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DRAFT
SITE INSPECTION REPORT

SITE 80: PARADISE POINT GOLF COURSE
MARINE CORPS BASE
CAMP LEJEUNE
JACKSONVILLE, NORTH CAROLINA

HALLIBURTON NUS PROJECT NUMBER 2F36

OCTOBER 1992

HALLIBURTON NUS
Environmental Corporation

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MARINE CORPS BASE, CAMP LEJEUNE
JACKSONVILLE, NORTH CAROLINA

A/E CONTRACT NO. N62470-90-B-7629

Prepared by:

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Prepared For:

DEPARTMENT OF THE NAVY
ATLANTIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORFOLK, VIRGINIA

HALLIBURTON NUS PROJECT NUMBER 2F36

OCTOBER 1992

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EXECUTIVE SUMMARY

This report documents the results of a site investigation, and preliminary risk assessment completed by HALLIBURTON NUS Environmental Corporation, Inc. (HALLIBURTON NUS) for a site within the Marine Corps Base (MCB) Camp Lejeune. This section presents a brief site history, a description of the field activities performed during the investigation, and conclusions based on the results of the investigation.

SITE HISTORY

Site 80: Paradise Point Golf Course: was not identified during the ES&E field investigation in 1986. As this is one of the newly identified sites, no previous field activities have been conducted. Field data was obtained and a preliminary risk assessment was performed on the data to determine if this site poses a threat to human health or the environment.

The site area is currently used by the base for the maintenance and cleaning of equipment used on the golf course. In addition to the machine shop, which is a potential source of waste oils, the routine application of pesticides and herbicides on the golf course and the potential inadvertent disposal of excess pesticides and herbicides behind the machine shop may also have contributed to potential contamination in this area. The site contains a large mounded area of bare, hummocky soil. There are areas of dead and/or dying vegetation in the vicinity of the soil mound. In addition, there are unvegetated areas where soils have been disturbed.

FIELD ACTIVITIES

Four soil borings were completed as part of the field investigation. In addition, three monitoring well borings were also sampled for subsurface soils during installation. A total of 14 subsurface soil samples were analyzed for TCL volatiles, petroleum hydrocarbons (TPH), pesticides, PCBs, and herbicides.

Three monitoring wells were installed at the site as part of the site investigation. The wells were installed to provide the necessary data to determine the lateral extent of potential groundwater contamination and to provide data for determining groundwater flow direction. The newly installed wells were sampled during the investigation for TCL volatiles, petroleum hydrocarbons (TPH), pesticides, PCBs, and herbicides..

Three surface water samples and five sediment samples were analyzed from the drainage that is downgradient from the site and might potentially be contaminated from site activities. All samples were analyzed for TCL volatiles, petroleum hydrocarbons (TPH), pesticides, PCBs, and herbicides.

In addition, three shallow subsurface soil samples were obtained from the large soil pile on site. All samples were analyzed for TCL volatiles, petroleum hydrocarbons (TPH), pesticides, PCBs, and herbicides.

Details of the field investigation performed at this site are summarized in Section 2.0 of this report.

CONCLUSIONS

The field investigation performed at this site is summarized in Section 1.7 of this report. The primary purpose was to determine whether a contamination problem existed on the site from its previous use. The analytical data were validated and a preliminary risk assessment was performed. The results of the risk assessment are discussed in detail in Section 6.0 of this document. The results are discussed by media

below.

The results of the preliminary risk assessment will be discussed on a media-specific basis. All chemicals of concern are identified based upon standard/criteria/PRG exceedence.

Maximum soil results for Aroclor-1254 exceeded the associated PRG (calculated based on a 1×10^{-6} cancer risk) by a factor of two.

None of the sample results for groundwater chemicals of concern were above the federal (MCL) or state (Class GA) standards. Based on this comparison and because no current usage of the shallow groundwater at the site is identified, no preliminary risks can be associated with this medium.

Analytical results for one of the three surface waters collected at the site exceeded the criteria based upon the AWQC for Protection of Aquatic Life and North Carolina State Class SC Surface Water Standards. Risk-based remediation goals were not employed for this medium.

No organic chemicals or petroleum hydrocarbons were found to be present in the sediment, therefore, no risks are associated with sediment at the site.

RECOMMENDATIONS

Based upon the results of the preliminary risk assessment, exposure to soil contaminants at the site is not expected to result in unacceptable risks. Although concentrations of Aroclor-1254 detected in two of seventeen soil samples soil exceeded the calculated remediation goals, the highest concentration exceeded the PRG by only a factor of two. The PRG for Aroclor-1254 was developed based on a target incremental cancer risk of 1×10^{-6}. The detection of Aroclor-1254 at twice the PRG value still results in an incremental cancer risk below the upper bound of the EPA target risk range of 1×10^{-4}.

No current risk from exposure to groundwater contaminants is noted as detected groundwater concentrations do not exceed associated Federal and State standards and criteria. Also, at this time no exposure route for shallow groundwater exists at the site.

The only chemical of concern of potential threat to the protection of aquatic life is toluene, which exceeded associated standards and criteria in one surface water sample. However, surface water chemicals of concern are expected to be attenuated to a large extent upon discharge to Northeast Creek and concentrations for this compound should be within acceptable limits at the discharge point.

Based on the results of this preliminary risk assessment it is recommended that no further action be conducted.

1.0 SITE BACKGROUND

This section presents the location, layout, and brief history of Site 80: Paradise Point Golf Course.

1.1 INTRODUCTION

HALLIBURTON NUS Environmental Corporation (HALLIBURTON NUS), under Contract Number N62470-90-R-7629, prepared this report for the Department of the Navy, Atlantic Division, for Marine Corps Base (MCB) Camp Lejeune. This report presents the results of the Site Investigation (SI) conducted at Site 80: Paradise Point Golf Course.

This site was not identified during the ES&E field investigation in 1986. As this is one of the newly identified sites, no previous field activities have been conducted. Field data was obtained and a preliminary risk assessment was performed on the data to determine if this site poses a threat to human health or the environment.

This investigation was conducted in accordance with the Scope of Work prepared by Department of Navy personnel, which was incorporated in the Final Work Plan prepared by HALLIBURTON NUS (HALLIBURTON NUS, August 1991). The objective of this investigation was to determine, via sampling and analysis activities, whether specific toxic and hazardous materials exist in concentrations considered to be hazardous.

The field investigation for the project was conducted in June 1991 to meet the above objective. This report presents the findings and conclusions of these studies.

1.2 SITE LOCATION

MCB Camp Lejeune is located in Onslow County, North Carolina. Figure 1-1 is a location map of Camp Lejeune that identifies approximate locations of the sites covered in the Final Work Plan prepared by HALLIBURTON NUS (HALLIBURTON NUS, August 1991). The facility currently covers approximately 170 square miles and is bisected by the New River. The Atlantic Ocean forms the southeastern boundary of the base. The western and northeastern boundaries are U.S. 17 and State Road 24, respectively.

The Paradise Point Golf Course site consists of a 1-acre area at the back of the machine shop and the truck wash area at the Paradise Point Golf Course.

1.3 SITE LAYOUT

The general layout of the site is shown in Figure 1-2. The area is used by the base for the maintenance and cleaning of equipment used on the golf course. In addition to the machine shop, which is a potential source of waste oils, the routine application of pesticides and herbicides on the golf course and the potential inadvertent disposal of excess pesticides and herbicides behind the machine shop may also have contributed to potential contamination in this area. The site contains a large mounded area of bare, hummocky soil. There are areas of dead and/or dying vegetation in the vicinity of the soil mound. In addition, there are unvegetated areas where soils have been disturbed. A drainage ditch runs from the truck wash area around the back of the machine shop and soil mound. Surface elevations vary from 3 to approximately 26 feet above mean sea level (MSL).

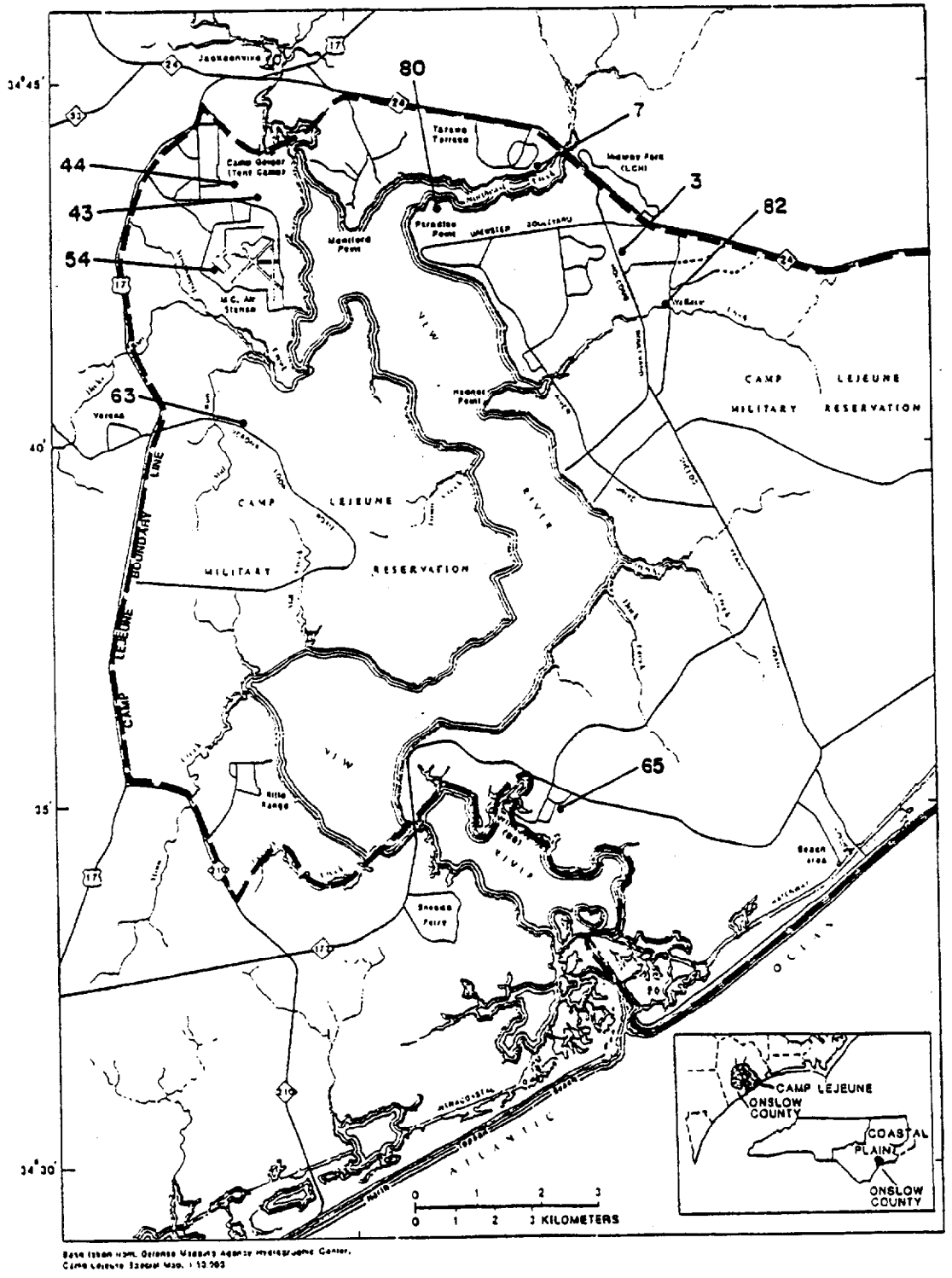

FIGURE 1-1
LOCATION MAP
MCB CAMP LEJEUNE

IAS site numbers are identified above with approximate locations.

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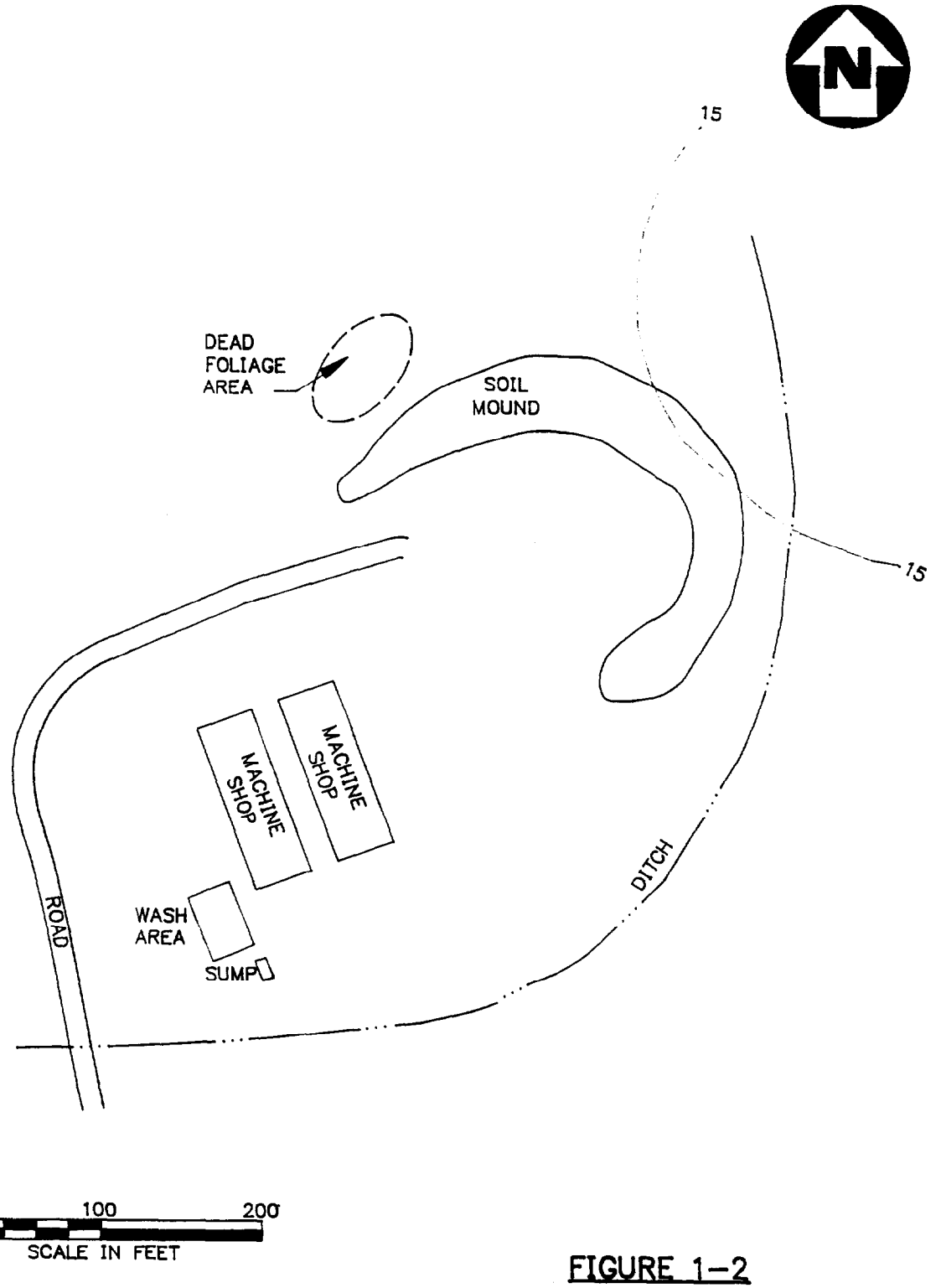

FIGURE 1-2

SITE LOCATION MAP
SITE 80:
PARADISE POINT GOLF COURSE
MCB CAMP LEJEUNE

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1.4 SITE OWNERSHIP HISTORY

This environmental investigation was performed for the Department of the Navy, Atlantic Division. The Paradise Point Golf Course is located within and is currently maintained by MCB Camp Lejeune.

1.5 PERMIT AND REGULATORY HISTORY

This study was conducted at MCB Camp Lejeune as part of the Department of the Navy's Installation Restoration Program (IRP). This site was not identified during the Initial Assessment Study (IAS) (Water and Air Research, Inc., March 1983). Rather, this site was later identified as potentially contaminated and is thus being evaluated for the first time. This report presents the results of the data gathering and preliminary risk assessment performed to determine whether the contaminants present at the site pose a risk to human health or the environment.

1.6 REMEDIAL ACTIONS TO DATE

The truck wash area consists of a concrete pad and sumps that collect wash water from the spraying equipment. Prior to the construction of this pad, however, the disposition of wash water may have been uncontrolled. The presence of dead vegetation indicates herbicides may have been disposed. However, during the field investigation there was some indication that the area may also be used to burn branches and limbs from trees, which could also cause the areas of dead vegetation. There is no indication that other chemicals have been used or disposed of in this area. With the exception of the installation of the truck wash rack and sump, no other remedial actions have been performed to date.

1.7 SITE INVESTIGATION SUMMARY

Several field investigation tasks were developed to support the objective of performing a preliminary risk assessment to determine if there is a threat to human health or the environment from this site. The field investigation activities, as developed in the Final Sampling and Analysis Plan (HALLIBURTON NUS, August 1991), are briefly summarized in the following sections. The specific tasks covered are subsurface soil investigation, surface water and sediment investigation, hydrogeologic investigation, and surveying. Table 1-1 summarizes all field activities that were conducted in June 1991. Figure 1-3 depicts the sampling locations.

1.7.1 Shallow Subsurface Soil Investigation

Three shallow subsurface soil samples were completed as part of the field investigation conducted at the Paradise Point Golf Course Site. The three samples were located on top of the waste soil piles and are depicted in Figure 1-2. The purpose of the soil samples was to obtain near surface soil samples for chemical analysis, for physical classification, and to determine the nature and extent of subsurface soil contamination at the site. A HALLIBURTON NUS geologist classified the subsurface soil samples based on grain size, color, moisture, and organic content.

One sample from each of the three locations was obtained by HALLIBURTON NUS personnel using a five-foot stainless steel hand auger in accordance with the Final Sampling and Analysis Plan. Soil samples were obtained from 0.0 to 2.0 feet below the surface of the pile.

The soil samples were analyzed by the Versar Laboratory in Springfield, Virginia, for TCL volatile organics, pesticides, PCBs, herbicides, and petroleum hydrocarbons (TPH). Appropriate QA/QC samples were incorporated in the sampling round. This included one duplicate soil sample.

TABLE 1-1

FIELD INVESTIGATION SUMMARY
SITE 80 - PARADISE POINT GOLF COURSE
MCB CAMP LEJEUNE
JACKSONVILLE, NORTH CAROLINA

Component	Purpose	Description
Soil Borings	To obtain subsurface soil samples for chemical and physical analysis (site characterization).	Four on-site soil borings including a total of 15 subsurface soil samples.
Subsurface Soil Sampling	Soil contaminant characterization.	Fourteen samples for chemical analysis of the on-site subsurface soils.
Shallow Subsurface Soil Samples	Shallow contaminant characterization of the on-site soil mounds.	Three samples for chemical analysis of the on-site soil mounds.
Monitoring Wells	Dissolved contaminant identification.	Drilling, installation, and development of three overburden monitoring wells.
Groundwater Sampling	Detailed groundwater contamination characterization.	One round of sampling for chemical analysis from all new monitoring wells.
Surface Water/Sediment Sampling	Surface water and sediment contaminant characterization.	Four samples of the on-site surface waters and six on-site sediments.
Background Sampling	To provide an estimate of background soil concentrations of metals.	Three off-site soil samples analyzed for TAL inorganics.
Surveying	Locate all sampling sites.	Survey all sampling locations.

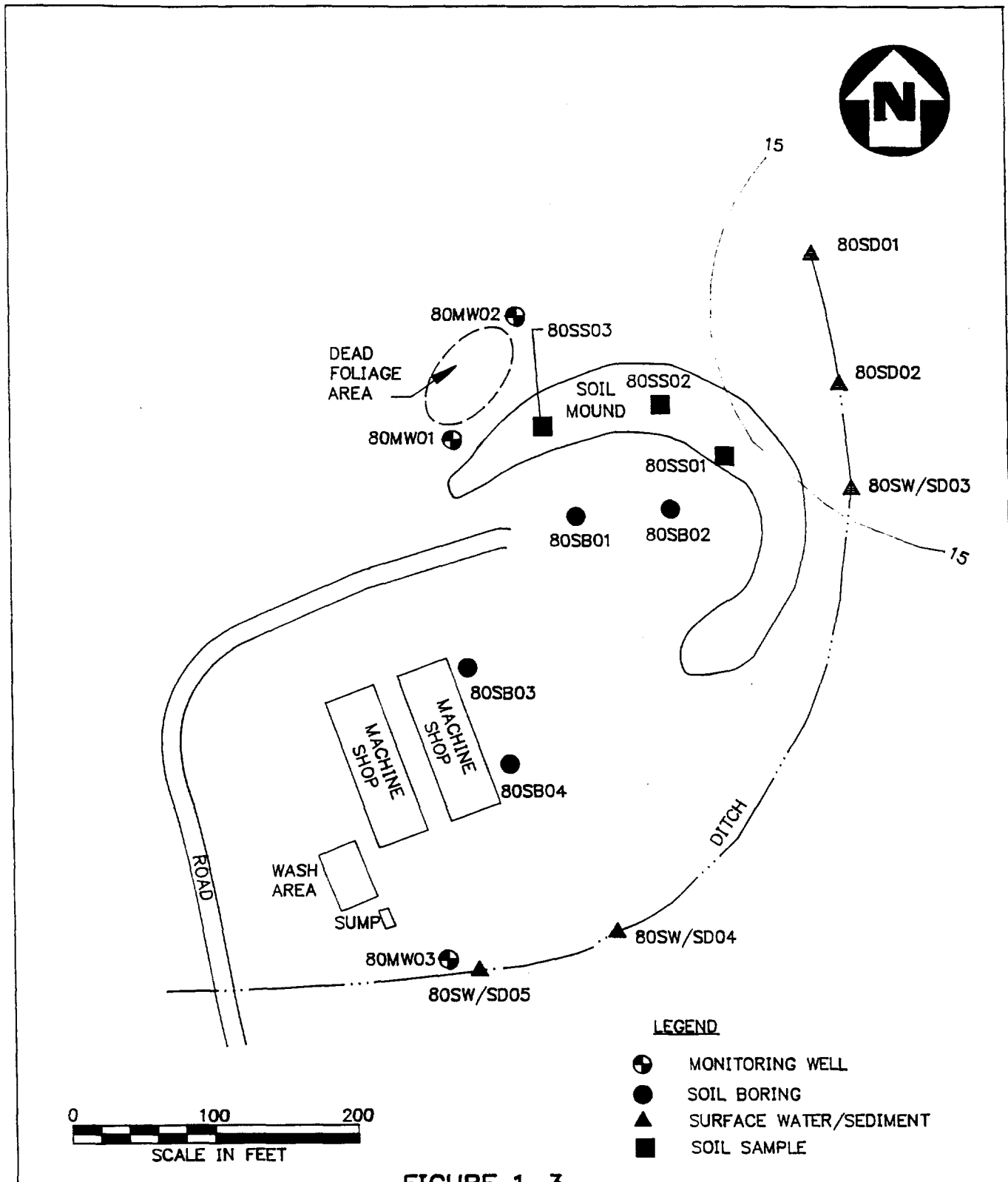

FIGURE 1-3

SAMPLING LOCATION MAP
SITE 80:
PARADISE POINT GOLF COURSE
MCB CAMP LEJEUNE

HALLIBURTON NUS
Environmental Corporation

1.7.2 Subsurface Soil Investigation

Four soil borings were completed as part of the field investigation conducted at the Paradise Point Golf Course Site. In addition, three monitoring well borings were also sampled for subsurface soils. All borings were located on site and are depicted in Figure 1-2. The purpose of the soil borings was to obtain subsurface soil samples for chemical analysis, for physical classification, and to determine the nature and extent of subsurface soil contamination at the site. A HALLIBURTON NUS geologist classified the subsurface soil samples based on grain size, color, moisture, and organic content.

All drilling was performed by Hardin-Huber, Inc., under sub-contract to HALLIBURTON NUS and directed in the field by HALLIBURTON NUS representatives. A CME-55 all-terrain drilling rig equipped with 6 1/4-inch inside diameter hollow-stem augers was used for drilling and sampling. An electromagnetometer (Heliflux) was used at each location prior to drilling in order to avoid contact with buried metallic debris.

Fifteen subsurface soil samples were obtained using a 2-1/2 inch outside diameter by 24-inch long split-barrel sampler. All split-barrel samplers, augers, and the drill rig were decontaminated prior to arriving on site and between borings in accordance with the Final Sampling and Analysis Plan. Soil samples were obtained at varying depths from the ground surface to the groundwater table. All sampling was performed in accordance with ASTM method D1586-84. Well borings were terminated approximately 5 feet below the water table at depths that range from 15 to 22 feet below the ground surface. Soil borings were terminated at or near the groundwater table at a depth of 12 feet below the ground surface.

During the soil boring program, HALLIBURTON NUS personnel continually monitored the breathing zone with a photoionization detector (HNu). As the subsurface soils were exposed upon opening of the split-barrel sampler, they also were monitored with the HNu. Only one positive HNu readings (2 ppm) was recorded when the subsurface soils were exposed. This reading was detected in boring 80SB04 at a depth of 0.0 to 2.0 feet below the ground surface. No measurable readings were obtained in the breathing zone. Upon completion of the three monitoring well borings, an attempt was made to obtain a 0-hour water-level measurement, after which a monitoring well was installed to the proposed depth as outlined in the Final Sampling and Analysis Plan. Attached in Appendix A are the boring logs for all well and soil borings.

Two subsurface soil samples were obtained from each well and soil boring. The first sample was obtained from the ground surface to a depth of 2 feet. The second sample was taken at or directly above the groundwater table. One additional sample was taken in the first boring drilled on site (80SB04) at a depth of 7.0 to 9.0 feet below the ground surface. This sample was taken to define the static groundwater level prior to drilling the additional borings and wells. Two samples from each borehole were obtained for chemical analyses. These included the surface soil sample and the sample taken at the water table. Any other subsurface soil samples obtained during drilling were used for lithologic description only and retained on site. Soil borings were backfilled with a cement/bentonite grout following sampling.

A total of fourteen subsurface soil samples were analyzed by the Versar Laboratory in Springfield, Virginia, for TCL volatile organics, pesticides, PCBs, herbicides, and petroleum hydrocarbons (TPH). Appropriate QA/QC samples were incorporated in the sampling round. These included one duplicate soil sample, one equipment rinsate blank, and one trip blanks. The trip blank accompanying the samples was analyzed for volatile organics only.

1.7.3 Hydrogeologic Investigation

Three monitoring wells were installed at the Paradise Point Golf Course Site as part of the site investigation. The locations of the monitoring wells are shown in Figure 1-2. The well locations were selected based on the suspected source areas, the overall expected groundwater flow pattern, and the data requirements

stated in the Final Sampling and Analysis Plan. The wells were installed to provide the necessary data to determine the lateral extent of any groundwater contamination and to provide data for determining groundwater flow direction.

Each monitoring well boring was initially drilled as a soil boring to obtain subsurface soil samples. The soil borings were then enlarged, using 6-1/4-inch inside diameter hollow-stem augers. Cuttings were containerized into 55 gallon DOT approved open-top drums, sealed and bolted, labeled, and left on site.

When the anticipated installation depth was reached, the augers were left in the boring to provide a temporary casing during well installation. Well construction materials consisted of 2-inch inside diameter, Schedule 40, flush-jointed, threaded PVC riser pipe and 0.02-inch slotted well screen. The screened sections were 10 feet in length. The screened section and riser pipe was then inserted into the borehole to a depth that resulted in the water level in the well being located within the upper portion of the screened interval.

The annular space between the PVC pipe and the wall of the borehole was filled using silica sand from the bottom of the borehole to a point approximately 1 to 2 feet above the top of the screened section. The hollow-stem augers which were originally left in to maintain the integrity of the hole were slowly withdrawn from the borehole during installation of the sand. An approximate 2-foot-thick bentonite pellet seal was installed within the annular space above the sand. After the pellets were allowed to fully hydrate, a grout mixture of cement, bentonite powder, and potable water was installed into the annular space above the bentonite seal using a tremie pipe. A 5-foot section of 8-inch diameter steel protective casing was placed into the grout so that approximately 2 to 3 feet of pipe was below ground surface and 2 to 3 feet remained aboveground. The protective casing was equipped with a locking cap to secure the well. Finally, an approximately 2-foot by 2-foot square, 1-foot thick concrete pad was constructed around each well.

The three monitoring wells were completed at depths ranging from 15.0 feet to 22.0 feet. The drilling and installation of the monitoring wells followed the Final Sampling and Analysis Plan concerning decontamination procedures and health and safety monitoring. All drilling was completed in Level "D" personal protection. Additional details regarding the monitoring well installation can be found on the Boring Logs in Appendix B and the Well Construction Diagrams in Appendix C. Table 1-2 presents a summary of the well construction data.

One round of groundwater sampling was conducted on June 16 and June 27, 1991 from the three newly installed monitoring wells.

All newly installed monitoring wells were developed after installation and purged prior to sampling in accordance with the Final Sampling and Analysis Plan. A dedicated stainless steel bailer was used for purging and sampling. Appropriate QA/QC samples were incorporated in the sampling round. These included two equipment rinsate blanks. All samples were analyzed for TCL volatile organics, pesticides, PCBs, herbicides, and petroleum hydrocarbons (TPH).

1.7.4 Surface Water/Sediment Investigation

Five surface water/sediment samples were proposed at the Paradise Point Golf Course Site. At sampling locations 80SW/SD01 and 80SW/SD02, however, no water was present to be sampled thus only sediments were obtained at these sampling points. Samples were collected at the site on June 13, 1991. These samples were collected in a small drainageway which runs along the southern and eastern perimeters of the site. Samples 80SD01, 80SD02, and 80SW/SD03 were located east of the Paradise Point Golf Course Site to evaluate whether the creek could be adversely affected by contamination from the waste soil piles on site. Samples 80SW/SD04 and 80SW/SD05 were located south of the site to evaluate whether the creek could be adversely affected by contamination from the wash rack.

TABLE 1-2

MONITORING WELL SUMMARY
SITE 80 - PARADISE POINT GOLF COURSE
MCB CAMP LEJEUNE
JACKSONVILLE, NORTH CAROLINA

Well Number	Ground Elevation[1]	Top of Casing Elevation[1]	Total Depth (feet)[2]	Screened Interval (feet)[2]	Depth to Water (feet)[3]	Water Level Elevation[1]
80MW01	15.73	19.10	20.5	10.0-20.0	16.38	2.72
80MW02	17.24	20.01	22.5	12.0-22.0	17.27	2.77
80MW03	14.63	17.98	15.0	4.8-14.8	8.41	9.57

[1] Feet above Mean Sea Level (MSL)
[2] Feet below ground surface
[3] Measured from top of PVC well casing (6-26-91)

Sample locations are shown in Figure 1-2. Each sample was obtained in accordance with the Final Sampling and Analysis Plan. A stainless steel trowel and pail was used for sampling. Appropriate QA/QC samples were incorporated in the sampling round. These included one duplicate at location 80SW/SD05. Samples were analyzed for TCL volatile organics, pesticides, and PCBs.

1.7.5 Background Soils

Three soil samples were obtained at different locations on the base to provide an estimation of the background concentrations of metals in the soils at the base. Background soil sample BS-1 was obtained from a wooded area east of the Piney Green Road VOC Site. Background soil sample BS-2 was obtained from a wooded area east of the Old Creosote Plant Site. Background soil sample BS-3 was obtained from a wooded area east of the Tarawa Terrace Dump Site. The samples were collected from the ground surface to a depth of approximately 0.5 feet using a stainless steel trowel and analyzed for TCL inorganics (no cyanide) only.

1.7.4 Surveying

Surveying of the Paradise Point Golf Course Site was performed by Murphy Yelle Environmental Surveyors, professional land surveyors. All work was performed under a sub-contract with HALLIBURTON NUS and was directed in the field by representatives of HALLIBURTON NUS.

During completion of the field activities, the contractor surveyed the vertical and horizontal locations of the four soil borings, the five surface water/sediment samples, the three surface soil samples, and the three background soil samples. Additionally, the surveyor also established the vertical and horizontal locations of the three newly installed monitoring wells, including ground surface, top of riser pipe, and top of protective casing.

The location map included as Figure 1-2 depicts all surveyed locations as well as the approximate locations of the two previously mentioned sampling points. Table 1-3 lists the coordinates and elevations of all surveyed sampling points at the Paradise Point Golf Course Site.

