01.08-1/1/85-00388

General
- use both sides of the page pls
- Extend contract date for all contracts including this one!
- should have included site maps w/ well & sample locations
- Improve readibility of computer tables
- Check w/ Jerry & Steve on results from well VOA sampling by MCB. If any potential wells near our sites & we haven't done VOA's pls include in this round.
- Add VOA's @ all possible sites

EVALUATION OF DATA FROM FIRST ROUND OF VERIFICATION SAMPLE COLLECTION AND ANALYSIS

CONFIRMATION STUDY TO DETERMINE EXISTENCE AND POSSIBLE MIGRATION OF SPECIFIC CHEMICALS IN SITU

MARINE CORPS BASE
Camp Lejeune, North Carolina

Contract No. N62470-83-C-6106

Prepared for:

Naval Facilities Engineering Command
Atlantic Division
Norfolk, Va. 23511-6287

soil gas investigation:
$8-9K
mobilization costs

Prepared by:

ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
Gainesville, Florida

January 1985

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES
(Continued)

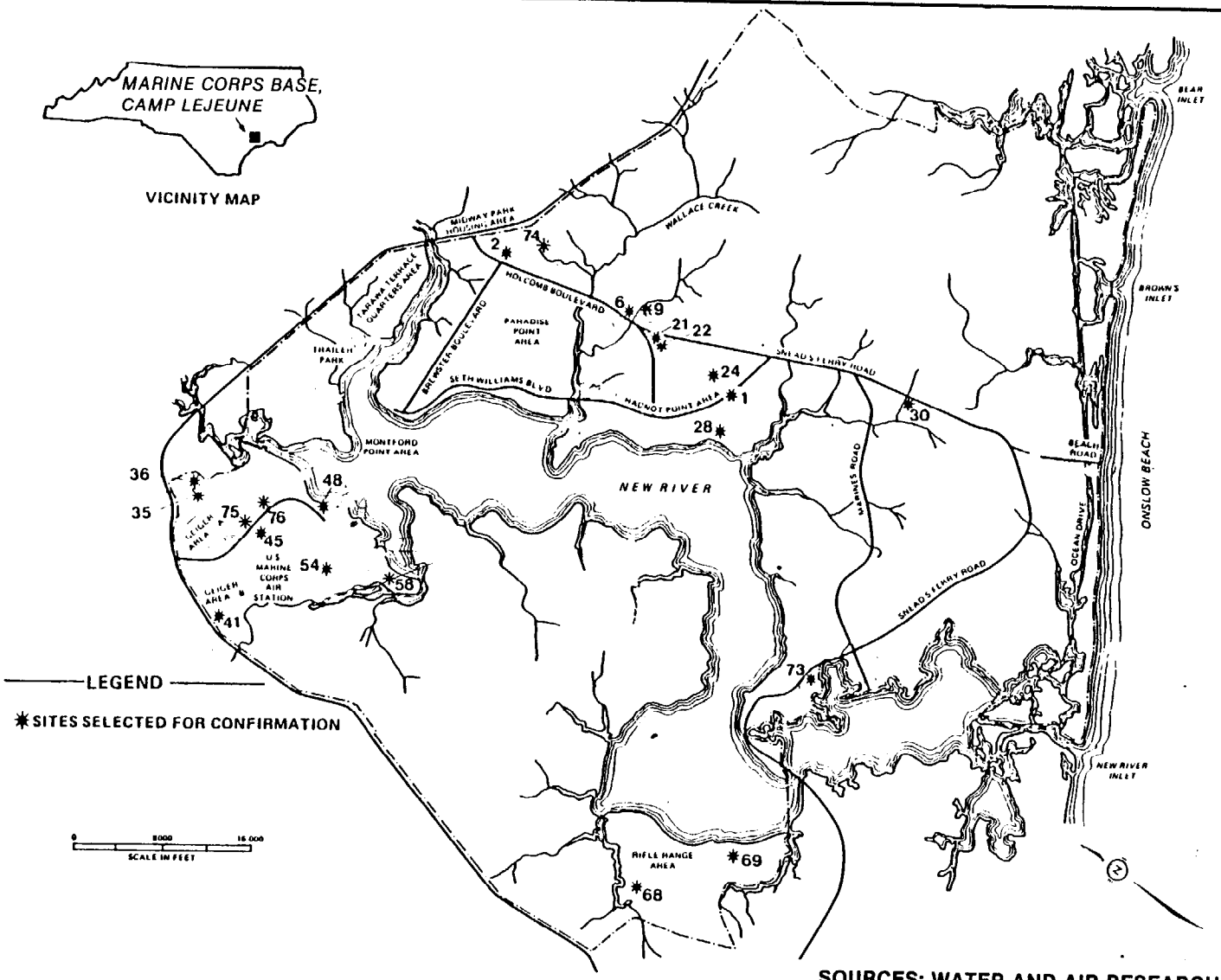
LIST OF TABLES
(Continued)

LIST OF FIGURES

1.0 INTRODUCTION

This report presents an evaluation of the data which was generated by the first round of verification sample collection and analysis of the Confirmation Study of Marine Corps Base, Camp Lejeune, North Carolina (MCB Camp Lejeune). The data presented in this report consist of analytical results for samples of surface and ground waters, sediments, soils, and fish tissue collected at 21 sites of potential contamination at MCB Camp Lejeune. These sites are listed below and shown in Figure 1-1.

Site Number	Name
1	French Creek Liquids Disposal Area
2	Former Nursery/Day Care Center (Bldg. 712)
6	Storage Lots 201 and 203
9	Fire Fighting Training Pit
21	Transformer Storage Lot 140
22	Industrial Area Tank Farm
24	Industrial Area Fly Ash Dump
28	Hadnot Point Burn Dump
30	Sneads Ferry Road Fuel Tank Sludge Area
35	Camp Geiger Area Fuel Farm
36	Camp Geiger Area Dump near Sewage Treatment Plant (STP)
41	Camp Geiger Dump
45	Campbell Street Fuel Farm and MCAS Air Field Rapid Refueling Area
48	Marine Corps Air Station (MCAS) Mercury Dump Site
54	Crash Crew Fire Training Burn Pit
68	Rifle Range Dump
69	Rifle Range Chemical Dump
73	Courthouse Bay Liquids Disposal Area
74	Mess Hall Grease Disposal Area
75	MCAS Basketball Court Site
76	MCAS Curtis Road Site



SOURCES: WATER AND AIR RESEARCH, INC., 1983.
ESE, 1984.

Figure 1-1
SITE MAP SHOWING LOCATIONS OF SITES OF POTENTIAL CONTAMINATION AT MARINE CORPS BASE, CAMP LEJEUNE

CONFIRMATION STUDY
MARINE CORPS BASE
CAMP LEJEUNE

During the onsite investigation of these 21 sites, 55 shallow ground water monitoring wells were installed, and a total of 75 ground water samples were collected for analysis from the 55 monitor wells, 17 existing potable water supply wells, and 3 hand-augered holes. Information on a site-by-site basis relative to the number of ground water monitoring wells installed; the total number of wells sampled; the number of surface water, sediment, and soil samples collected; and the analytical constituents for each sample type is presented in Table 1-1. In addition, Table 1-2 presents information relative to the number of soil borings, the number of soil samples collected from each boring, and the identification of the existing potable water supply wells that were sampled.

The objective of the data evaluation presented in Section 2.0 is to compare concentration data for the samples collected versus available standards and criteria to determine the presence of contamination. Also presented in Section 2.0 are recommendations for future monitoring, and these recommendations are summarized in Section 3.0.

Table 1-1. Confirmation Study Verification Step Sampling and Analysis Program—MCB Camp Lejeune

Site No.	Wells to be Installed	Total Wells	Surface Water	Sediments (S) or Tissues (T)	Soil Samples	Analytical Constituents*
1	6	7	0	0	0	Cd, Cr, Pb, Sb, O&G, VOA, T. Phenols
2	1	5	0	0	-	OCP, OCH
					11	OCP, OCH
6	0	0	0	0	20	DDT-R
9	2	3	0	0	0	Cd, Cr, Pb, O&G, VOA, T. Phenols
21	1	1	0	0	-	OCP, OCH, PCB
					6	OCP, OCH, PCB
					6	OCP, OCH
22	2	3	0	0	0	Pb, O&G, VOA
24	5	5	2	-	0	Metals A, VOA
				2S		Metals A
28	3	3	2	-	0	Metals B, OCP, PCB, O&G, VOA
				2S		Metals B, OCP, PCB, O&G
				2T		OCP, PCB
30	1	1	0	0	0	Pb, O&G, VOA
35	0	3†	0	0	-	Pb, O&G, VOA
					3	Visual Only, Pb, O&G
36	4	4	0	0	0	Cd, Cr, Pb, O&G, VOA, T. Phenols
41	4	4	0	0	0	Cd, Cr, Pb, VOA, T. Phenols, OCP, O&G, Mirex, Ordnance Compounds
45	3	5	0	0	-	Pb, O&G, VOA
					30	Visual Only
48	0	0	0	4S	4	Hg
54	1	2	0	0	-	Cd, Cr, Pb, O&G, VOA, T. Phenols

Table 1-1. Confirmation Study Verification Step Sampling and Analysis Program—MCB Camp Lejeune (Continued, Page 2 of 3)

Site No.	Wells to be Installed	Total Wells	Surface Water	Sediments (S) or Tissues (T)	Soil Samples	Analytical Constituents*
					15	Visual Only
68	3	5	0	0	0	VOA
69	8	8	3	0	0	OCP, PCB, PCP, VOA, Hg, Residual Chlorine
73	4	5	0	0	0	Cd, Cr, Pb, Sb, O&G, VOA, T. Phenols
74	2	3	0	0	–	OCP, OCH, PCB
					6	OCP, OCH, PCB
75	3	6	0	0	0	VOA
76	2	2	0	0	0	VOA

— = Not applicable.

* Key to Constituent Abbreviations:

Cd = Cadmium.
Cr = Chromium.
Pb = Lead.
Sb = Antimony.
O&G = Oil and grease.
VOA = Volatile organic analysis.
T. Phenols = Total phenols.
OCP = Organochlorine pesticides.
OCH = Organochlorine herbicides.
DDT-R = o,p- and p,p'-isomers of DDD, DDE, and DDT.
PCB = Polychlorinated biphenyls.
Metals A = Arsenic, cadmium, chromium, copper, lead, nickel, selenium, and zinc.
Metals B = Arsenic, cadmium, chromium, lead, mercury, nickel, and zinc.
Visual Only = Samples taken and inspected in the field for petroleum, oil, and/or lubricant (POL) contamination.
Ordnance Compounds = TNT, DNT, RDX, and white phosphorus (WP).
PCP = Pentachlorophenol.
Hg = Mercury.

† Hand-augered holes without casings.

Table 1-1. Confirmation Study Verification Step Sampling and Analysis Program—MCB Camp Lejeune (Continued, Page 3 of 3)

Organochlorine Pesticides (OCP)	Volatile Organic Analysis (VOA)
Aldrin	Acrolein
a-BHC	Acrylonitrile
b-BHC	Benzene
d-BHC	Bromomethane
g-BHC	Bromodichloromethane
Chlordane	Bromoform
4,4'-DDD	Carbon Tetrachloride
4,4'-DDE	Chlorobenzene
4,4'-DDT	Chloroethane
Dieldrin	Chloroform
Endosulfan I	Chloromethane
Endosulfan II	Dibromochloromethane
Endosulfan Sulfate	Dichlorodifluoromethane
Endrin	1,1-Dichloroethane
Endrin Aldehyde	1,2-Dichloroethane
Heptachlor	1,1-Dichloroethylene
Heptachlor Epoxide	T-1,2-Dichloroethene
Toxaphene	1,2-Dichloropropane
	Cis-1,3-dichloropropene
Organochlorine Herbicides (OCH)	T-1,3-dichloropropene
	Ethylbenzene
2,4-D	Methylene Chloride
2,4,5-T	1,1,2,2-Tetrachloroethane
Silvex	Tetrachloroethene
	1,1,1-Trichloroethane
DDT-R	1,1,2-Trichloroethane
	Trichloroethene
o,p-DDD	Trichlorofluoromethane
o,p-DDE	Toluene
o,p-DDT	Vinyl Chloride
p,p'-DDD	2-Chloroethylvinylether
p,p'-DDE	
p,p'-DDT	

Source: Environmental Science and Engineering (ESE), 1984.

Table 1-2. Soil Borings and Monitoring of Existing Wells

Site No.	No. of Soil Borings	No. of Samples Per Boring	Total No. of Soil Samples	(No.) and Bldg. No. of Existing Wells
1	0	0	0	(1) 636
2	5	3/3* and 1/2†	11	(4) 616,645,646, 647
6	20	1/20**	20	(0)
9	0	0	0	(1) 635
21	8 2	1/8† 2/2††	8 4	(0)
22	0	0	0	(1) 602
24	0	0	0	(0)
28	0	0	0	(0)
30	0	0	0	(0)
35	3	1/3***	3	(0)
36	0	0	0	(0)
41	0	0	0	(0)
45	9	0/9†††	0	(2) 131,4140
48	4	1/4***	4	(0)
54	9	0/9†††	0	(1) 5009
68	0	0	0	(2) RR-45,RR-97

Table 1-2. Soil Borings and Monitoring of Existing Wells (Page 2 of 2)

Site No.	No. of Soil Borings	No. of Samples Per Boring	Total No. of Soil Samples	(No.) and Bldg. No. of Existing Wells
69	0	0	0	(0)
73	0	0	0	(1) A-5
74	2	3/2*	6	(1) 654
75	0	0	0	(3) 106,203, S-TC-1251
76	0	0	0	(0)

* Composite sample from 0- to 1-foot depth, 1- to 2-foot depth, and 2- to 3-foot depth at each boring.
† Composite sample from 0- to 1-foot depth at each boring.
** Composite sample from 0- to 3-foot depth at each boring.
†† Composite sample from 0- to 1-foot depth and 1- to 2-foot depth at each boring.
*** Grab sample collected at ground water table elevation at each boring.
††† Visual inspection only.

Source: ESE, 1984.

As for AOL
Need to add NC, HA, SDWA, Water Quality, etc
for comparison!

2.0 DATA EVALUATION

As described in Section 1.0, this section presents the evaluation of the concentration data from the first round of verification sample collection and analysis relative to available standards and criteria. The data evaluation is presented on a site-by-site basis, and the potential for contaminant migration at each site also is discussed. Additionally, recommendations for future monitoring also are addressed.

The criteria used in the following data evaluation are the criteria for the protection of human health. These criteria are presented in the U.S. Environmental Protection Agency (EPA) 1980 Water Quality Criteria, Federal Register, 45(231). These criteria are based on the carcinogenic, toxic, or organoleptic (taste and odor) properties of the contaminants. Most criteria are based on the assumptions that exposure to the contaminant is derived solely through consumption of water containing a specified concentration of a toxic pollutant and through consumption of aquatic organisms which are assumed to have bioconcentrated pollutants from the water in which they lived.

In general, three types of criteria are presented in the EPA Water Quality Criteria: (1) specific health-based criteria, (2) criteria for suspect or proven carcinogens, and (3) organoleptic criteria.

Specific health-based criteria are presented as specific contaminant concentrations in water which, if exceeded, can be expected to cause a toxic effect in man. The criteria for suspect or proven carcinogens are presented as concentrations in water associated with a range of estimated incremental cancer risks to man. The range of concentrations corresponds to incremental cancer risks of 10^{-7} to 10^{-5} (one additional case of cancer in populations ranging from 10 million to 100,000, respectively). However, the concentration criteria associated with this range of estimated incremental cancer risks was developed by EPA for information purposes only; methods do not exist to establish the presence of a threshold for carcinogenic effects. The organoleptic

criteria are generally estimates of the levels of pollutants that will not produce unpleasant taste or odor either directly from water consumption or indirectly by consumption of contaminated aquatic organisms found in ambient waters. For some pollutants, however, specific toxicity-based criteria are presented for pollutants with derived organoleptic criteria.

The criteria described above were selected for use in this data evaluation because for most pollutants, these criteria are based on the most recent toxicity studies and account for the carcinogenic effects of contaminants. In addition, the EPA Water Quality Criteria which are based on carcinogenic effects are generally more conservative than other criteria which are based solely on acute toxic effects or a specific acute adverse response, such as the EPA Suggested No Adverse Response Levels (SNARLs). Furthermore, the use of EPA Water Quality Criteria in the assessment of ground water concentration data provides a more conservative evaluation because these criteria are based on the assumption that exposure to the contaminant includes consumption of contaminated aquatic organisms, which would not be found in ground water.

Health Advisories

That's why I don't only want to stick with them!

much to restrictive w/o proper interp.

Because Cr contamination was detected at several of the sites investigated (in terms of total Cr concentration) and the Cr criteria are presented for chromium in both the trivalent and hexavalent states, both the trivalent and hexavalent chromium criteria are addressed in the data evaluation. If the total Cr concentration detected exceeded the trivalent Cr criterion [170 milligrams per liter (mg/L)], then it was assumed that all of the chromium detected was in the trivalent state. Likewise, if the total Cr concentration exceeded the hexavalent Cr criterion [50 micrograms per liter (ug/L)], then it was assumed that all the Cr detected was in the hexavalent state.

2nd Rnd add Cr+6 to testing + total Cr.

Appendix A presents a list of abbreviations used in this report, and Appendix B contains the ground water elevation data for the shallow

ground water monitoring wells sampled during the investigation. Information concerning expected rate and direction of shallow ground water flow presented in the following sections is based on an analysis of the ground water elevation data contained in Appendix B.

SITE 1--FRENCH CREEK LIQUIDS DISPOSAL AREA

Site Investigation

- Six shallow ground water monitoring wells (Wells 1GW1 through 1GW6):
  - Five downgradient wells (Wells 1GW1 through 1GW5).
  - One upgradient well (Well 1GW6).

- Deep water supply well No. 636 (Well 1GW7).

Data Evaluation

Detectable levels of O&G, Cd, Cr, and Pb were identified in Wells 1GW1, 1GW2, and 1GW3 located north of the Main Service Road (see Table 2-1). Of these analytes, only Pb levels in Wells 1GW3 and 1GW2 exceeded the human health criterion (see Table 2-2). O&G values may exceed organoleptic (taste and odor) limits. Trace levels of volatile organic compounds and phenols were also detected, although distribution was sporadic. Levels of volatile organics in these wells were below the applicable 10^{-6} human health risk assessment levels (see Table 2-2). Levels of phenols in all wells were well below the human health criterion. South of the Main Service Road, detectable levels of O&G, phenols, Cd, Cr, and Pb occurred sporadically in Wells 1GW4, 1GW5, and 1GW6. All levels were below applicable criteria, as indicated in Table 2-2. Seven volatile organic compounds were detected in Well 1GW5. Only two compounds (11DCE and TCLEA) exceeded the 10^{-5} human health risk assessment level (see Table 2-2). In addition, 111TCE was detected in Well 1GW6, and TCE was detected in Wells 1GW1 and 1GW2. However, the levels of these compounds were below the 10^{-5} human health risk level.

Water supply well No. 636 (Well 1GW7) did not contain detectable levels of any analytes of concern. This well draws water from a lower zone of

Table 2-1. Site 1--French Creek Liquids Disposal Area Sampling Data

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400
FIELD GROUP: CLJW1
PARAMETERS: LJ1 SAMPLES: CLJW1S

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

PARAMETERS	STORET # METHOD #	SAMPLE NUMBERS 1GW1 374700	1GW2 374701	1GW3 374702	1GW4 374703	1GW5 374704	1GW6 374705	1GW7 374706
DATE		7/5/84	7/5/84	7/5/84	7/5/84	7/7/84	7/5/84	7/5/84
TIME		815	845	930	1015	1400	1130	1200
ACROLEIN (UG/L)	34210 0	<10	<10	<10	<10	<10	<10	<10
ACRYLONITRILE (UG/L)	34215 0	<10	<10	<10	<10	<10	<10	<10
BENZENE (UG/L)	34030 0	0.5	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
BROMODICHLOROMETHANE (UG/L)	32101 0	<0.60	<0.60	<0.60	<0.60	<0.60	<0.70	<0.60
BROMOFORM (UG/L)	32104 0	<1.30	<1.30	<1.30	<1.30	<1.30	<1.50	<1.40
BROMOMETHANE (UG/L)	34413 0	<1	<1	<1	<1	<1	<1	<1
CARBON TETRACHLORIDE (UG/L)	32102 0	<1.2	<1.2	<1.2	<1.1	<1.2	<1.4	<1.3
CHLOROBENZENE (UG/L)	34301 0	<0.40	<0.40	<0.40	<0.40	<0.40	<0.50	<0.40
CHLOROETHANE (UG/L)	34311 0	<1	<1	<1	<1	<1	<2	<1
2-CHLOROETHYLVINYLETHER (UG/L)	34576 0	<1	<1	<1	<1	<1	<1	<1
CHLOROFORM (UG/L)	32106 0	<0.60	<0.60	<0.60	<0.60	<0.60	<0.70	<0.60
CHLOROMETHANE (UG/L)	34418 0	<1	<1	<1	<1	<1	<1	<1
DIBROMOCHLOROMETHANE (UG/L)	34306 0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.20	<1.00
DICHLORODIFLUOROMETHANE (UG/L)	34668 0	<1	<1	<1	<1	<1	<1	<1
1,1-DICHLOROETHANE (UG/L)	34496 0	<0.50	<0.50	<0.50	<0.50	2.7	<0.60	<0.50
1,2-DICHLOROETHANE (UG/L)	34531 0	<0.80	<0.90	<0.90	<0.80	<0.90	<1.0	<0.90
1,1-DICHLOROETHYLENE (UG/L)	34501 0	<1.0	<1.0	<1.1	<1.0	1.1	<1.2	<1.1
T-1,2-DICHLOROETHENE (UG/L)	34546 0	1.0	<1.0	<1.0	<1.0	2.4	<1.2	<1.1
1,2-DICHLOROPROPANE (UG/L)	34541 0	<0.6	<0.6	<0.6	<0.6	<0.6	<0.7	<0.6
CIS-1,3-DICHLOROPROPENE (UG/L)	34704 0	<0.7	<0.7	<0.7	<0.7	<0.7	<0.8	<0.7

636

Add to this table the criteria used for evaluation to make it easier to see which ones exceed a criteria & how much in line of highlighting or print the criteria & then underline the offending value.

Table 2-1. Site 1--French Creek Liquids Disposal Area Sampling Data (Continued, Page 2 of 2)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400
FIELD GROUP: CLJW1
PARAMETERS: LJ1 SAMPLES: CLJW1S

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

PARAMETERS	STORET # METHOD #	SAMPLE NUMBERS 1GW1 374700	1GW2 374701	1GW3 374702	1GW4 374703	1GW5 374704	1GW6 374705	636 1GW7 374706
DATE		7/5/84	7/5/84	7/5/84	7/5/84	7/7/84	7/5/84	7/5/84
TIME		815	845	930	1015	1400	1130	1200
T-1,?-DICHL*PROPENE (UG/L)	34699 0	<0.5	<0	<0.5	<0.5	<0.5	<0.6	<0.5
ETHYLBENZENE (UG/L)	34371 0	<0.9	<0.9	<1	<0.9	<1	<1	<0.9
METHYLENE CHLORIDE (UG/L)	34423 0	<1	<1	<1	<1	<1	<1	<1
1,1,?,?-TE*CH*ETHANE TCLEA (UG/L)	34516 0	<0.7	<0.7	<0.8	<0.7	4	<0.8	<0.8
TETRACHLOROETHENE TCLEE (UG/L)	34475 0	<1.5	<1.5	<1.5	<1.5	6.8	<1.7	<1.5
1,1,1-TRICHL*ETHANE (UG/L)	34506 0	<1.0	<1.0	<1.0	<1.0	<1.0	14	<1.?
1,1,?-TRICHL*ETHANE (UG/L)	34511 0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.2	<0.90
TRICHLOROETHENE (UG/L)	39180 0	2.0	1.3	<1.2	<1.1	5.2	<1.3	<1.2
TRICHL*FLUOROMETHANE (UG/L)	34488 0	<1	<1	<1	<1	<1	<1	<1
TOLUENE (UG/L)	34010 0	<0.5	<0.5	0.6	<0.5	0.9	<0.6	<0.5
VINYL CHLORIDE(UG/L)	39175 0	<0.8	<0.8	<0.8	<0.8	<0.8	<0.9	<0.8
CADMIUM,TOTAL(UG/L) 10.0	1027 0	<6.0	7.0	10.0	7.0	<6.0	<6.0	<6.0
CHROMIUM,TOTAL(UG/L) 50.0 (Cr VI)	1034 0	94	150	29	49	7.0	34	<6.0
LEAD,TOTAL(UG/L)	1051 0	43.0	136.0	55.0	<40.0	<40.0	51.0	<40.0
ANTIMONY,TOTAL(UG/L)	1097 0	<54	<54	<54	<54	<54	<54	<54
OIL&GR,IR(MG/L)	560 0	2	2	3	2	<0.7	<0.8	<0.8
PHENOLS (UG/L)	32730 0	2	<1	2	2	2	<6	<5

Source: ESE, 1984.

Table 2-2. Site 1-- French Creek Liquids Disposal Area Data Evaluation

Analytes Detected	Regulatory Limits	Value (ug/L)	Samples Exceeding Limits
O&G	Organoleptic	NL*	NL
Phenols	Organoleptic	300	None
Cd	Drinking Water/Ambient Water	10	1GW3
Cr III	Ambient Water	170 mg/L	None
Cr VI	Drinking Water/Ambient Water	50	1GW1, 1GW2
Pb	Drinking Water/Ambient Water	50	1GW2, 1GW3, 1GW6
11DCLE	NCA†	NL	NL
11DCE	10^{-5} Human Health Risk Level	0.33	1GW5
T12DCE	NCA	NL	NL
TCLEE	10^{-5} Human Health Risk Level	8	None
TCLEA	10^{-5} Human Health Risk Level	1.7	1GW5
111TCE	Ambient Water	18.4 mg/L	None
TCE	10^{-5} Human Health Risk Level	27	None
Toluene	Ambient Water	14.3 mg/L	None

*NL = No numerical limit available.
†NCA = No criteria available.

Source: ESE, 1984.

the aquifer; there appears to be some degree of protection against vertical migration of observed shallow contaminants toward the lower producing zones of the aquifer.

The types of contaminants present at this site are consistent with the previous activities. Waste petroleum, oil, and lubricants (POL), battery acid, and general maintenance solvents were known to be used and disposed of at this site.

Suggest we add 2 SW and SD as shown

Migration Potential

Suggest we add 1 well as shown on attached

Site 1 is characterized by low natural ground water gradients. The shallow ground water flows at a low rate away from Site 1 toward Cogdels Creek to the northeast, north, northwest, and west, and toward a tributary to Cogdels Creek to the southwest. The current density of monitor wells is not sufficient to determine if contaminants are discharging into the surface water network. The low gradients will discourage the horizontal flow of contaminants, although some flow is expected.

Vertical migration of contaminants does not appear to be significant because well No. 636 is not yet affected by the presence of the shallow contaminants above it. Breakthrough of contaminants to the producing zone of well No. 636 remains a concern for the future.

Recommendations

All wells sampled in the first verification sampling event should be resampled in the second sampling event. All analyses conducted during the initial sampling and analysis effort should be repeated. OK

It appears that we do not have a true "up gradient" well. How will we explain away contamination in up gradient well/ or should we expand well field now or in characterization?
— Add Cr+6 along with Cr total everywhere we do Cr

SITE 2--FORMER NURSERY/DAY CARE CENTER (BLDG. 712)

Site Investigation

o One shallow ground water monitoring well (Well 2GW1).

o Four deep water supply wells:
  Well No. 616 (Well 2GW2)
  Well No. 645 (Well 2GW3)
  Well No. 646 (Well 2GW4)
  Well No. 647 (Well 2GW5)

o Three soil borings in former play area. Composite sample from 0- to 1-foot depth, 1- to 2-foot depth, and 2- to 3-foot depth at each boring.
  Soil Boring 2S1:
    0- to 1-foot depth (Sample 2S1A)
    1- to 2-foot depth (Sample 2S1B)
    2- to 3-foot depth (Sample 2S1C)
  Soil Boring 2S2:
    0- to 1-foot depth (Sample 2S2A)
    1- to 2-foot depth (Sample 2S2B)
    2- to 3-foot depth (Sample 2S2C)
  Soil Boring 2S3:
    0- to 1-foot depth (Sample 2S3A)
    1- to 2-foot depth (Sample 2S3B)
    2- to 3-foot depth (Sample 2S3C)

o Two soil borings in drainage ditch adjacent to site. Composite sample from 0- to 1-foot depth at each boring.
  Soil Boring 2S4 (upstream of site)
  Soil Boring 2S5 (downstream of site)

Data Evaluation

Ground Water:

(where is GW elev?)

As shown in Tables 2-3 and 2-4, detectable levels of DDD, DDE, and DDT above the 10^{-5} human health risk assessment level were identified in the shallow ground water monitoring well (Well 2GW1). These compounds were not detected in the four water supply wells in the vicinity of the site (Wells 2GW2, 2GW3, 2GW4, and 2GW5). Protection of these wells may be provided by horizontal separation from the site and vertical displacement of the producing zones in the wells relative to the shallow ground water at Site 2.

Soils/Sediments:

DDD, DDE, and DDT were detected in the majority of soil and sediment samples from Site 2. Only sample 2S5 (ditch-downstream) did not contain levels of these pesticides above detection limits. The presence of these compounds was reflected in the shallow ground water onsite.

Migration Potential

Although the natural ground water gradients in the vicinity of Site 2 are extremely low, pumping of four water supply wells in the area produces drawdown cones with increased gradients. Data describing these cones and the degree of hydraulic connection between deeper producing zones and the shallow aquifer are not available. The presence of shallow contaminants at Site 2 and active water withdrawal nearby indicates that further investigation may be required.

Recommendations

All wells sampled in the first verification sampling event should be resampled in the second sampling event. All analyses conducted during the initial sampling and analysis effort for the ground water samples should be repeated for the second sampling.

