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DRAFT
SITE INSPECTION REPORT

SITE 03: OLD CREOSOTE PLANT
MARINE CORPS BASE
CAMP LEJEUNE
JACKSONVILLE, NORTH CAROLINA

HALLIBURTON NUS PROJECT NUMBER 2F36

OCTOBER 1992

HALLIBURTON NUS
Environmental Corporation

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SITE INSPECTION REPORT

SITE 03: OLD CREOSOTE PLANT

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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DARYL HUTSON PROJECT MANAGER	VICKI L. BOMBERGER, LPG PROGRAM MANAGER

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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 Air Station (MCAS), New River as part of 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

The Old Creosote Plant operated from 1951 to 1952 to supply treated lumber during construction of the railroad on the base. Logs were cut into railroad ties at the onsite sawmill, then pressure treated with hot creosote stored in a railroad tank car. There is no indication of creosote disposal on site, and records show that creosote remaining in the pressure chamber at the end of a treatment cycle was stored for future use.

Upon completion of the railroad, the plant and mill were dismantled and sold. The only site features remaining are concrete pads and the boiler chimney.

FIELD ACTIVITIES

Five soil borings were completed as part of the field investigation conducted at the Old Creosote Plant site. In addition, three monitoring well borings were also sampled for subsurface soils. A total of 16 subsurface soil samples were analyzed for TCL semivolatile organics (base/neutral and acid extractables).

Three monitoring wells were installed at the Old Creosote Plant as part of the site investigation. 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. The groundwater was sampled for TCL semivolatile organics (base/neutral and acid extractables).

Two sediment samples were collected at the Old Creosote Plant site. These samples were collected in a drainage way that runs along the eastern perimeter of the site. The samples were obtained to evaluate whether the local water bodies could be adversely affected by contaminant releases from the site. All samples were analyzed for TCL semivolatile organics. Details of the field investigation performed at this site are summarized in Section 1.7 of this report.

CONCLUSIONS

The field investigation performed at this site is summarized in Section 2.0 of this report. The primary purpose was to determine whether a contamination problem existed on the site from its previous use as a creosote plant. 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.

One sample result for chrysene exceeded the cancer risk-based PRG for this chemical in soil and corresponds to an incremental cancer risk of approximately 2×10^{-6}. However, the risk associated with exposure to this chemical is below the 10^{-4} EPA upper risk range. No appreciable risk is associated with exposure to soils at Site 3.

One groundwater sample result for chrysene exceeded the Federal MCL for this chemical. Shallow groundwater at Site 3 is not currently used as a potable water source. Consequently, no risk as a result of exposure to this chemical can be identified.

Sediment contamination is believed to be below criteria for the protection of freshwater aquatic life based upon comparison to surface water quality standards.

RECOMMENDATIONS

Based upon the results of the preliminary risk assessment, a current cancer risk of approximately 2×10^{-6} is estimated for exposure to benzo(a)pyrene contamination in soils at Site 3. No additional risks could be identified as a result of soil exposure. However, further groundwater monitoring and possibly installation of additional monitoring wells to characterize the extent of transport of PAHs should be considered to address groundwater contamination. Additional source characterization may also be necessary.

No exceedence of criteria for sediment chemicals of concern was noted. However, surface water was not evaluated during this site investigation. Sampling of downstream surface waters and sediments may provide information regarding the potential impact on downstream locations.

1.0 SITE BACKGROUND

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 3: Old Creosote Plant.

This site was reviewed in the Initial Assessment Study (IAS) (Water and Air Research, 1983) and recommended for "No Further Action." It was determined to obtain field data and perform a risk assessment to further support this decision. There have been no previous investigations performed at this site. This section summarizes the scope and objectives of the investigation.

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 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 Old Creosote Plant is located at PWDM coordinates 5, N11-12/011-12, approximately 800 feet east of Building 613, on the opposite side of Holcomb Boulevard.

1.3 SITE LAYOUT

The general location of the site is shown in Figure 1-2. Its size is estimated to be 6 acres. The elevation range for the Old Creosote Plant is approximately 29-32 feet above mean sea level(MSL).

1.4 SITE OWNERSHIP HISTORY

The Old Creosote Plant operated from 1951 to 1952 to supply treated lumber during construction of the railroad on the base. Logs were cut into railroad ties at the onsite sawmill, then pressure treated with hot creosote stored in a railroad tank car. There is no indication of creosote disposal on site, and records show that creosote remaining in the pressure chamber at the end of a treatment cycle was stored for future use.

Upon completion of the railroad, the plant and mill were dismantled and sold. The only site features remaining are concrete pads and the boiler chimney.

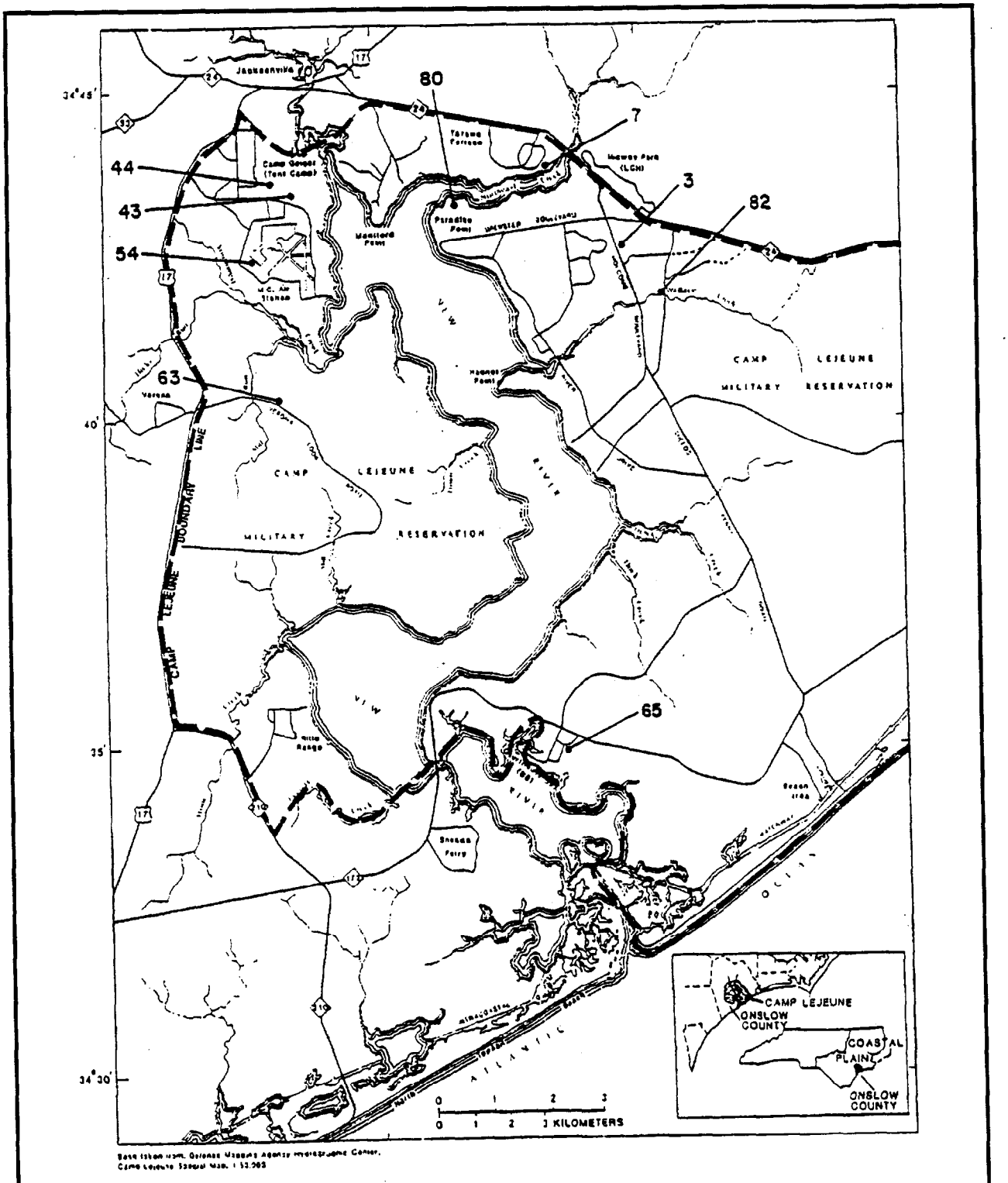

FIGURE 1-1
LOCATION MAP
MCB CAMP LEJEUNE

IAS site numbers are identified above with approximate locations.

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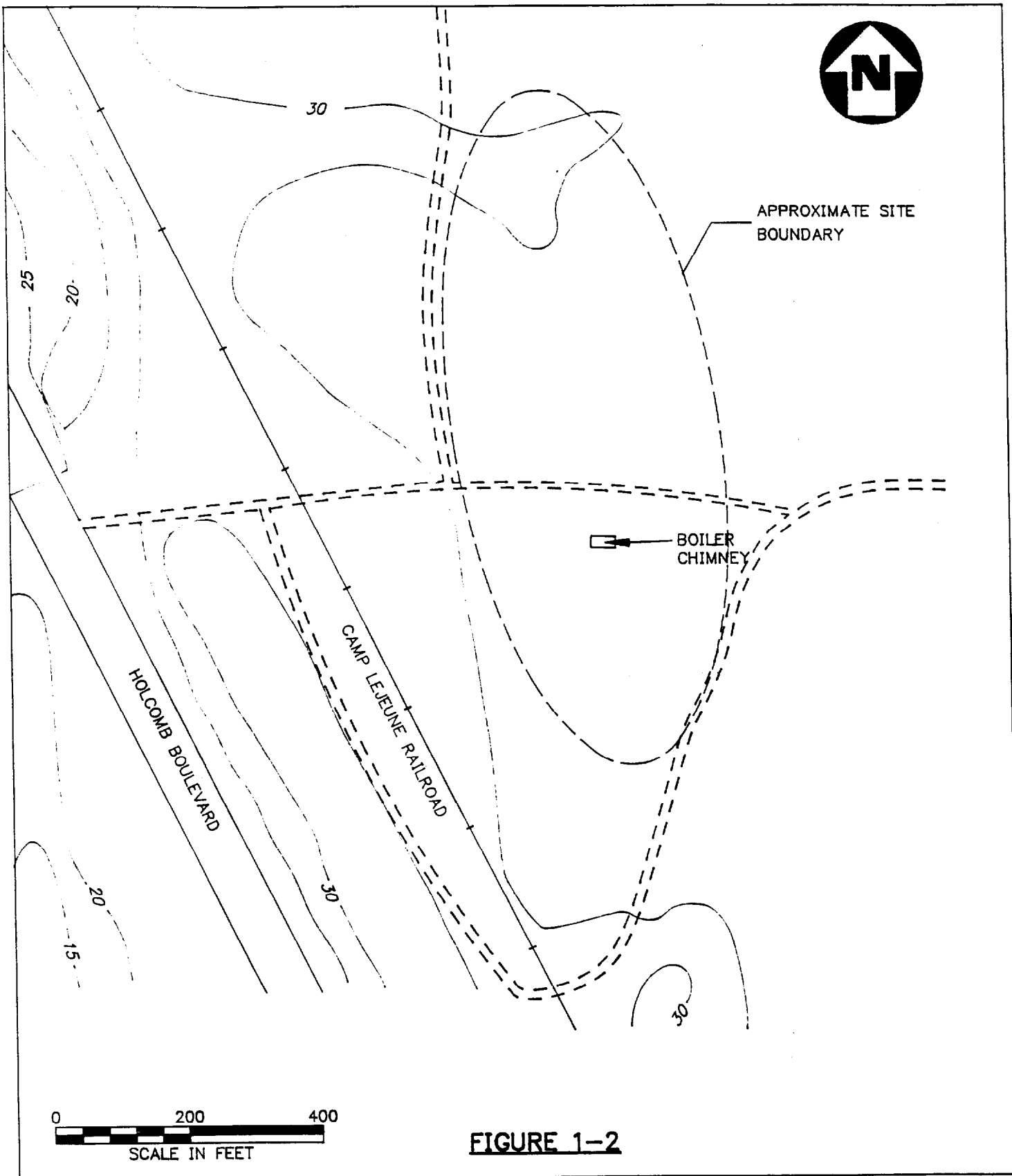

FIGURE 1-2

SITE LOCATION MAP
SITE 3: OLD CREOSOTE PLANT
MCB CAMP LEJEUNE

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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). The Initial Assessment Study (IAS) (Water and Air Research, Inc., March 1983), essentially equivalent to EPA's Superfund Program Preliminary Assessment (PA), collected and evaluated historical evidence indicating the existence of pollutants that may have contaminated the site. This study concluded that 22 of the original 76 sites warranted further study. Site 3: Old Creosote Plant, was originally identified as requiring no further action. This report presents the results of an additional data gathering and preliminary risk assessment performed to further characterize the site and provide recommendations as to their status.

1.6 REMEDIAL ACTIONS TO DATE

As discussed earlier, the Old Creosote Plant operated from 1951 to 1952 to supply treated lumber during construction of the railroad on the base. Upon completion of the railroad, the plant and mill were dismantled and sold. The only site features remaining are concrete pads and the boiler chimney. 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 Subsurface Soil Investigation

Five soil borings were completed as part of the field investigation conducted at the Old Creosote Plant site. In addition, three monitoring well borings were also sampled for subsurface soils. All borings were located on site and are depicted in Figure 1-3. 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.

Sixteen 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 17.0 to 25.0 feet. Soil borings were terminated at 5.0 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-

TABLE 1-1

FIELD INVESTIGATION SUMMARY
SITE 3 - OLD CREOSOTE PLANT
MCB CAMP LEJEUNE
JACKSONVILLE, NORTH CAROLINA

Component	Purpose	Description
Soil Borings	To obtain subsurface soil samples for chemical and physical analysis (site characterization).	Five onsite soil borings.
Subsurface Soil Sampling	Soil contaminant characterization.	Sixteen samples of the onsite subsurface soil.
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 the three new monitoring wells.
Sediment Sampling	Sediment contaminant characterization.	Two samples of the onsite surface sediments.
Background Sampling	To provide an estimation of background concentrations of metals.	One off-site soil sample analyzed for TLC inorganics.
Surveying	Locate all sampling sites.	Survey all sampling locations.

