03.15-01/22/97-01864 ARF ✓ CTO-0212

Baker

**Baker Environmental, Inc.**
Airport Office Park, Building 3
420 Rouser Road
Coraopolis, Pennsylvania 15108

(412) 269-6000
FAX (412) 269-2002

January 22, 1997

Commander
Atlantic Division
Naval Facilities Engineering Command
1510 Gilbert Street (Building N-26)
Norfolk, Virginia 23511-2699

Attn: Ms. Katherine Landman
Code 18232

Re: Contract N62470-89-D-4814
Navy CLEAN, District III
Contract Task Order (CTO) 0212
Site 69 Seep Analytical Results and Draft Focused ERA
MCB Camp Lejeune, North Carolina

Dear Ms. Landman:

This letter report provides the analytical results of the "seep sample" collected this past November at Site 69, and includes a Draft Focused Ecological Risk Assessment (ERA) of the onsite surface water pathway which was not included in the Remedial Investigation Report for Operable Unit No. 14 (Site 69). The conclusions generated by this Focused ERA will be used in conjunction with the results of the comprehensive human health and ecological risk assessments to determine the appropriate remedial alternative for Site 69.

## Background and Objectives

The ecological risk assessment that was conducted as part of the Remedial Investigation for Operable Unit No. 14 (Site 69) (Baker, 1996) did not address onsite surface water bodies as an exposure pathway since the onsite pools of water were not believed to support ecologically significant receptor populations. Additionally, onsite surface water was not identified as an exposure pathway for the human health risk assessment due to the limited size of the pools and because site access is restricted by a fence. It was subsequently determined that exposure to the onsite water by military personnel would not be significant if at all plausible. However, because the onsite surface water is influenced by the water table, and volatile organic compounds (VOCs) were detected in the onsite surface water bodies, this exposure pathway is now being reevaluated with respect to potential ecological receptors. The objective of this focused ecological risk assessment is to evaluate whether the onsite surface water bodies pose adverse risks to plausible ecological receptors.

## Sampling Locations and Description

The onsite surface water includes four sampling stations (69-OS-SW01, 02, 03, and 69-Seep) that can be described as small pools of water in low-lying areas of Site 69. The locations of the sampling stations are shown on Figure 1. The largest pool of water (Station 02) is estimated to cover a 10-foot by 10-foot area and may be one to two feet in depth. The other three pools of water are about one-half the size of the largest pool and shallow

(approximately 6 inches deep). It is possible that the onsite pools of water are seasonal and influenced by precipitation events. The pools of water appear dark in color due to the black/gray characteristics of the soil and sediment. This dark characteristic is consistent with other low-lying bodies of water that have been observed throughout MCB Camp Lejeune. The onsite water bodies may provide a habitat for frogs (i.e., tadpoles) and possibly benthic macroinvertebrates. The water also is likely to be utilized as a drinking water source for other animals that inhabit the area.

Three of the stations were sampled during the remedial field investigation in 1994; the fourth station was sampled on November 6, 1996 after it was discovered by various field personnel. Sediment samples were collected during the 1994 sampling event but not during the November 1996 event. During routine treatability study maintenance trips in mid to late 1996, field personnel reported the presence of what could be defined as a "seep" or pool of water that was not believed to be present during the 1994 field investigation. The upper reaches of the seep begin near sampling station 69-OS-SW01 (see Figure 1). (Note: It is possible that sampling station SW01 is associated with the seep based on its location) Between this point and sampling station 69-Seep is a flat low-lying channel that was observed to be moist/saturated, but not flowing with water at the time of sampling. This channel extends between the upper reaches of the seep (i.e., near SW01) and the fence that surrounds the southern portion of the site. Sample station 69-Seep was collected near the fence and analyzed for full Target Compound List (TCL) organics and Target Analyte List (TAL) inorganics.

## Analytical Results

Table 1 provides the analytical results for the four onsite surface water samples. Sediment sample results are provided on Table 2. It should be noted that the "sediment" samples are more characteristic of a surface soil sample than a sediment sample. Note that no sediment sample was collected from sample station 69-Seep since the intent was only to characterize the newly-discovered seep.

Three of the four surface water samples exhibited low levels of VOCs. Samples 69-OS-SW1 and 69-Seep exhibited similar VOC levels. As mentioned previously, these samples may be representative of the northern and southern portion of the seep, respectively. However, the time frame in which each sample was collected (almost three years apart) makes it difficult to confirm this possibility. Pesticides and a limited number of semi-volatile organic compounds (SVOCs) were detected in sample 69-Seep, but not in the other samples. Metal concentrations in the four samples were relatively similar with the exception of iron and aluminum, which exhibited elevated concentrations in sample 69-Seep.