(See attached)

Table 2-3. Site 2--Former Nursery/Day Care Center (Bldg 712)
Sampling Data

ENVIRONMENTAL SCIENCE & ENGINEERING 11/15/85 STATUS: PRELIMINARY

PROJECT NUMBER 8422240
FIELD GROUP: CLJM1
PARAMETERS: LJ2 SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/SEISZLER
FIELD GROUP LEADER: BOB GREGORY

PARAMETERS	STORET # METHOD #	2GM1	616 2GM2	625 2GM3	646 2GM4	647 SAMPLE NUMBERS 2GM5
		374707	374708	374709	374710	374711
DATE		7/4/84	7/4/84	7/4/84	7/4/84	7/4/84
TIME		1600	1530	1545	1510	1520
ALDRIN (UG/L)	39330 0	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008
BHC,A (UG/L)	39337 0	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
BHC,B (UG/L)	39338 0	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
BHC,D (UG/L)	39259 0	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
BHC,G(LINDANE)(UG/L)	39340 0	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
CHLORDANE (UG/L)	39350 0	<0.010	<0.010	<0.010	<0.010	<0.010
DDD,PP'(UG/L)	39310 0	0.029	<0.003	<0.003	<0.003	<0.003
DDE,PP'(UG/L)	39320 0	0.016	<0.0008	<0.0008	<0.0008	<0.0008
DDT,PP'(UG/L)	39300 0	0.15	<0.005	<0.005	<0.005	<0.005
DIELDRIN (UG/L)	39380 0	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
ENDOSULFAN,A (UG/L)	34361 0	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008
ENDOSULFAN,B (UG/L)	34356 0	<0.002	<0.002	<0.002	<0.002	<0.002
ENDOSULFAN SULFATE (UG/L)	34351 0	<0.005	<0.005	<0.005	<0.005	<0.005
ENDRIN (UG/L)	39390 0	<0.002	<0.002	<0.002	<0.002	<0.002
ENDRIN ALDEHYDE (UG/L)	34366 0	<0.004	<0.004	<0.004	<0.004	<0.004
HEPTACHLOR (UG/L)	39410 0	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007
HEPTACHLOR EPOXIDE (UG/L)	39420 0	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
TOXAPHENE (UG/L)	39400 0	<0.100	<0.100	<0.100	<0.100	<0.100
2,4-D, TOTAL (UG/L)	39730 0	<0.080	<0.080	<0.080	<0.080	<0.080
2,4,5-T ESTER(UG/L)	39740 0	<0.04	<0.04	<0.04	<0.04	<0.04

Table 2-3. Site 2--Former Nursery/Day Care Center (Bldg 712)
Sampling Data (Continued, Page 2 of 6)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400 PROJECT NAME CAMP LEJEUNE
FIELD GROUP: CLJW1 PROJECT MANAGER: BOWEN/GEISZLER
PARAMETERS: PART SAMPLES: PART FIELD GROUP LEADER: BOB GREGORY

		SAMPLE NUMBERS				
		2GW1	2GW2	2GW3	2GW4	2GW5
PARAMETERS	STORET # METHOD #	374707	374708	374709	374710	374711
DATE		7/4/84	7/4/84	7/4/84	7/4/84	7/4/84
TIME		1600	1530	1545	1510	1500
2,4,5-TP/SILVEX (UG/L)	39760 0	<0.02	<0.02	<0.02	<0.02	<0.02

Table 2-3. Site 2--Former Nursery/Day Care Center (Bldg 712)
Sampling Data (Continued, Page 3 of 6)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400 PROJECT NAME CAMP LEJEUNE
FIELD GROUP: CLJS1 PROJECT MANAGER: BOWEN/GEISZLER
PARAMETERS: LS1 SAMPLES: PART FIELD GROUP LEADER: BOB GREGORY

PARAMETERS	STORET # METHOD #	SAMPLE NUMBERS 2S1A 374600	2S1B 374601	2S1C 374602	2S2A 374603	2S2B 374604	2S2C 374605	2S3A 374606	2S3B 374607	2S3C 374608	2S4 374609
DATE		8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84
TIME		1630	1630	1630	1630	1630	1630	1630	1630	1630	1630
ALDRIN,SED(UG/KG-DRY)	39333 0	<0.08	<0.08	<0.07	<0.08	<0.09	<0.09	<0.09	<0.09	<0.09	<0.10
BHC-A,SED(UG/KG-DRY)	39076 0	<0.06	<0.06	<0.05	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.07
BHC-B,SED(UG/KG-DRY)	34257 0	<0.04	<0.05	<0.04	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.06
BHC-G(LINDANE),SED UG/KG-DRY	39343 0	<0.04	<0.05	<0.04	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.06
BHC-D,SED(UG/KG-DRY)	34262 0	<0.10	<0.1	<0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
CHLORDANE,SED(UG/KG-DRY)	39351 0	<1.9	<2.0	<1.8	<2.1	<2.1	<2.2	<2.1	<2.1	<2.1	<2.4
DDD,PP',SED(UG/KG-DRY)	39311 0	2.2	0.6	<0.5	1.2	<0.6	<0.6	3.8	<0.6	<0.6	11
DDE,PP',SED (UG/KG-DRY)	39321 0	15	2.3	1.5	42	2.6	0.3	35	23	1.2	55
DDT,PP',SED(UG/KG-DRY)	39301 0	9.5	5.0	<1.2	18	<1.4	<1.4	57	3.1	<1.4	150
DIELDRIN,SED(UG/KG-DRY)	39383 0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.3	<0.2	<0.2	<0.2	<0.3
ENDOSULFAN-A,SED(UG/KG-DRY)	34364 0	<0.06	<0.06	<0.05	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.07
ENDOSULFAN-B,SED(UG/KG-DRY)	34359 0	<0.6	<0.6	<0.5	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.7
ENDOSULFAN SULF,SED, UG/KG-DRY	34354 0	<0.8	<0.8	<0.7	<0.8	<0.9	<0.9	<0.9	<0.9	<0.9	<1.0
ENDRIN,SED(UG/KG-DRY)	39393 0	<0.4	<0.5	<0.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.6
ENDRIN ALD.,SED(UG/KG-DRY)	34369 0	<0.6	<0.6	<0.5	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.7
HEPTACHLOR,SED(UG/KG-DRY)	39413 0	<0.07	<0.07	<0.06	<0.07	<0.07	<0.08	<0.07	<0.07	<0.07	<0.08
HEPTACHLOR EPOX,SED UG/KG-DRY	39423 0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TOXAPHENE,SED(UG/KG-DRY)	39403 0	<19	<20	<18	<21	<21	<22	<21	<21	<21	<24
2,4-D,SED(UG/KG-DRY)	39731 0	<3.3	<3.5	<3.2	<3.6	<3.7	<3.8	<3.6	<3.7	<3.7	<4.2
2,4,5-T,SED(UG/KG-DRY)	39741 0	<1.1	<1.2	<1.1	<1.2	<1.2	<1.3	<1.2	<1.2	<1.2	<1.4

Table 2-3. Site 2--Former Nursery/Day Care Center (Bldg 712)
Sampling Data (Continued, Page 4 of 6)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400 PROJECT NAME CAMP LEJEUNE
FIELD GROUP: CLJS1 PROJECT MANAGER: BOJEV/GEISZLER
PARAMETERS: LS1 SAMPLES: PART FIELD GROUP LEADER: BOB GREGORY

		SAMPLE NUMBERS									
PARAMETERS	STORET # METHOD #	2S1A 374600	2S1B 374601	2S1C 374602	2S2A 374603	2S2B 374604	2S2C 374605	2S3A 374606	2S3B 3746 7	2S3C 374608	2S4 374609
DATE		8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84
TIME		1630	1630	1630	1630	1630	1630	1630	1630	1630	1630
SILVEX,SED(UG/KG-D)	39761 0	<0.6	<0.6	<0.5	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.7
MOISTURE(%WET WT)	70320 0	9.5	14.1	5.5	17.2	18.8	21.7	17.8	19.9	19.4	28.0

Table 2-3. Site 2--Former Nursery/Day Care Center (Bldg 712)
Sampling Data (Continued, Page 5 of 6)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400
FIELD GROUP: CLJS1
PARAMETERS: LS1 SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

PARAMETERS	STORET # / METHOD #	SAMPLE NUMBERS 255 374610
DATE		8/3/84
TIME		1630
ALDRIN,SED(UG/KG-DRY)	39333 0	<0.1
BHC,A,SED(UG/KG-DRY)	39076 0	<0.07
BHC,B,SED(UG/KG-DRY)	34257 0	<0.06
BHC,G(LINDANE),SED UG/KG-DRY	39343 0	<0.06
BHC,D,SED(UG/KG-DRY)	34262 0	<0.1
CHLORDANE,SED(UG/KG-DRY)	39351 0	<2.5
DDD,PP',SED(UG/KG-DRY)	39311 0	<0.7
DDE,PP',SED (UG/KG-DRY)	39321 0	<0.3
DDT,PP',SED(UG/KG-DRY)	39301 0	<1.6
DIELDRIN,SED(UG/KG-DRY)	39383 0	<0.3
ENDOSULFAN,A,SED(UG/KG-DRY)	34364 0	<0.07
ENDOSULFAN,B,SED(UG/KG-DRY)	34359 0	<0.7
ENDOSULFAN SULF,SED, UG/KG-DRY	34354 0	<1.0
ENDRIN,SED(UG/KG-DRY)	39393 0	<0.6
ENDRIN ALD.,SED(UG/KG-DRY)	34369 0	<0.7
HEPTACHLOR,SED(UG/KG-DRY)	39413 0	<0.09
HEPTACHLOR EPOX,SED UG/KG-DRY	39423 0	<0.1
TOXAPHENE,SED(UG/KG-DRY)	39403 0	<25
2,4-D,SED(UG/KG-DRY)	39731 0	<4.3
2,4,5-T,SED(UG/KG-DRY)	39741 0	<1.4

Table 2-3. Site 2--Former Nursery/Day Care Center (Bldg 712)
Sampling Data (Continued, Page 6 of 6)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400
FIELD GROUP: CLJS1
PARAMETERS: LS1 SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

		SAMPLE NUMBERS
PARAMETERS	STORET # / METHOD #	255 374610
DATE		8/3/84
TIME		1630
SILVEX,SED(UG/KG-D)	39761 0	<0.7
MOISTURE(%WET WT)	70320 0	30.7

Source: ESE, 1984.

Table 2-4. Site 2--Former Nursery/Day Care Center Data Evaluation

Analytes Detected	Regulatory Limits	Value (ng/L)	Samples Exceeding Limits
DDD, PP'	NCA*	NL†	NL
DDE, PP'	NCA	NL	NL
DDT, PP'	10^{-5} Human Health Risk Level	0.24	2GW1

*NCA = No criteria available.
†NL = No numerical limit available.

Source: ESE, 1984.

SITE 6--STORAGE LOTS 201 AND 203

Site Investigation

o Twenty soil borings. Composite sample from 0- to 3-foot depth at each boring. Samples 6S1 through 6S20.

Data Evaluation

In many of the samples obtained at both Lots 201 and 203, DDDPP', DDEPP', and/or DDTPP' were detected (see Table 2-5). The individual levels of pesticides were generally higher than observed in the soil at nearby Site 2. Because lower levels of pesticides in the soil at Site 2 resulted in detectable contamination of ground water at Site 2, higher levels of pesticides at Site 6 probably have resulted in ground water contamination at Site 6.

Migration Potential

No data are available which document the presence of contaminants in the ground water at Site 6, or the value(s) of present ground water gradients. Migration under natural conditions would be expected to be minimal; however, pumping of water supply wells in the vicinity may cause increased movement of ground water and, possibly, contaminants.

Recommendations

No additional verification monitoring is recommended. However, characterization monitoring should be conducted to determine if the contamination detected in the soil has migrated down to the ground water.

— Add 8 wells as shown on the attached sketch (one from site 9)

- Sample (3) potable water wells, on Piney Green Road, for pesticides, dioxin and contaminants found in MCB work. and one on Holcomb Blvd.

— Sample water & sediment in Bearhead Creek? Wallace Creek?

Table 2-5. Site 6--Storage Lots 201 and 203 Sampling Data

ENVIRONMENTAL SCIENCE & ENGINEERING MULTIPLE FIELD GROUP REPORT REPORT DATE: WED, DEC 05 1984

CAMP LEJEUNE
STATION 6

		6S1 374611	6S1 398630	6S2 374612	6S2 398631	6S3 374613	6S4 374614	6S5 374615	6S6 374616	6S7 374617	6S8 374618
COLLECTION DATE		8/6/84	8/6/84	8/6/84	8/6/84	8/6/84	8/6/84	8/6/84	8/6/84	8/6/84	8/6/84
COLLECTION TIME		1130	1130	1130	1130	1130	1130	1130	1045	1045	1045
DDD,PP',SED(UG/KG-DRY)	39316 0	<0.426	<0.427	<0.420	0.657	<0.535	<0.419	<0.418	<0.430	<0.432	<0.437
DDE,PP',SED(UG/KG-DRY)	39328 0	<0.319	<0.321	<0.315	<0.323	<0.401	<0.314	<0.313	<0.322	<0.324	<0.328
DDT,PP',SED(UG/KG-DRY)	39306 0	1.17	<1.18	2.31	<1.19	<1.47	<1.15	1.78	<1.18	<1.19	4.80
DDD,PP',SED(UG/KG-DRY)	39311 0	<0.5	0.5	<0.5	<0.2	<0.7	<0.5	1.7	0.6	0.6	0.9
DDE,PP',SED (UG/KG-DRY)	39321 0	1.2	0.6	1.4	1.3	<0.3	0.5	<0.2	1.3	1.6	1.
DDT,PP',SED(UG/KG-DRY)	39301 0	<1.2	1.0	<1.2	<0.6	<1.5	<1.2	7.3	2.7	3.5	14
MOISTURE (PERCENT WT)	70320 0	6.1	6.4	4.8	7.2	25.2	4.5	4.3	6.9	7.4	8.4

Table 2-5. Site 6--Storage Lots 201 and 203 Sampling Data (Continued, Page 2 of 3)

ENVIRONMENTAL SCIENCE & ENGINEERING MULTIPLE FIELD GROUP REPORT REPORT DATE: WED. DEC 05 1984

CAMP LEJEUNE
STATION 6

		6S9 374619	6S10 374620	6S11 374621	6S12 374622	6S13 374623	6S14 374624	6S15 374625	6S16 374626	6S17 374627	6S18 374628
COLLECTION DATE		8/6/84	8/6/84	8/6/84	8/6/84	8/6/84	8/6/84	8/6/84	8/6/84	8/6/84	8/6/84
COLLECTION TIME		1045	1045	900	900	900	900	900	1000	1000	1000
DDD,PP',SED(UG/KG-DRY)	39316 0	<0.439	1.37	35.4	<0.426	13.6	4.15	<0.436	1.34	3.25	1.25
DDE,PP',SED(UG/KG-DRY)	39328 0	<0.329	<0.316	32.0	<0.320	5.12	7.73	<0.327	1.11	1.36	<0.347
DDT,PP',SED(UG/KG-DRY)	39306 0	<1.21	15.8	324	<1.17	426	120	<1.20	47.1	77.4	28.7
DDD,PP',SED(UG/KG-DRY)	39311 0	<0.5	4.8	160	<0.5	25	12	<0.5	11	4.7	3.3
DDE,PP',SED(UG/KG-DRY)	39321 0	1.6	1.5	120	<0.2	29	17	<0.2	4.9	13	2.7
DDT,PP',SED(UG/KG-DRY)	39301 0	<1.2	49	<1.2	<1.2	770	310	<1.2	300	120	73
MOISTURE(PCT WT)	76320 0	8.8	5.0	10.0	6.2	9.2	13.3	8.2	10.1	4.6	12.2

Table 2-5. Site 6--Storage Lots 201 and 203 Sampling Data (Continued, Page 3 of 3)

ENVIRONMENTAL SCIENCE & ENGINEERING MULTIPLE FIELD GROUP REPORT REPORT DATE: WED, DEC 05 1984

CAMP LEJEUNE
STATION 6

		6S19 374629	6S20 374630
COLLECTION DATE		8/6/84	8/6/84
COLLECTION TIME		1000	1300
DDD,PP',SED(UG/KG-DRY)	39316 0	1.95	0.442
DDE,PP',SED(UG/KG-DRY)	39328 0	2.28	<0.332
DDT,PP',SED(UG/KG-DRY)	39306 0	41.3	12.4
DDD,PP',SED(UG/KG-DRY)	39311 0	6.1	1.9
DDE,PP',SED (UG/KG-DRY)	39321 0	18	1.1
DDT,PP',SED(UG/KG-DRY)	39301 0	140	41
MOISTURE(PCT WT)	70320 0	7.8	9.6

Source: ESE, 1984.

SITE 9--FIRE FIGHTING TRAINING PIT

Site Investigation

o Two shallow ground water monitoring wells (Wells 9GW1 and 9GW2).

o Deep water supply well No. 639 (Well 9GW3).

Data Evaluation

Detectable levels of phenols, Cr, and Pb were found in Wells 9GW1 and 9GW2 (see Table 2-6). Levels of Pb exceeded the human health criterion in both wells (see Table 2-7); levels of phenols and Cr do not exceed these limits. O&G in Wells 9GW1 [3 milligrams per liter (mg/L)] probably exceed organoleptic limits, as noted during sampling. The water supply well located adjacent to Site 9 (Well 9GW3) does not contain detectable levels of these analytes. Protection of this well is attributed to the same parameters described for most of the other on-base water supply wells: vertical and horizontal distance from the source areas of potential contamination. All analytes detected at this site can be attributed to the burning of waste POL.

Migration Potential

Very low natural ground water gradients are estimated to exist at Site 9. However, pumping at the water supply well would increase the gradient locally. No data exist to estimate the degree of vertical and/or horizontal hydraulic connection between shallow and deep aquifer zones at this site. Currently, contamination from Site 9 has not affected the supply well.

Recommendations

OK

All wells sampled in the first verification sampling event should be resampled in the second sampling event. All analyses conducted during the initial sampling and analysis effort should be repeated for the second sampling.

- add additional well as shown on figure used for site 6
- add any contaminants found in mcb work for potable well + pesticides, dioxin. & PCB's. and test for both total Cr & Cr+6

Table 2-6. Site 9--Fire Fighting Training Pit Sampling Data

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER P4222406
FIELD GROUP: CLJN1
PARAMETERS: LJ1 SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

SAMPLE NUMBERS

PARAMETERS	STORET # METHOD #	9GW1 374712	9GW2 374713	9GW3 374714
DATE		7/5/84	7/5/84	7/5/84
TIME		1345	1420	1430
ACROLEIN (UG/L)	34210 0	<10	<10	<10
ACRYLONITRILE (UG/L)	34215 0	<10	<10	<10
BENZENE (UG/L)	34030 0	<0.3	<0.3	<0.3
BROMODICHLOROMETHANE (UG/L)	32101 0	<0.70	<0.70	<0.60
BROMOFORM (UG/L)	32104 0	<1.40	<1.40	<1.30
BROMOMETHANE (UG/L)	34413 0	<1	<1	<1
CARBON TETRACHLORIDE (UG/L)	32102 0	<1.3	<1.3	<1.3
CHLOROBENZENE (UG/L)	34301 0	<0.50	<0.50	<0.40
CHLOROETHANE (UG/L)	34311 0	<1	<1	<1
2-CHLOROETHYLVINYLETHER (UG/L)	34576 0	<1	<1	<1
CHLOROFORM (UG/L)	32106 0	<0.60	<0.60	<0.60
CHLOROMETHANE (UG/L)	34418 0	<1	<1	<1
DIBROMOCHLOROMETHANE (UG/L)	34306 0	<1.10	<1.10	<1.00
DICHLORODIFLUOROMETHANE (UG/L)	34668 0	<1	<1	<1
1,1-DICHLOROETHANE (UG/L)	34496 0	<0.50	<0.50	<0.50
1,2-DICHLOROETHANE (UG/L)	34531 0	<0.90	<0.90	<0.90
1,1-DICHLOROETHYLENE (UG/L)	34501 0	<1.1	<1.1	<1.1
T-1,2-DICHLOROETHENE (UG/L)	34546 0	<1.1	<1.1	<1.0
1,2-DICHLOROPROPANE (UG/L)	34541 0	<0.7	<0.7	<0.6
CIS-1,3-DICHLOROPROPENE (UG/L)	34704 0	<0.7	<0.7	<0.7

Table 2-6. Site 9--Fire Fighting Training Pit Sampling Data (Continued, Page 2 of 2)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/18/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400
FIELD GROUP: CLJW1
PARAMETERS: LJ1 SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

PARAMETERS	STORET # / METHOD #	SAMPLE NUMBERS 9GW1 374712	9GW2 374713	9GW3 374714
DATE		7/5/84	7/5/84	7/5/84
TIME		1345	1420	1430
T-1,3-DICHL*PROPENE (UG/L)	34699 0	<0.6	<0.6	<0.5
ETHYLBENZENE (UG/L)	34371 0	<1	<1	<0.9
METHYLENE CHLORIDE (UG/L)	34423 0	<1	<1	<1
1,1,2,2-TE*CH*ETHANE (UG/L)	34516 0	<0.8	<0.8	<0.8
TETRACHLOROETHENE (UG/L)	34475 0	<1.6	<1.6	<1.5
1,1,1-TRICHL*ETHANE (UG/L)	345 6 0	<1.1	<1.1	<1.0
1,1,2-TRICHL*ETHANE (UG/L)	34511 0	<1.0	<1.0	<0.90
TRICHLOROETHENE (UG/L)	39180 0	<1.2	<1.2	<1.2
TRICHL*FLUOROMETHANE (UG/L)	34488 0	<1	<1	<1
TOLUENE (UG/L)	34010 0	<0.5	<0.5	<0.5
VINYL CHLORIDE(UG/L)	39175 0	<0.8	<0.8	<0.8
CADMIUM,TOTAL(UG/L)	1027 0	<6.0	<6.0	<6.0
CHROMIUM,TOTAL(UG/L)	1034 0	45	86	<6.0
LEAD,TOTAL(UG/L)	1051 0	80.0	94.0	<40.0
OIL&GR,IR(MG/L)	560 0	3	<0.7	<0.8
PHENOLS (UG/L)	32730 0	3	4	<1

Source: ESE, 1984.

Table 2-7. Site 9--Fire Fighting Training Pit Data Evaluation

Analytes Detected	Regulatory Limits	Value (ug/L)	Samples Exceeding Limits
O&G	Organoleptic	NL*	9GW1 (Obvious odor during sampling)
Phenols	Organoleptic	300	None
Cr III	Ambient Water	170 mg/L	None
Cr VI	Drinking Water/Ambient Water	50	9GW2
Pb	Drinking Water/Ambient Water	50	9GW1, 9GW2

*NL = No numerical limit available.

Source: ESE, 1984.

SITE 21--TRANSFORMER STORAGE LOT 140

Site Evaluation

o Four soil borings inside fenced compound.

Soil Boring 21S2A. Composite soil sample from 0- to 1-foot depth (Sample 21S2A).

Soil Boring 21S2B. Composite soil sample from 0- to 1-foot depth (Sample 21S2B).

Soil Boring 21S1. Composite soil sample from 0- to 1-foot depth and 1- to 2-foot depth.

0- to 1-foot depth (Sample 21S1A)

1- to 2-foot depth (Sample 21S1B)

Soil Boring 21S1C/21S2C. Composite soil sample from 0- to 1-foot depth and 1- to 2-foot depth.

0- to 1-foot depth (Sample 21S1C)

1- to 2-foot depth (Sample 21S2C)

o Six soil borings outside fenced compound. Composite soil sample from 0- to 1-foot depth at each boring (Samples 21S3A through 21S3C, and 21S4A through 21S4C).

Data Evaluation

Ground Water:

It is suspected that pesticides and PCB oils were disposed of at Site 21. As shown in Table 2-8, shallow ground water collected at Well 21GW1 did not contain detectable levels of any of these analytes, indicating that disposal may have involved quantities that have dispersed/degraded via natural mechanisms prior to reaching the ground water. Lack of mobility (vertical) would also preclude movement from a surface source toward the shallow ground water.

Table 2-8. Site 21--Transformer Storage Lot 140 Sampling Data

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400
FIELD GROUP: CLJW1
PARAMETERS: LJ4 SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

SAMPLE NUMBERS

PARAMETERS	STORET # METHOD #	21GW1 374715
DATE		7/4/84
TIME		920
ALDRIN (UG/L)	39330 0	<0.0008
BHC,A (UG/L)	39337 0	<0.0010
BHC,B (UG/L)	39338 0	<0.00010
BHC,D (UG/L)	39259 0	<0.0003
BHC,G(LINDANE)(UG/L)	39340 0	<0.00010
CHLORDANE (UG/L)	39350 0	<0.010
DDD,PP'(UG/L)	39310 0	<0.003
DDE,PP'(UG/L)	39320 0	<0.0008
DDT,PP'(UG/L)	39300 0	<0.005
DIELDRIN (UG/L)	39380 0	<0.0010
ENDOSULFAN,A (UG/L)	34361 0	<0.0008
ENDOSULFAN,B (UG/L)	34356 0	<0.002
ENDOSULFAN SULFATE (UG/L)	34351 0	<0.005
ENDRIN (UG/L)	39390 0	<0.002
ENDRIN ALDEHYDE (UG/L)	34366 0	<0.004
HEPTACHLOR (UG/L)	39410 0	<0.0007
HEPTACHLOR EPOXIDE (UG/L)	39420 0	<0.0006
TOXAPHENE (UG/L)	39400 0	<0.100
2,4-D, TOTAL (UG/L)	39730 0	<0.080
2,4,5-T WATER(UG/L)	39740 0	<0.04

Table 2-8. Site 21--Transformer Storage Lot 140 Sampling Data (Continued, Page 2 of 6)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400
FIELD GROUP: CLJW1
PARAMETERS: LJ4 SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

SAMPLE NUMBERS

PARAMETERS	STORET # / METHOD #	21GW1 374715
DATE		7/4/84
TIME		920
2,4,5-TP/SILVEX (UG/L)	39760 0	<0.02
PCBS, WATER(UG/L)	39516 0	<0.010

Table 2-8. Site 21--Transformer Storage Lot 140 Sampling Data (Continued, Page 3 of 6)

ENVIRONMENTAL SCIENCE & ENGINEERING MULTIPLE FIELD GROUP REPORT REPORT DATE: WED, DEC 05 1984

CAMP LEJEUNE
STATION 21

		21S1A 374631	21S1A 398602	21S1B 374632	21S1B 398603	21S1C 374633	21S1C 398604	21S2A 374634	21S2A 398605	21S2B 374635	21S2C 374636
COLLECTION DATE		8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84
COLLECTION TIME		1130	1730	1130	1730	1130	1730	1145	1730	1145	1145
ALDRIN,SED(UG/KG-DRY)	39333 0	1.1	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.07	<0.08	<0.08
BHC,A,SED(UG/KG-DRY)	39076 0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.06	<0.05	<0.05	<0.05	<0.06
BHC,B,SED(UG/KG-DRY)	34257 0	<0.04	<0.04	<0.04	<0.04	<0.04	<0.05	<0.04	<0.04	<0.04	<0.04
BHC,G(LINDANE),SED (UG/KG-DRY	39343 0	<0.04	<0.04	<0.04	<0.04	<0.04	<0.05	<0.04	<0.04	<0.04	<0.04
BHC,D,SED(UG/KG-DRY)	34262 0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.10
CHLORDANE,SED(UG/KG-DRY)	39351 0	<1.8	<1.8	<1.8	<1.8	<1.9	<1.9	<1.8	<1.8	<1.8	<1.9
DDD,PP',SED(UG/KG-DRY)	39311 0	5.1	4.0	<0.5	0.6	<0.5	<0.6	7.4	4.7	4.4	<0.6
DDE,PP',SED (UG/KG-DRY)	39321 0	46	4.3	<0.2	5.6	<0.2	3.1	74	5.7	48	25
DDT,PP',SED(UG/KG-DRY)	39301 0	52	14	<1.2	5.8	<1.2	<1.2	37	5.7	40	87
DIELDRIN,SED(UG/KG-DRY)	39383 0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
ENDOSULFAN,A,SED(UG/KG-DRY)	34364 0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.06	<0.05	<0.05	<0.05	<0.06
ENDOSULFAN,B,SED(UG/KG-DRY)	34359 0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.6	<0.5	<0.5	<0.5	<0.6
ENDOSULFAN SULF,SED, (UG/KG-DRY	34354 0	<0.7	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.7	<0.8	<0.8
ENDRIN,SED(UG/KG-DRY)	39393 0	<0.4	<0.4	<0.4	<0.4	<0.4	<0.5	<0.4	<0.4	<0.4	<0.4
ENDRIN ALD.,SED(UG/KG-DRY)	34369 0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.6	<0.5	<0.5	<0.5	<0.6
HEPTACHLOR,SED(UG/KG-DRY)	39413 0	<0.06	<0.06	<0.07	<0.06	<0.07	<0.07	<0.07	<0.06	<0.06	<0.07
HEPTACHLOR EPOX,SED (UG/KG-DRY	39423 0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TOXAPHENE,SED(UG/KG-DRY)	39403 0	<18	<19	<18	<18	<19	<19	<18	<18	<18	<19
2,4-D,SED(UG/KG-DRY)	39731 0	<3.2	<3.2	<3.3	<3.2	<3.3	NA	<3.3	NA	<3.2	<3.3
2,4,5-T,SED(UG/KG-DRY)	39741 0	<1.1	<1.1	<1.1	<1.1	<1.1	NA	<1.1	NA	<1.1	<1.1

Table 2-8. Site 21--Transformer Storage Lot 140 Sampling Data (Continued, Page 4 of 6)

ENVIRONMENTAL SCIENCE & ENGINEERING MULTIPLE FIELD GROUP REPORT REPORT DATE: WED, DEC 05 1984

CAMP LEJEUNE
STATION 21

		21S1A 374631	21S1A 398602	21S1B 374632	21S1B 398603	21S1C 374633	21S1C 398604	21S2A 374634	21S2A 398605	21S2B 374635	21S2C 374636
COLLECTION DATE		8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84
COLLECTION TIME		1130	1730	1130	1730	1130	1730	1145	1730	1145	1145
SILVER,SED(UG/KG-D)	39761 0	<0.5	<0.5	<0.5	<0.5	<0.5	NA	<0.5	NA	<0.5	<0.5
PCBS,SED(UG/KG-DRY)	39519 0	<1.8	<1.8	<1.8	<1.8	<1.9	<1.9	<1.8	<1.8	<1.8	<1.9
MOISTURE(PCT WT)	70320 0	6.3	6.7	8.0	7.6	8.5	11.7	8.0	5.0	5.7	9.8

Table 2-8. Site 21--Transformer Storage Lot 140 Sampling Data (Continued, Page 5 of 6)

ENVIRONMENTAL SCIENCE & ENGINEERING MULTIPLE FIELD GROUP REPORT REPORT DATE: WED, DEC 05 1984

CAMP LEJEUNE
STATION 21

		21S2A 374637	21S3B 374638	21S3C 374639	21S4A 374640	21S4B 374641	21S4C 374642
COLLECTION DATE		8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84
COLLECTION TIME		1200	1200	1200	1215	1215	1215
ALDRIN,SED(UG/KG-DRY)	39333 0	<0.08	<0.08	<0.08	<0.07	<0.08	<0.07
BHC,A,SED(UG/KG-DRY)	39076 0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
BHC,B,SED(UG/KG-DRY)	34257 0	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
BHC,G(LINDANE),SED (UG/KG-DRY	39343 0	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
BHC,D,SED(UG/KG-DRY)	34262 0	<0.10	<0.10	<0.10	<0.09	<0.10	<0.10
CHLORDANE,SED(UG/KG-DRY)	39351 0	<1.9	<1.8	<1.8	<1.8	<1.8	<1.8
DDD,PP',SED(UG/KG-DRY)	39311 0	4.4	3.6	7.0	<0.5	<0.5	23
DDE,PP',SED (UG/KG-DRY)	39321 0	53	42	40	160	220	7.9
DDT,PP',SED(UG/KG-DRY)	39301 0	20	14	30	780	2100	74
DIELDRIN,SED(UG/KG-DRY)	39383 0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
ENDOSULFAN,A,SED(UG/KG-DRY)	34364 0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ENDOSULFAN,B,SED(UG/KG-DRY)	34359 0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
ENDOSULFAN SULF,SED, UG/KG-DRY	34354 0	<0.8	<0.8	<0.8	<0.7	<0.8	<0.7
ENDRIN,SED(UG/KG-DRY)	39393 0	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
ENDRIN ALD.,SED(UG/KG-DRY)	34369 0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
HEPTACHLOR,SED(UG/KG-DRY)	39413 0	<0.07	<0.07	<0.06	<0.06	<0.06	2.7
HEPTACHLOR EPOX,SED UG/KG-DRY	39423 0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TOXAPHENE,SED(UG/KG-DRY)	39403 0	<19	<18	<18	<18	<18	<18
2,4-D,SED(UG/KG-DRY)	39731 0	<3.3	<3.3	<3.2	<3.2	<3.2	<3.2
2,4,5-T,SED(UG/KG-DRY)	39741 0	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1

Table 2-8. Site 21--Transformer Storage Lot 140 Sampling Data (Continued, Page 6 of 6)

ENVIRONMENTAL SCIENCE & ENGINEERING MULTIPLE FIELD GROUP REPORT REPORT DATE: WED, DEC 05 1984

CAMP LEJEUNE
STATION 21

		21S3A 374637	21S3B 374638	21S3C 374639	21S4A 374640	21S4B 374641	21S4C 374642
COLLECTION DATE		8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84
COLLECTION TIME		1200	1200	1200	1215	1215	1215
SILVER, SED(UG/KG-D)	39761 0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
PCBS, SED(UG/KG-DRY)	39519 0	<1.9	<1.8	<1.8	<1.8	<1.8	<1.9
MOISTURE(WET WT)	70320 0	8.9	7.9	7.6	5.0	7.2	6.1

Source: ESE, 1984.