TABLE 1-3

DETAILED SURVEY SUMMARY
SITE 80 - PARADISE POINT GOLF COURSE
MCB CAMP LEJEUNE
JACKSONVILLE, NORTH CAROLINA

Well/Boring Number	Ground Elevation[1]	Top of PVC Casing Elevation[1]	Top of Steel Casing Elevation[1]	Total Depth (feet)[2]	Northing Coordinate[3]	Easting Coordinate[3]
80MW01	15.73	19.10	19.22	20.5	356303.581	2485130.647
80MW02	17.24	20.01	20.69	22.5	356388.267	2485175.683
80MW03	14.63	17.98	18.40	15.0	355944.908	2485124.087
80SB01	17.20	NA	NA	12.0	356251.200	2485216.698
80SB02	16.90	NA	NA	12.0	356255.141	2485283.068
80SB03	15.84	NA	NA	12.0	356141.408	2485139.619
80SB04	16.40	NA	NA	12.0	356079.507	2485168.518
80SS01	21.47	NA	NA	2.0	356291.926	2485321.617
80SS02	24.19	NA	NA	2.0	356327.410	2485276.732
80SS03	25.96	NA	NA	2.0	356312.616	2485193.772
80SD01	3.73	NA	NA	0.5	356431.133	2485384.490
80SD02	5.77	NA	NA	0.5	356341.450	2485403.156
80SW/SD03	7.13	NA	NA	0.5	356269.259	2485410.759
80SW/SD04	11.05	NA	NA	0.5	355963.183	2485242.312
80SW/SD05	11.72	NA	NA	0.5	355936.798	2485145.435

[1] Feet above Mean Sea Level (MSL)
[2] Feet below ground surface
[3] Coordinates based on NAD 27 values

2.0 ENVIRONMENTAL SETTING

This section describes the different site features of the Paradise Point Golf Course Site. Specifically it will cover the surface features, climatology, surface water hydrology, geologic setting, hydrogeologic setting, and land use and natural resources.

Additional site information can be found in the following documents:

- Continuous Seismic Reflection Profiling of Hydrogeologic Features Beneath New River, Camp Lejeune, North Carolina (U.S. Geological Survey, 1990)
- Initial Assessment Study (IAS) of Marine Corps Base Camp Lejeune, North Carolina (Water and Air Research, 1983).
- Hydrogeologic Framework of U.S. Marine Corps Base, Camp Lejeune, North Carolina (Department of the Navy, 1990)
- Provisional Draft - Assessment of Hydrologic and Hydrogeologic Data at Camp Lejeune Marine Corps Base, North Carolina (U.S. Geological Survey, 1989)

2.1 TOPOGRAPHY

The surface topography of the inland portion of MCB Camp Lejeune is related to (1) undisected, nearly level marine sediments which comprise the interstream areas, (2) short, convex slopes and narrow valleys made by streams, and (3) low ridges formed by wind deposits of coastal sand with associated tidal marshes as at the Outer Banks. The elevation of MCB Camp Lejeune ranges from mean sea level (MSL) to about 72 feet above MSL, with an the average elevation of 20 feet.

The Paradise Point Golf Course Site is located within Marine Corps Base (MCB) Camp Lejeune, which lies southeast of Jacksonville in Onslow County, North Carolina. MCB Camp Lejeune covers approximately 170 square miles and is bisected by the New River. The base lies within the Tidewater Region of the Atlantic Coastal Plain physiographic province. Rivers in the Tidewater Region are affected by oceanic tides due to the area's proximity to the ocean and low relief.

The study area for this site consists of a 1-acre area at the back of the machine shop and the truck wash area at the Paradise Point Golf Course. The site contains an area of bare, hummocky soil, with a large soil mound. A drainage ditch runs from the truck wash area around the back of the machine shop and soil mound. The general site map is shown in Figure 1-2. Site elevations vary from 3 to approximately 26 feet above mean sea level (MSL)

2.2 SURFACE WATERS

This section covers the surface water hydrology from a regional perspective as well as site specific conditions.

2.2.1 Regional Surface Water Conditions

The surface-water hydrology of the Jacksonville area is dominated by the New River estuary, which is approximately 30 square miles in area or about 20 percent of the total base area. The New River has a maximum depth of approximately 15 feet but averages from 2 to 5 feet in depth in most areas. It is brackish, shallow, and warm with a normal tidal range of 3.0 to 3.6 feet. Surface water drainage at Camp Lejeune is predominately toward the New River, although areas near the coast drain directly to the Atlantic Ocean though the Intracoastal Waterway.

Flooding is a potential problem for those base areas located within the 100-year floodplain. This is compounded by the large percentage of developed areas where natural drainage has been changed by extensive paved areas. In general, drainage on the base is poor and soils are often wet.

2.2.2 Site Surface Water Conditions

Paradise Point Golf Course is located on a point of land that is surrounded by the confluence of Northeast Creek with the New River. Northeast Creek is wide and slow moving, and moderately influenced by tides.

Surface waters and runoff from the site flow into the drainage ditch that borders the site. This drainage way flows off site in a northerly direction and enters Northeast Creek approximately 1000 feet to the north. Northeast Creek flows in a southwesterly direction into the New River approximately 1 mile downstream.

2.3 GEOLOGY AND SOILS

This section discusses the geologic setting from a regional perspective as well as from a site specific basis.

2.3.1 Regional Geology

As mentioned earlier in this report, Camp Lejeune lies within the Tidewater Region of the Atlantic Coastal Plain physiographic province. The geology of the Atlantic Coastal Plain is a seaward-thickening wedge of clastic sediments consisting of sequences of interbedded sands, clays, calcareous clays, shell beds, sandstones, and limestones that overly a basement complex of igneous and metamorphic rocks. These Coastal Plain sediments were deposited in marine and non-marine environments and vary in age from Cretaceous to Recent. The sediment sequence is approximately 1,500 feet thick at Camp Lejeune and thickens to over 5,000 feet off the North Carolina coast.

The soils on the flood plains are classified according to the soil conservation service as poorly drained Muckalle loam; very poorly drained Dorovan muck; and poorly drained Bohicket silty clay loam, which occurs on wide estuarial flood plains of coastal creeks. The soils on the broad, nearly level interstream areas are somewhat poorly drained Lenoir loam, Lynchburg fine sandy loam, and Stallings fine sandy loam. Near the center part of the interstream areas are poorly drained Leon fine sand, Rains fine sandy loam, and Woodington loamy fine sand soils. Approximately 70 percent of MCB Camp Lejeune is in the broad, flat interstream area.

2.3.2 General Site Geology

Due to the shallow water table at the site, the field drilling program was confined to the top 22 feet of the subsurface. As a result, the geologic conditions at the site have been defined only to a depth of 22 feet.

The shallow subsurface geology of the study area consists of an approximately 2-foot thick surficial layer of unconsolidated fine grained silt and sand fill with varying amounts of clay and rock fragments. This surficial layer is underlain by fine grained clayey sand with thin, discontinuous silt and silty sand lenses. Soil density ranged from loose to medium dense. At a depth of approximately 10 feet, soils grade into a dense, fine to medium grained sand with silty sand lenses. Because of the relative homogeneity of the site soils and the small number of data points available, no cross-sections have been included in this report.

2.4 GROUNDWATER

This section discusses the hydrogeologic conditions from a regional perspective as well as from a site specific basis.

2.4.1 Regional Hydrogeology

The Coastal Plain consists of a sequence of aquifers made up of interbedded sands and permeable limestones separated by confining units of less permeable clays and calcareous clays. The surficial aquifer and the Castle Hayne aquifer are the principal aquifers of concern in this report.

The surficial aquifer is composed of a series of sands and thin, discontinuous clays that overlie the Castle Hayne. These deposits range in thickness from 25 to 100 feet and are not used directly for water supply at the base. There are several areas where the surficial aquifer has been contaminated by waste disposal activities (Putnam, 1983).

The Castle Hayne aquifer is composed of a series of sand, limestone, and clay beds that are of the Oligocene River Bend Formation and the middle Eocene Castle Hayne Formation. Most supply wells in the vicinity tap this aquifer at depths of 50 to 300 feet. The aquifer ranges in thickness from 250 to 400 feet but brackish water is usually found deeper than 300 feet below MSL (Shiver, 1982).

Confining beds that lie between the two aquifers restrict the exchange of groundwater between the two aquifers and protect the Castle Hayne aquifer from contaminant migration from the surficial aquifer. Research indicates however that there are some interconnections between the two aquifers, and that vertical faulting of the deeper sediments might be the cause (Harned and Lloyd, 1988). A later seismic reflection profiling investigation showed that faulting is not the cause of water migration into the Castle Hayne, but that some hydraulic connection between the two aquifers does exist (Dept. of the Navy, 1990).

The Beaufort, Peedee, Black Creek, and upper and lower Cape Fear aquifers make up the remaining aquifer sequence in the region, but due to their great depth and high salinity, are not of concern to this study.

2.4.2 General Site Hydrogeology

The water table at the Paradise Point Golf Course Site is located in the dense sands at depths ranging from approximately 5 to 14 feet below the ground surface.

Based on the potentiometric surface map shown in Figure 2-1, groundwater flow direction across the site is to the northwest and discharges into Northeast Creek at its confluence with the New River. It should be noted that the skew to the west is based upon a 0.05 foot head difference between wells 80MW01 and 80MW02, and surface water elevations in the on site drainage ditch. In addition, because well 80MW03 is very close to both the on site drainage ditch and to the truck wash sump, the groundwater elevation in that well may be artificially escalated. Based on regional topography and the close proximity of Northeast Creek, groundwater flow may be in a more northeasterly direction.

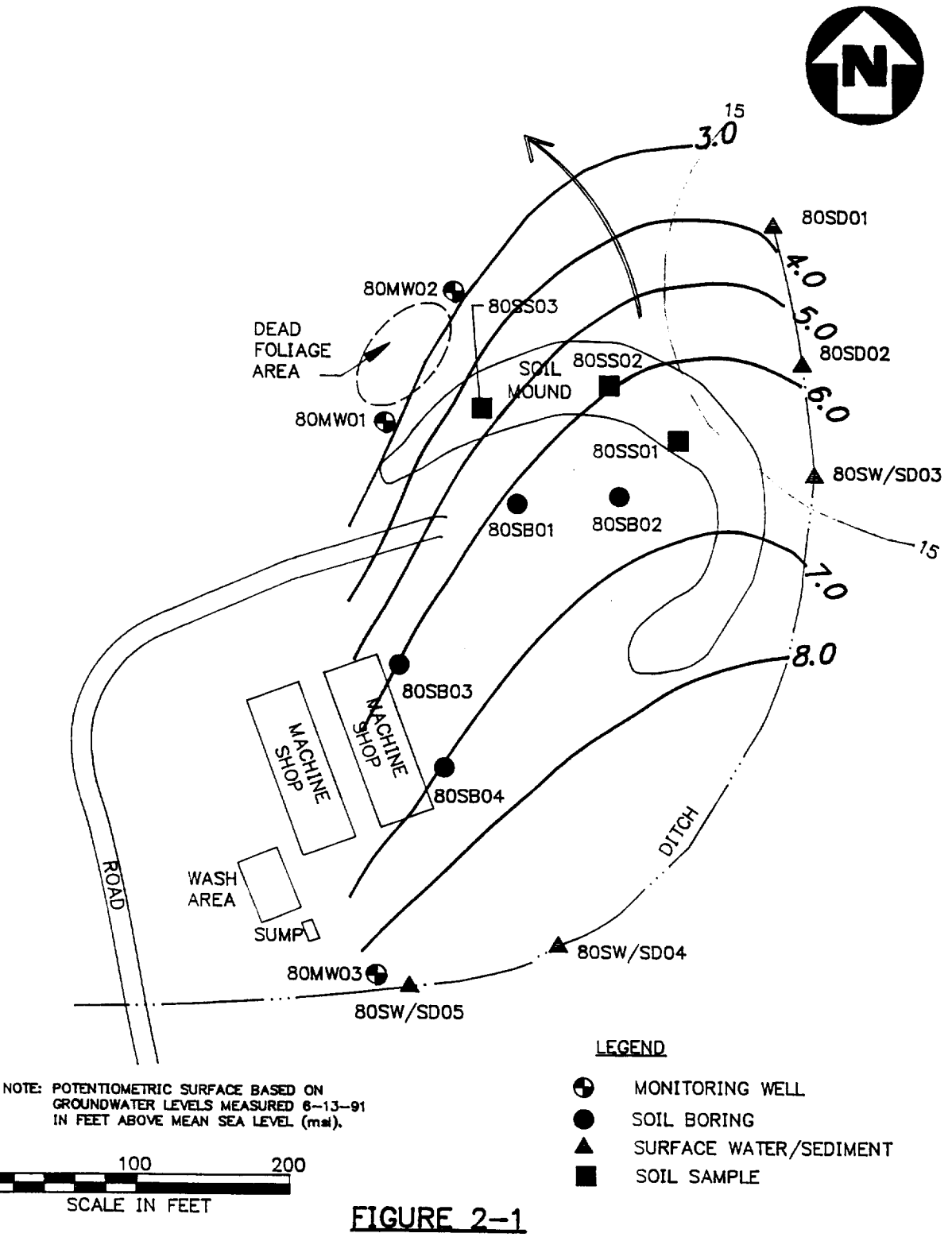

FIGURE 2-1

POTENTIOMETRIC SURFACE MAP
SITE 80:
PARADISE POINT GOLF COURSE
MCB CAMP LEJEUNE

HALLIBURTON NUS
Environmental Corporation

Although no in-situ hydraulic conductivity test were performed during the field investigation, the hydraulic conductivity (K) of soils present at the base are discussed in the USGS provisional draft report Assessment of Hydrologic And Hydrogeologic Data At Camp Lejeune Marine Corps Base, North Carolina, 1989, and is estimated to be 35 feet/day. The hydraulic gradient (i) at the site was calculated to be approximately 0.016. These estimates are based on one round of synoptic water level measurements taken in the three newly installed wells and surveyed well elevations. The regional hydraulic gradient from well 80MW03 to Northeast Creek was calculated to be approximately 0.008. Based on an estimated hydraulic conductivity value of 35 feet/day and the hydraulic gradient at the site of 0.016, the average groundwater velocity ($V = K \times i$) is .56 feet/day.

2.5 CLIMATE AND METEOROLOGY

MCB Camp Lejeune typically experiences mild winters with average daily temperature ranges from 33°F to 53°F. Summers are warm and humid with average daily temperature ranges from 71°F to 88°F. The mean daily temperature is about 61°F.

Rainfall averages 55.96 inches per year with potential evapotranspiration varying from 34 to 36 inches of rainfall equivalent per year. The greatest amount of precipitation occurs during the summer months of July and August.

During the summer months winds are generally south-southwesterly, while north-northwest winds predominate during the winter. The growing season is approximately 230 days (Water and Air Research Inc., 1983).

2.6 LAND USE & NATURAL RESOURCES

MCB Camp Lejeune presently covers an area of 170 square miles, including 30 square miles of the New River. The MCB Camp Lejeune is predominately tree covered, with large amounts of softwood and substantial stands of hardwood species. Of MCB Camp Lejeune's 112,000 acres, more than 60,000 are under forestry management. Timber-producing areas are under even-aged management with the exception of those areas along major streams and swamps. These areas are managed to provide for both wildlife habitat and erosion control. Smaller areas are managed for the benefit of threatened or endangered wildlife species.

The natural resources that could be affected by site contamination include Southwest Creek, the New River, and local groundwater. Southwest Creek flows into the New River, which is a productive estuary supporting commercial finfish and shellfish industries. Some areas of the New River at MCB Camp Lejeune are classified under Title 15 of the North Carolina Administrative Code as Class SC; usable for fishing and secondary recreation, but not for primary recreation or shellfish marketing. Many other areas are classified as SA, the highest estuarine classification; usable for shellfish marketing.

Within 15 miles of Camp Lejeune are three large, publicly owned forests - Croatan National Forest, Hofmann Forest, and Camp Davis Forest. Because of the large amount of low lying area and the area's close proximity to the coast, wetlands form a significant portion of this area. The remaining land is primarily agricultural with typical crops being soybeans, small grains, and tobacco.

2.7 POPULATION DISTRIBUTION

The total current military and civilian population at MCB Camp Lejeune is approximately 60,000 people. During the past 10-year period, urbanization has rapidly increased in Onslow County. Residential

development has flourished adjacent to all Base boundaries, except in areas where adverse soil conditions limited the use of septic tanks and central sewage treatment facilities were unavailable. Based on the monthly Camp Lejeune Area Population report, 1985, the military population of Camp Lejeune was approximately 40,928 active duty personnel. The military dependant community was in excess of 32,081. About one half of these personnel and dependents reside in Base housing units. The remaining personnel and dependents live off base and have had dramatic effects on the surrounding area. Several thousand additional civilian employees perform facilities management and support functions. The population of Onslow County had grown from 17,939 in 1940 (Federal Census, 1940), prior to the formation of the Base, to 121,350 in 1985 (Office of State Budget and Management Report, 27 Sept. 1985).

Due to the somewhat isolated location of the Paradise Point Golf Course no military or civilian personnel live near the site.

2.8 WATER SUPPLY

The water supply for MCB Camp Lejeune is entirely from water wells located within the boundaries of the installation. Groundwater is the source of water for MCB Camp Lejeune, as is the for most of the Coastal Plain of North Carolina. Information regarding groundwater conditions in the Coastal Plain is provided in the report Groundwater Evaluation in the Coastal Plain of North Carolina, prepared by the North Carolina Department of Natural Resources and Community Development.

More than 100 water supply well have been drilled and in 1986, groundwater withdrawal rates from the base wells ranked among the largest in the State and were estimated at 7.5 million gallons per day (Harned and Lloyd, 1988). There are currently 95 water wells at the Base, of which 77 are operational and are scheduled to remain in service. The other wells were either scheduled to be replaced, repaired, or are out of service. Additionally, many other wells are to be completed in the near future, including 20 wells involved in the program to expand the Holcomb Boulevard Treatment Plant. Also, there are many wells throughout the installation that have been removed from service for various reasons. Operational wells were of the following depth and yield:

System	Average Depth (feet)	Average Yield (gpm)
Hadnot Point	177	177
Holcomb Boulevard	240	236
Tarawa Terrace	95	109
Montford Point	98	121
MCAS New River	207	150
Camp Geiger	113	130
Rifle Range	138	184
Courthouse Bay	118	174
Onslow Beach	108	213

The shallow wells at Tarawa Terrace and Montford Point provide the lower yield; furthermore, the quality of water is not good because of iron content and hardness. The hardness is due primarily to calcium bicarbonate. The most recently constructed wells at MCB Camp Lejeune characteristically are deeper wells with better water quality. The 20 wells proposed for expansion of Holcomb Boulevard Treatment Plant are spaced approximately 2,000 feet apart to minimize overlapping drawdown effects between the wells (Camp Lejeune, North Carolina, 1987).

2.9 CRITICAL ENVIRONMENTS

The ecosystems found at MCB Camp Lejeune include terrestrial (or upland), wetland, and aquatic communities. The terrestrial ecosystems contain four habitat types--long leaf pine, loblolly pine, loblolly pine/hardwood, and oak/hickory. Loblolly pine is the main timber stand of the area. The wetlands ecosystems vary from those bordering freshwater streams to salt marshes along coastal estuaries. The aquatic ecosystems consist of small lakes, the New River estuary, numerous tributary creeks, and part of the Intracoastal Waterway.

The wetland ecosystems on MCB Camp Lejeune include five habitat types--pond pine or pocosin, sweet gum/water oak/cypress/tupelo, sweet bog/swamp black gum/red maple, tidal marshes, and coastal beaches. The tidal marsh at the mouth of the New River on MCB Camp Lejeune is one of the few remaining North Carolina coastal areas relatively free from filling or other man-made changes. Coastal beaches along the Outer Banks and Intracoastal Waterway of MCB Camp Lejeune are used for recreation and to house a small military command unit on the beach. The Marines also conduct beach assault training maneuvers ranging from company-size units to combined Second Division, Force Troops, and Marine Air Wing units. These exercises involve the use of heavy equipment; however, heavy-tracked vehicles are permitted to cross the dunes only in restricted areas to protect the ecologically sensitive coastal barrier dunes.

The aquatic ecosystems on MCB Camp Lejeune are important as a freshwater and marine fisheries resource, as a habitat for local and migratory bird species, as a recreational resource for pleasure boating, and as a commercial resource for year-round barge traffic. The aquatic ecosystem contains a wide variety of fresh and salt water fish species, local shore bird species, and migratory bird species.

MCB Camp Lejeune is also used for training exercises involving the use of large numbers of tracked and wheeled vehicles and live ordnance. The use of these items are restricted and carefully controlled to protect human health and safety and the environment.

According to the master plan, there are two major corridors of developable land in the area of MCB Camp Lejeune. These extend south from New Bern along U.S. 17 and U.S. 58, and from Swansboro northwest to Jacksonville and Richlands along Routes 24 and 258. The principal economic base of the area is MCB Camp Lejeune and associated military activities. More than 46,000 military personnel are stationed at the base and more than 110,000 people are either employed or are eligible for support (ES&E, 1990).

3.0 WASTE CHARACTERIZATIONS

3.1 WASTE TYPES

As detailed in Section 1.3, the Paradise Point Golf Course consists of a large mounded area of bare, hummocky soil. There are areas of dead and/or dying vegetation in the vicinity of the soil mound. In addition, there are unvegetated areas where soils have been disturbed. A drainage ditch runs from the truck wash area around the back of the machine shop and soil mound. The area of concern is used by the base for the maintenance and cleaning of equipment used on the golf course. In addition to the machine shop, which is a potential source of waste oils, the routine application of pesticides and herbicides on the golf course and the potential inadvertent disposal of excess pesticides and herbicides behind the machine shop may also have contributed to potential contamination in this area.

The presence of dead vegetation indicates herbicides may have been disposed. However, during the field investigation there was some indication that the area may also be used to burn branches and limbs from trees, which could also cause the areas of dead vegetation. There was no visible indication that other chemicals have been used or disposed of in this area. Potential contaminants at the site include petroleum hydrocarbons, volatile organics, pesticides, PCBs, and herbicides. Chemical analyses of the media collected at the site was designed to characterize these potential contaminants.

3.2 WASTE LOCATIONS

The truck wash area consists of a concrete pad and sumps that collect wash water from the spraying equipment. Prior to the construction of this pad, however, the disposition of wash water may have been uncontrolled. With the exception of the installation of the truck wash rack and sump, no other remedial actions have been performed to date.

Potential waste locations include the near surface and subsurface soils in the vicinity of the truck wash and soil mound. In addition, potential wastes may have migrated into the groundwater and/or surface water bodies. Based on the potential for contaminant migration, the sample locations and types were chosen to determine the actual waste locations.

4.0 LABORATORY DATA

This section provides a description of the methodologies employed by the analytical laboratory and during data evaluation (validation). The last subsection describes the nature and extent of contamination based on a systematic review of the analytical data.

4.1 ANALYTICAL METHODOLOGIES AND RESULTS

As discussed in Section 1.7, soil samples were collected and analyzed for TCL volatiles, polychlorinated biphenyls (PCBs), Total Petroleum Hydrocarbons (TPH), pesticides, and chlorinated herbicides. Groundwater, surface water, and sediment samples were analyzed for TCL volatiles, polychlorinated biphenyls (PCBs), Total Petroleum Hydrocarbons (TPH), pesticides, and herbicides.

Analysis of the organic compounds (TCL volatiles, pesticides, and PCBs) was performed according to the USEPA Contract Laboratory Program (CLP) Statement Of Work (SOW) dated February 1988 (2/88). Chlorinated herbicides were analyzed as per EPA SW-846, 3rd Ed. Method 8150. TPH was analyzed by EPA Method 418.1.

Results reported by the laboratory were validated and qualified analytical data were compiled in a database. The validation procedure is described in Section 4.2. The validated analytical data are presented in Appendix C.

4.2 DATA VALIDATION

All data were generated in accordance with Naval Energy and Environmental Support Activity (NEESA) Level D Quality Assurance/Quality Control (QA/QC) requirements.

The analytical results and raw data were reviewed in accordance with NEESA Level D data validation requirements. Organic analytical data were validated with reference to the "Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses" (USEPA, February 1, 1988). Inorganic analytical data were validated with reference to the "Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses" (USEPA, June 13, 1988).

Results of data validation were summarized in letter reports to the Project Manager. The reports summarize the data qualifiers that were applied to the data and the rationale for the actions. Copies of the letter reports are available upon request. The validated data were compiled into a database that is presented in Appendix C.

4.3 NATURE AND EXTENT OF CONTAMINATION

This section contains a description of the nature and extent of chemical contamination at Site 80. Surface and subsurface soils are discussed in Section 4.3.1 and groundwater is discussed in Section 4.3.2. Surface water samples are discussed in Section 4.3.3 and sediment samples are discussed in Section 4.3.4. The information presented in this section is based on the validated chemical analytical data base, which is contained in its entirety in Appendix C. All sample locations are shown in Figure 1-3.

4.3.1 SOIL

A total of 19 soil samples were collected from four boring locations and three monitoring well borings installed at Site 80. In addition, four surface soil samples were collected. The number of soil samples is detailed as follows:

- 3 surface soil samples (0 to 6 inches)
- 1 surface soil duplicate sample (0 to 6 inches)
- 7 surface soil samples (0 to 2 feet)
- 1 surface soil duplicate sample (0 to 2 feet)
- 7 subsurface soil samples (3 to 17 feet)

All soil samples were analyzed for Target Compound List volatile organics, pesticides, polychlorinated biphenyls (PCBs), and chlorinated herbicides. Table 4-1 presents a summary of the chemical analytical results. The results for the duplicate samples were averaged using one-half the detection limit for nondetects and counted as one sample for presentation in this table.

The surface soil samples contained the greatest variety and concentrations of contaminants. None of the subsurface soil samples was found to contain any analytes at concentrations above the detection limits.

Only one volatile organic (methylene chloride) was detected in any of the surface soil samples, at a concentration of 7 μg/kg in the surface sample from location MW02. Several pesticides were detected in these samples, such as aldrin, chlordane, 4,4'-DDT and its metabolites, and dieldrin. 4,4'-DDD was the pesticide that was found at the greatest concentration (700 μg/kg in sample SB02-0002). No herbicides were detected in any of the samples.

Aroclor-1254 was detected in two disparate locations (SB02 and MW03) at concentrations of 830 μg/kg and 1,500 μg/kg, respectively.

4.3.2 GROUNDWATER

Three monitoring wells were installed at the site. One sample was collected from each well and analyzed for Target Compound List volatile organics, pesticides, PCBs, and chlorinated herbicides. The analytical results are summarized in Table 4-2.

Four volatile organic chemicals were detected in the groundwater sample collected from MW03, as follows:

- Toluene (180 μg/L)
- Ethylbenzene (5 μg/L)
- Xylenes (21 μg/L)
- Carbon disulfide (25 μg/L)

No other wells were found to contain any analytes at concentrations that exceeded detection limits. The presence of the monocyclic aromatics at low concentrations is most likely related to past spillage of fuels used at this facility.

TABLE 4-1

NATURE AND EXTENT OF SOIL CONTAMINATION[1]
SITE 80 - PARADISE POINT GOLF COURSE
MCB CAMP LEJEUNE
JACKSONVILLE, NORTH CAROLINA

Analyte	Surface Soil (0-2 feet)		Subsurface Soil (3-12 feet)		Subsurface Soil (>12 feet)	
	No. of Positive Detections/ No. of Samples	Range of Positive Detections (µg/kg)	No. of Positive Detections/ No. of Samples	Range of Positive Detections (µg/kg)	No. of Positive Detections/ No. of Samples	Range of Positive Detections (µg/kg)
Methylene Chloride	1/10	7	0/6	ND	0/1	ND
Aldrin	2/10	6.8-220	0/6	ND	0/1	ND
alpha-Chlordane	1/10	60	0/6	ND	0/1	ND
4,4'-DDD	4/10	18*-700	0/6	ND	0/1	ND
4,4'-DDE	5/10	16-210	0/6	ND	0/1	ND
4,4'-DDT	4/10	14*-290	0/6	ND	0/1	ND
Dieldrin	4/10	16-440	0/6	ND	0/1	ND
Aroclor-1254	2/10	830-1,500	0/6	ND	0/1	ND

[1] Complete data base in Appendix C.
ND Not detected.
* Results reported are the average of two duplicate samples.

TABLE 4-2

NATURE AND EXTENT OF GROUNDWATER CONTAMINATION[1]
SITE 80 - PARADISE POINT GOLF COURSE
MCB CAMP LEJEUNE
JACKSONVILLE, NORTH CAROLINA

Analyte	No. of Positive Detections/ No. of Samples	Range of Positive Detections (µg/L)	Location of Maximum Concentration
Toluene	1/3	180	MW03
Ethylbenzene	1/3	5	MW03
Xylenes	1/3	21	MW03
Carbon Disulfide	1/3	25	MW03

(1) Complete data base in Appendix C.
* Results reported are the average of two duplicate samples.

4.3.3 SURFACE WATER

Four surface water samples (including one duplicate) were collected from the adjacent stream within the study area. Two proposed sample locations were dry at the time of sampling. The samples were analyzed for Target Compound List volatile organics, pesticides, PCBs, chlorinated herbicides, and total petroleum hydrocarbons. The analytical results are summarized in Table 4-3.

All of the surface water samples contained acetone, at concentrations ranging from 11 to 190 μg/L. Samples from locations SW04 and SW05 also contained toluene, at concentrations of 30 and an average of 104 μg/L in two duplicate samples, and petroleum hydrocarbons (1.39 mg/L and 1.66 mg/L, respectively). Carbon disulfide was also detected in sample SW05 (6 μg/L).

4.3.4 SEDIMENT

No organic chemical analytes or petroleum hydrocarbons were detected in the six sediment samples that were collected in the stream adjacent to the site.

TABLE 4-3

NATURE AND EXTENT OF SURFACE WATER CONTAMINATION[1]
SITE 80 - PARADISE POINT GOLF COURSE
MCB CAMP LEJEUNE
JACKSONVILLE, NORTH CAROLINA

Analyte	Near Site (SW03, SW04, SW05)	
	No. of Positive Detections/ No. of Samples	Range of Positive Detections (µg/L)
Acetone	3/3	11-190
Toluene	2/3	30-104*
Carbon Disulfide	1/3	6*
Total Petroleum Hydrocarbons (mg/L)	2/3	1.39-1.66*

[1] Complete data base in Appendix C.

* Results reported are the average of two duplicate samples.

5.0 PRELIMINARY RISK ASSESSMENT

This section provides a characterization of potential impacts on human health and the environment based upon an evaluation of analytical results, migration pathways, exposure routes, and potential receptors. The characterization is qualitative in nature and is based on comparison of site-specific concentrations with Applicable, or Relevant and Appropriate Requirements (ARARs), guidelines or criteria To Be Considered (TBCs), and Preliminary Risk-Based Remediation Goals (PRGs) developed in accordance with Part B of Risk Assessment Guidance for Superfund (USEPA, December 1991).

The organization and contents of this section may be summarized as follows:

- Section 5.1 - Fate and Transport. Discusses physical properties of site contaminants and relevant contaminant migration pathways and mechanisms.
- Section 5.2 - Potential Receptors, Exposure Pathways, and Sensitive Environments. Identifies and discusses existing exposure pathways and routes and provides a general description of sensitive environments in the site vicinity.
- Section 5.3 - ARARs, TBCs, and PRGs. Presents a textual description and tabular summary of regulatory standards, guidelines, and risk-based criteria for site media.
- Section 5.4 - Comparison with Criteria. Discusses the frequency of detection (number of detections/number of samples) and the number of detections which exceed ARARs/TBCs/PRGs on a media-specific basis.
- Section 5.5 - Summary and Conclusions. General summary of preliminary risk assessment with recommendations of future remedial or investigative actions.

5.1 CONTAMINANT FATE AND TRANSPORT

This section discusses the chemical and physical characteristics of chemicals detected at the Paradise Point Golf Course Site as they pertain to contaminant migration. The characteristics discussed in this section include water solubility, the organic carbon partition coefficient (K_{oc}), the Henry's Law Constant, and the diffusion coefficient (air) for chemicals of concern identified as a result of comparison with background. In addition, potential migration pathways are identified for each media.

5.1.1 Physical/Chemical Properties

5.1.1.1 Solubility

The rate at which a chemical is leached from a waste deposit by infiltrating precipitation is in part proportional to its water solubility. More soluble chemicals are more readily leached than less soluble chemicals. Volatile organics are highly soluble when compared to pesticides and PCBs. Volatile organic chemicals would therefore be expected to be most prevalent in the groundwater.

5.1.1.2 Organic Carbon Partition Coefficient (K_{oc})

The organic carbon partition coefficient is a measure of the tendency of a chemical to bind to soil particles containing organic carbon. Chemicals with high K_{oc}s generally have low water solubilities and vice versa. This parameter may be used to infer the relative rates at which chemicals are transported in the groundwater. Chemicals such as pesticides, which were detected at the site, may be relatively immobile

in the environment and are preferentially bound to organic carbon in the soil. These compounds may not be subject to groundwater transport to the same extent as compounds with lower K_{oc} values.