Based on the types of VOCs detected in the surface water, it is likely that the onsite pools of water, including what is referred to as the "seep", are connected to the water table since nearby monitoring wells 69-GW02 and 69-GW03 also exhibited the same VOCs. Additionally, elevated levels of iron, aluminum, and other metals have been detected in shallow groundwater as well as in the onsite surface water samples. The presence of pesticides in sample 69-Seep (refer to Table 1) may be associated with groundwater contamination; well 69-GW03 exhibited low levels of alpha-BHC (0.056 ug/L) and delta-BHC (2.3 ug/L). It is also possible that the pesticides are a result of particulates in the sample since pesticides have been detected in surface soil throughout the site area.

## Focused Ecological Risk Assessment

This ecological risk assessment (ERA) focused on the chemical data from samples collected in four onsite surface water bodies. This ERA did not evaluate potential impacts to terrestrial wildlife from contaminants in the surface soil since this was done previously as part of the RI for Operable Unit No. 14 (Baker, 1996). The contaminants

in the surface water and sediment were compared to applicable screening values. This was done as a very conservative measure since the small water bodies are unlikely to support a significant aquatic life population. The contaminants in the surface water also were compared to terrestrial wildlife drinking water benchmarks to determine if there are any potential impacts to wildlife that drink the ponded water. Attachment 1 contains all of the references used in this focused ERA.

**Surface Water Screening Values**

The contaminant concentrations in the surface water were compared to the following surface water screening values (SWSVs) to determine if there were any exceedances of the published values:

***North Carolina Water Quality Standards for Surface Water*** - The North Carolina Department of Environmental Management has promulgated Water Quality Standards (WQS) that are used to evaluate the quality of waters in North Carolina (NCDEM, 1996). WQS are the concentrations of toxic substances that will not result in acute or chronic toxicity to aquatic life.

***USEPA Water Quality Screening Values*** - WQSVs are non-enforceable regulatory guidelines and are of primary utility in assessing acute and chronic toxic effects in aquatic systems. These values were compiled from the following data sources: Region IV Toxic Substance Spreadsheet (USEPA, 1995a); Supplemental Guidance to RAGS: Region IV Bulletins, Ecological Risk Assessment (USEPA, 1995b); and Region III BTAG Screening Values (USEPA, 1995c).

***Oak Ridge National Laboratory Aquatic Benchmarks*** - ORNL Aquatic Benchmarks exist for many contaminants, including those that do not have WQS of WQSVs (Suter and Tsao, 1996). The ORNL aquatic benchmarks include secondary acute values and secondary chronic values that are calculated using the Tier II method described in EPA's Proposed Water Quality Guidance for the Great Lakes System (USEPA, 1993e). Tier II values were developed so that aquatic benchmarks could be established with fewer data than are required for the USEPA AWQC.

A comparison of the surface water contaminant levels to the SWSVs are presented on Table 3. Toluene (12 ug/L)was the only volatile organic compound (VOC) that exceeded the North Carolina WQS (11 ug/L). Toluene is a common laboratory contaminant and is not believed to be related to past site activities. None of the remaining VOCs exceeded any of the SWSVs.

Two SVOCs [bis(2-ethylhexyl)phthalate and di-n-butylphthalate], seven pesticides (alpha-BHC, beta-BHC, delta-BHC, gamma-BHC, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT), and eight metals (aluminum, barium, copper, iron, lead, manganese, thallium, and zinc) exceeded the applicable SWSVs. The two SVOCs are common laboratory contaminants and are not believed to be site related. The pesticides were detected at relatively low concentrations (0.12 to 1.8 ug/L) and may be due to widespread pesticide application at the base, as previously mentioned. Several of the metals that exceeded the SWSVs were detected at relatively high concentrations including aluminum (6,250 ug/L), iron (89,000 ug/L) and zinc (4,370 ug/L).

**Sediment Screening Values**

The contaminant concentrations in the sediment were compared to the following sediment screening values (SSVs) to determine if there were any exceedances of the published values:

***NOAA Effects Concentrations*** - Sediment screening values have been established by the National Oceanic and Atmospheric Administration (Long, et.al, 1995). These sediment screening values are provided as the lower ten percentile (Effects Range-Low [ER-L]) and the median percentile (Effects Range-Median [ER-M]) of biological effects. The concentration below the ER-L represents a minimal-effects range (adverse effects would be rarely observed). The concentration above the ER-L but below the ER-M represents a possible-effects range (adverse effects would occasionally occur). Finally, the concentration above the ER-M represents a probable-effects range (adverse effects would probably occur).

***Region IV Sediment Screening Values*** - USEPA Region IV has developed a Draft document titled Supplemental Guidance to RAGS: Region IV Bulletins, Ecological Risk Assessment (USEPA, 1995b). The document provides sediment screening values for several constituents based on either the ecological effects levels or the Contract Laboratory Program's practical quantification limit (PQL), whichever is greater. For those contaminants whose screening values are based on the PQL, data reported below the PQL was compared to the Effects Level number.