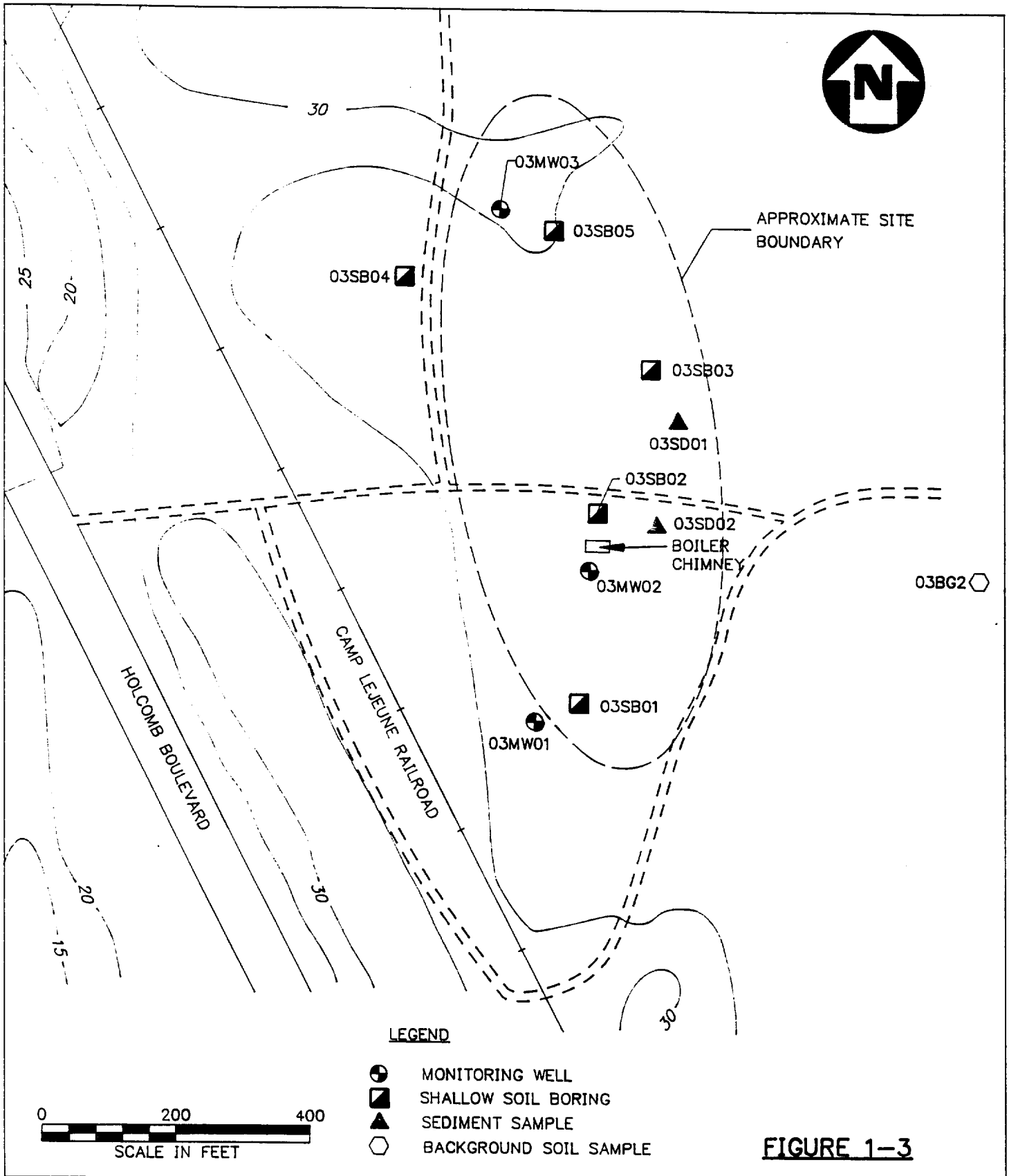

FIGURE 1-3

SAMPLING LOCATION MAP
SITE 3: OLD CREOSOTE PLANT
MCB CAMP LEJEUNE

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barrel sampler, they also were monitored with the HNu. HNu readings ranging from 0 to 4 parts per million (ppm) were observed when the subsurface soils were exposed. 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 to four subsurface soil samples were obtained from each well and soil boring. The first sample was obtained from the ground surface to a depth of two feet. In the soil borings, the second sample was obtained from 3.0 to 5.0 feet below the ground surface. In the well borings, samples were taken at five foot intervals from the ground surface to the water table. Only two samples from each borehole were obtained for chemical analyses. Both samples from the soil boring were analyzed for chemical constituents. From the well borings, the surface soil sample and the sample taken at the water table were analyzed. All soil borings were terminated at a depth of 5 feet because of the immobile nature of the polyaromatic hydrocarbons (PAHs) and chlorinated phenols expected to be present at the site. Soil borings were backfilled with a cement/bentonite grout following sampling. All well borings were terminated at approximately 5 feet below the ground water table. All other subsurface soil samples obtained during drilling were used for lithologic description only and retained on site.

A total of eighteen subsurface soil samples were analyzed by the Versar Laboratory in Springfield, Virginia, for TCL semivolatile organics (base/neutral and acid extractables). Appropriate QA/QC samples were incorporated in the sampling round. These included two duplicate soil samples.

1.7.2 Hydrogeologic Investigation

Three monitoring wells were installed at the Old Creosote Plant as part of the site investigation. The locations of the monitoring wells are shown in Figure 1-3. 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 4-foot by 4-foot square, 1-foot-thick concrete pad was constructed around each well. Four steel bumper posts filled with concrete were installed in the corners of the concrete pads.

The three monitoring wells were completed at depths ranging from 17.0 feet to 25.0 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 A and the Well Construction Diagrams in Appendix B. Table 1-2 presents a summary of the well construction data.

One round of groundwater sampling was conducted on June 16, 1991 from the three newly installed monitoring wells. All monitoring wells were developed after installation and purged prior to sampling in accordance with the Final Sampling and Analysis Plan. A dedicated stainless steel baller was used for purging and sampling. Appropriate QA/QC samples were incorporated in the sampling round. These included one rinsate blank. All samples were analyzed for TCL semivolatile organics.

1.7.2 Surface Water/Sediment Investigation

Two sediment samples were collected at the Old Creosote Plant site on June 10, 1991. These samples were collected in a drainage way that runs along the eastern perimeter of the site. The samples were obtained to evaluate whether the local water bodies could be adversely affected by contaminant releases from the site.

The sediment samples were obtained in accordance with the Final Sampling and Analysis Plan. A stainless steel trowel was used for sampling. Appropriate QA/QC samples were incorporated in the sampling round. These included one duplicate, one field blank, and one rinsate blank. All samples were analyzed for TCL semivolatile organics.

1.7.3 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. One of the three (BS-2) was obtained near the Old Creosote Plant site approximately 400 feet east of the boiler chimney in a wooded area south of Piney Green Road. Background soil sample BS-1 was obtained from a wooded area east of the Piney Green Road VOC 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 Old Creosote Plant 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 five soil borings, the two sediment samples, and the background soil sample. Additionally, the surveyor also surveyed the vertical and horizontal locations of the three installed monitoring wells, including ground surface, top of riser pipe and top of protective casing. The location map included as Figure 2-1 depicts these surveyed locations. Table 1-3 lists the coordinates and elevations of all surveyed sampling points at the Old Creosote Plant site.

TABLE 1-2

MONITORING WELL SUMMARY
SITE 3 - OLD CREOSOTE PLANT
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]
03MW01	31.35	35.40	25.0	14.5-24.5	25.50	9.90
03MW02	32.36	35.91	17.0	6.8-16.8	11.75	24.16
03MW03	29.39	32.66	18.0	7.8-17.8	12.10	20.56

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

TABLE 1-3

DETAILED SURVEY SUMMARY
SITE 3 - OLD CREOSOTE PLANT
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]	Coordinates[3]	
					Northing	Easting
03MW01	31.35	35.40	35.67	25.0	352554.139	2499893.340
03MW02	32.36	35.91	36.59	17.0	352780.199	2499975.570
03MW03	29.39	32.66	32.88	18.0	353318.929	2499842.415
03SB01	32.31	NA	NA	5.0	352582.400	2499958.864
03SB02	32.68	NA	NA	5.0	352866.648	2499987.710
03SB03	30.50	NA	NA	5.0	353081.681	2500066.755
03SB04	31.54	NA	NA	5.0	353217.322	2499698.586
03SB05	29.58	NA	NA	5.0	353287.828	2499922.045
03SD01	29.52	NA	NA	0.5	353003.055	2500107.873
03SD02	30.04	NA	NA	0.5	352847.420	2500075.969
BS-2	30.45	NA	NA	0.5	352769.166	2500559.903

[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 Old Creosote Plant 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 site is located at PWDM coordinates 5, N11-12/O 11-12, approximately 800 feet east of Building 613, on the opposite (east) side of Holcomb Boulevard. The area is a relatively flat, mostly cleared parcel of land with miscellaneous unrelated engineering and construction debris and trailers being stored on site. No visible contamination exists at the site. Remnants of the original creosote plant include the boiler chimney, rail spur, and cleared foundation areas. The area to the east of the boiler chimney is wet with areas of standing water. Site elevations vary from 29 to approximately 32 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

Several surface-water bodies and drainages within the vicinity of the Old Creosote Plant site are considered significant to this site investigation. These include surface waters within the site boundaries as well as the New River.

Surface waters and runoff from the site flow in both an easterly and westerly direction since runoff ditches flank the eastern and western edges of the site. To the east of the site is a small drainageway with intermittent areas of ponded water. Very little total flow, however, was observed during field activities. To the west of the site are several possible drainages that parallel the Camp Lejeune Railroad and Holcomb Boulevard. None of these potential drainages were under flow conditions during site activities.

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 25 feet of the subsurface. As a result, the geologic conditions at the site have been defined only to a depth of 25 feet.

The shallow subsurface geology of the study area consists of a surficial layer of unconsolidated fine grained sand with varying amounts of silt and rock fragments. This surficial layer is underlain by fine grained sand with thin, discontinuous silty sand lenses. Soil density ranged from very loose to medium dense. 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 Old Creosote Plant site is located in the near surface sands at depths ranging form approximately 10 to 25 feet below the ground surface. The large range in groundwater levels is believed to be caused be a rapid and pronounced change in surface topography across a relatively small area. Along the western edge of the site is a 10- to 15-foot drop in elevation to the Camp Lejeune Railroad bed. The close proximity of well 03MW01 to this drop off, and to a lesser extent well 03MW03, results in an anomalously low water level in the wells.

Based on the potentiometric surface map shown in Figure 2-1, groundwater flow direction across the site is sharply to the west toward Holcomb Boulevard. Although no in-situ hydraulic conductivity tests 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. As referenced in this document the estimated hydraulic conductivity value of the base soils are 35 feet/day.

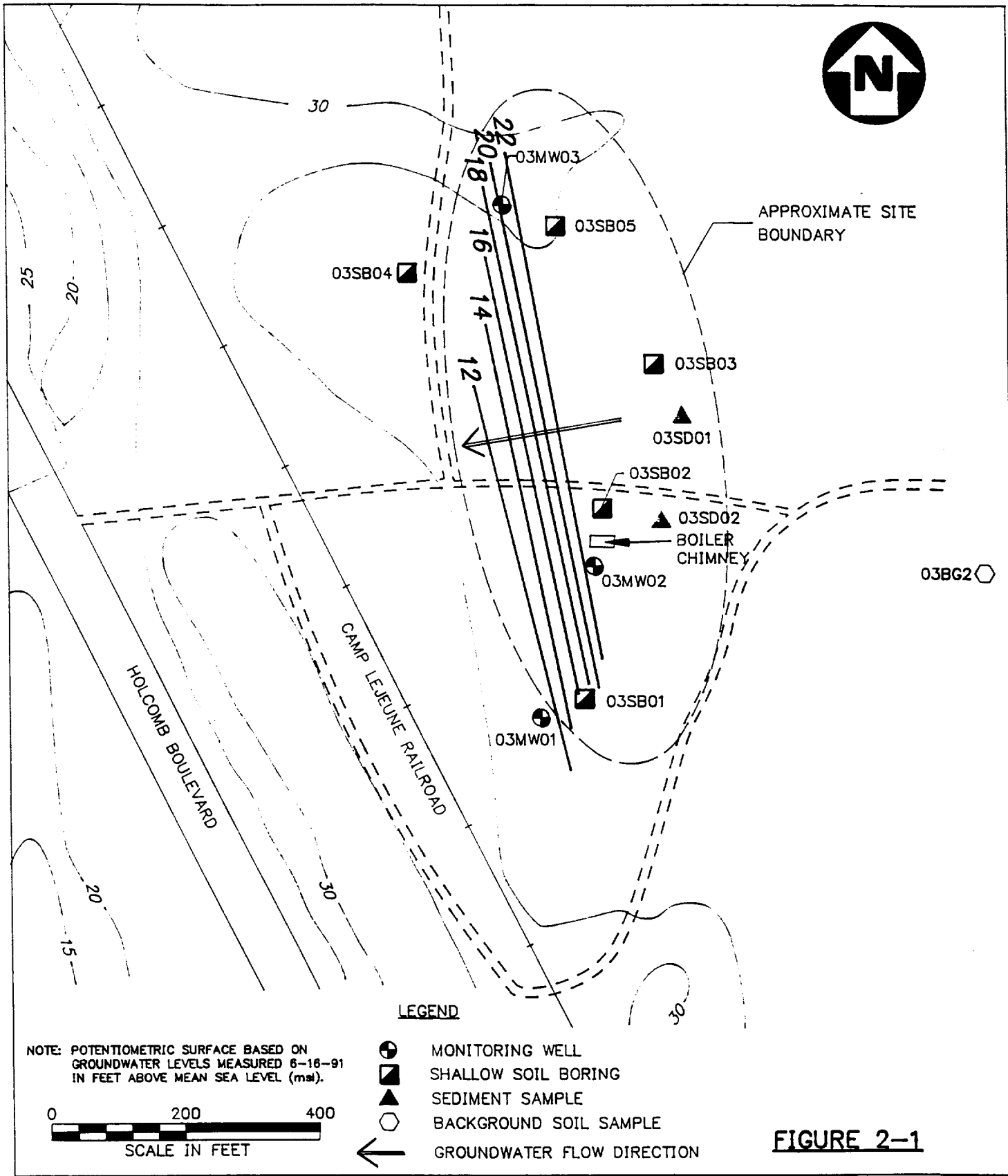

FIGURE 2-1

POTENTIOMETRIC SURFACE MAP
SITE 3: OLD CREOSOTE PLANT
MCB CAMP LEJEUNE

HALLIBURTON NUS
Environmental Corporation

The hydraulic gradient (i) at the site was calculated to be approximately 0.1 based on one round of synoptic water level measurements taken in the three newly installed wells, and surveyed well elevations. Based on an estimated hydraulic conductivity value of 35 feet/day, the average groundwater velocity ($v = K \times i$) is 3.5 feet/day. Based on this information, as well as the general topography of the site, it is likely that local groundwater flows west toward Holcomb Boulevard. Based on regional topography, however, and the sites close proximity to Wallace Creek, it is believed that at some distance away for the railroad groundwater may flow south toward Wallace Creek.

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 Old Creosote Plant within MCB Camp Lejeune, 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 general layout of the site consists of an open field with the only sign of the prior creosote plant being the original chimney and an abandoned railroad spur. The plant operated from 1951 to 1952 to supply treated lumber during construction of the railroad on the base. Logs were cut into railroad ties at the onsite sawmill, then pressure treated with hot creosote stored in a railroad tank car. There is no indication of creosote disposal on site, and records show that creosote remaining in the pressure chamber at the end of a treatment cycle was stored for future use.

Potential contaminants at the site include semi volatile organics (base/neutral and acid extractables). Chemical analyses of the media collected at the site was designed to characterize these potential contaminants.

3.2 WASTE LOCATIONS

Since the original layout of the Old Creosote Plant is unknown, the location of potential wastes is also unknown. Sample locations and types were chosen in an attempt 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 semivolatile organics (base/neutral and acid extractables). Groundwater and sediment samples were also analyzed for TCL semivolatile organics (base/neutral and acid extractables).