5.1.1.3 Henry's Law Constant

Henry's Law states that the partial pressure of a chemical above a solution is proportional to the chemical concentration in the solution. The ratio of the vapor pressure to the solubility (the Henry's Law Constant) is used to calculate the equilibrium contaminant concentration in the vapor (air) versus the liquid (water) phases for the dilute solutions encountered in environmental settings. In general, chemicals having a Henry's Law Constant greater than 5×10^{-6} atm-m^3/mole (such as the volatile organics detected at Site 80) would be expected to be found in the atmosphere or in the soil gas.

5.1.1.4 Diffusion Coefficient

Diffusive transport of a chemical in a fluid is mathematically expressed as the product of the concentration difference over a specified distance (the concentration gradient) and the diffusion coefficient of the material in the appropriate fluid (liquid or gas). For chemical emissions from contaminated media, diffusion coefficients in air for chemicals of concern are used to determine volatilization rates. Several chemicals found at the site (i.e., aldrin, dieldrin, chlordane, Aroclor-1254, 4,4'-DDD, 4,4'-DDE and 4,4'-DDT) are not expected to diffuse out of the soil, therefore, molecular diffusivity values for these organics are zero.

5.1.2 Transport Properties of Chemicals in Site Media

5.1.2.1 Soil

The frequency of occurrence and range of positive results for soil contaminants was presented in Table 4-1. Methylene chloride and various pesticides and PCBs were identified as chemicals of concern.

Pesticides and PCBs are generally immobile in the environment and tend to preferentially adhere to the organic carbon in soil rather than go into solution. These compounds have high K_{oc}s and low solubilities. They also tend to strongly bioaccumulate and are not readily volatilized.

5.1.2.2 Groundwater

The groundwater samples collected at the Paradise Point Golf Course Site contained carbon disulfide, toluene, ethylbenzene and xylenes. Based on their relatively low K_{oc} values and high solubilities, these compounds are expected to remain in groundwater.

A summary of the chemical and physical properties for these chemicals of concern detected in groundwater is presented in Table 5-1.

5.1.2.3 Surface Water

As addressed in Section 4.3, acetone, toluene, carbon disulfide and total petroleum hydrocarbons were recognized as chemicals of concern for surface water.

Total petroleum hydrocarbon results are an indicator parameter which encompasses a large group of hydrocarbons which may have variable chemical and physical properties.

Physical transport characteristics for the organic chemicals of concern are presented in Table 5-1.

TABLE 5-1

ENVIRONMENTAL FATE AND TRANSPORT PARAMETERS FOR ORGANIC CHEMICALS[1]
SITE 80 - PARADISE POINT GOLF COURSE
MCB CAMP LEJEUNE
JACKSONVILLE, NORTH CAROLINA

CAS Number	Chemical	Molecular Weight[2]	Specific Gravity (20/4°C)[2]	Vapor Pressure (mm Hg @20°C)[2]	Water Solubility (mg/L @ 20°C)	Octanol/Water Partition Coefficient (Kow)	Organic Carbon Partition Coefficient (Koc)	Henry's Law Constant (atm-m³/mole)	Diffusion Coefficient in Air (cm²/s)[13]
67-64-1	Acetone	58.08	7.91×10^{-1}	2.31×10^{2} [8]	1×10^{6} [9]	5.8×10^{-1}	1.0×10^{1} [11]	3.67×10^{-5} [8]	1.2×10^{-1}
108-88-3	Toluene	92.13	8.67×10^{-1}	2.87×10^{1}	5.35×10^{2} (@ 25°C)	6.2×10^{2}	3.0×10^{2}	6.66×10^{-3}	8.7×10^{-2}
100-41-4	Ethylbenzene	106.16	8.67×10^{-1}	7.0×10^{0}	1.52×10^{2}	2.2×10^{3}	1.1×10^{3}	6.6×10^{-3}	7.5×10^{-2}
	Xylenes[4]	106.17	8.68×10^{-1}	6.0×10^{0}	1.59×10^{2} [5]	1.4×10^{3} [5]	8.7×10^{2} [6]	6.82×10^{-3} [5]	7.5×10^{-2}
75-09-2	Methylene chloride	84.94	1.32×10^{0} [10]	3.62×10^{2}	2.0×10^{4}	1.82×10^{1}	8.8×10^{0}	2.03×10^{-3}	9.0×10^{-1}
75-15-0	Carbon disulfide	76.14	1.26×10^{0}	2.6×10^{2}	2.3×10^{3} (@ 25°C)	1.07×10^{1}	1.42×10^{2} [11]	1.13×10^{-2} [12]	NA[14]
309-99-2	Aldrin	365	NA	6×10^{-6} (@ 25°C)	1.8×10^{-1} (@ 25°C)	2.0×10^{5}	9.6×10^{4}	1.6×10^{-5}	NA[14]
60-57-1	Dieldrin	381	1.75×10^{0}	1.78×10^{-7}	1.95×10^{-1} (@ 25°C)	3.5×10^{3}	1.7×10^{3}	4.57×10^{-10}	NA[14]
74-54-8	4,4'-DDD	320	NA	1.4×10^{-6}	7.0×10^{-2}	1.6×10^{6}	7.7×10^{5}	2.2×10^{-4}	NA[14]
72-55-9	4,4'-DDE	318	NA	6.4×10^{-6}	4.0×10^{-2}	9.1×10^{6}	4.4×10^{6}	6.8×10^{-5}	NA[14]
50-29-3	4,4'-DDT	354.5	NA	1.9×10^{-7} (@ 25°C)	5.5×10^{-3} (@ 25°C)	8.1×10^{6}	3.9×10^{6}	1.58×10^{-5}	NA[14]
57-74-9	Chlordane	409.8	NA	1×10^{-5} (@ 25°C)	5.6×10^{-2} (@ 25°C)	3.0×10^{5}	1.4×10^{5}	9.4×10^{-6}	NA[14]
11097-69-1	Aroclor 1254	328.4	1.50×10^{0}	7.71×10^{-5} (@ 25°C)	3.1×10^{-2} (@ 25°C)	1.1×10^{6}	5.3×10^{5}	2.6×10^{-3}	1.3×10^{5}

[1] U.S. EPA, December 1982 unless noted otherwise.
[2] Verscheuren, 1983.
[3] Lyman et al., 1990, eq. 5-2 and 5-3, average value.
[4] Average of reported values for o-, m-, and p-xylene.
[5] Howard, 1989.
[6] Lyman et al., 1990, eq. 4-9.
[7] Lyman et al., 1990, eq. 5-2.
[8] Howard, 1990.
[9] Compound is reportedly totally miscible in water.
[10] Weiss, 1980.
[11] Lyman et al., 1990, eq. 4-5 and 4-8, average value.
[12] Lyman et al., 1990, eq. 15-8.
[13] U.S. EPA, December, 1987.
[14] NA - Not Applicable. Nonvolatile constituent or chemical not detected in soil matrix (volatile emissions not assessed).

5.1.2.4 Sediment

No organic compounds or petroleum hydrocarbons were found in the sediment samples collected at the site.

5.1.3 Migration Pathways

5.1.3.1 Air

Transport of contaminants in air can be a result of chemical volatilization from the source media and from emission of fugitive dust particulates as a result of wind erosion of partially vegetated ground surfaces. For Site 80, these migration pathways are applicable to soil and surface water since volatile organics were detected in both media.

5.1.3.2 Soil

Chemicals contained in soil bind to the particles in the matrix. One potential migration pathway of contaminants in soil is the physical movement of the soil itself. This is evident from the transport of soil contaminants during storm events as silt. Chemicals contained in soil can also act as sources for water contamination when chemical desorption occurs.

5.1.2.2 Groundwater

Transport of chemicals by groundwater flow and diffusion are the only routes of migration for groundwater chemicals in solution. The discharge of groundwater to surface water bodies and/or removal of groundwater from a well are the only potential migration pathways that may result in exposure to dissolved chemicals. Chemicals dissolved in groundwater can also exhibit partitioning and adsorption onto stationary media (i.e., soils in the saturated zone).

5.1.2.3 Surface Water

Contaminant migration of chemicals dissolved in surface waters can occur via the runoff of the surface water to another body of water or as a result of groundwater recharge. Partitioning from the dissolved phase may also occur, therefore surface water can act as a contaminant source for sediment or soils.

5.1.2.4 Sediment

Migration pathways for sediment in bulk are limited, as only transport by surface water during storm events can mobilize appreciable quantities of sediments. However, sediments can act as a source of surface water contamination as a result of desorption from the sediment particles into solution.

5.2 POTENTIAL RECEPTORS, EXPOSURE PATHWAYS, AND SENSITIVE ENVIRONMENTS

This section identifies current receptors that could be exposed to chemicals of concern. Also discussed are the exposure pathways and mechanisms by which the identified receptors can come into contact with media containing these chemicals. In the last subsection, sensitive environments are identified that could suffer potential adverse effects from exposure to site-related contaminants.

5.2.1 Receptors

Based on current land uses, receptors include transient military personnel and civilian base employees. Exposure by these individuals is dependent upon the activities in which they are engaged.

5.2.2 Exposure Pathways

Exposure pathways developed for the receptors identified in Section 5.2.1 must account for all media and potential means of exposure that a receptor may encounter during normal activity and under current conditions. Several exposure routes per media can be identified.

5.2.2.1 Air

Exposures to chemicals in air are the result of inhalation by a receptor. Potential exposure pathways include the inhalation of volatile chemicals generated in and around the immediate site, and the inhalation of fugitive dust generated when wind passes over partially vegetated ground surfaces. In both of these exposure routes, actual absorption of chemicals occurs in the lungs. In the latter pathway, absorption in the gastrointestinal tract results from ingestion of soil-laden sputum ejected from the lungs.

5.2.2.2 Soil

Exposures to chemicals contained in soil can be the result of direct dermal contact with soil and incidental ingestion of soil as a result of hand-to-mouth contact.

5.2.2.3 Groundwater

Groundwater chemical exposure occurs only from the use of water that is pumped from a contaminated aquifer. Under the current groundwater use scenario, no exposure pathway can be identified because no domestic or production wells are located at or near Site 80.

5.2.2.4 Surface Water

Exposure to surface water at the Paradise Point Golf Course Site is limited to the adjacent unnamed stream which is very small. Adolescents playing in the area may come in contact with contaminated surface water by playing in the stream. Exposure could occur via either incidental ingestion or dermal absorption. The stream is not large enough to support an edible fish population, therefore, fish ingestion is not considered to be a potential route of exposure.

5.2.3 Sensitive Environments

Areas surrounding Site 80 are not considered to be sensitive environments.

5.3 APPLICABLE, OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs), CRITERIA TO BE CONSIDERED (TBCS), AND PRELIMINARY REMEDIATION GOALS

This section provides a brief description of state and federal requirements and criteria and summarizes risk-based criteria for potential chemicals of concern at the Paradise Point Golf Course Site.

5.3.1 Applicable, or Relevant and Appropriate Regulations (ARARs) and Criteria To Be Considered (TBCs)

This section presents the available regulatory standards or guidelines for all of the chemicals of concern at Site 80.

5.3.1.1 Maximum Contaminant Levels (MCLs)

MCLs are enforceable standards promulgated under the Safe Drinking Water Act and are designed for the protection of human health. MCLs are based on laboratory or epidemiologic studies and apply to drinking

water supplies consumed by a minimum of 25 persons. They are designed for prevention of human health effects associated with lifetime exposure (70 years) of an average adult (weighing 70 kg) who consumes 2 liters of water per day, but they also reflect the technical feasibility of removing the contaminant from the water. These enforceable standards also reflect the fraction of toxicant expected to be absorbed by the gastrointestinal tract.

5.3.1.2 Ambient Water Quality Criteria (AWQC)

AWQC are not enforceable Federal regulatory guidelines and are of primary utility in assessing the potential for toxic effects in aquatic organisms. They may also be used to identify the potential for human health risks. AWQC consider both the acute and toxic effects from ingestion of both water (2 L/day) and aquatic organisms (6.5 g/day), and from ingestion of water alone. The AWQC for protection of human health for carcinogenic substances are based on the USEPA's specified incremental cancer risk range of one additional case of cancer in an exposed population of 10,000,000 to 100,000 persons (i.e., the 10^{-7} to 10^{-5} range) and are generally based on older toxicologic data.

5.3.1.3 Health Advisories

Health Advisories are guidelines developed by the USEPA Office of Drinking Water for nonregulated contaminants in drinking water. These guidelines are designed to consider both acute and chronic toxic effects in children (with an assumed body weight of 10 kg) who consume 1 liter of water per day, or in adults (with an assumed body weight of 70 kg) who consume 2 liters of water per day. Health Advisories are generally available for acute (1-day), subchronic (10-day), and chronic (longer-term or lifetime) exposure scenarios. These guidelines are designed to consider only threshold effects and, as such, are not used to set acceptable levels of known or probable human carcinogens.

5.3.1.4 North Carolina State Groundwater Quality Standards

North Carolina Administrative Code, Title 15, Subchapter 2L, dated December 1, 1989 presents standards and classification for groundwaters. Groundwater classifications are based upon existing or potential best usage, condition of the groundwater (based on chloride concentration), and occurrence. Associated with each class are prescribed maximum allowable concentrations of constituents. The standards are based on minimum concentrations for the protection of human health, or sensory thresholds.

5.3.1.5 North Carolina State Surface Water Quality Standards

North Carolina Administrative Code, Title 15, Subchapter 2B, dated January 29, 1991 establishes standards and classifications for surface water bodies. Several surface water bodies, in particular those in and around the New River drainage basin, have been classified by the State of North Carolina Department of Environment, Health, and Natural Resources. Maximum concentration allowances have been established for various chemical, physical, and biological parameters based on the protection of human health and aquatic life.

5.3.1.6 USEPA Region IV Surface Water Screening Values

The Water Management Division of the United States Environmental Protection Agency (USEPA) in Region IV has developed screening values for various toxic pollutants for protection of aquatic life in freshwater and marine environments and for protection of human health. Analogous to federal AWQC, these screening values provide a more complete listing for chemicals not covered by AWQC and are based on biological and toxicological studies.

5.3.1.7 Sediment Criteria

Guidelines for sediment are derived from EPA AWQC values for protection of aquatic life and are based on the partitioning of an organic chemical in equilibrium soil/water systems. As discussed in Section 5.1, partitioning is dependent on organic carbon content of soils. The following equations are employed to estimate equilibrium partitioning in sediment based on surface water quality criteria:

$$Sediment_{Criteria} = AWQC_{sw} \times K_{oc} \times f_{oc} \qquad \text{(organics only)}$$

Ambient surface water quality criteria for the protection of aquatic life are used as the basis for this calculation. In instances where a federal AWQC is not available, a maximum screening value for freshwater (EPA Region IV, October 1991) is used.

5.3.2 Risk-Based Criteria

Enforceable standards have not been specified for many of the chemicals of concern at Site 80; therefore, other regulatory guidelines may be used for comparative purposes to infer health risks and environmental impacts.

5.3.2.1 Noncarcinogenicity and Reference Doses (RfDs)

The RfD is developed by the USEPA for chronic and/or subchronic human exposure to hazardous chemicals and is solely based on the noncarcinogenic health effects imparted by a chemical. The RfD is usually expressed as a dose (mg) per unit body weight (kg) per unit time (day). It is generally derived by dividing a no-observed-(adverse)-effect-level (NOEL or NOAEL) or a lowest-observed-adverse-effect-level (LOAEL) by an appropriate uncertainty factor. NOAELs, etc., are determined from laboratory or epidemiological toxicity studies. The uncertainty factor is based on the availability of toxicity data.

Uncertainty factors are generally applied as multiples of 10 to represent specific areas of uncertainty in the available data. A factor of 10 is used to account for variations in the general population (to protect sensitive subpopulations), when extrapolating test results from animals to humans (to account for interspecies variability), when a NOAEL derived from a subchronic study (instead of a chronic study) is used to develop the RfD, and when a LOAEL is used instead of a NOAEL. In addition, the USEPA reserves the use of a modifying factor of up to 10 for professional judgment of uncertainties in the data base not already accounted for. The default value of the modifying factor is 1.

The RfD incorporates the surety of the evidence for chronic human health effects. Even if applicable human data exist, the RfD (as diminished by the uncertainty factor) still maintains a margin of safety so that chronic human health effects are not underestimated. Thus the RfD is an acceptable guideline for evaluation of noncarcinogenic risk, although the associated uncertainties preclude its use for precise risk quantitation.

5.3.2.2 Carcinogenicity and Cancer Slope Factor (CSF)

CSFs are applicable for estimating the lifetime probability (assuming a 70-year lifetime) of human receptors developing cancer as a result of exposure to known or potential carcinogens. This factor is generally reported by the USEPA in units of $(mg/kg/day)^{-1}$ and is derived through an assumed low-dosage linear relationship and an extrapolation from high to low dose responses determined from animal studies. The value used in reporting the CSF is the upper 95 percent confidence limit.

5.3.2.3 Weight of Evidence

The weight of evidence designations indicate the likelihood that a chemical is a human carcinogen, based on both animal and human studies. The classification is as follows:

- A - Known human carcinogen.
- B - Potential human carcinogen. B1 indicates that limited human data are available. B2 indicates that there is sufficient evidence of carcinogenicity in animals, but inadequate or no evidence in humans.
- C - Possible human carcinogen
- D - Not classifiable as to human carcinogenicity
- E - Evidence of noncarcinogenicity in humans

5.3.2.4 Risk-based Preliminary Remediation Goals (PRGs)

In accordance with United States Environmental Protection Agency (USEPA) risk assessment guidance, the development of risk-based PRGs provide initial clean-up goals for chemicals of concern that are protective of human health and comply with ARARs (USEPA, RAGS Volume I, Part B, 1991). The goals are chemical, media, and site specific and consider land and water usage patterns, receptors, exposure parameters, and chemical toxicity and carcinogenicity.

PRGs developed for soil at Site 80 are based on a current use scenario under an industrial setting. The receptors are assumed to be only transient military personnel. Exposure duration is for 2 years, and the routes of exposure evaluated are incidental ingestion and inhalation of volatiles and particulates. The minimum concentration goal calculated for target carcinogenic and noncarcinogenic risks (1×10^{-6} and 1.0, respectively) is presented as the PRG for the specific chemical of concern.

The sediment remediation goals are developed based upon partitioning values for each of the potential chemicals of concern and the chemical-specific AWQC.

5.3.3 Summary

Table 5-2 presents the values of the available State and Federal ARARs and dose-response parameters for both carcinogenic and noncarcinogenic chemicals of concern. All available toxicity information is included in this table. However, if a parameter is not available, previously published values from the USEPA or other sources are presented. Table 5-3 presents a summary of the North Carolina State Class GA groundwater and Class SC surface water criteria.

5.4 COMPARISON WITH CRITERIA

This section provides a media-specific comparison of analytical data for Site 80 to developed preliminary remediation goals.

5.4.1 Soil

Eight potential chemicals of concern were detected in soil samples from the Paradise Point Golf Course Site. The frequency of occurrence and range of positive results reported for soil samples was summarized in Table 4-1.

No Federal or State clean-up criteria exist for any of the soil chemicals of concern. Preliminary remediation goals for the soil chemicals were developed based on noncarcinogenic and carcinogenic toxicological information for the chemicals detected. Table 5-4 provides a comparison of potential chemicals of concern with the risk-based preliminary remediation goals (PRGs).

TABLE 5-2

REGULATORY REQUIREMENTS AND DOSE-RESPONSE PARAMETERS FOR CHEMICALS OF CONCERN
SITE 80 - PARADISE POINT GOLF COURSE
MCB CAMP LEJEUNE
JACKSONVILLE, NORTH CAROLINA

Chemical	Safe Drinking Water Act Maximum Contaminant Level (mg/L) (SDWA MCL)[1]	Reference Dose(2) (mg/kg/day)		Ambient Water Quality Criteria[3] (mg/L)		Health Advisory[1] (mg/L)	Cancer Slope Factor[2] (mg/kg/day)$^{-1}$		EPA Weight of Evidence[2]
		Oral	Inhalation	Federal	EPA Region IV		Oral	Inhalation	
Acetone		1×10^{-1}							
Toluene	1	2×10^{-1}	1×10^{-1}		3.7×10^{-2}	1-Day/Child: 20 10-Day/Child: 2 Longer-term/Child: 2 Longer-term/Adult: 7 Lifetime/Adult: 1			D
Ethylbenzene	0.7	1×10^{-1}	3×10^{-1}[b]		4.3×10^{-3}	1-Day/Child: 30 10-Day/Child: 3 Longer-term/Child: 1 Longer-term/Adult: 3 Lifetime/Adult: 0.7			D
Xylenes	10	2×10^{0}	9×10^{-2}			1-Day/Child: 40 10-Day/Child: 40 Longer-term/Child: 40 Longer-term/Adult: 100 Lifetime/Adult 10			D
Methylene chloride	0.005[a]	6×10^{-2}	9×10^{-1}		2.56×10^{0}	1-Day/Child: 10 10-Day/Child: 2	7.5×10^{-3}	1.6×10^{-3}	B2
Carbon disulfide		1×10^{-1}	3×10^{-3}						
Aroclor 1254	0.0005			3×10^{-5}	3×10^{-5}		7.7×10^{0}		B2

TABLE 5-2
REGULATORY REQUIREMENTS AND DOSE-RESPONSE PARAMETERS FOR CHEMICALS OF CONCERN
SITE 80 - PARADISE POINT GOLF COURSE
MCB CAMP LEJEUNE
JACKSONVILLE, NORTH CAROLINA
PAGE TWO

Chemical	Safe Drinking Water Act Maximum Contaminant Level (mg/L) (SDWA MCL)[1]	Reference Dose(2) (mg/kg/day)		Ambient Water Quality Criteria[3] (mg/L)		Health Advisory[1] (mg/L)	Cancer Slope Factor[2] (mg/kg/day)$^{-1}$		EPA Weight of Evidence[2]
		Oral	Inhalation	Federal	EPA Region IV		Oral	Inhalation	
Aldrin		3×10^{-5}			1.3×10^{-4}	1-Day/Child: 0.0003 10-Day/Child: 0.0003 *Longer-term/Child: 0.0003* Longer-term/Adult: 0.0003 Lifetime/Adult: 0.0003	1.7×10^{1}	1.7×10^{1}	B2
Chlordane	0.002	6×10^{-5}		4×10^{-6}	4×10^{-6}	*1-Day/Child: 0.06* 10-Day/Child: 0.06	1.3×10^{0}	1.3×10^{0}	B2
4,4'-DDD					2.5×10^{-5}		2.4×10^{-1}		B2
4,4'-DDE					1.4×10^{-4}		3.4×10^{-1}		B2
4,4'-DDT		5×10^{-4}		1×10^{-6}	1×10^{-6}		3.4×10^{-1}	3.4×10^{-1}	B2
Dieldrin		5×10^{-5}		1.9×10^{-6}	1.9×10^{-6}	1-Day/Child: 0.0005 10-Day/Child: 0.0005 Longer-term/Child: 0.0005 *Longer-term/Adult: 0.002*	1.6×10^{1}	1.6×10^{1}	B2

[1] U.S. EPA, April 1992.
[2] IRIS. On Line. September 1992.
[3] AWQC for protection of freshwater aquatic life. U.S. EPA, January 1991 and U.S. EPA, October 1991. Federal criteria are acute and chronic values.

[a] Proposed.
[b] Reference Dose has been revoked pending review of carcinogenicity and/or noncarcinogenicity.

TABLE 5-3

STATE OF NORTH CAROLINA WATER QUALITY STANDARDS[1]
SITE 80 - PARADISE POINT GOLF COURSE
MCB CAMP LEJEUNE
JACKSONVILLE, NORTH CAROLINA

Chemical	Class GA Groundwater Standard (mg/L)[2]	Class SC Surface Water Standard (mg/L)
Acetone	NR[3]	NR
Toluene	1×10^{0}	NR
Ethylbenzene	2.9×10^{-2}	NR
Xylenes	4×10^{-1}	NR
Carbon disulfide	NR	NR
Total petroleum hydrocarbons	NR	NR

(1) NCAC, Title 15, Subchapter 2L (December 1989) and NCAC, Title 15A, Subchapter 2B (August 1990).
(2) Chloride concentration less than 250 mg/L.
(3) NR - Not reported.

TABLE 5-4

OBSERVED CONCENTRATIONS VERSUS STANDARDS/CRITERIA - SOIL
SITE 80 - PARADISE POINT GOLF COURSE
MCB CAMP LEJEUNE
JACKSONVILLE, NORTH CAROLINA

Chemical of Concern	Frequency of Detection[1]	Range of Detections (mg/kg)	Standard or Criteria (mg/kg)	Frequency of Exceedences[2]
Methylene chloride	1/17	0.007	5.14[4]	0/1
Aldrin	2/17	0.0068 - 0.22	0.34[4]	0/2
Chlordane	1/17	0.06	4.46[4]	0/1
4,4'-DDD	4/17	0.018[3] - 0.7	24.17[4]	0/4
4,4'-DDE	5/17	0.016 - 0.21	17.06[4]	0/5
4,4'-DDT	4/17	0.014[3] -0.29	17.06[4]	0/4
Dieldrin	4/17	0.016 - 0.44	34.71[4]	0/4
Aroclor 1254	2/17	0.83 - 1.5	0.75[4]	2/2

[1] Number of positive detections per number of samples.
[2] Number of exceedances per number of positive detections.
[3] Result reported is the average of two duplicate samples.
[4] Standard/Criteria based on 1 x 10^{-6} cancer risk. See Appendix D.

With the exception of Aroclor-1254, none of the potential chemical of concern concentrations exceed the risk-based PRGs for the soil matrix. Aroclor-1254 was detected in two of seventeen soil samples at concentrations of 0.83 mg/kg and 1.5 mg/kg. Both of these concentrations slightly exceed the PRG based on a target incremental cancer risk of 1×10^{-6} (0.75 mg/kg). Soil samples from soil boring sample SB02-0002 (0- to 2-foot interval) and monitoring well boring MW03-0002 (0- to 2-foot interval) contained Aroclor-1254 above the PRG. The highest concentration detected (1.5 mg/kg) corresponds to an incremental cancer risk of approximately 2×10^{-6} (1.5/0.75) based on the exposure assumptions used to develop the PRG.

5.4.2 Groundwater

A summary of the chemicals detected in groundwater samples collected at the site was provided in Table 4-2. Of the detected chemicals, potential chemicals of concern for groundwater were identified based on a review of their individual toxicity.

Table 5-5 presents a summary of standards/criteria and analytical data for the chemicals of concern for groundwater. The standards/criteria used for comparative purposes are the lowest value of the Federal MCLs or North Carolina State Class GA groundwater quality standards for each of the potential chemicals of concern. No risk-based PRGs were used for comparison because no current groundwater usage exists.

Carbon disulfide was the only chemical of concern which did not have established federal or state groundwater quality standards. None of the remaining chemicals of concern (toluene, ethylbenzene and xylene) exceeded the associated standards or criteria.

5.4.3 Surface Water

A summary of the chemicals detected in surface water samples was provided in Table 4-3. Potential chemicals of concern include acetone, toluene, carbon disulfide, and total petroleum hydrocarbons.

Table 5-6 outlines the frequency of occurrence and range of positive results and a comparison to the appropriate criteria. The criteria used are the AWQC for each of the potential chemicals of concern. No risk-based PRGs were used for surface water.

Toluene was detected in one sample, SW05, at a concentration of 104 ug/L exceeding the Region IV screening value of 37 ug/L. No surface water standards or criteria were available for the other chemicals of concern.

5.5 SUMMARY AND CONCLUSIONS

This section provides a summary of the preliminary risk assessment and presents recommendations for future activities at the Paradise Point Golf Course Site.

5.5.1 Preliminary Risk Assessment

The results of the preliminary risk assessment will be discussed on a media-specific basis. All chemicals of concern are identified based upon standard/criteria/PRG exceedence.

Maximum soil results for Aroclor-1254 exceeded the associated PRG (calculated based on a 1×10^{-6} cancer risk) by a factor of two.

TABLE 5-5

OBSERVED CONCENTRATIONS VERSUS STANDARDS/CRITERIA - GROUNDWATER
SITE 80 - PARADISE POINT GOLF COURSE
MCB CAMP LEJEUNE
JACKSONVILLE, NORTH CAROLINA

Chemical of Concern	Frequency of Detection[1]	Range of Detections (µg/L)	Standard or Criteria (µg/L)	Frequency of Exceedences[2]
Toluene	1/3	180	1,000[3,4]	0/1
Ethylbenzene	1/3	5	29[4]	0/1
Xylenes	1/3	21	400[4]	0/1
Carbon disulfide	1/3	25	NR[5]	NA[5]

[1] Number of positive detections per number of samples.
[2] Number of exceedances per number of positive detections.
[3] Federal Maximum Contaminant Level.
[4] North Carolina Class GA Groundwater Quality Standard.
[5] NR - Not Reported. NA - Not Applicable - No standard/criteria.

TABLE 5-6

OBSERVED CONCENTRATIONS VERSUS STANDARDS/CRITERIA - SURFACE WATER
SITE 80 - PARADISE POINT GOLF COURSE
MCB CAMP LEJEUNE
JACKSONVILLE, NORTH CAROLINA

Chemical of Concern	Frequency of Detection[1]	Range of Detections (µg/L)	Standard or Criteria (µg/L)	Frequency of Exceedences[2]
Acetone	3/3	11 - 190	NR[4]	NA[4]
Toluene	2/3	30 - 104[3]	37[5]	1/2
Carbon disulfide	1/3	6[3]	NR	NA[4]
TPH	2/3	1.39 - 1.66[3]	NR	NA[4]

[1] Number of positive detections per number of samples.
[2] Number of exceedances per number of positive detections.
[3] Result reported is the average of two duplicate samples.
[4] NR - Not Reported. NA - Not Applicable - No standard/criteria.
[5] U.S. EPA, October 1991.

None of the sample results for groundwater chemicals of concern were above the federal (MCL) or state (Class GA) standards. Based on this comparison and because no current usage of the shallow groundwater at the site is identified, no preliminary risks can be associated with this medium.

Analytical results for one of the three surface waters collected at the site exceeded the criteria based upon the AWQC for Protection of Aquatic Life and North Carolina State Class SC Surface Water Standards. Risk-based remediation goals were not employed for this medium.

No organic chemicals or petroleum hydrocarbons were found to be present in the sediment, therefore, no risks are associated with sediment at the site.

5.5.2 Recommendations

Based upon the results of the preliminary risk assessment, exposure to soil contaminants at the site is not expected to result in unacceptable risks. Although concentrations of Aroclor-1254 detected in two of seventeen soil samples soil exceeded the calculated remediation goals, the highest concentration exceeded the PRG by only a factor of two. The PRG for Aroclor-1254 was developed based on a target incremental cancer risk of 1×10^{-6}. The detection of Aroclor-1254 at twice the PRG value still results in an incremental cancer risk below the upper bound of the EPA target risk range of 1×10^{-4}.

No current risk from exposure to groundwater contaminants is noted as detected groundwater concentrations do not exceed associated Federal and State standards and criteria. Also, at this time no exposure route for shallow groundwater exists at the site.

The only chemical of concern of potential threat to the protection of aquatic life is toluene, which exceeded associated standards and criteria in one surface water sample. However, surface water chemicals of concern are expected to be attenuated to a large extent upon discharge to Northeast Creek and concentrations for this compound should be within acceptable limits at the discharge point.

Based on the results of this preliminary risk assessment it is recommended that no further action be conducted.

6.0 CONCLUSIONS AND RECOMMENDATIONS

This section presents a summary of the field investigation for Site 80: Paradise Point Golf Course, as well as several recommendations for future activities at the site.

6.1 CONCLUSIONS

The field investigation performed at this site is summarized in Section 1.7 of this report. The primary purpose was to determine whether a contamination problem existed on the site from its previous use. The analytical data were validated and a preliminary risk assessment was performed. The results of the risk assessment are discussed in detail in Section 6.0 of this document. The results are discussed by media below.

The results of the preliminary risk assessment will be discussed on a media-specific basis. All chemicals of concern are identified based upon standard/criteria/PRG exceedence.

Maximum soil results for Aroclor-1254 exceeded the associated PRG (calculated based on a 1×10^{-6} cancer risk) by a factor of two.

None of the sample results for groundwater chemicals of concern were above the federal (MCL) or state (Class GA) standards. Based on this comparison and because no current usage of the shallow groundwater at the site is identified, no preliminary risks can be associated with this medium.

Analytical results for one of the three surface waters collected at the site exceeded the criteria based upon the AWQC for Protection of Aquatic Life and North Carolina State Class SC Surface Water Standards. Risk-based remediation goals were not employed for this medium.

No organic chemicals or petroleum hydrocarbons were found to be present in the sediment, therefore, no risks are associated with sediment at the site.