***Other Sediment Screening Values*** - When data from the above sources were not available, sediment screening values from the following data sources were used to evaluate the contaminants: ORNL Preliminary Remediation Goals (a compilation of values from several data sources), Region III BTAG Screening Values (USEPA, 1995b), Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario (OMOE, 1993), and Wisconsin Department of Natural Resources Interim Criteria for In-Water Disposal of Dredged Sediments (Sullivan et.,al., 1985).

The results of the sediment comparison are presented on Table 4. Acetone was the only VOC that exceeded the applicable SSVs. Acetone is a typical laboratory contaminant and is not believed to be related to site activities. No SVOCs exceeded an SSV. Four pesticides (alpha-BHC, beta-BHC, delta-BHC, and 4,4'-DDT), Aroclor 1254, and one metal (silver) exceeded the applicable SSVs. The Aroclor 1254 concentration exceeded the ER-L value but not the ER-M value. Therefore, there is a possibility that potential impacts to aquatic receptors may occur. Silver was detected in one sample at a concentration of 17.7 mg/kg, which is above the range of the base-wide background concentration for surface soil (4.3 mg/kg), to which it is more similar than it is to a sediment for background comparison purposes.

**Terrestrial Wildlife Drinking Water Benchmarks**

The contaminants in the surface water also were compared to terrestrial wildlife benchmarks for the ingestion of water. These values were developed by ORNL and are reported in the Toxicological Benchmarks for Wildlife:1996 Revision (Opresko et.al., 1996). The drinking water numbers were established by back-calculating an acceptable water concentration based on the animal's daily water consumption rate and available toxicological data. Based on the comparison of the water concentrations to the benchmarks (see Table 5), aluminum was the only contaminant that exceeded a terrestrial wildlife benchmark.

**Conclusions**

In conclusion, several contaminants in the onsite surface water and sediment exceeded applicable aquatic screening values. VOCs are the primary site-related contaminants. With the exception of toluene in one surface water sample, and acetone in two sediment samples, none of the VOCS were detected at concentrations above the screening values. Acetone and toluene are typical laboratory contaminants and are not expected to be related to the site based on past activities. The comparison of contaminant concentrations in the surface water and sediment to the aquatic screening values was done as a very conservative measure. The water bodies are stagnant

and most likely have many natural stressors (i.e., low dissolved oxygen concentration, high temperature). Some of the pools may only be present after heavy periods of rainfall. Therefore, ecologically significant aquatic life populations are not expected to inhabit these areas.

Aluminum, in one seep sample, was the only contaminant in the surface water that exceeded a terrestrial drinking water benchmark. The onsite pools may be a source of drinking water to various terrestrial wildlife.

In summary, based on the low potential risks to an ecologically significant aquatic life population and the terrestrial wildlife population, no further action is recommended for these onsite surface water bodies. It is noted that remediation of the shallow aquifer may result in reducing on-site surface water contaminant levels.

If you have any comments regarding the analytical results or the Focused ERA, please contact myself at (412) 269-2016 or Mr. Aaron Bernhardt at (412) 296-6090.