Analysis of the TCL semivolatile organics was performed according to the USEPA Contract Laboratory Program (CLP) Statement Of Work (SOW) dated February 1988 (2/88).

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).

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 3. Surface and subsurface soils are discussed in Section 4.3.1 and groundwater is discussed in Section 4.3.2. Sediment samples are discussed in Section 4.3.3. 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 18 soil samples were collected from five boring locations and three monitoring well borings installed at Site 3, as follows:

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

All soil samples were analyzed for Target Compound List semivolatile organics. 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 surficial soil samples from locations SB04 and MW02 (0 to 2 feet) contained a variety of polynuclear aromatic hydrocarbons (PAHs) at concentrations ranging from 260 μg/kg (benzo(g,h,i)perylene) to 2,200 μg/kg (benzo(b)fluoranthene). Other PAHs detected at concentrations greater than 1,000 μg/kg include chrysene, benzo(k)fluoranthene, benzo(a)pyrene, fluoranthene, pyrene, and indeno(1,2,3-cd)pyrene.

No PAHs were detected in any of the shallow subsurface soil samples (3 to 5 feet) collected at the site. However, in the deep sample collected from the zone above the water table in the MW02 boring (15 to 17 feet), a number of PAHs were detected at high concentrations. Some PAHs are fairly soluble, such as naphthalene and fluorene (see Section 5.1), but even less soluble compounds were detected in this deep sample. Several contaminants were found at concentrations greater than 35,000 μg/kg, such as acenaphthene, fluoranthene, fluorene, naphthalene, and phenanthrene. In addition, dibenzofuran was also detected at a concentration of 35,000 μg/kg.

This well was located in what might have been the center of the operations (approximately 100 feet south of the boiler chimney, which is still standing), and therefore would be expected to be more contaminated. In addition, the migration of PAHs through the soil may be aided by the sandy soil with assumed low organic carbon content (see Section 5.3).

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 semivolatile organics, and the analytical results are summarized in Table 4-2.

Of the three monitoring wells, only one (MW02) was found to contain any PAHs. Several PAHs were found in this well at concentrations greater than 1,000 μg/L (acenaphthene, 2-methylnaphthalene, naphthalene, and phenanthrene), as shown in Table 4-2. Other PAHs detected are anthracene (260 μg/L), chrysene (96 μg/L), fluoranthene (640 μg/L), fluorene (890 μg/L), and pyrene (460 μg/L). Dibenzofuran was also detected in this sample at a concentration of 1,100 μg/L.

TABLE 4-1

NATURE AND EXTENT OF SOIL CONTAMINATION[1]
SITE 3 - OLD CREOSOTE PLANT
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)
Acenaphthene	0/7	ND	0/5	ND	1/2	37,000
Anthracene	1/7	1,900	0/5	ND	1/2	8,600
Benzo(a)anthracene	2/7	460-660	0/5	ND	1/2	5,600
Benzo(b)fluoranthene	2/7	520-2,200	0/5	ND	1/2	2,300
Benzo(k)fluoranthene	2/7	420-1,200	0/5	ND	1/2	2,100
Benzo(g,h,i)perylene	2/7	260-720	0/5	ND	0/2	ND
Benzo(a)pyrene	2/7	320-1,300	0/5	ND	0/2	ND
Chrysene	2/7	750-1,400	0/5	ND	1/2	5,900
Fluoranthene	2/7	1,000-1,600	0/5	ND	1/2	35,000
Fluorene	0/7	ND	0/5	ND	1/2	35,000
Indeno(1,2,3-cd)pyrene	2/7	340-1,000	0/5	ND	0/2	ND
2-Methylnaphthalene	0/7	ND	0/5	ND	1/2	26,000
Naphthalene	1/7	550	0/5	ND	1/2	52,000
Phenanthrene	1/7	310	0/5	ND	1/2	81,000
Pyrene	2/7	920-1,400	0/5	ND	1/2	27,000
Dibenzofuran	0/7	ND	0/5	ND	1/2	35,000

ND Not detected.
[1] Complete data base in Appendix C.

TABLE 4-2

NATURE AND EXTENT OF GROUNDWATER CONTAMINATION[1]
SITE 3 - OLD CREOSOTE PLANT
MCB CAMP LEJEUNE
JACKSONVILLE, NORTH CAROLINA

Analyte	No. of Positive Detections/ No. of Samples	Range of Positive Detections (µg/L)	Location of Maximum Concentration
Acenaphthene	1/3	1,500	MW02
Anthracene	1/3	260	MW02
Chrysene	1/3	96	MW02
Fluoranthene	1/3	640	MW02
Fluorene	1/3	890	MW02
2-Methylnaphthalene	1/3	1,500	MW02
Naphthalene	2/3	9-4,400	MW02
Phenanthrene	1/3	1,600	MW02
Pyrene	1/3	460	MW02
Dibenzofuran	1/3	1,100	MW02

ND Not detected.
[1] Complete data base in Appendix C.

4.3.3 SEDIMENT

Two sediment samples and one duplicate sample were collected from low-lying areas of the site that collect water. All samples were analyzed for Target Compound List semivolatile organics. The analytical results are summarized in Table 4-3. Only bis(2-ethylhexyl)phthalate was detected, at a concentration of 750 μg/kg in sample SD01, which was collected on the far eastern side of the study area.

TABLE 4-3

NATURE AND EXTENT OF SEDIMENT CONTAMINATION[1]
SITE 3 - OLD CREOSOTE PLANT
MCB CAMP LEJEUNE
JACKSONVILLE, NORTH CAROLINA

Analyte	No. of Positive Detections/ No. of Samples	Range of Positive Detections (µg/kg)
Bis(2-ethylhexyl)phthalate	1/2	750

[1] Complete data base in Appendix C.

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 Old Creosote Plant 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. Some of the chemicals detected in site media have relatively high solubilities.

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 volatile organics may be relatively mobile in the environment, but may be retarded to some extent by adsorption.

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 could be expected to be present in the atmosphere or in soil gas.

5.1.1.4 Diffusion Coefficient

Diffusive transport of a chemical in a fluid between 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.

5.1.2 Transport Properties of Chemicals in Site Media

5.1.2.1 Soil

As discussed in Section 4.3, potential chemicals of concern for soil include a variety of Polynuclear Aromatic Hydrocarbons (PAHs) and dibenzofuran. These chemicals are common by-products of the combustion of petroleum fuels and exhibit similar chemical and physical characteristics.

Table 5-1 includes a summary of the chemical and physical properties for the organic chemicals detected in soils at Site 3.

5.1.2.2 Groundwater

As discussed in Section 4.3, PAHs and dibenzofuran are the only potential chemicals of concern for groundwater. Although some of these chemicals exhibit relatively high solubility in water, they mostly have negligible vapor pressures. Consequently, these chemicals have very low or no values reported for their Henry's Law Constants.

Table 5-1 includes a summary of the chemical and physical properties for the organic chemicals detected in groundwater at Site 3.

5.1.2.3 Surface Water

No surface water samples were collected at Site 3. No evaluation of the potential chemicals of concern can be made for this media.

5.1.2.4 Sediment

Two sediment samples collected at Site 3 were analyzed for TCL semivolatile compounds. One positive result was reported for bis(2-ethylhexyl)phthalate. The physical transport properties of this chemical is also presented in Table 5-1.

TABLE 5-1

ENVIRONMENTAL FATE AND TRANSPORT PARAMETERS FOR ORGANIC CHEMICALS
SITE 3 - OLD CREOSOTE PLANT
MCB CAMP LEJEUNE
JACKSONVILLE, NORTH CAROLINA

CAS Number	Chemical	Molecular Weight[1,2]	Specific Gravity (20/4°C)[2]	Vapor Pressure (mm Hg @ 20°C)[1,2]	Water Solubility (mg/L @ 20° C)[1]	Octanol/Water Partition Coefficient (Kow)[1]	Organic Carbon Partition Coefficient (Koc)[1]	Henry's Law Constant (atm-m³/mole)[1]	Diffusion Coefficient in Air (cm²/s)
117-81-7	Bis(2-ethylhexyl) phthalate	391	9.9×10^{-1}	2.0×10^{-7}	4.0×10^{-1} (@ 25°C)	4.1×10^{9}	2.0×10^{8}	3.0×10^{-7}	NA[7]
83-32-9	Acenaphthene	154.2	$1.189 \times 10^{0[6]}$	1.55×10^{-3} (@ 25°C)	3.42×10^{0} (@ 25°C)	9.6×10^{3}	4.6×10^{3}	9.1×10^{-5}	NA
120-12-7	Anthracene	178.2	1.25×10^{0}	1.7×10^{-5} (@ 25°C)	4.5×10^{-2} (@ 25°C)	2.8×10^{4}	1.4×10^{4}	8.6×10^{-5}	NA
56-55-3	Benzo(a)anthracene	228.3	NA	2.2×10^{-8}	5.7×10^{-3}	4.1×10^{5}	2.0×10^{5}	1.0×10^{-6}	NA
205-99-2	Benzo(b)fluoranthene	252.3	NA	5.0×10^{-7}	1.4×10^{-2} (@ 25°C)	1.15×10^{6}	5.5×10^{5}	1.22×10^{-5}	NA
207-08-9	Benzo(k)fluoranthene	252.3	NA	5.0×10^{-7}	4.3×10^{-3} (@ 25°C)	1.15×10^{6}	5.5×10^{5}	3.87×10^{-5}	NA
191-24-2	Benzo(g,h,i)perylene	276	NA	1.03×10^{-10} (@ 25°C)	2.6×10^{-4} (@ 25°C)	3.2×10^{6}	1.6×10^{6}	1.44×10^{-7}	NA
50-32-8	Benzo(a)pyrene	252	NA	5.6×10^{-9} (@ 25°C)	3.8×10^{-3} (@ 25°C)	1.15×10^{6}	5.5×10^{5}	4.9×10^{-7}	NA
218-01-9	Chrysene	228.3	1.274×10^{0}	6.3×10^{-9} (@ 25°C)	1.8×10^{-3} (@ 25°C)	4.1×10^{5}	2.0×10^{5}	1.05×10^{-6}	NA
206-44-0	Fluoranthene	202.3	NA	5.0×10^{-6} (@ 25°C)	2.6×10^{-1} (@ 25°C)	7.9×10^{4}	3.8×10^{4}	6.5×10^{-6}	NA
86-73-7	Fluorene	116.2	$1.202 \times 10^{0[6]}$	7.1×10^{-4}	1.7×10^{0} (@ 25°C)	1.5×10^{4}	7.3×10^{3}	6.4×10^{-5}	NA
193-39-5	Indeno(1,2,3-cd) pyrene	276.3	NA	1.0×10^{-10}	5.3×10^{-4} (@ 25°C)	3.2×10^{6}	1.6×10^{6}	6.95×10^{-8}	NA

TABLE 5-1
ENVIRONMENTAL FATE AND TRANSPORT PARAMETERS FOR ORGANIC CHEMICALS
SITE 3 - OLD CREOSOTE PLANT
MCB CAMP LEJEUNE
JACKSONVILLE, NORTH CAROLINA
PAGE TWO

CAS Number	Chemical	Molecular Weight [1][2]	Specific Gravity (20/4°C) [2]	Vapor Pressure (mm Hg @ 20°C) [1][2]	Water Solubility (mg/L @ 20° C)[1]	Octanol/Water Partition Coefficient (Kow)[1]	Organic Carbon Partition Coefficient (Koc)[1]	Henry's Law Constant ($atm\text{-}m^3/mole$)[1]	Diffusion Coefficient in Air (cm^2/s)
91-20-3	Naphthalene	128.2	1.152×10^{0}	8.7×10^{-2} (@ 25°C)	3.2×10^{1} (@ 25°C)	1.95×10^{3}	9.4×10^{2}	4.6×10^{-4}	NA
91-57-6	2-Methylnaphthalene	142.2	9.94×10^{-1}	NA	2.7×10^{1} (@ 25°C)	1.82×10^{4}[6]	2.5×10^{3}[3][4]	NA	NA
85-01-8	Phenanthrene	178.2	1.025×10^{0}	9.6×10^{-4} (@ 25°C)	1.0×10^{0} (@ 25°C)	2.8×10^{4}	1.4×10^{4}	2.26×10^{-4}	NA
129-00-0	Pyrene	202.3	1.271×10^{0}[5]	2.5×10^{-6} (@ 25°C)	1.3×10^{-1} (@ 25°C)	8.0×10^{4}	3.8×10^{4}	5.1×10^{-6}	NA

[1] U.S. EPA, December 1982.
[2] Verscheuren, 1983.
[3] No data available; data for similar compound 1-methylnaphthalene.
[4] Lyman, et al., 1990, eq. 4-6.
[5] Windholtz, 1983.
[6] Lyman, et al., 1990, eq. 2-20.
[7] NA - Value not available or not applicable (nonvolatile constituents not subject to volatile emissions from soil).

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 particles due to wind erosion of partially vegetated ground surfaces. For Site 3, these migration pathways are applicable to soil only, because volatile chemicals were not detected in surface water, the only other potential source media for air transport.

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

No surface water was observed in the drainage ditches at Site 3, however, this migration pathway can be significant during storm events. Contaminant migration of soluble 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 also act as a contaminant source for sediment or soils.

5.1.2.4 Sediment

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

5.2 POTENTIAL RECEPTORS, EXPOSURE PATHWAYS, AND SENSITIVE ENVIRONMENTS

This section provides identification of current potential receptors to chemical exposure. Also discussed are the exposure pathways and mechanisms by which the identified receptors can come into contact with media containing chemicals of concern. 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 exists because no domestic or production wells are located at or near Site 3.

5.2.2.4 Surface Water

Exposure to surface water at the Old Creosote Plant Site is limited to two shallow drainage ditches adjacent to the site. Because they are shallow, complete immersion of a receptor is unlikely. Realistic exposures are limited to incidental ingestion and direct dermal contact (over a reduced skin surface).

No surface water was observed at Site 3 during investigative activities, however, exposure may occur when the drainage ditches at the site contain runoff water.

5.2.2.5 Sediment

Sediment exposure is directly associated with surface water contact and the exposure routes include incidental ingestion and dermal contact.

It should be noted that transport of chemicals across the skin barrier is controlled by a large degree by the media in which it is contained. Aqueous chemical transport is mostly controlled by chemical specific permeability constants, whereas absorption of chemicals in sediment matrices is more closely associated with absorption of chemicals in soil (controlled by adherence factors and absorption percentages).

5.2.3 Sensitive Environments

No sensitive environments exist immediately adjacent to Site 3. The two drainage ditches that drain the site discharge into a series of intermittent ponds and to drainage ditches along Holcomb Boulevard and the Camp Lejeune Railroad. No sensitive environments can be identified downstream of the site based upon site observations.

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 Old Creosote Plant 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 3.

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. No surface waters were evaluated in association with the site investigation at Site 3.

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. No North Carolina State groundwater standards are available for the potential chemicals of concern detected in groundwater at Site 3.

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. No surface waters were investigate in association with the site investigation at Site 3.

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. No surface waters were investigated in association with the site investigation at Site 3.

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:

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

$$Sediment_{Criteria} = AWQC_{sw} \times K_{p} \qquad \text{(metals only)}$$

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.