Soil:

The majority of soil samples from Site 21 contained one or all of the following compounds: DDD, DDE, and DDT. In addition, one sample contained aldrin, and one contained heptachlor. These data verify the handling/disposal of these compounds at Site 21. No PCB was detected in any of the soil samples.

Migration Potential

Pesticide compounds were detected in the shallow soils but were not detected in the underlying ground water. These data suggest that pesticides are not mobile and that migration potential from Site 21 is low. If contaminants were to reach the shallow ground water, it is possible for them to migrate with ground water flow influenced by the pumping of numerous water supply wells in the area.

Recommendations concur

Well 21GW1 should be resampled in the second sampling event. All analyses conducted during the initial sampling and analysis effort should be repeated for the second sampling.

- add VOA's, dioxin, xylene, MIK, MIBK, EOB oil & grease to the list. This will also help us for Site 22

We must send them our (1141's) report on well data, what it means & what wells to keep shut down.

SITE 22--INDUSTRIAL AREA TANK FARM

Site Investigation

o Two shallow ground water monitoring wells:

Well 22GW1 - In tank farm area.

Well 22GW2 - Between tank farm and deep water supply well No. 602 (Well 22GW3).

o Deep water supply well No. 602 (Well 22GW3)

Data Evaluation

The analytical data for Site 22 is presented in Table 2-9, and information relative to the detected analytical parameters is presented in Table 2-10. As shown in Table 2-9, extremely high levels of benzene, ethylbenzene, toluene, and lead were detected in Well 22GW1 located at the tank farm. These compounds are fuel components and further document the leakage of large quantities of fuel at this site. Additionally, low levels of 1,2DCLEE and 12DCLP were detected in Well 22GW1. These levels may be attributed to possible spillage of degreasing solvents in the tank farm area. Well 22GW2 appears to be free from contamination, with the exception of a low concentration of O&G (1 mg/L). Of extreme importance is the high level of benzene (380 ug/L) detected in the sample collected from deep water supply well No. 602 (Well 22GW3). This benzene concentration far exceeds the 10^{-5} human health risk limit of 6.6 ug/L; therefore, the use of this well should be discontinued immediately. In addition, the CCL3F concentration of 3 ug/L detected in well No. 6 (Well 22GW3) exceeds the 10^{-5} human health risk limit of 1.9 ug/L.

Migration Potential

All analytical parameters for Well 22GW2 were below detection limit, except O&G, and the O&G concentration was only 1 mg/L. Significant migration of contaminants in the shallow ground water westward from the tank farm has not occurred. Water supply well No. 602 (Well 22GW3), however, contains detectable levels of six organic compounds which may

Table 2-9. Site 22--Industrial Area Tank Farm Sampling Data

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84

STATUS: PRELIMINARY

PROJECT NUMBER 8422246
FIELD GROUP: CLDW1
PARAMETERS: LDS SAMPLES: DART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

602

PARAMETERS	STORET # METHOD #	22GW1 374716	22GW2 374717	22GW3 374718
DATE		7/6/84	7/5/84	7/6/84
TIME		830	740	850
ACROLEIN (UG/L)	34210 0	<8	<10	<10
ACRYLONITRILE (UG/L)	34215 0	<8	<10	<10
BENZENE (UG/L)	34030 0	17000	<0.3	380
BROMODICHLOROMETHANE (UG/L)	32101 0	<0.50	<0.70	<0.70
BROMOFORM (UG/L)	32104 0	<1.10	<1.60	<1.50
BROMOMETHANE (UG/L)	34413 0	<0.8	<1	<1
CARBON TETRACHLORIDE (UG/L)	32102 0	<1.0	<1.6	<1.5
CHLOROBENZENE (UG/L)	34301 0	<0.40	<0.50	<0.50
CHLOROETHANE (UG/L)	34311 0	<1	<2	<2
2-CHLOROETHYLVINYLETHER (UG/L)	34576 0	<1	<2	<2
CHLOROFORM (UG/L)	32106 0	0.70	<0.70	<0.70
CHLOROMETHANE (UG/L)	34418 0	<0.9	<1	<1
DIBROMOCHLOROMETHANE (UG/L)	34306 0	<0.90	<1.20	<1.20
DICHLORODIFLUOROMETHANE (UG/L)	34668 0	<0.9	<1	<1
1,1-DICHLOROETHANE (UG/L)	34496 0	<0.40	<0.60	<0.60
1,2-DICHLOROETHANE (UG/L)	34531 0	52	<1.0	46
1,1-DICHLOROETHYLENE (UG/L)	34501 0	<0.90	<1.3	<1.3
T-1,2-DICHLOROETHENE (UG/L)	34546 0	<0.80	<1.3	7.8
1,2-DICHLOROPROPANE (UG/L)	34541 0	18	<0.7	<0.7
CIS-1,3-DICHLOROPROPENE (UG/L)	34704 0	<0.6	<0.8	<0.8

Table 2-9. Site 22--Industrial Area Tank Farm Sampling Data (Continued, Page 2 of 2)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 8422240
FIELD GROUP: CLJW1
PARAMETERS: LJ5 SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

SAMPLE NUMBERS

PARAMETERS	STORET # METHOD #	22GW1 374716	22GW2 374717	22GW3 374718
DATE		7/6/84	7/6/84	7/6/84
TIME		830	740	850
T-1,3-DICHLOROPROPENE (UG/L)	34699 0	<0.4	<0.6	<0.6
ETHYLBENZENE (UG/L)	34371 0	2800	<1	8
METHYLENE CHLORIDE (UG/L)	34423 0	<0.8	<1	<1
1,1,2,2-TETRACHLOROETHANE (UG/L)	34516 0	<0.6	<0.9	<0.9
TETRACHLOROETHENE (UG/L)	34475 0	<1.2	<2.0	<1.9
1,1,1-TRICHLOROETHANE (UG/L)	34506 0	<0.80	<1.3	<1.2
1,1,2-TRICHLOROETHANE (UG/L)	34511 0	<0.80	<1.2	<1.1
TRICHLOROETHENE (UG/L)	39180 0	<1.0	<1.4	<1.4
TRICHLOROFLUOROMETHANE (UG/L)	34488 0	<0.9	<1	3
TOLUENE (UG/L)	34010 0	27000	<0.6	10
VINYL CHLORIDE(UG/L)	39175 0	<0.6	<0.9	<0.9
LEAD,TOTAL(UG/L)	1051 0	807.0	<40.0	<40.0
OIL&GR,IR(MG/L)	560 0	<0.9	1	<0.8

Source: ESE, 1984.

Table 2-10. Site 22--Industrial Area Tank Farm Data Evaluation

Analytes Detected	Regulatory Limit*	Value (ug/L)	Samples Exceeding Limit
O&G	Organoleptic	NL*	None
Pb	Drinking Water/Ambient Water	50	22GW1
1,2-Dichloropropane	NCA†	NL	NL
12DCLEE	NCA	NL	NL
T-1,2-Dichloroethene	NCA	NL	NL
Benzene	10^{-5} Human Health Risk Level	6.6	22GW1, 22GW3
Chloroform	10^{-5} Human Health Risk Level	1.9	None
Ethylbenzene	10^{-5} Human Health Risk Level	1,400	22GW1
Toluene	10^{-5} Human Health Risk Level	14,300	22GW1
CCL3F	10^{-5} Human Health Risk Level	1.9	22GW3

* NCA = No criteria available.
† NL = No numerical limit.

Source: ESE, 1985.

be derived from the tank farm area. This may be attributed to hydraulic connection of the producing zone(s) of well No. 602 with deeper contaminated zones at the tank farm. The absence of contamination at Well 22GW2 indicates that the migration pathway is deep, not shallow. Of the six organic compounds detected at supply well No. 602 (Well 22GW3), only benzene and CCL3F exceed applicable health criteria/guidelines.

Recommendations

Because the first round of verification sampling and analysis conducted at Site 22 indicated significant contamination of deep water supply well No. 602, it is recommended that no further verification monitoring be performed and that a more intensive characterization monitoring program be developed and implemented. The following sections describe the background of the Site 22 investigation, outline the objectives of the proposed characterization monitoring program, and describe the proposed methodology for implementing the Characterization Study at Site 22.

Background--Water quality sampling at Site 22 conducted by ESE during the Verification Step detected the presence of fuel-derived contaminants (benzene, ethylbenzene, toluene, and lead) in shallow monitor Well 22GW1 and deep water supply well No. 602. Trace quantities of several chlorinated solvents also were identified.

In subsequent sampling by LANTDIV at well No. 602 and others, the levels of chlorinated solvents have increased dramatically, whereas the fuel-derived contaminants have remained relatively constant. These facts suggest that a second plume of contamination, characterized by the presence of chlorinated solvents, has reached well No. 602 subsequent to the Verification Step sampling.

Several potential source areas may exist. The main industrial area is a logical source of solvents, although a specific source was not identified in the Initial Assessment Study (IAS) report.

The area to the west of Holcomb Boulevard and well No. 602 contains a disposal area utilized by the Naval Research Laboratory. [Identified as the Naval Research Laboratory Dump (Site 19) in the IAS report.] The records evaluated by the IAS appear to indicate that activities producing the waste materials disposed of in this area did not include solvent use. The data, however, indicate that this area could be a source. This may be possible because small, unauthorized dumps of waste solvent could have taken place without any records.

Site 10, the Original Base Dump, was considered as a potential site. However, water quality data from well No. 637, which is located between Site 10 and the area in which contamination has been identified, show that well No. 637 does not contain detectable levels of any of the analytes of concern.

All proposed Characterization Step efforts will be confined to the Hadnot Point industrial area, and to the area to the west of Holcomb Boulevard and well No. 602.

Objectives--The objectives of the Characterization Step of the investigation of Site 22 are listed below:

1. Locate source of TCE and other chlorinated volatile organic compounds detected in deep water supply wells Nos. 601, 602, 604, and 608; 634, 637, 642
2. Determine concentration of detected analytes in source area(s);
3. Determine hydraulic conductivity of sediments in source area(s) and at affected wells; and
4. Determine continuity of semi-confining bed between water table aquifer and deep zones yielding ground water to supply wells.

Methodology--The observed distribution of contaminants near the main industrial area of Hadnot Point suggests that several contaminant

Integrate their objectives & our scope together & put to them as our idea on how to proceed.

sources may exist. ESE recommends that all records of activities within the industrial area be reviewed with the following goals:

1. Document historical usage of all solvents at specific buildings/yards; and
2. Map locations of all tanks, pits, drains, storage areas, loading docks, oil water separators, and maintenance racks.

The motor pool on the south side of Dogwood Street should be included in this effort because of the documented presence of TCE in an adjacent stream. In addition, a detailed review of the Naval Research Laboratory waste disposal activities should be included also in this study.

The work product of this effort should be a detailed map of all potential source areas within the industrial area and near the Naval Research Laboratory. This map will be used to determine the orientation and density of the grid to be utilized during the proposed soil gas investigation.

A soil gas investigaiton is recommended to delineate the source area(s) of observed waste solvents. An excerpt from a promotional document produced by Tracer Research Corporion of Tucson, Arizona, the developers of the soil gas technique, is presented in Appendix C. The theory, applicability, and benefits of this technique are outlined in Appendix C.

The soil gas investigation should be conducted in a grid-work distribution throughout the main industrial area to attempt to locate discrete sources (i.e., buried storage tanks, bulk liquid disposal areas). Additionally, the area to the west of well No. 602 should be investigated. The pattern of contamination observed in supply well No. 602 may be produced by a contaminant source in the vicinity of Site 19, the Naval Research Laboratory Dump.

The pattern and density of the soil gas investigation may be altered at any time to respond to the real time data generated in the field. The results of the soil gas investigation will allow accurate placement of ground water monitoring wells which will be required to determine concentrations of contaminants in the ground water.

The results of the soil gas investigation should consist of a map outlining source areas of the waste solvents. The pattern of contamination revealed by the soil gas accurately follows the pattern of contamination in the ground water. However, there is not an established correlation between concentration of a compound in the soil gas (micrograms of analyte per liter of air) and the concentration of the compound in the ground water (micrograms per liter of water). Because of this, and the fact that applicable environmental regulations/guidelines/criteria are tied to concentrations of contaminants in water, monitor wells must be installed to sample the ground water in source areas. Why not, let's try it depending on how much it costs!

A best-estimate plot of the proposed monitor well locations is shown in Figure 2-1. Final number and placement of these wells will depend on the results of the soil gas investigation. Wells 22GW4 through 22GW7 are shallow wells which will form pairs with the deep supply wells. The well pairs will allow delineation of flow path of contaminants to the supply wells. These flow paths may be via horizontal shallow ground water flow with vertical flow through discontinuous confining beds near the supply wells, or horizontal flow of contaminants through deep aquifer zones after initial vertical flow of contaminants near a source area.

The well pairs will also allow aquifer testing to quantify the amount of confinement of lower aquifer zones.

Well 22GW8 is a shallow well in the vicinity of the Dogwood Street motor pool facility, which may be the source of TCE observed in a nearby stream.

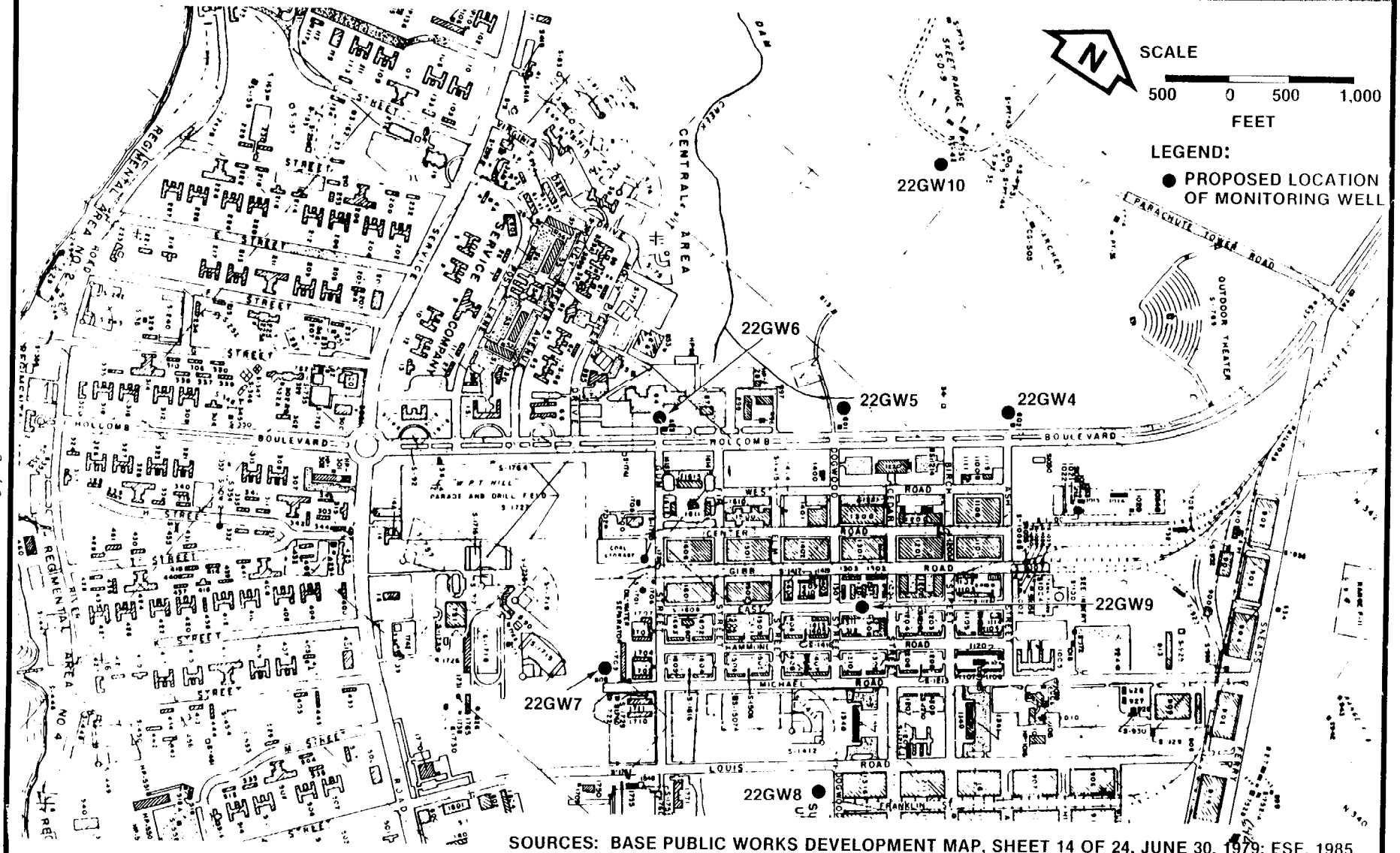


Figure 2-1
PROPOSED LOCATION OF CHARACTERIZATION STEP MONITORING WELLS AT SITE 22--INDUSTRIAL AREA TANK FARM

CONFIRMATION STUDY
MARINE CORPS BASE
CAMP LEJEUNE

Well 22GW9 is a proposed shallow well to quantify ground water contamination near an underground storage tank which has been preliminarily identified by LANTDIV personnel. move NE closer to fuel farm
who? Not me!

Well 22GW10 will monitor the ground water at the Naval Research Laboratory dump if so indicated by the soil gas investigation. All new monitor wells will be surveyed to a common vertical datum to allow measurement of ground water levels and gradients. Samples of ground water should be collected from Wells 22GW1 through 22GW3 (water supply well No. 602); 22GW4 through 22GW10; and deep water supply wells Nos. 601, 603, and 609, and analyzed for the same analytes tested in the verification program. 608? plus add 634, 637, 642 and Bldg 20 Hadnot Point Water Plant (untreated inf.) and shallow wells for 634, 637, 642
In order to develop data required to calculate rates of flow and travel times of contaminants from source areas toward streams, rivers, or wells, aquifer testing will be performed.

All monitor wells installed during the Characterization Step will be tested by the slug test method. This technique will generate values of horizontal hydraulic conductivity (permeability) of the aquifer in the immediate vicinity of the well screen.

Short-duration pump tests will be conducted at the well pair locations to allow quantification of the nature of the confining bed. Additionally, the pump tests will allow calculation of transmissivity, which is the hydraulic conductivity of the entire saturated aquifer thickness.

These aquifer coefficients, in conjunction with measured ground water gradients, will allow calculation of the rate(s) of movement of ground water contaminants.

need to address overlapping cones of depression

SITE 24--INDUSTRIAL AREA FLY ASH DUMP

Site Investigation

o Five shallow ground water monitoring wells:

Wells 24GW1 and 24GW2--On downgradient side of borrow and debris disposal area.

Wells 24GW3 and 24GW4--On downgradient side of fly ash and spirator disposal area.

Well 24GW5--Upgradient of Site 24; downgradient of main industrial area.

o Two surface water sampling stations:

Station 24SW1--At downstream end of Site 24 although in contact with disposal area.

Station 24SW2--Greater than 1,000 feet downstream of Site 24; Cogdels Creek receives flow from other areas in addition to Site 24.

o Two sediment sampling stations:

Station 24SE1--See surface water sampling station 24SW1.

Station 24SE2--See surface water sampling station 24SW2.

Data Evaluation

Ground Water:

All downgradient monitor Wells 24GW1, 24GW2, 24GW3, and 24GW4 contained low quantities of some or all of the following metals: Cr, Cu, Zn, As, Ni, Se, and Pb (see Table 2-11). Of these metals, levels of As exceeded the 10^{-5} risk level in Wells 24GW4 and 24GW3, and in upgradient Well 24GW5 (see Table 2-12). Levels of As exceeded the 10^{-6} risk level at Well 24GW2. In addition, levels of Ni exceeded the ambient water criterion at Well 24GW3.

Need new upgradient to be "clean"?

Table 2-11. Site 24--Industrial Area Fly Ash Dump Sampling Data

ENVIRONMENTAL SCIENCE & ENGINEERING MULTIPLE FIELD GROUP REPORT REPORT DATE: WED, DEC 05 1984

CAMP LEJEUNE
STATION 24

		24GW1 374719	24GW2 374720	24GW3 374721	24GW4 374722	24GW5 374723	24SW1 374724	24SW1 398500	24SW2 374725
COLLECTION DATE		7/7/84	7/7/84	7/7/84	7/7/84	7/7/84	8/4/84	8/4/84	8/4/84
COLLECTION TIME		730	945	1015	845	840	1630	1630	1530
ACROLEIN (UG/L)	34210 0	<11	<12	<10	<17	<11	<6	NA	<6
ACRYLONITRILE (UG/L)	34215 0	<11	<12	<10	<17	<11	<6	NA	<6
BENZENE (UG/L)	34030 0	<0.4	<0.4	<0.4	<0.6	3	<0.2	NA	<0.2
BROMODICHLOROMETHANE (UG/L)	32101 0	<0.70	<0.80	<0.70	<1.20	<0.80	<0.40	NA	<0.40
BROMOFORM (UG/L)	32104 0	<1.60	<1.80	<1.60	<2.70	<1.60	<0.80	NA	<0.70
BROMOMETHANE (UG/L)	34413 0	<1	<1	<1	<2	<1	<0.7	NA	<0.7
CARBON TETRACHLORIDE (UG/L)	32102 0	<1.6	<1.8	<1.5	<2.6	<1.6	<0.90	NA	<0.90
CHLOROBENZENE (UG/L)	34301 0	<0.50	<0.60	<0.50	<0.90	<0.50	<0.30	NA	<0.30
CHLOROETHANE (UG/L)	34311 0	<2	<2	<2	<3	<2	<0.9	NA	<0.9
2-CHLOROETHYLVINYLETHER (UG/L)	34576 0	<2	<2	<2	<3	<2	<0.8	NA	<0.8
CHLOROFORM (UG/L)	32106 0	1.0	<0.80	<0.70	<1.2	<0.70	<0.40	NA	<0.40
CHLOROMETHANE (UG/L)	34418 0	<1	<1	<1	<2	<1	<0.6	NA	<0.6
DIBROMOCHLOROMETHANE (UG/L)	34306 0	<1.20	<1.40	<1.20	<2.00	<1.30	<0.70	NA	<0.70
DICHLORODIFLUOROMETHANE (UG/L)	34668 0	<1	<2	<1	<2	<1	<0.8	NA	<0.7
1,1-DICHLOROETHANE (UG/L)	34496 0	<0.60	<0.70	<0.60	<1.0	<0.60	<0.40	NA	<0.30
1,2-DICHLOROETHANE (UG/L)	34531 0	<1.0	<1.1	<1.0	<1.7	<1.0	<0.60	NA	<0.60
1,1-DICHLOROETHYLENE (UG/L)	34501 0	<1.3	<1.5	<1.3	<2.2	<1.4	<0.70	NA	<0.70
T-1,2-DICHLOROETHENE (UG/L)	34546 0	<1.3	<1.4	<1.2	<2.1	<1.3	2.7	NA	<0.60
1,2-DICHLOROPROPANE (UG/L)	34541 0	<0.7	<0.8	<0.7	<1	<0.8	<0.4	NA	<0.4
CIS-1,3-DICHLOROPROPENE (UG/L)	34704 0	<0.8	<0.9	<0.8	<1	<0.8	<0.5	NA	<0.5

Table 2-11. Site 24--Industrial Area Fly Ash Dump Sampling Data (Continued, Page 2 of 3)

ENVIRONMENTAL SCIENCE & ENGINEERING MULTIPLE FIELD GROUP REPORT REPORT DATE: WED, DEC 05 1984

CAMP LEJEUNE
STATION 24

		24GW1 374719	24GW2 374720	24GW3 374721	24GW4 374722	24GW5 374723	24SW1 374724	24SW1 398500	24SW2 374725
COLLECTION DATE		7/7/84	7/7/84	7/7/84	7/7/84	7/7/84	8/4/84	8/4/84	8/4/84
COLLECTION TIME		730	945	1015	845	840	1630	1630	1530
T-1,2-DICHLOROETHENE (UG/L)	34699 0	<0.6	<0.7	<0.6	<1	<0.6	<0.4	NA	<0.3
ETHYLBENZENE (UG/L)	34371 0	<1	<1	<1	<2	<1	<0.6	NA	<0.6
METHYLENE CHLORIDE (UG/L)	34423 0	<1	2	<1	<2	<1	<0.6	NA	<0.6
1,1,2,2-TETRACHLOROETHANE (UG/L)	34516 0	<0.9	<1	<0.9	<2	<0.9	<0.4	NA	<0.4
TETRACHLOROETHENE (UG/L)	34475 0	<2.0	<2.2	<2.0	<3.3	<2.0	<1.0	NA	<1.0
1,1,1-TRICHLOROETHANE (UG/L)	34506 0	<1.3	<1.4	<1.3	<2.1	<1.3	<0.80	NA	<0.70
1,1,2-TRICHLOROETHANE (UG/L)	34511 0	<1.2	<1.3	<1.2	<2.0	<1.2	<0.70	NA	<0.60
TRICHLOROETHENE (UG/L)	39180 0	<1.4	<1.6	<1.4	<2.4	<1.5	7.1	NA	<0.90
TRICHLOROFLUOROETHANE (UG/L)	34488 0	<1	<2	<1	<2	<1	<0.8	NA	<0.7
TOLUENE (UG/L)	34010 0	<0.6	<0.7	<0.6	<1	<0.6	<0.3	NA	<0.3
VINYL CHLORIDE (UG/L)	39175 0	<0.9	<1	<0.9	<2	<1	<0.6	NA	<0.5
ARSENIC,TOTAL (UG/L)	1002 0	<1.0	3.0	7.1	16	5.6	<30	<30	<30
CADMIUM,TOTAL (UG/L)	1027 0	<6.0	<6.0	<6.0	<6.0	<6.0	<4.0	<4.0	<4.0
CHROMIUM,TOTAL (UG/L)	1034 0	6.6	24	130	<6.0	<6.0	<3.0	<3.0	<3.0
COPPER,TOTAL (UG/L)	1042 0	4.0	8.6	17.4	<3.0	<3.0	4.7	5.4	2.8
LEAD,TOTAL (UG/L)	1051 0	<40.0	<40.0	58.0	<40.0	<40.0	<33.0	<33.0	<33.0
NICKEL,TOTAL (UG/L)	1067 0	<15	<15	61	<15	<15	<9.0	<9.0	<9.0
SELENIUM,TOTAL (UG/L)	1147 0	<1.0	<1.0	7.6	2.2	<1.0	<20	<20	<20
ZINC,TOTAL (UG/L)	1092 0	26	87	341	<3	<3	28	25	20

Table 2-11. Site 24--Industrial Area Fly Ash Dump Sampling Data (Continued, Page 3 of 3)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER P4222400
FIELD GROUP: CLJS1
PARAMETERS: MAS SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

SAMPLE NUMBERS

PARAMETERS	STORET # METHOD #	24SE1 374643	24SE2 374644
DATE		8/3/84	8/3/84
TIME		1630	1530
CADMIUM,SED (MG/KG-DRY)	10280	0.3	1.9
CHROMIUM,SED (MG/KG-DRY)	10290	1.6	29.3
LEAD,SED (MG/KG-DRY)	10520	4	100
ARSENIC,SED (MG/KG-DRY)	10030	<0.05	0.3
COPPER,SED(MG/KG-DRY)	10430	1	7
NICKEL,SED (MG/KG-DRY)	10680	0.3	1
SELENIUM,SED (MG/KG-DRY)	11480	<0.8	<0.7
ZINC,SED (MG/KG-DRY)	10090	6	95
MOISTURE(WET WT)	70320 0	25.0	19.4

Source: ESE, 1984.

Table 2-12. Site 24--Industrial Area Fly Ash Dump Data Evaluation

Analytes Detected	Regulatory Limits	Value (ug/L)	Samples Exceeding Limits
Cr III	Ambient Water	170 mg/L	None
Cr VI	Drinking Water/Ambient Water	50	24GW3
Pb	Drinking Water/Ambient Water	50	24GW3
As	10^{-5} Human Health Risk Level	22 ng/L	24GW3, 24GW4, 24GW5 24GW2 ?
Cu	Organoleptic	1 mg/L	None
Ni	Ambient Water	13.4	24GW3
Se	Drinking Water/Ambient Water	10	None
Zn	Organoleptic	5 mg/L	None
T12DCE	NCA*	NL†	NL
MC	10^{-5} Human Health Risk Level	1.9	24GW2
Benzene	10^{-5} Human Health Risk Level	6.6	None
Chloroform	10^{-5} Human Health Risk Level	1.9	None
TCE	10^{-5} Human Health Risk Level	27	None

*NCA = No criteria available.
†NL = No numerical limit.

Source: ESE, 1984.