Sincerely,

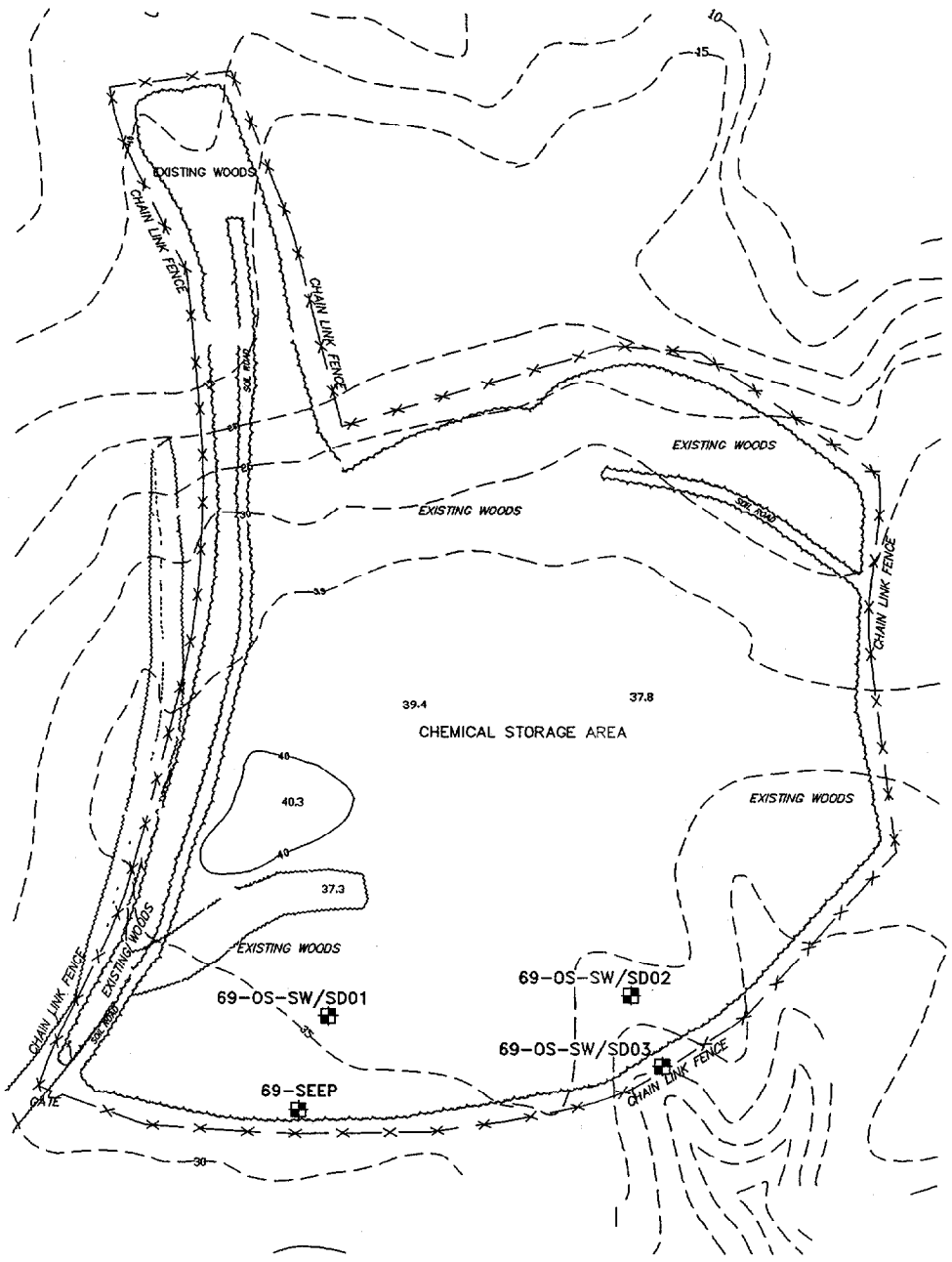
BAKER ENVIRONMENTAL, INC.

Raymond P. Wattras
Project Manager

RPW/lq
Attachments

cc: Ms. Lee Anne Rapp, P.E., Code 18312
Ms. Beth Collier, Code 02115
Mr. Neal Paul, MCB Camp Lejeune
Ms. Gena Townsend, EPA Region IV
Mr. David Lown, NC DEHNR

212148RI




200 0 100 200 400

1 inch = 200 ft.

Baker

Baker Environmental, Inc.

## LEGEND

69-OS-SW01 — SURFACE WATER/SEDIMENT SAMPLE LOCATION

FENCE

VEGETATION

TOPOGRAPHIC ELEVATION LINES (FEET, MSL)

SOURCE: REVISED FROM LANTDIV, OCT. 1991

# FIGURE 1
## ON-SITE SURFACE WATER/SEDIMENT SAMPLING LOCATIONS
SITE 69 – RIFLE RANGE CHEMICAL DUMP
REMEDIAL INVESTIGATION CTO-0212
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

**TABLE 1**

**SURFACE WATER POSITIVE DETECTION RESULTS**
**SITE 69**
**MCB CAMP LEJEUNE, NC**

| Constituent | 69-OS-SW01 1/8/94 | 69-OS-SW02 1/7/94 | 69-OS-SW03 1/7/94 | 69-SEEP 11/6/96 |
|---|---|---|---|---|
| **Volatiles (ug/L)** | | | | |
| Acetone | ND | ND | ND | 6.6 JB |
| 2-Butanone | ND | ND | ND | 2.6 J |
| Chloroform | 2 J | ND | ND | ND |
| 1,2-Dichloroethane | ND | ND | ND | 1.5 J |
| 1,2-Dichloroethene | 55 | 13 | ND | 43 |
| Toluene | ND | 1 J | ND | 12 |
| Trichloroethene | 4 J | ND | ND | ND |
| Vinyl chloride | 8 J | ND | ND | 4.1 J |
| **Semivolatiles (ug/L)** | | | | |
| Bis(2-ethylhexyl)phthalate | ND | ND | ND | 1.5 J |
| Di-n-butylphthalate | ND | ND | ND | 14 |
| 4-Methylphenol | ND | ND | ND | 17 |
| **Pesticides/PCBs (ug/L)** | | | | |
| alpha-BHC | ND | ND | ND | 0.4 |
| beta-BHC | ND | ND | ND | 1.8 D |
| delta-BHC | ND | ND | ND | 0.49 |
| gamma-BHC | ND | ND | ND | 0.14 |
| 4,4'-DDD | ND | ND | ND | 0.5 |
| 4,4'-DDE | ND | ND | ND | 0.12 |
| 4,4'-DDT | ND | ND | ND | 0.15 |
| **Inorganics (ug/L)** | | | | |
| Aluminum | 972 | 2210 | 487 | 6250 N |
| Arsenic | ND | 4.1 | ND | 7.5 B |
| Barium | 45.1 | 66.6 | 54.1 | 36.4 B |
| Calcium | 5770 | 3080 | 5870 | 3640 B |
| Chromium | ND | ND | ND | 6.3 B |
| Cobalt | ND | ND | ND | 16 B |
| Copper | ND | 22.8 | ND | 13.8 B |
| Iron | 1910 | 3820 | 1090 | 89000 |
| Lead | ND | 40.1 | 3.5 | 31.1 |
| Magnesium | 1460 | 885 | 2400 | 1220 B |
| Manganese | 339 | 73.4 | 156 | 69.2 |
| Potassium | 365 | 365 | ND | 1900 B |
| Selenium | ND | ND | ND | 2 B |
| Sodium | 6440 | 4900 | 6820 | 15800 |
| Thallium | ND | ND | ND | 11.6 |
| Zinc | 4370 | 1970 | 1560 | 90.6 |

