieldrin	0.10 u
72-55-9	4,4'-DDE	0.10 u
72-20-8	Endrin	0.10 u
33213-65-	Endosulfan II	0.10 u
72-54-8	4,4'-DDD	0.10 u
7421-93-4	Endrin Aldehyde	0.10 u
1031-07-8	Endosulfan Sulfate	0.10 u
50-29-3	4,4'-DDT	0.10 u
72-43-5	Methoxychlor	0.10 u
53494-70-	Endrin Ketone	0.10 u
57-74-9	Chlordane	0.5 u
8001-35-2	Toxaphene	1.0 u
12674-11-	Aroclor-1016	0.5 u
11104-28-	Aroclor-1221	0.5 u
11141-16-	Aroclor-1232	0.5 u
53469-21-	Aroclor-1242	0.5 u
12672-29-	Aroclor-1248	0.5 u
11097-69-	Aroclor-1254	1.0 u
11096-82-	Aroclor-1260	1.0 u

Vi = Volume of extract injected (ul)
Vs = Volume of Water Extracted (ml)
Ws = Weight of sample extracted (g)
Vt = Volume of total extract (ul)

D.L. 11/4/85

Vs 1000.00 or Ws _____ Vt 10000 Vi 2.00

ATTACHMENT 6
RESULTS OF HERBICIDE ANALYSES IN WELL WATER SAMPLES
CANNON AIR FORCE BASE, NEW MEXICO
PROJECT: EPA 68-01-7037, WA 223

HERBICIDE RESULTS
PROJECT 914.31

FIELD SAMPLE NUMBER	2,4-D CONCENTRATION (ug/l)	SILVEX CONCENTRATION (ug/l)	2,3,5-T CONCENTRATION (ug/l)	COMMENTS
10896	ND	ND	ND	
10905	ND	ND	ND	
10914	ND	ND	ND	
10923	ND	ND	ND	
10932	ND	ND	ND	
10941	ND	ND	ND	
10950	ND	ND	ND	

ND = NONE DETECTED. DETECTION LIMIT 1 ug/l.

Charles Carter
Organic Laboratory Manager

Appendix II

Wells Logs

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RADIAN CORPORATION

Completion Log: Sheet 1 of 2

Well No. Monitor Well A
Location Landfill No. 5

Project Cannon AFB IRP
Log Recorded by T.K. Walters

Construction

Construction Started January 4, 1985
Completed January 7, 1985
Total Depth Drilled (ft) 365
Hole Diameter 8-inch
Drilling Method mud rotary
Problems encountered during drilling/completion hole collapsed back to 343 feet, set casing to 343' 625

Water source for drilling and completion procedures base potable water supply well

Sampling

Number, type and disposition of samples collected water samples, collected after well development

Sample interval (ft-ft) 343', top of Ogallala Aquifer

Storage and/or preservation method(s) 4°C, shipped overnight delivery OEHL/RAS

Materials

Casing type Schedule 80 PVC
Diameter 4 inch
Top of well casing (ft-AGL/BGL) 3'/343'
Elevation (ft-msl) 4267.46
Depth of casing (ft) 343'
Screen type mill slot
Diameter 4 inch (internal)
Slot size 0.01 inch
Screen interval (ft-ft) 343-328

Type(s) of glue used to join casing None - threaded flush joint couplings
Type of gravel/sand pack used Clemtex No. 2 (8-40 mesh)
Amount of gravel pack used 4 bags
Grain size distribution of gravel pack Retained #8 (2.0%), #16 (51.2%), #20 (62.8%)[1]
Lithology of gravel pack Mostly silica (94%)
Source (company and quarry/pit) Clemtex, Inc., Houston, Texas

Interval of gravel pack (ft-ft) 343 - 325
Interval of bentonite seal (ft-ft) 325 - 323
Interval of grouting (ft-ft) 323 - Land surface

Comments

Type of bentonite - Pellets (Volclay)
Type of grout - Portland Type 1 (neat cement)
[1] #30 (78.4%), #40 (91.2%), #50 (98.9%), #100 (100.0%)

Description of Security Measures

N/A

Padlock ID No. N/A
Location of key(s) Cannon AFB

RADIAN CORPORATION

Well Completion Log: Sheet 2 of 2 (Development)

Well A (continued)

Development started January 7, 1985 Development ended January 7, 1985
Static level of water before _____ (ft) and after _____ (ft) development.
Measuring point (MP) description top of steel casing

MP Height 2.35 (ft) Elevation 4267.46 (ft)
Quantity of water discharged during development 5 well volumes below static level
Type, size/capacity of pump or bailer used for developmnt air line - lift development

Depth of open hole inside well (below ground level on measuring point)
Before development 343 (ft) After development 343 (ft)

Date/Time	Discharge (GPM/Bail(s)) Note SWL start/End.(1)		Field Measurements Temperature	Conductivity	pH	Remarks
1/25/85	1320 hrs	3 gpm	18.5°	740	7.6	
	1330 hrs		18.5°	750	7.5	
	1410 hrs		18.4°	750	7.4	
	1500 hrs		18.4°	750	7.4	

NOTE: (1) Depth measurements made by Steel Tape (ST); Rope and Bailer (R/B) and Electric Line (EL).
(2) Temperature in degrees celsius.
(3) Conductivity in micromhos/centimeter at field temperature.

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RADIAN CORPORATION

Completion Log: Sheet 1 of 2

Well No. Monitor Well B
Location Landfill No. 5

Project Cannon AFB IRP
Log Recorded by T.K. Walters

Construction

Construction Started November 25, 1984
Completed November 30, 1984
Total Depth Drilled (ft) 362.3
Hole Diameter 8-inch
Drilling Method mud rotary
Problems encountered during drilling/completion none

Water source for drilling and completion procedures potable base supply well

Sampling

Number, type and disposition of samples collected water samples collected after well development

Sample interval (ft-ft) 362.3' at top of Ogallala Aquifer

Storage and/or preservation method(s) 4°C, shipped to OEHL/RAS, overnight delivery

Materials

Casing type Schedule 80 PVC
Diameter 4 inch (interval)
Top of well casing (ft-AGL/BGL) 2.8/362.3'
Elevation (ft-msl) 4266.04
Depth of casing (ft) 362.3
Screen type mill slotted
Diameter 4 inch (internal)
Slot size 0.01 inch
Screen interval (ft-ft) 362.3-347.3

Type(s) of glue used to join casing None - threaded flush joint couplings
Type of gravel/sand pack used Clemtex No. 2 (8-40 mesh)
Amount of gravel pack used 5 bags
Grain size distribution of gravel pack Retained #8 (2.0%), #16 (51.2%), #20 (62.8%)[1]
Lithology of gravel pack Mostly silica (94%)
Source (company and quarry/pit) Clemtex, Inc., Houston, Texas

Interval of gravel pack (ft-ft) 362.3 - 342.3
Interval of bentonite seal (ft-ft) 342.3 - 340.3
Interval of grouting (ft-ft) 340.3 - Land Surface

Comments

Type of bentonite - Volclay (Pellets)
Type of grout - Portland Type 1 (neat cement)
[1] #30 (78.4%), #40 (91.2%), #50 (98.9%), #100 (100.0%)

Description of Security Measures

N/A

Padlock ID No. N/A
Location of key(s) Cannon AFB

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RADIAN CORPORATION

Well Completion Log: Sheet 2 of 2 (Development) Well B (continued)

Development started November 30, 1984 Development ended November 30, 1984
Static level of water before 245 (ft) and after 265.7 (ft) development.
Measuring point (MP) description steel casing

MP Height 2.8 (ft) Elevation 4266.04 (ft)
Quantity of water discharged during development 5 well volumes
Type, size/capacity of pump or bailer used for developmnt air lift development

Depth of open hole inside well (below ground level on measuring point)
Before development 362.3 (ft) After development 362.3 (ft)

Date/Time	Discharge (GPM/Bail(s)) Note SWL start/End.(1)		Field Measurements Temperature	Conductivity	pH	Remarks
1/24/85	9040	3 gpm	18.1°	760	7.45	
	1000		18.1°	800	7.68	
	1120		18.1°	760	7.5	

NOTE: (1) Depth measurements made by Steel Tape (ST); Rope and Bailer (R/B) and Electric Line (EL).
(2) Temperature in degrees celsius.
(3) Conductivity in micromhos/centimeter at field temperature.

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RADIAN CORPORATION

Completion Log: Sheet 1 of 2

Well No. Monitor Well C
Location Landfill No. 5

Project Cannon AFB IRP
Log Recorded by T.K. Walters

Construction

Construction Started January 9, 1985
Completed January 11, 1985
Total Depth Drilled (ft) 362
Hole Diameter 8-inch
Drilling Method mud rotary
Problems encountered during drilling/completion none

Water source for drilling and completion procedures Base potable water well

Sampling

Number, type and disposition of samples collected water collected after well development

Sample interval (ft-ft) 362', top of Ogallala Formation

Storage and/or preservation method(s) 4°C, shipped overnight to OEHL/RAS

Materials

Casing type Schedule 80 PVC
Diameter 4 inch
Top of well casing (ft-AGL/BGL) 2.96/362
Elevation (ft-msl) 4267.90
Depth of casing (ft) 362
Screen type mill slotted
Diameter 4 inch (internal)
Slot size 0.01 inch
Screen interval (ft-ft) 362-347

Type(s) of glue used to join casing None - threaded flush joint couplings
Type of gravel/sand pack used Clemtex No. 2 (8-40 mesh)
Amount of gravel pack used 5 bags
Grain size distribution of gravel pack Retained #8 (2.0%), #16 (51.2%), #20 (62.8%)[1]
Lithology of gravel pack Mostly silica (94%)
Source (company and quarry/pit) Clemtex, Inc., Houston, Texas

Interval of gravel pack (ft-ft) 362 - 344
Interval of bentonite seal (ft-ft) 344 - 342
Interval of grouting (ft-ft) 342 - Land Surface

Comments

Type of bentonite - Pellets (Volclay)
Type of grout - Portland Type 1 (neat cement)
[1] #30 (78.4%), #40 (91.2%), #50 (98.9%), #100 (100.0%)

Description of Security Measures

N/A

Padlock ID No. N/A
Location of key(s) Cannon AFB

RADIAN CORPORATION

Well Completion Log: Sheet 2 of 2 (Development) Well C (continued)

Development started 11 January 1985 Development ended 11 January 1985
Static level of water before 250 (ft) and after 267 (ft) development.
Measuring point (MP) description top of steel casing

MP Height 2.96 (ft) Elevation 4267.90 (ft)
Quantity of water discharged during development 5 well volumes below static water level
Type, size/capacity of pump or bailer used for developmnt air lift development

Depth of open hole inside well (below ground level on measuring point)
Before development 362 (ft) After development 362 (ft)

Date/Time	Discharge (GPM/Bail(s)) Note SWL start/End.(1)		Field Measurements Temperature	Conductivity	pH	Remarks
1/24/85	1300 hrs	3 gpm	18.7°	725	7.15	
	1400 hrs		18.7°	740	7.2	
	1430 hrs		18.7°	740	7.2	

NOTE: (1) Depth measurements made by Steel Tape (ST); Rope and Bailer (R/B) and Electric Line (EL).
(2) Temperature in degrees celsius.
(3) Conductivity in micromhos/centimeter at field temperature.