Trace levels of organic compounds were detected in Wells 24GW1, 24GW2, indicating that small quantities of solvents may have been disposed of in the western side of the site. Although the 10^{-5} risk levels for the organic compounds were not exceeded, chloroform in Well 24GW1 exceeded the 10^{-6} risk level, and methylene chloride in Well 24GW2 exceeded the 10^{-7} risk level. Levels of benzene above the 10^{-6} risk level were detected in upgradient Well 24GW5; benzene was not detected in any of the other wells at this site. Benzene, therefore, may be derived from activities within the Industrial Area outside of Site 24.

The observed metals and trace organics in the ground water corroborate the reported disposal of fly ash and solvents at Site 24.

Surface Water:
The surface water at the downgradient side of the site (24SW1) was found to contain Cu and Zn. Levels of these two metals are well below organoleptic limits and are of no concern. Levels of two volatile organic compounds (TCE and T12DCE) were also detected at this station. Although the TCE level did not exceed the 10^{-5} risk level, it exceeded the 10^{-6} risk level; no satisfactory criterion exists for T12DCE.

At Station 24SW2, downstream of Station 24SW1, no volatile organics were detected indicating that attenuation (volatilization) of these compounds occurs under the conditions present at time of sampling (i.e., low flow). Cu and Zn were also detected at Station 24SW2, but the levels are of no concern.

Sediment:
The two sediment stations at Site 24 contained detectable levels of six metals: Cd, Cr, Pb, Cu, Ni, and Zn. Each of these metals was also detected in ground and surface water samples from this site.

Migration Potential

The ground water gradient at time of sampling indicated ground water flow across the site from north to south. The levels of metals observed in the shallow monitor wells would be carried to the south with the shallow ground water. The monitor wells currently in place cannot provide data concerning the southern limit of the contaminated ground water. No water supply wells which could affect ground water flow rate and direction are located close to Site 24. COB is sort of close!

The surface water sampling stations indicated that migration of the detected analytes TCE and T12DCE was not occurring under the flow conditions at the time of sampling. The presence of detectable levels of volatile compounds at Station 24SW1 during low flow conditions may indicate the potential for higher levels during high flow periods. Conversely, high flow conditions may result in dilution greater than that observed during the initial sampling period.

Recommendations

All ground water, surface water, and sediment stations should be resampled during the second sampling period. All analyses conducted during the initial sampling and analysis effort should be repeated for the second sampling. + add (2) downgradient wells sample twice
+ add 2 sw/sd on trib. to Cogdel's Creek.

SITE 28--HADNOT POINT BURN DUMP

Site Investigation

o Three shallow ground water monitoring wells:

Wells 28GW1 and 28GW2--On downgradient side of site at the shoreline of the New River.

Well 28GW3--On the downgradient side of the eastern portion of the site, east of Cogdels Creek.

o Two surface water sampling stations:

Station 28SW1--In the north-central area of the site, where Cogdels Creek passes through the landfill area.

Station 28SW2--In Cogdels Creek, downstream of the site, near intersection with the New River.

o Two sediment sampling stations:

Station 28SE1--See surface water sampling station 28SW1.

Station 28SE2--See surface water sampling station 28SW2.

o One tissue sampling station:

Tissue from two different species of fish were obtained from a freshwater pond at Site 28.

Data Evaluation

Ground Water:

Detectable levels of DDD and DDE were identified in all monitor wells (see Table 2-13); detectable levels document disposal of these compounds at this site. Trace levels of volatile organic compounds were detected in Well 28GW1 only. Trace levels indicated disposal of these compounds in the western portion of the site. The level of vinyl chloride in this well exceeded the 10^{-5} risk level (see Table 2-14).

Table 2-13. Site 28--Hadnot Point Burn Dump Sampling Data

ENVIRONMENTAL SCIENCE & ENGINEERING MULTIPLE FIELD GROUP REPORT REPORT DATE: TUE, DEC 18 1984

CAMP LEJEUNE
STATION 28

		28GW1 374726	28GW2 374727	28GW3 374728	28SW1 374729	28SW1 398501	28SW2 37473	28SW2 398502
COLLECTION DATE		7/7/84	7/7/84	7/7/84	8/3/84	8/4/84	8/3/84	8/4/84
COLLECTION TIME		1100	1120	1315	830	830	1000	1000
ALDRIN (UG/L)	39330	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008
BHC,A (UG/L)	39337	<0.0010	<0.0010	<0.0010	0.010	<0.0010	<0.0010	<0.0010
BHC,B (UG/L)	39338	<0.00010	<0.00010	<0.00010	0.0009	<0.00010	0.002	<0.00010
BHC,D (UG/L)	39259	<0.0003	<0.0003	<0.0003	0.004	<0.0003	<0.0003	<0.0003
BHC,G(LINDANE)(UG/L)	39340	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
CHLORDANE (UG/L)	39350	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
DDD,PP'(UG/L)	39310	0.12	0.093	0.22	<0.003	<0.003	<0.003	<0.003
DDE,PP'(UG/L)	39320	0.015	0.028	0.007	<0.0008	<0.0008	<0.0008	<0.0008
DDT,PP'(UG/L)	39300	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
DIELDRIN (UG/L)	39380	0.003	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
ENDOSULFAN,A (UG/L)	34361	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008
ENDOSULFAN,B (UG/L)	34356	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
ENDOSULFAN SULFATE (UG/L)	34351	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
ENDRIN (UG/L)	39390	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
ENDRIN ALDEHYDE (UG/L)	34366	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
HEPTACHLOR (UG/L)	39410	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007
HEPTACHLOR EPOXIDE (UG/L)	39420	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
TOXAPHENE (UG/L)	39400	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
OIL&GR,IR(MG/L)	5600	5	2	0.8	<0.9	NA	<0.9	NA

Table 2-13. Site 28--Hadnot Point Burn Dump Sampling Data (Continued, Page 2 of 6)

ENVIRONMENTAL SCIENCE & ENGINEERING MULTIPLE FIELD GROUP REPORT REPORT DATE: TUE, DEC 18 1984

CAMP LEJEUNE
STATION 28

		28GW1 374726	28GW2 374727	28GW3 374728	28SW1 374729	28SW1 398501	28SW2 374730	28SW2 398502
COLLECTION DATE		7/7/84	7/7/84	7/7/84	8/3/84	8/4/84	8/3/84	8/4/84
COLLECTION TIME		1100	1120	1315	830	83[illegible]	10[illegible]	10[illegible]
ARSENIC,TOTAL(UG/L)	1 02 0	18	<1.0	21	<30	NA	<30	<1.[illegible]
PCBS, WATER(UG/L)	39516 0	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.[illegible]10
CADMIUM,TOTAL(UG/L)	1 27 0	<6.0	<6.0	<6.0	<4.0	NA	<4.0	8.4
CHROMIUM,TOTAL(UG/L)	1 34 0	<6.0	<6.0	330	<3.0	NA	<3.0	<5.0
LEAD,TOTAL(UG/L)	1 51 0	<40.0	<40.0	336.0	<33.0	NA	<33.0	<48.0
MERCURY,TOTAL(UG/L)	71900 0	0.3	<0.2	<0.2	<0.2	NA	<0.2	<[illegible].2
NICKEL,T,(UG/L)	1 67 0	<15	<15	39	<9.0	NA	<9.0	<12
ZINC,TOTAL(UG/L)	1 92 0	<3	<3	143	32	NA	20	29
ACROLEIN (UG/L)	34210 0	<11	<11	<13	<6	NA	<6	NA
ACRYLONITRILE (UG/L)	34215 0	<11	<11	<13	<6	NA	<6	NA
BENZENE (UG/L)	34 30 0	<0.4	<0.3	<0.4	<0.2	NA	<0.2	NA
BROMODICHLOROMETHANE (UG/L)	32101 0	<0.80	<0.70	<0.90	<0.40	NA	<0.40	NA
BROMOFORM (UG/L)	32104 0	<1.60	<1.50	<1.80	<0.80	NA	<0.80	NA
BROMOMETHANE (UG/L)	34413 0	<1	<1	<2	<0.7	NA	<0.7	NA
CARBON TETRACHLORIDE (UG/L)	32102 0	<1.6	<1.5	<1.8	<0.90	NA	<0.90	NA
CHLOROBENZENE (UG/L)	34301 0	<0.60	<0.50	<0.60	<0.30	NA	<0.30	NA
CHLOROETHANE (UG/L)	34311 0	<2	<2	<2	<0.9	NA	<0.9	NA
2-CHLOROETHYLVINYLETHER (UG/L)	34576 0	<2	<2	<2	<0.8	NA	<0.8	NA
CHLOROFORM (UG/L)	32106 0	<0.70	<0.70	<0.80	<0.40	NA	<0.40	NA
CHLOROMETHANE (UG/L)	34418 0	<1	<1	<1	<0.6	NA	<0.6	NA

Table 2-13. Site 28--Hadnot Point Burn Dump Sampling Data (Continued, Page 3 of 6)

ENVIRONMENTAL SCIENCE & ENGINEERING MULTIPLE FIELD GROUP REPORT REPORT DATE: TUE, DEC 18 1984

CAMP LEJEUNE
STATION 28

		28GW1 374726	28GW2 374727	28GW3 374728	28SW1 374729	28SW1 398501	28SW2 374730	28SW2 398502
COLLECTION DATE		7/7/84	7/7/84	7/7/84	8/3/84	8/4/84	8/3/84	8/4/84
COLLECTION TIME		1100	1120	1315	830	830	1000	1000
DIBROMOCHLOROMETHANE (UG/L)	34306 0	<1.30	<1.30	<1.50	<0.70	NA	<0.70	NA
DICHL*DIFLUO*METHANE (UG/L)	34668 0	<1	<1	<2	<0.7	NA	<0.7	NA
1,1-DICHLOROETHANE (UG/L)	34496 0	<0.60	<0.60	<0.70	<0.30	NA	<0.30	NA
1,2-DICHLOROETHANE (UG/L)	34531 0	<1.0	<1.0	<1.2	<0.60	NA	<0.60	NA
1,1-DICHLOROETHYLENE (UG/L)	34501 0	<1.4	<1.3	<1.6	<0.70	NA	<0.70	NA
T-1,2-DICHLOROETHENE (UG/L)	34546 0	38	<1.3	<1.5	<0.70	NA	<0.70	NA
1,2-DICHLOROPROPANE (UG/L)	34541 0	<0.8	<0.7	<0.9	<0.4	NA	<0.4	NA
CIS-1,3-DICH*PROPENE (UG/L)	34704 0	<0.9	<0.8	<1	<0.5	NA	<0.5	NA
T-1,3-DICHL*PROPENE (UG/L)	34699 0	<0.7	<0.6	<0.7	<0.3	NA	<0.3	NA
ETHYLBENZENE (UG/L)	34371 0	<1	<1	<1	<0.6	NA	<0.6	NA
METHYLENE CHLORIDE (UG/L)	34423 0	<1	<1	<1	<0.6	NA	<0.6	NA
1,1,2,2-TE*CH*ETHANE (UG/L)	34516 0	<0.9	<0.9	<1	<0.4	NA	<0.4	NA
TETRACHLOROETHENE (UG/L)	34475 0	<2.1	<1.9	<2.3	<1.0	NA	<1.0	NA
1,1,1-TRICHL*ETHANE (UG/L)	34506 0	<1.4	<1.3	<1.6	<0.70	NA	<0.70	NA
1,1,2-TRICHL*ETHANE (UG/L)	34511 0	<1.3	<1.2	<1.4	<0.70	NA	<0.70	NA
TRICHLOROETHENE (UG/L)	39180 0	15	<1.4	<1.7	1.3	NA	1.1	NA
TRICHL*FLUOROMETHANE (UG/L)	34488 0	<1	<1	<2	<0.7	NA	<0.7	NA
TOLUENE (UG/L)	34 10 0	<0.6	<0.6	<0.7	<0.3	NA	<0.3	NA
VINYL CHLORIDE(UG/L)	39175 0	22	<1	<1	<0.5	NA	<0.5	NA

Table 2-13. Site 28--Hadnot Point Burn Dump Sampling Data (Continued, Page 4 of 6)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400
FIELD GROUP: CLJS1
PARAMETERS: LS41 SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

PARAMETERS	STORET # / METHOD #	SAMPLE NUMBERS 28SE1 374645	28SE2 374646
DATE		8/3/84	8/3/84
TIME		830	1000
ALDRIN,SED(UG/KG-DRY)	39333 0	<0.09	<0.2
BHC,A,SED(UG/KG-DRY)	39076 0	<0.07	<0.1
BHC,B,SED(UG/KG-DRY)	34257 0	<0.05	<0.10
BHC,G(LINDANE),SED UG/KG-DRY	39343 0	<0.05	<0.10
BHC,D,SED(UG/KG-DRY)	34262 0	<0.1	<0.2
CHLORDANE,SED(UG/KG-DRY)	39351 0	<2.3	<4.1
DDD,PP',SED(UG/KG-DRY)	39311 0	84	2.2
DDE,PP',SED (UG/KG-DRY)	39321 0	1.2	0.5
DDT,PP',SED(UG/KG-DRY)	39301 0	<1.5	<2.7
DIELDRIN,SED(UG/KG-DRY)	39383 0	<0.3	<0.5
ENDOSULFAN,A,SED(UG/KG-DRY)	34364 0	<0.07	<0.1
ENDOSULFAN,B,SED(UG/KG-DRY)	34359 0	<0.7	<1.2
ENDOSULFAN SULF,SED, UG/KG-DRY	34354 0	<0.9	<1.7
ENDRIN,SED(UG/KG-DRY)	39393 0	<0.5	<1.0
ENDRIN ALD.,SED(UG/KG-DRY)	34369 0	<0.7	<1.2
HEPTACHLOR,SED(UG/KG-DRY)	39413 0	<0.08	<0.1
HEPTACHLOR EPOX,SED UG/KG-DRY	39423 0	<0.1	<0.2
TOXAPHENE,SED(UG/KG-DRY)	39403 0	<23	<41
PCBS,SED(UG/KG-DRY)	39519 0	<2.3	<4.1
OIL&GR,IR,SED(MG/KG-DRY)	561 0	474	1440

Table 2-13. Site 28--Hadnot Point Burn Dump Sampling Data (Continued, Page 5 of 6)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400
FIELD GROUP: CLJS1
PARAMETERS: LS41 SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

PARAMETERS	STORET # / METHOD #	SAMPLE NUMBERS 28SE1 374645	28SE2 374646
DATE		8/3/84	8/3/84
TIME		830	1000
CADMIUM,SED (MG/KG-DRY)	1028 0	0.1	<0.1
CHROMIUM,SED (MG/KG-DRY)	1029 0	10.0	0.4
LEAD,SED (MG/KG-DRY)	1052 0	46	2
ARSENIC,SED (MG/KG-DRY)	1003 0	1.5	<0.1
NICKEL,SED (MG/KG-DRY)	1068 0	2	0.8
ZINC,SED (MG/KG-DRY)	1093 0	16	1
MERCURY,SED(MG/KG-DRY)	71921 0	<0.28	<0.43
MOISTURE(%WET WT)	70320 0	25.0	58.6

Table 2-13. Site 23--Hadnot Point Burn Dump Sampling Data (Continued, Page 6 of 6)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER R4222400
FIELD GROUP: CLJT1
PARAMETERS: ALL SAMPLES: ALL

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

PARAMETERS	STORET # / METHOD #	SAMPLE NUMBERS 28T11	28T12
		374800	374871
DATE		7/17/84	7/17/84
TIME		930	930
ALDRIN,TISS(UG/KG-WET)	39334 / 0	<1	<1
DIELDRIN,TISS(UG/KG-WET)	39387 / 0	<0.3	<0.3
ENDRIN,TISS(UG/KG-WET)	39397 / 0	<0.3	<0.3
HEPTACHLOR,TISS(UG/KG-WET)	39414 / 0	<1	<1
HEPTACHLOR EPOX,TISS UG/KG-WET	39424 / 0	<0.2	<0.2
PCBS,TOTAL,TISS(UG/KG-WET)	39520 / 0	11	8
BHC,A,TISS (UG/KG-WET)	81819 / 0	0.10	0.1
BHC,B,TISS (UG/KG-WET)	81820 / 0	<0.3	<0.3
BHC,D,TISS (UG/KG-WET)	81821 / 0	<0.10	<0.10
BHC,G(LINDANE)TISS UG/KG-WET	39784 / 0	<0.07	<0.07
CHLORDANE,TISS(UG/KG-WET)	39349 / 0	<2	<2
DDD,PP',TISS (UG/KG-WET)	81860 / 0	<0.4	<0.4
DDE,PP',TISS (UG/KG-WET)	81861 / 0	<2	<2
DDT,PP',TIS(UG/KG-WET)	39317 / 0	<0.9	<0.9
ENDOSULFAN,A,TISS UG/KG-WET	99359 / 0	<0.2	<0.2
ENDOSULFAN,B,TISS UG/KG-WET	99360 / 0	<0.4	<0.4
ENDOSULFAN SULFATE TS-UG/KG-W	98169 / 0	<2	<2
ENDRIN ALDEHYDE,TISS UG/KG-WET	99118 / 0	<0.9	<0.9
TOXAPHENE,TISS(UG/KG-WET)	39407 / 0	<10	<10

Source: ESE, 1984.

Table 2-14. Site 28--Hadnot Point Burn Dump Data Evaluation

Analytes Detected	Regulatory Limits	Value (ug/L)	Samples Exceeding Limits
BHC,A	10^{-5} Human Health Risk Level	92 ng/L	None
BHC,B	10^{-5} Human Health Risk Level	163 ng/L	None
BHC,D	NCA*	NL†	NL
DDD,PP'	NCA	NL	NL
DDE,PP'	NCA	NL	NL
Dieldrin	10^{-5} Human Health Risk Level	0.71 ng/L	28GWI
O&G	Organoleptic	NL	28GW1
Cr III	Ambient Water	170 mg/L	None
Cr VI	Drinking Water/Ambient Water	50	28GW3
Pb	Drinking Water/Ambient Water	50	28GW3
As	10^{-5} Human Health Risk Level	22 ng/L	28GW1, 28GW3
Ni	Ambient Water	13.4	28GW3
Zn	Organoleptic	5 mg/L	None
Hg	Ambient Water	144 ng/L	28GW1
T12DCE	NCA	NL	NL
Vinyl Chloride	10^{-5} Human Health Risk Level	20	28GW1
TCE	10^{-5} Human Health Risk Level	27	None

*NCA = No criteria available.
†NL = No numerical limit.

Source: ESE, 1984.

O&G was detected at low levels in all wells. The highest concentration of metals was found at Well 28GW3. Cr, Pb, and Ni exceeded the applicable criteria at this well. Hg was detected in Well 28GW1 at levels which exceeded the ambient water criterion. The levels of pesticides, metals, and organic solvents were consistent with the types of materials disposed of at this site.

Surface Water:

Water chemistry data for the two surface water stations was significantly different from the ground water chemistry data, indicating that the analytes detected in the surface water may be attributed to activities upstream of Site 28 or of unique disposal in the northern portion of the site. For example, the pesticides BHC,A; BHC,B; and BHC,D were detected in the surface water, whereas the pesticides DDD and DDE were detected in the ground water. In addition, TCE was detected in the surface water but was not detected in the ground water.

The detected levels of the BHC isomers are below the 10^{-5} risk levels. The levels of TCE were very low and exceeded only the 10^{-7} risk level.

Sediment:

The sediment stations at Site 28 were found to contain detectable levels of Cd, Cr, Pb, As, Ni, Zn, O&G, DDD, and DDE. Each of these analytes has also been detected in monitor wells and/or surface water stations at this site.

Tissue:

Samples from fish tissue obtained from the freshwater pond at the north terminus of Site 28 indicated detectable levels of PCB and BHC,A. The BHC,A data indicated that this compound is present in this area of the site and may be discharging into Cogdels Creek, as indicated by the surface water chemical data. Levels of PCB and BHC,A were below acute toxicity levels.

Migration Potential

Monitor Wells 28GW1 and 28GW2 were located at the New River shoreline; Cogdels Creek discharges directly into the New River. These facts indicated that contaminants are migrating from the site into the New River via ground water discharge, surface water discharge, and sediment scour/transport. As many analytes are above applicable regulatory limits at the boundary of the site, it appears that the concentration of several contaminants migrating into the New River may also be above applicable limits. Significant dilution, however, does occur within the New River.

Recommendations

All sampling stations at Site 28, with the exception of the fish tissue samples, should be resampled during the second sampling effort. The list of analytes should be identical to that used for the initial sampling effort.

+ add new upgradient well & SW & SD near this well plus 4' SW/SD in New River. (See attached sketch)

SITE 30--SNEADS FERRY ROAD FUEL TANK SLUDGE AREA

Site Investigation

o One shallow ground water monitoring well (Well 30GW1).

Data Evaluation

Sampling data for Site 30 are presented in Table 2-15. The presence of Pb at levels slightly above the criterion (see Table 2-16) was detected in Monitor Well 30GW1. This was attributed to the reported dumping of fuel tank sludge in this area. However, the O&G and volatile components of this sludge were not detected and therefore appear to have dissipated.

Migration Potential

Where is elevation data?

Site 30 lies on the edge of a small stream valley (French Creek), and shallow ground water at the site flows south-southwest toward the stream channel. Contaminants present at Site 30 will move downgradient to the south-southwest. The Pb concentration detected at the site is slightly above the regulatory limit; as it moves downgradient, it may mix with clean ground water and thereby reduce the Pb level. It is possible that Well 30GW1 is not in the area of highest Pb concentration. In this case, levels of Pb higher than the criterion may exist, but would remain subject to mixing and dilution during downgradient flow.

Recommendations

Well 30GW1 should be resampled for all the analytes that were investigated during the initial sampling effort.

Install another well downgradient and sample French Creek tributary for SW, sediment.

Table 2-15. Site 30--Sneads Ferry Road Fuel Tank Sludge Area Sampling Data

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400
FIELD GROUP: CLJW1
PARAMETERS: LJ5 SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

SAMPLE NUMBERS

PARAMETERS	STORET # METHOD #	30GW1 374731
DATE		7/6/84
TIME		945
ACROLEIN (UG/L)	34210 0	<11
ACRYLONITRILE (UG/L)	34215 0	<11
BENZENE (UG/L)	34030 0	<0.3
BROMODICHLOROMETHANE (UG/L)	32101 0	<0.70
BROMOFORM (UG/L)	32104 0	<1.50
BROMOMETHANE (UG/L)	34413 0	<1
CARBON TETRACHLORIDE (UG/L)	32102 0	<1.5
CHLOROBENZENE (UG/L)	34301 0	<0.50
CHLOROETHANE (UG/L)	34311 0	<2
2-CHLOROETHYLVINYLETHER (UG/L)	34576 0	<2
CHLOROFORM (UG/L)	32106 0	<1.2
CHLOROMETHANE (UG/L)	34418 0	<1
DIBROMOCHLOROMETHANE (UG/L)	34306 0	<1.30
DICHLORODIFLUOROMETHANE (UG/L)	34668 0	<1
1,1-DICHLOROETHANE (UG/L)	34496 0	<0.6
1,2-DICHLOROETHANE (UG/L)	34531 0	<1.5
1,1-DICHLOROETHYLENE (UG/L)	34501 0	<1.3
T-1,2-DICHLOROETHENE (UG/L)	34546 0	<1.3
1,2-DICHLOROPROPANE (UG/L)	34541 0	<0.7
CIS-1,3-DICHLOROPROPENE (UG/L)	34704 0	<0.4

Table 2-15. Site 30--Sneads Ferry Road Fuel Tank Sludge Area
Sampling Data (Continued, Page 2 of 2)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400
FIELD GROUP: CLJW1
PARAMETERS: LJ5 SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

SAMPLE NUMBERS

PARAMETERS	STORET # / METHOD #	30GW1 374731
DATE		7/6/84
TIME		945
T-1,3-DICHL*PROPENE (UG/L)	34699 0	<0.6
ETHYLBENZENE (UG/L)	34371 0	<1
METHYLENE CHLORIDE (UG/L)	34423 0	<1
1,1,2,2-TE*CH*ETHANE (UG/L)	34516 0	<0.9
TETRACHLOROETHENE (UG/L)	34475 0	<2.0
1,1,1-TRICHL*ETHANE (UG/L)	34506 0	<1.3
1,1,2-TRICHL*ETHANE (UG/L)	34511 0	<1.2
TRICHLOROETHENE (UG/L)	39180 0	<1.4
TRICHL*FLUOROMETHANE (UG/L)	34488 0	<1
TOLUENE (UG/L)	34010 0	<0.6
VINYL CHLORIDE(UG/L)	39175 0	<1
LEAD,TOTAL(UG/L)	1051 0	58.0
OIL&GR,TR(MG/L)	560 0	<0.7

Source: ESE, 1984.

Table 2-16. Site 30--Sneads Ferry Road Fuel Tank Sludge Area

Analytes Detected	Regulatory Limits	Value (ug/L)	Samples Exceeding Limits
Pb	Drinking Water/Ambient Water	50	30GW1

Source: ESE, 1984.

SITE 35--CAMP GEIGER AREA FUEL FARM

Site Investigation

- o Three hand-augered borings to the ground water surface.
- o Three ground water samples collected from the soil borings (Samples 35GW1, 35GW2, and 35GW3).
- o Three soil samples from materials at soil and ground water contact (Samples 35S1, 35S2, and 35S3).

Data Evaluation

Ground Water:

The ground water samples obtained from hand-augered bore holes at the downgradient side of this facility contained high levels (i.e., above criteria) of Pb (see Tables 2-17 and 2-18). These levels indicate that leaks of leaded fuels from tanks have contaminated the shallow ground water at this site. The volatile organic components of the fuel were not detected.

O&G above organoleptic limits was detected in one boring, 35GW2.

Soil:

Pb and O&G were also detected in all soil samples obtained at Site 35.

Migration Potential

A small surface water stream passes by Site 35 to the east-northeast. This stream was dry at the time of sampling, and no visual evidence of discharge of contaminated ground water was noted between Site 35 and the stream channel. In all probability, ground water from Site 35 does discharge into the stream at times of high ground water level. Pb and O&G may migrate via surface water to areas downstream of the site.

Recommendations

No additional sampling is recommended as part of the verification step. The sampling points were temporary and no longer exist.

See attached

Table 2-17. Site 35--Camp Geiger Area Fuel Farm Sampling Data

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400
FIELD GROUP: CLJW1
PARAMETERS: LJ5 SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

PARAMETERS	STORET # METHOD #	35GW1 374732	35GW2 374733	35GW3 374734
		SAMPLE NUMBERS		
DATE		8/7/84	8/6/84	8/7/84
TIME		1145	1100	1230
ACROLEIN (UG/L)	34210 0	<7	<7	<7
ACRYLONITRILE (UG/L)	34215 0	<7	<7	<7
BENZENE (UG/L)	34030 0	<0.2	<0.2	<0.2
BROMODICHLOROMETHANE (UG/L)	32101 0	<0.50	<0.50	<0.50
BROMOFORM (UG/L)	32104 0	<0.90	<0.90	<0.90
BROMOMETHANE (UG/L)	34413 0	<0.8	<0.8	<0.8
CARBON TETRACHLORIDE (UG/L)	32102 0	<1.0	<1.0	<1.0
CHLOROBENZENE (UG/L)	34301 0	<0.30	<0.30	<0.30
CHLOROETHANE (UG/L)	34311 0	<1	<1	<1
2-CHLOROETHYLVINYLETHER (UG/L)	34576 0	<0.9	<0.9	<0.9
CHLOROFORM (UG/L)	32106 0	<0.40	<0.50	<0.50
CHLOROMETHANE (UG/L)	34418 0	<0.7	<0.7	<0.7
DIBROMOCHLOROMETHANE (UG/L)	34306 0	<0.80	<0.90	<0.80
DICHLORODIFLUOROMETHANE (UG/L)	34668 0	<0.9	<0.9	<0.9
1,1-DICHLOROETHANE (UG/L)	34496 0	<0.40	<0.40	<0.40
1,2-DICHLOROETHANE (UG/L)	34531 0	<0.80	<0.80	<0.80
1,1-DICHLOROETHYLENE (UG/L)	34501 0	<0.80	<0.80	<0.80
T-1,2-DICHLOROETHENE (UG/L)	34546 0	<0.70	<0.70	<0.70
1,2-DICHLOROPROPANE (UG/L)	34541 0	<0.5	<0.5	<0.5
CIS-1,3-DICHLOROPROPENE (UG/L)	34704 0	<0.6	<0.6	<0.6

Table 2-17. Site 35--Camp Geiger Area Fuel Farm Sampling Data (Continued, Page 2 of 3)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400
FIELD GROUP: CLJW1
PARAMETERS: LJ5 SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

SAMPLE NUMBERS

PARAMETERS	STORET # METHOD #	35GW1 374732	35GW2 374733	35GW3 374734
DATE		8/7/84	8/6/84	8/7/84
TIME		1145	1100	1230
T-1,3-DICHLOROPENE (UG/L)	34699 0	<0.4	<0.4	<0.4
ETHYLBENZENE (UG/L)	34371 0	<0.6	<0.6	<0.6
METHYLENE CHLORIDE (UG/L)	34423 0	4	<0.7	<0.7
1,1,2,2-TETRACHLOROETHANE (UG/L)	34516 0	<0.5	<0.5	<0.5
TETRACHLOROETHENE (UG/L)	34475 0	<1.0	<1.0	<1.0
1,1,1-TRICHLOROETHANE (UG/L)	34506 0	<0.70	<0.80	<0.80
1,1,2-TRICHLOROETHANE (UG/L)	34511 0	<0.70	<0.70	<0.70
TRICHLOROETHENE (UG/L)	39180 0	<0.80	<0.90	<0.90
TRICHLOROFLUOROMETHANE (UG/L)	34488 0	<0.9	<0.9	<0.9
TOLUENE (UG/L)	34010 0	<0.3	<0.3	<0.3
VINYL CHLORIDE(UG/L)	39175 0	<0.6	<0.6	<0.6
LEAD,TOTAL(UG/L)	1051 0	1063	1102	3659
OIL&GR,IR(MG/L)	560 0	<1.0	46	<1.0

Table 2-17. Site 35--Camp Geiger Area Fuel Farm Sampling Data (Continued, Page 3 of 3)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400
FIELD GROUP: CLJS1
PARAMETERS: PRO SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

		SAMPLE NUMBERS		
PARAMETERS	STORET # METHOD #	35S1 374647	35S2 374648	35S3 374649
DATE		8/6/84	8/6/84	8/6/84
TIME		1130	1045	1200
LEAD,SED (MG/KG-DRY)	1052 0	6	6	6
OIL&GR,IR,SED(MG/KG-DRY)	561 0	67	2200	40
MOISTURE(%WET WT)	70320 0	33.6	26.1	26.8

Source: ESE, 1984.

Table 2-18. Site 35--Camp Geiger Area Fuel Farm Data Evaluation

Analytes Detected	Regulatory Limits	Value (ug/L)	Samples Exceeding Limits
O&G	Organoleptic	NL*	35GW2 (Sampling personnel detected odor)
Pb	Drinking Water/Ambient Water	50	35GW1, 35GW2, 35GW3

*NL = No numerical limit.