ND - Not Detected
J - Estimated result. Result is less than reporting limit
D - Diluted Sample
B (for organics) - Detected in blank sample.
B (for inorganics) - Estimated result. Result is less than reporting limit
N - Spiked analyte recovery is outside stated control limits.

**TABLE 2**

**SEDIMENT POSITIVE DETECTION RESULTS**
**SITE 69**
**MCB CAMP LEJEUNE, NC**

| Constituent | 69-OS-SD01-06 1/8/94 | 69-OS-SD02-06 1/7/94 | 69-OS-SD03-06 1/7/94 |
|---|---|---|---|
| **Volatiles (ug/kg)** | | | |
| Acetone | 9 J | 850 J | 170 J |
| 1,2-Dichloroethene | 9 J | ND | ND |
| 2-Methyl-2-pentanone | ND | 17 | 9 J |
| Methylene chloride | 8 J | ND | ND |
| **Semivolatiles (ug/kg)** | | | |
| Di-n-butylphthalate | ND | 110 J | 110 J |
| **Pesticides/PCBs (ug/kg)** | | | |
| alpha-BHC | ND | 3.1 J | ND |
| beta-BHC | ND | 23.4 J | ND |
| delta-BHC | ND | 54.5 J | ND |
| 4,4'-DDT | ND | 2.1 J | ND |
| Aroclor 1254 | 79 J | ND | ND |
| **Chemical Surety (ug/kg)** | | | |
| Acetophenone | ND | 60 J | ND |
| **Inorganics (mg/kg)** | | | |
| Aluminum | 1570 | 1550 | 2300 |
| Barium | 12.1 | ND | ND |
| Calcium | 107 | ND | ND |
| Chromium | ND | ND | 2.9 |
| Copper | ND | 21.7 | ND |
| Iron | 2360 | 534 | 571 |
| Lead | 5.3 | 8.2 J | 3.1 J |
| Magnesium | 28 | 37.2 | 49.5 |
| Manganese | 5.5 | ND | 1.4 |
| Potassium | ND | ND | 104 |
| Silver | 17.7 J | ND | ND |
| Zinc | 98.4 | 44.3 | ND |

ND - Not Detected

J - Estimated result. Result is less than reporting limit

**TABLE 3**

**FREQUENCY AND RANGE OF CONTAMINANT DETECTIONS COMPARED TO FRESHWATER SURFACE WATER SCREENING VALUES SITE 69 MCB CAMP LEJEUNE, NC**

| Contaminant | Surface Water Screening Values (SWSVs) | | | Contaminant Frequency/Range | | No. of Positive Detects Above Lowest SWSV |
|---|---|---|---|---|---|---|
| | North Carolina Water Quality Standards (WQS)[1] | USEPA Region IV Water Quality Screening Values (WQSV)[2] | | No. of Positive Detects/No. of Samples | Range of Positive Detections | |
| | | Acute | Chronic | | | |
| **Volatiles (ug/L)** | | | | | | |
| Acetone | NE | 28,000[5] | 1,500[5] | 1/4 | 6.6JB | 0 |
| 2-Butanone | NE | 240,000[5] | 14,000[5] | 1/4 | 2.6J | 0 |
| Chloroform | NE | 2,890[6] | 289[6] | 1/4 | 2J | 0 |
| 1,2-Dichloroethane | NE | 11,800[6] | 2,000[6] | 1/4 | 1.5J | 0 |
| 1,2-Dichloroethene (total) | NE | 13,500[6] | 1,350[6] | 3/4 | 13-55 | 0 |
| Toluene | 11 | 1,750[6] | 175[6] | 2/4 | 1J-12 | 1 |
| Trichloroethene | NE | 440[5] | 47[5] | 1/4 | 4J | 0 |
| Vinyl Chloride | NE | 11,600[4] | NE | 2/4 | 4.1J-8J | 0 |
| **Semivolatiles (ug/L)** | | | | | | |
| Bis(2-ethylhexyl)phthalate | NE | 1,110[6] | <0.3[6] | 1/4 | 1.5J | 1 |
| Di-n-butylphthalate | NE | 94[6] | 9.4[6] | 1/4 | 14 | 1 |
| 4-Methylphenol | NE | NE | NE | 1/4 | 17 | NA |
| **Pesticides/PCBs (ug/L)** | | | | | | |
| alpha-BHC | 0.01[7] | 2[7] | 500[6] | 1/4 | 0.4 | 1 |
| beta-BHC | 0.01[7] | 2[7] | 5,000[6] | 1/4 | 1.8D | 1 |
| delta-BHC | 0.01[7] | 2[7] | 0.08[7] | 1/4 | 0.49 | 1 |
| gamma-BHC | 0.01 | 2[7] | 0.08[6] | 1/4 | 0.14 | 1 |
| 4,4'-DDD | 0.001[8] | 0.064[6] | 0.0064[6] | 1/4 | 0.5 | 1 |
| 4,4'-DDE | 0.001[8] | 105[6] | 10.5[6] | 1/4 | 0.12 | 1 |
| 4,4'-DDT | 0.001 | 1.1[6] | 0.001[6] | 1/4 | 0.15 | 1 |
| **Inorganics (ug/L)** | | | | | | |
| Aluminum | NE | 750 | 87 | 4/4 | 487-6,250N | 4 |
| Arsenic | 50 | 360 | 190 | 2/4 | 4.1-7.5B | 0 |
| Barium | NE | 110[5] | 4.0[5] | 4/4 | 36.4B-66.6 | 4 |