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RADIAN CORPORATION

Completion Log: Sheet 1 of 2

Well No. Monitor Well D
Location Landfill No. 5

Project Cannon AFB IRP
Log Recorded by T.K. Walters

Construction

Construction Started December 10, 1984
Completed December 16, 1984
Total Depth Drilled (ft) 356.75
Hole Diameter 8-inch
Drilling Method mud rotary
Problems encountered during drilling/completion none

Water source for drilling and completion procedures Base potable water supply well

Sampling

Number, type and disposition of samples collected water, collected after well development

Sample interval (ft-ft) 356' in top portion of Ogallala Aquifer

Storage and/or preservation method(s) 4°C, shipped overnight delivery OEHL/RAS

Materials

Casing type Schedule 80 PVC
Diameter 4 inch
Top of well casing (ft-AGL/BGL) 2.67/356.75
Elevation (ft-msl) 4265.90
Depth of casing (ft) 356.75
Screen type mill slotted sch. 80 PVC
Diameter 4 inch (internal)
Slot size 0.01 inch
Screen interval (ft-ft) 356.75-341.75

Type(s) of glue used to join casing None - threaded flush joint couplings
Type of gravel/sand pack used Clemtex No. 2 (8-40 mesh)
Amount of gravel pack used 5 bags
Grain size distribution of gravel pack Retained #8 (2.0%), #16 (51.2%), #20 (62.8%)[1]
Lithology of gravel pack Mostly silica (94%)
Source (company and quarry/pit) Clemtex, Inc., Houston, Texas

Interval of gravel pack (ft-ft) 356.75 - 336.75
Interval of bentonite seal (ft-ft) 336.75 - 334.75
Interval of grouting (ft-ft) 334.75 - land surface

Comments

Type of bentonite - Pellets (Volclay)
Type of grout - Portland Type 1 (neat cement)
[1] #30 (78.4%), #40 (91.2%), #50 (98.9%), #100 (100.0%)

Description of Security Measures

N/A

Padlock ID No. N/A
Location of key(s) Cannon AFB

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RADIAN CORPORATION

Well Completion Log: Sheet 2 of 2 (Development) Well D (continued)

Development started December 16, 1984 Development ended December 16, 1984
Static level of water before 265 (ft) and after 265.2 (ft) development.
Measuring point (MP) description top of steel casing

MP Height 2.67 (ft) Elevation 4265.90 (ft)
Quantity of water discharged during development 5 well volumes, below static water level
Type, size/capacity of pump or bailer used for developmnt air lift development

Depth of open hole inside well (below ground level on measuring point)
Before development 356.75 (ft) After development 356.75 (ft)

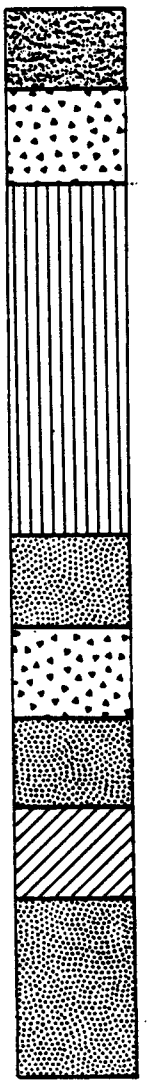
Date/Time	Discharge (GPM/Bail(s)) Note SWL start/End.(1)		Field Measurements Temperature	Conductivity	pH	Remarks
1/25/85	0730	3 gpm	19.0°	720	8.25	
	0800		18.3°	725	8.37	
	0900		18.2°	720	8.10	
	0930		18.3°	720	8.20	

NOTE: (1) Depth measurements made by Steel Tape (ST); Rope and Bailer (R/B) and Electric Line (EL).
(2) Temperature in degrees celsius.
(3) Conductivity in micromhos/centimeter at field temperature.

Log of Drilling Operations
Monitor Well #A

Location Cannon AFB, Site 5 Landfill No. 5
Log Recorded by T.K. Walters
Type Drill Rig and Operator Failing 1500
Air/mud rotary - Winnek,Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 4 Jan. 1985 and end
7 Jan. 1985 of drilling operation
Sampling Interval (Estimated) 5(ft)

Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken	Lithologic Description
0-			G	TOPSOIL; red-brown, fair amount organic matter, caliche contact, 4'.
5-			G	CALICHE; light tan with buff silt.
10-			G	SILT;sandy light brown, with white caliche clasts.
15-			G	SILT; interbedded with caliche, some fine sand 22-25'.
20-			G	SILT; sandy with hard white caliche interbedded.
25-			G	SILT; sandy with hard white caliche interbedded.
30-			G	SAND; silty with caliche buff brown.
35-			G	CALICHE; hard, white, nodular with buff-brown silty sand.
40-			G	SAND; silty, light brown, cemented with calcite, caliche nodules in lower portion.
45-			G	SILT; sandy, unconsolidated, poorly sorted, fine-medium grained with black lithic fragments.
50-			G	SAND; silty, fine-medium grained, unconsolidated, angular, with caliche fragments.
55-			G	SAND; dark brown, poorly cemented, poorly sorted, with clear quartz (angular).
60-				

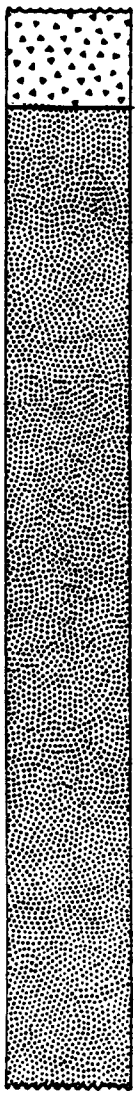
Monitor Well A was grouted from 325 ft to the surface with 8 yds.^{3} of Portland Type I neat cement.

ST = Shelby tube; SS = split-spoon; G = grab.

Log of Drilling Operations
Monitor Well #A

Location Cannon AFB. Site 5 Landfill No. 5
Log Recorded by T.K. Walters
Type Drill Rig and Operator Failing 1500
Air/mud rotary - Winnek.Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 4 Jan. 1985 and end
7 Jan 1985 of drilling operation
Sampling Interval (Estimated) 5(ft)

Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken	Lithologic Description
60-			G	CALICHE; buff white and silt, extremely hard, 2' sand, cemented, medium grained.
65-			G	SAND; red-brown, unconsolidated, fine-medium grained, poorly sorted.
70-			G	SAND; light brown, unconsolidated, fine-medium, sorted, coarser than above.
75-			G	SAND; tan-brown, unconsolidated, medium - grained, quartzose, coarser than above unit, subrounded grains.
80-			G	SAND; fine-medium grained, poorly sorted, unconsolidated with 6' calcite cemented layer.
85-			G	SAND; fine-medium grained, poorly sorted, increase in calcite cement.
90-			G	SAND; fine-medium grained, poorly sorted, coarser than above, calcite cement about 10%.
95-			G	SAND; medium grained, moderately sorted, quartzose, grains sub-rounded, decrease in calcite.
100-			G	SAND; fine-medium poorly sorted, semi-consolidated, calcite cement 50%, coarser than above.
105-			G	SAND; medium-coarse grained, unconsolidated subangular grains.
110-			G	SAND; same as above.
115			G	SAND; same as above.
120-				

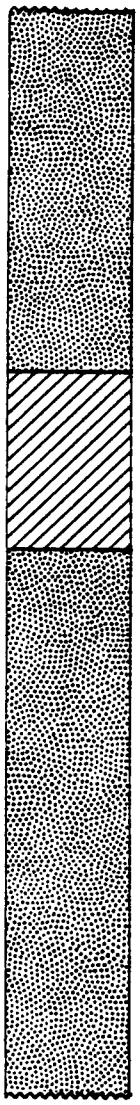
Monitor Well A was grouted from 325 ft to the surface with 8 yds.^{3} of Portland Type I neat cement.

ST = Shelby tube; SS = split-spoon; G = grab.

Log of Drilling Operations
Monitor Well #A

Location Cannon AFB, Site 5 Landfill No. 5
Log Recorded by T.K. Walters
Type Drill Rig and Operator Failing 1500
Air/mud rotary - Winnek.Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 4 Jan. 1985 and end
7 Jan. 1985 of drilling operation
Sampling Interval (Estimated) 5(ft)

Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken	Lithologic Description
120-			G	SAND; fine-medium grained, unconsolidated, well sorted, subrounded, quartzose.
125-			G	SAND; fine-grained, well sorted, unconsolidated, subrounded, with 5% caliche.
130-			G	SAND; fine-medium grained, well sorted, unconsolidated, subrounded, 5% caliche nodules.
135-			G	SAND; fine grained, very well sorted, unconsolidated, subrounded, 5% lithic fragments.
140-			G	SILT; fine, well sorted, much finer than above unit, unconsolidated.
145-			G	SILT; fine grained, very well sorted, quartzose, with 5% lithic fragments, subrounded.
150-			G	SAND; fine grained, very well sorted, subrounded, quartzose, clear, 5% lithics, drilling slightly slower.
155-			G	SAND; fine grained, silty, with 90% clear quartz, subrounded, 10% lithics.
160-			G	SAND; silty, fine grained, moderately well sorted, subrounded, quartzose.
165-			G	SAND; fine-medium grained, slightly cemented with calcite, caliche nodules 10%.
170-			G	SAND; loosely consolidated, by calcite, fine-medium grained, moderately sorted, caliche 10%.
175-			G	SAND; slightly cemented, by calcite, and caliche nodules (25%), sand is fine-medium, subrounded.
180-				

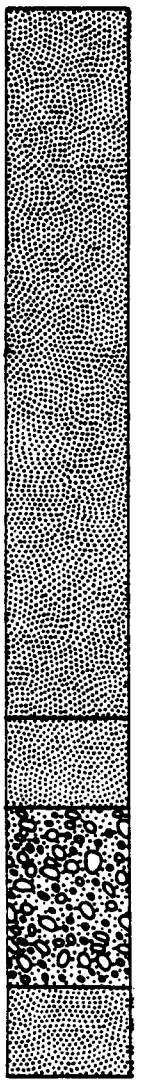
Monitor Well A was grouted from 325 ft to the surface with 8 yds.^{3} of Portland Type I neat cement.

ST = Shelby tube; SS = split-spoon; G = grab.

Log of Drilling Operations
Monitor Well #A

Location Cannon AFB, Site 5 Landfill No. 5
Log Recorded by T.K. Walters
Type Drill Rig and Operator Failing 1500
Air/mud rotary - Winnek.Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 4 Jan. 1985 and end
7 Jan. 1985 of drilling operation
Sampling Interval (Estimated) 5(ft)

Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken	Lithologic Description
180-			G	SAND; slightly cemented, fine-medium grained, calcite 50%.
185-			G	SAND; silty, brown, poorly sorted, slightly cemented, fine-medium grained.
190-			G	SAND; unconsolidated, fine-medium grained, subrounded, poorly sorted, 10% lithics.
195-			G	SAND; coarse, and pea gravel, angular, with reworked clay and silt (Cretaceous), unconsolidated, lithics-clay 30%.
200-			G	SAND; tan, fine-medium grained, poorly sorted, angular, with 10% lithic fragments.
205-			G	SAND; tan, fine-medium grained, subangular, with abundant iron staining on quartz grains, lithics 5%, unconsolidated.
210-			G	SAND; tan, medium-coarse, subangular, with reworked shale and silt, poorly sorted, unconsolidated.
215-			G	SAND; olive-brown, 50% green-brown silt and shale, angular quartz, fine-medium grained, poorly sorted.
220-			G	SAND AND SHALE; olive brown, sand medium grained, shale green-brown, with red clay clasts.
225-			G	GRAVEL; unconsolidated, with shale, silt, lithic fragments, unsorted conglomerate.
230-			G	SAND AND GRAVEL; sand cemented, by calcite, gravel angular, loosely consolidated.
235-			G	SAND; with minor gravel, sand fine-medium grained, loosely cemented, poorly sorted.
240-				

Monitor Well A was grouted from 325 ft to the surface with 8 yds.^{3} of Portland Type I neat cement.

ST = Shelby tube; SS = split-spoon; G = grab.