Source: ESE, 1984.

SITE 36--CAMP GEIGER AREA DUMP NEAR SEWAGE TREATMENT PLANT (STP)

Site Investigation

o Four shallow ground water monitoring wells:

Well 36GW1--Placed on the southern side of the disposal area.

Wells 36GW2 and 36GW3--Placed on the east and northeast sides, respectively, of the disposal area, between the disposal area and Brinson Creek.

Well 36GW4--Background well placed approximately 300 feet to the west (upgradient) of the disposal area.

Data Evaluation

As shown in Table 2-19, the presence of Cd, Cr, Pb, and phenols was detected in the four monitor wells. Cr and Pb criteria were exceeded in all wells; the criterion for Cd was exceeded in Wells 36GW1 and 36GW2 (see Table 2-20). Low levels of two volatile organic compounds were detected in Well 36GW4; satisfactory criteria do not exist for either of these compounds.

The chemical data supported the burning/burial of metallic objects. The presence of waste oils may be indicated by the levels of phenols. Only Well 36GW4 contained detectable levels of organic solvents; therefore, it is probable that solvents may be buried in the western side of the disposal area.

The presence of contamination at Well 36GW4 (designed as a background well) may indicate that the disposal area at Site 36 extends farther to the west than originally estimated.

Migration Potential

Ground water at Site 36 flows from the elevated disposal area eastward toward Brinson Creek. Wells 36GW1, 36GW2, and 36GW3 are located on the downgradient side of the disposal area and contain elevated levels of Cd, Cr, and Pb. The ground water flow carries these contaminants into Brinson Creek where they are diluted by the large surface water flow.

Table 2-19. Site 36--Camp Geiger Area Dump Sampling Data

ENVIRONMENTAL SCIENCE & ENGINEERING MULTIPLE FIELD GROUP REPORT REPORT DATE: WED, DEC 05 1984

CAMP LEJEUNE
STATION 36

		36GW1 374735	36GW1 398503	36GW2 374736	36GW2 398504	36GW3 374737	36GW3 398505	36GW4 374738	36GW4 398506
COLLECTION DATE		7/31/84	7/31/84	7/31/84	7/31/84	7/31/84	7/31/84	7/31/84	7/31/84
COLLECTION TIME		1445	1445	1400	1400	1330	1330	2230	1030
ACROLEIN (UG/L)	34210 0	<6	<6	<6	<6	<6	<6	<7	<6
ACRYLONITRILE (UG/L)	34215 0	<6	<6	<6	<6	<6	<6	<7	<6
BENZENE (UG/L)	34030 0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
BROMODICHLOROMETHANE (UG/L)	32101 0	<0.40	<0.40	<0.40	<0.40	<0.40	<0.50	<0.50	<0.40
BROMOFORM (UG/L)	32104 0	<0.90	<0.90	<0.90	<0.90	<0.90	<1.00	<1.00	<0.80
BROMOMETHANE (UG/L)	34413 0	<0.7	<0.7	<0.7	<0.7	<0.7	<0.8	<0.9	<0.7
CARBON TETRACHLORIDE (UG/L)	32102 0	<0.90	<0.90	<0.90	<0.90	<0.90	<1.0	<1.1	<0.90
CHLOROBENZENE (UG/L)	34301 0	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.40	<0.30
CHLOROETHANE (UG/L)	34311 0	<1	<1	<1	<1	<1	<1	<1	<0.9
2-CHL*ETH*VINYLETHER (UG/L)	34576 0	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.9	<0.8
CHLOROFORM (UG/L)	32106 0	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.50	<0.40
CHLOROMETHANE (UG/L)	34418 0	<0.6	<0.6	<0.6	<0.6	<0.6	<0.7	<0.7	<0.6
DIBROMOCHLOROMETHANE (UG/L)	34306 0	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.80	<0.70
DICHL*DIFLUO*METHANE (UG/L)	34668 0	<0.7	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.7
1,1-DICHLOROETHANE (UG/L)	34496 0	<0.30	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.30
1,2-DICHLOROETHANE (UG/L)	34531 0	<0.60	<0.70	<0.60	<0.70	<0.70	<0.70	<0.70	<0.60
1,1-DICHLOROETHYLENE (UG/L)	34501 0	<0.70	<0.70	<0.70	<0.70	<0.70	<0.80	<0.80	<0.70
T-1,2-DICHLOROETHENE (UG/L)	34546 0	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	2.0	1.2
1,2-DICHLOROPROPANE (UG/L)	34541 0	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.5	<0.4
CIS-1,3-DICH*PROPENE (UG/L)	34704 0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Table 2-19. Site 36--Camp Geiger Area Dump Sampling Data (Continued, Page 2 of 2)

ENVIRONMENTAL SCIENCE & ENGINEERING MULTIPLE FIELD GROUP REPORT REPORT DATE: WED, DEC 05 1984

CAMP LEJEUNE
STATION 36

		36GW1 374735	36GW1 398503	36GW2 374736	36GW2 398504	36GW3 374737	36GW3 398505	36GW4 374738	36GW4 398506
COLLECTION DATE		7/31/84	7/31/84	7/31/84	7/31/84	7/31/84	7/31/84	7/31/84	7/31/84
COLLECTION TIME		1445	1445	1400	1400	1330	1330	2230	1030
T-1,3-DICHL*PROPENE (UG/L)	34699 0	<0.3	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.3
ETHYLBENZENE (UG/L)	34371 0	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.7	<0.6
METHYLENE CHLORIDE (UG/L)	34423 0	<0.6	<0.7	<0.6	<0.7	<0.6	<0.7	<0.7	7
1,1,2,2-TE*CH*ETHANE (UG/L)	34516 0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	4	3
TETRACHLOROETHENE (UG/L)	34475 0	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.3	<1.0
1,1,1-TRICHL*ETHANE (UG/L)	34506 0	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.90	<0.70
1,1,2-TRICHL*ETHANE (UG/L)	34511 0	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.80	<0.70
TRICHLOROETHENE (UG/L)	39180 0	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.90	<0.80
TRICHL*FLUOROMETHANE (UG/L)	34488 0	<0.7	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.7
TOLUENE (UG/L)	34010 0	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.4	<0.3
VINYL CHLORIDE(UG/L)	39175 0	<0.5	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.5
CADMIUM,TOTAL(UG/L)	1027 0	12.0	8.0	14.0	19.0	7.0	NA	9.0	NA
CHROMIUM,TOTAL(UG/L)	1034 0	480	510	420	680	280	NA	510	NA
LEAD,TOTAL(UG/L)	1051 0	324.0	265.0	249.0	346.0	104.0	NA	217.0	NA
OIL&GR,IR(MG/L)	560 0	<0.9	<1.0	<0.9	<0.9	<1.0	<1.0	<0.9	<0.9
PHENOLS (UG/L)	32730 0	3	2	2	6	3	3	2	1

Source: ESE, 1984.

Table 2-20. Site 36--Camp Geiger Area Dump Near Sewage Treatment Plant Data Evaluation

Analytes Detected	Regulatory Limits	Value (ug/L)	Samples Exceeding Limits
Phenols	Organoleptic	300	None
Cd	Drinking Water/Ambient Water	10	36GW1, 36GW2
CrIII	Ambient Water	170 mg/L	None
CrVI	Drinking Water/Ambient Water	50	36GW1, 36GW2, 36GW3, 36GW4
Pb	Drinking Water/Ambient Water	50	36GW1, 36GW2, 36GW3, 36GW4
T12DCE	NCA*	NL†	NL
TCLEE	NCA	NL	NL

*NCA = No criteria available.
†NL = No numerical limit.

Source: ESE, 1984.

Recommendations

The second round of sampling for the verification step should consist of the resampling of all four monitor wells for all analytes investigated during the initial sampling effort.

+ new aggradient of 2 sw/sd in Brinson Creek and 2 sw/sd in unnamed creek South of the site

SITE 41--CAMP GEIGER DUMP

Site Investigation

o Four shallow ground water monitoring wells:

Well 41GW1--Placed at the northern (upgradient) end of disposal area.

Wells 41GW2 and 41GW3--Placed at the southern (downgradient) end of disposal area, between the site and Tank Creek.

Well 41GW4--Placed east (downgradient) of the disposal area between the site and an unnamed tributary to Southwest Creek.

Data Evaluation

As shown in Table 2-21, detectable levels of O&G and phenols were found in all wells except Well 41GW3 (phenols below detection limit). Cr was found in all wells; the highest concentration was found at Well 41GW2 (above criterion) (see Table 2-22). Pb was found in all wells except Well 41GW4 and is above criterion in the other three wells. Highest Pb levels are at Well 41GW2. Four volatile organic compounds were detected at Well 41GW2, the only well found to contain detectable levels of volatile organics. Although the levels of vinyl chloride and benzene did not exceed the 10^{-5} risk level, they exceeded the 10^{-7} risk level. The level of DCFM exceeded the 10^{-5} risk level. The highest levels of contamination (metals, volatile organics) at this site appear to be located in the southwest quadrant. The reported burials of pesticides and ordnance compounds were not observed in the ground water chemistry data.

Migration Potential

Migration, via ground water, of contamination derived from Site 41 can occur in all directions except to the northwest. Ground water in the elevated disposal area discharges to two unnamed stream channels to the north and east, and Tank Creek to the southeast-south.

Table 2-21. Site 41--Camp Geiger Dump Sampling Data

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400 PROJECT NAME CAMP LEJEUNE
FIELD GROUP: CLJW1 PROJECT MANAGER: BOWEN/GEISZLER
PARAMETERS: LJ9 SAMPLES: PART FIELD GROUP LEADER: BOB GREGORY

		SAMPLE NUMBERS			
PARAMETERS	STORET # METHOD #	41GW1 374739	41GW2 374740	41GW3 374741	41GW4 374742
DATE		7/16/84	7/16/84	7/16/84	7/16/84
TIME		1410	1600	1635	1725
ACROLEIN (UG/L)	34210 0	<9	<9	<10	<9
ACRYLONITRILE (UG/L)	34215 0	<9	<9	<10	<9
BENZENE (UG/L)	34030 0	<0.3	0.3	<0.3	<0.3
BROMODICHLOROMETHANE (UG/L)	32101 0	<0.60	<0.60	<0.60	<0.60
BROMOFORM (UG/L)	32104 0	<1.20	<1.20	<1.30	<1.30
BROMOMETHANE (UG/L)	34413 0	<1	<1	<1	<1
CARBON TETRACHLORIDE (UG/L)	32102 0	<1.1	<1.1	<1.2	<1.2
CHLOROBENZENE (UG/L)	34301 0	<0.40	<0.40	<0.40	<0.40
CHLOROETHANE (UG/L)	34311 0	<1	<1	<2	<2
2-CHLOROETHYLVINYLETHER (UG/L)	34576 0	<1	<1	<1	<1
CHLOROFORM (UG/L)	32106 0	<0.60	<0.60	<0.60	<0.60
CHLOROMETHANE (UG/L)	34418 0	<0.9	<1	<1	<1
DIBROMOCHLOROMETHANE (UG/L)	34306 0	<1.00	<1.00	<1.10	<1.00
DICHLORODIFLUOROMETHANE (UG/L)	34668 0	<1	8	<1	<1
1,1-DICHLOROETHANE	34496 (UG/L) 0	<0.50	<0.50	<0.50	<0.50
1,2-DICHLOROETHANE	34531 (UG/L) 0	<0.80	<0.80	<0.90	<0.90
1,1-DICHLOROETHYLENE	34501 (UG/L) 0	<1.0	<1.0	<1.1	<1.1
T-1,2-DICHLOROETHENE	34546 (UG/L) 0	<1.0	1.1	<1.1	<1.1
1,2-DICHLOROPROPANE	34541 (UG/L) 0	<0.6	<0.6	<0.6	<0.6
CIS-1,3-DICHLOROPROPENE	34704 (UG/L) 0	<0.7	<0.7	<0.7	<0.7

Table 2-21. Site 41--Camp Geiger Dump Sampling Data (Continued, Page 2 of 4)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400 PROJECT NAME CAMP LEJEUNE
FIELD GROUP: CLJW1 PROJECT MANAGER: BOWEN/SEISZLER
PARAMETERS: LJ9 SAMPLES: PART FIELD GROUP LEADER: BOB GREGORY

PARAMETERS	STORET # METHOD #	SAMPLE NUMBERS 41GW1 374739	41GW2 374740	41GW3 374741	41GW4 374742
DATE		7/16/84	7/16/84	7/16/84	7/16/84
TIME		1410	1600	1635	1725
T-1,3-DICHLOROPROPENE (UG/L)	34699 0	<0.5	<0.5	<0.5	<0.5
ETHYLBENZENE (UG/L)	34371 0	<0.8	<0.9	<0.9	<0.9
METHYLENE CHLORIDE (UG/L)	34423 0	<1	<1	<1	<1
1,1,2,2-TETRACHLOROETHANE (UG/L)	34516 0	<0.7	<0.7	<0.8	<0.8
TETRACHLOROETHENE (UG/L)	34475 0	<1.4	<1.4	<1.5	<1.5
1,1,1-TRICHLOROETHANE (UG/L)	34506 0	<0.90	<0.90	<1.1	<1.1
1,1,2-TRICHLOROETHANE (UG/L)	34511 0	<1.0	<1.0	<1.1	<1.1
TRICHLOROETHENE (UG/L)	39180 0	<1.1	<1.1	<1.2	<1.1
TRICHLOROFLUOROMETHANE (UG/L)	34488 0	<1	<1	<1	<1
TOLUENE (UG/L)	34010 0	<0.5	<0.5	<0.5	<0.5
VINYL CHLORIDE(UG/L)	39175 0	<0.7	1	<0.9	<0.9
CADMIUM,TOTAL(UG/L)	1027 0	<6.0	<6.0	7.1	<6.0
CHROMIUM,TOTAL(UG/L)	1034 0	76	530	230	32
LEAD,TOTAL(UG/L)	1051 0	74.6	196.7	119.4	<40.0
OIL&GR,IR(MG/L)	560 0	2	2	2	48
PHENOLS (UG/L)	32730 0	<1	4	1	2
ALDRIN (UG/L)	39330 0	<0.0008	<0.0008	<0.0008	<0.0008
BHC,A (UG/L)	39337 0	<0.0010	<0.0010	<0.0010	<0.0010
BHC,B (UG/L)	39338 0	<0.00010	<0.00010	<0.00010	<0.00010
BHC,D (UG/L)	39259 0	<0.0003	<0.0003	<0.0003	<0.0003

Table 2-21. Site 41--Camp Geiger Dump Sampling Data (Continued, Page 3 of 4)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222406
FIELD GROUP: CLJW1
PARAMETERS: LJ9 SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

PARAMETERS	STORET # METHOD #	SAMPLE NUMBERS 41GW1 374739	41GW2 374740	41GW3 374741	41GW4 374742
DATE		7/16/84	7/16/84	7/16/84	7/16/84
TIME		1410	1600	1635	1725
BHC,G(LINDANE)(UG/L)	39340 0	<0.00010	<0.00010	<0.00010	<0.00010
CHLORDANE (UG/L)	39350 0	<0.010	<0.010	<0.010	<0.010
DDD,PP'(UG/L)	39310 0	<0.003	<0.003	<0.003	<0.003
DDE,PP'(UG/L)	39320 0	<0.0008	<0.0008	<0.0008	<0.0008
DDT,PP'(UG/L)	39300 0	<0.005	<0.005	<0.005	<0.005
DIELDRIN (UG/L)	39380 0	<0.0010	<0.0010	<0.0010	<0.0010
ENDOSULFAN,A (UG/L)	34361 0	<0.0008	<0.0008	<0.0008	<0.0008
ENDOSULFAN,B (UG/L)	34356 0	<0.002	<0.002	<0.002	<0.002
ENDOSULFAN SULFATE (UG/L)	34351 0	<0.005	<0.005	<0.005	<0.005
ENDRIN (UG/L)	39390 0	<0.002	<0.002	<0.002	<0.002
ENDRIN ALDEHYDE (UG/L)	34366 0	<0.004	<0.004	<0.004	<0.004
HEPTACHLOR (UG/L)	39410 0	<0.0007	<0.0007	<0.0007	<0.0007
HEPTACHLOR EPOXIDE (UG/L)	39420 0	<0.0006	<0.0006	<0.0006	<0.0006
TOXAPHENE (UG/L)	39400 0	<0.100	<0.100	<0.100	<0.100
MIREX (UG/L)	99834 0	<0.0010	<0.0010	<0.0010	<0.0010
TRINITROTOLUENE,TOTAL(UG/L)	81360 3	<1.0	<0.9	<0.9	<0.9
2,4-DINITROTOLUENE (UG/L)	34611 0	<3	<3	<3	<3
2,6-DINITROTOLUENE (UG/L)	34626 0	<2	<2	<2	<2
TRINITROBENZENE,TOTAL(UG/L)	99735 0	<4.4	<4.1	<4.2	<4.3
WHITE PHOSPHORUS (UG/L)	99790 0	<1.4	<1.4	<1.4	<1.4

Table 2-21. Site 41--Camp Geiger Dump Sampling Data (Continued, Page 4 of 4)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400
FIELD GROUP: CLJW1
PARAMETERS: LJP SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

		SAMPLE NUMBERS			
PARAMETERS	STORET # METHOD #	41GW1 374739	41GW2 374740	41GW3 374741	41GW4 374742
DATE		7/16/84	7/16/84	7/16/84	7/16/84
TIME		1410	1600	1635	1725
RDX (UG/L)	81364 0	<3.42	<3.23	<3.30	<3.30

Source: ESE, 1984.

Table 2-22. Site 41--Camp Geiger Dump Data Evaluation

Analytes Detected	Regulatory Limits	Value (ug/L)	Samples Exceeding Limits
O&G	Organoleptic	--	41GW4
Phenols	Organoleptic	300	None
Cd	Drinking Water/Ambient Water	10	None
CrIII	Ambient Water	170 mg/L	None
CrVI	Drinking Water/Ambient Water	50	41GW1, 41GW2, 41GW3,
Pb	Drinking Water/Ambient Water	50	41GW1, 41GW2, 41GW3
T12DCE	NCA*	NL†	NL
Vinyl chloride	10^{-5} Human Health Risk Level	20	None
Benzene	10^{-5} Human Health Risk Level	6.6	None
DCFM	10^{-5} Human Health Risk Level	1.9	41GW1

*NCA = No critera available.
†NL = No numerical limit.

Source: ESE, 1984.

The low levels of volatile organic compounds do not present a hazard to the southwest because they most likely volatize when discharged. The levels of Cr and Pb, as well as O&G at Well 41GW4 are more persistent and are of concern because they are likely to enter the stream environments.

Recommendations

All four monitor wells should be resampled during the second verification step sampling effort. All analytical techniques utilized during the initial sampling and analysis effort should be included in the second effort.

+ add new upgradient sample twice etc, Sample tank creek & unnamed creek to the north in two locations each. (See attached.)

SITE 45--CAMPBELL STREET FUEL FARM AND MCAS AIR FIELD RAPID REFUELING AREA

CAMPBELL STREET FUEL FARM

Site Investigation

o Three shallow ground water monitoring wells:

Well 45GW1--Located in southwest corner of site in area of known POL seeps.

Well 45GW2--Located north of site.

Well 45GW3--Located east of site between site and deep water supply well No. 131 (Well 45GW4).

o Two deep water supply wells:

Well No. 131 (Well 45GW4)

Well No. 4140 (Well 45GW5)

How come we have two rounds of data and Pb only? ?

Data Evaluation

O&G was detected in all sampled wells at this site, including the two water supply wells (see Table 2-23). The levels were generally low except in Well 45GW2. Pb (above criterion) was detected only in Well 45GW1 (see Table 2-24). The volatile components of the fuels reported to have spill/leaked at this site were not detected.

Migration Potential

The Campbell Street Fuel Farm is located in an area without significant topographic relief. As a result, ground water gradients under natural conditions are extremely low. Migration of contaminants from this site is possible because of the pumping of two water supply wells in close proximity. The observed levels of O&G indicate that some migration has occurred, although it does not appear that organoleptic limits have been exceeded in the water supply wells.

Table 2-23. Site 45--Campbell Street Fuel Farm Sampling Data

ENVIRONMENTAL SCIENCE & ENGINEERING MULTIPLE FIELD GROUP REPORT REPORT DATE: TUE, DEC 18 1984

CAMP LEJEUNE
STATION 45

		45GW1 374743	45GW1 398507	45GW2 374744	45GW2 398508	45GW3 374745	45GW3 398509	45GW4 374746	45GW4 398510	45GW4 374747	
COLLECTION DATE		7/16/84	8/1/84	8/1/84	8/1/84	8/1/84	8/1/84	8/1/84	8/1/84	8/1/84	
COLLECTION TIME		0	930	1015	1015	1130	1130	1130	1130	1130	
ACROLEIN (UG/L)	34210 0	<7	NA	<6	NA	<7	NA	<7	NA	<8	<8
ACRYLONITRILE (UG/L)	34215 0	<7	NA	<6	NA	<7	NA	<7	NA	<8	<8
BENZENE (UG/L)	34 30 0	<0.2	NA	<0.2	NA	<0.2	NA	<0.2	NA	<.3	<.3
BROMODICHLOROMETHANE (UG/L)	32101 0	<0.50	NA	<0.40	NA	<0.50	NA	<0.50	NA	<.6	<.6
BROMOFORM (UG/L)	32104 0	<1.00	NA	<0.70	NA	<1.10	NA	<1.10	NA	<1.2	<1.2
BROMOMETHANE (UG/L)	34413 0	<0.9	NA	<0.7	NA	<0.9	NA	<0.8	NA	<.9	<.9
CARBON TETRACHLORIDE (UG/L)	32102 0	<1.1	NA	<0.90	NA	<1.1	NA	<1.1	NA	<1.2	<1.2
CHLOROBENZENE (UG/L)	34301 0	<0.40	NA	<0.30	NA	<0.40	NA	<0.40	NA	<.4	<.4
CHLOROETHANE (UG/L)	34311 0	<1	NA	<0.9	NA	<1	NA	<1	NA	<1	<1
2-CHL*ETH*VINYLETHER (UG/L)	34576 0	<0.9	NA	<0.8	NA	<0.9	NA	<0.9	NA	<1	<1
CHLOROFORM (UG/L)	32106 0	<0.50	NA	<0.40	NA	<0.50	NA	<0.50	NA	<.5	<.5
CHLOROMETHANE (UG/L)	34418 0	<0.7	NA	<0.6	NA	<0.8	NA	<0.7	NA	<.8	<.8
DIBROMOCHLOROMETHANE (UG/L)	34306 0	<0.80	NA	<0.70	NA	<0.90	NA	<0.80	NA	<.9	<.9
DICHL*DIFLUO*METHANE (UG/L)	34668 0	<0.8	NA	<0.7	NA	<0.9	NA	<0.9	NA	<.9	<.9
1,1-DICHLOROETHANE (UG/L)	34496 0	<0.40	NA	<0.30	NA	<0.40	NA	<0.40	NA	<.4	<.4
1,2-DICHLOROETHANE (UG/L)	34531 0	<0.70	NA	<0.60	NA	<0.80	NA	<0.70	NA	<.8	
1,1-DICHLOROETHYLENE (UG/L)	34501 0	<0.80	NA	<0.70	NA	<0.90	NA	<0.80	NA	<.9	
T-1,2-DICHLOROETHENE (UG/L)	34546 0	<0.80	NA	<0.60	NA	<0.80	NA	<0.80	NA	<.9	
1,2-DICHLOROPROPANE (UG/L)	34541 0	<0.5	NA	<0.4	NA	<0.5	NA	<0.5	NA	<.5	
CIS-1,3-DICH*PROPENE (UG/L)	34704	<0.5	NA	<0.5	NA	<0.6	NA	<0.5	NA	<.6	

Table 2-23. Site 45--Campbell Street Fuel Farm Sampling Data (Continued, Page 2 of 2)

ENVIRONMENTAL SCIENCE & ENGINEERING MULTIPLE FIELD GROUP REPORT REPORT DATE: TUE, DEC 18 1984

CAMP LEJEUNE
STATION 45

		45GW1 374743	45GW1 398517	45GW2 374744	45GW2 398508	45GW3 374745	45GW3 398509	45GW4 374746	45GW4 398511	45GW5 374747
COLLECTION DATE		7/16/84	8/1/84	8/1/84	8/1/84	8/1/84	8/1/84	8/1/84	8/1/84	8/1/84
COLLECTION TIME			930	1015	1015	1130	1130	1100	1100	1030
T-1,3-DICHL*PROPENE (UG/L)	34699 0	<0.4	NA	<0.3	NA	<0.4	NA	<0.4	NA	<0.4
ETHYLBENZENE (UG/L)	34371 0	<0.8	NA	<0.6	NA	<0.8	NA	<0.8	NA	<0.8
METHYLENE CHLORIDE (UG/L)	34423 0	<0.7	NA	<0.6	NA	<0.8	NA	<0.7	NA	<0.8
1,1,2,2-TE*CH*ETHANE (UG/L)	34516 0	<0.5	NA	<0.4	NA	<0.5	NA	<0.5	NA	<0.5
TETRACHLOROETHENE (UG/L)	34475 0	<1.3	NA	<1.0	NA	<1.3	NA	<1.3	NA	<1.4
1,1,1-TRICHL*ETHANE (UG/L)	34506 0	<0.90	NA	<0.70	NA	<0.90	NA	<0.90	NA	<1.
1,1,2-TRICHL*ETHANE (UG/L)	34511 0	<0.80	NA	<0.60	NA	<0.80	NA	<0.80	NA	<0.90
TRICHLOROETHENE (UG/L)	39180 0	<0.90	NA	<0.80	NA	<1.0	NA	<0.90	NA	<1.
TRICHL*FLUOROMETHANE (UG/L)	34488 0	<0.8	NA	<0.7	NA	<0.9	NA	<0.9	NA	<0.9
TOLUENE (UG/L)	34 10 0	<0.4	NA	<0.4	NA	<0.5	NA	<0.4	NA	<0.4
VINYL CHLORIDE(UG/L)	39175 0	<0.6	NA	<0.5	NA	<0.6	NA	<0.6	NA	<0.7
LEAD,TOTAL(UG/L)	1 51 0	73.6	<50.0	<50.0	NA	<50.0	NA	<50.0	NA	<50.0
OIL&GR,IR(MG/L)	560 0	2	4	22	<0.9	2	1	2	<1.	1

Source: ESE, 1984.

Table 2-24. Site 45--Campbell Street Fuel Farm Data Evaluation

Analytes Detected	Regulatory Limits	Value (ug/L)	Samples Exceeding Limits
O&G	Organoleptic	NL*	45GW2
Pb	Drinking Water/Ambient Water	50	45GW1

*NL = No numerical limit.

Source: ESE, 1984.

Recommendations

All wells sampled in the initial verification sampling event should be resampled in the second sampling event. The same analytes tested in the first sampling event should be repeated in the second sampling event. + new well to the south +(2)SW/SD in canal + 6 core samples perimeter of fuel farm

MCAS AIR FIELD RAPID REFUELING AREA

Site Investigation

o Nine soil borings (hand auger).

Data Evaluation

The purpose of the soil boring investigation at the MCAS Air Field Rapid Refueling Area was to determine if the extent of underground fuel contamination had increased. The extent of fuel contamination is documented in the report "Leaked Fuel Inventory Direct Fueling Pipeline Marine Corps Naval Air Station Camp Lejeune, North Carolina," Soil & Material Engineers, Inc., December 1983. The approximate locations of the nine soil borings performed in this investigation are shown in Figure 2-2, and the results of the investigation are presented in Table 2-25. The data presented in Table 2-25 indicate that the underground fuel contamination has not spread and remains in the area identified in the previous investigation conducted by Soil & Material Engineers, Inc.

Migration Potential

Due to the lack of significant topographic relief in the Rapid Refueling Area, ground water gradients under normal conditions are extremely low, and rapid horizontal migration of the fuel floating above the shallow ground water is not expected. This is corroborated by the relative immobility of the existing underground contamination indicated by the soil boring investigation.

Recommendations

No further verification monitoring is recommended. Serious consideration should be given to installing a recovery well(s) in this area to recover the large volume of fuel currently floating above the shallow ground water.

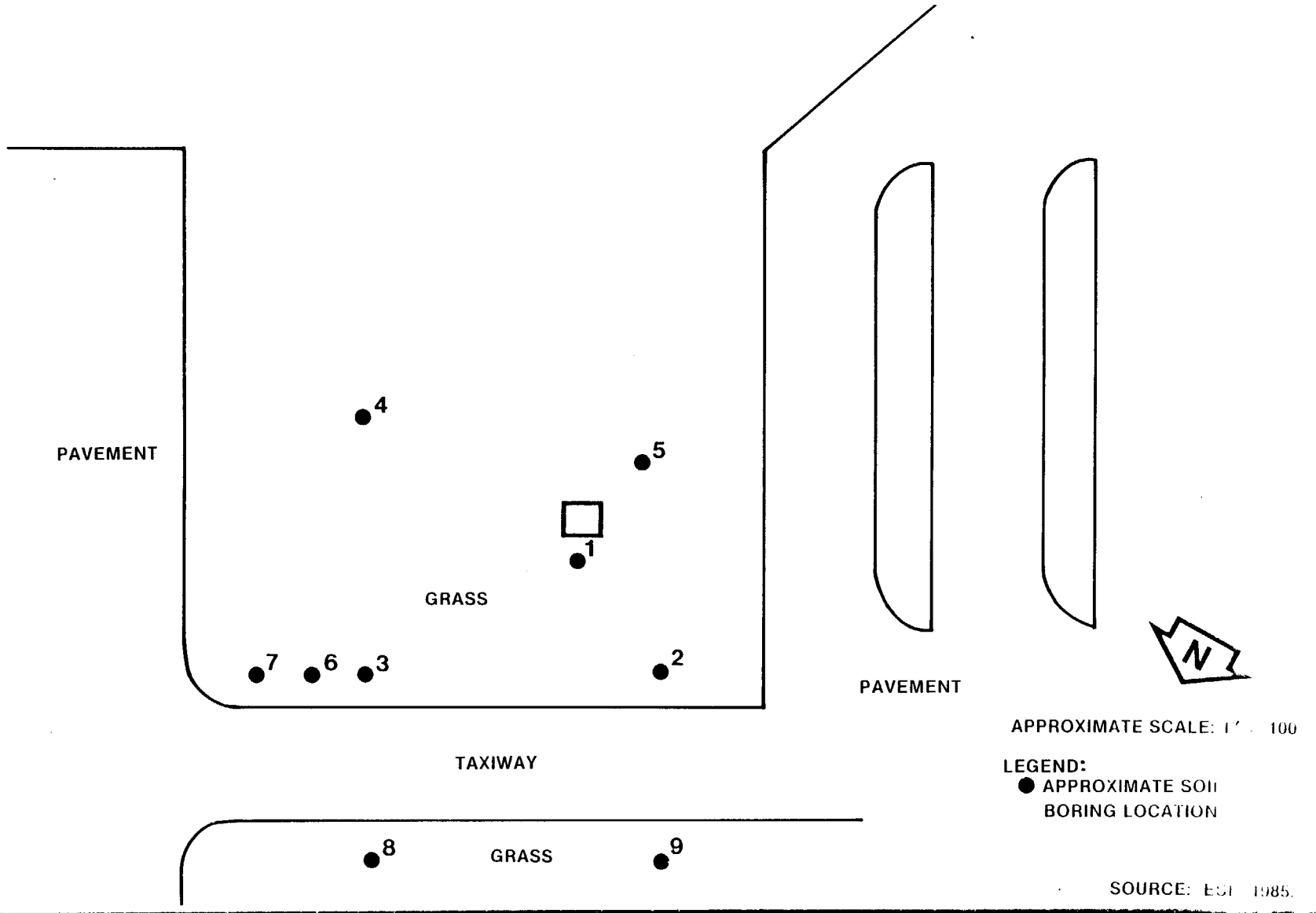


Figure 2-2
MCAS AIR FIELD RAPID REFUELING
AREA SOIL BORING LOCATIONS

CONFIRMATION STUDY
MARINE CORPS BASE
CAMP LEJEUNE

Table 2-25. Site 45--MCAS Air Field Rapid Refueling Area Soil Boring Investigation

Boring No.*	Depth to Boring (ft)	Depth to Liquid (ft)	Estimated Thickness of Fuel Layer (ft)
1	7.6	5.4	>2.2
2	7.4	7.1	<0.1
3	6.8	5.1	>1.7
4	5.6	†	NFD**
5	Boring was filled in during 24-hour ground water stabilization period following drilling.		
6	6.6	5.5	>1.1
7	4.3	3.4	NFD
8	3.6	1.2	NFD
9	4.2	3.95	NFD

*Drilling was performed on August 5, 1984. Depth to liquid measurements were made on August 7, 1984.
†No free standing liquid present. Boring collapsed during 24-hour ground water stabilization period following drilling.
**NFD = No fuel detected by odor or conductivity meter.

