03.13-08/22/96-01712

FINAL

REMEDIAL INVESTIGATION REPORT
OPERABLE UNIT NO. 6
(SITE 36)

MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

CONTRACT TASK ORDER 0303
APPENDICES L-AA
VOLUME III
AUGUST 22, 1996

Prepared For:

DEPARTMENT OF THE NAVY
ATLANTIC DIVISION
NAVAL FACILITIES
ENGINEERING COMMAND
Norfolk, Virginia

Under:

LANTDIV CLEAN Program
Contract N62470-89-D-4814

Prepared by:

BAKER ENVIRONMENTAL, INC.
Coraopolis, Pennsylvania

APPENDICES

A	Test Boring Records
B	Test Boring and Well Construction Records
C	Exploratory Test Pit Records
D	Chain-of-Custody Forms
E	Field Well Development Records
F	Investigation Derived Waste Summary and Recommendations
G	Sampling Summaries
H	Data and Frequency Summaries
I	Statistical Summaries
J	Field Duplicate Summaries
K	QA/QC Sampling Summaries
L	Grain Size Analytical Results
M	Wet Chemistry Analytical Results
N	Aquifer Test Results
O	Aquifer Property Calculations
P	Base Background Analytical Results and Evaluation Report
Q	Shower Model
R	Lead UBK Model
S	Site Conceptual Model
T	CDI Calculations
U	Field Data Sheets
V	White Oak River Basin Reference Stations
W	Positive Detection Summary for Upstream Surface Water and Sediment Samples
X	Screening Value and Quotient Index Calculations
Y	Fish and Crab Sample Collection Logs
Z	Benthic Macroinvertebrate Raw Data Tables and Laboratory Bench Sheets
AA	Terrestrial Reference Values and Cdi Calculations

APPENDIX L
GRAIN SIZE ANALYTICAL RESULTS

ROY F. WESTON, INC. ENVIRONMENTAL TECHNOLOGY LABORATORY

GEOTECHNICAL TESTING DATA AND RESULTS

PROJECT	Baker Environmental	PROJECT SAMPLE I.D.	36-GW07DW	PROJECT ANALYST	JRA
JOB NUMBER	9503G614	ETL SAMPLE NUMBER	001	QA/QC ANALYST	RWF
W. O. NUMBER	06629-009-004-0001-00	DATE RECEIVED	03/13/95	DATE COMPLETED	03/23/95

PARTICLE SIZE DISTRIBUTION

U. S. Standard Sieve Size	Diameter mm	% Finer
3"	75.00	100.0
1 1/2"	37.50	100.0
3/4"	19.00	100.0
3/8"	9.500	100.0
#4	4.750	100.0
#10	2.000	99.7
#20	0.850	96.4
#50	0.300	77.0
#100	0.150	44.2
#200	0.075	15.4
HYDROMETER	0.0484	14.6
	0.0347	12.8
	0.0245	12.8
	0.0174	11.9
	0.0127	11.9
	0.0091	11.0
	0.0064	10.1
	0.0046	9.2
	0.0033	8.3
	0.0023	8.3
	0.0013	8.3
	0.0009	8.3

EFFECTIVE SIZES

% Finer	Diameter mm
60	0.222
30	0.113
10	NA
Uniformity Coefficient	Gradation Coefficient
NA	NA

SAMPLE DESCRIPTION

light brown silty SAND
with 15% silt of low plasticity

Unified Soil Classification System (USCS) Group Symbol

SM

INDEX PROPERTIES
% moisture dry basis

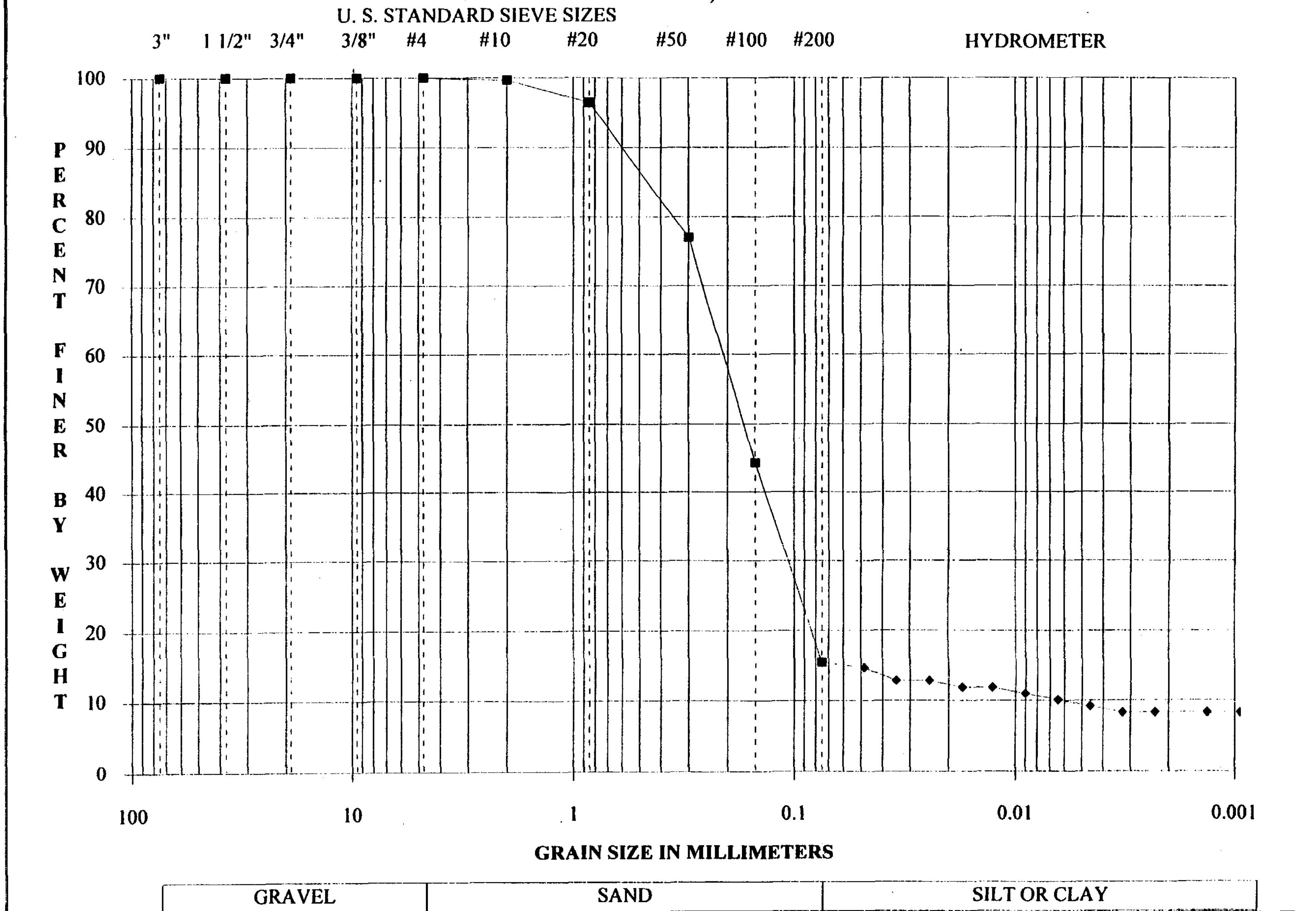
Liquid Limit	Plastic Limit	Plasticity Index
non-cohesive, non-plastic		