6.2 RECOMMENDATIONS

Based upon the results of the preliminary risk assessment, exposure to soil contaminants at the site is not expected to result in unacceptable risks. Although concentrations of Aroclor-1254 detected in two of seventeen soil samples soil exceeded the calculated remediation goals, the highest concentration exceeded the PRG by only a factor of two. The PRG for Aroclor-1254 was developed based on a target incremental cancer risk of 1×10^{-6}. The detection of Aroclor-1254 at twice the PRG value still results in an incremental cancer risk below the upper bound of the EPA target risk range of 1×10^{-4}.

No current risk from exposure to groundwater contaminants is noted as detected groundwater concentrations do not exceed associated Federal and State standards and criteria. Also, at this time no exposure route for shallow groundwater exists at the site.

The only chemical of concern of potential threat to the protection of aquatic life is toluene, which exceeded associated standards and criteria in one surface water sample. However, surface water chemicals of concern are expected to be attenuated to a large extent upon discharge to Northeast Creek and concentrations for this compound should be within acceptable limits at the discharge point.

Based on the results of this preliminary risk assessment it is recommended that no further action be conducted.

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APPENDIX A

BORING LOGS

BORING LOG — **NUS CORPORATION**

PROJECT: CAMP LEJEUNE — BORING NO.: 80-[illegible]
PROJECT NO.: 2936 — DATE: 6-13-91 — DRILLER: C. [illegible]
ELEVATION: 17.20 — FIELD GEOLOGIST: L. YOST
WATER LEVEL DATA: [illegible]
(Date, Time & Conditions) [illegible]

SAMPLE NO. & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	MATERIAL DESCRIPTION: COLOR	MATERIAL DESCRIPTION: MATERIAL CLASSIFICATION	BORE USCS	REMARKS
	0 0	5 7				WHITE	FINE SAND		
1-80	2 0	7 15	2 0 / 2 0		FRIABLE DENSE	BLACK MOTTLED	FINE SAND TRACE [illegible]	SM	[illegible] DRY [illegible]
									[illegible]
	4 0								
						ORANGE BROWN	FINE SAND TRACE [illegible]		
	6 0								HNU DOES NOT SEEM
									TO BE WORKING PROPERLY
	8 0			8.0	STIFF	ORANGE BROWN	SANDY CLAY	SC	
	10 0			10.5		ORANGE BROWN	CLAYEY SAND WITH [illegible]	SC	
		7 9							
1435	12 0	17 17	2 0 / 2 0		FRIABLE DENSE	ORANGE BROWN	CLAYEY SAND SOME SILT	SC	[illegible] MOIST
				12.0					[illegible]
							SPLIT SPOON 10-12		
							2-3" SPOONS		
							EOB 12.0'		

REMARKS MOBILE B-61 RIG 4¼" INCH I.D. HOLLOW STEM AUGERS
3" I.D. SPLIT SPOONS FOR LITHOLOGICAL & CHEMICAL SAMPLES

BORING 80SB01

PAGE 1 OF 1

BORING LOG — **NUS CORPORATION**

PROJECT: CAMP LEJEUNE — BORING NO.: SB 502
PROJECT NO.: 3F36 — DATE: 6-13-91 — DRILLER: [illegible]
ELEVATION: 16.90 — FIELD GEOLOGIST: D. Yost
WATER LEVEL DATA: [illegible]
(Date, Time & Conditions) [illegible]

SAMPLE NO. & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth,ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	BORING UNIFIED SOIL CONSISTENCY	REMARKS
	0.0	8 / 8				WHITE	V. FINE SAND [illegible]		
S-1 1500	- 0	10 / 9	2.0 / 2.0		MEDIUM DENSE	BROWN	SILT SAND TR WOOD FRAG	SM	DRY
						WHITE	FINE SAND		NA - NA
	4.0								
					MEDIUM DENSE	TAN	FINE SAND TR SILT	SM	
	6.0								
						LT. TAN	FINE SAND	P	SAND GETS SILTY
	8.0			8.0		GRAY BROWN	SANDY CLAY TR SILT	CL	@ 7.5'
	10.0			10.5		ORANGE BROWN	SAND SOME SILT	SC	
		13 / 13							
S-2 1316	12.0	12 / 15	2.0 / 2.0		MEDIUM DENSE	ORANGE BROWN	SAND some SILT	SM	SOME MOIST
				12.0			SAND IS FINE		NA - NA
							SPLIT SPOON 10-12		
							2-3" SPOONS		
							FOR 12.0'		

REMARKS: 4 1/4 INCH I.D HOLLOW STEM AUGERS. MOBILE B61 RIG
2" I.D SPLITSPOONS FOR SAMPLES

BORING SB502

PAGE 1 : 1

BORING LOG — **NUS CORPORATION**

PROJECT: CAMP LEJEUNE — BORING NO.: [illegible]
PROJECT NO.: ZF36 — DATE: 6-13-91 — DRILLER: [illegible]
ELEVATION: 15.84 — FIELD GEOLOGIST: D YOST
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	BORE USCS	REMARKS
	0.6	2 / 3				WHITE BROWN	SAND TRACE		
SS 1-0	2.0	3 / 4	2.6 / 2.0		LOOSE	BROWN WHITE	FINE SAND TRACE	SM	[illegible] FIR - [illegible] OPPM HNU
	4.0								
						BROWN	FINE SAND SOME SILT	SM	CAMP
	6.0								
	8.0					BROWN	FINE SAND SOME SILT		CAMP
				9.0		ORANGE BROWN	SANDY CLAY	CL	TRACE
	10.0			10.0					
		5 / 7		11.0		ORANGE BROWN	CLAYEY SAND		
SS 2 11.0-12.0	12.0	12 / 21			MEDIUM DENSE	ORANGE BROWN	CLAYEY SAND	SC	SS 2 10.0-12.0 V MOIST - WET [illegible]
				12.0					
							SPLIT SPOON 10-12		
							- 2 SPOONS		
							EOB 12.0		

REMARKS: MOBILE B 61 RIG. 4 1/4 INCH I.D. HOLLOWSTEM AUGERS. 3" I.D SPLIT SPOONS FOR SAMPLES

BORING [illegible]

PAGE 1 .: [illegible]

BORING LOG — **NUS CORPORATION**

PROJECT: CAMP LEJEUNE — BORING NO.: 80 SB04
PROJECT NO.: 2536 — DATE: 6.13.91 — DRILLER: C.CH/SM (H HI)
ELEVATION: 16.40 — FIELD GEOLOGIST: D. YOST
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE OR ROD	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	BOREHOLE USCS CONSISTENCY	REMARKS
	0.0	9 13				WHITE	SAND TR SILT		
S-1 1050	2.0	13 [illegible]	2.0 2.0		MED IN DENS	WHITE	FINE SAND TR SILT	SM	S-1 0-2' [illegible] DUPLICATE
							WELL SORTED		[illegible] NU
	4.0								
						BROWN	SAND TR SILT		
	6.0								
				7.0		BROWN ORANGE	SANDY CLAY W SILT	CL	
	8.0	7 9							
S-2 1055		10 8	2.0 2.0		V STIFF	ORANGE - BROWN	SANDY CLAY W SILT	CL	S-2 7-9' DAMP
	10.0			10.5			CLAYEY SAND		0 PPM HNU
		11 11							
S-3 1100	12.0	12 19	2.0 2.1		MED IM DENSE	ORANGE BROWN	CLAYEY SAND	SC	S-3 10-12' [illegible] V MOIST - WET
				12.0					0 PPM HNU
	14.0								
							SPLIT SPOON 10-12		
							3 - 3' SPOONS		
							EOB 12'		

REMARKS: MOBILE B61 R-6 4 1/4 INCH I.D. HOLLOW STEM AUGERS 3" I.D SPLITSPOONS FOR SAMPLES

BORING [illegible]

PAGE 1

BORING LOG — **NUS CORPORATION**

PROJECT: CAMP LEJEUNE — BORING NO.: 80MW01
PROJECT NO.: ZF36 — DATE: 6-16-91 — DRILLER: [illegible]
ELEVATION: 15.73 — FIELD GEOLOGIST: D. Yost
WATER LEVEL DATA: [illegible]
(Date, Time & Conditions) [illegible]

SAMPLE NO. & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	MATERIAL DESCRIPTION: COLOR	MATERIAL DESCRIPTION: MATERIAL CLASSIFICATION	USCS SOIL CONSTITUENTS	REMARKS
	00	3 4				BROWN	SAND [illegible] SILT		
C-1 1230	2.0	4 8	-2/2.0		LOOSE	WITH [illegible] BROWN	FINE SAND TR SILT	SM/SP	S-1 0-2' CAMP
						[illegible]			OFFM NNV
	4.6				LOOSE	RELATIVELY LIGHT BROWN	FINE SAND TR SILT	SM/SP	SAND SE[illegible]
									[illegible]
	6.0				LOOSE	TAN-ORANGE	FINE SAND [illegible] SILT	SM	DAMP
	8.0						SAME SILTIER		
	10.0								
		1 2							
C-2 1235	12.0	22 30	2.0/2.0		DENSE	ORANGE TAN	SAND TR SILT	SM/SP	S-2 [illegible] MOIST - VMOIST
									OFFM NNV
	14.0					ORANGE	SAND [illegible] FINE		
	16.0								
						ORANGE BROWN	SAND TR SILT	SM/SP	SAT/SATD
	18.0								WATER ROSE [illegible] N
									5 MINUTES. SETTLED [illegible]
	20.0			20.0					
							EOTM - 20.0		
							BOREHOLE TO 20'		
							2 3' SPOONS		

REMARKS 4¼ INCH HOLLOW STEM AUGERS. CME 55 ATV
3" I.D. SPLIT SPOONS FOR SAMPLES

BORING 80MW01

PAGE 1 : 1

BORING LOG — **NUS CORPORATION**

PROJECT: CAMP LEJEUNE — BORING NO.: 80MW03
PROJECT NO.: ZF36 — DATE: 6-16-91 — DRILLER: S CHISM / J N I
ELEVATION: 17.24 — FIELD GEOLOGIST: D. Yost
WATER LEVEL DATA :
(Date, Time & Conditions)

SAMPLE NO. & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth,ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	BORE HOLE USCS CONSCRS	REMARKS
	00	2 / 1				[illegible]	FINE SAND [illegible]		
S1 [illegible]	20	4 / [illegible]	[illegible] / 20		LOOSE	WHITE TAN	FINE SAND [illegible]	[illegible]	SLIGHT DAMP
						BROWN	WELL SORTED		DAMP-WET
	40								
						TAN	FINE SAND TRACE		DAMP
	60								
					LOOSE	BROWN	FINE SAND [illegible] SILT	SM	DAMP
	80								
						BROWN	SILTY SAND [illegible] CLAY		DAMP-MOIST
	100								
					MEDIUM DENSE	WHITE TAN	SAND FINE - MODERATE GRADING	SW/SP	
	120								
		15 / 24							
S2 [illegible]	140	51 / 77	20 / 20		V. DENSE	WHITE TAN	SAND FINE - MODERATE GRADING	SP	[illegible] V. MOIST DAMP-WET
	160								
	180				LOOSE	TAN-BROWN	V. FINE SAND WELL SORTED	SM/SP	SATURATED
	[illegible]								
	220			22.0					
							BOTM 22.0		SCREEN SET [illegible]
	240						2-3 SPLIT SPOONS		

REMARKS 4¼ INCH I.D. HOLLOW STEM AUGERS; CME 55 ATV
3" I.D. SPLIT SPOONS FOR SAMPLES

BORING 80MW03
PAGE 1 : 1

BORING LOG — **NUS CORPORATION**

PROJECT: CAMP LEJEUNE — BORING NO.: [illegible]
PROJECT NO.: 2F36 — DATE: 6-13-91 — DRILLER: [illegible]
ELEVATION: 14.63 — FIELD GEOLOGIST: L. YOST
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE OR ROD	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	BOREHOLE CONSTRUCTION SCREENS	REMARKS
	2.0	5 7				BROWN	SILT, SAND		
S-1 1635	2.5	3 3	0.5 2.0		LOOSE	BROWN	SAND W TR ROCK FRAG	SM/SP	[illegible]
	4.0					W BROWN	SAND TR SILT		4' CUTTINGS MOIST
						GRAY-BLACK	SAND TR SILT	SM/SP	ODOR IN CUTTINGS
	6.0			6.0			SANDY CLAY		
		7 7		7.0		TAN	CLAYEY SAND	SC	
S-2 1634	8.0	7 4			MEDIUM DENSE	GRAY BROWN	CLAYEY SAND W [illegible]		S-2 6-8' SATURATED
	10.0								H_2O RISES TO 8' IN AUGERS
				11.0		BROWN TAN	SANDY SILTY CLAY		
S-	12.0								EXTRA 3" SPLIT SPOON TAKEN A-0-3' FOR [illegible]
									LAST OF RECOVERY
	14.0								
				15.0					
	16.0								
	18.0								
	20.0								

REMARKS: MOBILE B61 R.G. 4¼ INCH I.D HOLLOW STEM AUGERS.
2" I.D SPLIT SPOONS FOR SAMPLES

BORING 80M10

PAGE 1 OF 1

APPENDIX B

WELL CONSTRUCTION DIAGRAMS

NUS CORPORATION
A Halliburton Company

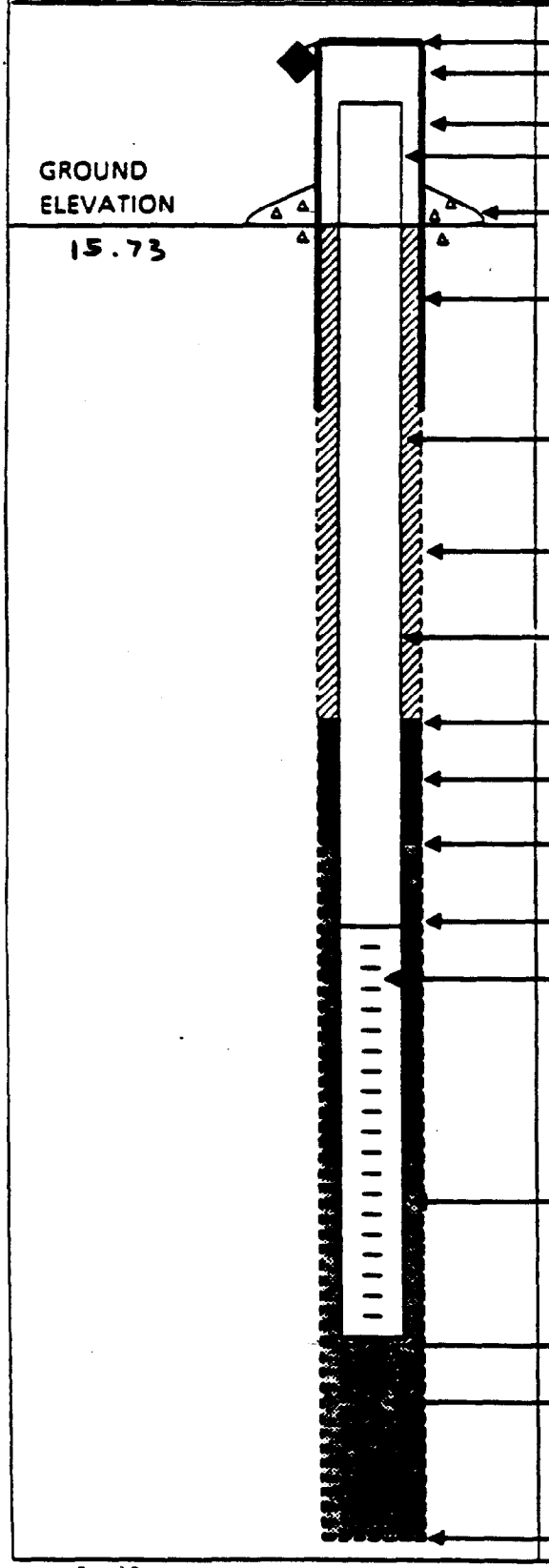
BORING NO 60MW01

OVERBURDEN
MONITORING WELL SHEET

PROJECT CAMP LEJEUNE
PROJECT NO. ZF36
ELEVATION 15.73
FIELD GEOLOGIST L. Yost

LOCATION CAMP LEJEUNE N.C
BORING 60MW01
DATE 6-16-91

DRILLER [illegible]
DRILLING METHOD H.S.A
DEVELOPMENT METHOD SS BAILER



ELEVATION OF TOP OF SURFACE CASING: 19.22
ELEVATION OF TOP OF RISER PIPE: 19.10
STICK - UP TOP OF SURFACE CASING: 3.49
STICK - UP RISER PIPE: 3.37
TYPE OF SURFACE SEAL: CEMENT/GROUT
I.D. OF SURFACE CASING: 4 INCH
TYPE OF SURFACE CASING: STEEL
RISER PIPE I.D. 2 INCH
TYPE OF RISER PIPE: PVC
BOREHOLE DIAMETER: 8¼ INCH
TYPE OF BACKFILL: CEMENT / GROUT
ELEVATION / DEPTH TOP OF SEAL: [illegible]
TYPE OF SEAL: BENTONITE
DEPTH TOP OF SAND PACK: [illegible]
ELEVATION / DEPTH TOP OF SCREEN: 10.0
TYPE OF SCREEN: PVC
SLOT SIZE x LENGTH: 0.02" x 10'
I.D. OF SCREEN: 2 INCH
TYPE OF SAND PACK: #2 SILICA SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: [illegible]
ELEVATION / DEPTH BOTTOM OF SAND PACK: [illegible]
TYPE OF BACKFILL BELOW OBSERVATION WELL: #2 SILICA SAND
ELEVATION / DEPTH OF HOLE: 20.5

NUS CORPORATION
A Halliburton Company

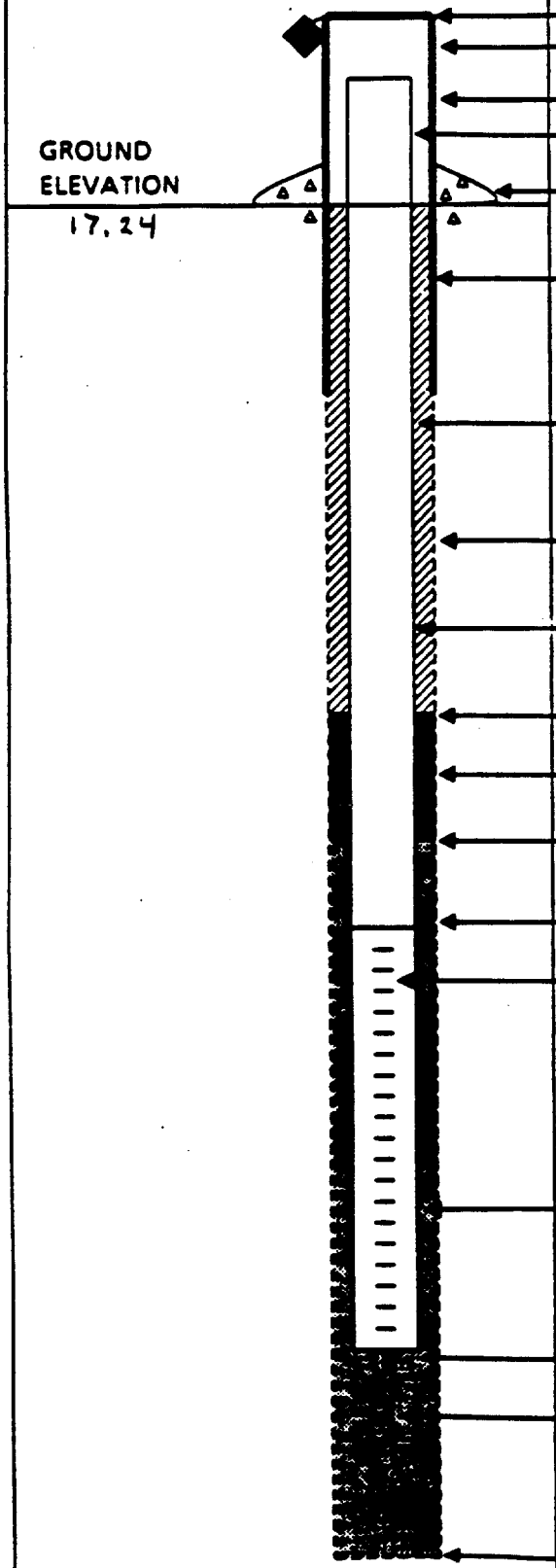
BORING NO 80MW02

OVERBURDEN
MONITORING WELL SHEET

PROJECT CAMP LEJEUNE
PROJECT NO. 2F36
ELEVATION 17.24
FIELD GEOLOGIST D. Yost

LOCATION CAMPLEJEUNE NC
BORING #80MW02
DATE 6-16-91

DRILLER C.C.H.sm (H.H.I.)
DRILLING METHOD H.S.A
DEVELOPMENT METHOD SS BAILER



ELEVATION OF TOP OF SURFACE CASING: 20.69
ELEVATION OF TOP OF RISER PIPE: 20.01
STICK - UP TOP OF SURFACE CASING: 3.45
STICK - UP RISER PIPE: 2.77
TYPE OF SURFACE SEAL: CEMENT / GROUT
I.D. OF SURFACE CASING: 4 INCH
TYPE OF SURFACE CASING: STEEL
RISER PIPE I.D. 2 INCH
TYPE OF RISER PIPE: PVC
BOREHOLE DIAMETER: 8 1/4 INCH
TYPE OF BACKFILL: CEMENT / GROUT
ELEVATION / DEPTH TOP OF SEAL: 8G
TYPE OF SEAL: BENTONITE
DEPTH TOP OF SAND PACK: 10.0
ELEVATION / DEPTH TOP OF SCREEN: 12.0
TYPE OF SCREEN: PVC
SLOT SIZE x LENGTH: 0.02 x 10'
I.D. OF SCREEN: 2 INCH
TYPE OF SAND PACK: # SILICA SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: 22.0
ELEVATION / DEPTH BOTTOM OF SAND PACK: 22.5
TYPE OF BACKFILL BELOW OBSERVATION WELL: #2 SAND
ELEVATION / DEPTH OF HOLE: 22.5

NUS CORPORATION
A Halliburton Company

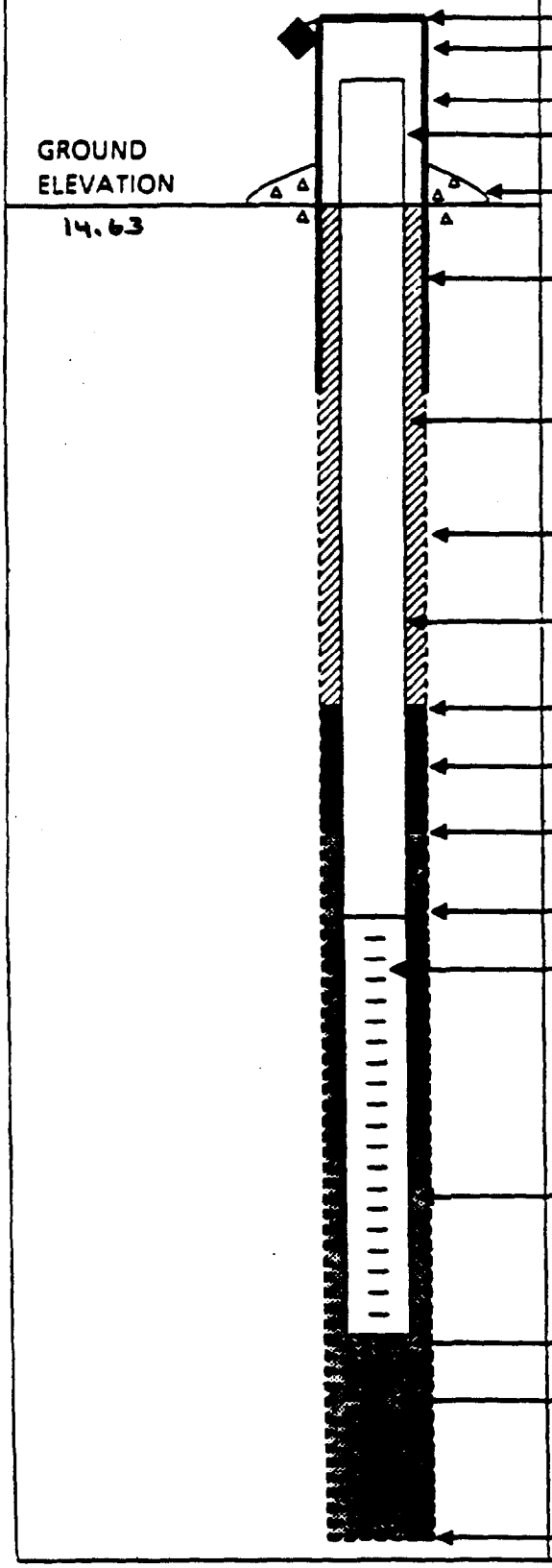
BORING NO. 80MW05

OVERBURDEN
MONITORING WELL SHEET

PROJECT CAMP LEJEUNE
PROJECT NO. 2F36
ELEVATION 14.63
FIELD GEOLOGIST C Yost

LOCATION CAMP LEJEUNE N.C.
BORING 80MW03
DATE 6-13-91

DRILLER E.C.H. SM (H.T.)
DRILLING METHOD H S A
DEVELOPMENT METHOD AIRLIFT



ELEVATION OF TOP OF SURFACE CASING: 18.40
ELEVATION OF TOP OF RISER PIPE: 17.98
STICK - UP TOP OF SURFACE CASING: 3.77
STICK - UP RISER PIPE: 3.35
TYPE OF SURFACE SEAL: CEMENT
I.D. OF SURFACE CASING: 4 INCH
TYPE OF SURFACE CASING: STEEL
RISER PIPE I.D. 2 INCH
TYPE OF RISER PIPE: PVC
BOREHOLE DIAMETER: 8 1/4 INCH
TYPE OF BACKFILL: CEMENT/GROUT
ELEVATION / DEPTH TOP OF SEAL: 1.5
TYPE OF SEAL: BENTONITE
DEPTH TOP OF SAND PACK: 3.9
ELEVATION / DEPTH TOP OF SCREEN: 4.8
TYPE OF SCREEN: PVC
SLOT SIZE x LENGTH: 0.02 x 10'
I.D. OF SCREEN: 2 INCH
TYPE OF SAND PACK: #2 SILICA SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: 14.8
ELEVATION / DEPTH BOTTOM OF SAND PACK: 15.0
TYPE OF BACKFILL BELOW OBSERVATION WELL: #2 SILICA SAND
ELEVATION / DEPTH OF HOLE: 15.0

APPENDIX C

CHEMICAL ANALYTICAL RESULTS

VOLATILE ANALYSIS (ug/kg)
SITE: CAMP LEJEUNE - SITE 80
CASE: 4997/5005

SAMPLE LOCATION:		SO01-0002	SO01-0002-D	SO02-0002	SO03-0002	SB01-0002	SB01-1012	SB02-0002	SB02-1012
SAMPLE NUMBER:									
QC DESIGNATION:	CRQL		FIELD DUPLICATE						
CHLOROMETHANE	10	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U
BROMOMETHANE	10	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U
VINYL CHLORIDE	10	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U
CHLOROETHANE	10	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U
METHYLENE CHLORIDE	5	6 U	5 U	6 U	6 U	4 UJ	6 U	6 U	5 U
ACETONE	10	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U
CARBON DISULFIDE	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
1,1-DICHLOROETHENE	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
1,1-DICHLOROETHANE	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
1,2-DICHLOROETHENE (TOTAL)	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
CHLOROFORM	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
1,2-DICHLOROETHANE	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
2-BUTANONE	10	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U
1,1,1-TRICHLOROETHANE	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
CARBON TETRACHLORIDE	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
VINYL ACETATE	10	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U
BROMODICHLOROMETHANE	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
1,2-DICHLOROPROPANE	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
CIS-1,3-DICHLOROPROPENE	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
TRICHLOROETHENE	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
DIBROMOCHLOROMETHANE	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
1,1,2-TRICHLOROETHANE	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
BENZENE	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
TRANS-1,3-DICHLOROPROPENE	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
BROMOFORM	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
4-METHYL-2-PENTANONE	10	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U
2-HEXANONE	10	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U
TETRACHLOROETHENE	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
1,1,2,2-TETRACHLOROETHANE	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
TOLUENE	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
CHLOROBENZENE	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
ETHYL BENZENE	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
STYRENE	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
TOTAL XYLENES	5	6 U	5 U	6 U	6 U	6 U	6 U	6 U	5 U
% MOISTURE:		11	9	12	10	12	13	12	5
DILUTION FACTOR:		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
DATE SAMPLED:		6/13/91	6/13/91	6/13/91	6/13/91	6/13/91	6/13/91	6/13/91	6/13/91
DATE ANALYZED:		6/21/91	6/21/91	6/21/91	6/21/91	6/21/91	6/21/91	6/21/91	6/21/91
ASSOCIATED BLANKS:		80SB04-T	80SB04-T	80SB04-T	80SB04-T	80SB04-T			

VOLATILE ANALYSIS (ug/kg)
SITE: CAMP LEJEUNE - SITE 80
CASE: 4997/5005

SAMPLE LOCATION:		SB03-0002	SB03-1012	SB04-0002	SB04-0002-D	SB04-1012	MW01-0002	MW01-1012	MW02-0002
SAMPLE NUMBER:									
QC DESIGNATION:	CRQL				FIELD DUPLICATE				
CHLOROMETHANE	10	11 U	13 U	10 U	10 U	12 U	10 U	11 UJ	11 UJ
BROMOMETHANE	10	11 U	13 U	10 U	10 U	12 U	10 U	11 U	11 U
VINYL CHLORIDE	10	11 U	13 U	10 U	10 U	12 U	10 U	11 U	11 U
CHLOROETHANE	10	11 U	13 U	10 U	10 U	12 U	10 U	11 U	11 U
METHYLENE CHLORIDE	5	7 UJ	9 UJ	3 UJ	5 U	6 U	5 U	5 U	6 U
ACETONE	10	11 U	13 U	10 U	10 U	12 U	10 U	11 U	11 U
CARBON DISULFIDE	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
1,1-DICHLOROETHENE	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
1,1-DICHLOROETHANE	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
1,2-DICHLOROETHENE (TOTAL)	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
CHLOROFORM	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
1,2-DICHLOROETHANE	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
2-BUTANONE	10	11 U	13 U	10 U	10 U	12 U	10 U	11 U	11 U
1,1,1-TRICHLOROETHANE	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
CARBON TETRACHLORIDE	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
VINYL ACETATE	10	11 U	13 U	10 U	10 U	12 U	10 U	11 U	11 U
BROMODICHLOROMETHANE	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
1,2-DICHLOROPROPANE	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
CIS-1,3-DICHLOROPROPENE	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
TRICHLOROETHENE	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
DIBROMOCHLOROMETHANE	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
1,1,2-TRICHLOROETHANE	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
BENZENE	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
TRANS-1,3-DICHLOROPROPENE	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
BROMOFORM	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
4-METHYL-2-PENTANONE	10	11 U	13 U	10 U	10 U	12 U	10 U	11 U	11 U
2-HEXANONE	10	11 U	13 U	10 U	10 U	12 U	10 U	11 U	11 U
TETRACHLOROETHENE	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
1,1,2,2-TETRACHLOROETHANE	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
TOLUENE	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
CHLOROBENZENE	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
ETHYL BENZENE	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
STYRENE	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
TOTAL XYLENES	5	5 U	7 U	5 U	5 U	6 U	5 U	5 U	6 U
% MOISTURE:		7	24	4	4	15	4	7	12
DILUTION FACTOR:		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
DATE SAMPLED:		6/13/91	6/13/91	6/13/91	6/13/91	6/13/91	6/16/91	6/16/91	6/16/91
DATE ANALYZED:		6/21/91	6/21/91	6/20/91	6/21/91	6/21/91	6/27/91	6/25/91	6/25/91
ASSOCIATED BLANKS:		80SB04-T	80SB04-T	80SB04-T	80SB04-T	80SB04-T	80GW03-R	80GW03-R	80GW03-R
							80MW01-R	80MW01-R	80MW01-R
							82SW02-T	82SW02-T	82SW02-T