**TABLE 3 (Continued)**

**FREQUENCY AND RANGE OF CONTAMINANT DETECTIONS COMPARED TO FRESHWATER SURFACE WATER SCREENING VALUES SITE 69 MCB CAMP LEJEUNE, NC**

| Contaminant | Surface Water Screening Values (SWSVs) | | | Contaminant Frequency/Range | | No. of Positive Detects Above Lowest SWSV |
|---|---|---|---|---|---|---|
| | North Carolina Water Quality Standards (WQS)[1] | USEPA Region IV Water Quality Screening Values (WQSV)[2] | | No. of Positive Detects/No. of Samples | Range of Positive Detections | |
| | | Acute | Chronic | | | |
| Calcium | NE | NE | NE | 4/4 | 3,080-5,870 | NA |
| Chromium | 50 | 984 [3] | 117[3] | 1/4 | 6.3B | 0 |
| Cobalt | NE | 1,500[5] | 23[5] | 1/4 | 16B | 0 |
| Copper | 7 | 9.2[3] | 6.5[3] | 2/4 | 13.8B-22.8 | 2 |
| Iron | 1,000 | NE | 1,000[6] | 4/4 | 1,090-89,000 | 4 |
| Lead | 25 | 33.8[3] | 1.32[3] | 3/4 | 3.5-40.1 | 3 |
| Magnesium | NE | NE | NE | 4/4 | 885-2,400 | NA |
| Manganese | NE | 2,300[5] | 120[5] | 4/4 | 69.2-339 | 2 |
| Potassium | NE | NE | NE | 3/4 | 365-1,900B | NA |
| Selenium | 5 | 20 | 5 | 1/4 | 2B | 0 |
| Sodium | NE | NE | NE | 4/4 | 4,900-15,800 | NA |
| Thallium | NE | 140[6] | 4.0[6] | 1/4 | 11.6 | 1 |
| Zinc | 50 | 65[3] | 58.9[3] | 4/4 | 90.6-4,370 | 4 |

NE = Not Established
NA = Not Applicable
[1] NC DEHNR, 1994 (Water Quality Standards for Class C Waters)
[2] USEPA, 1995c (Region IV Toxic Substance Spreadsheet), unless otherwise noted
[3] Criteria are hardness dependent; values are based on a hardness of 50 mg/L as $CaCO_3$
[4] USEPA, 1995b (Region III BTAG Screening Levels)
[5] Suter and Tsao, 1996 (Toxicological Benchmarks for Screening Potential COCs for Effects on Aquatic Biota)
[6] USEPA, 1995b (Supplemental Guidance to Rags: Region 4 Bulletins, Ecological Risk Assessment)
[7] Used Lindane Value
[8] Used 4,4'-DDT Value