Additional sediment screening criteria are applicable for sediments in USEPA Region IV. No criteria are provided for sediment potential chemicals of concern at Site 3.

5.3.1.8 Lead

Soil cleanup goals for lead contamination have been established by the United States Environmental Protection Agency at 500 to 1000 parts per million. The exact goal is dependent upon site conditions and potential receptors. These values are based on toxicological studies of lead exposure by children and are the lower range values that result in an increase in blood lead levels above background levels (USEPA Office of Solid Waste and Remedial Response, OSWER Directive #9355.4-02, September 7,1989).

5.3.1.9 Background Concentrations

As discussed in Section 4.1 , background samples were taken from three locations in and around Camp Lejeune in areas suspected to be free of contamination to determine native concentrations of metals. Background soils were not analyzed for organic compounds, consequently, all positive results reported organic compounds in soil samples are conservatively assumed to be above background levels.

5.3.2 Risk-Based Criteria

Enforceable standards have not been specified for many of the chemicals of concern at Site 3; 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 Vol 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 3 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 25 years, and the

routes of exposure evaluated are incidental ingestion and inhalation of volatiles and particulates. The minimum concentration goal calculated for target carcinogenic (1×10^{-6}) and noncarcinogenic (unity) risks 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. For example, the Reference Dose for lead has been revoked pending an evaluation of its carcinogenicity, but because lead is considered to be a site-related contaminant, an older published value is presented.

5.4 COMPARISON WITH CRITERIA

This section provides a media-specific comparison of analytical data for Site 3 to standards, criteria, and/or preliminary remediation goals.

5.4.1 Soil

Sixteen potential chemicals of concern were detected in soil samples from Site 3. The frequency of occurrence and range of positive results reported for soil samples is 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 5-3 presents a summary of PRGs and analytical data for the chemicals of concern in soil.

Fourteen soil samples (and two field duplicate samples) were collected at the Old Creosote Plant Site. Of the fourteen, at most three samples contained concentrations of potential chemicals of concern above analytical detection limits.

One positive result reported for benzo(a)pyrene (1.3 mg/Kg) exceeded the $1x10^{-6}$ cancer risk-based PRG for this chemical of 0.79 mg/Kg. This exceedence would result in a cancer risk of $2x10^{-6}$ ($1.3/0.79 \times 10^{-6}$) for this individual chemical. This cancer risk is below the 10^{-4} EPA upper range goal for carcinogens.

No other positive results for any of the detected compounds exceeded respective risk-based PRGs for that compound. No risks are expected from exposure to soils at Site 3 from these chemicals.

5.4.2 Groundwater

A summary of the chemicals detected via analysis of groundwater samples collected at Site 3 was provided in Table 4-3. The potential chemicals of concern included PAHs and dibenzofuran. Table 5-4 provides a comparison of concentrations of potential chemicals of concern detected in at least one of the groundwater samples with appropriate standards/criteria. The criteria used for comparative purposes are the Federal MCLs for each of the potential chemicals of concern. No risk-based PRGs were used for comparison because no current groundwater usage exists.

The Federal MCL for chrysene of 0.2 ug/L was exceeded in one groundwater sample collected from Site 3. The sample result of 96 ug/L is well above the MCL value. No other Federal or State standard/criteria was

TABLE 5-2

REGULATORY REQUIREMENTS AND DOSE-RESPONSE PARAMETERS FOR CHEMICALS OF CONCERN
SITE 3 - OLD CREOSOTE PLANT
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	
Acenaphthene		6×10^{-2}			0.017				D
Anthracene		3×10^{-1}							D
Benzo(a)anthracene	0.0001[w]						7.3×10^{-1}	$8.8\ 10^{-1}$	B2
Benzo(b)fluoranthene	0.0002[w]						7.3×10^{-1}	8.5×10^{-1}	B2
Benzo(k)fluoranthene	0.0002[w]						7.3×10^{-1}	4.0×10^{-2}	B2
Benzo(a)pyrene	0.0002[w]						7.3×10^{0}	2.7×10^{-2}	B2
Chrysene	0.0002[w]						7.3×10^{-2}	2.7×10^{-2}	B2
Fluoranthene		4×10^{-2}			0.0398				D
Fluorene		4×10^{-2}							D
Indeno(1,2,3-cd)pyrene	0.0004[w]						7.3×10^{-3}	1.4×10^{0}	B2
2-Methylnaphthalene									D
Naphthalene		4×10^{-3}			0.062	1-Day/Child: 0.5 10-Day/Child: 0.5 Longer-term/Child: 0.04 Longer-term/Adult: 1.0 Lifetime/Adult: 0.02			D
Phenanthrene									

TABLE 5-2
REGULATORY REQUIREMENTS AND DOSE-RESPONSE PARAMETERS FOR CHEMICALS OF CONCERN
SITE 3 - OLD CREOSOTE PLANT
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][M] (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	
Pyrene		3×10^{-2}							D
Dibenzofuran									
Bis(2-ethylhexyl) phthalate	0.004[M]	2×10^{-2}			0.0003		1.4×10^{-2}		B2

[1] U.S. EPA, April 1992.
[2] U.S. EPA, January 1991.
[3] U.S. EPA, October 1986.
[M] Proposed.
[N] Total PAHs.

TABLE 5-3

OBSERVED CONCENTRATIONS VERSUS STANDARDS/CRITERIA - SOIL
SITE 3 - OLD CREOSOTE PLANT
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]
Acenaphthene	1/14	37	122,400[3]	0/1
Anthracene	2/14	1.9 - 8.6	612,000[3]	0/2
Benzo(a)anthracene	3/14	0.46 - 5.6	7.95[4]	0/3
Benzo(b)fluoranthene	3/14	0.52 - 2.3	7.95[4]	0/3
Benzo(k)fluoranthene	3/14	0.42 - 2.1	7.95[4]	0/3
Benzo(g,h,i)perylene	2/14	0.26 - 0.72	NR[5]	NA[5]
Benzo(a)pyrene	2/14	0.32 - 1.3	0.79[4]	1/2
Chrysene	3/14	0.75 - 5.9	79.5[4]	0/3
Fluoranthene	3/14	1 - 35	81,600[3]	0/3
Fluorene	1/14	35	81,600[3]	0/1
Indeno(1,2,3-cd)pyrene	2/14	0.34 - 1	7.95[4]	0/2
2-Methylnaphthalene	1/14	26	NR[5]	NA[5]
Naphthalene	2/14	0.55 - 52	320[3]	0/2
Phenanthrene	2/14	0.31 - 81	NR[5]	NA[5]
Pyrene	3/14	0.92 - 27	193[3]	0/3
Dibenzofuran	1/14	35	NR[5]	NA[5]

(1) Number of positive detections per number of samples.
(2) Number of exceedences per number of positive detections.
(3) Based on a Hazard Quotient of 1.0. See Appendix D.
(4) Based on a cancer risk of 1×10^{-6}. See Appendix D.
(5) NR - Not Reported, no dose-response data available, NA - Not Applicable.

TABLE 5-4

OBSERVED CONCENTRATIONS VERSUS STANDARDS/CRITERIA - GROUNDWATER
SITE 3 - OLD CREOSOTE PLANT
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]
Acenaphthene	1/3	1,500	NR[4]	NA[4]
Anthracene	1/3	260	NR[4]	NA[4]
Chrysene	1/3	96	0.2[3]	1/1
Fluoranthene	1/3	640	NR[4]	NA[4]
Fluorene	1/3	890	NR[4]	NA[4]
2-Methylnaphthalene	1/3	1,500	NR[4]	NA[4]
Naphthalene	2/3	9 - 4,400	NR[4]	NA[4]
Phenanthrene	1/3	1,600	NR[4]	NA[4]
Pyrene	1/3	460	NR[4]	NA[4]
Dibenzofuran	1/3	1,100	NR[4]	NA[4]

(1) Number of positive detections per number of samples.
(2) Number of exceedences per number of positive detections.
(3) Federal MCL.
(4) NR - Not Reported; NA - Not Applicable.

available for the other potential chemicals of concern at Site 3. No current usage of the groundwater is noted for Site 3, consequently, no risk to chrysene is evident.

5.4.3 Surface Water

Surface water was not evaluated during the site investigation at Site 3.

5.4.4 Sediment

A summary of the frequency of occurrence and range of positive results for sediment samples collected at and near Site 3 were presented in Table 4-4. Bis(2-ethylhexyl)phthalate was the only organic compound detected. This compound was detected in one sediment sample.

Table 5-5 provides a summary of the analytical results and comparison to criteria for the sediment chemical of concern. No exceedence is noted for the sediment chemical of concern.

5.5 SUMMARY AND CONCLUSIONS

This section provides a summary of the preliminary risk assessment and presents recommendations for future activities at Site 3.

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 exceedence of criteria on a media-specific basis.

One sample result for chrysene exceeded the cancer risk-based PRG for this chemical in soil and corresponds to an incremental cancer risk of approximately 2×10^{-6}. However, the risk associated with exposure to this chemical is below the 10^{-4} EPA upper risk range. No appreciable risk is associated with exposure to soils at Site 3.

One groundwater sample result for chrysene exceeded the Federal MCL for this chemical. Shallow groundwater at Site 3 is not currently used as a potable water source. Consequently, no risk as a result of exposure to this chemical can be identified.

Sediment contamination is believed to be below criteria for the protection of freshwater aquatic life based upon comparison to surface water quality standards.

5.5.2 Recommendations

Based upon the results of the preliminary risk assessment, a current cancer risk of approximately 2×10^{-6} is estimated for exposure to benzo(a)pyrene contamination in soils at Site 3. No additional risks could be identified as a result of soil exposure. However, further groundwater monitoring and possibly installation of additional monitoring wells to characterize the extent of transport of PAHs should be considered to address groundwater contamination. Additional source characterization may also be necessary.

No exceedence of criteria for sediment chemicals of concern was noted. However, surface water was not evaluated during this site investigation. Sampling of downstream surface waters and sediments may provide information regarding the potential impact on downstream locations.

TABLE 5-5

OBSERVED CONCENTRATIONS VERSUS STANDARDS/CRITERIA - SEDIMENT
SITE 3 - OLD CREOSOTE PLANT
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]
bis(2-ethylhexyl)phthalate	1/2	0.75	19,200[3]	0/1

(1) Number of positive detections per number of samples.
(2) Number of exceedences per number of positive detections.
(3) Criterion based on U.S. EPA Region IV chronic screening value for surface water and assumed fractional organic carbon content of 3.2% (equilibrium partitioning).

6.0 CONCLUSIONS AND RECOMMENDATIONS

This section presents a summary of the field investigation for Site 3: Old Creosote Plant, 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 2.0 of this report. The primary purpose was to determine whether a contamination problem existed on the site from its previous use as a creosote plant. 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.

One sample result for chrysene exceeded the cancer risk-based PRG for this chemical in soil and corresponds to an incremental cancer risk of approximately 2×10^{-6}. However, the risk associated with exposure to this chemical is below the 10^{-4} EPA upper risk range. No appreciable risk is associated with exposure to soils at Site 3.

One groundwater sample result for chrysene exceeded the Federal MCL for this chemical. Shallow groundwater at Site 3 is not currently used as a potable water source. Consequently, no risk as a result of exposure to this chemical can be identified.

Sediment contamination is believed to be below criteria for the protection of freshwater aquatic life based upon comparison to surface water quality standards.

6.2 RECOMMENDATIONS

Based upon the results of the preliminary risk assessment, a current cancer risk of approximately 2×10^{-6} is estimated for exposure to benzo(a)pyrene contamination in soils at Site 3. No additional risks could be identified as a result of soil exposure. However, further groundwater monitoring and possibly installation of additional monitoring wells to characterize the extent of transport of PAHs should be considered to address groundwater contamination. Additional source characterization may also be necessary.

No exceedence of criteria for sediment chemicals of concern was noted. However, surface water was not evaluated during this site investigation. Sampling of downstream surface waters and sediments may provide information regarding the potential impact on downstream locations.

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APPENDIX A

BORING LOGS

BORING LOG — **NUS CORPORATION**

PROJECT: CAMP LEJEUNE — BORING NO.: 03SB01
PROJECT NO.: 2F36 — DATE: 6-11-91 — DRILLER: L. CA SM. LA H. I.
ELEVATION: 32.31 — 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 CONSCESS	REMARKS
	30	4 5					WHITE SAND - 2"		
S-1 1305	40	7 4	0.8/2.0		MED. DENSE	BROWN	FINE SAND SOME SILT POORLY GRADED	SM	S: 0-2 2 PPM - NAD CAMP-LEJ
				3.0					
	40	5 3							
S-2 1310		3 3	1.7/2.0		LOOSE	TAN-LT BROWN	SAND SOME SILT POORLY GRADED	SM	S-2 3-4 CAMP-LEJ MK-51 1PPM - NAD
	60			5.0					
							SPLIT SPOON 3-5'		
							EOB - 5'		
							2 - 2" - SPLIT SPOONS		

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

BORING 03SB01

PAGE 1 : 1

BORING LOG — **NUS CORPORATION**

PROJECT: CAMP LEJEUNE — BORING NO.: 03SB02
PROJECT NO.: 2F36 — DATE: 6-11-91 — DRILLER: C. CHIEM (A.H.I.)
ELEVATION: 32.68 — 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	USCS OR ROCK CORE SIZE	REMARKS
	0.0	10/9				WHITE	SAND - 3" THICK		
S-1 1135	2.0	10/14	1.8/2.0		V. STIFF	BROWN	SILT TR V. FINE SAND	ML	S-1 0-2' [illegible] SAMPLE DRY [illegible]
				3.0					[illegible]
	4.0	9/9							
S-2 1145		14/9	1.0/2.0		MED DEN	BROWN	SILTY FINE SAND	SM	S-2 3-5' [illegible] MOIST SATURATED
	6.0			5.0					POSSIBLE FIBERGLASS LINE WATER PIPING SET OFF
									CLAY LEAKS TO CENTER [illegible]
									SEWERS TYP. [illegible]
							SPLIT SPOON 3-5'		
							EOB 5'		
							2" I.D SPLIT SPOON S		

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

BORING 03SB02

PAGE 1 : 1

BORING LOG — **NUS CORPORATION**

PROJECT: CAMP LEJEUNE — BORING NO.: 03SB03
PROJECT NO.: 2F36 — DATE: 6-11-91 — DRILLER: L CHISM
ELEVATION: 30.50 — 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	MATERIAL DESCRIPTION: COLOR	MATERIAL DESCRIPTION: MATERIAL CLASSIFICATION	BOREHOLE CONSCRESS	REMARKS
	0.0	7/5					WHITE SAND 2" THICK		
S-1 1355	2.0	6/3	0.5/2.0		STIFF	BROWN-BROWN	SILT W SAND TR ROCK FRAG	M	S-1 0-2' DRY - 0 ppm
				3.0					DUPM-HNU
	4.0	2/3							
S-2 1356		7/5	1.3/2.0		MEDIUM DENSE	WHITE BROWN	SAND SOME SILT SAND..	SM	S-2 3-5' MOIST
	5.0			5.0			POORLY GRADED FINE		0.4 ppm - HNU
							SPLIT SPOON 3-5'		
							EOB 5'		
							2-2' SPOONS		

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

BORING 03SB03

PAGE 1 OF 1

BORING LOG — **NUS CORPORATION**

PROJECT: CAMP LEJEUNE — BORING NO.: GB SB04
PROJECT NO.: 2536 — DATE: 6-11-91 — DRILLER: C. CHISM, H. HILL
ELEVATION: 31.54 — FIELD GEOLOGIST: D. HOST
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	USCS BOREHOLE CONSCESS	REMARKS
	0.0	3/2				WHITE	FINE SAND		
S-1 1427	2.0	1/1	2/0		V. LOOSE	BROWN	SILT + SAND POORLY GRADED	SM	S-1 0-2 CRY-DAMP 0 PPM-INV
				3.0					
	4.0	3/2							
S-2 1427		2/4	2.0/2.0			WHITE	FINE SAND TR SILT	SM	S-2 3-5 DAMP
	6.0			5.0			POORLY GRADED		0.4 PPM-INV
							SPLIT SPOON 3-5'		
							FOR <'		

REMARKS: MOBILE B-61 RIG 4 1/4 INCH I.D. HOLLOW STEM AUGER; 2" I.D SPLIT SPOONS.