VOLATILE ANALYSIS (ug/kg)
SITE: CAMP LEJEUNE - SITE 80
CASE: 4997/5005

SAMPLE LOCATION:		MW02-1214	MW03-0002	MW03-0608
SAMPLE NUMBER:				
QC DESIGNATION:	CRQL			
CHLOROMETHANE	10	11 UJ	11 UJ	13 UJ
BROMOMETHANE	10	11 U	11 U	13 U
VINYL CHLORIDE	10	11 U	11 U	13 U
CHLOROETHANE	10	11 U	11 U	13 U
METHYLENE CHLORIDE	5	6 U	7	6 U
ACETONE	10	11 U	11 U	13 U
CARBON DISULFIDE	5	6 U	5 U	6 U
1,1-DICHLOROETHENE	5	6 U	5 U	6 U
1,1-DICHLOROETHANE	5	6 U	5 U	6 U
1,2-DICHLOROETHENE (TOTAL)	5	6 U	5 U	6 U
CHLOROFORM	5	6 U	5 U	6 U
1,2-DICHLOROETHANE	5	6 U	5 U	6 U
2-BUTANONE	10	11 U	11 U	13 U
1,1,1-TRICHLOROETHANE	5	6 U	5 U	6 U
CARBON TETRACHLORIDE	5	6 U	5 U	6 U
VINYL ACETATE	10	11 U	11 U	13 U
BROMODICHLOROMETHANE	5	6 U	5 U	6 U
1,2-DICHLOROPROPANE	5	6 U	5 U	6 U
CIS-1,3-DICHLOROPROPENE	5	6 U	5 U	6 U
TRICHLOROETHENE	5	6 U	5 U	6 U
DIBROMOCHLOROMETHANE	5	6 U	5 U	6 U
1,1,2-TRICHLOROETHANE	5	6 U	5 U	6 U
BENZENE	5	6 U	5 U	6 U
TRANS-1,3-DICHLOROPROPENE	5	6 U	5 U	6 U
BROMOFORM	5	6 U	5 U	6 U
4-METHYL-2-PENTANONE	10	11 U	11 U	13 U
2-HEXANONE	10	11 U	11 U	13 U
TETRACHLOROETHENE	5	6 U	5 U	6 U
1,1,2,2-TETRACHLOROETHANE	5	6 U	5 U	6 U
TOLUENE	5	6 U	5 U	6 U
CHLOROBENZENE	5	6 U	5 U	6 U
ETHYL BENZENE	5	6 U	5 U	6 U
STYRENE	5	6 U	5 U	6 U
TOTAL XYLENES	5	6 U	5 U	6 U
% MOISTURE:		13	8	22
DILUTION FACTOR:		1.0	1.0	1.0
DATE SAMPLED:		6/16/91	6/13/91	6/13/91
DATE ANALYZED:		6/25/91	6/24/91	6/24/91
ASSOCIATED BLANKS:		80GW03-R	82SW06-R	82SW06-R
		80MW01-R	82SD06-R	82SD06-R
		82SW02-T		

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PESTICIDE/PCB ANALYSIS (ug/kg)
SITE: CAMP LEJEUNE - SITE 80
CASE: 4997

SAMPLE LOCATION:		SO01-0002	SO01-0002-D	SO02-0002	SO03-0002	SB01-0002	SB01-1012	SB02-0002	SB02-1012
SAMPLE NUMBER:									
QC DESIGNATION:	CRQL		FIELD DUPLICATE						
ALPHA-BHC	8.0	4.7 U	4.6 U	4.5 U	11 U	4.7 U	4.5 U	4.3 U	4.2 U
BETA-BHC	8.0	4.7 U	4.6 U	4.5 U	11 U	4.7 U	4.5 U	4.3 U	4.2 U
DELTA-BHC	8.0	4.7 U	4.6 U	4.5 U	11 U	4.7 U	4.5 U	4.3 U	4.2 U
GAMMA-BHC (LINDANE)	8.0	4.7 U	4.6 U	4.5 U	11 U	4.7 U	4.5 U	4.3 U	4.2 U
HEPTACHLOR	8.0	4.7 U	4.6 U	4.5 U	11 U	4.7 U	4.5 U	4.3 U	4.2 U
ALDRIN	8.0	4.7 UJ	4.6 UJ	4.5 UJ	11 UJ	4.7 UJ	4.5 UJ	220 J	4.2 UJ
HEPTACHLOR EPOXIDE	8.0	4.7 U	4.6 U	4.5 U	11 U	4.7 U	4.5 U	4.3 U	4.2 U
ENDOSULFAN I	8.0	4.7 U	4.6 U	4.5 U	11 U	4.7 U	4.5 U	4.3 U	4.2 U
DIELDRIN	16.0	9.3 U	9.2 U	9.0 U	22 U	150	9.1 U	110 J	8.4 U
4,4'-DDE	16.0	9.3 U	9.2 U	9.0 U	22 U	9.5 U	9.1 U	210 J	8.4 U
ENDRIN	16.0	9.3 U	9.2 U	9.0 U	22 U	9.5 U	9.1 U	8.7 U	8.4 U
ENDOSULFAN II	16.0	9.3 U	9.2 U	9.0 U	22 U	9.5 U	9.1 U	8.7 U	8.4 U
4,4'-DDD	16.0	18 J	9.2 UJ	9.0 U	22 U	20	9.1 U	700	8.4 U
ENDOSULFAN SULFATE	16.0	9.3 U	9.2 U	9.0 U	22 U	9.5 U	9.1 U	8.7 U	8.4 U
4,4'-DDT	16.0	9.3 U	9.2 U	9.0 U	22 U	9.5 U	9.1 U	290 J	8.4 U
METHOXYCHLOR	80.0	47 U	46 U	45 U	110 U	47 U	45 U	43 U	42 U
ENDRIN KETONE	16.0	9.3 U	9.2 U	9.0 U	22 U	9.5 U	9.1 U	8.7 U	8.4 U
ALPHA-CHLORODANE	80.0	47 U	46 U	45 U	110 U	47 U	45 U	43 U	42 U
GAMMA-CHLORDANE	80.0	47 U	46 U	45 U	110 U	47 U	45 U	43 U	42 U
TOXAPHENE	160.0	93 U	92 U	90 U	220 U	95 U	91 U	87 U	84 U
AROCLOR 1016	80.0	47 U	46 U	45 U	110 U	47 U	45 U	43 U	42 U
AROCLOR 1221	80.0	47 U	46 U	45 U	110 U	47 U	45 U	43 U	42 U
AROCLOR 1232	80.0	47 U	46 U	45 U	110 U	47 U	45 U	43 U	42 U
AROCLOR 1242	80.0	47 U	46 U	45 U	110 U	47 U	45 U	43 U	42 U
AROCLOR 1248	80.0	47 U	46 U	45 U	110 U	47 U	45 U	43 U	42 U
AROCLOR 1254	160.0	93 U	92 U	90 U	220 U	95 U	91 U	830	84 U
AROCLOR 1260	160.0	93 U	92 U	90 U	220 U	95 U	91 U	87 U	84 U
% MOISTURE:		14	13	12	65	15	12	8	5
DILUTION FACTOR:		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
DATE SAMPLED:		6/13/91	6/13/91	6/13/91	6/13/91	6/13/91	6/13/91	6/13/91	6/13/91
DATE EXTRACTED:		6/19/91	6/19/91	6/19/91	6/19/91	6/19/91	6/19/91	6/19/91	6/19/91
DATE ANALYZED:		7/24/91	7/24/91	7/24/91	7/24/91	7/24/91	7/24/91	7/24/91	7/24/91
ASSOCIATED BLANKS:									

PESTICIDE/PCB ANALYSIS (ug/kg)
SITE: CAMP LEJEUNE - SITE 80
CASE: 4997

SAMPLE LOCATION:		SB03-0002	SB03-1012	SB04-0002	SB04-0002-D	SB04-1012	MW01-0002	MW01-1012	MW02-0002
SAMPLE NUMBER:									
QC DESIGNATION:	CRQL				FIELD DUPLICATE				
ALPHA-BHC	8.0	5.1 U	5.0 U	4.2 U	4.1 U	4.7 U	4.2 U	4.3 U	4.4 U
BETA-BHC	8.0	5.1 U	5.0 U	4.2 U	4.1 U	4.7 U	4.2 U	4.3 U	4.4 U
DELTA-BHC	8.0	5.1 U	5.0 U	4.2 U	4.1 U	4.7 U	4.2 U	4.3 U	4.4 U
GAMMA-BHC (LINDANE)	8.0	5.1 U	5.0 U	4.2 U	4.1 U	4.7 U	4.2 U	4.3 U	4.4 U
HEPTACHLOR	8.0	5.1 U	5.0 U	4.2 U	4.1 U	4.7 U	4.2 U	4.3 U	4.4 U
ALDRIN	8.0	5.1 UJ	5.0 UJ	4.2 UJ	4.1 UJ	4.7 UJ	4.2 U	4.3 U	4.4 U
HEPTACHLOR EPOXIDE	8.0	5.1 U	5.0 U	4.2 U	4.1 U	4.7 U	4.2 U	4.3 U	4.4 U
ENDOSULFAN I	8.0	5.1 U	5.0 U	4.2 U	4.1 U	4.7 U	4.2 U	4.3 U	4.4 U
DIELDRIN	16.0	10 U	10 U	8.4 U	8.2 U	9.3 U	8.4 U	8.7 U	16 J
4,4'-DDE	16.0	10 U	10 U	30	26	9.3 U	81	8.7 U	16 J
ENDRIN	16.0	10 U	10 U	8.4 U	8.2 U	9.3 U	8.4 U	8.7 U	8.9 U
ENDOSULFAN II	16.0	10 U	10 U	8.4 U	8.2 U	9.3 U	8.4 U	8.7 U	8.9 U
4,4'-DDD	16.0	10 U	10 U	8.4 U	8.2 U	9.3 U	8.4 U	8.7 U	8.9 U
ENDOSULFAN SULFATE	16.0	10 U	10 U	8.4 U	8.2 U	9.3 U	8.4 U	8.7 U	8.9 U
4,4'-DDT	16.0	10 U	10 U	15	13	9.3 U	58	8.7 U	8.9 U
METHOXYCHLOR	80.0	51 U	50 U	42 U	41 U	47 U	42 U	43 U	44 U
ENDRIN KETONE	16.0	10 U	10 U	8.4 U	8.2 U	9.3 U	8.4 U	8.7 U	8.9 U
ALPHA-CHLORODANE	80.0	51 U	50 U	42 U	41 U	47 U	42 U	43 U	44 U
GAMMA-CHLORDANE	80.0	51 U	50 U	42 U	41 U	47 U	42 U	43 U	44 U
TOXAPHENE	160.0	100 U	100 U	84 U	82 U	93 U	84 U	87 U	89 U
AROCLOR 1016	80.0	51 U	50 U	42 U	41 U	47 U	42 U	43 U	44 U
AROCLOR 1221	80.0	51 U	50 U	42 U	41 U	47 U	42 U	43 U	44 U
AROCLOR 1232	80.0	51 U	50 U	42 U	41 U	47 U	42 U	43 U	44 U
AROCLOR 1242	80.0	51 U	50 U	42 U	41 U	47 U	42 U	43 U	44 U
AROCLOR 1248	80.0	51 U	50 U	42 U	41 U	47 U	42 U	43 U	44 U
AROCLOR 1254	160.0	100 U	100 U	84 U	82 U	93 U	84 U	87 U	89 U
AROCLOR 1260	160.0	100 U	100 U	84 U	82 U	93 U	84 U	87 U	89 U
% MOISTURE:		21	20	5	3	14	5	8	10
DILUTION FACTOR:		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
DATE SAMPLED:		6/13/91	6/13/91	6/13/91	6/13/91	6/13/91	6/16/91	6/16/91	6/16/91
DATE EXTRACTED:		6/19/91	6/19/91	6/19/91	6/19/91	6/19/91	6/20/91	6/20/91	6/20/91
DATE ANALYZED:		7/24/91	7/24/91	7/24/91	7/24/91	7/24/91	8/01/91	8/01/91	8/01/91
ASSOCIATED BLANKS:									

PESTICIDE/PCB ANALYSIS (ug/kg)
SITE: CAMP LEJEUNE - SITE 80
CASE: 4997

SAMPLE LOCATION:		MW02-1214	MW03-0002	MW03-0608
SAMPLE NUMBER:				
QC DESIGNATION:	CRQL			
ALPHA-BHC	8.0	4.4 U	4.3 U	5.2 U
BETA-BHC	8.0	4.4 U	4.3 U	5.2 U
DELTA-BHC	8.0	4.4 U	4.3 U	5.2 U
GAMMA-BHC (LINDANE)	8.0	4.4 U	4.3 U	5.2 U
HEPTACHLOR	8.0	4.4 U	4.3 U	5.2 U
ALDRIN	8.0	4.4 U	6.8 J	5.2 UJ
HEPTACHLOR EPOXIDE	8.0	4.4 U	4.3 U	5.2 U
ENDOSULFAN I	8.0	4.4 U	4.3 U	5.2 U
DIELDRIN	16.0	8.8 U	440 J	10 U
4,4'-DDE	16.0	8.8 U	140 J	10 U
ENDRIN	16.0	8.8 U	8.7 U	10 U
ENDOSULFAN II	16.0	8.8 U	8.7 U	10 U
4,4'-DDD	16.0	8.8 U	60	10 U
ENDOSULFAN SULFATE	16.0	8.8 U	8.7 U	10 U
4,4'-DDT	16.0	8.8 U	24 J	10 U
METHOXYCHLOR	80.0	44 U	43 U	52 U
ENDRIN KETONE	16.0	8.8 U	8.7 U	10 U
ALPHA-CHLORODANE	80.0	44 U	60 J	52 U
GAMMA-CHLORDANE	80.0	44 U	43 UJ	52 U
TOXAPHENE	160.0	88 U	87 U	100 U
AROCLOR 1016	80.0	44 U	43 U	52 U
AROCLOR 1221	80.0	44 U	43 U	52 U
AROCLOR 1232	80.0	44 U	43 U	52 U
AROCLOR 1242	80.0	44 U	43 U	52 U
AROCLOR 1248	80.0	44 U	43 U	52 U
AROCLOR 1254	160.0	88 U	1500	100 U
AROCLOR 1260	160.0	88 U	87 U	100 U
% MOISTURE:		9	8	23
DILUTION FACTOR:		1.0	1.0	1.0
DATE SAMPLED:		6/16/91	6/13/91	6/13/91
DATE EXTRACTED:		6/20/91	6/19/91	6/19/91
DATE ANALYZED:		8/01/91	7/24/91	7/24/91
ASSOCIATED BLANKS:				

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HERBICIDE ANALYSIS (ug/kg)
SITE: CAMP LEJEUNE - SITE 80
CASE: 4997

SAMPLE LOCATION:		SO01-0002	SO01-0002-D	SO02-0002	SO03-0002	SB01-0002	SB01-1012	SB02-0002	SB02-1012
SAMPLE NUMBER:									
QC DESIGNATION:	CRQL		FIELD DUPLICATE						
2,4-D	8.0	930 U	900 U	880 U	2200 U	190 U	180 U	170 U	170 U
SILVEX	8.0	930 U	900 U	880 U	2200 U	190 U	180 U	170 U	170 U
2,4,5-T	8.0	930 U	900 U	880 U	2200 U	190 U	180 U	170 U	170 U
% MOISTURE:		14.1	12.7	12.7	64.5	15	12	8	5
DILUTION FACTOR:		9.3	9.0	8.8	22	1.0	1.0	1.0	1.0
DATE SAMPLED:		6/13/91	6/13/91	6/13/91	6/13/91	6/13/91	6/13/91	6/13/91	6/13/91
DATE EXTRACTED:		6/20/91	6/20/91	6/20/91	6/20/91	6/20/91	6/20/91	6/20/91	6/20/91
DATE ANALYZED:		7/05/91	7/05/91	7/05/91	7/06/91	7/05/91	7/05/91	7/05/91	7/05/91
ASSOCIATED BLANKS:		80MW01-R	80MW01-R	80MW01-R	80MW01-R	80MW01-R	80MW01-R	80MW01-R	80MW01-R
		80GW03-R	80GW03-R	80GW03-R	80GW03-R	80GW03-R	80GW03-R	80GW03-R	80GW03-R

HERBICIDE ANALYSIS (ug/kg)
SITE: CAMP LEJEUNE - SITE 80
CASE: 4997

SAMPLE LOCATION:		SB03-0002	SB03-1012	SB04-0002	SB04-0002-D	SB04-1012	MW01-0002	MW01-1012	MW02-0002
SAMPLE NUMBER:									
QC DESIGNATION:	CRQL				FIELD DUPLICATE				
2,4-D	8.0	200 U	200 U	840 U	820 U	910 U	820 U	870 U	860 U
SILVEX	8.0	200 U	200 U	840 U	820 U	910 U	820 U	870 U	860 U
2,4,5-T	8.0	200 U	200 U	840 U	820 U	910 U	820 U	870 U	860 U
% MOISTURE:		21	20	5.1	2.6	14.1	4.6	8	9.8
DILUTION FACTOR:		1.0	1.0	8.4	8.2	9.1	8.2	8.7	8.6
DATE SAMPLED:		6/13/91	6/13/91	6/13/91	6/13/91	6/13/91	6/16/91	6/16/91	6/16/91
DATE EXTRACTED:		6/20/91	6/20/91	6/20/91	6/20/91	6/20/91	6/21/91	6/21/91	6/21/91
DATE ANALYZED:		7/05/91	7/05/91	7/05/91	7/05/91	7/05/91	7/08/91	7/08/91	7/08/91
ASSOCIATED BLANKS:		80MW01-R	80MW01-R	80MW01-R	80MW01-R	80MW01-R	80MW01-R	80MW01-R	80MW01-R
		80GW03-R	80GW03-R	80GW03-R	80GW03-R	80GW03-R	80GW03-R	80GW03-R	80GW03-R

HERBICIDE ANALYSIS (ug/kg)
SITE: CAMP LEJEUNE - SITE 80
CASE: 4997

SAMPLE LOCATION:		MW02-1214	MW03-0002	MW03-0608
SAMPLE NUMBER:				
QC DESIGNATION:	CRQL			
2,4-D	8.0	870 U	170 U	200 U
SILVEX	8.0	870 U	170 U	200 U
2,4,5-T	8.0	870 U	170 U	200 U
% MOISTURE:		9	8	23
DILUTION FACTOR:		8.7	1.0	1.0
DATE SAMPLED:		6/16/91	6/13/91	6/13/91
DATE EXTRACTED:		6/21/91	6/20/91	6/20/91
DATE ANALYZED:		7/08/91	7/05/91	7/08/91
ASSOCIATED BLANKS:		80MW01-R	80MW01-R	80MW01-R
		80GW03-R	80GW03-R	80GW03-R

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VOLATILE ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - SITE 80
CASE: 5075/5005

SAMPLE LOCATION:		GW01	GW02	GW03
SAMPLE NUMBER:				
QC DESIGNATION:	CRQL			
CHLOROMETHANE	10	10 U	10 U	10 U
BROMOMETHANE	10	10 U	10 U	10 U
VINYL CHLORIDE	10	10 U	10 U	10 U
CHLOROETHANE	10	10 U	10 U	10 U
METHYLENE CHLORIDE	5	5 U	5 U	4 UJ
ACETONE	10	10 U	10 U	80 UJ
CARBON DISULFIDE	5	5 U	5 U	25 J
1,1-DICHLOROETHENE	5	5 U	5 U	5 U
1,1-DICHLOROETHANE	5	5 U	5 U	5 U
1,2-DICHLOROETHENE (TOTAL)	5	5 U	5 U	5 U
CHLOROFORM	5	5 U	5 U	5 U
1,2-DICHLOROETHANE	5	5 U	5 U	5 U
2-BUTANONE	10	10 U	10 U	10 UJ
1,1,1-TRICHLOROETHANE	5	5 U	5 U	5 U
CARBON TETRACHLORIDE	5	5 U	5 U	5 U
VINYL ACETATE	10	10 U	10 U	10 U
BROMODICHLOROMETHANE	5	5 U	5 U	5 U
1,2-DICHLOROPROPANE	5	5 U	5 U	5 U
CIS-1,3-DICHLOROPROPENE	5	5 U	5 U	5 U
TRICHLOROETHENE	5	5 U	5 U	5 U
DIBROMOCHLOROMETHANE	5	5 U	5 U	5 U
1,1,2-TRICHLOROETHANE	5	5 U	5 U	5 U
BENZENE	5	5 U	5 U	5 U
TRANS-1,3-DICHLOROPROPENE	5	5 U	5 U	5 U
BROMOFORM	5	5 U	5 U	5 U
4-METHYL-2-PENTANONE	10	10 U	10 U	10 U
2-HEXANONE	10	10 U	10 U	10 U
TETRACHLOROETHENE	5	5 U	5 U	5 U
1,1,2,2-TETRACHLOROETHANE	5	5 U	5 U	5 U
TOLUENE	5	5 U	5 U	180
CHLOROBENZENE	5	5 U	5 U	5 U
ETHYL BENZENE	5	5 U	5 U	5
STYRENE	5	5 U	5 U	5 U
TOTAL XYLENES	5	5 U	5 U	21
DILUTION FACTOR:		1.0	1.0	1.0
DATE SAMPLED:		6/27/91	6/27/91	6/16/91
DATE ANALYZED:		7/10/91	7/10/91	6/23/91
ASSOCIATED BLANKS:		80GW02-R	80GW02-R	80GW03-R
		07GW03-T	07GW03-T	82SW02-T
		07GW03-R	07GW03-R	80MW01-R
		82GW01-F	82GW01-F	
		82GW31-R	82GW31-R	
		DECON-F	DECON-F	

PESTICIDE/PCB AQUEOUS ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - SITE 80
CASE: 5075/5005

SAMPLE LOCATION:		GW01	GW02	GW03
SAMPLE NUMBER:				
QC DESIGNATION:	CRQL			
ALPHA-BHC	0.05	0.05 U	0.05 U	0.50 U
BETA-BHC	0.05	0.05 U	0.05 U	0.50 U
DELTA-BHC	0.05	0.05 U	0.05 U	0.50 U
GAMMA-BHC (LINDANE)	0.05	0.05 U	0.05 U	0.50 U
HEPTACHLOR	0.05	0.05 U	0.05 U	0.50 U
ALDRIN	0.05	0.05 U	0.05 U	0.50 U
HEPTACHLOR EPOXIDE	0.05	0.05 U	0.05 U	0.50 U
ENDOSULFAN I	0.05	0.05 U	0.05 U	0.50 U
DIELDRIN	0.10	0.10 U	0.10 U	0.99 U
4,4'-DDE	0.10	0.10 U	0.10 U	0.99 U
ENDRIN	0.10	0.10 U	0.10 U	0.99 U
ENDOSULFAN II	0.10	0.10 U	0.10 U	0.99 U
4,4'-DDD	0.10	0.10 U	0.10 U	0.99 U
ENDOSULFAN SULFATE	0.10	0.10 U	0.10 U	0.99 U
4,4'-DDT	0.10	0.10 U	0.10 U	0.99 U
METHOXYCHLOR	0.5	0.50 U	0.51 U	5.0 U
ENDRIN KETONE	0.10	0.10 U	0.10 U	0.99 U
ALPHA-CHLORODANE	0.5	0.50 U	0.51 U	5.0 U
GAMMA-CHLORDANE	0.5	0.50 U	0.51 U	5.0 U
TOXAPHENE	1.0	1.0 U	1.0 U	9.9 U
AROCLOR 1016	0.5	0.50 U	0.51 U	5.0 U
AROCLOR 1221	0.5	0.50 U	0.51 U	5.0 U
AROCLOR 1232	0.5	0.50 U	0.51 U	5.0 U
AROCLOR 1242	0.5	0.50 U	0.51 U	5.0 U
AROCLOR 1248	0.5	0.50 U	0.51 U	5.0 U
AROCLOR 1254	1.0	1.0 U	1.0 U	9.9 U
AROCLOR 1260	1.0	1.0 U	1.0 U	9.9 U
DILUTION FACTOR:		1.0	1.0	10.0
DATE SAMPLED:		6/27/91	6/27/91	6/16/91
DATE EXTRACTED:		7/03/91	7/03/91	6/21/91
DATE ANALYZED:		8/09/91	8/09/91	7/23/91
ASSOCIATED BLANKS:		80GW02-R	80GW02-R	80GW03-R
		82GW01-F	82GW01-F	80MW01-R
		82GW31-R	82GW31-R	82SD06-R

HERBICIDE ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - SITE 80
CASE: 5075/5005

SAMPLE LOCATION:		GW01	GW02	GW03
SAMPLE NUMBER:				
QC DESIGNATION:	CRQL			
2,4-D	0.2	0.20 U	0.20 U	R
SILVEX	0.2	0.20 U	0.20 U	R
2,4,5-T	0.2	0.20 U	0.20 U	R
DINOSEB	0.2	0.20 U	0.20 U	NA
DILUTION FACTOR:		1.0	1.0	1.0
DATE SAMPLED:		6/27/91	6/27/91	6/16/91
DATE EXTRACTED:		7/03/91	7/03/91	6/21/91
DATE ANALYZED:		7/15/91	7/15/91	7/05/91
ASSOCIATED BLANKS:		80GW02-R	80GW02-R	80GW03-R
		DECON-F	DECON-F	80MW01-R

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VOLATILE ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - SITE 80
CASE: 4999

SAMPLE LOCATION:		SW03	SW04	SW05	SW05-D
SAMPLE NUMBER:					
QC DESIGNATION:	CRQL				FIELD DUPLICATE
CHLOROMETHANE	10	10 U	20 U	20 U	20 U
BROMOMETHANE	10	10 U	20 U	20 U	20 U
VINYL CHLORIDE	10	10 U	20 U	20 U	20 U
CHLOROETHANE	10	10 U	20 U	20 U	20 U
METHYLENE CHLORIDE	5	5 U	10 U	6 UJ	12 UJ
ACETONE	10	11	190	170	150
CARBON DISULFIDE	5	5 U	10 U	6 J	10 U
1,1-DICHLOROETHENE	5	5 U	10 U	10 U	10 U
1,1-DICHLOROETHANE	5	5 U	10 U	10 U	10 U
1,2-DICHLOROETHENE (TOTAL)	5	5 U	10 U	10 U	10 U
CHLOROFORM	5	5 U	10 U	10 U	10 U
1,2-DICHLOROETHANE	5	5 U	10 U	10 U	10 U
2-BUTANONE	10	10 U	20 U	20 U	20 U
1,1,1-TRICHLOROETHANE	5	5 U	10 U	10 U	10 U
CARBON TETRACHLORIDE	5	5 U	10 U	10 U	10 U
VINYL ACETATE	10	10 U	20 U	20 U	20 U
BROMODICHLOROMETHANE	5	5 U	10 U	10 U	10 U
1,2-DICHLOROPROPANE	5	5 U	10 U	10 U	10 U
CIS-1,3-DICHLOROPROPENE	5	5 U	10 U	10 U	10 U
TRICHLOROETHENE	5	5 U	10 U	10 U	10 U
DIBROMOCHLOROMETHANE	5	5 U	10 U	10 U	10 U
1,1,2-TRICHLOROETHANE	5	5 U	10 U	10 U	10 U
BENZENE	5	5 U	10 U	10 U	10 U
TRANS-1,3-DICHLOROPROPENE	5	5 U	10 U	10 U	10 U
BROMOFORM	5	5 U	10 U	10 U	10 U
4-METHYL-2-PENTANONE	10	10 U	20 U	20 U	20 U
2-HEXANONE	10	10 U	20 U	20 U	20 U
TETRACHLOROETHENE	5	5 U	10 U	10 U	10 U
1,1,2,2-TETRACHLOROETHANE	5	5 U	10 U	10 U	10 U
TOLUENE	5	5 U	30	110	97
CHLOROBENZENE	5	5 U	10 U	10 U	10 U
ETHYL BENZENE	5	5 U	10 U	10 U	10 U
STYRENE	5	5 U	10 U	10 U	10 U
TOTAL XYLENES	5	5 UJ	10 U	10 U	10 U
DILUTION FACTOR:		1.0	2.0	2.0	2.0
DATE SAMPLED:		6/13/91	6/13/91	6/13/91	6/13/91
DATE ANALYZED:		6/22/91	6/25/91	6/25/91	6/25/91
ASSOCIATED BLANKS:		80GW03-R	80GW03-R	80GW03-R	80GW03-R
		82SW02-T	82SW02-T	82SW02-T	82SW02-T
		80MW01-R	80MW01-R	80MW01-R	80MW01-R

PESTICIDE/PCB AQUEOUS ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - SITE 80
CASE: 4999

SAMPLE LOCATION:		SW03	SW04	SW05	SW05-D
SAMPLE NUMBER:					
QC DESIGNATION:	CRQL				FIELD DUPLICATE
ALPHA-BHC	0.05	0.05 U	0.05 U	0.05 U	0.05 U
BETA-BHC	0.05	0.05 U	0.05 U	0.05 U	0.05 U
DELTA-BHC	0.05	0.05 U	0.05 U	0.05 U	0.05 U
GAMMA-BHC (LINDANE)	0.05	0.05 U	0.05 U	0.05 U	0.05 U
HEPTACHLOR	0.05	0.05 U	0.05 U	0.05 U	0.05 U
ALDRIN	0.05	0.05 U	0.05 U	0.05 U	0.05 U
HEPTACHLOR EPOXIDE	0.05	0.05 U	0.05 U	0.05 U	0.05 U
ENDOSULFAN I	0.05	0.05 U	0.05 U	0.05 U	0.05 U
DIELDRIN	0.10	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDE	0.10	0.10 U	0.10 U	0.10 U	0.10 U
ENDRIN	0.10	0.10 U	0.10 U	0.10 U	0.10 U
ENDOSULFAN II	0.10	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDD	0.10	0.10 U	0.10 U	0.10 U	0.10 U
ENDOSULFAN SULFATE	0.10	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDT	0.10	0.10 U	0.10 U	0.10 U	0.10 U
METHOXYCHLOR	0.5	0.50 U	0.50 U	0.50 U	0.50 U
ENDRIN KETONE	0.10	0.10 U	0.10 U	0.10 U	0.10 U
ALPHA-CHLORODANE	0.5	0.50 U	0.50 U	0.50 U	0.50 U
GAMMA-CHLORDANE	0.5	0.50 U	0.50 U	0.50 U	0.50 U
TOXAPHENE	1.0	1.0 U	1.0 U	1.0 U	1.0 U
AROCLOR 1016	0.5	0.50 U	0.50 U	0.50 U	0.50 U
AROCLOR 1221	0.5	0.50 U	0.50 U	0.50 U	0.50 U
AROCLOR 1232	0.5	0.50 U	0.50 U	0.50 U	0.50 U
AROCLOR 1242	0.5	0.50 U	0.50 U	0.50 U	0.50 U
AROCLOR 1248	0.5	0.50 U	0.50 U	0.50 U	0.50 U
AROCLOR 1254	1.0	1.0 U	1.0 U	1.0 U	1.0 U
AROCLOR 1260	1.0	1.0 U	1.0 U	1.0 U	1.0 U
DILUTION FACTOR:		1.0	1.0	1.0	1.0
DATE SAMPLED:		6/13/91	6/13/91	6/13/91	6/13/91
DATE EXTRACTED:		6/14/91	6/14/91	6/14/91	6/14/91
DATE ANALYZED:		7/02/91	7/02/91	7/02/91	7/02/91
ASSOCIATED BLANKS:		80GW03-R	80GW03-R	80GW03-R	80GW03-R
		82SW06-R	82SW06-R	82SW06-R	82SW06-R
		82SD06-R	82SD06-R	82SD06-R	82SD06-R
		80MW01-R	80MW01-R	80MW01-R	80MW01-R
		54SB02-R	54SB02-R	54SB02-R	54SB02-R

HERBICIDE ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - SITE 80
CASE: 4997

SAMPLE LOCATION:		SW03	SW04	SW05	SW05-D
SAMPLE NUMBER:					
QC DESIGNATION:	CRQL				FIELD DUPLICATE
2,4-D	8.0	0.22 U	R	R	0.22 U
SILVEX	8.0	0.22 U	R	R	0.22 U
2,4,5-T	8.0	0.22 U	R	R	0.22 U
DILUTION FACTOR:		1.0	1.0	1.0	1.0
DATE SAMPLED:		6/13/91	6/13/91	6/13/91	6/13/91
DATE EXTRACTED:		6/17/91	6/17/91	6/17/91	6/17/91
DATE ANALYZED:		7/03/91	7/03/91	7/03/91	7/03/91
ASSOCIATED BLANKS:		80GW03-R	80GW03-R	80GW03-R	80GW03-R
		80MW01-R	80MW01-R	80MW01-R	80MW01-R

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VOLATILE ANALYSIS (ug/kg)
SITE: CAMP LEJEUNE - SITE 80
CASE: 4997/4999