**TABLE 4**

**FREQUENCY AND RANGE OF CONTAMINANT DETECTIONS COMPARED TO SEDIMENT SCREENING VALUES SITE 69 MCB CAMP LEJEUNE, NC**

| Contaminant | Sediment Screening Values | | Contaminant Frequency/Range | | No. of Positive Detects Above Lowest SSV |
|---|---|---|---|---|---|
| | ER-L | ER-M | No. of Positive Detects/No. of Samples | Range of Positive Detections | |
| **VOCs (ug/kg)** | | | | | |
| Acetone | NE | 9.1[4] | 3/3 | 9J-850J | 2 |
| 1,2-Dichloroethene | NE | 400[4] | 1/3 | 9J | 0 |
| 4-Methyl-2-Pentanone | NE | 15,000[4] | 2/3 | 9J-17 | 0 |
| Methylene Chloride | NE | 18,000[4] | 1/3 | 8J | 0 |
| **SVOCs (ug/kg)** | | | | | |
| Di-n-butylphthalate | 1,400[5] | 240,000[4] | 2/3 | 110J | 0 |
| **Pesticides/PCBs (ug/kg)** | | | | | |
| alpha-BHC | NE | 0.32/3.3[2] | 1/3 | 3.1J | 1 |
| beta-BHC | NE | 0.32/3.3[2] | 1/3 | 23.4J | 1 |
| delta-BHC | NE | 0.32/3.3[2] | 1/3 | 54.5J | 1 |
| 4',4-DDT | 1.6[3] | 46.1[1] | 1/3 | 2.1J | 1 |
| Aroclor 1254 | 22.7[1,8] | 180[1,8] | 1/3 | 79J | 1 |
| **Chemical Surety (ug/kg)** | | | | | |
| Acetophenone | NE | NE | 1/3 | 60J | NA |
| **Inorganics (mg/kg)** | | | | | |
| Aluminum | NE | NE | 3/3 | 1,550-2,300 | NA |
| Barium | 500[7] | NE | 1/3 | 12.1 | 0 |
| Calcium | NE | NE | 1/3 | 107 | NA |
| Chromium | 81[1] | 370[1] | 1/3 | 2.9 | 0 |
| Copper | 34[1] | 270[1] | 1/3 | 21.7 | 0 |
| Iron | 20,000[6] | 40,000[6] | 3/3 | 534-2,360 | 0 |
| Lead | 46.7[1] | 218[1] | 3/3 | 3.1J-8.2J | 0 |
| Magnesium | NE | NE | 3/3 | 28-49.5 | NA |
| Manganese | 460[6] | 1,110[6] | 2/3 | 1.4-5.5 | 0 |
| Potassium | NE | NE | 1/3 | 104 | NA |
| Silver | 1.0[1] | 3.7[1] | 1/3 | 17.7J | 1 |
| Zinc | 150[1] | 410[1] | 2/3 | 44.3-98.4 | 0 |

NE Not Established
NA Not Applicable
VOCs Volatile Organic Chemicals
SVOCs Semivolatile Organic Chemicals
ERL Effects Range Low
ERM Effects Range Median

(1) Long et.al., 1995
(2) Used Lindane Values, USEPA, 1995b (Supplemental Guidance to RAGS:Region 4 Bulletins, Ecological Risk Assessment)
(3) USEPA, 1996 (Eco-Update-Ecotox Thresholds)
(4) Efroymson et.al., 1996 (Preliminary Remediation Goals for Ecological Endpoints)
(5) USEPA, 1995c (Region III BTAG Screening Value for Sediment)
(6) OMOE, 1993
(7) Sullivan, et. al., 1985
(8) Value is for total PCBs

**TABLE 5**

**FREQUENCY AND RANGE OF CONTAMINANT DETECTIONS COMPARED TO TERRESTRIAL WILDLIFE BENCHMARKS SITE 69 MCB CAMP LEJEUNE, NC**

| Contaminant | ORNL Terrestrial Wildlife Benchmark for Ingestion of Water [1] | Contaminant Frequency/Range | | No. of Positive Detects Above Benchmark |
|---|---|---|---|---|
| | | No. of Positive Detects/No. of Samples | Range of Positive Detections | |
| **Volatiles (ug/L)** | | | | |
| Acetone | 28,525 | 1/4 | 6.6JB | 0 |
| 2-Butanone | 5,051,754 | 1/4 | 2.6J | 0 |
| Chloroform | 42,787 | 1/4 | 2J | 0 |
| 1,2-Dichloroethane | 66,708 | 1/4 | 1.5J | 0 |
| 1,2-Dichloroethene (total) | 57,316 | 3/4 | 13-55 | 0 |
| Toluene | 32,969 | 2/4 | 1J-12 | 0 |
| Trichloroethene | 888 | 1/4 | 4J | 0 |
| Vinyl Chloride | 485 | 2/4 | 4.1J-8J | 0 |
| **Semivolatiles (ug/L)** | | | | |
| Bis(2-ethylhexyl)phthalate | 10,022 | 1/4 | 1.5J | 0 |
| Di-n-butylphthalate | 1,002 | 1/4 | 14 | 0 |
| 4-Methylphenol | NE | 1/4 | 17 | NA |
| **Pesticides/PCBs (ug/L)** | | | | |
| alpha-BHC | 88[2] | 1/4 | 0.4 | 0 |
| beta-BHC | 1,141 | 1/4 | 1.8D | 0 |
| delta-BHC | 88[2] | 1/4 | 0.49 | 0 |
| gamma-BHC | 22,820 | 1/4 | 0.14 | 0 |
| 4,4'-DDD | 71[3] | 1/4 | 0.5 | 0 |
| 4,4'-DDE | 71[3] | 1/4 | 0.12 | 0 |
| 4,4'-DDT | 71[3] | 1/4 | 0.15 | 0 |
| **Inorganics (ug/L)** | | | | |
| Aluminum | 2,447 | 4/4 | 487-6,250N | 0 |
| Arsenic | 160 | 2/4 | 4.1-7.5B | 0 |
| Barium | 15,629 | 4/4 | 36.4B-66.6 | 0 |
| Calcium | NE | 4/4 | 3,080-5,870 | NA |
| Chromium | 9,356[4] | 1/4 | 6.3B | 0 |