BORING GB SB 04

PAGE 1 : 1

BORING LOG — **NUS CORPORATION**

PROJECT: CAMP LEJEUNE — BORING NO.: 03 SB 05
PROJECT NO.: 2F26 — DATE: 6-6-91 — DRILLER: S. CHAPMAN
ELEVATION: 29.58 — FIELD GEOLOGIST: C. 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	USCS OR BOUAZZA CODES	REMARKS
	0.0	3 5				WHITE	SAND - 3" TOPSOIL		
S-1 1325	2.0	7 6	2.0/2.0		MEDIUM DENSE	WHITE BROWN	SAND SOME SILT	SM	S-1 C-2 DAMP SL. MOIST
				3.0			POORLY GRADED		0PPM-HNU
	4.0	5 5							
S-2 1330		5 7	1.8/2.0		MEDIUM DENSE	WHITE LT BROWN	SAND - TR SILT SANDIS	SM	S-2 3-5 DAMP
	6.0			5.0			POORLY GRADED FINE		0PPM. HNU
							SPLIT SPOON 3-5'		
							EOB. 5.0		

REMARKS: MOBILE B-61 R-6 4¼" I.D HOLLOW STEM AUGERS 2" I.D SPLIT SPOONS FOR SAMPLES

BORING 03 of 05

PAGE 1 of 1

BORING LOG — **NUS CORPORATION**

PROJECT: CAMP LEJEUNE — BORING NO.: SSMW01
PROJECT NO.: 2F36 — DATE: 6-12-91 — DRILLER: C. CHISM (LIMITED)
ELEVATION: 31.35 — 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	MATERIAL DESCRIPTION: COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK SCHEME	REMARKS
	0.0	4/7					SILT SAND TR ROOT FRAG		
S-1 1035	2.0	7/4	1.5/2.0	2.0	LOOSE	BROWN	SILT SAND TR ROOTFRAG		
						WHITE	SAND TR SILT	SM	S-1 0-2' * SOME ROOTLA DRY
	4.0								FROM HNU
	6.0								
	8.0	5/5							
S-2 1040		2/2	1.9/2.0		LOOSE	WHITE	SAND TR SILT	SM	S-2 7-9 DAMP
	10.0						POORLY GRADED		1PPM-HNU
		4/3							
S-3 1045	12.0	4/4	1.9/2.0		LOOSE	WHITE TAN	SAND TR SILT	SM	S-3 10-12 MOIST
							POORLY GRADED		1PPM-HNU
	14.0								
	16.0	4/4				V			
S-4 1048		4/3	2.0/2.0		LOOSE	TAN-ORANGE	SAND SOME SILT	SM	S-4 15-17 PLENTY OF MOIST - SATURATED
	18.0						POORLY GRADED		1PPM-HNU SATURATED IN 16'
									SAMPLE TO LAB 15-16'
	20.0								
					MEDIUM DENSE	ORANGE RUSTY RED	SAND SOME SILT	SM	
	22.0						POORLY GRADED		
	24.0								
				25.0	MEDIUM DENSE	ORANGE RUSTY RED	SAND SOME SILT	SM	

EOB = 25.0

REMARKS: MOBILE B-61 R-6 4¼ INCH I.D. HOLLOW STEM AUGERS 2" I.D. SPLIT SPOONS FOR LITHOLOGICAL SAMPLES

BORING SSMW01

PAGE 1 OF 1

BORING LOG — **NUS CORPORATION**

PROJECT: CAMP LEJEUNE — BORING NO.: [illegible]
PROJECT NO.: 2F36 — DATE: 6-12-91 — DRILLER: [illegible]
ELEVATION: 32.36 — FIELD GEOLOGIST: C. 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 OR ROCK CORES	REMARKS
	0.0	7 / 16					[illegible] SAND [illegible] FRAG [illegible]		[illegible]
S-1 0.0-2.0	2.0	[illegible]	1.0 / 2.0	2.0	[illegible]	BROWN	SILT SAND TR BLACK FRAG	SM	S: 0-2 LRY
					[illegible]	[illegible]	FINE SAND		HPPM - ANU
	4.0								
	6.0	7 / 16							
S-2 6.0-8.0		[illegible]	1.7 / [illegible]		MEDIUM DENSE	WHITE	FINE SAND SOME SILT	SM	S-2 6.0-8.0 MOIST
	8.0						POORLY GRADED		HPPM - ANU
									WATER 9' DRILLER
	10.0								
		10 / 9							
S-3 12.0-14.0	12.0	9 / 7	2.0 / 2.0		[illegible] DENSE	WHITE	SAND TR SILT	SM	S-3 12.0-14.0 SATURATED
							[illegible] GRAVEL GRAINS		HPPM - ANU
	14.0								
	16.0	[illegible] / 7					[illegible] / GRADED		
S-4 [illegible]		5 / 8	2.0 / 2.0	17.1	[illegible]	WHITE	SAND TR SILT	SM	[illegible] SATURATED
	18.0						NOTE: THIS SAMPLE CONTAINS [illegible]		HPPM - ANU
							[illegible]		NO RECOVERY FROM 8 - 20 AUGERS
	20.0								
							BOTTOM 17.0		
	22.0						[illegible] BE SCREENED 7-17		
							4-2" SPOONS		
	24.0								

REMARKS: MOBILE B61 RIG. 4 1/4 INCH I.D. HOLLOW STEM AUGERS.

BORING: SBMW02

PAGE 1 : 1

BORING LOG — **NUS CORPORATION**

PROJECT: CAMP LEJEUNE — BORING NO.: SBMW03
PROJECT NO.: 2126 — DATE: 6-11-91 — DRILLER: L.CENTER
ELEVATION: 29.39 — 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 UNSUCCESSFUL	REMARKS
	0.0	2 3				VARIED	FINE SAND - 2" TOPSOIL		
S1 1455	2.0	2 2	1.4/2.0		SOFT	GRAY-BROWN	SILT w F SAND	ML	S1 0-2 * SENT TO LAB FOR LAB ANALYSIS
									1PPM - BKGD
	4.0						GETS MORE SANDY		
	6.0	3 5							
S2 1457		7 5	1.2/2.0		VARIED CLAYS	WHITE TAN	FINE SAND SOME SILT	SM	S-2 5-7 MOIST
	8.0						POORLY GRADED		1PPM - BKGD
S3 1507		9 16	1.0/2.0		MEDIUM DENSE	WHITE TAN	FINE SAND TR SILT	SW	S-3 7-9 * SENT TO LAB MOIST
	10.0			▽			POORLY GRADED		OPPM - BKGD
S4 1517	12.0		2.0/2.0			WHITE TAN	FINE SAND TR SILT	SW	S-4 10-12 SATURATED
							POORLY GRADED		0PPM - BKGD
	14.0	2 2							
S5 1527		2 2	2.0/2.0		LOOSE	WHITE TAN	FINE SAND TR SILT	SW	S-5 15-17 SATURATED
	16.0						POORLY GRADED		OPPM - BKGD
	18.0			18.0					
							BOTM 18.0		
	20.0								
							5 2" SPLIT SPOONS		

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

BORING 1 of 1
PAGE 1 of 1

APPENDIX B

WELL CONSTRUCTION DIAGRAMS

NUS CORPORATION
A Halliburton Company

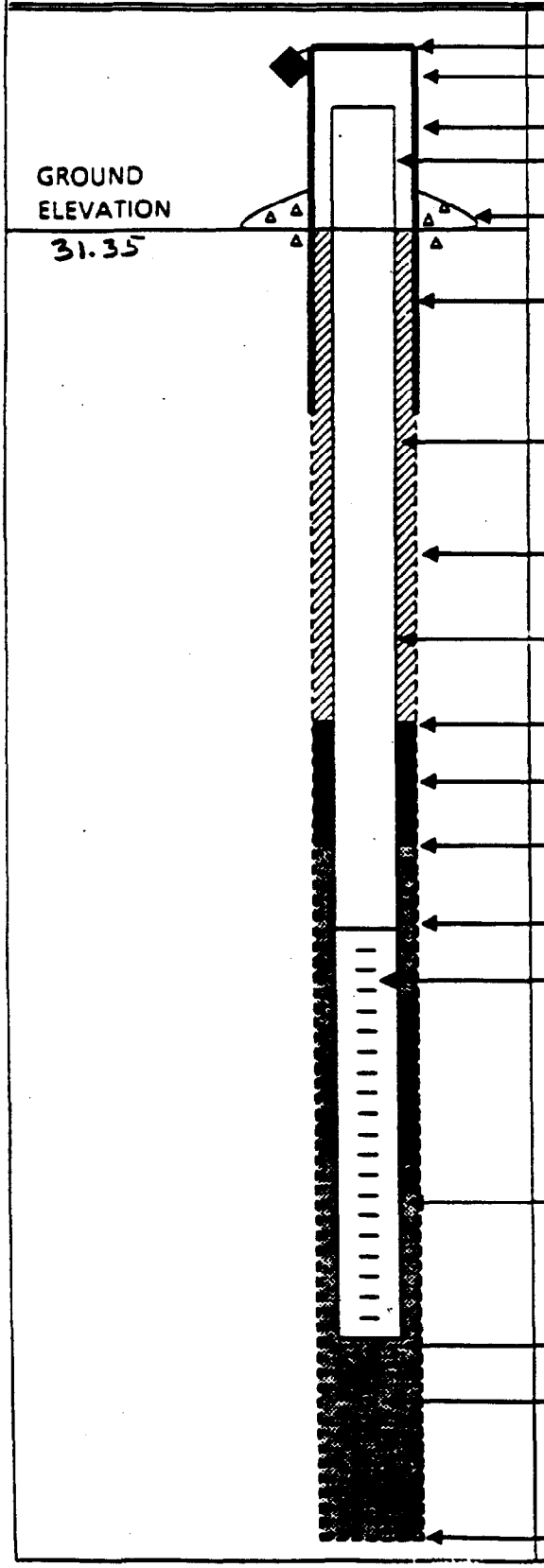
BORING NO. 03MW01

OVERBURDEN
MONITORING WELL SHEET

PROJECT CAMP LEJEUNE
PROJECT NO. 2F36
ELEVATION 31.35
FIELD GEOLOGIST D. YOST

LOCATION CAMP LEJEUNE N.C.
BORING 03MW01
DATE 6-12-91

DRILLER SCHRUM (H.N.E.)
DRILLING METHOD H.S.A.
DEVELOPMENT METHOD AIR LIFT



ELEVATION OF TOP OF SURFACE CASING: 35.67
ELEVATION OF TOP OF RISER PIPE: 35.40
STICK - UP TOP OF SURFACE CASING: 4.32
STICK - UP RISER PIPE: 4.05
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: 10.0
TYPE OF SEAL: BENTONITE
DEPTH TOP OF SAND PACK: 12.0
ELEVATION / DEPTH TOP OF SCREEN: 14.5
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: 24.5
ELEVATION / DEPTH BOTTOM OF SAND PACK: 25.0
TYPE OF BACKFILL BELOW OBSERVATION WELL: SILICA SAND
ELEVATION / DEPTH OF HOLE: 25.0

NUS CORPORATION
A Halliburton Company

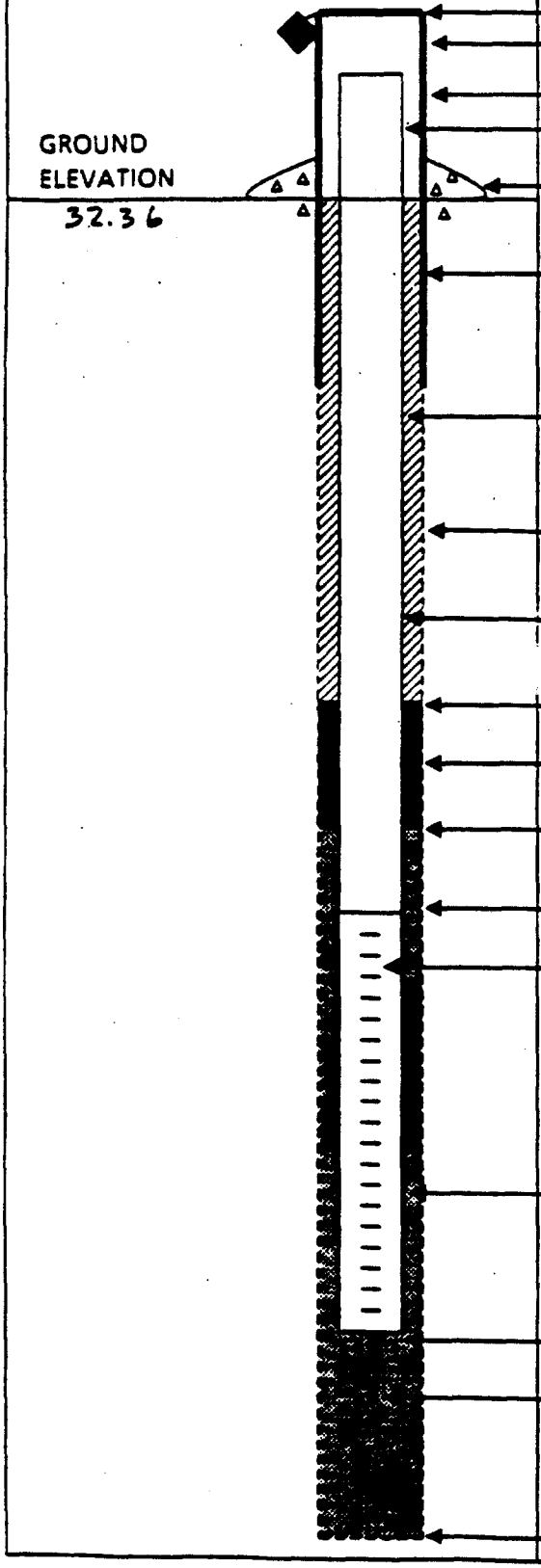
BORING NO. 03MW02

OVERBURDEN
MONITORING WELL SHEET

PROJECT CAMP LEJEUNE
PROJECT NO. 2F36
ELEVATION 32.36
FIELD GEOLOGIST D. YOST

LOCATION CAMP LEJEUNE N.C.
BORING 03MW02
DATE 6-12-91

DRILLER [illegible]
DRILLING METHOD H S A.
DEVELOPMENT METHOD AIR LIFT



ELEVATION OF TOP OF SURFACE CASING: 36.59
ELEVATION OF TOP OF RISER PIPE: 35.91

STICK - UP TOP OF SURFACE CASING: 4.23
STICK - UP RISER PIPE: 3.55

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: 2.0

TYPE OF SEAL: BENTONITE

DEPTH TOP OF SAND PACK: 4.0'