Log of Drilling Operations
Monitor Well #A

Location Cannon AFB, Site 5 Landfill No. 5
Log Recorded by T.K. Walters
Type Drill Rig and Operator Failing 1500
Air/mud rotary - Winnek.Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 4 Jan. 1985 and end 7 Jan. 1985 of drilling operation
Sampling Interval (Estimated) 5(ft)

Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken	Lithologic Description
240-			G	SAND; tan, medium-coarse grained, with 15% gravel, (may be coming in from gravel zone above).
245-			G	SAND; tan, fine-medium grained, poorly sorted, with calcite matrix, slightly silty, 10% lithics.
250-			G	SAND; brown, fine-coarse, unconsolidated, angular, with 15% lithics also angular, clay matrix 20%.
255-			G	SAND; brown, fine grained, with calcite cement, unconsolidated, poorly sorted with coarse sand-size lithic fragments 10%.
260-			G	SAND; brown, fine-medium grained, loosely consolidated with calcite cement, coarse lithics 20%, angular.
265-			G	SAND; brown, 95% quartz, fine-medium grained, absence of coarse lithic fragments, "beach sand" texture.
270-			G	SAND; brown, 95% quartz, rounded, medium grained, well sorted, lithics also rounded and sorted.
275-			G	SAND; brown, medium grained, subrounded, same as above unit with 10% lithics.
280-			G	SAND; brown, medium-coarse, subangular, poorly sorted, unconsolidated, lithics 10-15% subangular, out of "clean sand."
285-			G	SAND; tan, fine-medium grained, moderately well sorted, subrounded, calcite 10%, lithics 10%.
290-			G	SAND; tan, fine-medium, well sorted, subrounded, "clean" with 10% lithics, also fine-medium grained.
295-			G	SAND; tan, fine-medium grained, well sorted, rounded with 10% black lithic fragments, no matrix.
300-				

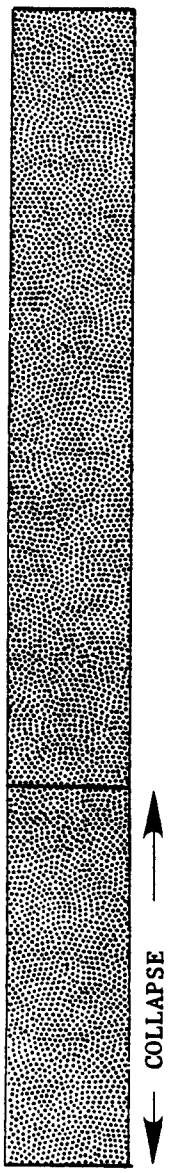
Monitor Well A was grouted from 325 ft to the surface with 8 yds.^{3} of Portland Type I neat cement.

ST = Shelby tube; SS = split-spoon; G = grab.

Log of Drilling Operations
Monitor Well #A

Location Cannon AFB, Site 5 Landfill No. 5
Log Recorded by T.K. Walters
Type Drill Rig and Operator Failing 1500
Air/mud rotary - Winnek.Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 4 Jan. 1985 and end 7 Jan. 1985 of drilling operation
Sampling Interval (Estimated) 5(ft)

Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken	Lithologic Description
300-			G	SAND; tan to brown, fine-medium grained, poorly sorted, with 10% coarse sand fragments, subrounded.
305-			G	SAND; brown, fine-coarse, poorly sorted, with 15% lithics, also coarse, subrounded, unconsolidated.
310-			G	SAND; with gravel, olive brown, sand is fine-medium grained, poorly sorted, subrounded, gravel coarse.
315-			G	SAND; fine-coarse, slightly cemented to larger lithic fragments, sand is subrounded.
320-			G	SAND; tan, fine-medium grained, loosely cemented, subrounded, calcite 10%.
325-			G	SAND; sand and gravel conglomerate, cemented by calcite, coarse texture, w/grey shale and reworked red silt, well indurated.
330-			G	SAND; cemented, with 10% gravel, buff-brown, iron stained, conglomerate, calcite matrix, lithics (red plagioclase, volcanics)
335-			G	SAND; medium-coarse, loosely consolidated, lithics 25%, coarse grained, out of confining zone at 339'.
340-			G	SAND; fine-coarse, unconsolidated, with sub-angular quartz 342-343' sand and gravel conglomerate; 343-345' sand unconsolidated.
345-			G	SAND; loosely consolidated, fine-medium grain, moderately sorted, subrounded lithics 5-15%, water changed to dark brown at 350'.
350-			G	SAND; fine-medium grained, poorly sorted, subrounded with 10% lithic clasts.
355-			G	SAND; medium grained, loosely consolidated subangular, subrounded with 10% lithic fragments.
360-			G	SAND; fine-coarse, poorly sorted, angular, with 30% lithic fragments.
365-				

COLLAPSE

Monitor Well A was grouted from 325 ft to the surface with 8 yds.^{3} of Portland Type I neat cement.

ST = Shelby tube; SS = split-spoon; G = grab.

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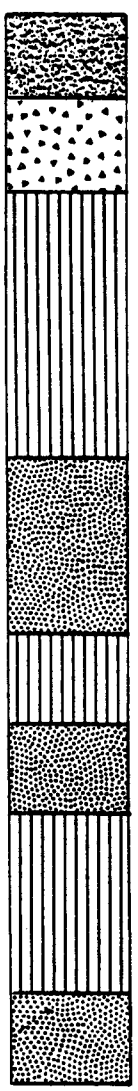
Log of Drilling Operations
Monitor Well #B

Location Site 5B Landfill No. 5
Log Recorded by T.K. Walters/W. Boettner
Type Drill Rig and Operator Failing 1500
Air/mud Rotary-Winnek, Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 25 November 1985 and end
30 Nov. 1985 of drilling operation
Sampling Interval (Estimated) 5(ft)

Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken *	Lithologic Description
0-			G	TOPSOIL; dark brown, loamy fine sand slightly moist caliche at 4.5'.
5-			G	CALICHE; extremely hard, white, sharp upper contact increase in sand 9-10'.
10-			G	SILT; sandy,pink,poorly sorted, slightly moist, calcarceous.
15-			G	SILT; buff cemented by calcite, hard, slightly sandy.
20-			G	SILT; buff-brown, cemented with calcite.
25-			G	SAND; red-brown, fine grain, moderately sorted, slightly consolidated.
30-			G	SAND; silty, buff-brown, fine-medium, well sorted, subangular, calcite cement.
35-			G	SILT; very fine with calcite matrix, unconsolidated, well sorted.
40-			G	SAND; fine-medium grained, oxidized with 6" caliche stringers.
45-			G	SILT; sandy buff, well sorted, unconsolidated.
50-			G	SILT; sandy, cemented, with hard 6" layers of caliche.
55-			G	SAND; silty, brown, grading to red oxidized sand, medium grained, moderately sorted.
60-				

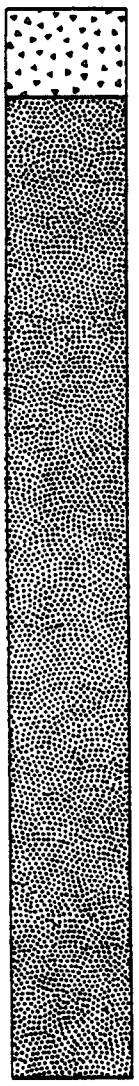
Monitor Well B was grouted from 344 ft to the surface with 7 yds.^{3} of Portland Type I neat cement.

ST = Shelby tube; SS = split-spoon; G = grab.

Log of Drilling Operations
Monitor Well #B

Location Site 5B Landfill No. 5
Log Recorded by T.K. Walters/W. Boettner
Type Drill Rig and Operator Failing 1500 Air/mud Rotary-Winnek, Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 25 November 1985 and end 30 Nov. 1985 of drilling operation
Sampling Interval (Estimated) 5(ft)

Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken*	Lithologic Description
60-			G	CALICHE; buff-white, and silt, extremely hard, 2' sand, cemented, medium grained.
65-			G	SAND; red-brown, unconsolidated, fine-medium grained, poorly sorted.
70-			G	SAND: light brown, unconsolidated, moderately sorted, coarser than above.
75-			G	SAND; light brown, unconsolidated, moderately sorted, coarser than above.
80-			G	SAND; tan-brown, unconsolidated, medium grained, quartzose, coarser than above unit, sub-rounded grains.
85-			G	SAND; fine-medium grained, poorly sorted, unconsolidated with 6" calcite cemented layer.
90-			G	SAND; fine-medium grained, increase in calcite cement.
95-			G	SAND; fine-medium grained, poorly sorted, coarser than above, calcite cement about 10%.
100-			G	SAND; medium grained, moderately sorted, quartzose, grains sub-rounded, decrease in calcite.
105-			G	SAND; fine-medium, poorly sorted, semi-consolidated, calcite cement 50%, coarser than above.
110-			G	SAND; medium-coarse grained, unconsolidated subangular grains.
115-			G	SAND; same as above.
120-			G	SAND; same as above.

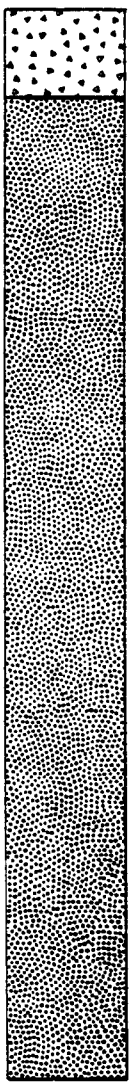
Monitor Well B was grouted from 344 ft to the surface with 7 yds.3 of Portland Type I neat cement.

ST = Shelby tube; SS = split-spoon; G = grab.

Log of Drilling Operations
Monitor Well #B

Location Site 5B Landfill No. 5
Log Recorded by T.K. Walters/W. Boettner
Type Drill Rig and Operator Failing 1500 Air/mud Rotary-Winnek, Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 25 November 1984 and end Nov. 30 1984 of drilling operation
Sampling Interval (Estimated) 5(ft)

Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken *	Lithologic Description
120-			G	CALICHE; medium-coarse, cemented with calcite moderately sorted, subangular.
125-			G	SAND; same as above.
130-			G	SAND; brown, fine-medium grained, poorly sorted, cemented, 10% lithic fragments.
135			G	SAND; same as above.
140-			G	SAND; slightly cemented, fine-medium grain, calcite 25%.
145-			G	SAND; medium grained, moderately sorted, with 10% lithic fragments.
150-			G	SAND; silty, fine-medium grained with 10% clay.
155-			G	SAND; fine-medium grained, well sorted, decrease in clay.
160-			G	SAND; medium grained, angular, poorly sorted.
165-			G	SAND; brown, fine-medium grained, slightly cemented.
170-			G	SAND; fine-medium grained, moderately sorted, subrounded, lithics 10%.
175-			G	SAND; buff-brown, fine-medium grained, slightly cemented with calcite, calcite nodules 10-15%.
180-				

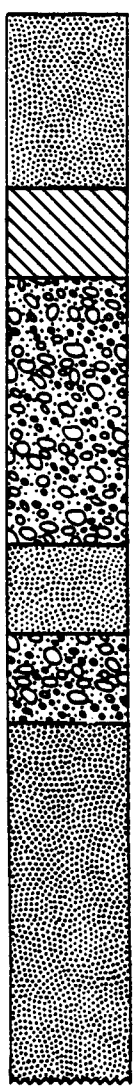
Monitor Well B was grouted from 344 ft to the surface with 7 yds.3 of Portland Type I neat cement.

ST = Shelby tube; SS = split-spoon; G = grab.

Log of Drilling Operations
Monitor Well #B

Location Site 5B Landfill No. 5
Log Recorded by T.K. Walters/W. Boettner
Type Drill Rig and Operator Failing 1500 Air/mud Rotary-Winnek, Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 25 November 1984 and end 30 Nov. 1984 of drilling operation
Sampling Interval (Estimated) 5(ft)

Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken*	Lithologic Description
180-			G	SAND; fine-medium grained, moderately sorted, subrounded, unconsolidated.
185-			G	SAND; red-brown, extremely hard, cemented, silt light brown clasts.
190-			G	CLAY; silty, much finer than above, poor plasticity, dark brown.
195-			G	SAND AND GRAVEL; coarse, cemented, poorly sorted, lightly calcareous, subangular, lithic 25%.
200-			G	GRAVEL; pebble size, angular, unconsolidated chert fragments, and other lithics 35%.
205-			G	GRAVEL; cobble size, high energy, angular-subrounded, slightly cemented by calcite, loosely consolidated, with lithic fragments.
210-			G	SAND; coarse grain with fine silty clay matrix, poorly sorted.
215-			G	SAND AND GRAVEL; poorly sorted, unconsolidated, subrounded, chert fragments, dull grey.
220-			G	SAND; with minor gravel, silty brown, poorly sorted, unconsolidated-semi cemented.
225-			G	SAND; medium-coarse grain, unconsolidated, poorly sorted.
230-			G	SAND; medium-coarse grain, unconsolidated, light brown, fairly well sorted.
235-			G	SAND; light brown, medium-coarse grain, subrounded, moderately sorted, slightly calcareous.
240-				

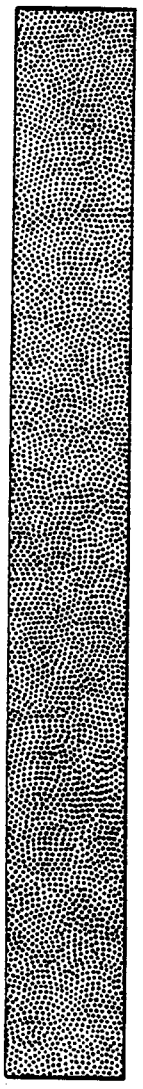
Monitor Well B was grouted from 344 ft to the surface with 7 yds.^{3} of Portland Type I neat cement.