Source: ESE, 1984.

SITE 48--MCAS MERCURY DUMP SITE

Site Investigation

o Four soil borings (hand auger) to the water table (behind Photo Lab in area of disposal).

o Four soils samples from materials at soil and ground water contact (Samples 48S1 through 48S4).

o Four sediment sampling stations:

Stations 48SE1 through 48SE4--In marsh area to the north of Photo Lab.

Data Evaluation

Soil:

Hg was found in all four soil borings (see Table 2-26). Values ranged from 0.009 to 0.02 milligram per kilogram (mg/kg).

Sediment:

Hg was found in all four sediment samples obtained from the marsh adjacent to Site 48 (see Table 2-26). Values ranged from 0.02 to 0.03 mg/kg.

Migration Potential

The presence of Hg in the soil and in the sediments of the marsh suggests that Hg may have migrated into the surface water system via the shallow ground water. Correlation between Hg levels in solid media (i.e., soil and sediment) and levels in ground water and surface water cannot be made using the existing data base.

Recommendations

The conceptual design of the verification step specifies that if all suspected analytes at a given site are detected in all environmental media by the initial sampling effort, then additional sampling is not required. Hg was detected in all samples from Site 48. Hg was the only suspected analyte; therefore, no additional sampling is recommended at Site 48 during the verification step.

Table 2-26. Site 48--MCAS Mercury Dump Site Sampling Data

ENVIRONMENTAL SCIENCE & ENGINEERING MULTIPLE FIELD GROUP REPORT REPORT DATE: WED, DEC 05 1984

CAMP LEJEUNE
STATION 48

		48S1 374650	48S1 398616	48S2 374651	48S3 374652	48S4 374653	48SE1 374654	48SE2 374655	48SE3 374656	48SE4 374657
COLLECTION DATE		8/6/84	8/6/84	8/6/84	8/6/84	8/5/84	8/6/84	8/6/84	8/6/84	8/21/84
COLLECTION TIME		230	1500	0	0	0	1515	1520	1525	845
MERCURY,SED(MG/KG-DRY)	71921 0	0.02	0.03	0.02	0.02	0.009	0.02	0.02	0.03	0.02
MOISTURE(%WET WT)	70320 0	28.0	29.1	33.5	27.0	24.6	42.4	44.1	48.8	31.7

SITE 54--CRASH CREW FIRE TRAINING BURN PIT

Site Investigation

o One shallow ground water monitoring well:

Well 54GW1--Located between burn pit and deep water supply well No. 5009 (Well 54GW2)

o Deep water supply well No. 5009 (Well 54GW2)

o 9 soil borings (hand auger)

Data Evaluation

Ground water:

As shown in Table 2-27, low levels of O&G, phenols, and chromium were detected in the shallow ground water at Site 54 (Well 54GW1). Levels of O&G and phenols did not exceed criteria (see Table 2-28). Total Cr is also within criteria unless all the Cr is hexavalent Cr. Water supply well No. 5009 contained low levels (below criteria) of phenol only. No volatile organic compounds were detected in either of the two wells from this site.

Soil:

The purpose of the soil boring investigation at Site 54 was to determine if oil contamination of the shallow ground water underlying the site had occurred. The approximate locations of the nine soil borings performed in the investigation are shown in Figure 2-3, and the results of the investigation are presented in Table 2-29. The results of the soil boring investigation indicate that some oil contamination underlies the site to the east and southeast of the burn pit, as evidenced by a fuel odor detected during drilling in these areas.

Migration Potential

The immediate human health concern at Site 54 is the status of water quality at water supply well No. 5009 (Well 54GW2). It does not appear that significant contamination from Site 54 is capable of migrating toward well No. 5009 even with the influence of pumping.

Table 2-27. Site 54--Crash Crew Fire Training Burn Pit Sampling Data

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER [illegible]
FIELD GROUP: CLJ01
PARAMETERS: LU7 SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

5/7

PARAMETERS	STORET # / METHOD #	SAMPLE NUMBERS 54001 374748	54002 374749
DATE		7/16/84	7/16/84
TIME		1250	1315
ACROLEIN (UG/L)	34210 6	<10	<11
ACRYLONITRILE (UG/L)	34215 6	<13	<11
BENZENE (UG/L)	34030 6	<0.3	<0.3
BROMODICHLOROMETHANE (UG/L)	32101 6	<0.70	<0.70
BROMOFORM (UG/L)	32104 6	<1.30	<1.50
BROMOMETHANE (UG/L)	34413 6	<1	<1
CARBON TETRACHLORIDE (UG/L)	32102 6	<1.3	<1.4
CHLOROBENZENE (UG/L)	34301 6	<0.50	<0.50
CHLOROETHANE (UG/L)	34311 6	<2	<2
2-CHLOROETHYLVINYLETHER (UG/L)	34576 6	<1	<1
CHLOROFORM (UG/L)	32106 6	<0.60	<0.70
CHLOROMETHANE (UG/L)	74418 6	<1	<1
DIBROMOCHLOROMETHANE (UG/L)	34306 6	<1.10	<1.20
DICHLORODIFLUOROMETHANE (UG/L)	34668 6	<1	<1
1,1-DICHLOROETHANE (UG/L)	34496 6	<0.50	<0.60
1,2-DICHLOROETHANE (UG/L)	34531 6	<0.90	<1.0
1,1-DICHLOROETHYLENE (UG/L)	34501 6	<1.2	<1.3
TRANS-1,2-DICHLOROETHENE (UG/L)	34546 6	<1.1	<1.2
1,2-DICHLOROPROPANE (UG/L)	34541 6	<0.7	<0.7
CIS-1,3-DICHLOROPROPENE (UG/L)	34704 6	<0.7	<0.6

Table 2-27. Site 54--Crash Crew Fire Training Burn Pit Sampling Data (Continued, Page 2 of 2)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER [illegible]
FIELD GROUP: CLDL1
PARAMETERS: LJ3 SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

PARAMETERS	STORET # / METHOD #	SAMPLE NUMBERS 54GW1 374749	54GW2 374749
DATE		7/16/84	7/16/84
TIME		125	1315
T-1,2-DICHLOROPROPENE (UG/L)	34699 0	<0.5	<0.6
ETHYLBENZENE (UG/L)	34371 0	<1	<1
METHYLENE CHLORIDE (UG/L)	34423 0	<1	<1
1,1,2,2-TETRACHLOROETHANE (UG/L)	34516 0	< .8	<0.9
TETRACHLOROETHENE (UG/L)	34475 0	<1.5	<1.7
1,1,1-TRICHLOROETHANE (UG/L)	34506 0	<1.1	<1.2
1,1,2-TRICHLOROETHANE (UG/L)	34511 0	<1.1	<1.2
TRICHLOROETHENE (UG/L)	39180 0	<1.2	<1.3
TRICHLOROFLUOROMETHANE (UG/L)	34488 0	<1	<1
TOLUENE (UG/L)	34010 0	<0.5	<0.6
VINYL CHLORIDE(UG/L)	39175 0	<0.9	<1
CADMIUM,TOTAL(UG/L)	1027 0	<6.0	<6.0
CHROMIUM,TOTAL(UG/L)	1034 0	6	<8.0
LEAD,TOTAL(UG/L)	1051 0	<40.0	<40.0
[illegible]	[illegible] 0	1	<0.9
PHENOLS (UG/L)	32730 0	3	2

Table 2-28. Site 54--Crash Crew Fire Training Burn Pit Data Evaluation

Analytes Detected	Regulatory Limits	Value (ug/L)	Samples Exceeding Limits
O&G	Organoleptic	NL*	NL
Phenols	Organoleptic	300	None
CrIII	Ambient Water	170 mg/L	None
CrIV	Drinking water/Ambient Water	50	54GW1

*NL = No numerical limit.

Source: ESE, 1984.

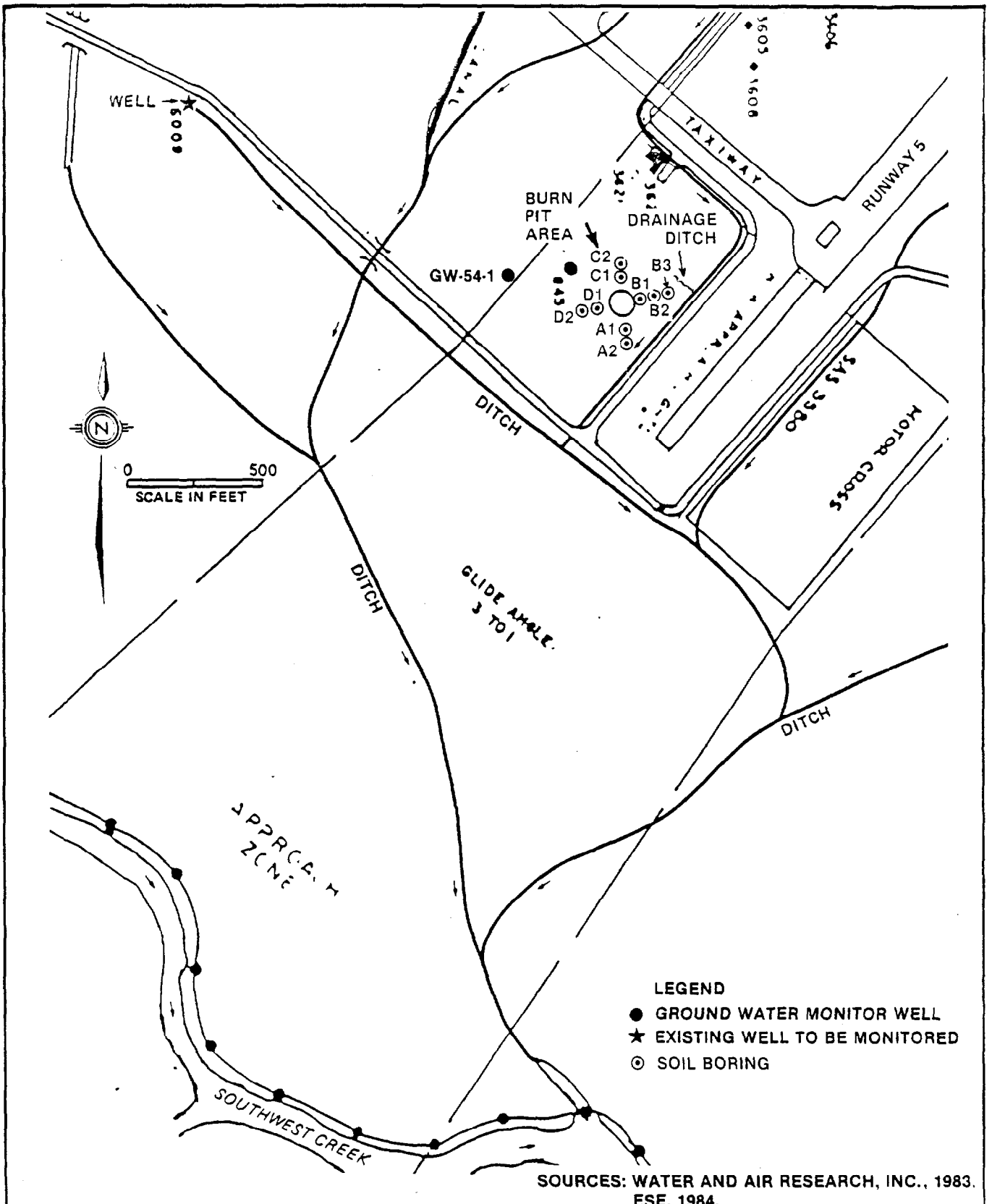


Figure 2-3
SAMPLING LOCATIONS AT SITE 54--
CRASH CREW FIRE TRAINING BURN PIT

CONFIRMATION STUDY
MARINE CORPS BASE
CAMP LEJEUNE

Table 2-29. Site 54--Crash Crew Fire Training Burn Pit Soil Boring Investigation

Boring No.*	Depth of Boring (ft)	Depth to Liquid (ft)	Estimated Thickness of Fuel Layer (ft)
A1	10	9.7	NFD†
A2	4.7	NL**	NFD
B1	4.6	NL	NFD
B2	7.2	6.8	Fuel Odor
B3	3.4	1.7	Fuel Odor
C1	4.4	NL	Fuel Odor
C2	4.6	NL	NFD
D1	10	9.8	NFD
D2	4.4	NL	NFD

*Drilling was performed on August 5, 1984. Depth to liquid measurements were made on August 7, 1984.
†NFD = No fuel detected.
**NL = No liquid.

Source: ESE, 1984.

From a long-range health or aesthetic viewpoint, significant O&G contamination derived from Site 54 exists on the south and southeast sides of the burn pit. At the time of sampling, discharge of oil-contaminated ground water into the drainage ditch located east of the burn pit was observed.

Recommendations

The shallow monitor well and the deep water supply well (well No. 5009) should be resampled for the analytes investigated during the initial sampling effort. No further effort regarding soil augering is recommended during the verification step.

Where is the elevation for 54GW01?
Add two new wells sample twice
Add three SW/SD samples in drainage ditches as shown on attached.

SITE 68--RIFLE RANGE DUMP

Site Investigation

o Three shallow ground water monitoring wells:

Well 68GW1--Upgradient between disposal area and deep water supply well Nos. RR-45 (Well 68GW4) and RR-97 (Well 68GW5).

Well 68GW2--Downgradient (north) between disposal area and Stone Creek.

Well 68GW3--Downgradient (west) between disposal area and Stone Creek.

o Two deep water supply wells, Nos. RR-45 (Well 68GW4) and RR-97. (Well 68GW5).

Data Evaluation

The three monitor wells and two supply wells at this site did not contain detectable levels of the analytes of concern (see Table 2-30). If disposal of solids and/or liquids did occur at this site, the volumes were very small and significant movement offsite has not occurred.

Recommendations

The second round of sampling in the verification step should include the resampling of all five wells at Site 68 for the same list of analytes used in the initial sampling.

Table 2-30. Site 68--Rifle Range Dump Sampling Data

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400 PROJECT NAME CAMP LEJEUNE
FIELD GROUP: CLJW1 PROJECT MANAGER: BOWEN/GEISZLER
PARAMETERS: VOAS SAMPLES: PART FIELD GROUP LEADER: BOB GREGORY

PARAMETERS	STORET # METHOD #	SAMPLE NUMBERS 68GW1 374750	68GW2 374751	68GW3 374752	68GW4 374753	68GW5 374754
DATE		7/17/84	7/17/84	7/17/84	7/17/84	7/17/84
TIME		1205	1145	1100	1225	1235
ACROLEIN (UG/L)	34210 0	<10	<10	<10	<10	<10
ACRYLONITRILE (UG/L)	34215 0	<10	<10	<10	<10	<10
BENZENE (UG/L)	34030 0	<0.3	<0.3	<0.3	<0.3	<0.3
BROMODICHLOROMETHANE (UG/L)	32101 0	<0.70	<0.70	<0.70	<0.70	<0.70
BROMOFORM (UG/L)	32104 0	<1.40	<1.40	<1.40	<1.40	<1.40
BROMOMETHANE (UG/L)	34413 0	<1	<1	<1	<1	<1
CARBON TETRACHLORIDE (UG/L)	32102 0	<1.3	<1.3	<1.4	<1.4	<1.4
CHLOROBENZENE (UG/L)	34301 0	<0.50	<0.50	<0.50	<0.50	<0.50
CHLOROETHANE (UG/L)	34311 0	<2	<2	<2	<2	<2
2-CHLOROETHYLVINYLETHER (UG/L)	34576 0	<1	<1	<2	<1	<1
CHLOROFORM (UG/L)	32106 0	<0.60	<0.60	<0.70	<0.60	<0.60
CHLOROMETHANE (UG/L)	34418 0	<1	<1	<1	<1	<1
DIBROMOCHLOROMETHANE (UG/L)	34306 0	<1.10	<1.10	<1.20	<1.10	<1.10
DICHLORODIFLUOROMETHANE (UG/L)	34668 0	<1	<1	<1	<1	<1
1,1-DICHLOROETHANE (UG/L)	34496 0	<0.60	<0.60	<0.60	<0.60	<0.60
1,2-DICHLOROETHANE (UG/L)	34531 0	<0.90	<0.90	<1.0	<0.90	<0.90
1,1-DICHLOROETHYLENE (UG/L)	34501 0	<1.2	<1.2	<1.2	<1.2	<1.2
T-1,2-DICHLOROETHENE (UG/L)	34546 0	<1.1	<1.2	<1.2	<1.2	<1.2
1,2-DICHLOROPROPANE (UG/L)	34541 0	<0.7	<0.7	<0.7	<0.7	<0.7
CIS-1,3-DICHLOROPROPENE (UG/L)	34704 0	<0.7	<0.7	<0.8	<0.8	<0.8

Table 2-30. Site 68--Rifle Range Dump Sampling Data (Continued, Page 2 of 2)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400 PROJECT NAME CAMP LEJEUNE
FIELD GROUP: CLJW1 PROJECT MANAGER: BOWEN/GEISZLER
PARAMETERS: VOAS SAMPLES: PART FIELD GROUP LEADER: BOB GREGORY

PARAMETERS	STORET # / METHOD #	SAMPLE NUMBERS 68GW1 374750	68GW2 374751	68GW3 374752	68GW4 374753	68GW5 374754
DATE		7/17/84	7/17/84	7/17/84	7/17/84	7/17/84
TIME		1205	1145	1100	1225	1235
T-1,3-DICHLOROPROPENE (UG/L)	34699 0	<0.6	<0.6	<0.6	<0.6	<0.6
ETHYLBENZENE (UG/L)	34371 0	<1	<1	<1	<1	<1
METHYLENE CHLORIDE (UG/L)	34423 0	<1	<1	<1	<1	<1
1,1,2,2-TETRACHLOROETHANE (UG/L)	34516 0	<0.8	<0.8	<0.8	<0.8	<0.8
TETRACHLOROETHENE (UG/L)	34475 0	<1.6	<1.6	<1.6	<1.6	<1.6
1,1,1-TRICHLOROETHANE (UG/L)	34506 0	<1.1	<1.2	<1.2	<1.1	<1.1
1,1,2-TRICHLOROETHANE (UG/L)	34511 0	<1.1	<1.2	<1.2	<1.1	<1.1
TRICHLOROETHENE (UG/L)	39180 0	<1.2	<1.2	<1.3	<1.3	<1.3
TRICHLOROFLUOROMETHANE (UG/L)	34488 0	<1	<1	<1	<1	<1
TOLUENE (UG/L)	34010 0	<0.5	<0.5	<0.6	<0.5	<0.5
VINYL CHLORIDE(UG/L)	39175 0	<0.9	<1	<0.9	<0.9	<0.9

Source: ESE, 1984.

SITE 69--RIFLE RANGE CHEMICAL DUMP

Site Investigation

o Eight shallow ground water monitoring wells:

Wells 69GW1 and 69GW2--South (downgradient) of disposal area.

Wells 69GW3 and 69GW4--East (downgradient) of disposal area.

Wells 69GW5, 69GW6, and 69GW7--North (downgradient) of disposal area.

Well 69GW8--West (downgradient) of disposal area.

o Three surface water sampling station:

Station 69SW1--Pooled water at southern boundary of disposal area.

Station 69SW2--Drainage swale to the east of disposal area.

Station 69SW3--Drainage swale to the north of disposal area.

Data Evaluation

Ground Water:

As shown in Table 2-31, the rifle range chemical dump was found to contain high levels of certain volatile organic compounds and low levels of others. Contamination appeared to be limited to the southeast quarter of the site; the potential for offsite migration was to the south, southeast, and east. Monitor Well 69GW2 contained very high levels of T12DCE (no criterion), TCE, TCLEA, and vinyl chloride (above criterion as shown in Table 2-32) with moderate-to-low levels of six other organic compounds. Well 69GW3 contained very high levels of T12DCE with moderate-to-low levels of seven other organic compounds. Well 69GW4 contained moderate levels of T12DCE and TCLEA (above criterion) and low levels of two other organic compounds.

Well 69GW1 was the only well found to contain Hg and methylene chloride. Wells 69GW5, 69GW6, 69GW7, and 69GW8 did not contain detectable limit levels of the analytes of concern. No pesticides were detected in any of the ground water samples.

Table 2-31. Site 69--Rifle Range Chemical Dump Sampling Data

ENVIRONMENTAL SCIENCE & ENGINEERING MULTIPLE FIELD GROUP REPORT REPORT DATE: WED, DEC 05 1984

CAMP LEJEUNE
STATION 69

		69GW1 374755	69GW2 374756	69GW3 374757	69GW4 374758	69GW5 374759	69GW6 374760	69GW7 374761	69GW8 374762	69SW1 374763	69SW1 398511
COLLECTION DATE		7/18/84	7/18/84	7/18/84	7/18/84	7/18/84	7/18/84	7/18/84	7/18/84	8/4/84	8/4/84
COLLECTION TIME		1225	1200	1115	930	1010	1025	1430	1345	12:0	0
ALDRIN (UG/L)	39330 0	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008
BHC,A (UG/L)	39337 0	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
BHC,B (UG/L)	39338 0	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.030	<0.00010
BHC,D (UG/L)	39259 0	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	0.20	<0.0003
BHC,G(LINDANE)(UG/L)	39340 0	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
CHLORDANE (UG/L)	39350 0	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
DDD,PP'(UG/L)	39310 0	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
DDE,PP'(UG/L)	39320 0	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008
DDT,PP'(UG/L)	39300 0	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
DIELDRIN (UG/L)	39380 0	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
ENDOSULFAN,A (UG/L)	34361 0	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008
ENDOSULFAN,B (UG/L)	34356 0	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
ENDOSULFAN SULFATE (UG/L)	34351 0	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
ENDRIN (UG/L)	39390 0	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
ENDRIN ALDEHYDE (UG/L)	34366 0	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
HEPTACHLOR (UG/L)	39410 0	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007
HEPTACHLOR EPOXIDE (UG/L)	39420 0	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
TOXAPHENE (UG/L)	39400 0	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
PCBS, WATER(UG/L)	39516 0	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	NA
MERCURY,TOTAL(UG/L)	71900 0	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

ENVIRONMENTAL SCIENCE & ENGINEERING MULTIPLE FIELD GROUP REPORT REPORT DATE: WED, DEC 05 1984

CAMP LEJEUNE
STATION 69

		69GW1 374755	69GW2 374756	69GW3 374757	69GW4 374758	69GW5 374759	69GW6 374760	69GW7 374761	69GW8 374762	69SW1 374763	69SW1 393511
COLLECTION DATE		7/18/84	7/18/84	7/18/84	7/18/84	7/18/84	7/18/84	7/18/84	7/18/84	8/4/84	8/4/84
COLLECTION TIME		1225	1200	1115	930	1010	1025	1430	1345	1200	0
PENTACHLOROPHENOL (UG/L)	39032 0	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	10	4
ACROLEIN (UG/L)	34210 0	<10	<10	<10	<20	<10	<10	<10	<11	<6	NA
ACRYLONITRILE (UG/L)	34215 0	<10	<10	<10	<20	<10	<10	<10	<11	<6	NA
BENZENE (UG/L)	34030 0	<0.3	0.7	4	<0.6	<0.3	<0.3	<0.3	<0.3	0.4	NA
BROMODICHLOROMETHANE (UG/L)	32101 0	<0.70	<0.70	<0.70	<1.30	<0.70	<0.70	<0.70	<0.70	<0.40	NA
BROMOFORM (UG/L)	32104 0	<1.40	<1.40	<1.40	<2.70	<1.40	<1.40	<1.40	<1.40	<0.80	NA
BROMOMETHANE (UG/L)	34413 0	<1	<1	<1	<2	<1	<1	<1	<1	<0.7	NA
CARBON TETRACHLORIDE (UG/L)	32102 0	<1.4	<1.4	<1.4	<2.6	<1.4	<1.4	<1.4	<1.4	<0.90	NA
CHLOROBENZENE (UG/L)	34301 0	<0.50	<0.50	49	<0.90	<0.50	<0.50	<0.50	<0.50	2.1	NA
CHLOROETHANE (UG/L)	34311 0	<2	<2	<2	<3	<2	<2	<2	<2	<1	NA
2-CHL*ETH*VINYLETHER (UG/L)	34576 0	<2	<2	<2	<3	<2	<2	<2	<1	<0.8	NA
CHLOROFORM (UG/L)	32106 0	<0.70	<0.60	<0.60	1.3	<0.70	<0.60	<0.70	<0.70	5.0	NA
CHLOROMETHANE (UG/L)	34418 0	<1	<1	<1	<2	<1	<1	<1	<1	<0.7	NA
DIBROMOCHLOROMETHANE (UG/L)	34306 0	<1.20	<1.20	<1.20	<2.20	<1.20	<1.20	<1.20	<1.20	<0.70	NA
DICHL*DIFLUO*METHANE (UG/L)	34668 0	<1	<1	<1	<3	<1	<1	<1	<1	<0.8	NA
1,1-DICHLOROETHANE (UG/L)	34496 0	<0.60	<0.60	<0.60	<1.1	<0.60	<0.60	<0.60	<0.60	<0.40	NA
1,2-DICHLOROETHANE (UG/L)	34531 0	<1.0	5.9	1.9	<1.8	<1.0	<0.90	<1.0	<1.0	0.90	NA
1,1-DICHLOROETHYLENE (UG/L)	34501 0	<1.2	1.6	2.7	<2.4	<1.2	<1.2	<1.2	<1.3	<0.80	NA
T-1,2-DICHLOROETHENE (UG/L)	34546 0	<1.2	9700	4000	410	<1.2	<1.2	<1.2	<1.2	410	NA
1,2-DICHLOROPROPANE (UG/L)	34541 0	<0.7	<0.7	<0.7	<1	<0.7	<0.7	<0.7	<0.7	<0.4	NA

Table 2-31. Site 69--Rifle Range Chemical Dump Sampling Data (Continued, Page 3 of 6)

ENVIRONMENTAL SCIENCE & ENGINEERING MULTIPLE FIELD GROUP REPORT REPORT DATE: TUE, DEC 18 1984

CAMP LEJEUNE
STATION 69

		69GW1 374755	69GW2 374756	69GW3 374757	69GW4 374758	69GW5 374759	69GW6 37476	69GW7 374761	69GW8 374762	69SW1 374763	69SW2 378511
COLLECTION DATE		7/18/84	7/18/84	7/18/84	7/18/84	7/18/84	7/18/84	7/18/84	7/18/84	8/4/84	8/4/84
COLLECTION TIME		1225	1200	1115	930	1010	1025	143	1345	12 0	0
CIS-1,3-DICH*PROPENE (UG/L)	34704 0	<0.8	<0.8	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<0.5	NA
T-1,3-DICHL*PROPENE (UG/L)	34699 0	<0.6	<0.6	<0.6	<1	<0.6	<0.6	<0.6	<0.6	<0.4	NA
ETHYLBENZENE (UG/L)	34371 0	<1	<1	<1	<2	<1	<1	<1	<1	3	NA
METHYLENE CHLORIDE (UG/L)	34423 0	10	<1	<1	<2	<1	<1	<1	<1	< .6	NA
1,1,2,2-TE*CH*ETHANE (UG/L)	34516 0	<0.9	44	<0.8	2	<0.9	<0.8	<0.9	<0.9	59	NA
TETRACHLOROETHENE (UG/L)	34475 0	<1.7	20	<1.6	<3.3	<1.7	<1.6	<1.7	<1.7	<1.1	NA
1,1,1-TRICHL*ETHANE (UG/L)	34506 0	<1.2	<1.1	<1.1	<2.3	<1.2	<1.1	<1.2	<1.2	<0.80	NA
1,1,2-TRICHL*ETHANE (UG/L)	34511 0	<1.2	7.9	<1.2	3.1	<1.2	<1.2	<1.2	<1.2	6.0	NA
TRICHLOROETHENE (UG/L)	39180 0	<1.3	340	4.9	<2.5	<1.3	<1.3	<1.3	<1.3	55	NA
TRICHL*FLUOROMETHANE (UG/L)	34488 0	<1	<1	<1	<3	<1	<1	<1	<1	< .8	NA
TOLUENE (UG/L)	34 10 0	0.7	5	14	<1	<0.6	<0.6	<0.6	<0.6	11	NA
VINYL CHLORIDE(UG/L)	39175 0	<0.9	80	2	<2	<1	<0.9	<1	<0.9	15	NA
CHLORINE,T.RES(MG/L)	50060 0	<0.010	<0.010	<0.010	<0.010	<0.010	<0. 10	<0.010	<0.010	<0.010	NA

Table 2-31. Site 69--Rifle Range Chemical Dump Sampling Data (Continued, Page 4 of 6)

ENVIRONMENTAL SCIENCE & ENGINEERING MULTIPLE FIELD GROUP REPORT REPORT DATE: WED, DEC 05 1984

CAMP LEJEUNE
STATION 69

		69SW2 374764
COLLECTION DATE		8/4/84
COLLECTION TIME		1130
ALDRIN (UG/L)	39330 0	<0.0008
BHC,A (UG/L)	39337 0	<0.0010
BHC,B (UG/L)	39338 0	0.005
BHC,D (UG/L)	39259 0	0.020
BHC,G(LINDANE)(UG/L)	39340 0	<0.00010
CHLORDANE (UG/L)	39350 0	<0.010
DDD,PP'(UG/L)	39310 0	<0.003
DDE,PP'(UG/L)	39320 0	<0.0008
DDT,PP'(UG/L)	39300 0	<0.005
DIELDRIN (UG/L)	39380 0	<0.0010
ENDOSULFAN,A (UG/L)	34361 0	<0.0008
ENDOSULFAN,B (UG/L)	34356 0	<0.002
ENDOSULFAN SULFATE (UG/L)	34351 0	<0.005
ENDRIN (UG/L)	39390 0	<0.002
ENDRIN ALDEHYDE (UG/L)	34366 0	<0.004
HEPTACHLOR (UG/L)	39410 0	<0.0007
HEPTACHLOR EPOXIDE (UG/L)	39420 0	<0.0006
TOXAPHENE (UG/L)	39400 0	<0.100
PCBS, WATER(UG/L)	39516 0	<0.010
MERCURY,TOTAL(UG/L)	71900 0	<0.2

Table 2-31. Site 69--Rifle Range Chemical Dump Sampling Data (Continued, Page 5 of 6)

ENVIRONMENTAL SCIENCE & ENGINEERING MULTIPLE FIELD GROUP REPORT REPORT DATE: WED, DEC 05 1984

CAMP LEJEUNE
STATION 69

		69SW2 374764
COLLECTION DATE		8/4/84
COLLECTION TIME		1130
PENTACHLOROPHENOL (UG/L)	39032 0	<0.9
ACROLEIN (UG/L)	34210 0	<7
ACRYLONITRILE (UG/L)	34215 0	<7
BENZENE (UG/L)	34030 0	<0.2
BROMODICHLOROMETHANE (UG/L)	32101 0	<0.50
BROMOFORM (UG/L)	32104 0	<0.90
BROMOMETHANE (UG/L)	34413 0	<0.8
CARBON TETRACHLORIDE (UG/L)	32102 0	<1.0
CHLOROBENZENE (UG/L)	34301 0	<0.30
CHLOROETHANE (UG/L)	34311 0	<1
2-CHL*ETH*VINYLETHER (UG/L)	34576 0	<0.9
CHLOROFORM (UG/L)	32106 0	<0.50
CHLOROMETHANE (UG/L)	34418 0	<0.7
DIBROMOCHLOROMETHANE (UG/L)	34306 0	<0.80
DICHL*DIFLUO*METHANE (UG/L)	34668 0	<0.9
1,1-DICHLOROETHANE (UG/L)	34496 0	<0.40
1,2-DICHLOROETHANE (UG/L)	34531 0	<0.80
1,1-DICHLOROETHYLENE (UG/L)	34501 0	<0.80
T-1,2-DICHLOROETHENE (UG/L)	34546 0	10
1,2-DICHLOROPROPANE (UG/L)	34541 0	<0.5

Table 2-31. Site 69--Rifle Range Chemical Dump Sampling Data (Continued, Page 6 of 6)

ENVIRONMENTAL SCIENCE & ENGINEERING MULTIPLE FIELD GROUP REPORT REPORT DATE: TUE, DEC 18 1984

CAMP LEJEUNE
STATION 69

		69SW2 374764
COLLECTION DATE		8/4/84
COLLECTION TIME		1130
CIS-1,3-DICH*PROPENE (UG/L)	34704 0	<0.6
T-1,3-DICHL*PROPENE (UG/L)	34699 0	<0.4
ETHYLBENZENE (UG/L)	34371 0	<0.6
METHYLENE CHLORIDE (UG/L)	34423 0	8
1,1,2,2-TE*CH*ETHANE (UG/L)	34516 0	<0.5
TETRACHLOROETHENE (UG/L)	34475 0	<1.0
1,1,1-TRICHL*ETHANE (UG/L)	34506 0	<0.80
1,1,2-TRICHL*ETHANE (UG/L)	34511 0	<0.80
TRICHLOROETHENE (UG/L)	39180 0	1.3
TRICHL*FLUOROMETHANE (UG/L)	34488 0	<0.9
TOLUENE (UG/L)	34010 0	<0.4
VINYL CHLORIDE(UG/L)	39175 0	<0.6
CHLORINE,T.RES(MG/L)	50060 0	<0.010

Source: ESE, 1984.