ELEVATION / DEPTH TOP OF SCREEN: 6.6'

TYPE OF SCREEN: PVC

SLOT SIZE x LENGTH [illegible] x 10'

I.D. OF SCREEN: [illegible] PVC

TYPE OF SAND PACK [illegible]

ELEVATION / DEPTH BOTTOM OF SCREEN: 16.6'

ELEVATION / DEPTH BOTTOM OF SAND PACK: 17.0'

TYPE OF BACKFILL BELOW OBSERVATION WELL: [illegible]

ELEVATION / DEPTH OF HOLE: 17.0

NUS CORPORATION
A Halliburton Company

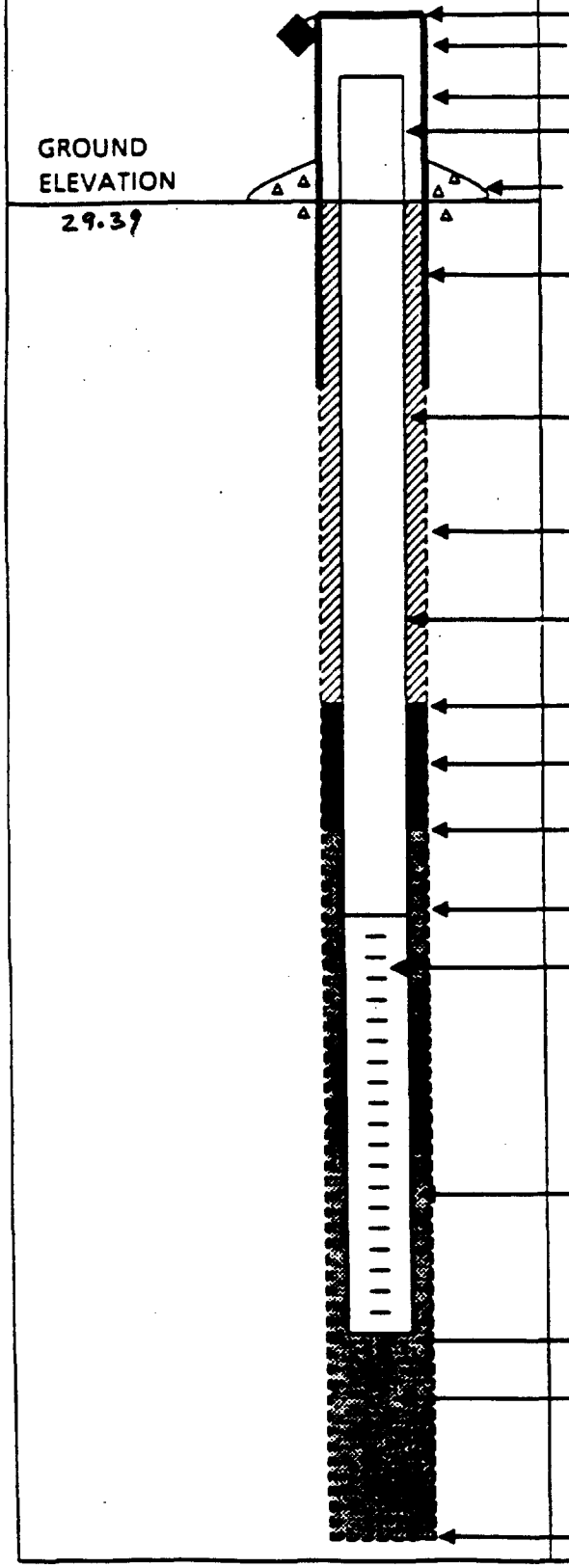
BORING NO 03MW03

OVERBURDEN
MONITORING WELL SHEET

PROJECT CAMP LEJEUNE
PROJECT NO. 2F36
ELEVATION 29.39
FIELD GEOLOGIST D. YOST

LOCATION CAMP LEJEUNE N.C
BORING 03MW03
DATE 6-11-91

DRILLER SCHISM (H.E.)
DRILLING METHOD H.S. AUGERS
DEVELOPMENT METHOD AIR LIFT



ELEVATION OF TOP OF SURFACE CASING: 32.88
ELEVATION OF TOP OF RISER PIPE: 32.66
STICK - UP TOP OF SURFACE CASING: 3.49
STICK - UP RISER PIPE : 3.27
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: 4.0
TYPE OF SEAL: BENTONITE
DEPTH TOP OF SAND PACK: 6.0'
ELEVATION / DEPTH TOP OF SCREEN: 7.8'
TYPE OF SCREEN: PVC
SLOT SIZE x LENGTH: 0.20 x 10'
I.D. OF SCREEN: 2 INCH
TYPE OF SAND PACK: 0.02 SILICA SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: 17.8
ELEVATION / DEPTH BOTTOM OF SAND PACK: 18.0
TYPE OF BACKFILL BELOW OBSERVATION WELL: SILICA SAND
ELEVATION / DEPTH OF HOLE: 18.0

APPENDIX C

CHEMICAL ANALYTICAL RESULTS

SEMIVOLATILE ANALYSIS (ug/kg)
SITE: CAMP LEJEUNE - SITE 03
CASE: 4961

SAMPLE LOCATION:		SB01-0002	SB01-0305	SB02-0002	SB02-0002-D	SB02-0305	SB03-0002	SB03-0305	SB04-0002
SAMPLE NUMBER:									
QC DESIGNATION:	CRQL				FIELD DUPLICATE				
PHENOL	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
BIS(2-CHLOROETHYL)ETHER	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
2-CHLOROPHENOL	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
1,3-DICHLOROBENZENE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
1,4-DICHLOROBENZENE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
BENZYL ALCOHOL	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
1,2-DICHLOROBENZENE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
2-METHYLPHENOL	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
BIS(2-CHLOROISOPROPYL)ETHER	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
4-METHYLPHENOL	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
N-NITROSODI-N-PROPYLAMINE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
HEXACHLOROETHANE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
NITROBENZENE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
ISOPHORONE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
2-NITROPHENOL	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
2,4-DIMETHYLPHENOL	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
BENZOIC ACID	1600	R	R	1700 U	1800 U	1900 U	1700 U	2000 U	1700 U
BIS(2-CHLOROETHOXY)METHANE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
2,4-DICHLOROPHENOL	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
1,2,4-TRICHLOROBENZENE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
NAPHTHALENE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
4-CHLORANILINE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
HEXACHLOROBUTADIENE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
4-CHLORO-3-METHYLPHENOL	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
2-METHYLNAPHTHALENE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
HEXACHLOROCYCLOPENTADIENE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
2,4,6-TRICHLOROPHENOL	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
2,4,5-TRICHLOROPHENOL	1600	R	R	1700 U	1800 U	1900 U	1700 U	2000 U	1700 U
2-CHLORONAPHTHALENE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
2-NITROANILINE	1600	R	R	1700 U	1800 U	1900 U	1700 U	2000 U	1700 U
DIMETHYL PHTHALATE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
ACENAPHTHYLENE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
2,6-DINITROTOLUENE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
3-NITROANILINE	1600	R	R	1700 U	1800 U	1900 U	1700 U	2000 U	1700 U
ACENAPHTHENE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
2,4-DINITROPHENOL	1600	R	R	1700 U	1800 U	1900 U	1700 U	2000 U	1700 U
4-NITROPHENOL	1600	R	R	1700 U	1800 U	1900 U	1700 U	2000 U	1700 U

SEMIVOLATILE ANALYSIS (ug/kg)
SITE: CAMP LEJEUNE - SITE 03
CASE: 4961

SAMPLE LOCATION:		SB01-0002	SB01-0305	SB02-0002	SB02-0002-D	SB02-0305	SB03-0002	SB03-0305	SB04-0002
SAMPLE NUMBER:									
QC DESIGNATION:	CRQL				FIELD DUPLICATE				
DIBENZOFURAN	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
2,4-DINITROTOLUENE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
DIETHYL PHTHALATE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
4-CHLOROPHENYL-PHENYLETHER	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
FLUORENE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
4-NITROANILINE	1600	R	R	1700 U	1800 U	1900 U	1700 U	2000 U	1700 U
4,6-DINITRO-2-METHYLPHENOL	1600	R	R	1700 U	1800 U	1900 U	1700 U	2000 U	1700 U
N-NITROSODIPHENLYAMINE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
4-BROMOPHENYL-PHENYLETHER	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
HEXACHLOROBENZENE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
PENTACHLOROPHENOL	1600	R	R	1700 U	1800 U	1900 U	1700 U	2000 U	1700 U
PHENANTHRENE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
ANTHRACENE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
DI-N-BUTYLPHTHALATE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
FLUORANTHENE	330	R	R	360 U	380 U	390 U	350 U	400 U	1000
PYRENE	330	R	R	360 U	380 U	390 U	350 U	400 U	920
BUTYLBENZYLPHTHALATE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
3,3'-DICHLOROBENZIDINE	660	R	R	710 U	750 U	780 U	710 U	800 U	700 U
BENZO(a)ANTHRACENE	330	R	R	360 U	380 U	390 U	350 U	400 U	660
CHRYSENE	330	R	R	360 U	380 U	390 U	350 U	400 U	750
BIS(2-ETHYLHEXYL)PHTHALATE	330	R	R	360 U	380 U	390 U	350 U	400 U	350 U
DI-N-OCTYLPHTHALATE	330	R	R	360 UJ	380 UJ	390 U	350 U	400 U	350 U
BENZO(b)FLUORANTHENE	330	R	R	360 UJ	380 UJ	390 U	350 U	400 U	520
BENZO(k)FLUARANTHENE	330	R	R	360 UJ	380 UJ	390 U	350 U	400 U	420
BENZO(a)PYRENE	330	R	R	360 UJ	380 UJ	390 U	350 U	400 U	320 J
INDENO(1,2,3-cd)PYRENE	330	R	R	360 UJ	380 UJ	390 U	350 U	400 U	340 J
DIBENZ(a,h)ANTHRACENE	330	R	R	360 UJ	380 UJ	390 U	350 U	400 U	350 U
BENZO(ghi)PERYLENE	330	R	R	360 UJ	380 UJ	390 U	350 U	400 U	260 J
% MOISTURE:		5	12	8	13	16	7	19	6
DILUTION FACTOR:		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
DATE SAMPLED:		6/11/91	6/11/91	6/11/91	6/11/91	6/11/91	6/11/91	6/11/91	6/11/91
DATE EXTRACTED:		6/17/91	6/17/91	6/17/91	6/17/91	6/17/91	6/17/91	6/17/91	6/17/91
DATE ANALYZED:		7/24/91	7/24/91	7/23/91	7/23/91	7/24/91	7/24/91	7/24/91	7/25/91
ASSOCIATED BLANKS:		03SD02-F	03SD02-F	03SD02-F	03SD02-F	03SD02-F	03SD02-F	03SD02-F	03SD02-F
		[illegible]	[illegible]-R	03SD[illegible]	[illegible]02-R	03SD[illegible]	[illegible]D02-R	03SD[illegible]	[illegible]SD02-F

SEMIVOLATILE ANALYSIS (ug/kg)
SITE: CAMP LEJEUNE - SITE 03
CASE: 4961

SAMPLE LOCATION:		SB04-0305	SB04-0305-D	SB05-0002	SB05-0305	MW01-0002	MW01-1516	MW02-0002	MW02-1517
SAMPLE NUMBER:									
QC DESIGNATION:	CRQL		FIELD DUPLICATE						
PHENOL	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
BIS(2-CHLOROETHYL)ETHER	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
2-CHLOROPHENOL	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
1,3-DICHLOROBENZENE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
1,4-DICHLOROBENZENE	330	360 U	350 U	370 U	380 U	350 UJ	400 U	690 U	8600 U
BENZYL ALCOHOL	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
1,2-DICHLOROBENZENE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
2-METHYLPHENOL	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
BIS(2-CHLOROISOPROPYL)ETHER	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
4-METHYLPHENOL	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
N-NITROSODI-N-PROPYLAMINE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
HEXACHLOROETHANE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
NITROBENZENE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
ISOPHORONE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
2-NITROPHENOL	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
2,4-DIMETHYLPHENOL	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
BENZOIC ACID	1600	1700 U	1700 U	1800 U	1800 U	1700 U	2000 U	3400 U	42000 U
BIS(2-CHLOROETHOXY)METHANE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
2,4-DICHLOROPHENOL	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
1,2,4-TRICHLOROBENZENE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
NAPHTHALENE	330	360 U	350 U	370 U	380 U	350 U	400 U	550 J	52000
4-CHLORANILINE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
HEXACHLOROBUTADIENE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
4-CHLORO-3-METHYLPHENOL	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
2-METHYLNAPHTHALENE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	26000
HEXACHLOROCYCLOPENTADIENE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
2,4,6-TRICHLOROPHENOL	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
2,4,5-TRICHLOROPHENOL	1600	1700 U	1700 U	1800 U	1800 U	1700 U	2000 U	3400 U	42000 U
2-CHLORONAPHTHALENE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
2-NITROANILINE	1600	1700 U	1700 U	1800 U	1800 U	1700 U	2000 U	3400 U	42000 U
DIMETHYL PHTHALATE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
ACENAPHTHYLENE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
2,6-DINITROTOLUENE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
3-NITROANILINE	1600	1700 U	1700 U	1800 U	1800 U	1700 U	2000 U	3400 U	42000 U
ACENAPHTHENE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	37000
2,4-DINITROPHENOL	1600	1700 U	1700 U	1800 U	1800 U	1700 U	2000 U	3400 U	42000 U
4-NITROPHENOL	1600	1700 U	1700 U	1800 U	1800 U	1700 U	2000 U	3400 U	42000 U