ST = Shelby tube; SS = split-spoon; G = grab.

Log of Drilling Operations
Monitor Well #B

Location Site 5B Landfill No. 5
Log Recorded by T.K. Walters/W. Boettner
Type Drill Rig and Operator Failing 1500 Air/mud Rotary-Winnek, Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 25 November 1984 and end 30 Nov. 1985 of drilling operation
Sampling Interval (Estimated) 5(ft)

Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken*	Lithologic Description
240-			G	SAND; silty with clay matrix, calcite nodules 30%, much more clay than above unit.
245-			G	SAND; tan-brown, fine-medium grain, moderately well sorted, subangular, quartzose.
250-			G	SAND; same as above.
255-			G	SAND; buff, cemented with calcite, silty, fine grain, poorly sorted, semi-consolidated.
260-			G	SAND; light-brown, fine-medium grain, poorly sorted, angular, with calcite nodules, clay stringers.
265-			G	SAND; brown, fine-medium grain, unconsolidated with clay stringers.
270-			G	SAND; medium-coarse grain, moderately sorted, quartzose, sub-rounded.
275-			G	SAND; same as above unit.
280-			G	SAND; medium grained, subangular, moderately sorted.
285-			G	SAND; medium grain, subangular quartz, moderately sorted.
290-			G	SAND; fine grained, with clay matrix, quartzose, subangular.
295-			G	SAND; fine-coarse, poorly sorted, unconsolidated, subangular.
300-				

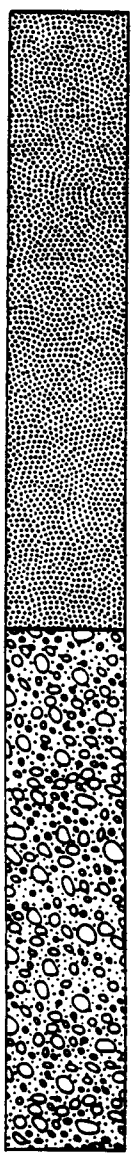
Monitor Well B was grouted from 344 ft to the surface with 7 yds.3 of Portland Type I neat cement.

ST = Shelby tube; SS = split-spoon; G = grab.

Log of Drilling Operations
Monitor Well #B

Location Site 5B Landfill No.5
Log Recorded by T.K. Walters/W. Boettner
Type Drill Rig and Operator Failing 1500 Air/mud Rotary-Winnek, Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 25 November 1984 and end 30 Nov. 1985 of drilling operation
Sampling Interval (Estimated) 5(ft)

Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken *	Lithologic Description
300-			G	SAND; fine-medium, cemented, brown, drilling slow, bit skating occasionally.
305-			G	SAND; fine-medium, mostly quartz, plagioclase and shale.
310-			G	SAND; medium grained with minor lithic fragments.
315-			G	SAND; same as above unit.
320-			G	SAND; same as above unit.
325-			G	SAND; pebbles and chips of larger angular gravel, hard drilling.
330-			G	SAND AND SILT; minor gravel, caliche (calcrete?).
335-			G	SAND; with gravel, calcrete cement, resembling caliche, no water.
340-			G	SAND AND GRAVEL; angular, hard drilling.
345-			G	SAND; with gravel, drilling much faster.
350-			G	GRAVEL; hard cemented, quartzose, with olivine, lithic fragments, shale and some calcite matrix .
355-			G	GRAVEL; hard, cemented, same as above unit.
360-			G	GRAVEL; hard cemented, same as above unit.
365-				

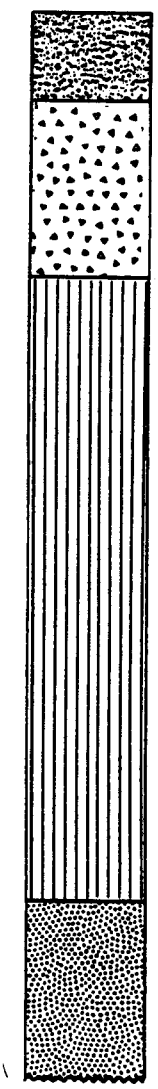
Monitor Well B was grouted from 344 ft to the surface with 7 yds.3 of Portland Type I neat cement.

ST = Shelby tube; SS = split-spoon; G = grab.

Log of Drilling Operations
Monitor Well #C

Location Site 5, Landfill No. 5, Cannon AFB
Log Recorded by T.K. Walters
Type Drill Rig and Operator Failing 1500 Air/Mud Rotary Rig-Winnek, Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 9 Jan. 1985 and end 10 Jan. 1985 of drilling operation
Sampling Interval (Estimated) 5 (ft)



Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken*	Lithologic Description
0-			G	TOPSOIL; dark red, loam.
5-			G	CALICHE; hard, contact at 6'.
10-			G	CALICHE; with silt, buff - slightly cemented.
15-			G	SILT; buff, with caliche, silt is cemented, hard chert streak 18'-19'.
20-			G	SILT; brown, slight consolidated, caliche nodules.
25-			G	SILT; buff, fine grained cemented with calcite, chert pebbles 5%.
30-			G	SILT; buff white, slightly cemented with clay, caliche nodules 5%.
35-			G	SILT; with caliche, cemented, fine grained.
40-			G	SILT; sandy, brown with clay, 10% caliche, loosely consolidated.
45-			G	SILT; sandy, light brown, loosely consolidated.
50-			G	SAND; silty, poorly sorted, cemented by calcite, caliche nodules present.
55-			G	SAND; silty, with caliche nodules, sand portion poorly sorted, quartzose.
60-				

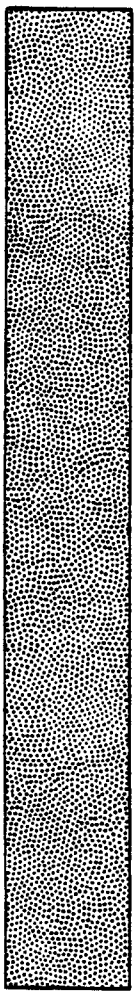
Monitor Well C was grouted from 344 ft to the surface with 7 1/2 yds.^{3} of Portland Type I neat cement.

*ST = Shelby tube; SS = split-spoon; G = grab.

Log of Drilling Operations
Monitor Well #C

Location Site 5, Landfill No. 5, Cannon AFB
Log Recorded by T.K. Walters
Type Drill Rig and Operator Failing 1500 Air/Mud Rotary Rig-Winnek,Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 9 Jan. 1985 and end 10 Jan. 1985 of drilling operation
Sampling Interval (Estimated) 5 (ft)

Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken*	Lithologic Description
60-			G	SAND; fine, medium grained, poorly sorted, consolidated with caliche.
70-			G	SAND; silty brown, consolidated, fairly well sorted, cemented with caliche.
75-			G	SAND; brown, consolidated, poorly sorted, cemented by calcite.
80-			G	SAND; Brown, semi-consolidated, poorly sorted cemented by calcite.
85-			G	SAND; silty, brown, poorly sorted, loosely loosely consolidated fine to medium grained.
90-			G	SILT; sandy, brown, unconsolidated, angular grains, poorly sorted.
95-			G	SAND; loosely cemented, poorly sorted, fine-medium grained, with fine medium cemented zones.
100-			G	SAND; unconsolidated fine-medium grained, poorly sorted with caliche "float", lithics 10%.
105-			G	SAND; fine grained, buff white, hard cemented with calcite.
110-			G	SAND; fine medium grained, cemented, quartzose, clear, poorly sorted with calcite matrix.
115-			G	SAND; fine - medium grained cemented, poorly sorted, lithics 15%, clear, quartzose, angular, calcite matrix.
120-				

Monitor Well C was grouted from 344 ft to the surface with 7 1/2 yds.^{3} of Portland Type I neat cement.

*ST = Shelby tube; SS = split-spoon; G = grab.

Log of Drilling Operations
Monitor Well #C

Location Site 5, Landfill No. 5, Cannon AFB
Log Recorded by T.K. Walters
Type Drill Rig and Operator Failing 1500 Air/Mud Rotary Rig-Winnek,Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 9 Jan. 1985 and end 10 Jan. 1985 of drilling operation
Sampling Interval (Estimated) 5 (ft)

Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken*	Lithologic Description
120-			G	SAND; fine grained, unconsolidated, well-sorted.
125-			G	SAND; fine - medium grained, loosely consolidated, poorly sorted.
130-			G	SAND; fine - medium grained, poorly sorted, clear quartz, angular.
135-			G	SAND; medium grained, moderately sorted, cemented, grains cemented by calcite.
140-			G	SAND; silty, fine - medium grained, poorly sorted cemented.
145-			G	SAND; fine grained, well sorted, unconsolidated.
150-			G	SAND; brown, cemented with calcite, lithics 15%, quartz, subrounded, moderately sorted.
155-			G	SAND; brown, cemented with calcite, quartz grains well sorted, subrounded.
160-			G	SAND; silty, loosely consolidated, poorly sorted with 10% lithics.
165-			G	SAND; silty, loosely consolidated, poorly sorted with 10% lithics.
170-			G	SAND; silty, poorly sorted, loosely consolidated.
175-			G	SAND; silty, fine-medium grained, cemented by calcite, moderately sorted, subrounded quartz.
180-				

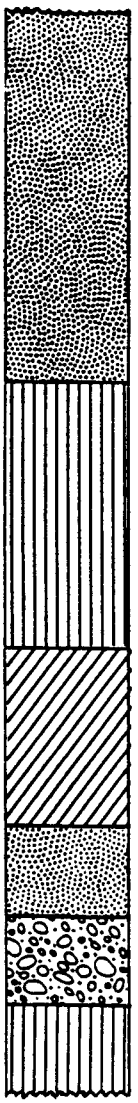
Monitor Well C was grouted from 344 ft(TD) to the surface with 7 1/2 yds.3 of Portland Type I neat cement.

*ST = Shelby tube; SS = split-spoon; G = grab.

Log of Drilling Operations
Monitor Well #C

Location Site 5, Landfill No. 5, Cannon AFB
Log Recorded by T.K. Walters
Type Drill Rig and Operator Failing 1500 Air/Mud Rotary Rig-Winnek,Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 9 Jan. 1985 and end 10 Jan. 1985 of drilling operation
Sampling Interval (Estimated) 5 (ft)



Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken*	Lithologic Description
180-			G	SAND; silty, fine grained, cemented, similar to above unit.
185-			G	SAND; silty, fine-medium, unconsolidated.
190-			G	SAND; fine-medium grained, silty, unconsolidated, poorly sorted.
195-			G	SAND; similar to above unit.
200-			G	SILT; brown, unconsolidated, little sand, sand, quartz, unconsolidated, poorly sorted.
205-			G	SILT; brown, unconsolidated, poorly cemented.
210-			G	SILT; brown with caliche clasts, and 10% sand, fine, moderately well sorted, subrounded.
215-			G	CLAY; green, with red oxidized sand clasts and fragments of grey clay and silt also.
220-			G	CLAY; silty, green, with medium grained sand, angular, lithics 10%.
225-			G	SAND; coarse, with minor gravel, poorly sorted angular, lithics 30%.
230-			G	GRAVEL; sandy with caliche nodules, unconsolidated, poorly sorted.
235-			G	SILT; buff-white, with white clay clasts, fine grained, well sorted, unconsolidated.
240-				

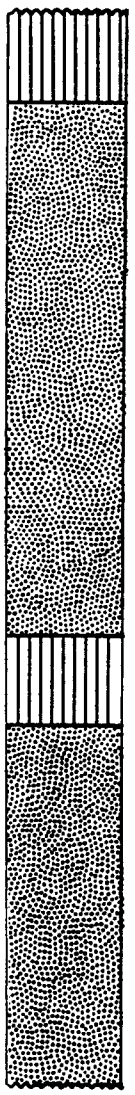
Monitor Well C was grouted from 344 ft to the surface with 7 1/2 yds.^{3} of Portland Type I neat cement.