Table 2-32. Site 69--Rifle Range Chemical Dump Data Evaluation

Analytes Detected	Regulatory Limits	Value (ug/L)	Samples Exceeding Limits
BHC,B	10^{-5} Human Health Risk Level	163 ng/L	None
BHC,D	NCA*	NL†	NL
Hg	Ambient Water	144 ng/L	69GW1
11DCE	10^{-5} Human Health Risk Level	0.33	69GW2, 69GW3
Chlorobenzene	Organoleptic	20	69GW3
12DCLEE	NCA	NL	NL
T12DCE	NCA	NL	NL
Methylene Chloride	10^{-5} Human Health Risk Level	1.9	69GW1
TCLEE	10^{-5} Human Health Risk Level	8	69GW2
112TCE	10^{-5} Human Health Risk Level	6	69GW2, 69SW1
TCLEA	10^{-5} Human Health Risk Level	1.7	69GW2, 69GW4, 69SW1
Vinyl Chloride	10^{-5} Human Health Risk Level	20	69GW2
Benzene	10^{-5} Human Health Risk Level	6.6	None
Chloroform	10^{-5} Human Health Risk Level	1.9	69SW1
TCE	10^{-5} Human Health Risk Level	27	69GW2, 69SW1
Toluene	Ambient Water	14.3 mg/L	None
Pentachlorophenol	Organoleptic	30	None

*NCA = No criterion available.
†NL = No numerial limit.

Source: ESE, 1984.

Surface Water:

Surface water chemical data for Station 69SW1 indicated the presence of ten volatile organic compounds; T12DCE, TCLEA, and vinyl chloride were present in the highest concentration (see Tables 2-31 and 2-32). In addition, BHC,B, BHC,D, and pentachorophenol were detected. Detection indicated the disposal of these compounds at this site. BHC,B and BHC,D were also detected at Station 69SW2, although low levels of only three volatile organic compounds were detected. It appears that the BHC isomers may be located at or near the land surface and therefore, may move more readily via surface water flow. Although the detected levels of the BHC isomers do not exceed the 10^{-5} risk level, they exceed the 10^{-7} risk level.

The occurrence of volatile organics in the surface water roughly corresponds to their occurrence in the ground water. The BHC isomers were detected in the surface water, but were not detected in the underlying ground water.

Station 69SW3 was dry at the time of sampling.

Migration Potential

The ground and surface water contaminated by the waste materials at Site 69 appear to be located along the south and southeast areas of the site. Ground water flow in this area is from the elevated disposal area toward the east, southeast, and south. The detected contaminants will travel with the ground water flow, and have been carried offsite to the east, southeast, and south. The extent of this offsite migration cannot be determined at this time.

In addition to ground water migration pathways, contaminant migration may also occur via surface water means; standing water was found to contain detectable levels of mixed contaminants. High surface water flows during rainfall events would allow rapid, although episodic migration of contaminants east-southeast toward the New River drainage network.

Recommendations

All eight monitor wells and the three surface water sampling stations should be resampled during the second sampling effort. The analytes of concern should be those investigated during the initial sampling effort.

Unless they can explain away the grnd water elev., I cannot clearly say which way the GW flows and certainly not + to the south/southeast! May have to add additional wells/monitoring points to accurately determine which way it goes!

+ Add two more SW/SD as shown

SITE 73--COURTHOUSE BAY LIQUIDS DISPOSAL AREA

Site Investigation

o Four shallow ground water monitoring wells:

Well 73GW1--Upgradient (north) between disposal area and deep water supply well No. A-5 (Well 73GW5).

Well 73GW2--Downgradient (south) between disposal area and Courthouse Bay.

Wells 73GW3 and 73GW4--Downgradient (east) between disposal area and Courthouse Bay.

o One deep water supply well No. A-5 (Well 73GW5).

Data Evaluation

As shown in Table 2-33, all downgradient monitor wells contained a similar mix of metals and volatile organic compounds which were attributed to the reported use/disposal of parent substances at this site. Cr and Pb were the metals present; Pb exceeded the criterion (see Table 2-34) in all monitor wells. Benzene and vinyl chloride exceeded the 10^{-5} risk level at Well 73GW4. T12DCE appeared to be the primary waste solvent present and was found in Wells 73GW4 and 75GW3. O&G was detected only in Wells 73GW1 and 73GW2 which are farthest from the obvious source areas. Supply well No. A-5 (73GW5) was found to contain three volatile organic compounds which were not found elsewhere at Site 74. Individual levels of DBCM, BDCM, and chloroform exceeded the 10^{-5} risk level for halomethanes. However, the National Interim Primary Drinking Water Standard for total trihalomethanes is 100 ug/L, and the sum of the concentrations of DBCM, BDCM, and chloroform (68 ug/L) does not exceed this standard.

Migration Potential

Contaminated ground water in the area surrounded by Wells 73GW1 through 73GW4 discharges directly into Courthouse Bay. As noted above, ground water at these wells exceeded criteria for several analytes; therefore,

Table 2-33. Site 73--Courthouse Bay Liquids Disposal Area Sampling Data

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400
FIELD GROUP: CLJW1
PARAMETERS: LJ1 SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

PARAMETERS	STORET # METHOD #	SAMPLE NUMBERS 73GW1 374766	73GW2 374767	73GW3 374768	73GW4 374769	73GW5 374770
DATE		7/6/84	7/6/84	7/6/84	7/6/84	7/6/84
TIME		1035	1100	1145	1200	1240
ACROLEIN (UG/L)	34210 0	<11	<12	<11	<14	<12
ACRYLONITRILE (UG/L)	34215 0	<11	<12	<11	<14	<12
BENZENE (UG/L)	34030 0	<0.4	<0.4	0.9	17	<0.4
BROMODICHLOROMETHANE (UG/L)	32101 0	<0.80	<0.90	<0.80	<0.90	20.0
BROMOFORM (UG/L)	32104 0	<1.60	<1.70	<1.60	<1.90	<1.70
BROMOMETHANE (UG/L)	34413 0	<1	<1	<1	<2	<1
CARBON TETRACHLORIDE (UG/L)	32102 0	<1.6	<1.7	<1.6	<1.9	<1.7
CHLOROBENZENE (UG/L)	34301 0	<0.50	<0.60	<0.50	<0.70	<0.60
CHLOROETHANE (UG/L)	34311 0	<2	<2	<2	<2	<2
2-CHLOROETHYLVINYLETHER (UG/L)	34576 0	<2	<2	<2	<2	<2
CHLOROFORM (UG/L)	32106 0	<0.70	<0.80	<0.70	<0.90	38
CHLOROMETHANE (UG/L)	34418 0	<1	<1	<1	<2	<1
DIBROMOCHLOROMETHANE (UG/L)	34306 0	<1.30	<1.40	<1.30	<1.60	10.0
DICHLORODIFLUOROMETHANE (UG/L)	34668 0	<1	<2	<1	<2	<2
1,1-DICHLOROETHANE (UG/L)	34496 0	<0.60	<0.70	<0.60	<0.70	<0.70
1,2-DICHLOROETHANE (UG/L)	34531 0	<1.0	<1.1	<1.0	<1.2	<1.1
1,1-DICHLOROETHYLENE (UG/L)	34501 0	<1.4	<1.5	<1.4	2.3	<1.5
T-1,2-DICHLOROETHENE (UG/L)	34546 0	<1.3	<1.4	1.3	360	<1.4
1,2-DICHLOROPROPANE (UG/L)	34541 0	<0.8	<0.8	<0.8	<0.9	<0.8
CIS-1,3-DICHLOROPROPENE (UG/L)	34704 0	<0.9	<0.9	<0.8	<1	<0.9

Table 2-33. Site 73--Courthouse Bay Liquids Disposal Area Sampling Data (Continued, Page 2 of 2)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400 PROJECT NAME CAMP LEJEUNE
FIELD GROUP: CLJW1 PROJECT MANAGER: BOWEN/GEISZLER
PARAMETERS: LJ1 SAMPLES: PART FIELD GROUP LEADER: BOB GREGORY

PARAMETERS	STORET # METHOD #	SAMPLE NUMBERS 73GW1 374766	73GW2 374767	73GW3 374768	73GW4 374769	73GW5 374770
DATE		7/6/84	7/5/84	7/6/84	7/6/84	7/6/84
TIME		1035	1100	1145	1200	1240
T-1,3-DICHLOROPROPENE (UG/L)	34699 0	<0.7	<0.7	<0.6	<0.8	<0.7
ETHYLBENZENE (UG/L)	34371 0	<1	<1	<1	<2	<1
METHYLENE CHLORIDE (UG/L)	34423 0	<1	<1	<1	<1	<1
1,1,2,2-TETRACHLOROETHANE (UG/L)	34516 0	<0.9	<1	<0.9	<1	<1
TETRACHLOROETHENE (UG/L)	34475 0	<2.0	<2.2	<2.0	<2.5	<2.2
1,1,1-TRICHLOROETHANE (UG/L)	34506 0	<1.4	<1.5	<1.3	<1.6	<1.4
1,1,2-TRICHLOROETHANE (UG/L)	34511 0	<1.2	<1.3	<1.2	<1.5	<1.3
TRICHLOROETHENE (UG/L)	39180 0	<1.5	<1.6	<1.5	<1.8	<1.6
TRICHLOROFLUOROMETHANE (UG/L)	34488 0	<1	<2	<1	<2	<2
TOLUENE (UG/L)	34010 0	0.7	<0.7	<0.6	4	<0.7
VINYL CHLORIDE(UG/L)	39175 0	<1	<1	<1	74	<1
CADMIUM,TOTAL(UG/L)	1027 0	<6.0	<6.0	<6.0	<6.0	<6.0
CHROMIUM,TOTAL(UG/L)	1034 0	95	46	62	43	<6.0
LEAD,TOTAL(UG/L)	1051 0	109.0	63.0	89.0	57.0	<40.0
ANTIMONY,TOTAL(UG/L)	1097 0	<54	<54	<54	<54	<54
OIL&GR,IR(MG/L)	560 0	2	2	<0.7	<0.7	<0.7
PHENOLS (UG/L)	32730 0	10	5	10	15	<1

Source: ESE, 1984.

Table 2-34. Site 73--Courthouse Bay Liquids Disposal Area Data Evaluation

Analyte Detected	Regulatory Limits	Value (ug/L)	Samples Exceeding Limits
O&G	Organoleptic	NL*	None
Phenols	Organoleptic	300	None
CrIII	Ambient Water	170 mg/L	None
CrVI	Drinking Water/Ambient Water	50	73GW1,73GW3
Pb	Drinking Water/Ambient Water	50	73GW1, 73GW2, 73GW3, 73GW4
DBCM	10^{-5} Human Health Risk Level†	1.9	73GW5
11DCE	10^{-5} Human Health Risk Level	0.33	73GW4
BDCM	10^{-5} Human Health Risk Level†	1.9	73GW5
T12DCE	NCA**	NL	NL
Vinyl chloride	10^{-5} Human Health Risk Level	20	73GW4
Benzene	10^{-5} Human Health Risk Level	6.6	73GW4
Chloroform	10^{-5} Human Health Risk Level†	1.9	73GW5
Toluene	10^{-5} Human Health Risk Level	14.3 mg/L	None

*NL = No numerical limit.
†For halomethanes.
**NCA = No criteria available.

Source: ESE, 1984.

it can be assumed that the discharge into Courthouse Bay also exceeded criteria. Once in Courthouse Bay, the contaminants can migrate quickly; however, they may disperse quickly to levels below criteria.

DBCM, BDCM, and chloroform contamination at well No. A-5 (73GW5) may be attributed to the use of chlorine to disinfect the ground water prior to use as the drinking water supply. No migration of these compounds is expected because formation of these compounds occurs after the ground water has been withdrawn from the aquifer.

Recommendations

All four monitor wells and the single deep supply well should be resampled during the second sampling effort. The analytes of concern should be those investigated during the initial verification step sampling effort. OK

- Install new upgradient well to bypass contamination?
- + sample surface water & sediment in three locations in Courthouse Bay (see attached)

SITE 74--MESS HALL GREASE ~~DISPOSAL~~ PIT AREA

Site Investigation

o Two shallow ground water monitoring wells:

Well 74GW1--Within disposal area.

Well 74GW2--Between disposal area and deep water supply well No. 654 (Well 74GW3).

o Deep supply well no. 654 (Well 74GW3)

o Two shallow soil borings in pest control area. Composite sample from 0- to 1-foot depth, 1- to 2-foot depth, and 2- to 3-foot depth at each boring.

Soil boring 74S1

0- to 1-foot depth (Sample 74S1A)

1- to 2-foot depth (Sample 74S1B)

2- to 3-foot depth (Sample 74S1C)

Soil boring 74S2

0- to 1-foot depth (Sample 74S2A)

1- to 2-foot depth (Sample 74S2B)

2- to 3-foot depth (Sample 74S2C)

Data Evaluation

Ground Water:

Pesticides and PCB compounds were not detected in the ground water at Site 74 (see Table 2-35). Burial of these compounds may not have occurred in the area originally described, or the environment of deposition does not favor migration of these compounds into the shallow ground water.

Soils:

As shown in Table 2-35, one or all of the following components; DDD, DDE, and DDT; were detected in each soil sample obtained from the pest

Table 2-35. Site 74--Mess Hall Grease Disposal Area Sampling Data

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84

STATUS: PRELIMINARY

PROJECT NUMBER R4222400
FIELD GROUP: CLJW1
PARAMETERS: LJ4 SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/REISZLER
FIELD GROUP LEADER: BOB GREGORY

SAMPLE NUMBERS

654

PARAMETERS	STORET # METHOD #	74GW1 374771	74GW2 374772	74GW3 374773
DATE		7/4/84	7/4/84	7/4/84
TIME		1040	1140	1200
ALDRIN (UG/L)	39330 0	<0.0008	<0.0008	<0
BHC,A (UG/L)	39337 0	<0.0010	<0.0010	<0.0010
BHC,B (UG/L)	39338 0	<0.00010	<0.00010	<0.00010
BHC,D (UG/L)	39259 0	<0.0003	<0.0003	<0.0003
BHC,G(LINDANE)(UG/L)	39340 0	<0.00010	<0.00010	<0.00010
CHLORDANE (UG/L)	39350 0	<0.010	<0.010	<0.010
DDD,PP'(UG/L)	39310 0	<0.003	<0.003	<0.003
DDE,PP'(UG/L)	39320 0	<0.0008	0.0010	<0.0008
DDT,PP'(UG/L)	39300 0	<0.005	0.007	<0.005
DIELDRIN (UG/L)	39380 0	<0.0010	<0.0010	<0.0010
ENDOSULFAN,A (UG/L)	34361 0	<0.0008	<0.0008	<0.0008
ENDOSULFAN,B (UG/L)	34356 0	<0.002	<0.002	<0.002
ENDOSULFAN SULFATE (UG/L)	34351 0	<0.005	<0.005	<0.005
ENDRIN (UG/L)	39390 0	<0.002	<0.002	<0.002
ENDRIN ALDEHYDE (UG/L)	34366 0	<0.004	<0.004	<0.004
HEPTACHLOR (UG/L)	39410 0	<0.0007	<0.0007	<0.0007
HEPTACHLOR EPOXIDE (UG/L)	39420 0	<0.0006	<0.0006	<0.0006
TOXAPHENE (UG/L)	39400 0	<0.100	<0.100	<0.100
2,4-D, TOTAL (UG/L)	39730 0	<0.080	<0.080	<0.080
2,4,5-T (UG/L)	39740 0	<0.04	<0.04	<0.04

Table 2-35. Site 74--Mess Hall Grease Disposal Area Sampling Data (Continued, Page 2 of 4)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400
FIELD GROUP: CLJW1
PARAMETERS: LJ4 SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

SAMPLE NUMBERS

PARAMETERS	STORET # / METHOD #	746W1 374771	746W2 374772	746W3 374773
DATE		7/4/84	7/4/84	7/4/84
TIME		1040	1140	1200
2,4,5-TP/SILVEX (UG/L)	39760 0	<0.02	<0.02	<0.02
PCBS, WATER(UG/L)	39516 0	<0.010	<0.010	<0.010

Table 2-35. Site 74--Mess Hall Grease Disposal Area Sampling Data (Continued, Page 3 of 4)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400 PROJECT NAME CAMP LEJEUNE
FIELD GROUP: CLJS1 PROJECT MANAGER: BOWEN/GEISZLER
PARAMETERS: LS31 SAMPLES: PART FIELD GROUP LEADER: BOB GREGORY

PARAMETERS	STORET # METHOD #	SAMPLE NUMBERS 74S1A 374658	74S1B 374659	74S1C 374660	74S2A 374661	74S2B 374662	74S2C 374663
DATE		8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84
TIME		1730	1730	1730	1730	1730	1730
ALDRIN,SED(UG/KG-DRY)	39333 0	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
BHC,A,SED(UG/KG-DRY)	39076 0	<0.05	<0.06	<0.06	<0.05	<0.06	<0.06
BHC,B,SED(UG/KG-DRY)	34257 0	<0.04	<0.05	<0.05	<0.04	<0.04	<0.05
BHC,G(LINDANE),SED UG/KG-DRY	39343 0	<0.04	<0.05	<0.05	<0.04	<0.04	<0.05
BHC,D,SED(UG/KG-DRY)	34262 0	<0.10	<0.1	<0.1	<0.10	<0.1	<0.1
CHLORDANE,SED(UG/KG-DRY)	39351 0	<1.9	<1.9	<1.9	<1.8	<1.9	<2.0
DDD,PP',SED(UG/KG-DRY)	39311 0	8.4	<0.6	0.6	2.9	0.6	0.6
DDE,PP',SED (UG/KG-DRY)	39321 0	44	6.0	7.2	5.1	1.0	0.4
DDT,PP',SED(UG/KG-DRY)	39301 0	260	8.6	11	<1.2	<1.2	<1.3
DIELDRIN,SED(UG/KG-DRY)	39303 0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
ENDOSULFAN,A,SED(UG/KG-DRY)	34364 0	<0.05	<0.06	<0.06	<0.05	<0.06	<0.06
ENDOSULFAN,B,SED(UG/KG-DRY)	34359 0	<0.5	<0.6	<0.6	<0.5	<0.6	<0.6
ENDOSULFAN SULF,SED, UG/KG-DRY	34354 0	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
ENDRIN,SED(UG/KG-DRY)	39393 0	<0.4	<0.5	<0.5	<0.4	<0.4	<0.5
ENDRIN ALD.,SED(UG/KG-DRY)	34369 0	<0.5	<0.6	<0.6	<0.5	<0.6	<0.6
HEPTACHLOR,SED(UG/KG-DRY)	39413 0	<0.07	<0.07	<0.07	<0.06	<0.07	<0.07
HEPTACHLOR EPOX,SED UG/KG-DRY	39423 0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TOXAPHENE,SED(UG/KG-DRY)	39403 0	<19	<19	<19	<18	<19	<20
PCBS,SED(UG/KG-DRY)	39519 0	<1.9	<1.9	<1.9	<1.8	<1.9	<2.0
2,4-D,SED(UG/KG-DRY)	39731 0	<3.3	<3.4	<3.4	<3.2	<3.3	<3.5

Table 2-35. Site 74--Mess Hall Grease Disposal Area Sampling Data (Continued, Page 4 of 4)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 8422240G
FIELD GROUP: CLJS1
PARAMETERS: LS31 SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

		SAMPLE NUMBERS					
PARAMETERS	STORET # METHOD #	74S1A 374658	74S1B 374659	74S1C 374660	74S2A 374661	74S2B 374662	74S2C 374663
DATE		8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84
TIME		1730	1730	1730	1730	1730	1730
2,4,5-T,SED(UG/KG-DRY)	39741 0	<1.1	<1.1	<1.1	<1.1	<1.1	<1.2
SILVEX,SED(UG/KG-D)	39761 0	<0.5	<0.6	<0.6	<0.5	<0.6	<0.6
MOISTURE(%WET WT)	70320 0	8.2	11.8	11.3	7.4	10.3	14.8

Source: ESE, 1984.

control area north of Pump House 654 (Well 74GW3), verifying the disposal of pesticides in that area. As noted above, the presence of pesticides in the soil has not resulted in similar levels of pesticides in the shallow ground water, although no ground water samples were obtained in the immediate area of the soil samples.

Migration Potential

The differences between the ground water chemistry data and the soil chemistry data suggest that migration of the detected soil analytes has not occurred. However, the shallow ground water in the pest control area has not been sampled.

No contamination was detected in the grease pit area; this suggests that if wastes were buried in this area as reported, migration of these wastes has not occurred to any significant degree.

The zero relief topography at the site indicated that ground water gradients are very low, further suggesting that migration potential is low.

Recommendations

The two shallow monitor wells and the deep water supply well should be resampled during the second round of sampling. The analytical procedures should be identical to those utilized during the initial sampling effort.

No further soil investigation is recommended as part of the verification step.

- Add new well sample twice, (see attached)

SITES 75 AND 76--MCAS BASKETBALL COURT AND CURTIS ROAD SITES

Site Investigation

o Five shallow ground water monitoring wells:

Well 75GW1--In suspected drum burial area.

Well 75GW2--Between burial area and deep supply well No. 106 (Well 75GW4).

Well 75GW3--Between burial area and deep supply well No. S-TC-1251 (Well 75GW5).

Well 76GW1--In suspected drum burial area.

Well 76GW2--In suspected drum burial area.

o Three deep water supply wells, Nos. 106 (Well 75GW4), S-TC-1251 (Well 75GW5), and 203 (Well 76GW3).

Data Evaluation

A total of eight wells (five monitor wells and three supply wells) were sampled in this area. The analytes of concern, volatile organic compounds, were not detected in any of the wells (see Tables 2-36 and 2-37). The ground water samples were not analyzed for chloropicrin as planned because the analytical method proposed [purge and trap volatile organic analysis by gas chromatograph/mass spectrometer (EPA Method 624)] did not prove to be successful. Although records indicate that drums of waste fluids were buried at these sites, there is no chemical data to support the burial. Additionally, a geophysical survey was conducted prior to installation of the monitor wells, and no targets were identified. If drums do exist in the subsurface, they do not represent a human health hazard at this time.

Recommendations

All eight wells should be resampled during the second sampling effort. All analytes investigated during the initial sampling effort should be included in the second effort.

Table 2-36. Site 75--MCAS Basketball Court Site Sampling Data

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400 PROJECT NAME CAMP LEJEUNE
FIELD GROUP: CLJW1 PROJECT MANAGER: BOWEN/GEISZLER
PARAMETERS: LJ7 SAMPLES: PART FIELD GROUP LEADER: BOB GREGORY

PARAMETERS	STORET # METHOD #	SAMPLE NUMBERS 75GW1 374774	75GW2 374775	75GW3 374776	75GW4 374777	75GW5 374778	75GW6 374779
DATE		7/16/84	7/16/84	7/16/84	7/16/84	7/15/84	7/16/84
TIME		1000	1029	1045	935	1100	1439
ACROLEIN (UG/L)	34210 0	<11	<11	<11	<11	<11	<11
ACRYLONITRILE (UG/L)	34215 0	<11	<11	<11	<11	<11	<11
BENZENE (UG/L)	34030 0	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
BROMODICHLOROMETHANE (UG/L)	32101 0	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70
BROMOFORM (UG/L)	32104 0	<1.40	<1.40	<1.40	<1.40	<1.50	<1.40
BROMOMETHANE (UG/L)	34413 0	<1	<1	<1	<1	<1	<1
CARBON TETRACHLORIDE (UG/L)	32102 0	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4
CHLOROBENZENE (UG/L)	34301 0	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
CHLOROETHANE (UG/L)	34311 0	<2	<2	<2	<2	<2	<2
2-CHLOROETHYLVINYLETHER (UG/L)	34576 0	<1	<1	<1	<1	<2	<1
CHLOROFORM (UG/L)	32106 0	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70
CHLOROMETHANE (UG/L)	34418 0	<1	<1	<1	<1	<1	<1
DIBROMOCHLOROMETHANE (UG/L)	34306 0	<1.20	<1.20	<1.20	<1.20	<1.20	<1.20
DICHLORODIFLUOROMETHANE (UG/L)	34668 0	<1	<1	<1	<1	<1	<1
1,1-DICHLOROETHANE (UG/L)	34496 0	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60
1,2-DICHLOROETHANE (UG/L)	34531 0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-DICHLOROETHYLENE (UG/L)	34501 0	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3
T-1,2-DICHLOROETHENE (UG/L)	34546 0	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
1,2-DICHLOROPROPANE (UG/L)	34541 0	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
CIS-1,3-DICHLOROPROPENE (UG/L)	34704 0	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8

Table 2-36. Site 75--MCAS Basketball Court Site Sampling Data (Continued, Page 2 of 2)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400 PROJECT NAME CAMP LEJEUNE
FIELD GROUP: CLJW1 PROJECT MANAGER: BOWEN/GEISZLER
PARAMETERS: LJ7 SAMPLES: PART FIELD GROUP LEADER: BOB GREGORY

PARAMETERS	STORET # METHOD #	SAMPLE NUMBERS 75GW1 374774	75GW2 374775	75GW3 374776	75GW4 374777	75GW5 374778	75GW6 374779
DATE		7/16/84	7/16/84	7/16/84	7/16/84	7/16/84	7/16/84
TIME		1000	1029	1045	935	1100	1439
T-1,2-DICHLOROPROPENE (UG/L)	34699 0	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
ETHYLBENZENE (UG/L)	34371 0	<1	<1	<1	<1	<1	<1
METHYLENE CHLORIDE (UG/L)	34423 0	<1	2	<1	<1	<1	<1
1,1,2,2-TETRACHLOROETHANE (UG/L)	34516 0	<0.9	<0.9	<0.9	<0.9	<0.9	<0.8
TETRACHLOROETHENE (UG/L)	34475 0	<1.8	<1.8	<1.8	<1.8	<1.8	<1.7
1,1,1-TRICHLOROETHANE (UG/L)	34506 0	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
1,1,2-TRICHLOROETHANE (UG/L)	34511 0	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
TRICHLOROETHENE (UG/L)	39180 0	<1.3	<1.4	<1.4	<1.4	<1.4	<1.3
TRICHLOROFLUOROMETHANE (UG/L)	34488 0	<1	<1	<1	<1	<1	<1
TOLUENE (UG/L)	34010 0	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
VINYL CHLORIDE(UG/L)	39175 0	<0.9	<1	<0.9	<1	<1	<0.9

Source: ESE, 1984.