SEMIVOLATILE ANALYSIS (ug/kg)
SITE: CAMP LEJEUNE - SITE 03
CASE: 4961

SAMPLE LOCATION:		SB04-0305	SB04-0305-D	SB05-0002	SB05-0305	MW01-0002	MW01-1516	MW02-0002	MW02-1517
SAMPLE NUMBER:									
QC DESIGNATION:	CRQL		FIELD DUPLICATE						
DIBENZOFURAN	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	35000
2,4-DINITROTOLUENE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
DIETHYL PHTHALATE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
4-CHLOROPHENYL-PHENYLETHER	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
FLUORENE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	35000
4-NITROANILINE	1600	1700 U	1700 U	1800 U	1800 U	1700 U	2000 U	3400 U	42000 U
4,6-DINITRO-2-METHYLPHENOL	1600	1700 U	1700 U	1800 U	1800 U	1700 U	2000 U	3400 U	42000 U
N-NITROSODIPHENLYAMINE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
4-BROMOPHENYL-PHENYLETHER	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
HEXACHLOROBENZENE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
PENTACHLOROPHENOL	1600	1700 U	1700 U	1800 U	1800 U	1700 U	2000 U	3400 U	42000 U
PHENANTHRENE	330	360 U	350 U	370 U	380 U	350 U	400 U	310 J	81000
ANTHRACENE	330	360 U	350 U	370 U	380 U	350 U	400 U	1900	8600
DI-N-BUTYLPHTHALATE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
FLUORANTHENE	330	360 U	350 U	370 U	380 U	350 U	400 U	1600	35000
PYRENE	330	360 U	350 U	370 U	380 U	350 U	400 U	1400	27000
BUTYLBENZYLPHTHALATE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
3,3'-DICHLOROBENZIDINE	660	720 U	700 U	730 U	750 U	690 U	810 U	1400 U	17000 U
BENZO(a)ANTHRACENE	330	360 U	350 U	370 U	380 U	350 U	400 U	460 J	5600 J
CHRYSENE	330	360 U	350 U	370 U	380 U	350 U	400 U	1400	5900 J
BIS(2-ETHYLHEXYL)PHTHALATE	330	360 U	350 U	370 U	380 U	350 U	400 U	690 U	8600 U
DI-N-OCTYLPHTHALATE	330	360 U	350 U	370 U	380 U	350 UJ	400 U	690 UJ	8600 U
BENZO(b)FLUORANTHENE	330	360 U	350 U	370 U	380 U	350 UJ	400 U	2200 J	2300 J
BENZO(k)FLUARANTHENE	330	360 U	350 U	370 U	380 U	350 UJ	400 U	1200 J	2100 J
BENZO(a)PYRENE	330	360 U	350 U	370 U	380 U	350 UJ	400 U	1300 J	8600 U
INDENO(1,2,3-cd)PYRENE	330	360 U	350 U	370 U	380 U	350 UJ	400 U	1000 J	8600 U
DIBENZ(a,h)ANTHRACENE	330	360 U	350 U	370 U	380 U	350 UJ	400 U	690 UJ	8600 U
BENZO(ghi)PERYLENE	330	360 U	350 U	370 U	380 U	350 UJ	400 U	720 J	8600 U
% MOISTURE:		8	6	11	13	6	19	5	23
DILUTION FACTOR:		1.0	1.0	1.0	1.0	1.0	1.0	2.0	20
DATE SAMPLED:		6/11/91	6/11/91	6/11/91	6/11/91	6/12/91	6/12/91	6/12/91	6/12/91
DATE EXTRACTED:		6/17/91	6/17/91	6/17/91	6/17/91	6/17/91	6/17/91	6/17/91	6/17/91
DATE ANALYZED:		7/25/91	7/25/91	7/24/91	7/24/91	7/23/91	7/23/91	7/23/91	7/25/91
ASSOCIATED BLANKS:		03SD02-F	03SD02-F	03SD02-F	03SD02-F	03SD02-F	03SD02-F	03SD02-F	03SD02-F

[redacted] 3SD0[redacted] 2-R [redacted] 03SD[redacted] 02-F [redacted] 03[redacted] D02[redacted] 0[redacted] R [redacted] 3SD0[redacted]

SEMIVOLATILE ANALYSIS (ug/kg)
SITE: CAMP LEJEUNE - SITE 03
CASE: 4961

SAMPLE LOCATION:		MW03-0002	MW03-0709
SAMPLE NUMBER:			
QC DESIGNATION:	CRQL		
PHENOL	330	350 U	370 U
BIS(2-CHLOROETHYL)ETHER	330	350 U	370 U
2-CHLOROPHENOL	330	350 U	370 U
1,3-DICHLOROBENZENE	330	350 U	370 U
1,4-DICHLOROBENZENE	330	350 U	370 U
BENZYL ALCOHOL	330	350 U	370 U
1,2-DICHLOROBENZENE	330	350 U	370 U
2-METHYLPHENOL	330	350 U	370 U
BIS(2-CHLOROISOPROPYL)ETHER	330	350 U	370 U
4-METHYLPHENOL	330	350 U	370 U
N-NITROSODI-N-PROPYLAMINE	330	350 U	370 U
HEXACHLOROETHANE	330	350 U	370 U
NITROBENZENE	330	350 U	370 U
ISOPHORONE	330	350 U	370 U
2-NITROPHENOL	330	350 U	370 U
2,4-DIMETHYLPHENOL	330	350 U	370 U
BENZOIC ACID	1600	1700 U	1800 U
BIS(2-CHLOROETHOXY)METHANE	330	350 U	370 U
2,4-DICHLOROPHENOL	330	350 U	370 U
1,2,4-TRICHLOROBENZENE	330	350 U	370 U
NAPHTHALENE	330	350 U	370 U
4-CHLORANILINE	330	350 U	370 U
HEXACHLOROBUTADIENE	330	350 U	370 U
4-CHLORO-3-METHYLPHENOL	330	350 U	370 U
2-METHYLNAPHTHALENE	330	350 U	370 U
HEXACHLOROCYCLOPENTADIENE	330	350 U	370 U
2,4,6-TRICHLOROPHENOL	330	350 U	370 U
2,4,5-TRICHLOROPHENOL	1600	1700 U	1800 U
2-CHLORONAPHTHALENE	330	350 U	370 U
2-NITROANILINE	1600	1700 U	1800 U
DIMETHYL PHTHALATE	330	350 U	370 U
ACENAPHTHYLENE	330	350 U	370 U
2,6-DINITROTOLUENE	330	350 U	370 U
3-NITROANILINE	1600	1700 U	1800 U
ACENAPHTHENE	330	350 U	370 U
2,4-DINITROPHENOL	1600	1700 U	1800 U
4-NITROPHENOL	1600	1700 U	1800 U

SEMIVOLATILE ANALYSIS (ug/kg)
SITE: CAMP LEJEUNE - SITE 03
CASE: 4961

SAMPLE LOCATION:		MW03-0002	MW03-0709
SAMPLE NUMBER:			
QC DESIGNATION:	CRQL		
DIBENZOFURAN	330	350 U	370 U
2,4-DINITROTOLUENE	330	350 U	370 U
DIETHYL PHTHALATE	330	350 U	370 U
4-CHLOROPHENYL-PHENYLETHER	330	350 U	370 U
FLUORENE	330	350 U	370 U
4-NITROANILINE	1600	1700 U	1800 U
4,6-DINITRO-2-METHYLPHENOL	1600	1700 U	1800 U
N-NITROSODIPHENLYAMINE	330	350 U	350 U
4-BROMOPHENYL-PHENYLETHER	330	350 U	350 U
HEXACHLOROBENZENE	330	350 U	350 U
PENTACHLOROPHENOL	1600	1700 U	1800 U
PHENANTHRENE	330	350 U	370 U
ANTHRACENE	330	350 U	370 U
DI-N-BUTYLPHTHALATE	330	350 U	370 U
FLUORANTHENE	330	350 U	370 U
PYRENE	330	350 U	370 U
BUTYLBENZYLPHTHALATE	330	350 U	370 U
3,3'-DICHLOROBENZIDINE	660	700 U	740 U
BENZO(a)ANTHRACENE	330	350 U	370 U
CHRYSENE	330	350 U	370 U
BIS(2-ETHYLHEXYL)PHTHALATE	330	350 U	370 U
DI-N-OCTYLPHTHALATE	330	350 U	370 U
BENZO(b)FLUORANTHENE	330	350 U	370 U
BENZO(k)FLUARANTHENE	330	350 U	370 U
BENZO(a)PYRENE	330	350 U	370 U
INDENO(1,2,3-cd)PYRENE	330	350 U	370 U
DIBENZ(a,h)ANTHRACENE	330	350 U	370 U
BENZO(ghi)PERYLENE	330	350 U	370 U
% MOISTURE:		6	11
DILUTION FACTOR:		1.0	1.0
DATE SAMPLED:		6/11/91	6/11/91
DATE EXTRACTED:		6/17/91	6/17/91
DATE ANALYZED:		7/25/91	7/23/91
ASSOCIATED BLANKS:		03SD02-F	03SD02-F
		[illegible]SD02-F	[illegible]-R

SEMIVOLATILE AQUEOUS ANALYSIS (ug/L)

SITE: CAMP LEJEUNE - SITE 03

CASE: 5005

SAMPLE LOCATION:		GW01		GW02		GW03	
SAMPLE NUMBER:							
QC DESIGNATION:	CRQL						
PHENOL	10	10	U	110	U	10	U
BIS(2-CHLOROETHYL)ETHER	10	10	U	110	U	10	U
2-CHLOROPHENOL	10	10	U	110	U	10	U
1,3-DICHLOROBENZENE	10	10	U	110	U	10	U
1,4-DICHLOROBENZENE	10	10	U	110	U	10	U
BENZYL ALCOHOL	10	10	U	110	U	10	U
1,2-DICHLOROBENZENE	10	10	U	110	U	10	U
2-METHYLPHENOL	10	10	U	110	U	10	U
BIS(2-CHLOROISOPROPYL)ETHER	10	10	U	110	U	10	U
4-METHYLPHENOL	10	10	U	110	U	10	U
N-NITROSODI-N-PROPYLAMINE	10	10	U	110	U	10	U
HEXACHLOROETHANE	10	10	U	110	U	10	U
NITROBENZENE	10	10	U	110	U	10	U
ISOPHORONE	10	10	U	110	U	10	U
2-NITROPHENOL	10	10	U	110	U	10	U
2,4-DIMETHYLPHENOL	10	10	U	110	U	10	U
BENZOIC ACID	50	49	U	560	U	50	U
BIS(2-CHLOROETHOXY)METHANE	10	10	U	110	U	10	U
2,4-DICHLOROPHENOL	10	10	U	110	U	10	U
1,2,4-TRICHLOROBENZENE	10	10	U	110	U	10	U
NAPHTHALENE	10	10	U	4400		9	J
4-CHLORANILINE	10	10	U	110	U	10	U
HEXACHLOROBUTADIENE	10	10	U	110	U	10	U
4-CHLORO-3-METHYLPHENOL	10	10	U	110	U	10	U
2-METHYLNAPHTHALENE	10	10	U	1500		10	U
HEXACHLOROCYCLOPENTADIENE	10	10	U	110	U	10	U
2,4,6-TRICHLOROPHENOL	10	10	U	110	U	10	U
2,4,5-TRICHLOROPHENOL	50	49	U	560	U	50	U
2-CHLORONAPHTHALENE	10	10	U	110	U	10	U
2-NITROANILINE	50	49	U	560	U	50	U
DIMETHYL PHTHALATE	10	10	U	110	U	10	U
ACENAPHTHYLENE	10	10	U	110	U	10	U
2,6-DINITROTOLUENE	10	10	U	110	U	10	U
3-NITROANILINE	50	49	U	560	U	50	U
ACENAPHTHENE	10	10	U	1500		10	U
2,4-DINITROPHENOL	50	49	U	560	U	50	U

SEMIVOLATILE AQUEOUS ANALYSIS (ug/L)
SITE: CAMP LEJEUNE - SITE 03
CASE: 5005

SAMPLE LOCATION:		GW01	GW02	GW03
SAMPLE NUMBER:				
QC DESIGNATION:	CRQL			
4-NITROPHENOL	50	49 U	560 U	50 U
DIBENZOFURAN	10	10 U	1100	10 U
2,4-DINITROTOLUENE	10	10 U	110 U	10 U
DIETHYL PHTHALATE	10	10 U	110 U	10 U
4-CHLOROPHENYL-PHENYLETHER	10	10 U	110 U	10 U
FLUORENE	10	10 U	890	10 U
4-NITROANILINE	50	49 U	560 U	50 U
4,6-DINITRO-2-METHYLPHENOL	50	49 U	560 U	50 U
N-NITROSODIPHENLYAMINE	10	10 U	110 U	10 U
4-BROMOPHENYL-PHENYLETHER	10	10 U	110 U	10 U
HEXACHLOROBENZENE	10	10 U	110 U	10 U
PENTACHLOROPHENOL	50	49 U	560 U	50 U
PHENANTHRENE	10	10 U	1600	10 U
ANTHRACENE	10	10 U	260	10 U
DI-N-BUTYLPHTHALATE	10	10 U	110 U	10 U
FLUORANTHENE	10	10 U	640	10 U
PYRENE	10	10 U	460	10 U
BUTYLBENZYLPHTHALATE	10	10 U	110 U	10 U
3,3'-DICHLOROBENZIDINE	20	19 U	220 U	20 U
BENZO(a)ANTHRACENE	10	10 U	110 U	10 U
CHRYSENE	10	10 U	96 J	10 U
BIS(2-ETHYLHEXYL)PHTHALATE	10	10 U	110 U	10 U
DI-N-OCTYLPHTHALATE	10	10 U	110 U	10 U
BENZO(b)FLUORANTHENE	10	10 U	110 U	10 U
BENZO(k)FLUARANTHENE	10	10 U	110 U	10 U
BENZO(a)PYRENE	10	10 U	110 U	10 U
INDENO(1,2,3-cd)PYRENE	10	10 U	110 U	10 U
DIBENZ(a,h)ANTHRACENE	10	10 U	110 U	10 U
BENZO(ghi)PERYLENE	10	10 U	110 U	10 U
% MOISTURE:				
DILUTION FACTOR:		1.0	10.0	1.0
DATE SAMPLED:		6/16/91	6/16/91	6/16/91
DATE EXTRACTED:		6/21/91	6/21/91	6/21/91
DATE ANALYZED:		8/01/91	8/12/91	8/01/91
ASSOCIATED BLANKS:		03GW02-R	03GW02-R	03GW02-R

SEMIVOLATILE ANALYSIS (ug/kg)

SITE: CAMP LEJEUNE - SITE 03

CASE: 4961

SAMPLE LOCATION:		SD01	SD02	SD02-D
SAMPLE NUMBER:				
QC DESIGNATION:	CRQL			FIELD DUPLICATE
PHENOL	330	790 U	900 U	890 U
BIS(2-CHLOROETHYL)ETHER	330	790 U	900 U	890 U
2-CHLOROPHENOL	330	790 U	900 U	890 U
1,3-DICHLOROBENZENE	330	790 U	900 U	890 U
1,4-DICHLOROBENZENE	330	790 U	900 U	890 U
BENZYL ALCOHOL	330	790 U	900 U	890 U
1,2-DICHLOROBENZENE	330	790 U	900 U	890 U
2-METHYLPHENOL	330	790 U	900 U	890 U
BIS(2-CHLOROISOPROPYL)ETHER	330	790 U	900 U	890 U
4-METHYLPHENOL	330	790 U	900 U	890 U
N-NITROSODI-N-PROPYLAMINE	330	790 U	900 U	890 U
HEXACHLOROETHANE	330	790 U	900 U	890 U
NITROBENZENE	330	790 U	900 U	890 U
ISOPHORONE	330	790 U	900 U	890 U
2-NITROPHENOL	330	790 U	900 U	890 U
2,4-DIMETHYLPHENOL	330	790 U	900 U	890 U
BENZOIC ACID	1600	3800 U	4400 U	4300 U
BIS(2-CHLOROETHOXY)METHANE	330	790 U	900 U	890 U
2,4-DICHLOROPHENOL	330	790 U	900 U	890 U
1,2,4-TRICHLOROBENZENE	330	790 U	900 U	890 U
NAPHTHALENE	330	790 U	900 U	890 U
4-CHLORANILINE	330	790 U	900 U	890 U
HEXACHLOROBUTADIENE	330	790 U	900 U	890 U
4-CHLORO-3-METHYLPHENOL	330	790 U	900 U	890 U
2-METHYLNAPHTHALENE	330	790 U	900 U	890 U
HEXACHLOROCYCLOPENTADIENE	330	790 U	900 U	890 U
2,4,6-TRICHLOROPHENOL	330	790 U	900 U	890 U
2,4,5-TRICHLOROPHENOL	1600	3800 U	4400 U	4300 U
2-CHLORONAPHTHALENE	330	790 U	900 U	890 U
2-NITROANILINE	1600	3800 U	4400 U	4300 U
DIMETHYL PHTHALATE	330	790 U	900 U	890 U
ACENAPHTHYLENE	330	790 U	900 U	890 U
2,6-DINITROTOLUENE	330	790 U	900 U	890 U
3-NITROANILINE	1600	3800 U	4400 U	4300 U
ACENAPHTHENE	330	790 U	900 U	890 U
2,4-DINITROPHENOL	1600	3800 U	4400 U	4300 U
4-NITROPHENOL	1600	3800 U	4400 U	4300 U