SAMPLE LOCATION:		SD01	SD02	SD03	SD04	SD05	SD05-D
SAMPLE NUMBER:							
QC DESIGNATION:	CRQL						FIELD DUPLICATE
CHLOROMETHANE	10	12 U	14 U	14 U	14 U	14 U	13 U
BROMOMETHANE	10	12 U	14 U	14 U	14 U	14 U	13 U
VINYL CHLORIDE	10	12 U	14 U	14 U	14 U	14 U	13 U
CHLOROETHANE	10	12 U	14 U	14 U	14 U	14 U	13 U
METHYLENE CHLORIDE	5	6 UJ	6 UJ	7 U	7 U	6 UJ	6 U
ACETONE	10	12 U	14 U	14 U	14 U	14 U	13 U
CARBON DISULFIDE	5	6 U	7 U	7 U	7 U	7 U	6 U
1,1-DICHLOROETHENE	5	6 U	7 U	7 U	7 U	7 U	6 U
1,1-DICHLOROETHANE	5	6 U	7 U	7 U	7 U	7 U	6 U
1,2-DICHLOROETHENE (TOTAL)	5	6 U	7 U	7 U	7 U	7 U	6 U
CHLOROFORM	5	6 U	7 U	7 U	7 U	7 U	6 U
1,2-DICHLOROETHANE	5	6 U	7 U	7 U	7 U	7 U	6 U
2-BUTANONE	10	12 U	14 U	14 U	14 U	14 U	13 U
1,1,1-TRICHLOROETHANE	5	6 U	7 U	7 U	7 U	7 U	6 U
CARBON TETRACHLORIDE	5	6 U	7 U	7 U	7 U	7 U	6 U
VINYL ACETATE	10	12 U	14 U	14 U	14 U	14 U	13 U
BROMODICHLOROMETHANE	5	6 U	7 U	7 U	7 U	7 U	6 U
1,2-DICHLOROPROPANE	5	6 U	7 U	7 U	7 U	7 U	6 U
CIS-1,3-DICHLOROPROPENE	5	6 U	7 U	7 U	7 U	7 U	6 U
TRICHLOROETHENE	5	6 U	7 U	7 U	7 U	7 U	6 U
DIBROMOCHLOROMETHANE	5	6 U	7 U	7 U	7 U	7 U	6 U
1,1,2-TRICHLOROETHANE	5	6 U	7 U	7 U	7 U	7 U	6 U
BENZENE	5	6 U	7 U	7 U	7 U	7 U	6 U
TRANS-1,3-DICHLOROPROPENE	5	6 U	7 U	7 U	7 U	7 U	6 U
BROMOFORM	5	6 U	7 U	7 U	7 U	7 U	6 U
4-METHYL-2-PENTANONE	10	12 U	14 U	14 U	14 U	14 U	13 U
2-HEXANONE	10	12 U	14 U	14 U	14 U	14 U	13 U
TETRACHLOROETHENE	5	6 U	7 U	7 U	7 U	7 U	6 U
1,1,2,2-TETRACHLOROETHANE	5	6 U	7 U	7 U	7 U	7 U	6 U
TOLUENE	5	6 U	7 U	7 U	7 U	7 U	6 U
CHLOROBENZENE	5	6 U	7 U	7 U	7 U	7 U	6 U
ETHYL BENZENE	5	6 U	7 U	7 U	7 U	7 U	6 U
STYRENE	5	6 U	7 U	7 U	7 U	7 U	6 U
TOTAL XYLENES	5	6 U	7 U	7 U	7 U	7 U	6 U
% MOISTURE:		19	29	29	30	27	22
DILUTION FACTOR:		1.0	1.0	1.0	1.0	1.0	1.0
DATE SAMPLED:		6/13/91	6/13/91	6/13/91	6/13/91	6/13/91	6/13/91
DATE ANALYZED:		6/21/91	6/21/91	6/21/91	6/21/91	6/21/91	6/21/91
ASSOCIATED BLANKS:		80SB04-T	80SB04-T				

PESTICIDE/PCB ANALYSIS (ug/kg)
SITE: CAMP LEJEUNE - SITE 80
CASE: 4997/4999

SAMPLE LOCATION:		SD01	SD02	SD03	SD04	SD05	SD05-D
SAMPLE NUMBER:							
QC DESIGNATION:	CRQL						FIELD DUPLICATE
ALPHA-BHC	8.0	2.0 U	2.3 U	2.2 U	2.1 U	2.3 U	2.2 U
BETA-BHC	8.0	2.0 U	2.3 U	2.2 U	2.1 U	2.3 U	2.2 U
DELTA-BHC	8.0	2.0 U	2.3 U	2.2 U	2.1 U	2.3 U	2.2 U
GAMMA-BHC (LINDANE)	8.0	2.0 U	2.3 U	2.2 U	2.1 U	2.3 U	2.2 U
HEPTACHLOR	8.0	2.0 U	2.3 U	2.2 U	2.1 U	2.3 U	2.2 U
ALDRIN	8.0	2.0 U	2.3 U	2.2 U	2.1 U	2.3 U	2.2 U
HEPTACHLOR EPOXIDE	8.0	2.0 U	2.3 U	2.2 U	2.1 U	2.3 U	2.2 U
ENDOSULFAN I	8.0	2.0 U	2.3 U	2.2 U	2.1 U	2.3 U	2.2 U
DIELDRIN	16.0	4.1 U	4.6 U	4.5 U	4.1 U	4.7 U	4.3 U
4,4'-DDE	16.0	4.1 U	4.6 U	4.5 U	4.1 U	4.7 U	4.3 U
ENDRIN	16.0	4.1 U	4.6 U	4.5 U	4.1 U	4.7 U	4.3 U
ENDOSULFAN II	16.0	4.1 U	4.6 U	4.5 U	4.1 U	4.7 U	4.3 U
4,4'-DDD	16.0	4.1 U	4.6 U	4.5 U	4.1 U	4.7 U	4.3 U
ENDOSULFAN SULFATE	16.0	4.1 U	4.6 U	4.5 U	4.1 U	4.7 U	4.3 U
4,4'-DDT	16.0	4.1 U	4.6 U	4.5 U	4.1 U	4.7 U	4.3 U
METHOXYCHLOR	80.0	20 U	23 U	22 U	21 U	23 U	22 U
ENDRIN KETONE	16.0	4.1 U	4.6 U	4.5 U	4.1 U	4.7 U	4.3 U
ALPHA-CHLORODANE	80.0	20 U	23 U	22 U	21 U	23 U	22 U
GAMMA-CHLORDANE	80.0	20 U	23 U	22 U	21 U	23 U	22 U
TOXAPHENE	160.0	41 U	46 U	45 U	41 U	47 U	43 U
AROCLOR 1016	80.0	20 U	23 U	22 U	21 U	23 U	22 U
AROCLOR 1221	80.0	20 U	23 U	22 U	21 U	23 U	22 U
AROCLOR 1232	80.0	20 U	23 U	22 U	21 U	23 U	22 U
AROCLOR 1242	80.0	20 U	23 U	22 U	21 U	23 U	22 U
AROCLOR 1248	80.0	20 U	23 U	22 U	21 U	23 U	22 U
AROCLOR 1254	160.0	41 U	46 U	45 U	41 U	47 U	43 U
AROCLOR 1260	160.0	41 U	46 U	45 U	41 U	47 U	43 U
% MOISTURE:		19	28	26	22	29	25
DILUTION FACTOR:		1.0	1.0	1.0	1.0	1.0	1.0
DATE SAMPLED:		6/13/91	6/13/91	6/13/91	6/13/91	6/13/91	6/13/91
DATE EXTRACTED:		6/17/91	6/17/91	6/17/91	6/17/91	6/17/91	6/17/91
DATE ANALYZED:		7/13/91	7/13/91	7/13/91	7/13/91	7/13/91	7/13/91
ASSOCIATED BLANKS:							

HERBICIDE ANALYSIS (ug/kg)
SITE: CAMP LEJEUNE - SITE 80
CASE: 4997/4999

SAMPLE LOCATION:		SD01	SD02	SD03	SD04	SD05	SD05-D
SAMPLE NUMBER:							
QC DESIGNATION:	CRQL						FIELD DUPLICATE
2,4-D	8.0	190 U	210 U	200 U	190 U	210 U	200 U
SILVEX	8.0	190 U	210 U	200 U	190 U	210 U	200 U
2,4,5-T	8.0	190 U	210 U	200 U	190 U	210 U	200 U
% MOISTURE:		19	28	26	22	29	25
DILUTION FACTOR:		1.0	1.0	1.0	1.0	1.0	1.0
DATE SAMPLED:		6/13/91	6/13/91	6/13/91	6/13/91	6/13/91	6/13/91
DATE EXTRACTED:		6/18/91	6/18/91	6/18/91	6/18/91	6/18/91	6/18/91
DATE ANALYZED:		7/03/91	7/03/91	7/03/91	7/05/91	7/05/91	7/05/91
ASSOCIATED BLANKS:		80MW01-R	80MW01-R	80MW01-R	80MW01-R	80MW01-R	80MW01-R
		80GW03-R	80GW03-R	80GW03-R	80GW03-R	80GW03-R	80GW03-R

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Versar Laboratories

ANALYSIS REPORT
General Inorganic Chemistry Section

DATE: 12-JUL-91 PAGE: 1
CODE / CONTROL #: NUS LEJU / 4997
CLIENT / SITE: NUS / CAMP LEJUNE, NC
PROJECT / BATCH: 420.109.0 / 3

Lab#	Field #	TRPH (mg/kg)		
53395	80MW030002	< 53.7		
53396	80MW030608	< 66.6		
53397	80SB010002	< 56.5		
53398	80SB011012	< 56.1		
53399	80SB020002	< 54.7		
53400	80SB021012	< 52.2		
53401	80SB030002	< 53.7		
53402	80SB031012	< 65.7		
53403	80SB040002	< 51.9		
53404	80SB040002D	< 52.1		
53405	80SB041012	< 58.6		
53406	80SO010002	< 56.3		
53407	80SO010002D	< 54.8		
53408	80SO020002	< 56.2		
53409	80SO030002	< 54.7		

C. Thompson
Laboratory Manager

Versar Laboratories

ANALYSIS REPORT
General Inorganic Chemistry Section

DATE: 12-JUL-91 PAGE: 1
CODE / CONTROL #: NUS LEJU / 5005
CLIENT / SITE: NUS / CAMP LEJUNE, NC
PROJECT / BATCH: 420.109.0 / 6

Lab#	Field #	TRPH (mg/L)	TRPH (mg/kg)
53581	80MW01-R	< 0.54	
53582	80GW03-R	< 0.52	
53583	80GW03	< 0.52	
53584	80MW01-0002		< 52.1
53585	80MW01-1012		< 53.5
53586	80MW02-0002		< 56.6
53587	80MW02-1214		< 57.1

C. Thompson
Laboratory Manager

Versar Laboratories INC

ANALYSIS REPORT
General Inorganic Chemistry Section

DATE: 22-JUL-91 PAGE: 1
CODE / CONTROL #: NUS LEJU / 5075
CLIENT / SITE: NUS / CAMP LEJUNE, NC
PROJECT / BATCH: 420.109.0 / 11

Lab#	Field #	TRPH (mg/L)		
54833	[redacted]	< 0.54		
54834	[redacted]	< 0.53		
54835	[redacted]02-R	< 0.53		
54836	DECON-F	< 0.50		

M Dillman for C. Thompson
Laboratory Manager

Versar Laboratories INC

ANALYSIS REPORT
General Inorganic Chemistry Section

DATE: 11-JUL-91
CODE / CONTROL #: NUS LEJU / 4969
CLIENT / SITE: NUS / CAMP LEJUNE, NC
PROJECT / BATCH: 420.109.0 / 2

Lab#	Field #	TRPH (mg/L)	TRPH (mg/kg)
52952	[redacted]03	< 0.51	
52953	[redacted]04	1.39	
52954	[redacted]05	1.45	
52955	[redacted]05-D	1.88	
52964	[redacted]01		< 62.1
52965	[redacted]02		< 70.4
52966	[redacted]03		< 69.3
52967	[redacted]04		< 65.1
52968	[redacted]05		< 71.0
52969	[redacted]-D		< 66.1

C. Thomas
Laboratory Manager

VOLATILE ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - TRIP BLANKS
CASE: 5075/5054/5064/4961/4997/5013/5019/5005

SAMPLE LOCATION:		07GW03-T	07SB05-T	54GW03-T	54SB02-T	80SB04-T	82MW02-0002-T	82SB03-T	82SW02-T
SAMPLE NUMBER:									
QC DESIGNATION:	CRQL								
CHLOROMETHANE	10	10 U	10 U	NA	NA	20 U	10 U	10 U	10 U
BROMOMETHANE	10	10 U	10 U	NA	NA	20 U	10 U	10 U	10 U
VINYL CHLORIDE	10	10 U	10 U	NA	NA	20 U	10 U	10 U	10 U
CHLOROETHANE	10	10 U	10 U	NA	NA	20 U	10 U	10 U	10 U
METHYLENE CHLORIDE	5	5 U	8 J	NA	NA	17	4 J	7	9
ACETONE	10	54 J	150	NA	NA	160 J	37 J	160	290 J
CARBON DISULFIDE	5	5 U	5 U	NA	NA	10 U	5 U	5 U	5 U
1,1-DICHLOROETHENE	5	5 U	5 U	NA	NA	10 U	5 U	5 U	5 U
1,1-DICHLOROETHANE	5	5 U	5 U	NA	NA	10 U	5 U	5 U	5 U
1,2-DICHLOROETHENE (TOTAL)	5	5 U	5 U	NA	NA	10 U	5 U	5 U	5 U
CHLOROFORM	5	30	35	NA	NA	31	30	32	32
1,2-DICHLOROETHANE	5	5 U	5 U	NA	NA	10 U	5 U	5 U	5 U
2-BUTANONE	10	10 U	10 U	NA	NA	20 U	10 U	10 U	10 UJ
1,1,1-TRICHLOROETHANE	5	5 U	5 U	NA	NA	10 U	5 U	5 U	5 U
CARBON TETRACHLORIDE	5	5 U	5 U	NA	NA	10 U	5 U	5 U	5 U
VINYL ACETATE	10	10 U	10 U	NA	NA	20 U	10 U	10 U	10 U
BROMODICHLOROMETHANE	5	5 U	5 U	NA	NA	10 U	5 U	5 U	5 U
1,2-DICHLOROPROPANE	5	5 U	5 U	NA	NA	10 U	5 U	5 U	5 U
CIS-1,3-DICHLOROPROPENE	5	5 U	5 U	NA	NA	10 U	5 U	5 U	5 U
TRICHLOROETHENE	5	5 U	5 U	NA	NA	10 U	5 U	5 U	5 U
DIBROMOCHLOROMETHANE	5	5 U	5 U	NA	NA	10 U	5 U	5 U	5 U
1,1,2-TRICHLOROETHANE	5	5 U	5 U	NA	NA	10 U	5 U	5 U	5 U
BENZENE	5	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U
TRANS-1,3-DICHLOROPROPENE	5	5 U	5 U	NA	NA	10 U	5 U	5 U	5 U
BROMOFORM	5	5 U	5 U	NA	NA	10 U	5 U	5 U	5 U
4-METHYL-2-PENTANONE	10	10 U	10 U	NA	NA	20 U	10 U	10 U	10 U
2-HEXANONE	10	10 U	10 U	NA	NA	20 U	10 U	10 U	10 UJ
TETRACHLOROETHENE	5	5 U	5 U	NA	NA	10 U	5 U	5 U	5 U
1,1,2,2-TETRACHLOROETHANE	5	5 U	5 U	NA	NA	10 U	5 U	5 U	5 U
TOLUENE	5	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U
CHLOROBENZENE	5	5 U	5 U	NA	NA	10 U	5 U	5 U	5 U
ETHYL BENZENE	5	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U
STYRENE	5	5 U	5 U	NA	NA	10 U	5 U	5 U	5 U
TOTAL XYLENES	5	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U
DILUTION FACTOR:		1.0	1.0	1.0	1.0	2.0	1.0	1.0	1.0
DATE SAMPLED:		6/26/91	6/24/91	6/26/91	6/12/91	6/13/91	6/17/91	6/19/91	6/16/91
DATE ANALYZED:		7/10/91	6/28/91	7/10/91	6/19/91	6/25/91	6/25/91	6/25/91	6/23/91
ASSOCIATED BLANKS:									

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VOLATILE ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - FIELD BLANKS
CASE: 5075/4961/5054

SAMPLE LOCATION:		DECON-F	03SD02-F	07GW03-F	54GW04-F	82GW01-F
SAMPLE NUMBER:						
QC DESIGNATION:	CRQL					
CHLOROMETHANE	10	10 U	NA	NA	NA	10 U
BROMOMETHANE	10	10 U	NA	NA	NA	10 U
VINYL CHLORIDE	10	10 U	NA	NA	NA	10 U
CHLOROETHANE	10	10 U	NA	NA	NA	10 U
METHYLENE CHLORIDE	5	4 J	NA	NA	NA	5 U
ACETONE	10	10 U	NA	NA	NA	32 J
CARBON DISULFIDE	5	5 U	NA	NA	NA	5 U
1,1-DICHLOROETHENE	5	5 U	NA	NA	NA	5 U
1,1-DICHLOROETHANE	5	5 U	NA	NA	NA	5 U
1,2-DICHLOROETHENE (TOTAL)	5	5 U	NA	NA	NA	5 U
CHLOROFORM	5	31	NA	NA	NA	5 U
1,2-DICHLOROETHANE	5	5 U	NA	NA	NA	5 U
2-BUTANONE	10	10 U	NA	NA	NA	10 U
1,1,1-TRICHLOROETHANE	5	5 U	NA	NA	NA	5 U
CARBON TETRACHLORIDE	5	5 U	NA	NA	NA	5 U
VINYL ACETATE	10	10 U	NA	NA	NA	10 U
BROMODICHLOROMETHANE	5	11	NA	NA	NA	5 U
1,2-DICHLOROPROPANE	5	5 U	NA	NA	NA	5 U
CIS-1,3-DICHLOROPROPENE	5	5 U	NA	NA	NA	5 U
TRICHLOROETHENE	5	5 U	NA	NA	NA	5 U
DIBROMOCHLOROMETHANE	5	3 J	NA	NA	NA	5 U
1,1,2-TRICHLOROETHANE	5	5 U	NA	NA	NA	5 U
BENZENE	5	5 U	NA	NA	5 U	5 U
TRANS-1,3-DICHLOROPROPENE	5	5 U	NA	NA	NA	5 U
BROMOFORM	5	5 U	NA	NA	NA	5 U
4-METHYL-2-PENTANONE	10	10 U	NA	NA	NA	10 U
2-HEXANONE	10	10 U	NA	NA	NA	10 U
TETRACHLOROETHENE	5	5 U	NA	NA	NA	5 U
1,1,2,2-TETRACHLOROETHANE	5	5 U	NA	NA	NA	5 U
TOLUENE	5	5 U	NA	NA	5 U	5 U
CHLOROBENZENE	5	5 U	NA	NA	NA	5 U
ETHYL BENZENE	5	5 U	NA	NA	5 U	5 U
STYRENE	5	5 U	NA	NA	NA	5 U
TOTAL XYLENES	5	5 U	NA	NA	5 U	5 U
DILUTION FACTOR:		1.0			1.0	1.0
DATE SAMPLED:		6/27/91			6/25/91	6/27/91
DATE ANALYZED:		7/10/91			7/08/91	7/10/91
ASSOCIATED BLANKS:						

SEMIVOLATILE AQUEOUS ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - FIELD BLANKS
CASE: 5075/4961

SAMPLE LOCATION:		DECON-F	03SD02-F	07GW03-F	54GW04-F	82GW01-F
SAMPLE NUMBER:						
QC DESIGNATION:	CRQL					
PHENOL	10	10 U	10 U	10 U	NA	NA
BIS(2-CHLOROETHYL)ETHER	10	10 U	10 U	10 U	NA	NA
2-CHLOROPHENOL	10	10 U	10 U	10 U	NA	NA
1,3-DICHLOROBENZENE	10	10 U	10 U	10 U	NA	NA
1,4-DICHLOROBENZENE	10	10 U	10 U	10 U	NA	NA
BENZYL ALCOHOL	10	10 U	10 U	10 U	NA	NA
1,2-DICHLOROBENZENE	10	10 U	10 U	10 U	NA	NA
2-METHYLPHENOL	10	10 U	10 U	10 U	NA	NA
BIS(2-CHLOROISOPROPYL)ETHER	10	10 U	10 U	10 U	NA	NA
4-METHYLPHENOL	10	10 U	10 U	10 U	NA	NA
N-NITROSODI-N-PROPYLAMINE	10	10 U	10 U	10 U	NA	NA
HEXACHLOROETHANE	10	10 U	10 U	10 U	NA	NA
NITROBENZENE	10	10 U	10 U	10 U	NA	NA
ISOPHORONE	10	10 U	10 U	10 U	NA	NA
2-NITROPHENOL	10	10 U	10 U	10 U	NA	NA
2,4-DIMETHYLPHENOL	10	10 U	10 U	10 U	NA	NA
BENZOIC ACID	50	50 U	50 U	51 U	NA	NA
BIS(2-CHLOROETHOXY)METHANE	10	10 U	10 U	10 U	NA	NA
2,4-DICHLOROPHENOL	10	10 U	10 U	10 U	NA	NA
1,2,4-TRICHLOROBENZENE	10	10 U	10 U	10 U	NA	NA
NAPHTHALENE	10	10 U	10 U	10 U	NA	NA
4-CHLORANILINE	10	10 U	10 U	10 U	NA	NA
HEXACHLOROBUTADIENE	10	10 U	10 U	10 U	NA	NA
4-CHLORO-3-METHYLPHENOL	10	10 U	10 U	10 U	NA	NA
2-METHYLNAPHTHALENE	10	10 U	10 U	10 U	NA	NA
HEXACHLOROCYCLOPENTADIENE	10	10 U	10 U	10 U	NA	NA
2,4,6-TRICHLOROPHENOL	10	10 U	10 U	10 U	NA	NA
2,4,5-TRICHLOROPHENOL	50	50 U	50 U	51 U	NA	NA
2-CHLORONAPHTHALENE	10	10 U	10 U	10 U	NA	NA
2-NITROANILINE	50	50 U	50 U	51 U	NA	NA
DIMETHYL PHTHALATE	10	10 U	10 U	10 U	NA	NA
ACENAPHTHYLENE	10	10 U	10 U	10 U	NA	NA
2,6-DINITROTOLUENE	10	10 U	10 U	10 U	NA	NA
3-NITROANILINE	50	50 U	50 U	51 U	NA	NA
ACENAPHTHENE	10	10 U	10 U	10 U	NA	NA
2,4-DINITROPHENOL	50	50 U	50 U	51 U	NA	NA
4-NI...ENOL	50	50 U	50 U	51 U	...	NA

SEMIVOLATILE AQUEOUS ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - FIELD BLANKS
CASE: 5075/4961

SAMPLE LOCATION:		DECON-F	03SD02-F	07GW03-F	54GW04-F	82GW01-F
SAMPLE NUMBER:						
QC DESIGNATION:	CRQL					
DIBENZOFURAN	10	10 U	10 U	10 U	NA	NA
2,4-DINITROTOLUENE	10	10 U	10 U	10 U	NA	NA
DIETHYL PHTHALATE	10	10 U	10 UJ	10 U	NA	NA
4-CHLOROPHENYL-PHENYLETHER	10	10 U	10 U	10 U	NA	NA
FLUORENE	10	10 U	10 U	10 U	NA	NA
4-NITROANILINE	50	50 U	50 U	51 U	NA	NA
4,6-DINITRO-2-METHYLPHENOL	50	50 U	50 U	51 U	NA	NA
N-NITROSODIPHENLYAMINE	10	10 U	10 U	10 U	NA	NA
4-BROMJPHENYL-PHENYLETHER	10	10 U	10 U	10 U	NA	NA
HEXACHLOROBENZENE	10	10 U	10 U	10 U	NA	NA
PENTACHLOROPHENOL	50	50 U	50 U	51 U	NA	NA
PHENANTHRENE	10	10 U	10 U	10 U	NA	NA
ANTHRACENE	10	10 U	10 U	10 U	NA	NA
DI-N-BUTYLPHTHALATE	10	10 U	10 U	10 U	NA	NA
FLUORANTHENE	10	10 U	10 U	10 U	NA	NA
PYRENE	10	10 U	10 U	10 U	NA	NA
BUTYLBENZYLPHTHALATE	10	10 U	10 U	10 U	NA	NA
3,3'-DICHLOROBENZIDINE	20	20 U	20 U	20 U	NA	NA
BENZO(a)ANTHRACENE	10	10 U	10 U	10 U	NA	NA
CHRYSENE	10	10 U	10 U	10 U	NA	NA
BIS(2-ETHYLHEXYL)PHTHALATE	10	10 U	10 U	10 U	NA	NA
DI-N-OCTYLPHTHALATE	10	10 U	10 U	10 U	NA	NA
BENZO(b)FLUORANTHENE	10	10 U	10 U	10 U	NA	NA
BENZO(k)FLUARANTHENE	10	10 U	10 U	10 U	NA	NA
BENZO(a)PYRENE	10	10 U	10 U	10 U	NA	NA
INDENO(1,2,3-cd)PYRENE	10	10 U	10 U	10 U	NA	NA
DIBENZ(a,h)ANTHRACENE	10	10 U	10 U	10 U	NA	NA
BENZO(ghi)PERYLENE	10	10 U	10 U	10 U	NA	NA
DILUTION FACTOR:		1.0	1.0	1.0		
DATE SAMPLED:		6/27/91	6/10/91	6/26/91		
DATE EXTRACTED:		7/01/91	6/14/91	7/01/91		
DATE ANALYZED:		8/02/91	7/16/91	8/02/91		
ASSOCIATED BLANKS:						

PESTICIDE/PCB AQUEOUS ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - FIELD BLANKS
CASE: 5075

SAMPLE LOCATION:		DECON-F	03SD02-F	07GW03-F	54GW04-F	82GW01-F
SAMPLE NUMBER:						
QC DESIGNATION:	CRQL					
ALPHA-BHC	0.05	0.05 U	NA	0.05 U	NA	0.05 U
BETA-BHC	0.05	0.05 U	NA	0.05 U	NA	0.05 U
DELTA-BHC	0.05	0.05 U	NA	0.05 U	NA	0.05 U
GAMMA-BHC (LINDANE)	0.05	0.05 U	NA	0.05 U	NA	0.05 U
HEPTACHLOR	0.05	0.05 U	NA	0.05 U	NA	0.05 U
ALDRIN	0.05	0.05 U	NA	0.05 U	NA	0.05 U
HEPTACHLOR EPOXIDE	0.05	0.05 U	NA	0.05 U	NA	0.05 U
ENDOSULFAN I	0.05	0.05 U	NA	0.05 U	NA	0.05 U
DIELDRIN	0.10	0.10 U	NA	0.10 U	NA	0.10 U
4,4'-DDE	0.10	0.10 U	NA	0.10 U	NA	0.10 U
ENDRIN	0.10	0.10 U	NA	0.10 U	NA	0.10 U
ENDOSULFAN II	0.10	0.10 U	NA	0.10 U	NA	0.10 U
4,4'-DDD	0.10	0.10 U	NA	0.10 U	NA	0.10 U
ENDOSULFAN SULFATE	0.10	0.10 U	NA	0.10 U	NA	0.10 U
4,4'-DDT	0.10	0.10 U	NA	0.10 U	NA	0.10 U
METHOXYCHLOR	0.5	0.49 U	NA	0.50 U	NA	0.49 U
ENDRIN KETONE	0.10	0.10 U	NA	0.10 U	NA	0.10 U
ALPHA-CHLORODANE	0.5	0.49 U	NA	0.50 U	NA	0.49 U
GAMMA-CHLORDANE	0.5	0.49 U	NA	0.50 U	NA	0.49 U
TOXAPHENE	1.0	0.98 U	NA	1.0 U	NA	0.99 U
AROCLOR 1016	0.5	0.49 U	NA	0.50 U	0.50 U	0.49 U
AROCLOR 1221	0.5	0.49 U	NA	0.50 U	0.50 U	0.49 U
AROCLOR 1232	0.5	0.49 U	NA	0.50 U	0.50 U	0.49 U
AROCLOR 1242	0.5	0.49 U	NA	0.50 U	0.50 U	0.49 U
AROCLOR 1248	0.5	0.49 U	NA	0.50 U	0.50 U	0.49 U
AROCLOR 1254	1.0	0.98 U	NA	1.0 U	1.0 U	0.99 U
AROCLOR 1260	1.0	0.98 U	NA	1.0 U	1.0 U	0.99 U
DILUTION FACTOR:		1.0		1.0	1.0	1.0
DATE SAMPLED:		6/27/91		6/26/91	6/25/91	6/27/91
DATE EXTRACTED:		7/03/91		7/03/91	6/28/91	7/03/91
DATE ANALYZED:		8/12/91		8/08/91	7/31/91	8/12/91
ASSOCIATED BLANKS:						

HERBICIDE ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - FIELD BLANKS
CASE: 5075

SAMPLE LOCATION:		DECON-F	03SD02-F	07GW03-F	54GW04-F	82GW01-F
SAMPLE NUMBER:						
QC DESIGNATION:	CRQL					
2,4-D	0.2	0.20 U	NA	NA	NA	NA
SILVEX	0.2	0.20 U	NA	NA	NA	NA
2,4,5-T	0.2	0.20 U	NA	NA	NA	NA
DINOSEB	0.2	0.20 U	NA	NA	NA	NA
DILUTION FACTOR:		1.0				
DATE SAMPLED:		6/27/91				
DATE EXTRACTED:		7/03/91				
DATE ANALYZED:		7/15/91				
ASSOCIATED BLANKS:						

INORGANIC AQUEOUS ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - FIELD BLANKS
CASE: 5075/5054
LABORATORY:

SAMPLE LOCATION:	ANALYTICAL	DECON-F	03SD02-F	07GW03-F	54GW04-F	82GW01-F	
SAMPLE NUMBER:	METHOD						
QC DESIGNATION:							CRQL
ALUMINUM	P	133	NA	NA	10.0	NA	200
ANTIMONY	P	17.0 U	NA	NA	23.0	NA	60
ARSENIC	F	3.0 U	NA	NA	4.0 UJ	NA	10
BARIUM	P	5.5	NA	NA	1.0	NA	200
BERYLLIUM	P	2.0 U	NA	NA	1.0	NA	5
CADMIUM	P	5.0 UJ	NA	NA	5.0 UJ	NA	5
CALCIUM	P	21500	NA	NA	72.0	NA	5000
CEROMIUM	P	4.0 U	NA	NA	5.0 UJ	NA	10
COBALT	P	5.0 U	NA	NA	8.0	NA	50
COPPER	P	5.0 U	NA	NA	15.0	NA	25
IRON	P	23.0	NA	NA	5.2 J	NA	100
LEAD	F	2.0 UJ	NA	NA	2.0 UJ	NA	3
MAGNESIUM	P	2200	NA	NA	14.2	NA	5000
MANGANESE	P	2.0 U	NA	NA	2.0 UJ	NA	15
MERCURY	CV	0.20 U	NA	NA	0.20	NA	0.2
NICKEL	P	8.0 U	NA	NA	13.0	NA	40
POTASSIUM	P	1440	NA	NA	503	NA	5000
SELENIUM	F	3.0 UJ	NA	NA	R	NA	5
SILVER	P	4.0	NA	NA	3.0	NA	10
SODIUM	P	7550	NA	NA	37.7	NA	5000
THALLIUM	F	2.0 UJ	NA	NA	2.0 UJ	NA	10
TIN	P	NA	NA	NA	NA	NA	40
VANADIUM	P	3.0 U	NA	NA	5.0 UJ	NA	50
ZINC	P	13.2	NA	NA	17.0 J	NA	20
CYANIDE	C	NA	NA	NA	R	NA	10
HEXAVALENT CHROMIUM	P	NA	NA	NA	10.0 U	NA	10
DILUTION FACTOR:		1.0			1.0		
DATE SAMPLED:		6/27/91			6/25/91		
ASSOCIATED BLANKS:							

ANALYTICAL METHOD
F - FURNACE
P - ICP/FLAME AA
CV - COLD VAPOR
C - COLORMETRIC

J - QUANTITATION IS APPROXIMATE DUE TO LIMITATIONS IDENTIFIED IN THE QUALITY CONTROL REVIEW (DATA REVIEW)
R - VALUE IS REJECTED.
-- VALUE IS NON-DETECTED
NA- NOT ANALYZED

VOLATILE ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - RINSATE BLANKS
CASE: 5075/5054/4961/5019/5064/5005/5000