*ST = Shelby tube; SS = split-spoon; G = grab.

Log of Drilling Operations
Monitor Well #C

Location Site 5, Landfill No. 5, Cannon AFB
Log Recorded by T.K. Walters
Type Drill Rig and Operator Failing 1500 Air/Mud Rotary Rig-Winnek,Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 9 Jan. 1985 and end 10 Jan. 1985 of drilling operation
Sampling Interval (Estimated) 5 (ft)



Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken*	Lithologic Description
240-			G	SILT; sandy, brown, poorly sorted, unconsolidated fine grained.
245-			G	SAND; silty brown, poorly sorted, unconsolidated, with caliche nodules.
250-			G	SAND; medium grained, cemented, well sorted.
255-			G	SAND; buff-white, consolidated, fine - medium grained, moderately well sorted, with 10% lithics.
260-			G	SAND; white, loosely consolidated, fine-medium sorted, subrounded.
265-			G	SILT; sandy, brown, loosely consolidated fine-medium, grained, poorly sorted, with caliche nodules.
270-			G	SAND; medium-coarse grained, angular, unconsolidated poorly sorted, with 15% black lithics.
275-			G	SILT; red-brown, fine, unconsolidated slightly cemented, with minor sand.
280-			G	SAND; red-brown, silty, poorly sorted, unconsolidated, sand, angular, clear.
285-			G	SAND; coarse, with minor gravel, unconsolidated, poorly sorted, angular.
290-			G	SAND; silty, fine-coarse, red-brown, unconsolidated, poorly sorted, sub-angular, 10% lithics.
295-			G	SAND; medium-coarse, with red-brown silty zones, loosely consolidated, 10% lithics.
300-				

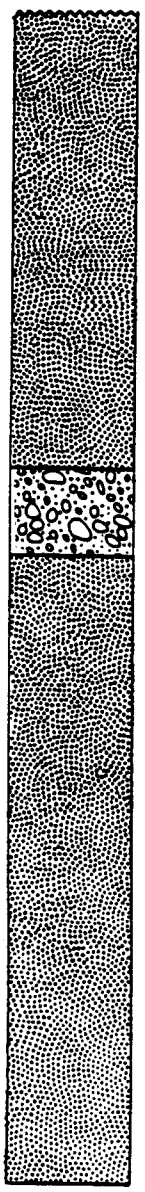
Monitor Well C was grouted from 344 ft to the surface with 7 1/2 yds.3 of Portland Type I neat cement.

*ST = Shelby tube; SS = split-spoon; G = grab.

Log of Drilling Operations
Monitor Well #C

Location Site 5, Landfill No. 5, Cannon AFB
Log Recorded by T.K. Walters
Type Drill Rig and Operator Failing 1500
Air/Mud Rotary Rig-Winnek,Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 9 Jan. 1985 and end
10 Jan. 1985 of drilling operation
Sampling Interval (Estimated) 5 (ft)

Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken	Lithologic Description
300-			G	SAND; silty, cemented, poorly sorted, fine-medium grained, subangular.
305-			G	SAND; hard cemented, medium-coarse, 1st hard streak 305'-306', out at 306', clay matrix.
310-			G	SAND; medium-very coarse, unconsolidated, poorly sorted, 30% lithics, angular no matrix.
315-			G	SAND; unconsolidated, fine-coarse, angular with 30% lithics, some calcite matrix.
320-			G	SAND; medium-coarse, unconsolidated, with 30% lithics, subangular, gravel 10%.
325-			G	SAND/GRAVEL; loosely cemented, with red silt, also hard, drilling fast, color olive-brown.
330-			G	SAND; medium-coarse, unconsolidated, subangular, with 30% lithics, silt 20%, color olive brown.
335-			G	SAND; oxidized, highly weathered, with cemented grains, hard, fine-coarse, angular lithics.
340-			G	SAND; fine-coarse, and red silt, mottled with green clay clasts, reworked red beds, very hard 332'345'.
345-			G	SAND; cemented, confining, conglomerate, extremely hard, out of hard zone 349'.
350-			G	SAND; coarse, with gravel, unconsolidated with clay stringers grey and red.
355-			G	SAND; medium-coarse, unconsolidated, poorly sorted, with 20% clay, brown, hard cemented streak 6".
360-			G	SAND; hard, cemented, poorly sorted, angular very slow drilling.
362-				

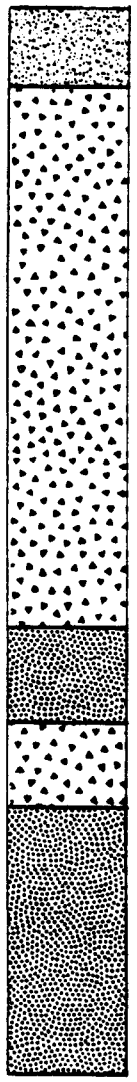
Monitor Well C was grouted from 344 ft to the surface using 7 1/2 yds.^{3} of Portland Type I neat cement.
*ST = Shelby tube; SS = split-spoon; G = grab.

DRAFT

Log of Drilling Operations
Monitor Well #D

Location Cannon AFB, Site 5 Landfill No. 5
Log Recorded by T.K. Walters
Type Drill Rig and Operator Failing 1500 Air/mud rotary-Winnek,Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 10 December 1984 and end 16 Dec. 1984 of drilling operation
Sampling Interval (Estimated) 5(ft)

Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken*	Lithologic Description
0-			G	TOPSOIL; red, clayey with roots and organic matter.
5-			G	CALICHE; 4' with clayey silt, light grey.
10-			G	CALICHE; with silty sand.
15-			G	CALICHE; with silt, some fine sand (white nodules 19').
20-			G	CALICHE; extremely hard, silty, interbedded with fine sand.
25-			G	CALICHE; with sand, caliche nodules extremely hard, sand is cemented.
30-			G	CALICHE; with fine sand, caliche 80%, sand 20%.
35-			G	SAND; red-brown, cemented, medium-grained, oxidized, with bone grey chert and caliche fragments.
40-			G	CALICHE; with chert, buff grey, with minor sand, medium grained.
45-			G	SAND; buff grey, cemented, fine-medium grained, moderate-well sorted, grading to light tan clayey sand, cemented.
50-			G	SAND; light grey, extremely well sorted, cemented, hard.
55-			G	SAND; bone white, cemented, interbedded with red-brown, cemented sand.
60-				

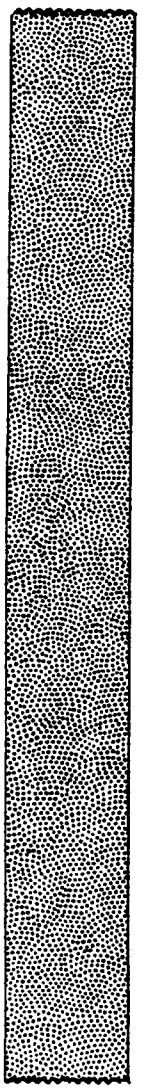
Monitor Well D was grouted from 338 ft to the surface with 5 yds.^{3} of Portland Type I neat cement.

*ST = Shelby tube; SS = split-spoon; G = grab.

Log of Drilling Operations
Monitor Well #D

Location Cannon AFB, Site 5 Landfill No. 5
Log Recorded by T.K. Walters
Type Drill Rig and Operator Failing 1500 Air/mud rotary-Winnek,Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 10 Dec. 1984 and end 16 Dec. 1984 of drilling operation
Sampling Interval (Estimated) 5(ft)

Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken*	Lithologic Description
60-			G	SAND; cemented, fine-medium grained, extremely well sorted, buff white.
65-			G	SAND; light brown, poorly sorted, loosely consolidated, fine-medium grained, subangular, friable, red volcanic fragments.
70-			G	SAND; brown, poorly sorted, uncemented, fine to medium grained, subangular, 10% clay.
75-			G	SAND; quartzose, fine-medium grain, well-sorted with 10% red lithic fragments, no clay or calcite cement.
80-			G	SAND; same as above, slightly finer grained.
85-			G	SAND; brown, fine-medium grained, very well well sorted, subrounded quartz, clear.
90-			G	SAND; brown, fine-medium grain, poorly sorted, lithics 10%, quartz well-rounded.
95-			G	SAND; brown, medium grained, moderately sorted, quartzose, subrounded, quartz (blue-clear), 10% volcanic fragments.
100-			G	SAND; brown, fine-medium, well sorted, finer than above unit.
105-			G	SAND; quartzose, brown, fine-medium grain, caliche stringer 1' thick.
110-			G	SAND; brown, fine-medium grained slightly cemented, trace of calcite cement.
115-			G	SAND; buff-white, fine grain, cemented with calcite, moderately sorted, hard.
120-				

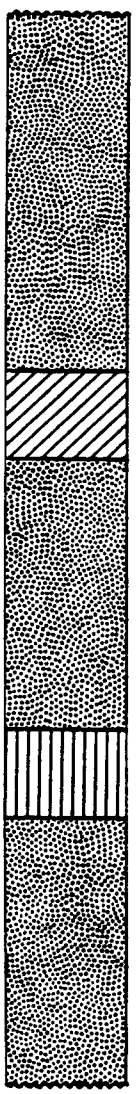
Monitor Well D was grouted from 338 ft to the surface with 5 yds.^{3} of Portland Type I neat cement.

*ST = Shelby tube; SS = split-spoon; G = grab.

Log of Drilling Operations
Monitor Well #D

Location Cannon AFB, Site 5 Landfill No. 5
Log Recorded by T.K. Walters
Type Drill Rig and Operator Failing 1500 Air/mud rotary-Winnek.Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 10 December 1984 and end 16 Dec. 1984 of drilling operation
Sampling Interval (Estimated) 5(ft)

Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken*	Lithologic Description
120-			G	SAND; brown, unconsolidated, fine-medium grained, quartzose.
125-			G	SAND; Fine-medium, quartzose, well sorted, subrounded.
130-			G	SAND; brown, fine-medium quartzose subrounded, unconsolidated.
135-			G	SAND; brown, medium grain, well sorted, subangular, quartz 90%.
140-			G	CLAY; silty, with sand, fine.
145-			G	SAND; silty, fine grained, well sorted with caliche nodules (from above).
150-			G	SAND; silty, fine, well sorted, subrounded, quartz 90%.
155-			G	SAND; silty, fine grained, well sorted, quartzose.
160-			G	SILT; sandy, fine grained, quartzose, well sorted.
165-			G	SAND; brown, fine grained, very well sorted, well-rounded.
170-			G	SAND; brown, medium grained, well sorted.
175-			G	SAND; brown, medium grained, very well sorted with 10% black lithic fragments.
180-				

Monitor Well D was grouted from 338 ft to the surface with 5 yds.3 of Portland Type I neat cement.

*ST = Shelby tube; SS = split-spoon; G = grab.