Table 2-37. Site 76--Curtis Road Site Sampling Data

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 84222400
FIELD GROUP: CLJW1
PARAMETERS: LJ7 SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

SAMPLE NUMBERS

PARAMETERS	STORET # METHOD #	76GW1 374780	76GW2 374781
DATE		7/16/84	7/16/84
TIME		1118	1223
ACROLEIN (UG/L)	34210 0	<11	<11
ACRYLONITRILE (UG/L)	34215 0	<11	<11
BENZENE (UG/L)	34030 0	<0.3	<0.3
BROMODICHLOROMETHANE (UG/L)	32101 0	<0.70	<0.70
BROMOFORM (UG/L)	32104 0	<1.40	<1.40
BROMOMETHANE (UG/L)	34413 0	<1	<1
CARBON TETRACHLORIDE (UG/L)	32102 0	<1.4	<1.4
CHLOROBENZENE (UG/L)	34301 0	<0.50	<0.50
CHLOROETHANE (UG/L)	34311 0	<2	<2
2-CHLOROETHYLVINYLETHER (UG/L)	34576 0	<1	<1
CHLOROFORM (UG/L)	32106 0	<0.70	<0.70
CHLOROMETHANE (UG/L)	34418 0	<1	<1
DIBROMOCHLOROMETHANE (UG/L)	34306 0	<1.20	<1.20
DICHLORODIFLUOROMETHANE (UG/L)	34668 0	<1	<1
1,1-DICHLOROETHANE (UG/L)	34496 0	<0.60	<0.60
1,2-DICHLOROETHANE (UG/L)	34531 0	<1.0	<1.0
1,1-DICHLOROETHYLENE (UG/L)	34501 0	<1.3	<1.3
T-1,2-DICHLOROETHENE (UG/L)	34546 0	<1.2	<1.2
1,2-DICHLOROPROPANE (UG/L)	34541 0	<0.7	<0.7
CIS-1,3-DICHLOROPROPENE (UG/L)	34704 0	<0.8	<0.8

Table 2-37. Site 76--Curtis Road Site Sampling Data (Continued, Page 2 of 2)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84 STATUS: PRELIMINARY

PROJECT NUMBER 8422240u
FIELD GROUP: CLJW1
PARAMETERS: LJ7 SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

SAMPLE NUMBERS

PARAMETERS	STORET # / METHOD #	76GW1 374780	76GW2 374781
DATE		7/16/84	7/16/84
TIME		1118	1223
T-1,3-DICHLOROPROPENE (UG/L)	34699 0	<0.6	<0.6
ETHYLBENZENE (UG/L)	34371 0	<1	<1
METHYLENE CHLORIDE (UG/L)	34423 0	<1	<1
1,1,2,2-TETRACHLOROETHANE (UG/L)	34516 0	<0.9	<0.9
TETRACHLOROETHENE (UG/L)	34475 0	<1.7	<1.7
1,1,1-TRICHLOROETHANE (UG/L)	34506 0	<1.2	<1.2
1,1,2-TRICHLOROETHANE (UG/L)	34511 0	<1.2	<1.2
TRICHLOROETHENE (UG/L)	39180 0	<1.3	<1.3
TRICHLOROFLUOROMETHANE (UG/L)	34488 0	<1	<1
TOLUENE (UG/L)	34010 0	<0.6	<0.6
VINYL CHLORIDE(UG/L)	39175 0	<0.9	<0.9

Source: ESE, 1984.

send scope of Rd 2 to MCB Bobs; NREA for review!

3.0 SUMMARY OF RECOMMENDATIONS

A summary of the recommended sampling and analysis efforts described in Section 2.0 is presented in Table 3-1. Information in this table is presented on a site-by-site basis relative to the number of ground water monitoring wells to be installed, the total number of wells to be sampled, the number of surface water and sediment samples to be collected, and the analytical constituents for each sample type. All of the recommended sampling and analysis shown in this table are for the Verification Step of the Confirmation Study, with the exception of that for Site 22, the Industrial Area Tank Farm. As discussed in Section 2.0, no additional verification monitoring is recommended for this site; rather, more intensive monitoring under the Characterization Step of the Confirmation Study is recommended.

Table 3-1. Summary of Recommendations

Site No.	Wells To Be Installed	Total Wells To Be Sampled	Surface Water Samples	Sediment Samples	Analytical Constituents* (1)
1	~~0~~ 1	~~7~~ 8	~~0~~ 2	~~0~~ 2	Cd, Cr, Pb, Sb, O&G, VOA, T. Phenols
2	~~0~~ 2	~~5~~ 7	0 2SD 4-5	0	OCP, OCH VOA
~~6~~	8	11	4	4	DDT(R) VOA
9	~~0~~ 1	~~3~~ 4	~~0~~ 2 (2)	~~0~~ 2 (2)	Cd, Cr, Pb, O&G, VOA, T. Phenols
21	0	1	0	0	OCP, OCH, PCB, VOA, Pb O&G,
22	~~7~~ 10	~~13~~ 19	~~0~~ 1 (3)	0	Pb, O&G, VOA
24	~~0~~ 2/3	~~5~~ 7/8	~~2~~ 4	2	Metals A, VOA
				2S	Metals A
28	~~0~~ 1	~~3~~ 4	~~2~~ 6	4	Metals B, OCP, PCB, O&G, VOA
				2S	Metals B, OCP, PCB, O&G
30	~~0~~ 1	~~1~~ 2 (4)	~~0~~ 1	~~0~~ 1	Pb, O&G, VOA
~~35~~	3	5	2	2	Pb, O&G VOA
36	0	4	0	0	Cd, Cr, Pb, O&G, VOA, T. Phenols
41	~~0~~ 1	~~4~~ 5	~~0~~ 4	~~0~~ 4	Cd, Cr, Pb, VOA, OCP, O&G, T. Phenols, Mirex, Ordnance Compounds
45	~~0~~ 1	~~5~~ 6	2 ~~0~~	~~0~~ 4-5 2-30	Pb, O&G, VOA, ~~Visual Only~~

610 619

(1) Add o,m,p -xylene, MEK, MIBK and EDB to all VOA scan samples.

(2) Sample points the same as for site 6 3-2

(3) Bldg 20

(4) Both 610 & 619

Table 3-1. Summary of Recommendations (Continued, Page 2 of 3)

Site No.	Wells To Be Installed	Total Wells To Be Sampled	Surface Water Samples	Sediment Samples	Analytical Constituents*
54	~~0~~ 2	~~2~~ 4	~~0~~ 3	~~0~~ 3	Cd, Cr, Pb, O&G, VOA, T. Phenols
68	0	5	~~0~~	0	VOA
69	0	8	~~3~~ 5	~~0~~ 2	OCP, PCB, PCP, VOA, Hg, Residual Chlorine
73	~~0~~ 2 (6)	~~5~~ 6	~~0~~ 3	~~0~~ 3	Cd, Cr, Pb, Sb, O&G, VOA, T. Phenols
74	~~0~~ 1	~~3~~ 4	0	0	OCP, OCH, PCB, VOA
75	0	6	0	0	VOA
76	0	2	0	0	VOA

-- = Not applicable.

* Key to Constituent Abbreviations:

Cd = Cadmium.
Cr = Chromium.
Pb = Lead.
Sb = Antimony.
O&G = Oil and grease.
VOA = Volatile organic analysis.
T. Phenols = Total phenols.
OCP = Organochlorine pesticides.
OCH = Organochlorine herbicides.
DDT-R = o,p- and p,p'-isomers of DDD, DDE, and DDT.
PCB = Polychlorinated biphenyls.
Metals A = Arsenic, cadmium, chromium, copper, lead, nickel, selenium ,
Metals B = Arsenic, cadmium, chromium, lead, mercury, nickel, and zin c
Visual Only = Samples taken and inspected in the field for petroleum, lubricant (POL) contamination.
Ordnance Compounds = TNT, DNT, RDX, and white phosphorus (WP).
PCP = Pentachlorophenol.
Hg = Mercury.

(6) Install new up gradient and relocate 73GW04

Table 3-1. Summary of Recommendations (Continued, Page 3 of 3)

Organochlorine Pesticides (OCP)	Volatile Organic Analysis (VOA)
Aldrin	Acrolein
a-BHC	Acrylonitrile
b-BHC	Benzene
d-BHC	Bromomethane
g-BHC	Bromodichloromethane
Chlordane	Bromoform
4,4'-DDD	Carbon Tetrachloride
4,4'-DDE	Chlorobenzene
4,4'-DDT	Chloroethane
Dieldrin	Chloroform
Endosulfan I	Chloromethane
Endosulfan II	Dibromochloromethane
Endosulfan Sulfate	Dichlorodifluoromethane
Endrin	1,1-Dichloroethane
Endrin Aldehyde	1,2-Dichloroethane
Heptachlor	1,1-Dichloroethylene
Heptachlor Epoxide	T-1,2-Dichloroethene
Toxaphene	1,2-Dichloropropane
	Cis-1,3-dichloropropene
Organochlorine Herbicides (OCH)	T-1,3-dichloropropene
	Ethylbenzene
2,4-D	Methylene Chloride
2,4,5-T	1,1,2,2-Tetrachloroethane
Silvex	Tetrachloroethene
	1,1,1-Trichloroethane
DDT-R	1,1,2-Trichloroethane
	Trichloroethene
o,p-DDD	Trichlorofluoromethane
o,p-DDE	Toluene
o,p-DDT	Vinyl Chloride
p,p'-DDD	2-Chloroethylvinylether
p,p'-DDE	
p,p'-DDT	

Source: ESE, 1984.

APPENDIX A

LIST OF ABBREVIATIONS

ACRONYMS AND ABBREVIATIONS

As	Arsenic
BDCM	Bromodichloromethane
BHC,A	alpha-hexachlorocyclohexane
BHC,B	beta-hexachlorocyclohexane
BHC,D	delta-hexachlorocyclohexane
CCL3F	Trichlorofluoromethane (Freon 11)
Cd	Cadmium
~~Cr~~	~~Chromium~~
Cr III	Chromium, trivalent
Cr VI	Chromium, hexavalent
Cr	Chromium, total
Cu	Copper
DBCM	Dibromochloromethane
DCE	Dichloroethene
DCFM	Dichlorodifluoromethane (Freon 12)
DDD	1,1-dichloro-2,2-bis(p-chlorophenyl)ethane
DDE	1,1-dichloro-2,2-bis(p-chlorophenyl)ethene
DDT	1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane
DDT-R	o,p- and p,p'-isomers of DDD, DDE, and DDT
EPA	U.S. Environmental Protection Agency
ESE	Environmental Science and Engineering, Inc.
Hg	Mercury
IAS	Initial Assessment Study
Mc	Methylene chloride
MCAS (H)	Marine Corps Air Station, New River
MCB Camp Lejeune	Marine Corps Base, Camp Lejeune, North Carolina
mg/kg	milligram per kilogram
mg/L	milligrams per liter
NCA	no criteria available
NFD	no fuel detected
ng/L	nanograms per liter
Ni	Nickel
NL	no liquid
O&G	Oil and grease
OCH	Organochlorine herbicides
OCP	Organochlorine pesticides
11DCE	1,1-Dichloroethene/dichloroethylene
11DCLE	1,1-Dichloroethane
12DCLP	1,2-Dichloropropane

ACRONYMS AND ABBREVIATIONS
(Continued, Page 2 of 2)

12DCLEE	1,2-Dichloroethane
111TCE	1,1,1-Trichloroethane
112TCE	1,1,2-Trichloroethane
Pb	Lead
PCB	Polychlorinated biphenyls
PCP	Pentachlorophenol
POL	Petroleum, oil, and/or lubricant
Sb	Antimony
Se	Selenium
SNARLs	Suggested No Adverse Response Levels
STP	Sewage Treatment Plant
T. Phenols	Total phenols
TCE	Trichloroethene
TCLEA	1,1,2,2-Tetrachloroethane
TCLEE	Tetrachloroethene/tetrachloroethylene
T12DCE	trans-1,2-Dichloroethene
TNT	Trinitrotoluene
ug/L	micrograms per liter
VOA	Volatile organic analysis
WP	White phosphorus
Zn	Zinc

APPENDIX B

GROUND WATER LEVEL ELEVATIONS

APPENDIX B

GROUND WATER LEVEL ELEVATIONS (FEET)

Need to the Nearest 1/100 ft

Well Number	Date	Relative Elevation*	Water Level†	Elevation of Water Level**
1GW1	7-5-84	95.10	8.1	87.00
1GW2	7-5-84	95.60	9.7	85.90
1GW3	7-5-84	99.53	14.6	84.93
1GW4	7-5-84	102.28	16.0	86.28
1GW5	7-5-84	101.27	14.0	87.27
1GW6	7-5-84	106.00 — ?	15.6	90.40
2GW1	7-4-84		8.0	
9GW1	7-5-84	105.53 Why	9.7	95.83
9GW2	7-5-84	102.54	9.5	93.04
21GW1	7-4-84	105.74 data gaps?	11.0	94.74
22GW1	7-6-84	105.60	10.5	95.10
22GW2	7-6-84	102.85	9.6	93.25
24GW1	7-7-84	93.61	9.7	83.91
24GW2	7-7-84	89.29	3.6	85.69
24GW3	7-7-84	91.45	5.1	86.35
24GW4	7-7-84	94.28	8.5	85.78
24GW5	7-7-84	102.07	12.4	89.67
28GW1	7-7-84	103.29	4.6	98.69
28GW2	7-7-84	102.47	2.8	99.67
28GW3	7-7-84	102.20 — ?	3.5	98.70
30GW1	7-6-84		10.2	
36GW1	7-31-84	102.82	5.0	97.82
36GW2	7-31-84	102.61	4.8	97.81
36GW3	7-31-84	102.56	4.9	97.66
36GW4	7-31-84	108.18	5.7	102.48
41GW1	7-16-84	105.98	9.12	96.86
41GW2	7-16-84	98.00	6.21	91.79
41GW3	7-16-84	102.62	12.70	89.92
41GW4	7-17-84	95.39	7.09	88.30
45GW1	8-1-84	101.21	3.0	98.21
45GW2	8-1-84	103.11	3.4	99.71
45GW3	8-1-84	102.73 — ?	5.6	97.13
54GW1	7-16-84		9.0	
68GW1	7-17-84	100.35	8.67	91.68
68GW2	7-17-84	71.94	20.37	51.57
68GW3	7-17-84	79.98	19.14	60.84

APPENDIX B

GROUND WATER LEVEL ELEVATIONS (FEET)
(Continued, Page 2 of 2)

Need to thousandth ft nearest 100 ie .32

Well Number	Date	Relative Elevation*	Water Level†	Elevation of Water Level**
69GW1	7-18-84	97.05	8.93	88.12
69GW2	7-18-84	101.72	8.30	93.42
69GW3	7-18-84	101.09	7.40	93.69
69GW4	7-18-84	105.17	8.94	96.23
69GW5	7-18-84	99.34	11.45	87.89
69GW6	7-18-84	93.46	27.75	65.71
69GW7	7-17-84	82.41	17.7 - WC	64.71
69GW8	7-17-84	97.03	10.52	86.51
73GW1	7-6-84	103.36	4.3 - WC	99.06
73GW2	7-6-84	102.84	3.1	99.74
73GW3	7-6-84	100.60	4.9	95.70
73GW4	7-6-84	96.70	3.4	93.30
74GW1	7-4-84	103.12	7.0	96.12
74GW2	7-4-84	102.51	9.1	93.41
75GW1	7-16-84	111.60	7.05	104.55
75GW2	7-16-84	114.25	8.0	106.25
75GW3	7-16-84	114.54	9.16	105.38
76GW1	7-16-84	111.25	9.29	101.96
76GW2	7-16-84	102.55	4.74	97.81

Talk to Jerry, these elev. look incorrect!

*Elevation of top of well casing relative to 100-foot reference datum.
†Depth to water from top of well casing.
**Water level elevation relative to 100-foot reference datum.

Source: ESE, 1984.

APPENDIX C

SOIL GAS METHOD

What Is A Soil-Gas Contaminant Investigation?

A soil gas contaminant investigation refers to a method developed by Tracer Research Corporation (TRC) for investigating underground contamination from volatile chemicals such as industrial solvents, cleaning fluids and petroleum products by looking for traces of their vapors in the shallow soil gas. The method involves pumping a small amount of soil gas out of the ground through a hollow probe driven a few feet into the ground and analysing the gas for the presence of volatile contaminants. The presence of contaminants in the soil gas usually means that there is contamination from the observed compound either in the soil near the probe or in the groundwater below the probe. The soil gas analysis is performed in the field so that samples do not have to be packed or shipped. Even more importantly, the analytical results are available immediately and can be used to help direct the investigation. The investigation usually proceeds by analysing soil gas in transects across the contaminated area until the boundaries are well defined.

How Does Soil Gas Sampling Save Costs?

Soil gas contaminant mapping saves costs in a contamination investigation by providing a rapid means of detecting and delineating the contaminant distribution in groundwater. Standard drilling and sampling methods are much more cumbersome and costly because they are much slower and require far more effort to obtain a data point. For example: in an area where the depth to water is 30 feet, in one day only three holes could typically be augered down to the depth required for water sampling.

The samples would then be packed and delivered to a laboratory and the results would be available in 4 to 20 days. Only after receiving the results could plans be made for the next phase of the investigation.

By contrast, using the TRC method 15 to 30 soil gas samples can be collected and analysed in one day. Thus, much more can be learned about the contaminant distribution in one day than from 3 bore holes. Most inudstrial plant sites of less than 10 acres can be thoroughly covered in 3 days.

The cost to investigate underground leakage of volatile contaminants using conventional drilling and sampling methods is likely to be about 5 times greater than by soil gas sampling in an area where the depth to water is about 30 feet. The method becomes even more cost effective relative to conventional methods as the depth to water increases. (Soil gas sampling has been successful for mapping groundwater contaminants at depths up to 125 feet).

TRC Method of Operation

Soil gas samples are collected by driving a hollow probe into the ground and evacuating a small amount (10 to 20 liters) of air. The sample is collected in a syringe during the evacuation step by inserting the needle through the evacuation line and drawing the sample from the gas stream. The sample size may range from 1 ul to 1 ml depending on the requirements of the analysis. The sample is analyzed immediately in the TRC mobile analytical van. Probes are typically driven 3 to 20 feet into the ground. Most soil gas plume mapping operations are performed with probes driven to a depth of 5 feet. The complete operation of sampling to a depth of 5 feet, soil gas analysis, and probe removal takes 15 to 20 minutes.

Typically, 26 probes will be measured in a 10 hour day. Probes can be installed in landscaped areas, through concrete or asphalt covers or inside buildings with relatively little disturbance to the immediate area. Probes can be driven by hand if vehicular access is not possible.

Analytical Capability

The TRC analytical van is equipped with a Varian Vista 6000 series gas chromatograph. The instrument is set up to make analyses on both packed and cappillary columns. It is equipped with the following detectors:

a) electron capture (ECD) for measurement of halogenated compounds: industrial solvents, pesticides, etc.
b) flame ionization (FID) for all hydrocarbons: methane, gasoline components, as well as total hydrocarbon measurements.
c) photo ionization detector (PID) for measurement of aromatic compounds: benzene, toluene, etc.
d) thermal conductivity detector (TCD) for measurement of major gas components: N_2, O_2, CO_2, CH_4, etc.

The instrument is also equipped with a Hewlett Packard dual channel integrator. Thus, any two detectors can used simultaneously.

TRC has developed special analytical technology (patent pending) that enables very rapid measurement of contaminants in either soil gas or water. Both are injected directly into the instrument without the use of purge and trap or any type of preconcentrating. Using the TRC method, a typical measurement for most of the priority pollutant purgables requires approximately five minutes. An examples is shown in Figure 1.

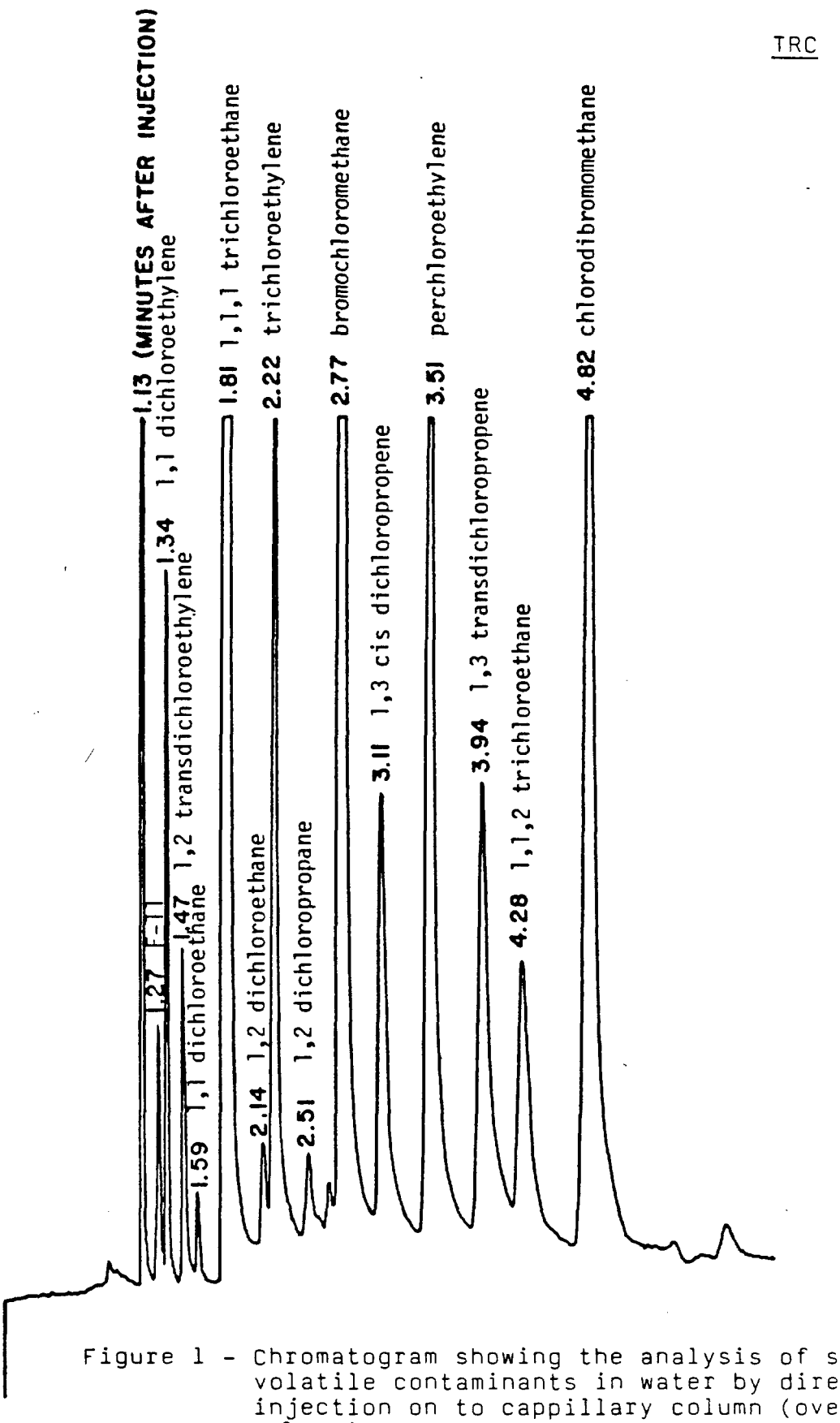


Figure 1 - Chromatogram showing the analysis of selected volatile contaminants in water by direct injection on to cappillary column (oven temp. 50° C isothermal). Analyses of soil gas or water are identical by TRC method and require 5 minutes or less to perform.

Measurements made for only a few compounds take less time, typically 1 to 2 minutes. The sensitivity and precision are typically as good as conventional methods, but the speed of analysis is about a factor of 10 better.

The rapid analysis is extremely beneficial to the TRC soil gas operation. It allows the analysis to be performed in about the same period of time required to drive, sample and pull the probe. Thus, the TRC soil gas sampling operation proceeds very efficiently.

Reproducibility

The standard deviation for repeat probes in a small area (within a 5 foot radius) made within a few days of each other is typically 21% ± 18%. Table 3 shows the repeat sampling data.

Table 3 - Repeat sampling within a 5 foot radius of selected points to test reproducibility.

Sample/Depth	111 TCA ug/l			TCE ug/l		
	Day 1	Day 2	s	Day 1	Day 2	s
1 - 5 Feet	1.9	1.8	± 4%	4.0	4.1	± 2%
2 - 5 Feet	2.9	3.2	± 7%	.85	.99	± 11%
3 - 5 Feet	2.9	2.7	± 5%	3.6	3.3	± 6%
4 - 5 Feet	315	200	± 32%	675	360	± 43%
5 - 5 Feet	220	172	± 17%	240	200	± 13%

	TCE ug/l			
	Day 1	Day 2	Day 3	s
6 - 4 Feet	.049	.061	.052	± 12%
7 - 4 Feet	.072	.11	.047	± 42%
8 - 2 Feet	90	137	301	± 63%
8 - 5 Feet	520	880	520	± 32%
8 - 7.5 Feet	800	970	620	± 22%

How TRC Services Aid A Contamination Investigation Program

Soil gas contaminant mapping helps to reduce the time and cost required to deliniate underground contamination by volatile contaminants. The soil gas investigation does this by outlining the general areal extent of the contamination; then conventional bore holes or observation wells are used to verify both the presence and absence of the subsurface contamination as indicated in the soil gas survey. In this manner, soil gas contaminant mapping can assist in determining placement of monitoring wells. Thus, there is less likelihood of unnecessary monitoring wells being drilled. The soil gas survey is not intended as a substitute for the conventional methodology, but rather is intended to enable one to use conventional methods more efficiently.

In addition to mapping underground contamination, TRC can lend field analytical support to contaminant investigations. TRC can analyse water or soil samples for purgable priority pollutants at a rate fast enough to keep up with several drill rigs or with soil excavating equipment. Field screening permits a great reduction in the number of samples to be sent off for laboratory analysis. Drilling operations guided by field analysis are able to stop or continue drilling as needed depending on the contamination encountered.

Acceptance By Regulators

TRC has provided soil gas sampling services for a variety of private industrial and governmental clients, including work for EPA in the investigation of Super Fund sites in the western United States.

All site investigation plans in which TRC's services have been proposed have been approved by the state regulating authorities involved. These have included the Los Angeles and San Francisco Regional Water Quality Boards and the New Mexico State Board of Health.

Theory of Operation

Volatile organic pollutants evaporate out of groundwater into the overlying soil gas and move upward by molecular diffusion. Their tendency to escape from the groundwater into the soil gas is a function of their concentration in the groundwater, their aqueous solubility and their vapor pressure (boiling point). Groundwater acts as a "source" and the above ground atmosphere acts as a "sink". Thus a contaminant concentration gradient is established in the soil gas that accounts for the vertical flux of contaminants from the water table to the ground surface.

Ideally the concentration of the contaminant at any given depth in the soil gas is a function of its concentration in the groundwater. In practice, the concentration gradient between the water table and the ground surface of the contaminant in the soil gas is affected or distorted by several hydrologic and geologic variables such as clay, perched water or other impermeable materials. However, the geologic and hydrologic variables seldom distort the soil gas distribution to the point that it no longer approximates the distribution of the groundwater contamination. The principal parameters that impede the diffusive movement of volatile contaminants are pore fluids and clay layers. Pore fluids tend to dissolve contaminant vapors and block the conduits for diffusion through the soil. Clay layers are relatively impermeable zones because they tend to be water saturated, but unless they are very extensive laterally, diffusion occurs around them.

Extensive layers of perched water which occur on top of impermeable layers in the soil will also impede the vertical movement of volatile contaminants in the soil gas.

Chemicals Amenable To Detection In Soil Gas

Virtually all industrial solvents will produce vapors in the soil gas if they are dissolved in the groundwater. Dissolved metals and salts will not produce vapors in the soil gas. In general, the compounds that produce the most favorable distribution into the soil gas are compounds with low boiling points (less than 110 C) and low solubility in water. The gas-liquid partitioning coefficient is the best single parameter to assess the tendency of the compound to vaporize into the soil gas. By definition, this coefficient is the gas/liquid concentration ratio of the chemical at equilibrium in a closed system containing only air and water. The tendency of a chemical to partition into the air enhances its ability to be detected in the soil gas. The partition coefficients or air/water concentration ratios for a variety of common solvents are listed in Table 1.

Table 1. Air/Water Concentration Ratios For Some Common Industrial Solvents at 23° C.

	Air : Water
1,1 dichloroethylene (DCE)	1 : 1
1,2 transdichloroethylene	1 : 3
methylenechloride	1 : 12
1,1,1 trichloroethane (TCA)	1 : 1.5
trichloroethylene (TCE)	1 : 2.6
carbontetrachloride	1 : 1
tetrachloroethylene (PCE)	1 : 1.7
chloroform	1 : 9
F-113	4 : 1

The compounds best suited to measurement in the soil gas are the halocarbon solvents. Most halocarbon solvents offer the advantage of being highly detectable by means of the electron capture detector, are highly volatile, and are not subject to biodegradation in the subsurface. Most halocarbons having 3 or more halogens (bromines or chlorines) on the molecule are easily detectable in concentrations of 0.001 ug/l in soil gas and thus are particularly adaptable to this technology. Detection sensitivity decreases with fewer halogens on the molecule.

Hydrocarbon liquids are also detectable in the soil gas by their vapors. TRC has done some very useful soil gas investigative work at sites where hydrocarbons are the principal contaminants. But there are some limitations in the method applied to hydrocarbon mapping. Hydrocarbons are degradable in the subsurface and are particularly susceptible to degradation in the upper portions of the soil profile where oxygen is present. As a result, soil gas measurements will only reliably detect hydrocarbon product vapors when the samples are collected near the surface of the water table. TRC is equipped to drive probes 20 feet in most soils and deeper in soft silty soils. In areas where the groundwater contamination is significantly deeper, vapors from hydrocarbon decomposition products in the soil gas such as carbondioxide or methane may be used for mapping the extent of the contamination.

The results of several soil gas measurements over two aquifers contaminated with hydrocarbons are shown in Table 2. Note that the hydrocarbons appear rather abruptly in the deepest samples in comparison with the halocarbons that are apparent at all depths. Some multiple depth soil gas samples collected over hydrocarbon contamination are shown in Table 2 to illustrate how hydrocarbon distributions commonly differ from halocarbon distributions as a result of hydrocarbon degradation.

Table 2. Hydrocarbon Variation With Depth

	111 TCA	Benzene	Methane	Total Hydrocarbons
Sample A - 3 Feet	.057[1]	ND[2]	280	283
Sample A - 5 Feet	.035	420	54,000	56,000
Sample B - 2 Feet	6	ND	2.3	3.5
Sample B - 3 Feet	3	ND	1	1
Sample B - 5 Feet	.3	64	700	1800

	PCE	Benzene	Toluene	Total Hydrocarbons
Sample C - 5 Feet	.006	ND	ND	ND
Sample C - 10 Feet	.012	ND	ND	ND
Sample C - 15 Feet	.028	225	31	600

1) All samples are expressed in ug/l

2) ND Not detected, <0.1 ug/l