SAMPLE LOCATION:		BS-1-R	03GW02-R	3SD02-R	07GW03-R	07SB05-R	54GW04-R	54SB02-R	54SD01-R
SAMPLE NUMBER:									
QC DESIGNATION:	CRQL								
CHLOROMETHANE	10	NA	NA	NA	10 U	10 U	NA	NA	NA
BROMOMETHANE	10	NA	NA	NA	10 U	10 U	NA	NA	NA
VINYL CHLORIDE	10	NA	NA	NA	10 U	10 U	NA	NA	NA
CHLOROETHANE	10	NA	NA	NA	10 U	10 U	NA	NA	NA
METHYLENE CHLORIDE	5	NA	NA	NA	5 U	5 U	NA	NA	NA
ACETONE	10	NA	NA	NA	34 J	38	NA	NA	NA
CARBON DISULFIDE	5	NA	NA	NA	5 U	5 U	NA	NA	NA
1,1-DICHLOROETHENE	5	NA	NA	NA	5 U	5 U	NA	NA	NA
1,1-DICHLOROETHANE	5	NA	NA	NA	5 U	5 U	NA	NA	NA
1,2-DICHLOROETHENE (TOTAL)	5	NA	NA	NA	5 U	5 U	NA	NA	NA
CHLOROFORM	5	NA	NA	NA	5 U	5 U	NA	NA	NA
1,2-DICHLOROETHANE	5	NA	NA	NA	5 U	5 U	NA	NA	NA
2-BUTANONE	10	NA	NA	NA	10 U	10 U	NA	NA	NA
1,1,1-TRICHLOROETHANE	5	NA	NA	NA	5 U	5 U	NA	NA	NA
CARBON TETRACHLORIDE	5	NA	NA	NA	5 U	5 U	NA	NA	NA
VINYL ACETATE	10	NA	NA	NA	10 U	10 U	NA	NA	NA
BROMODICHLOROMETHANE	5	NA	NA	NA	5 U	5 U	NA	NA	NA
1,2-DICHLOROPROPANE	5	NA	NA	NA	5 U	5 U	NA	NA	NA
CIS-1,3-DICHLOROPROPENE	5	NA	NA	NA	5 U	5 U	NA	NA	NA
TRICHLOROETHENE	5	NA	NA	NA	5 U	5 U	NA	NA	NA
DIBROMOCHLOROMETHANE	5	NA	NA	NA	5 U	5 U	NA	NA	NA
1,1,2-TRICHLOROETHANE	5	NA	NA	NA	5 U	5 U	NA	NA	NA
BENZENE	5	NA	NA	NA	5 U	5 U	5 U	5 U	5 U
TRANS-1,3-DICHLOROPROPENE	5	NA	NA	NA	5 U	5 U	NA	NA	NA
BROMOFORM	5	NA	NA	NA	5 U	5 U	NA	NA	NA
4-METHYL-2-PENTANONE	10	NA	NA	NA	10 U	10 U	NA	NA	NA
2-HEXANONE	10	NA	NA	NA	10 U	10 U	NA	NA	NA
TETRACHLOROETHENE	5	NA	NA	NA	5 U	5 U	NA	NA	NA
1,1,2,2-TETRACHLOROETHANE	5	NA	NA	NA	5 U	5 U	NA	NA	NA
TOLUENE	5	NA	NA	NA	5 U	5 U	5 U	5 U	5 U
CHLOROBENZENE	5	NA	NA	NA	5 U	5 U	NA	NA	NA
ETHYL BENZENE	5	NA	NA	NA	5 U	5 U	5 U	5 U	5 U
STYRENE	5	NA	NA	NA	5 U	5 U	NA	NA	NA
TOTAL XYLENES	5	NA	NA	NA	5 U	5 U	5 U	5 U	5 U
DILUTION FACTOR:					1.0	1.0	1.0	1.0	1.0
DATE SAMPLED:					6/26/91	6/25/91	6/25/91	6/12/91	6/19/91
DATE ANALYZED:					7/10/91	6/28/91	7/08/91	6/19/91	6/26/91
ASSOCIATED BLANKS:									

VOLATILE ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - RINSATE BLANKS
CASE: 5075/5054/4961/5019/5064/5005/5000

SAMPLE LOCATION:		54SD03-R	54SW01-R	80GW02-R	80GW03-R	80MW01-R	82GW31-R	82SB02-R	82SD06-R
SAMPLE NUMBER:									
QC DESIGNATION:	CRQL								
CHLOROMETHANE	10	NA	NA	10 U	10 U	10 U	10 U	10 U	10 U
BROMOMETHANE	10	NA	NA	10 U	10 U	10 U	10 U	10 U	10 U
VINYL CHLORIDE	10	NA	NA	10 U	10 U	10 U	10 U	10 U	10 U
CHLOROETHANE	10	NA	NA	10 U	10 U	10 U	10 U	10 U	10 U
METHYLENE CHLORIDE	5	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U
ACETONE	10	NA	NA	30 J	10 UJ	9 J	81 J	18	10 U
CARBON DISULFIDE	5	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U
1,1-DICHLOROETHENE	5	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U
1,1-DICHLOROETHANE	5	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U
1,2-DICHLOROETHENE (TOTAL)	5	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U
CHLOROFORM	5	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U
1,2-DICHLOROETHANE	5	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U
2-BUTANONE	10	NA	NA	10 U	10 UJ	10 UJ	10 U	10 U	10 U
1,1,1-TRICHLOROETHANE	5	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U
CARBON TETRACHLORIDE	5	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U
VINYL ACETATE	10	NA	NA	10 U	10 U	10 U	10 U	10 U	10 U
BROMODICHLOROMETHANE	5	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U
1,2-DICHLOROPROPANE	5	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U
CIS-1,3-DICHLOROPROPENE	5	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U
TRICHLOROETHENE	5	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U
DIBROMOCHLOROMETHANE	5	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-TRICHLOROETHANE	5	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U
BENZENE	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
TRANS-1,3-DICHLOROPROPENE	5	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U
BROMOFORM	5	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U
4-METHYL-2-PENTANONE	10	NA	NA	10 U	10 U	10 U	10 U	10 U	10 U
2-HEXANONE	10	NA	NA	10 U	10 UJ	10 UJ	10 U	10 U	10 U
TETRACHLOROETHENE	5	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-TETRACHLOROETHANE	5	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U
TOLUENE	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
CHLOROBENZENE	5	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U
ETHYL BENZENE	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
STYRENE	5	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U
TOTAL XYLENES	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
DILUTION FACTOR:		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
DATE SAMPLED:		6/26/91	6/19/91	6/27/91	6/16/91	6/16/91	6/27/91	6/19/91	6/13/91
DATE ANALYZED:		7/10/91	6/26/91	7/10/91	6/23/91	6/23/91	7/10/91	6/25/91	6/25/91
ASSOCIATED BLANKS:									

VOLATILE ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - RINSATE BLANKS
CASE: 5075/5054/4961/5019/5064/5005/5000

SAMPLE LOCATION:		82SW06-R
SAMPLE NUMBER:		
QC DESIGNATION:	CRQL	
CHLOROMETHANE	10	10 U
BROMOMETHANE	10	10 U
VINYL CHLORIDE	10	10 U
CHLOROETHANE	10	10 U
METHYLENE CHLORIDE	5	5 U
ACETONE	10	10 U
CARBON DISULFIDE	5	5 U
1,1-DICHLOROETHENE	5	5 U
1,1-DICHLOROETHANE	5	5 U
1,2-DICHLOROETHENE (TOTAL)	5	5 U
CHLOROFORM	5	5 U
1,2-DICHLOROETHANE	5	5 U
2-BUTANONE	10	10 U
1,1,1-TRICHLOROETHANE	5	5 U
CARBON TETRACHLORIDE	5	5 U
VINYL ACETATE	10	10 U
BROMODICHLOROMETHANE	5	5 U
1,2-DICHLOROPROPANE	5	5 U
CIS-1,3-DICHLOROPROPENE	5	5 U
TRICHLOROETHENE	5	5 U
DIBROMOCHLOROMETHANE	5	5 U
1,1,2-TRICHLOROETHANE	5	5 U
BENZENE	5	5 U
TRANS-1,3-DICHLOROPROPENE	5	5 U
BROMOFORM	5	5 U
4-METHYL-2-PENTANONE	10	10 U
2-HEXANONE	10	10 U
TETRACHLOROETHENE	5	5 U
1,1,2,2-TETRACHLOROETHANE	5	5 U
TOLUENE	5	5 U
CHLOROBENZENE	5	5 U
ETHYL BENZENE	5	5 U
STYRENE	5	5 U
TOTAL XYLENES	5	5 U
DILUTION FACTOR:		1.0
DATE SAMPLED:		6/13/91
DATE ANALYZED:		6/25/91
ASSOCIATED BLANKS:		

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SEMIVOLATILE AQUEOUS ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - RINSATE BLANKS
CASE: 5005/4961/5075/5054

SAMPLE LOCATION:		BS-1-R	03GW02-R	03SD02-R	07GW03-R	07SB05-R	54GW04-R	54SB02-R	54SD01-R
SAMPLE NUMBER:									
QC DESIGNATION:	CRQL								
PHENOL	10	NA	10 U	10 U	10 U	9 J	NA	NA	NA
BIS(2-CHLOROETHYL)ETHER	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
2-CHLOROPHENOL	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
1,3-DICHLOROBENZENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
1,4-DICHLOROBENZENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
BENZYL ALCOHOL	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
1,2-DICHLOROBENZENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
2-METHYLPHENOL	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
BIS(2-CHLOROISOPROPYL)ETHER	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
4-METHYLPHENOL	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
N-NITROSODI-N-PROPYLAMINE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
HEXACHLOROETHANE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
NITROBENZENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
ISOPHORONE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
2-NITROPHENOL	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
2,4-DIMETHYLPHENOL	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
BENZOIC ACID	50	NA	50 U	50 U	52 U	23 J	NA	NA	NA
BIS(2-CHLOROETHOXY)METHANE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
2,4-DICHLOROPHENOL	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
1,2,4-TRICHLOROBENZENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
NAPHTHALENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
4-CHLORANILINE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
HEXACHLOROBUTADIENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
4-CHLORO-3-METHYLPHENOL	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
2-METHYLNAPHTHALENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
HEXACHLOROCYCLOPENTADIENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
2,4,6-TRICHLOROPHENOL	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
2,4,5-TRICHLOROPHENOL	50	NA	50 U	50 U	52 U	49 U	NA	NA	NA
2-CHLORONAPHTHALENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
2-NITROANILINE	50	NA	50 U	50 U	52 U	49 U	NA	NA	NA
DIMETHYL PHTHALATE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
ACENAPHTHYLENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
2,6-DINITROTOLUENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
3-NITROANILINE	50	NA	50 U	50 U	52 U	49 U	NA	NA	NA
ACENAPHTHENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
2,4-DINITROPHENOL	50	NA	50 U	50 U	52 U	49 U	NA	NA	NA
4-NITROPHENOL	50	NA	50 U	50 UJ	52 U	49 U	NA	NA	NA

SEMIVOLATILE AQUEOUS ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - RINSATE BLANKS
CASE: 5005/4961/5075/5054

SAMPLE LOCATION:		BS-1-R	03GW02-R	03SD02-R	07GW03-R	07SB05-R	54GW04-R	54SB02-R	54SD01-R
SAMPLE NUMBER:									
QC DESIGNATION:	CRQL								
DIBENZOFURAN	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
2,4-DINITROTOLUENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
DIETHYL PHTHALATE	10	NA	10 U	10 UJ	10 U	10 U	NA	NA	NA
4-CHLOROPHENYL-PHENYLETHER	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
FLUORENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
4-NITROANILINE	50	NA	50 U	50 U	52 U	49 U	NA	NA	NA
4,6-DINITRO-2-METHYLPHENOL	50	NA	50 U	50 U	52 U	49 U	NA	NA	NA
N-NITROSODIPHENLYAMINE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
4-BROMOPHENYL-PHENYLETHER	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
HEXACHLOROBENZENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
PENTACHLOROPHENOL	50	NA	50 U	50 U	52 U	49 U	NA	NA	NA
PHENANTHRENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
ANTHRACENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
DI-N-BUTYLPHTHALATE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
FLUORANTHENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
PYRENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
BUTYLBENZYLPHTHALATE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
3,3'-DICHLOROBENZIDINE	20	NA	20 U	20 U	21 U	20 U	NA	NA	NA
BENZO(a)ANTHRACENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
CHRYSENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
BIS(2-ETHYLHEXYL)PHTHALATE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
DI-N-OCTYLPHTHALATE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
BENZO(b)FLUORANTHENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
BENZO(k)FLUARANTHENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
BENZO(a)PYRENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
INDENO(1,2,3-cd)PYRENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
DIBENZ(a,h)ANTHRACENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
BENZO(ghi)PERYLENE	10	NA	10 U	10 U	10 U	10 U	NA	NA	NA
DILUTION FACTOR:			1.0	1.0	1.0	1.0			
DATE SAMPLED:			6/16/91	6/10/91	6/26/91	6/25/91			
DATE EXTRACTED:			6/21/91	6/14/91	7/01/91	6/27/91			
DATE ANALYZED:			8/01/91	7/16/91	8/02/91	7/31/91			
ASSOCIATED BLANKS:									

SEMIVOLATILE AQUEOUS ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - RINSATE BLANKS
CASE: 5005/4961/5075/5054

SAMPLE LOCATION:		54SD03-R	54SW01-R	80GW02-R	80GW03-R	80MW01-R	82GW31-R	82SB02-R	82SD06-R
SAMPLE NUMBER:									
QC DESIGNATION:	CRQL								
PHENOL	10	NA	NA	NA	NA	NA	NA	NA	NA
BIS(2-CHLOROETHYL)ETHER	10	NA	NA	NA	NA	NA	NA	NA	NA
2-CHLOROPHENOL	10	NA	NA	NA	NA	NA	NA	NA	NA
1,3-DICHLOROBENZENE	10	NA	NA	NA	NA	NA	NA	NA	NA
1,4-DICHLOROBENZENE	10	NA	NA	NA	NA	NA	NA	NA	NA
BENZYL ALCOHOL	10	NA	NA	NA	NA	NA	NA	NA	NA
1,2-DICHLOROBENZENE	10	NA	NA	NA	NA	NA	NA	NA	NA
2-METHYLPHENOL	10	NA	NA	NA	NA	NA	NA	NA	NA
BIS(2-CHLOROISOPROPYL)ETHER	10	NA	NA	NA	NA	NA	NA	NA	NA
4-METHYLPHENOL	10	NA	NA	NA	NA	NA	NA	NA	NA
N-NITROSODI-N-PROPYLAMINE	10	NA	NA	NA	NA	NA	NA	NA	NA
HEXACHLOROETHANE	10	NA	NA	NA	NA	NA	NA	NA	NA
NITROBENZENE	10	NA	NA	NA	NA	NA	NA	NA	NA
ISOPHORONE	10	NA	NA	NA	NA	NA	NA	NA	NA
2-NITROPHENOL	10	NA	NA	NA	NA	NA	NA	NA	NA
2,4-DIMETHYLPHENOL	10	NA	NA	NA	NA	NA	NA	NA	NA
BENZOIC ACID	50	NA	NA	NA	NA	NA	NA	NA	NA
BIS(2-CHLOROETHOXY)METHANE	10	NA	NA	NA	NA	NA	NA	NA	NA
2,4-DICHLOROPHENOL	10	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-TRICHLOROBENZENE	10	NA	NA	NA	NA	NA	NA	NA	NA
NAPHTHALENE	10	NA	NA	NA	NA	NA	NA	NA	NA
4-CHLORANILINE	10	NA	NA	NA	NA	NA	NA	NA	NA
HEXACHLOROBUTADIENE	10	NA	NA	NA	NA	NA	NA	NA	NA
4-CHLORO-3-METHYLPHENOL	10	NA	NA	NA	NA	NA	NA	NA	NA
2-METHYLNAPHTHALENE	10	NA	NA	NA	NA	NA	NA	NA	NA
HEXACHLOROCYCLOPENTADIENE	10	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-TRICHLOROPHENOL	10	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-TRICHLOROPHENOL	50	NA	NA	NA	NA	NA	NA	NA	NA
2-CHLORONAPHTHALENE	10	NA	NA	NA	NA	NA	NA	NA	NA
2-NITROANILINE	50	NA	NA	NA	NA	NA	NA	NA	NA
DIMETHYL PHTHALATE	10	NA	NA	NA	NA	NA	NA	NA	NA
ACENAPHTHYLENE	10	NA	NA	NA	NA	NA	NA	NA	NA
2,6-DINITROTOLUENE	10	NA	NA	NA	NA	NA	NA	NA	NA
3-NITROANILINE	50	NA	NA	NA	NA	NA	NA	NA	NA
ACENAPHTHENE	10	NA	NA	NA	NA	NA	NA	NA	NA
2,4-DINITROPHENOL	50	NA	NA	NA	NA	NA	NA	NA	NA
4-NITROPHENOL	50	NA	NA	NA	NA	NA	NA	NA	NA

SEMIVOLATILE AQUEOUS ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - RINSATE BLANKS
CASE: 5005/4961/5075/5054

SAMPLE LOCATION:		54SD03-R	54SW01-R	80GW02-R	80GW03-R	80MW01-R	82GW31-R	82SB02-R	82SD06-R
SAMPLE NUMBER:									
QC DESIGNATION:	CRQL								
DIBENZOFURAN	10	NA	NA	NA	NA	NA	NA	NA	NA
2,4-DINITROTOLUENE	10	NA	NA	NA	NA	NA	NA	NA	NA
DIETHYL PHTHALATE	10	NA	NA	NA	NA	NA	NA	NA	NA
4-CHLOROPHENYL-PHENYLETHER	10	NA	NA	NA	NA	NA	NA	NA	NA
FLUORENE	10	NA	NA	NA	NA	NA	NA	NA	NA
4-NITROANILINE	50	NA	NA	NA	NA	NA	NA	NA	NA
4,6-DINITRO-2-METHYLPHENOL	50	NA	NA	NA	NA	NA	NA	NA	NA
N-NITROSODIPHENLYAMINE	10	NA	NA	NA	NA	NA	NA	NA	NA
4-BROMOPHENYL-PHENYLETHER	10	NA	NA	NA	NA	NA	NA	NA	NA
HEXACHLOROBENZENE	10	NA	NA	NA	NA	NA	NA	NA	NA
PENTACHLOROPHENOL	50	NA	NA	NA	NA	NA	NA	NA	NA
PHENANTHRENE	10	NA	NA	NA	NA	NA	NA	NA	NA
ANTHRACENE	10	NA	NA	NA	NA	NA	NA	NA	NA
DI-N-BUTYLPHTHALATE	10	NA	NA	NA	NA	NA	NA	NA	NA
FLUORANTHENE	10	NA	NA	NA	NA	NA	NA	NA	NA
PYRENE	10	NA	NA	NA	NA	NA	NA	NA	NA
BUTYLBENZYLPHTHALATE	10	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-DICHLOROBENZIDINE	20	NA	NA	NA	NA	NA	NA	NA	NA
BENZO(a)ANTHRACENE	10	NA	NA	NA	NA	NA	NA	NA	NA
CHRYSENE	10	NA	NA	NA	NA	NA	NA	NA	NA
BIS(2-ETHYLHEXYL)PHTHALATE	10	NA	NA	NA	NA	NA	NA	NA	NA
DI-N-OCTYLPHTHALATE	10	NA	NA	NA	NA	NA	NA	NA	NA
BENZO(b)FLUORANTHENE	10	NA	NA	NA	NA	NA	NA	NA	NA
BENZO(k)FLUARANTHENE	10	NA	NA	NA	NA	NA	NA	NA	NA
BENZO(a)PYRENE	10	NA	NA	NA	NA	NA	NA	NA	NA
INDENO(1,2,3-cd)PYRENE	10	NA	NA	NA	NA	NA	NA	NA	NA
DIBENZ(a,h)ANTHRACENE	10	NA	NA	NA	NA	NA	NA	NA	NA
BENZO(ghi)PERYLENE	10	NA	NA	NA	NA	NA	NA	NA	NA
DILUTION FACTOR:									
DATE SAMPLED:									
DATE EXTRACTED:									
DATE ANALYZED:									
ASSOCIATED BLANKS:									

SEMIVOLATILE AQUEOUS ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - RINSATE BLANKS
CASE: 5005/4961/5075/5054

SAMPLE LOCATION:		82SW06-R
SAMPLE NUMBER:		
QC DESIGNATION:	CRQL	
PHENOL	10	NA
BIS(2-CHLOROETHYL)ETHER	10	NA
2-CHLORCPHENOL	10	NA
1,3-DICHLOROBENZENE	10	NA
1,4-DICHLOROBENZENE	10	NA
BENZYL ALCOHOL	10	NA
1,2-DICHLOROBENZENE	10	NA
2-METHYLPHENOL	10	NA
BIS(2-CHLOROISOPROPYL)ETHER	10	NA
4-METHYLPHENOL	10	NA
N-NITROSODI-N-PROPYLAMINE	10	NA
HEXACHLOROETHANE	10	NA
NITROBENZENE	10	NA
ISOPHORONE	10	NA
2-NITROPHENOL	10	NA
2,4-DIMETHYLPHENOL	10	NA
BENZOIC ACID	50	NA
BIS(2-CHLOROETHOXY)METHANE	10	NA
2,4-DICHLOROPHENOL	10	NA
1,2,4-TRICHLOROBENZENE	10	NA
NAPHTHALENE	10	NA
4-CHLORANILINE	10	NA
HEXACHLOROBUTADIENE	10	NA
4-CHLORO-3-METHYLPHENOL	10	NA
2-METHYLNAPHTHALENE	10	NA
HEXACHLOROCYCLOPENTADIENE	10	NA
2,4,6-TRICHLOROPHENOL	10	NA
2,4,5-TRICHLOROPHENOL	50	NA
2-CHLORONAPHTHALENE	10	NA
2-NITROANILINE	50	NA
DIMETHYL PHTHALATE	10	NA
ACENAPHTHYLENE	10	NA
2,6-DINITROTOLUENE	10	NA
3-NITROANILINE	50	NA
ACENAPHTHENE	10	NA
2,4-DINITROPHENOL	50	NA
4-NITROPHENOL	50	NA

SEMIVOLATILE AQUEOUS ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - RINSATE BLANKS
CASE: 5005/4961/5075/5054

SAMPLE LOCATION:		82SW06-R
SAMPLE NUMBER:		
QC DESIGNATION:		CRQL
DIBENZOFURAN	10	NA
2,4-DINITROTOLUENE	10	NA
DIETHYL PHTHALATE	10	NA
4-CHLOROPHENYL-PHENYLETHER	10	NA
FLUORENE	10	NA
4-NITROANILINE	50	NA
4,5-DINITRO-2-METHYLPHENOL	50	NA
N-NITROSODIPHENLYAMINE	10	NA
4-BROMOPHENYL-PHENYLETHER	10	NA
HEXACHLOROBENZENE	10	NA
PENTACHLOROPHENOL	50	NA
PHENANTHRENE	10	NA
ANTHRACENE	10	NA
DI-N-BUTYLPHTHALATE	10	NA
FLUORANTHENE	10	NA
PYRENE	10	NA
BUTYLBENZYLPHTHALATE	10	NA
3,3'-DICHLOROBENZIDINE	20	NA
BENZO(a)ANTHRACENE	10	NA
CHRYSENE	10	NA
BIS(2-ETHYLHEXYL)PHTHALATE	10	NA
DI-N-OCTYLPHTHALATE	10	NA
BENZO(b)FLUORANTHENE	10	NA
BENZO(k)FLUARANTHENE	10	NA
BENZO(a)PYRENE	10	NA
INDENO(1,2,3-cd)PYRENE	10	NA
DIBENZ(a,h)ANTHRACENE	10	NA
BENZO(ghi)PERYLENE	10	NA

DILUTION FACTOR:	
DATE SAMPLED:	
DATE EXTRACTED:	
DATE ANALYZED:	
ASSOCIATED BLANKS:	

PESTICIDE/PCB AQUEOUS ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - RINSATE BLANKS
CASE: 5075/5054/4961/5019/5064/5005/5000

SAMPLE LOCATION:		BS-1-R	03GW02-R	03SD02-R	07GW03-R	07SB05-R	54GW04-R	54SB02-R	54SD01-R
SAMPLE NUMBER:									
QC DESIGNATION:	CRQL								
ALPHA-BHC	0.05	NA	NA	NA	0.05 U	NA	NA	NA	NA
BETA-BHC	0.05	NA	NA	NA	0.05 U	NA	NA	NA	NA
DELTA-BHC	0.05	NA	NA	NA	0.05 U	NA	NA	NA	NA
GAMMA-BHC (LINDANE)	0.05	NA	NA	NA	0.05 U	NA	NA	NA	NA
HEPTACHLOR	0.05	NA	NA	NA	0.05 U	NA	NA	NA	NA
ALDRIN	0.05	NA	NA	NA	0.05 U	NA	NA	NA	NA
HEPTACHLOR EPOXIDE	0.05	NA	NA	NA	0.05 U	NA	NA	NA	NA
ENDOSULFAN I	0.05	NA	NA	NA	0.05 U	NA	NA	NA	NA
DIELDRIN	0.10	NA	NA	NA	0.10 U	NA	NA	NA	NA
4,4'-DDE	0.10	NA	NA	NA	0.10 U	NA	NA	NA	NA
ENDRIN	0.10	NA	NA	NA	0.10 U	NA	NA	NA	NA
ENDOSULFAN II	0.10	NA	NA	NA	0.10 U	NA	NA	NA	NA
4,4'-DDD	0.10	NA	NA	NA	0.10 U	NA	NA	NA	NA
ENDOSULFAN SULFATE	0.10	NA	NA	NA	0.10 U	NA	NA	NA	NA
4,4'-DDT	0.10	NA	NA	NA	0.10 U	NA	NA	NA	NA
METHOXYCHLOR	0.5	NA	NA	NA	0.50 U	NA	NA	NA	NA
ENDRIN KETONE	0.10	NA	NA	NA	0.10 U	NA	NA	NA	NA
ALPHA-CHLORODANE	0.5	NA	NA	NA	0.50 U	NA	NA	NA	NA
GAMMA-CHLORDANE	0.5	NA	NA	NA	0.50 U	NA	NA	NA	NA
TOXAPHENE	1.0	NA	NA	NA	1.0 U	NA	NA	NA	NA
AROCLOR 1016	0.5	NA	NA	NA	0.50 U	NA	0.50 U	0.50 U	0.50 U
AROCLOR 1221	0.5	NA	NA	NA	0.50 U	NA	0.50 U	0.50 U	0.50 U
AROCLOR 1232	0.5	NA	NA	NA	0.50 U	NA	0.50 U	0.50 U	0.50 U
AROCLOR 1242	0.5	NA	NA	NA	0.50 U	NA	0.50 U	0.50 U	0.50 U
AROCLOR 1248	0.5	NA	NA	NA	0.50 U	NA	0.50 U	0.50 U	0.50 U
AROCLOR 1254	1.0	NA	NA	NA	1.0 U	NA	1.0 U	1.0 U	1.0 U
AROCLOR 1260	1.0	NA	NA	NA	1.0 U	NA	1.0 U	1.0 U	1.0 U
DILUTION FACTOR:					1.0		1.0	1.0	1.0
DATE SAMPLED:					6/26/91		6/25/91	6/12/91	6/19/91
DATE EXTRACTED:					7/03/91		6/28/91	6/14/91	6/24/91
DATE ANALYZED:					8/08/91		7/31/91	7/02/91	7/24/91
ASSOCIATED BLANKS:									

PESTICIDE/PCB AQUEOUS ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - RINSATE BLANKS
CASE: 5075/5054/4961/5019/5064/5005/5000

SAMPLE LOCATION:		54SD03-R	54SW01-R	80GW02-R	80GW03-R	80MW01-R	82GW31-R	82SB02-R	82SD06-R
SAMPLE NUMBER:									
QC DESIGNATION:	CRQL								
ALPHA-BHC	0.05	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
BETA-BHC	0.05	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
DELTA-BHC	0.05	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
GAMMA-BHC (LINDANE)	0.05	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
HEPTACHLOR	0.05	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
ALDRIN	0.05	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
HEPTACHLOR EPOXIDE	0.05	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
ENDOSULFAN I	0.05	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
DIELDRIN	0.10	NA	NA	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDE	0.10	NA	NA	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
ENDRIN	0.10	NA	NA	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
ENDOSULFAN II	0.10	NA	NA	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDD	0.10	NA	NA	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
ENDOSULFAN SULFATE	0.10	NA	NA	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDT	0.10	NA	NA	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
METHOXYCHLOR	0.5	NA	NA	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.49 U
ENDRIN KETONE	0.10	NA	NA	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
ALPHA-CHLORODANE	0.5	NA	NA	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.49 U
GAMMA-CHLORDANE	0.5	NA	NA	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.49 U
TOXAPHENE	1.0	NA	NA	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.98 U
AROCLOR 1016	0.5	0.50 U	0.52 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.49 U
AROCLOR 1221	0.5	0.50 U	0.52 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.49 U
AROCLOR 1232	0.5	0.50 U	0.52 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.49 U
AROCLOR 1242	0.5	0.50 U	0.52 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.49 U
AROCLOR 1248	0.5	0.50 U	0.52 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.49 U
AROCLOR 1254	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.98 U
AROCLOR 1260	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.98 U
DILUTION FACTOR:		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
DATE SAMPLED:		6/26/91	6/19/91	6/27/91	6/16/91	6/16/91	6/27/91	6/19/91	6/13/91
DATE EXTRACTED:		6/28/91	6/24/91	7/03/91	6/20/91	6/20/91	7/03/91	6/24/91	6/20/91
DATE ANALYZED:		7/31/91	7/24/91	8/09/91	7/23/91	7/23/91	8/09/91	7/24/91	7/23/91
ASSOCIATED BLANKS:									

PESTICIDE/PCB AQUEOUS ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - RINSATE BLANKS
CASE: 5075/5054/4961/5019/5064/5005/5000

SAMPLE LOCATION:		82SW06-R
SAMPLE NUMBER:		
QC DESIGNATION:	CRQL	

ALPHA-BHC	0.05	0.05	U
BETA-BHC	0.05	0.05	U
DELTA-BHC	0.05	0.05	U
GAMMA-BHC (LINDANE)	0.05	0.05	U
HEPTACHLOR	0.05	0.05	U
ALDRIN	0.05	0.05	U
HEPTACHLOR EPOXIDE	0.05	0.05	U
ENDOSULFAN I	0.05	0.05	U
DIELDRIN	0.10	0.10	U
4,4'-DDE	0.10	0.10	U
ENDRIN	0.10	0.10	U
ENDOSULFAN II	0.10	0.10	U
4,4'-DDD	0.10	0.10	U
ENDOSULFAN SULFATE	0.10	0.10	U
4,4'-DDT	0.10	0.10	U
METHOXYCHLOR	0.5	0.50	U
ENDRIN KETONE	0.10	0.10	U
ALPHA-CHLORODANE	0.5	0.50	U
GAMMA-CHLORDANE	0.5	0.50	U
TOXAPHENE	1.0	0.99	U
AROCLOR 1016	0.5	0.50	U
AROCLOR 1221	0.5	0.50	U
AROCLOR 1232	0.5	0.50	U
AROCLOR 1242	0.5	0.50	U
AROCLOR 1248	0.5	0.50	U
AROCLOR 1254	1.0	0.99	U
AROCLOR 1260	1.0	0.99	U

DILUTION FACTOR:	1.0
DATE SAMPLED:	6/13/91
DATE EXTRACTED:	6/20/91
DATE ANALYZED:	7/23/91
ASSOCIATED BLANKS:	

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HERBICIDE ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - RINSATE BLANKS
CASE: 5075/5005

SAMPLE LOCATION:		BS-1-R	03GW02-R	03SD02-R	07GW03-R	07SB05-R	54GW04-R	54SB02-R	54SD01-R
SAMPLE NUMBER:									
QC DESIGNATION:	CRQL								
2,4-D	0.2	NA	NA	NA	NA	NA	NA	NA	NA
SILVEX	0.2	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-T	0.2	NA	NA	NA	NA	NA	NA	NA	NA
DINOSEB	0.2	NA	NA	NA	NA	NA	NA	NA	NA
DILUTION FACTOR:									
DATE SAMPLED:									
DATE EXTRACTED:									
DATE ANALYZED:									
ASSOCIATED BLANKS:									

HERBICIDE ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - RINSATE BLANKS
CASE: 5075/5005

SAMPLE LOCATION:		54SD03-R	54SW01-R	80GW02-R	80GW03-R	80MW01-R	82GW31-R	82SB02-R	82SD06-R
SAMPLE NUMBER:									
QC DESIGNATION:	CRQL								
2,4-D	0.2	NA	NA	0.20 U	0.20 U	0.20 U	NA	NA	NA
SILVEX	0.2	NA	NA	0.20 U	0.20 U	0.20 U	NA	NA	NA
2,4,5-T	0.2	NA	NA	0.20 U	0.20 U	0.20 U	NA	NA	NA
DINOSEB	0.2	NA	NA	0.20 U	NA	NA	NA	NA	NA
DILUTION FACTOR:				1.0	1.0	1.0			
DATE SAMPLED:				6/27/91	6/16/91	6/16/91			
DATE EXTRACTED:				7/03/91	6/21/91	6/21/91			
DATE ANALYZED:				7/15/91	7/05/91	7/05/91			
ASSOCIATED BLANKS:									

HERBICIDE ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - RINSATE BLANKS
CASE: 5075/5005

SAMPLE LOCATION:		82SW06-R
SAMPLE NUMBER:		
QC DESIGNATION:	CRQL	
2,4-D	0.2	NA
SILVEX	0.2	NA
2,4,5-T	0.2	NA
DINOSEB	0.2	NA
DILUTION FACTOR:		
DATE SAMPLED:		
DATE EXTRACTED:		
DATE ANALYZED:		
ASSOCIATED BLANKS:		