**TABLE 5 (Continued)**

**FREQUENCY AND RANGE OF CONTAMINANT DETECTIONS COMPARED TO TERRESTRIAL WILDLIFE BENCHMARKS SITE 69 MCB CAMP LEJEUNE, NC**

| Contaminant | ORNL Terrestrial Wildlife Benchmark for Ingestion of Water [1] | Contaminant Frequency/Range | | No. of Positive Detects Above Benchmark |
|---|---|---|---|---|
| | | No. of Positive Detects/No. of Samples | Range of Positive Detections | |
| Cobalt | NE | 1/4 | 16B | NA |
| Copper | 47,190 | 2/4 | 13.8B-22.8 | 0 |
| Iron | NE | 4/4 | 1,090-89,000 | NA |
| Lead | 10,184 | 3/4 | 3.5-40.1 | 0 |
| Magnesium | NE | 4/4 | 885-2,400 | NA |
| Manganese | 251,019 | 4/4 | 69.2-339 | 0 |
| Potassium | NE | 3/4 | 365-1,900B | NA |
| Selenium | 96 | 1/4 | 2B | 0 |
| Sodium | NE | 4/4 | 4,900-15,800 | NA |
| Thallium | 21 | 1/4 | 11.6 | 0 |
| Zinc | 303,883 | 4/4 | 90.6-4,370 | 0 |

NE - Not Established
NA - Not Applicable
(1) - Opresko et.al., 1996
(2)- BHC - Mixed Isomers
(3)- DDT (and Metabolites)
(4)- Chromium (+6)

## ATTACHMENT 1 - REFERENCES


Baker, 1996. Remedial Investigation Report for Operable Unit No. 14 (Site 69). MCB Camp Lejeune, North Carolina. Prepared by Baker Environmental Inc., for the Department of the Navy, Atlantic Division, Naval Facilities Engineering Command. September, 1994.

Efroymson, R.A., G.W. Suter, B.E. Sample, and D.S. Jones. July 1996. Preliminary Remediation Goals for Ecological Endpoints. Environmental Restoration Risk Assessment Program. Oak Ridge National Laboratory.

Fitchko, J. 1989. Criteria for Contaminated Soil/Sediment Cleanup. Pudvan Publishing Company, Northbrook, Illinois.

Long, E.W., D.D. Macdonald, S.L. Smith, and F.D. Calder. 1995. "Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments." Environmental Management Vol. 19, No.1, pp. 81-97.

NC DEHNR. 1994. 15A NCAC 2b.0200 - Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina. State of North Carolina Department of Health and Natural Resources. June 1, 1994.

OMOE, 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Standards Development Branch and Environmental Monitoring and Reporting Branch, Ontario Ministry of Environment and Energy.

Opresko, D. M., B. E. Sample, G.W. Suter II. 1995. Toxicological Benchmarks for Wildlife: 1994 Revision. Environmental Restoration Program. U.S. Department of Energy Report. 1995.

Sullivan, J., J. Ball, E. Brick, S. Hausmann, G., G. Pilarski, and D. Sopcich. 1985. Report of the Technical Subcommittee on Determination of Dredge Material Suitability for In-Water Disposal. Wisconsin Department of Natural Resources, Madison, WI. November, 1985.

Suter, G.W. II. and C.L. Tsao. 1996. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota:1996 Revision. Environmental Sciences Division, Oak Ridge National Laboratory.

USEPA, US Environmental Protection Agency. January, 1996. ECO Update, Ecotox Thresholds. Office of Solid Waste and Emergency Response. Publication 9345.0-12FSI. EPA 540/F-95/038.

USEPA, US Environmental Protection Agency. January 26, 1995a. "Toxic Substance Spreadsheet". Region IV, Atlanta, Georgia.

USEPA, US Environmental Protection Agency. November, 1995b. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. Waste Management Division.

USEPA, US Environmental Protection Agency. January 19, 1995c. "Region III BTAG Screening Levels". Region III, Philadelphia, PA.

USEPA, US Environmental Protection Agency. 1993c. "Water Quality Guidance for the Great Lakes System and Correction: Proposed Rules". Federal Register. 58(72) 20802-21047. Cited in Suter and Mabrey, 1994.