SEMIVOLATILE ANALYSIS (ug/kg)
SITE: CAMP LEJEUNE - SITE 03
CASE: 4961

SAMPLE LOCATION:		SD01	SD02	SD02-D
SAMPLE NUMBER:				
QC DESIGNATION:	CRQL			FIELD DUPLICATE
DIBENZOFURAN	330	790 U	900 U	890 U
2,4-DINITROTOLUENE	330	790 U	900 U	890 U
DIETHYL PHTHALATE	330	790 U	900 U	890 U
4-CHLOROPHENYL-PHENYLETHER	330	790 U	900 U	890 U
FLUORENE	330	790 U	900 U	890 U
4-NITROANILINE	1600	3800 U	4400 U	4300 U
4,6-DINITRO-2-METHYLPHENOL	1600	3800 U	4400 U	4300 U
N-NITROSODIPHENLYAMINE	330	790 U	900 U	890 U
4-BROMOPHENYL-PHENYLETHER	330	790 U	900 U	890 U
HEXACHLOROBENZENE	330	790 U	900 U	890 U
PENTACHLOROPHENOL	1600	3800 U	4400 U	4300 U
PHENANTHRENE	330	790 U	900 U	890 U
ANTHRACENE	330	790 U	900 U	890 U
DI-N-BUTYLPHTHALATE	330	790 U	900 U	890 U
FLUORANTHENE	330	790 U	900 U	890 U
PYRENE	330	790 U	900 U	890 U
BUTYLBENZYLPHTHALATE	330	790 U	900 U	890 U
3,3'-DICHLOROBENZIDINE	660	1600 U	1800 U	1800 U
BENZO(a)ANTHRACENE	330	790 U	900 U	890 U
CHRYSENE	330	790 U	900 U	890 U
BIS(2-ETHYLHEXYL)PHTHALATE	330	750 J	900 U	890 U
DI-N-OCTYLPHTHALATE	330	790 UJ	900 UJ	890 UJ
BENZO(b)FLUORANTHENE	330	790 UJ	900 UJ	890 UJ
BENZO(k)FLUARANTHENE	330	790 UJ	900 UJ	890 UJ
BENZO(a)PYRENE	330	790 UJ	900 UJ	890 UJ
INDENO(1,2,3-cd)PYRENE	330	790 UJ	900 UJ	890 UJ
DIBENZ(a,h)ANTHRACENE	330	790 UJ	900 UJ	890 UJ
BENZO(ghi)PERYLENE	330	790 UJ	900 UJ	890 UJ
% MOISTURE:		17	28	27
DILUTION FACTOR:		2.0	2.0	2.0
DATE SAMPLED:		6/10/91	6/10/91	6/10/91
DATE EXTRACTED:		6/17/91	6/17/91	6/17/91
DATE ANALYZED:		7/23/91	7/23/91	7/23/91
ASSOCIATED BLANKS:		03SD02-F	03SD02-F	03SD02-F
		03SD02-R	03SD02-R	03SD02-R

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-NITROPHENOL	50	50 U	50 U	51 U	NA	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-BROMOPHENYL-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
CHROMIUM	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-CHLOROPHENOL	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
4,6-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), $x = 0.886\left(\frac{U_t}{U_m}\right) = 0.886\left(\frac{12.8\ m/s}{4.0\ m/s}\right) = 2.84$ ✓

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

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

② CALCULATE PEF

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

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

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

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. 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.

HALLIBURTON NUS Environmental Corporation and Subsidiaries			STANDARD CALCULATION SHEET
CLIENT: CAMP LEJEUNE	FILE NO.: 2F36	BY: MJS	PAGE 1 OF 1
SUBJECT: CALCULATION OF PEF FOR SITE 3		CHECKED BY: MMS	DATE: 10-2-92

PURPOSE: CALCULATE PARTICULATE EMISSION FACTOR FOR SITE 3

RELEVANT EQUATION:

$$PEF = \left(\frac{LS}{A}\right)\left(8.30 \times 10^{11}\right)$$

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

SAMPLE CALCULATION:

WIDTH = 150 m
LS = 300 m
$A = (150.m)(300\,m) = 45000\,m^2$.

$$PEF = \left(\frac{300\,m}{45000.m^2}\right)\left(8.30 \times 10^{11}\right)$$

$$\boxed{PEF = 5.5 \times 10^{9} \quad m^3/kg}.$$

REFERENCE:

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

HALLIBURTON NUS Environmental Corporation and Subsidiaries			STANDARD CALCULATION SHEET
CLIENT: CAMP LEJEUNE	FILE NO.: 2F36	BY: NLS	PAGE 1 OF 7
SUBJECT: CALCULATION OF SOIL PRGS FOR SITE 3		CHECKED BY: KMS	DATE: 10-01-92

PURPOSE: TO CALCULATE PRELIMINARY REMEDIATION GOALS (PRGS) FOR CHEMICALS BASED CARCINOGENIC and NONCARCINOGENIC RISKS FOR SITE 3.

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)

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

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)

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

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

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 =	5.5×10^9	(m^3/kg)

FOR ANTHRACENE and CHRYSENE THE FOLLOWING PHYSICAL CONSTANTS AND RISK-DOSE PARAMETERS ARE:

PARAMETER	(UNITS)	ANTHRACENE	CHRYSENE
D_i	(cm^2/s)	N.A.	N.A.
H	(atm m^3/mol)	8.75×10^{-2}	1.18×10^{-9}
K_{OC}	(cm^3/gm)	1.4×10^4	2×10^5
RfD_{ING}	(mg/kg/day)	3×10^{-1}	—
RfD_{INH}	(mg/kg/day)	—	—
CSF_{ING}	$(mg/kg/day)^{-1}$	—	7.3×10^{-2}
CSF_{INH}	$(mg/kg/day)^{-1}$	—	—

NA - NOT AVAILABLE

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 3		CHECKED BY: KWS	DATE: 10-01-92

FOR SITE 3, THE FOLLOWING PHYSICAL DIMENSIONS APPLY:

LS = 300 m
V = 2.0 m/s (ONE-HALF OF MEAN WINDSPEED FOR WILMINGTON A
A = 4.5×10^8 cm^2

FOR SOIL PRG FOR ANTHRACENE (NONCARCINOGENIC):

① CALCULATE α:

$$\alpha = \frac{(\ 0\ \frac{cm^2}{s})(\ 0.35\ )^{1.33}}{0.35 + \left[\frac{(2.65\ g/cm^3)(1-0.35)(1.4\times10^{4}\ cm^3/g)(0.032)}{41\ (8.75\times10^{-2}\ atm\ m^3/mol)}\right]} = \boxed{0\ cm^2/s}$$ ✓

② CALCULATE VF:

$$VF = \left(\frac{(300m)(2m/s)(2m)}{4.5\times10^8\ cm^2}\right)\left(\frac{((3.14)(\ 0\ \frac{cm^2}{s})(7.88\times10^{8}\ sec))^{0.5}}{(2)(\ 0\ \frac{cm^2}{s})(0.35)^{1.33}\times\left(\frac{41(8.75\times10^{-2})}{(1.4\times10^{4})(0.032)}\right)\times10^{-3}\ kg/g}\right)$$

$$\boxed{VF = 0\ m^3/kg}$$ ✓

③ CALCULATE PRG:

$$C_{SOIL} = \frac{102}{\left[\frac{5\times10^{-5}\ kg/day}{3\times10^{-1}\ mg/kg\ bdy} + (\ 0\ )(\ 0\ + \frac{20\ m^3/day}{5.5\times10^{9}\ m^3/kg})\right]}$$

$$\boxed{C_{SOIL} = 612000\ mg/kg}$$ ✓

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 3		CHECKED BY: KMS	DATE: 10-01-92

FOR SOIL PRG FOR CHRYSENE (CARCINOGENIC):

① CALCULATE α:

$$\alpha = \frac{(\ 0\ cm^2/s)(0.35)^{1.33}}{0.35 + \left[\frac{(2.65\ gm/cm^3)(1-0.35)(2\times10^5\ cm^3/gm)(0.032)}{41\ (1.18\times10^{-7}\ atm\cdot m^3/mol)}\right]} = \frac{0\ cm^2/s}{}$$ ✓

② CALCULATE VF:

$$VF = \left(\frac{(300m)(2\ m/s)(2\ m)}{4.5\times10^8\ cm^2}\right)\left(\frac{((3.14)(\ 0\ cm^2/s)(7.88\times10^8\ sec))^{0.5}}{(2)(\ 0\ cm^2/s)(0.35)^{1.33}\left(\frac{41(1.18\times10^{-7})}{(2\times10^5\ cm^3/gm)(0.032)}\right)(10^{-3}\ kg/gm)}\right)$$

$$\boxed{VF = 0\ m^3/kg}$$ ✓

③ CALCULATE SOIL PRG:

$$C_{SOIL} = \frac{2.9\times10^{-4}\ (kg)}{\left[(5\times10^{-5}\ kg/day)(7.3\times10^{-2}\ kg\cdot day/mg) + (\ 0\ kg\cdot day/mg)(\ 0\ + \frac{20\ m^3/day}{5.5\times10^{9}\ m^3/kg})\right]}$$

$$\boxed{C_{SOIL} = 79.45\ mg/kg}$$ ✓

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 - IAS Site 3 - Old Creosote Plant
LOCATION: Jacksonville, NC
MEDIA: Soil

Relevant Equations:
(reduced form for 1E-6 target cancer risk)
PRG = 2.9e-4 / ((5e-5 x CSFing) + (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)))

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) = (41 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)

Input parameters:						
LS = 300 (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 = 4.50E+08 (cm2)	Ps =	2.65 (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)
Acenaphthene	6.00E-02					7.71E-03 (2)	4.60E+03 (3)	0.00E+00	122400.00	0.00	122400.00
Anthracene	3.00E-01					8.75E-02 (2)	1.40E+04 (3)	0.00E+00	612000.00	0.00	612000.00
Benzo(a)anthracene			7.30E-01		5.10E-02 (2)	1.38E-09 (2)	2.00E+05 (3)	1.51E+08	0.00	7.95	7.95
Benzo(b)fluoranthene			7.30E-01				5.50E+05 (3)	0.00E+00	0.00	7.95	7.95
Benzo(k)fluoranthene			7.30E-01				5.50E+05 (3)	0.00E+00	0.00	7.95	7.95
Benzo(g,h,i)perylene							1.60E+06 (3)	0.00E+00	0.00	0.00	0.00
Benzo(a)pyrene			7.30E+00		4.30E-02 (2)	1.38E-09 (2)	5.50E+06 (3)	8.64E+08	0.00	0.79	0.79
Chrysene			7.30E-02			1.18E-09 (2)	2.00E+05 (3)	0.00E+00	0.00	79.45	79.45
Fluoranthene	4.00E-02					5.70E-02 (2)	3.80E+04 (3)	0.00E+00	81600.00	0.00	81600.00
Fluorene	4.00E-02					1.17E-04 (2)	7.30E+03 (3)	0.00E+00	81600.00	0.00	81600.00
Indeno(1,2,3-cd)pyrene			7.30E-01			5.07E-13 (2)	1.60E+06 (3)	0.00E+00	0.00	7.95	7.95
2-Methylnaphthalene						5.80E-05 (2)		0.00E+00	0.00	0.00	0.00
Naphthalene	4.00E-03	4.00E-03			5.90E-02	4.80E-04 (2)	9.40E+02 (3)	1.64E+04	320.47	0.00	320.47
Phenanthrene						5.00E-06 (2)	1.40E+04 (3)	0.00E+00	0.00	0.00	0.00
Pyrene	3.00E-02	3.00E-02				7.00E-09 (2)	3.80E+04 (3)	0.00E+00	61195.58	0.00	61195.58
Dibenzofuran								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.

HALLIBURTON NUS Environmental Corporation and Subsidiaries			STANDARD CALCULATION SHEET
CLIENT: CAMP LEJEUNE	FILE NO.: 2F36	BY: MJS	PAGE 1 OF 1
SUBJECT: CALCULATION of SEDIMENT CRITERIA FOR SITE 3		CHECKED BY: KMS	DATE: 10-02-92

PURPOSE: To calculate sediment criteria based surface water quality criteria and equilibrium partitioning coefficients.

RELEVANT EQUATIONS:

$$\text{CRITERIA}_{(\text{SEDIMENT})} = \text{CRITERIA}_{(\text{SW})} \times K_{OC} \times f_{OC} \quad (\text{ORGANICS})$$

WHERE:

$\text{CRITERIA}_{(\text{SEDIMENT})}$	=	CALCULATED SEDIMENT CRITERIA	(mg/kg)
$\text{CRITERIA}_{(\text{SW})}$	=	SURFACE WATER QUALITY CRITERIA	(mg/L)
K_{OC}	=	ORGANIC CARBON PARTITION COEFFICIENT	(L/kg)
f_{OC}	=	FRACTION ORGANIC CARBON IN SEDIMENT (UNITLE	

Sample Calculation:

Assume $f_{OC} = 0.032$

FOR BIS(2-ETHYLHEXYL)PHTHALATE, USEPA REGION IV SCREENING VALUE (CHRONIC) IS 3×10^{-4} mg/L, $K_{OC} = 2 \times 10^9$ L/kg.

$$\therefore \quad \text{CRITERIA}_{\text{SEDIMENT}} = (3 \times 10^{-4} \text{ mg/L})(2 \times 10^9 \text{ L/kg})(0.032) = \boxed{19200 \text{ mg/kg}} \checkmark$$

Development of Sediment Criteria Based on Surface water AWQCs
Site: Camp Lejeune – Site 03 – Old Creosote Plant
Reference:

Relevant Equation:

Criteria (sed) = AWQCsw x Koc x foc (organics)
Criteria (sed) = AWQCsw x Kd (metals)

Input parameter:

foc = 0.032 (fraction)

Chemical	Surface Water AWQC (mg/L)	Organic Carbon Partition Coefficient (Koc) (L/Kg)	Soil – Water Partition Coeffiecient (Kp) (mg/Kg)	Sediment Criteria (mg/Kg)
Bis(2-ethylhexyl)phthalate	3.00E-04 (1)	2.00E+09		19200
				0
				0
				0
				0
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				0

(1) USEPA Region IV Chromic Screening Value, January 27, 1992.