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INORGANIC AQUEOUS ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - RINSATE BLANKS
CASE: 5013/5075/5054/4961/5019/5064
LABORATORY:

SAMPLE LOCATION:	ANALYTICAL	BS-1-R	03GW02-R	03SD02-R	07GW03-R	07SB05-R	54GW04-R	54SB02-R	
SAMPLE NUMBER:	METHOD								
QC DESIGNATION:									CRQL
ALUMINUM	P	13.0 UJ	NA	NA	40.3	10.0	13.1	NA	200
ANTIMONY	P	17.0 U	NA	NA	17.0 U	23.0	23.0	NA	60
ARSENIC	F	4.0 UJ	NA	NA	3.0 U	4.0 UJ	4.0 UJ	NA	10
BARIUM	P	1.0 U	NA	NA	1.3	1.0	1.0	NA	200
BERYLLIUM	P	2.0 U	NA	NA	2.0 U	1.0	1.0	NA	5
CADMIUM	P	5.0 UJ	NA	NA	5.0 UJ	5.0 UJ	5.0 UJ	NA	5
CALCIUM	P	88.8	NA	NA	69.0	73.7	88.2	NA	5000
CHROMIUM	P	4.0 U	NA	NA	4.0 U	5.0 UJ	5.5 J	NA	10
COBALT	P	5.0 U	NA	NA	5.0 U	8.0	8.0	NA	50
COPPER	P	5.0 U	NA	NA	5.0 U	15.0	15.0	NA	25
IRON	P	6.0 U	NA	NA	10.7	8.7 J	8.5 J	NA	100
LEAD	F	2.1 J	NA	NA	2.0 UJ	2.0	2.0	NA	3
MAGNESIUM	P	16.9	NA	NA	13.8	12.2	18.7	NA	5000
MANGANESE	P	2.0 U	NA	NA	2.0 U	2.0 UJ	2.0 UJ	NA	15
MERCURY	CV	0.20 U	NA	NA	0.20 U	0.20	0.20	NA	0.2
NICKEL	P	8.0 U	NA	NA	8.0 U	13.0	13.0	NA	40
POTASSIUM	P	483 U	NA	NA	483 U	503	503	NA	5000
SELENIUM	F	4.0 UJ	NA	NA	3.0 UJ	R	R	NA	5
SILVER	P	2.0 UJ	NA	NA	3.0	3.0	3.0	NA	10
SODIUM	P	63.4	NA	NA	90.8	40.5	39.1	NA	5000
THALLIUM	F	1.0 U	NA	NA	2.0 U	2.0 UJ	2.0 UJ	NA	10
TIN	P	NA	NA	NA	NA	NA	NA	NA	40
VANADIUM	P	3.0 U	NA	NA	3.0 U	5.0 UJ	5.0 UJ	NA	50
ZINC	P	8.6	NA	NA	10.5	9.0 J	9.0 J	NA	20
CYANIDE	C	NA	NA	NA	10.0 UJ	R	R	NA	10
HEXAVALENT CHROMIUM	P	NA	NA	NA	NA	NA	10.0 U	10.0 U	10
DILUTION FACTOR:		1.0			1.0	1.0	1.0	1.0	
DATE SAMPLED:		6/18/91			6/26/91	6/25/91	6/25/91	6/12/91	
ASSOCIATED BLANKS:									

ANALYTICAL METHOD
F - FURNACE
P - ICP/FLAME AA
CV - COLD VAPOR
C - COLORMETRIC

J - QUANTITATION IS APPROXIMATE DUE TO LIMITATIONS IDENTIFIED IN THE QUALITY CONTROL REVIEW (DATA REVIEW)
R - VALUE IS REJECTED.
-- VALUE IS NON-DETECTED
NA- NOT ANALYZED

INORGANIC AQUEOUS ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - RINSATE BLANKS
CASE: 5013/5075/5054/4961/5019/5064
LABORATORY:

SAMPLE LOCATION: / SAMPLE NUMBER: / QC DESIGNATION:	ANALYTICAL METHOD	54SD01-R	54SD03-R	54SW01-R	80GW02-R	80GW03-R	80MW01-R	82GW31-R	CRQL
ALUMINUM	P	13.0 U	57.6	13.0 U	NA	NA	NA	NA	200
ANTIMONY	P	17.0 U	17.0 U	17.0 U	NA	NA	NA	NA	60
ARSENIC	F	4.0 UJ	4.0 U	4.0 UJ	NA	NA	NA	NA	10
BARIUM	P	1.0 U	20.4	1.0 U	NA	NA	NA	NA	200
BERYLLIUM	P	2.0 U	2.0 U	2.0 U	NA	NA	NA	NA	5
CADMIUM	P	5.0 UJ	5.0 U	5.0 UJ	NA	NA	NA	NA	5
CALCIUM	P	67.7	72500	61.5	NA	NA	NA	NA	5000
CHROMIUM	P	4.0 UJ	4.0 U	4.0 UJ	NA	NA	NA	NA	10
COBALT	P	5.0 U	5.0 U	5.0 U	NA	NA	NA	NA	50
COPPER	P	5.0 UJ	5.0 U	5.0 UJ	NA	NA	NA	NA	25
IRON	P	13.3	7540	6.0 U	NA	NA	NA	NA	100
LEAD	F	4.7 J	2.0 U	1.0 UJ	NA	NA	NA	NA	3
MAGNESIUM	P	11.9	2690	11.4	NA	NA	NA	NA	5000
MANGANESE	P	2.1	289	2.0 U	NA	NA	NA	NA	15
MERCURY	CV	0.20 U	0.20 U	0.20 U	NA	NA	NA	NA	0.2
NICKEL	P	8.0 UJ	8.0 U	8.0 UJ	NA	NA	NA	NA	40
POTASSIUM	P	483 UJ	2040	483 UJ	NA	NA	NA	NA	5000
SELENIUM	F	4.0 UJ	2.0 UJ	4.0 UJ	NA	NA	NA	NA	5
SILVER	P	2.0 U	2.4	2.0 U	NA	NA	NA	NA	10
SODIUM	P	47.1	4010	40.4	NA	NA	NA	NA	5000
THALLIUM	F	2.0 U	2.0 UJ	2.0 U	NA	NA	NA	NA	10
TIN	P	NA	NA	NA	NA	NA	NA	NA	40
VANADIUM	P	3.0 U	3.0 U	3.0 U	NA	NA	NA	NA	50
ZINC	P	8.3 J	16.3	6.2 J	NA	NA	NA	NA	20
CYANIDE	C	10.0 U	10.0 U	10.0 U	NA	NA	NA	NA	10
HEXAVALENT CHROMIUM	P	10.0 U	10.0 U	10.0 U	NA	NA	NA	NA	10
DILUTION FACTOR:		1.0	1.0	1.0					
DATE SAMPLED:		6/19/91	6/26/91	6/19/91					
ASSOCIATED BLANKS:									

ANALYTICAL METHOD
F - FURNACE
P - ICP/FLAME AA
CV - COLD VAPOR
C - COLORMETRIC

J - QUANTITATION IS APPROXIMATE DUE TO LIMITATIONS IDENTIFIED IN THE QUALITY CONTROL REVIEW (DATA REVIEW)
R - VALUE IS REJECTED.
-- VALUE IS NON-DETECTED
NA- NOT ANALYZED

INORGANIC AQUEOUS ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - RINSATE BLANKS
CASE: 5013/5075/5054/4961/5019/5064
LABORATORY:

SAMPLE LOCATION:	ANALYTICAL	82SB02-R	82SD06-R	82SW06-R	
SAMPLE NUMBER:	METHOD				
QC DESIGNATION:					CRQL
ALUMINUM	P	NA	NA	NA	200
ANTIMONY	P	NA	NA	NA	60
ARSENIC	F	NA	NA	NA	10
BARIUM	P	NA	NA	NA	200
BERYLLIUM	P	NA	NA	NA	5
CADMIUM	P	NA	NA	NA	5
CALCIUM	P	NA	NA	NA	5000
CHROMIUM	P	NA	NA	NA	10
COBALT	P	NA	NA	NA	50
COPPER	P	NA	NA	NA	25
IRON	P	NA	NA	NA	100
LEAD	F	NA	NA	NA	3
MAGNESIUM	P	NA	NA	NA	5000
MANGANESE	P	NA	NA	NA	15
MERCURY	CV	NA	NA	NA	0.2
NICKEL	P	NA	NA	NA	40
POTASSIUM	P	NA	NA	NA	5000
SELENIUM	F	NA	NA	NA	5
SILVER	P	NA	NA	NA	10
SODIUM	P	NA	NA	NA	5000
THALLIUM	F	NA	NA	NA	10
TIN	P	NA	NA	NA	40
VANADIUM	P	NA	NA	NA	50
ZINC	P	NA	NA	NA	20
CYANIDE	C	NA	NA	NA	10
HEXAVALENT CHROMIUM	P	NA	NA	NA	10

DILUTION FACTOR:
DATE SAMPLED:
ASSOCIATED BLANKS:

ANALYTICAL METHOD
F - FURNACE
P - ICP/FLAME AA
CV - COLD VAPOR
C - COLORMETRIC

J - QUANTITATION IS APPROXIMATE DUE TO LIMITATIONS IDENTIFIE
QUALITY CONTROL REVIEW (DATA REVIEW)
R - VALUE IS REJECTED.
-- VALUE IS NON-DETECTED
NA- NOT ANALYZED

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APPENDIX D

RISK ASSESSMENT CALCULATIONS

HALLIBURTON NUS Environmental Corporation and Subsidiaries — **STANDARD CALCULATION SHEET**

CLIENT: CAMP LEJEUNE	FILE NO.: 2F36	BY: NJS	PAGE 1 OF 2
SUBJECT: CALCULATION OF PARTICULATE EMISSION FACTOR		CHECKED BY: KMS	DATE: 09-28-92

PURPOSE: TO CALCULATE PARTICULATE EMISSION FACTOR IN TERMS OF SITE DIMENSIONS FOR LOCATIONS AT CAMP LEJEUNE.

RELEVANT EQUATIONS:

$$PEF = \frac{LS \times V \times DH \times 3600}{A} \times \frac{1000}{0.036 \times (1 - V_g) \times \left(\frac{u_m}{u_t}\right)^3 \times F(x)}$$

WHERE:
- LS = WIDTH OF CONTAMINATED AREA (m)
- V = WINDSPEED IN MIXING ZONE (m/s)
- DH = DIFFUSION HEIGHT (m)
- 3600 = CONVERSION FACTOR (SEC/HOUR)
- A = AREA OF CONTAMINATION (m^2)
- 1000 = CONVERSION FACTOR (g^m/kg)
- 0.036 = RESPIRABLE FRACTION ($g^m/m^2 \cdot hr$)
- V_g = FRACTION OF VEGATATIVE COVER (UNITLESS)
- u_m = MEAN ANNUAL WINDSPEED (m/s)
- u_t = EQUIVALENT THRESHOLD VALUE OF WINDSPEED (m/s)
- $F(x)$ = FUNCTION DEPENDENT ON u_m/u_t (UNITLESS)

SAMPLE CALCULATION:

ASSUMPTIONS:		RATIONALE
	$V = \frac{1}{2} u_m$	AS PER RAGS PART B GUIDANCE
	DH = 2 m	RECEPTOR BREATHING ZONE
	$V_g = 0$	ZERO PERCENT VEGETATIVE COVER
	$u_m = 4.0$ m/s	MEAN ANNUAL WINDSPEED FOR WILMINGTON, NC
	$u_t = 12.8$ m/s	DEFAULT VALUE FOR EROSION THRESHOLD WINDSPEE

(1) CALCULATE $F(x)$, $x = 0.886\left(\frac{u_t}{u_m}\right) = 0.886\left(\frac{12.8 \text{ m/s}}{4.0 \text{ m/s}}\right) = 2.84$ ✓

FOR $x > 2$ ⇒ $F(x) = 0.18\left(8x^3 + 12x\right)\exp(-x^2)$

$$F(x) = 0.18\left[8(2.84)^3 + 12(2.84)^2\right]\exp -(2.84)^2 = \underline{0.0158}$$ ✓

HALLIBURTON NUS Environmental Corporation and Subsidiaries			STANDARD CALCULATION SHEET
CLIENT: CAMP LEJEUNE	FILE NO.: 2F36	BY: NJS	PAGE 2 OF 2
SUBJECT: CALCULATION of PARTICULATE		CHECKED BY: KMS	DATE: 09-28-92

② CALCULATE PEF

$$PEF = \left(\frac{LS}{A}\right) \times \left(\frac{\frac{1}{2} U_m \times DH \times 3600\ s/hr \times 1000\ g/kg}{0.036 \times (1-V_g) \times \left(\frac{U_m}{U_t}\right)^3 \times F(x)}\right)$$

$$= \left(\frac{LS}{A}\right)\left(\frac{\frac{1}{2}(4.0\ m/s) \times 2\ m \times 3600\ s/hr \times 1000\ g/kg}{0.036 \times (1-0) \times \left(\frac{4.0\ m/s}{12.8\ m/s}\right)^3 \times 0.0158}\right)$$

$$PEF\left(\frac{m^3}{kg}\right) = \left(\frac{LS}{A}\right)\left(8.30 \times 10^{11}\right) \quad \checkmark$$

REFERENCES:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (USEPA), RISK ASSESSMENT GUIDANCE FOR SUPERFUND, VOLUME I - HUMAN HEALTH EVALUATION MANUAL (PART B, DEVELOPMENT OF RISK-BASED PRELIMINARY REMEDIATION GOALS). INTERIM. OSWER DIRECTIVE 9285.7-01B. OFFICE of EMERGENCY and REMEDIAL RESPONSE. WASHINGTON, DC 20460.

COWHERD, J.A., G.E. MALLSKI, P.J. ENGLEHART, and D.A. GILLETTE, 1984. RAPID ASSESSMENT of EXPOSURE TO PARTICULATE EMISSIONS FROM SURFACE CONTAMINATED SITES. MIDWEST RESEARCH INSTITUTE. KANSAS CITY, MISSOURI.

HALLIBURTON NUS Environmental Corporation and Subsidiaries | **STANDARD CALCULATION SHEET**

CLIENT: MCB CAMP LEJEUNE	FILE NO.: 2F3/0	BY: KMS	PAGE 1 OF 1
SUBJECT: PEF CALCULATION FOR SITE 80		CHECKED BY: MJS	DATE: 10/02/92

PURPOSE: CALCULATE PARTICULATE EMISSION FACTOR FOR SITE 80.

RELEVANT EQUATION:

$$PEF = \left(\frac{LS}{A}\right)(8.3 \times 10^{11})$$

WHERE: LS = WIDTH OF CONTAMINATED ZONE (m)
A = AREA " " " (m^2)

SAMPLE CALCULATION:

LS = 100m WIDTH = 150m

$A = (100\,m)(150\,m) = 1.5 \times 10^4\ m^2$

$$PEF = \left(\frac{100\,m}{1.5 \times 10^4\ m^2}\right)(8.3 \times 10^{11})$$

$$PEF = \boxed{5.53 \times 10^9\ m^3/kg}$$ ✓

REFERENCE:

USEPA, RISK ASSESSMENT GUIDANCE FOR SUPERFUND (RAGS) - VOLUME I - HUMAN HEALTH EVALUATION MANUAL (PART B - DEVELOPMENT OF RISK-BASED PRELIMINARY REMEDIATION GOALS). WASHINGTON D.C. 20460.

HALLIBURTON NUS Environmental Corporation and Subsidiaries			STANDARD CALCULATION SHEET
CLIENT: CAMP LEJEUNE	FILE NO.: 2F36	BY: MLS	PAGE 1 OF 7
SUBJECT: CALCULATION OF SOIL PRGS FOR SITE 80		CHECKED BY: KMS	DATE: 10-02-92

PURPOSE: TO CALCULATE PRELIMINARY REMEDIATION GOALS (PRGS) FOR CHEMICALS BASED CARCINOGENIC and NONCARCINOGENIC RISKS.

RELEVANT EQUATIONS:

(1) NONCARCINOGENIC EFFECTS – INDUSTRIAL/COMMERCIAL USAGE - SOIL

$$\text{CUMULATIVE NONCANCER RISK} = \text{INGESTION RISK} + \text{INHALATION RISK (VOLATILES)} + \text{INHALATION RISK (PARTICULATES)}$$

$$\text{CUMULATIVE RISK } (TR_N) = \left(\frac{1}{RfD_{ING}}\right)\left(\frac{C_{SOIL} \times IR_{SOIL} \times EF \times ED \times 10^{-6}}{BW \times AT}\right) + \left(\frac{1}{RfD_{INH}}\right)\left(\frac{C_{SOIL} \times EF \times ED \times IR_{AIR} \times \left(\frac{1}{VF}\right) \times \left(\frac{1}{PEF}\right)}{BW \times AT}\right)$$

WHERE: TR_N: TOTAL NONCARCINOGENIC RISK FOR A SPECIFIC CHEMICAL

RfD_{ING}	=	INGESTION REFERENCE DOSE	(mg/kg/day)
RfD_{INH}	=	INHALATION " "	(mg/kg/day)
C_{SOIL}	=	CONTAMINANT CHEMICAL CONCENTRATION IN SOIL	(mg/kg)
IR_{SOIL}	=	SOIL INGESTION RATE	(g/DAY)
EF	=	EXPOSURE FREQUENCY	(DAYS/YR)
ED	=	EXPOSURE DURATION	(YEARS)
IR_{AIR}	=	AIR INHALATION RATE	(m^3/DAY)
VF	=	VOLATILIZATION FACTOR	(m^3/kg)
PEF	=	PARTICULATE EMISSION FACTOR	(m^3/kg)
BW	=	RECEPTOR BODY WEIGHT	(kg)
AT	=	AVERAGING TIME (EQUAL TO ED × 365 days/YR FOR NONCARCINOGENS)	
10^{-6}	=	CONVERSION FACTOR	(kg/mg)

SOLVING FOR C_{SOIL} (PRG) YIELDS:

$$C_{SOIL}(mg/kg) = \frac{TR_N \times BW \times AT}{EF \times ED \times \left[\left(\frac{10^{-6} \times IR_{SOIL}}{RfD_{ING}}\right) + \left(\frac{IR_{AIR} \times \left(\frac{1}{VF}\right) \times \left(\frac{1}{PEF}\right)}{RfD_{INH}}\right)\right]} \quad (1)$$

✓

(2) CARCINOGENIC EFFECTS - INDUSTRIAL/COMMERCIAL USAGE - SOIL

CUMULATIVE CANCER RISK = INGESTION CANCER RISK + INHALATION CANCER RISK (VOLATILES) + INHALATION CANCER RISK (PARTICULATES)

$$\text{CUMULATIVE RISK } (TR_c) = (CSF_{ING})\left(\frac{C_{SOIL} \times IR_{SOIL} \times ED \times EF \times 10^{-6}}{BW \times AT}\right) + (CSF_{INH})\left(\frac{C_{SOIL} \times IR_{AIR} \times ED \times EF \times \left(\frac{1}{VF}\right) \times \left(\frac{1}{PE}\right.}{BW \times AT}\right.$$

WHERE: TR_c = TOTAL CARCINOGENIC CANCER RISK FOR A SPECIFIC CHEMICAL

CSF_{ING} = INGESTION CANCER SLOPE FACTOR $(mg/kg/day)^{-1}$

CSF_{INH} = INHALATION " " " $(mg/kg/day)^{-1}$

AT = AVERAGING TIME (DAYS) (EQUAL TO 70 YRS × 365 DAYS/YR FOR CARCINOGEN

SOLVING FOR C_{SOIL} YIELDS:

$$C_{SOIL} = \frac{TR_c \times BW \times AT}{ED \times EF \times \left[\left(CSF_{ING} \times IR_{SOIL} \times 10^{-6}\right) + \left(CSF_{INH} \times IR_{AIR} \times \left(\frac{1}{VF} + \frac{1}{PEF}\right)\right)\right]} \quad (2)$$

ASSUMING THE FOLLOWING DEFAULT VALUES:

		RATIONALE
TR_N	= 1.0	HAZARD QUOTIENT EQUALS UNITY FOR NC HEALTH EFFEC
TR_c	= 10^{-6}	10^{-6} CANCER RISK
BW	= 70 kg	ADULT RECEPTOR
ED	= 25 YRS	BASE EMPLOYEE DURING CAREER
EF	= 250 DAYS/YR	EMPLOYMENT SCENARIO
IR_{SOIL}	= 50 mg/DAY	INCIDENTAL INGESTION
IR_{AIR}	= 20 m^3/DAY	WORKDAY INHALATION RATE

EQUATIONS (1) and (2) CAN BE REDUCED TO:

1)

$$C_{SOIL}\,(mg/kg) = \frac{(1.0)(70\ kg)(365\ day/yr)(ED)}{(250\ days/yr)(ED)\left[\left(\frac{5\times10^{-5}\ kg/day}{RfD_{ING}}\right)+\left(\frac{20\ m^3/day}{RfD_{INH}}\right)\left(\frac{1}{VF}+\frac{1}{PEF}\right)\right]}$$

$$C_{SOIL}\,(mg/kg) = \frac{102\ (kg)}{\left[\left(\frac{5\times10^{-5}\ kg/day}{RfD_{ING}}\right)+\left(\frac{20}{VF}+\frac{20}{PEF}\right)\left(\frac{1}{RfD_{INH}}\right)\right]}$$

(REDUCED FORM EQUATION (1))

and

2)

$$C_{SOIL}\,(mg/kg) = \frac{(10^{-6})(70\ kg)(70\ yr)(365\ day/yr)}{(25\ yrs)(250\ days/yr)\left[(5\times10^{-5}\ kg/day)(CSF_{ING})+(CSF_{INH})\left(\frac{20}{VF}+\frac{20}{PEF}\right)\right]}$$

$$C_{SOIL}\,(mg/kg) = \frac{2.9\times10^{-4}\ (kg)}{\left[(5\times10^{-5}\ kg/day)(CSF_{ING})+(CSF_{INH})\left(\frac{20}{VF}+\frac{20}{PEF}\right)\right]}$$

(REDUCED FORM EQUATION (2)) ✓

③ CALCULATION of VOLATILIZATION FACTOR (VF)

$$VF = \left(\frac{LS\times V\times DH}{A}\right)\times\left(\frac{(3.14\times\alpha\times T)^{0.5}}{2\times D_i\times E^{1.33}\times\left(\frac{41\ H}{K_d}\right)\times10^{-3}}\right)$$

$$\alpha = \frac{D_i^{cm^2/s}\times E^{1.33}}{E+\left[\frac{P_s(1-E)K_d}{41\ H}\right]}$$ and $K_d = K_{OC}\times f_{OC}$ (ORGANICS)

WHERE:

LS =	LENGTH of CONTAMINATED ZONE	(m)	
V =	WINDSPEED IN MIXING ZONE	(m/s)	
DH =	DIFFUSION HEIGHT	(m)	
A =	AREA of CONTAMINATION	(cm^2)	
T =	EXPOSURE INTERVAL	(sec)	
D_i =	DIFFUSION COEFFICIENT IN AIR	(cm^2/s)	
E =	SOIL POROSITY	(UNITLESS)	
H =	HENRY'S LAW CONSTANT	($atm\ m^3/mol$)	
K_d =	SOIL/WATER PARTITION COEFFICIENT	(cm^3/gm)	$= K_{oc} \cdot f_{oc}$
10^{-3} =	CONVERSION FACTOR	(kg/gm)	
ρ_s =	SOIL DENSITY	(gm/cm^3)	
K_{oc} =	ORGANIC CARBON PARTITION COEFFICIENT	(cm^3/gm)	

SAMPLE CALCULATION:

ASSUMPTIONS:

DH =	2 m	
T =	7.88×10^8 sec	(25 YRS)
E =	0.35	
f_{oc} =	0.032	
ρ_s =	2.65	(gm/cm^3)
PEF =	5.53×10^9	(m^3/kg)

FOR METHYLENE CHLORIDE THE FOLLOWING PHYSICAL CONSTANTS AND RISK-DOSE PARAMETERS ARE:

PARAMETER	(UNITS)	METHYLENE CHLORIDE
D_i	(cm^2/s)	1.01×10^{-1}
H	($atm\ m^3/mol$)	2.03×10^{-3}
K_{oc}	(cm^3/gm)	8.80
RfD_{ING}	($mg/kg/day$)	6×10^{-2}
RfD_{INH}	($mg/kg/day$)	9×10^{-1}
CSF_{ING}	$(mg/kg/day)^{-1}$	7.5×10^{-3}
CSF_{INH}	$(mg/kg/day)^{-1}$	1.6×10^{-3}

HALLIBURTON NUS Environmental Corporation and Subsidiaries			STANDARD CALCULATION SHEET
CLIENT: CAMPLEJEUNE	FILE NO.: 2F36	BY: NJS	PAGE 5 OF 7
SUBJECT: CALCULATION OF SOIL PRG FOR SITE 80		CHECKED BY: KMS	DATE: 10-02-92

FOR SITE 80, THE FOLLOWING PHYSICAL DIMENSIONS APPLY:

LS = 100 m
V = 2.0 m/s (ONE-HALF OF MEAN WINDSPEED FOR WILMINGTON A
A = 1.50×10^8 cm^2

FOR SOIL PRG FOR $MeCl_2$ (NONCARCINOGENIC):

① CALCULATE α:

$$\alpha = \frac{\left(1.01\times10^{-1}\ \frac{cm^2}{s}\right)(0.35)^{1.33}}{0.35 + \left[\frac{(2.65\ gm/cm^3)(1-0.35)(8.8\ cm^3/gm)(0.032)}{41\left(2.03\times10^{-3}\ \frac{atm\ m^3}{mol}\right)}\right]} = \boxed{4.05\times10^{-3}\ cm^2/s}$$ ✓

② CALCULATE VF:

$$VF = \left(\frac{(100\ m)(2\ m/s)(2\ m)}{1.5\times10^8\ cm^2}\right)\left(\frac{\left((3.14)(4.05\times10^{-3}\ cm^2/s)(7.88\times10^8\ sec)\right)^{0.5}}{(2)(1.01\times10^{-1}\ \frac{cm^2}{s})(0.35)^{1.33}\times\left(\frac{41(2.03\times10^{-3})}{(8.8)(0.032)}\right)\times10^{-3}\ \frac{kg}{gm}}\right)$$

$$\boxed{VF = 571\ m^3/kg}$$ ✓

③ CALCULATE PRG:

$$C_{SOIL} = \frac{102}{\left[\frac{5\times10^{-5}\ kg/day}{6\times10^{-2}\ mg/kg\ bdg} + \left(\frac{1}{9\times10^{-1}\ \frac{mg}{m^3}}\right)\left(\frac{20\ m^3/day}{571\ m^3/kg} + \frac{20\ m^3/day}{5.53\times10^9\ m^3/day}\right)\right]}$$

$$\boxed{C_{SOIL} = 2567\ mg/kg}$$ ✓

HALLIBURTON NUS Environmental Corporation and Subsidiaries			STANDARD CALCULATION SHEET
CLIENT: CAMP LEJEUNE	FILE NO.: 2F36	BY: NJS	PAGE 6 OF 7
SUBJECT: CALCULATION of SOIL PRGS FOR SITE 80		CHECKED BY: KMG	DATE: 10-02-92

FOR SOIL PRG FOR $MeCl_2$ (CARCINOGENIC):

① CALCULATE α:

$\alpha = 4.05 \times 10^{-3}\ cm^2/s$ (as calculated on pg. 5)

② CALCULATE VF:

$VF = 574\ m^3/kg$ (as calculated on pg. 5)

③ CALCULATE SOIL PRG:

$$C_{SOIL} = \frac{2.9 \times 10^{-4}\ (kg)}{\left[(5\times10^{-5}\ kg/day)(7.5\times10^{-3}\ \frac{kg\,day}{mg}) + (1.6\times10^{-3})\left(\frac{20\ m^3/day}{571\ m^3/kg} + \frac{20\ m^3/day}{5.53\times10^{9}\ m^3/kg}\right)\right]}$$

$$\boxed{C_{SOIL} = 5.14\ mg/kg}$$

REFERENCES:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (USEPA), RISK ASSESSMENT GUIDANCE FOR SUPERFUND, VOLUME I - HUMAN HEALTH EVALUATION MANUAL (PART B, DEVELOPMENT OF RISK-BASED PRELIMINARY REMEDIATION GOALS). INTERIM. OSWER DIRECTIVE 9285.7-01B. OFFICE of EMERGENCY and REMEDIAL RESPONSE. WASHINGTON, DC 20460.

COWHERD, J.A., G.E. MALESKI, P.J. ENGLEHART, and D.A. GILLETTE, 1984. RAPID ASSESSMENT of EXPOSURE TO PARTICULATE EMISSIONS FROM SURFACE CONTAMINATED SITES. MIDWEST RESEARCH INSTITUTE. KANSAS CITY, MISSOURI.

Development of Risk-Based PRGs
Scenario: Industrial Land Use

SITE: Camp Lejeune - Site 80
LOCATION: Jacksonville, NC
MEDIA: Soil

Relevant Equations:
(reduced form for 1E-6 target cancer risk)
PRG = 2.9e-4 / ((5e-5 x CSFinh) + (CSFinh x ((20/VF) + (20/PEF))))
(reduced form for target noncancer risk of unity)
PRG = 102 / ((5e-5 / RfDing) + (1/RfDinh)((20/VF) + (20/PEF)))

Input parameters:

LS =	100	(m)	ED =	7.88E+08 (sec)	PEF = 5.53E+09 (m2/kg)
V =	2.00	(m/s)	E =	0.35 (unitless)	
DH =	2.00	(m)	foc=	0.0320 (unitless)	
A =	1.50E+06	(cm2)	Ps =	2.65 (gm/cm3)	

Determine VF:
VF = (LS x V x DH / A)((sqrt(3.14 x a x ED))/(2 x Dei x E x Kas x 1e-3))
where: LS = Length of contaminated zone (m)
V = Wind speed in mixing zone (m/s)
DH = Diffusion height (m)
A = Area of contamination (cm2)
ED = Exposure duration (sec)
Dei = Effective diffusivity (cm2/s) = (Di x E^0.33)
E = Soil porosity (unitless)
Kas = Soil/air partition coefficient (gm soil/cm3 air) = ((1 x H / (Koc x foc))
Di = Diffusion coefficient in air (cm2/s)
and: a = (Dei X E) / E + (Ps(1 - E)/Kas))
where: Ps = Soil density (gm/cm3)

Chemical	Reference Dose (Oral) (mg/kg/day)	Reference Dose (Inhalation) (mg/kg/day)	Oral Cancer Slope Factor (mg-day/kg)	Inhalation Cancer Slope Factor (mg-day/kg)	Molecular Diffusivity (cm2/sec)	Henry's Law Constant (atm-m3/mol)	Organic Carbon Partition Coefficient (Koc)	Soil-to-Air Volatilization Factor (m3/kg)	Preliminary Risk-based Goal (Noncarcinogens) (mg/kg)	Preliminary Risk-based Goal (Carcinogens) (mg/kg)	Final Risk-based Goal (mg/kg)
Methylene chloride	6.00E-02 (1)	9.00E-01 (1)	7.50E-03 (1)	1.60E-03 (1)	1.01E-01 (2)	2.03E-03 (3)	8.80E+00 (3)	5.71E+02	2566.57	5.14	5.14
Aldrin	3.00E-05 (1)		1.70E+01 (1)	1.70E+01 (1)		1.60E-05 (3)	9.80E+04 (3)	0.00E+00	61.20	0.34	0.34
Dieldrin	5.00E-05 (1)		1.67E+01 (1)	1.60E+00 (1)		4.57E-10 (3)	1.70E+03 (3)	0.00E+00	102.00	34.71	34.71
4,4'-DDD			2.40E-01 (1)			2.20E-06 (3)	7.70E+05 (3)	0.00E+00	0.00	24.17	24.17
4,4'-DDE			3.40E-01 (1)			6.80E-05 (3)	4.40E+06 (3)	0.00E+00	0.00	17.06	17.06
4,4'-DDT	5.00E-04 (1)		3.40E-01 (1)	3.40E-01 (1)		1.58E-05 (3)	3.90E+06 (3)	0.00E+00	1020.00	17.06	17.06
Chlordane	6.00E-05 (1)		1.30E+00 (1)	1.30E+00 (1)		9.40E-05 (3)	1.40E+05 (3)	0.00E+00	122.40	4.46	4.46
Aroclor-1254			7.70E+00 (1)			2.60E-03 (3)	5.30E+03 (3)	0.00E+00	0.00	0.75	0.75
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00
								0.00E+00	0.00	0.00	0.00

(1) IRIS, On Line, September 1992.
(2) TSDF
(3) USEPA, December 1982.