Log of Drilling Operations
Monitor Well #D

Location Cannon AFB, Site 5 Landfill No. 5
Log Recorded by T.K. Walters
Type Drill Rig and Operator Failing 1500 Air/mud rotary-Winnek,Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 10 December 1984 and end 16 Dec. 1984 of drilling operation
Sampling Interval (Estimated) 5(ft)

Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken*	Lithologic Description
180-			G	SAND; silty, brown, fine-medium grained, well sorted, subrounded.
185-			G	SAND; brown, silty, very fine grained, well sorted, unconsolidated, finer than above.
190-			G	SAND; brown, medium grained, moderately sorted, coarser than above unit, quartz, subangular, clear, 10% lithics.
195-			G	SAND; brown, poorly sorted, fine to medium grained, 10% lithic fragments.
200-			G	SAND; brown, fine-medium grained, very little clay, 10% lithic fragments, black.
205-			G	SAND; brown, unconsolidated, silty, fine-medium grained with caliche layer at 205'-206'.
210-			G	CLAY; yellow regolith, with iron stained clasts.
215-			G	SAND; fine-coarse, poorly sorted, with 25% red and black lithics, unconsolidated gravel 18%.
220-			G	SAND; fine-medium grained, poorly sorted, finer than above unit, unconsolidated, subrounded sand and gravel.
225-			G	SAND; coarse, with 25% gravel, sand is poorly sorted, subangular, quartz is clear and yellow.
230-			G	SAND AND GRAVEL: buff-brown, cemented poorly with calcite, gravel 10%.
235-			G	SAND; buff-brown, fine-medium grained, poorly cemented, calcite matrix, lithics, 5% gravel.
240-				

Monitor Well D was grouted from 338 ft to the surface with 5 yds.^{3} of Portland Type I neat cement.

*ST = Shelby tube; SS = split-spoon; G = grab.

Log of Drilling Operations
Monitor Well #D

Location Cannon AFB, Site 5 Landfill No. 5
Log Recorded by T.K. Walters
Type Drill Rig and Operator Failing 1500 Air/mud rotary-Winnek.Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 10 December 1984 and end 16 Dec. 1984 of drilling operation
Sampling Interval (Estimated) 5(ft)

Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken*	Lithologic Description
240-			G	SAND; buff-brown, cemented, fine-medium grained, poorly sorted.
245-			G	SAND; brown, unconsolidated, medium grained, quartzose.
250-			G	SAND; coarse, unconsolidated, poorly sorted, angular, with 15% lithics, calcite cement.
255-			G	SAND; brown, unconsolidated, poorly sorted, angular with 10% lithics, calcite cement.
260-			G	SAND; fine-medium grained, poorly sorted, subangular, unconsolidated.
265-			G	SAND; brown, medium grained, very well sorted, quartz 95%, clear, rounded.
270-			G	SAND; brown, fine-medium grained, moderately sorted, 15% lithics.
275-			G	SAND; unconsolidated, well sorted, 85% quartz, rounded.
280-			G	SAND; fine-medium grained, unconsolidated, moderately well sorted, quartz 85%.
285-			G	SAND; brown, medium grained, moderately well sorted, 20% lithic fragments.
290-			G	SAND; brown, fine-medium grained, poorly sorted, unconsolidated, subrounded, 20% lithics, caliche clasts 5-10%.
295-			G	SAND; brown, well sorted, medium grained, less dirty than unit above, hard streak at 299'.
300-				

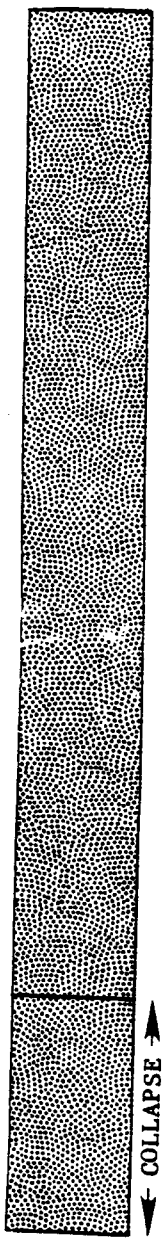
Monitor Well D was grouted from 338 ft to the surface with 5 yds.^{3} of Portland Type I neat cement.

*ST = Shelby tube; SS = split-spoon; G = grab.

Log of Drilling Operations
Monitor Well #D

Location Cannon AFB, Site 5 Landfill No. 5
Log Recorded by T.K. Walters
Type Drill Rig and Operator Failing 1500 Air/mud rotary-Winnek.Inc.-B Holland

Project Cannon AFB-Phase II Stage I
Beginning 10 December 1984 and end 16 Dec. 1984 of drilling operation
Sampling Interval (Estimated) 5(ft)

Depth (ft)	Graphic Log	Core Sample Interval/ID	Type of Sample Taken*	Lithologic Description
300-			G	SAND; medium-coarse, poorly sorted, unconsolidated with 30% black lithic fragments.
305-			G	SAND; brown, fine grained, well sorted.
310-			G	SAND; fine-medium grained, moderately well sorted, rounded, with 10% lithics.
315-			G	SAND; brown, coarse grain, poorly sorted, subangular with 15% lithics.
320-			G	SAND; brown, fine-medium grain, poorly sorted, subrounded.
325-			G	SAND; dark brown, extremely hard zone at 329', cemented.
330-			G	SAND; very hard sand, fine grain, out of hard zone 333', in again 334'-335'.
335-			G	SAND; medium grain, 335-339' unconsolidated, cemented sand 339-340', confining.
340-			G	SAND; unconsolidated 340-342', fine-medium hard streak 342-344', medium-coarse sand with 15% lithic fragments.
345-			G	SAND; medium grained, fairly unconsolidated, drilling faster than above.
350-			G	SAND; same as above, medium grained, moderately well sorted.
355-			G	SAND; fine-medium grained, moderately well sorted , unconsolidated, hard streak at 359-360'.
360-			G	360-361' out of cemented zone. 361-362' into cemented zone.
365-			G	SAND; 362-365' unconsolidated, drilling faster.
367 1/2--			G	SAND: Same as above.

COLLAPSE

Monitor Well D was grouted from 338 ft to the surface with 5 yds.^{3} of Portland Type I neat cement.
*ST = Shelby tube; SS = split-spoon; G = grab.

Appendix III

Ground-Water Quality Assessment Plan Outline

DRAFT

GROUND-WATER QUALITY ASSESSMENT OUTLINE

A. The groundwater monitoring that is being performed now IAW the New Mexico Hazardous Waste Regulation (NMHWR) Section 206.C.1.c will give an adequate initial contamination assessment and determine if hazardous waste or hazardous waste constituents have entered the groundwater. The initial assessment should identify the particular chemical or contaminant and identify all possible sources of the contamination.

B. If a statistically significant increase (or pH decrease) is reported, the monitor wells will immediately be resampled to confirm the original result.

1. When a statistically significant result is reported, the monitor well's sampling frequency will be increased to quarterly.

2. Also, the Total Organic Carbon (TOC) and Total Organic Halogen (TOX) analyses will be replaced with TOX and TOC screens which will more accurately quantify the contaminants.

C. The groundwater flow directions and water-transmitting properties of the geologic units are used to estimate the rate and direction of contaminant transport and the size of the contaminant plume. Some hydrologic principles which need to be recognized when assessing the rate and extent of contaminant plumes in groundwater are:

1. the contaminant plume is not diluted with the entire body of groundwater, but tends to remain as an intact body with only slight dispersion and diffusion along the edges;

2. the contaminant actually moves faster than the average groundwater velocity because of hydrodynamic dispersion;

3. the path of a soluble contaminant plume will generally follow the direction from induced changes in gradient (e.g., a pumped well) will also divert the contaminant plume;

4. the flow direction of a water-immiscible contaminant will be affected by the groundwater flow direction, but they do not necessarily coincide;

5. hydraulic and lithologic conditions and fluid density determine the vertical depth to which the contaminant will migrate into the aquifer. The thickness of the plume in the aquifer will probably increase with distance downgradient from the source;

6. the extent and movement of various constituents in the contaminant plume will vary depending on attenuation from the various chemical and biochemical reactions.

If these methods don't give an adequate assessment of the extent of the contamination, then extra monitor wells may need to be installed and sampled.

D. In order to adequately determine the concentration of hazardous waste or hazardous waste constituents in the groundwater an accurate assessment of the fate of the groundwater pollutant must be made with regard to three types of processes which are:

1. partitioning of the chemical between the three phases (soil, water, air) of the 'soil';

2. degradation of the chemical by such processes as hydrolysis, biodegradation, and oxidation; and

3. transport of the chemical, either in the vapor phase to the atmosphere or in solution with the groundwater.

E. In the event that a significant increase (or pH decrease) is reported, IAW NMHWR Section 206.C.1.d.(6) a specific plan for a ground-water quality assessment program will be prepared for the facility by the Occupational and Environmental Health Laboratory (OEHL) Consultant Services Division (Environmental Quality Branch), and will be submitted to the Director of the New Mexico Environmental Improvement Division (NMEID) within 15 days of the notification date.

Appendix IV

Monitoring Data

GW

DEPARTMENT OF THE AIR FORCE

HEADQUARTERS 27TH COMBAT SUPPORT GROUP (TAC)
CANNON AIR FORCE BASE, NM 88101

RECEIVED
APR 29 1985
HAZARDOUS WASTE SECTION

REPLY TO ATTN OF: CC

26 April 1985

SUBJECT: Groundwater Monitor Well Sample Results

TO: Environmental Improvement Division
Hazardous Waste Section
P.O. Box 968
Santa Fe, New Mexico 87504-0968

1. Analysis results of samples taken from our groundwater monitoring wells on 25 January 1985 are enclosed. These are the first quarter samples for RCRA compliance of the sanitary landfill located in the southeast corner of the base.

2. Please note that the samples taken for pesticides analysis were not analyzed for reasons beyond our control. The contractor took samples to be analyzed for pesticide content but realized once he got back to his office that pesticide analysis was not included in the contract. Then he sent the samples to the Air Force laboratory at Brooks AFB, Texas along with check samples of other samples he had taken. He did not indicate to our lab that the pesticide samples were not check samples and since our lab analyzes only ten percent of the check samples, the pesticide samples were not analyzed. Per our conversation with Ann Claassen on 25 April, we will retake a sample from each well to be analyzed for pesticides between our scheduled second and third quarter samples (on 17 Jun 85).

3. For your information, we took second quarter samples on 22 April 1985 and anticipate results in about a month.

4. Ann also requested that we delay our third quarter samples from the end of July to sometime in August so that she can arrange to be here to observe. Lt Walton will schedule that with her as the time gets closer.

5. If you have any questions regarding the sample results, feel free to contact either Lt Scott or Lt Walton at (505) 784-4064.

MARY N. TURNER, Colonel, USAF
Commander

1 Atch
Sampling Results

cc: 27TFW/JA
27TFW/PA
27CSG/DEEV

Readiness is our Profession

GROUNDWATER MONITORING RESULTS - 25 JAN 85

ANALYSIS ↓/WELL→	WELL A	WELL B	WELL C	WELL D
206.C.1.c(2)(a) PARAMETERS CHARACTERIZING SUITABILITY FOR DRINKING WATER				
ARSENIC (ug/ml)	0.006	<.0002	0.0004	0.0005
BARIUM (ug/ml)	0.074	0.32	0.079	0.15
CADMIUM (ug/ml)	<.001	0.003	0.002	<.002
CHROMIUM (ug/ml)	0.001	0.002	<.002	0.004
FLUORIDE (mg/l)	2.6	2.7	2.6	2.4
LEAD (ug/ml)	<.002	<.002	<.002	<.002
MERCURY (ug/ml)	0.0004	0.0006	0.0004	0.0006
NITRATE (mg/l as N)	0.81	0.81	0.82	0.88
SELENIUM (ug/ml)	<.002	<.002	<.002	<.002
SILVER (ug/ml)	<.002	<.002	<.002	<.002
ENDRIN (ug/ml)	- - - - Not analyzed - - - -			
LINDANE (ug/ml)	- - - - Not analyzed - - - -			
METHOXYCHLOR (mg/l)	- - - - Not analyzed - - - -			
TOXAPHENE (ug/ml)	- - - - Not analyzed - - - -			
2,4-D (mg/l)	- - - - Not analyzed - - - -			
2,4,5-TP SILVEX (ug/ml)	- - - - Not analyzed - - - -			
GROSS ALPHA (pCi/l)	1.2	3.0	2.1	<1
COLIFORM BACTERIA (colonies/100ml) (Note: Coliform bacteria tested by MPN method)	<2.2	16	9.2	5.1
206.C.1.c(2)(b) PARAMETERS ESTABLISHING GROUND-WATER QUALITY				
CHLORIDE (mg/l)	53	50	50	51
IRON (ug/ml)	0.020	0.34	0.020	0.047
MANGANESE (ug/ml)	0.021	0.76	0.33	0.52

ANALYSIS ↓/WELL→	WELL A	WELL B	WELL C	WELL D
PHENOLS (mg/l)	<.005	0.041	<.005	<.005
SODIUM (ug/l)	60	62	57	53
SULFATE (mg/l)	120	130	120	110
206.C.1.c(2)(c) INDICATORS OF GROUND-WATER CONTAMINATION				
pH (pH units)	7.6	7.5	7.4	7.4
SPECIFIC CONDUCTANCE (umhos)	740	750	750	750
TOTAL ORGANIC CARBON (mg/l)	<1	<1	<1	<1
TOTAL ORGANIC HALOGEN (mg/l)	<.01	<.01	<.01	<.01
ELEVATION OF WATER (ft)	4005.26	4000.63	4000.30	4001.07

GROUNDWATER MONITORING RESULTS - 22 APRIL 85

ANALYSIS ↓/WELL-)	WELL A	WELL B	WELL C	WELL D
206.C.1.c(2)(a) PARAMETERS CHARACTERIZING SUITABILITY FOR DRINKING WATER				
ARSENIC (ug/l)	< 10	< 10	< 10	< 10
BARIUM (ug/l)	< 200	< 200	< 200	< 200
CADMIUM (ug/l)	< 10	< 10	< 10	< 10
CHROMIUM (ug/l)	< 50	< 50	< 50	< 50
FLUORIDE (mg/l)	2.0	0.2	0.5	0.1
LEAD (ug/l)	< 20	< 20	< 20	< 20
MERCURY (ug/l)	< 1	< 1	< 1	< 1
NITRATE (mg/l as N)	0.80	0.83	0.77	0.91
SELENIUM (ug/l)	< 10	< 10	< 10	< 10
SILVER (ug/l)	< 10	< 10	< 10	< 10
ENDRIN (ug/l)	<0.02	<0.02	<0.02	<0.02
LINDANE (ug/l)	<0.01	<0.01	<0.01	<0.01
METHOXYCHLOR (mg/l)	<0.20	<0.20	<0.20	<0.20
TOXAPHENE (ug/l)	< 1	< 1	< 1	< 1
2,4-D (mg/l)	<0.06	<0.06	<0.06	<0.06
2,4,5-TP SILVEX (ug/l)	<0.06	<0.06	0.08	0.14
GROSS ALPHA (pCi/l)	3.0	4.0	3.0	3.0
COLIFORM BACTERIA (colonies/100ml)	< 1	< 1	< 1	< 1

ANALYSIS ↓/WELL->	WELL A	WELL B	WELL C	WELL D
206.C.1.c(2)(b) PARAMETERS ESTABLISHING GROUND-WATER QUALITY				
CHLORIDE (mg/l)	56	44	60	52
IRON (ug/l)	< 100	163	< 100	< 100
MANGANESE (ug/l)	< 50	243	260	139
PHENOLS (ug/l)	- - - - NOT ANALYZED - - - -			
SODIUM (ug/l)	49.6	56.0	49.8	48.6
SULFATE (mg/l)	125	150	108	108
206.C.1.c(2)(c) INDICATORS OF GROUND-WATER CONTAMINATION				
pH (pH units)	7.3	7.4	7.5	7.5
SPECIFIC CONDUCTANCE (umhos)	690	720	710	700
	700	720	710	680
	700	720	705	680
	700	720	710	690
TOTAL ORGANIC CARBON (mg/l)	2	< 1	< 1	3
	2	< 1	< 1	2
	2	< 1	< 1	2
	2	< 1	< 1	2
TOTAL ORGANIC HALOGEN (ug/l)	16	66	42	76
	15	30	<15	121
	<15	29	<15	<15
ELEVATION OF WATER (ft)	4004.96	4000.89	4000.58	4001.50

GROUNDWATER MONITORING RESULTS - 6 AUG 85

ANALYSIS ↓/WELL->	WELL A	WELL B	WELL C	WELL D
206.C.1.c(2)(a) PARAMETERS CHARACTERIZING SUITABILITY FOR DRINKING WATER				
ARSENIC (ug/l)	< 10	< 10	< 10	< 10
BARIUM (ug/l)	< 200	< 200	< 200	< 200
CADMIUM (ug/l)	< 10	< 10	< 10	< 10
CHROMIUM (ug/l)	< 50	< 50	< 50	< 50
FLUORIDE (mg/l)	- - - - NOT ANALYZED - - - -			
LEAD (ug/l)	< 20	< 20	< 20	< 20
MERCURY (ug/l)	< 1	< 1	< 1	< 1
NITRATE (mg/l as N)	0.60	0.50	0.60	0.80
SELENIUM (ug/l)	< 10	< 10	< 10	< 10
SILVER (ug/l)	< 10	< 10	< 10	< 10
ENDRIN (ug/l)	ND	ND	ND	ND
LINDANE (ug/l)	ND	ND	ND	ND
METHOXYCHLOR (mg/l)	ND	ND	ND	ND
TOXAPHENE (ug/l)	ND	ND	ND	ND
2,4-D (mg/l)	- - - - NOT ANALYZED - - - -			
2,4,5-TP SILVEX (ug/l)	- - - - NOT ANALYZED - - - -			
GROSS ALPHA (pCi/l)	1.8	3.6	2.8	3.2
COLIFORM BACTERIA (colonies/100ml)	< 1	< 1	< 1	< 1

ANALYSIS ↓/WELL→	WELL A	WELL B	WELL C	WELL D
206.C.1.c(2)(b) PARAMETERS ESTABLISHING GROUND-WATER QUALITY				
CHLORIDE (mg/l)	60	56	60	56
IRON (ug/l)	< 100	122	< 100	< 100
MANGANESE (ug/l)	< 50	243	< 50	< 50
PHENOLS (ug/l)	< 10	< 10	< 10	< 10
SODIUM (ug/l)	53.3	53.3	45.8	46
SULFATE (mg/l)	150	160	135	120
206.C.1.c(2)(c) INDICATORS OF GROUND-WATER CONTAMINATION				
pH (pH units)	7.6	7.6	7.6	7.6
	7.6	7.6	7.6	7.6
	7.6	7.6	7.6	7.6
	7.6	7.6	7.6	7.6
SPECIFIC CONDUCTANCE (umhos)	720	720	725	720
	720	725	725	720
	730	730	725	720
	730	730	730	720
TOTAL ORGANIC CARBON (mg/l)	<1	<1	<1	<1
	1			
	<1			
	<1			
TOTAL ORGANIC HALOGEN (mg/l)	- - - - NOT ANALYZED - - - -			
VOLATILE HALOCARBONS (ug/l) (EPA Method 601)	ND	ND	2.0 (1,2-Dichloroethane)	ND
	8.3 (Chloroform)			
	ND			
	ND			
ELEVATION OF WATER (ft)	4004.74	4000.32	4000.03	4000.74

Appendix V

Ground-Water Sampling and Analysis Plan

draft copy

GROUND-WATER SAMPLING AND ANALYSIS PLAN

A. SAMPLE COLLECTION.

1. Determine the static water elevation to the nearest 0.01 inch using an electronic well probe.

2. Calculate the wetted well volume

3. Pump out 5 wetted well volumes or until pH, conductivity and temperature stabilize (whichever is greater).

4. Fill the sample container until overfilled, place the cap on the lid and tighten. Turn the container upside down and check for air bubbles. If any air is present retake the sample.

B. SAMPLE PRESERVATION AND SHIPMENT

ANALYSIS	PRES. GROUP	STORET#	PRESERVATIVE WORK CENTER	NOTES	REF
NITRATE	A	00620	A1XX-10110	A,X	E353
Note: From table II-5 max. holding time = 48 hrs.					
ORGANIC CARBON	A	00680	A1XX-10130	A	E415
PHENOLS	E	32730	E1XX-10400	A	E420
ARSENIC	F	01002	F1XX-10510	A	E206
BARIUM	F	01007	F1XX-10510	A	E208
CADMIUM	F	01027	F1XX-10510	A	E213
CHROMIUM	F	01034	F1XX-10510	A	E218
IRON	F	01045	F1XX-10510	A	E236
LEAD	F	01051	F1XX-10510	A	E239
MANGANESE	F	01055	F1XX-10510	A	E243
MERCURY	F	71900	F1XX-10510	A	E245
SELENIUM	F	01147	F1XX-10510	A	E370
SILVER	F	01077	F1XX-10510	A	E272
SODIUM	F	00929	F1XX-10510	A	E273
CHLORIDE	G	00940	G1XX-10630	A	E325
FLUORIDE	G	00951	G1XX-10630	B	E340
SPECIFIC COND.	G	00095	G1XX-10620	A	E120
SULFATE	G	00945	G1XX-10630	A	E375

ENDRIN	H	39390	H1XX-10700	C	E608
LINDANE	H	39782	H1XX-10700	C	E608
METHOXYCHLOR	H	39480	H1XX-10700	C	E608
TOXAPHENE	H	39400	H1XX-10700	C	E608
2,4-D	H	39730	H1XX-10700	C	A509
2,4,5-TP-SILVEX	H	39760	H1XX-10700	C	A509
TOT ORG HALOGENS	T			D	E601
COLIFORM BACT.	N/A	N/A	N/A	N/A	AXXX
RADIUM, GROSS ALPHA AND BETA	R1 OR R2	N/A	N/A	N/A	XXXX

NOTE: STORET# is a number assigned by EPA to a specific environmental parameter such as a physical characteristic or a chemical.

REF is the source for the analytical method.

E = EPA Manual for Chemical Analysis of Water and Wastes or EPA Manual of Methods, Pesticide Residues in Human and Environmental Samples.

A = APHA Standard Methods for the Examination of Water and Waste Water.

C = a special USAF OEHL method.

NOTES

NOTE A. Sample containers for environmental samples may be either polyethylene (plastic) or glass except where a specific container and/or special sampling techniques are called for in the notes.

NOTE B. Samples must be submitted in polyethylene (plastic) containers for this analysis.

NOTE C. Samples must be submitted in glass containers for this test.

NOTE D. Volatile Halocarbon Compounds

Sample Collection and Handling

1. Sample Containers

Sample containers are 40 ml glass screw cap bottles with a TFE fluorocarbon faced silicon septa liners. These containers will be supplied by the USAF OEHL.

2. Sample Preservation

A chemical dechlorinating agent (sodium thiosulfate) is added to the bottles which are going to be used to collect samples

containing free chlorine. This will arrest the formation of trihalomethanes after sample collection.

3. Sample Collection

a. Collect samples from each sampling site in duplicate. Mark the bottles A and B.

b. Fill the sample bottles in such a manner that no air bubbles pass through the sample as the bottle is filled to overflowing.

c. Place bottle on a level surface and position the TFE side side of the septum liner upon he convex meniscus of the sample. Seal the bottle by screwing the cap on tightly. If a preservative has been added to the sample bottles, shake vigorously for one minute.

NOTE: If the septum liner is inverted, (i.e., the silicon side against the sample), then significant losses of volatile compounds will occur in shipment and storage.

d. Invert the sample bottle and slightly tap the cap on a solid surface. The absence of entrapped air (bubble) indicates a successful seal. If bubbles are present, open the bottle, add a few additional drops of sample and reseal bottle as before.

4. Sampling from a water tap

a. Turn on water and allow system to flush until the temperature of the water has stabilized.

b. adjust flow to about 500 ml/min and collect samples from the flowing stream.

5. Sampling from an open body of water

a. Fill a clean one-quart wide mouth bottle or one-liter beaker with sample from a representative area.

b. Carefully fill bottles from sample containers.

6. Blanks

a. Reagent blanks will be supplied by USAF OEHL every time sample bottles are requested.

b. The se blanks contain pretested water and should be shipped from the sampling site along with the sample bottles.

c. Blanks should be stored together with the samples at 40 degrees C in an area known to be free of organic vapors.

NOTE X. Holding time for the chemical/compound is 7 days or less. See table II-5."Recommended Sample Holding Time". Consult the chemist at USAF OEHL/SA or the Water Quality Function at USAF OEHL/ECQ. This analysis should be done at base level, unless you are assured sample can arrive at USAF OEHL and be analyzed before the recommended maximum holding time in table II-5 is exceeded.

PRESERVATION

A1XX Cool to 4 degrees C. Add sulfuric acid to pH<2. Submit 1liter in a polyethylene or glass container.

E1XX Cool to 4 degrees C. Add sulfuric acid to pH<2. Submit 1 liter in a polyethylene or glass container.

F1XX Add nitric acid to pH<2. Submit 1 liter in a polyethylene or glass container.

G1XX Cool to 4 degrees C. Add no other preservative. Submit 1 liter in a glass or polyethylene container.

H1XX Cool to 4 degrees C. Add sodium thiosulfate if residual chlorine exists in sample. Submit 1 liter in glass container with Teflon(R) lined cap.

R1 (sample in plastic container) Add Nitric acid to pH<2.0.

R2 (sample in glass containerwith Na2S2O3) Add Hydrochloric acid to pH<2.0
T1XX Submit only in special containers obtained from USAF OEHL/SAN [AUTOVON 240-3626 or (512) 536-3626/Mr. Rodriguez].

D. CHAIN OF CUSTODY. Samples will be sent to USAF OEHL in a sealed shipping container. A Chain-Of-Custody record (attachment) will be filled out, signed and placed in a plastic bag along with the usual sample submission form (see attachment) and sealed in the shipping container. A duplicate will be kept by SGPB with the duplicates of the sample submission forms. OEHL personnel will acknowledge receipt of the samples in good condition by signing the
Chain-Of-Custody form and returning it to Cannon AFB) If the container is damaged in any way or not sealed when the lab receives the package, the technician will so annotate on the form.

SAMPLING FREQUENCY.

1ST YEAR. Sampling for all parameters will be performed on a quarterly basis.

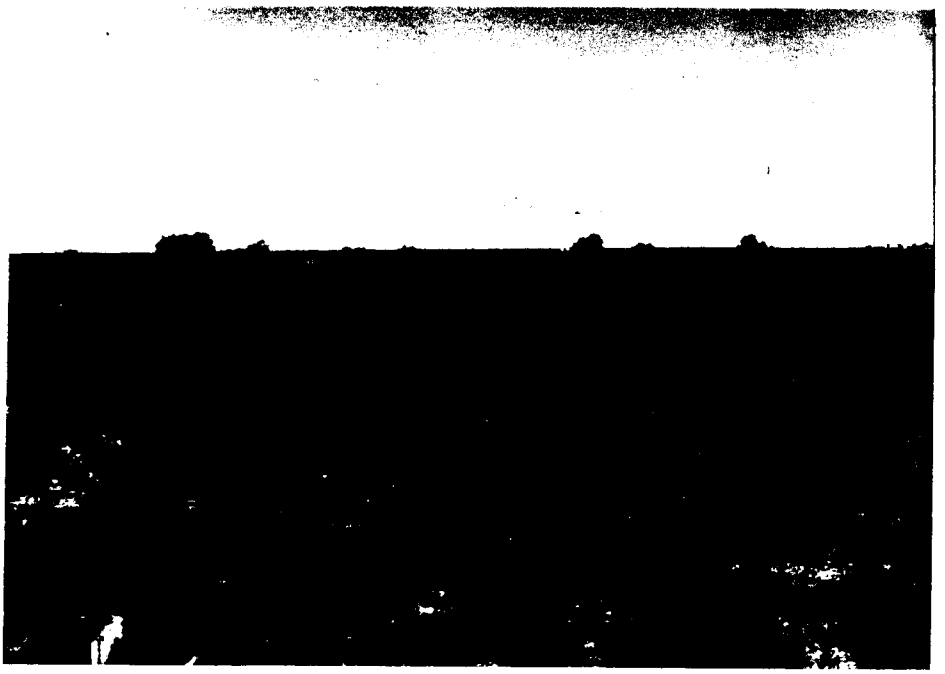
AFTER 1ST YEAR. Samples collected to establish ground water quality, i.e. chloride, iron, manganese, phenols, sodium, and sulfate, will be collected annually.

Samples collected to indicate groundwater contamination, i.e. pH, specific conductance, total organic carbon, and total organic halogen, will be collected semi-annually.

There is no requirement for periodic sampling for parameters indicating suitablility as potable water (EPA Interim Primary Drinking Water Standards).

Appendix VI

Photographs



Photograph No. 1. View of Landfill No. 5,
Looking south from monitor well A.

Photograph No. 2. Monitor well B, generator used
for power dedicated pump at right of photograph
and Landfill No. 5 is seen in the background.

Photograph No. 3. Cannon AFB personnel operating Hach kit during sampling activity.

Photograph No. 4. Well A during purging operation.

Appendix VII

Completed Compliance Checklist Forms

APPENDIX A-1

FACILITY INSPECTION FORM FOR COMPLIANCE WITH INTERIM STATUS STANDARDS COVERING GROUND-WATER MONITORING

Company Name: Cannon AFB ; **EPA I.D. Number:** NM757212445

Company Address: Cannon AFB, New Mexico 88103 ; **Inspector's Name:** Tom Hahne, Shin Ahn

Company Contact/Official: 2lt Bob Walton ; **Branch/Organization:** USAF

Title: Second Lieutenant ; **Date of Inspection:** 9/24/85 to 9/26/85

	Yes	No	Unknown	Waived
Type of facility: (check appropriately)				
a) surface impoundment		x		
b) landfill	x			
c) land treatment facility		x		
d) disposal waste pile*		x		
Ground-Water Monitoring Program				
1. Was the ground-water monitoring program reviewed prior to site visit? If "No",	x			
a) Was the ground-water program reviewed at the facility prior to site inspection?	x			
2. Has a ground-water monitoring program (capable of determining the facility's impact on the quality of groundwater in the uppermost aquifer underlying the facility) been implemented? 265.90(a)	x			

*Listed separate from landfill for convenience of identification.

	Yes	No	Unknown	Waived
3. Has at least one monitoring well been installed in the uppermost aquifer hydraulically upgradient from the limit of the waste management area? 265.91(a)(1)	x	however, this well may be downgradient of on-site sources of potential contam.		
a) Are ground-water samples from the uppermost aquifer, representative of background ground-water quality and not affected by the facility (as ensured by proper well number, locations and depths?)	x			
4. Have at least three monitoring wells been installed hydraulically downgradient at the limit of the waste handling or management area? 265.91(a)(2)		x if entire landfill 5 is considered the waste management area then site may have enough downgradient wells, only trench 3 is regulated		
a) Do well number, locations and depths ensure prompt detection of any statistically significant amounts of HW or HW constituents that migrate from the waste management area to the uppermost aquifer?	x			
5. Have the locations of the waste management areas been verified to conform with information in the ground-water program?			x	
a) If the facility contains multiple waste management components, is each component adequately monitored?			x	
6. Do the numbers, locations, and depths of the ground-water monitoring wells agree with the data in the ground-water monitoring system program? If "No", explain discrepancies.	x			
7. Well completion details. 265.91(c)				
a) Are wells properly cased?	x			
b) Are wells screened (perforated) and packed where necessary to enable sampling at appropriate depths?	x			
c) Are annular spaces properly sealed to prevent contamination of ground-water?	x			

	Yes	No	Unknown
8. Has a ground-water sampling and analysis plan been developed? 265.92(a)	x		
a) Has it been followed?	x		
b) Is the plan kept at the facility?	x		
c) Does the plan include procedures and techniques for:	x		
1) Sample collection?			
2) Sample preservation?	x		
3) Sample shipment?	x		
4) Analytical procedures?	x		
5) Chain of custody control?	x		
9. Are the required parameters in ground-water samples being tested quarterly for the first year? 265.92(b) and 265.92 (c)(1)	x		
a) Are the ground-water samples analyzed for the following:			
1) Parameters characterizing the suitability of the ground-water as a drinking water supply? 265.92(b)(1)	x		
2) Parameters establishing ground-water quality? 265.92(b)(2)	x		
3) Parameters used as indicators of ground-water contamination? 265.92(b)(3)	x		
(i) For each indicator parameter are at least four replicate measurements obtained at each upgradient well for each sample obtained during the first year of monitoring? 265.92(c)(2)	x		
(ii) Are provisions made to calculate the initial background arithmetic mean and variance of the respective parameter concentrations or values obtained from the upgradient well(s) during the first year? 265.92(c)(2)	x		
b) For facilities which have completed first year ground-water sampling and analysis requirements:			
1) Have samples been obtained and analyzed for the ground-water quality parameters at least annually? 265.92(d)(1)	N/A		
2) Have samples been obtained and analyzed for the indicators of ground-water contamination at least semi-annually? 265.92(d)(2)	N/A		

	Yes	No	Unknown
c) Were ground-water surface elevations determined at each monitoring well each time a sample was taken? 265.92(e)	N/A		
d) Were the ground-water surface elevations evaluated annually to determine whether the monitoring wells are properly placed? 265.93(f)	N/A		
e) If it was determined that modification of the number, location or depth of monitoring wells was necessary, was the system brought into compliance with 265.91(a)? 265.93(f)	N/A		
10. Has an outline of a ground-water quality assessment program been prepared? 265.93(a)*	x		
a) Does it describe a program capable of determining:			
1) Whether hazardous waste or hazardous waste constituents have entered the ground water?	x		
2) The rate and extent of migration of hazardous waste or hazardous waste constituents in ground water?	x		
3) Concentrations of hazardous waste or hazardous waste constituents in ground water?	x		
b) After the first year of monitoring, have at least four replicate measurements of each indicator parameter been obtained for samples taken for each well? 265.93(b)	N/A		
1) Were the results compared with the initial background means from the upgradient well(s) determined during the first year?	N/A		
(i) Was each well considered individually?	N/A		
(ii) Was the Student's t-test used (at the 0.01 level of significance)?	N/A		
2) Was a significant increase (or pH decrease as well) found in the:			
(i) Upgradient wells	N/A		
(ii) Downgradient wells	N/A		
If "Yes", Compliance Checklist A-2 must also be completed.			

*See note Page 2-10

	Yes	No	Unknown
11. Have records been kept of analyses for parameters in 265.92(c) and (d)? 265.94(a)(1)	X		
12. Have records been kept of ground-water surface elevations taken at the time of sampling for each well? 265.94(a)(1)	x		
13. Have records been kept of required elevations in 265.93(b)? 265.94(a)(1)	x		
14. Have the following been submitted to the Regional Administrator 265.94(a)(2) :*			
a) Initial background concentrations of parameters listed in 265.92(b) within 15 days after completing each quarterly analysis required during the first year?	x		
b) For each well, have any parameters whose concentrations or values have exceeded the maximum contaminant levels allowed in drinking water supplies been separately identified?	N/A		
c) Annual reports including:			
1) Concentrations or values of parameters used as indicators of ground-water contamination for each well along with required evaluations under 265.93(b)?	N/A		
2) Any significant differences from initial background values in up-gradient wells separately identified?	N/A		
3) Results of the evaluation of ground-water surface elevations?	N/A		

*EPA will be proposing (Spring 1982) to replace this reporting requirement with an exception reporting system where reports will be submitted only where maximum contaminant levels or significant changes in the contamination indicators or other parameters are observed. EPA has delayed compliance stage for 14 a) above until August 1, 1982 (Federal Register, February 23, 1982, p.7841-7842) to be coupled with exception reporting in the interim.