NOTES

NA=NOT APPLICABLE

GSC1.XLS

PARTICLE-SIZE DISTRIBUTION CURVE FOR PROJECT SAMPLE 36-GW07DW, ETL SAMPLE 9503G614-001



APPENDIX M
WET CHEMISTRY ANALYTICAL RESULTS

SITE 36, GAMP GEIGER AREA DUMP
WET CHEMISTRY ANALYTICAL SUMMARY
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

LOCATION	36-GW01-01	36-GW02-01	36-GW02-01D	36-GW03-01	36-GW04-01	36-GW05-01
DATE_SAMPLED	03/28/95	03/27/95	03/27/95	03/26/95	03/26/95	03/26/95
DEPTH	N/A	N/A	N/A	N/A	N/A	N/A
UNITS	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
TOTAL DISSOLVED SOLIDS	510	580	570	140	150	120
TOTAL SUSPENDED SOLIDS	23	24	5 U	24	18	5 U

SITE 36, GAMP GEIGER AREA DUMP
WET CHEMISTRY ANALYTICAL SUMMARY
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

LOCATION	36-GW06-01	36-GW06-01D	36-GW06DW-01	36-GW07-01	36-GW07DW-01	36-GW08-01
DATE_SAMPLED	03/27/95	03/27/95	03/26/95	03/26/95	03/26/95	03/27/95
DEPTH	N/A	N/A	N/A	N/A	N/A	N/A
UNITS	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
TOTAL DISSOLVED SOLIDS	90	74	260	280	250	170
TOTAL SUSPENDED SOLIDS	5 U	7	5 U	5 U	32	5 U

SITE 36, GAMP GEIGER AREA DUMP
WET CHEMISTRY ANALYTICAL SUMMARY
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

LOCATION	36-GW09-01	36-GW10-01	36-GW10DW-01	36-GW10IW-01	36-GW10IW-01D	36-GW11-01
DATE_SAMPLED	03/27/95	03/25/95	07/12/95	05/09/95	05/09/95	03/27/95
DEPTH	N/A	N/A	N/A	N/A	N/A	N/A
UNITS	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
TOTAL DISSOLVED SOLIDS	920	430	420	580	500	840
TOTAL SUSPENDED SOLIDS	5 U	5 U	5 U	5 U	5 U	5 U

SITE 36, CAMP GEIGER AREA DUMP
WET CHEMISTRY ANALYTICAL SUMMARY
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

LOCATION	36-GW11DW-01	36-GW12-01	36-GW12IW-01	36-GW13-01	36-GW13IW-01	36-GW14-01
DATE_SAMPLED	03/27/95	05/08/95	05/08/95	05/09/95	05/08/95	05/08/95
DEPTH	N/A	N/A	N/A	N/A	N/A	N/A
UNITS	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
TOTAL DISSOLVED SOLIDS	470	330	330	380	340	180
TOTAL SUSPENDED SOLIDS	5 U	22	5 U	5 U	5 U	23

SITE 36, CAMP GEIGER AREA DUMP
WET CHEMISTRY ANALYTICAL SUMMARY
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

LOCATION	36-GWER-01	36-TW02-01
DATE_SAMPLED	03/25/95	03/14/95
DEPTH	N/A	N/A
UNITS	MG/L	MG/L
TOTAL DISSOLVED SOLIDS	10 U	1100
TOTAL SUSPENDED SOLIDS	5 U	5 U

SITE 36, CAMP GEIGER AREA DUMP
SEDIMENT TOTAL ORGANIC CARBON RESULTS
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

LOCATION	36-SD01-06	36-SD02-06	36-SD02-612	36-SD03-06	36-SD03-06D	36-SD03-612
DATE_SAMPLED	08/08/95	08/08/95	08/08/95	08/08/95	08/08/95	08/08/95
DEPTH	0-6"	0-6"	6-12"	0-6"	0-6"	6-12"
UNITS	%	%	%	%	%	%
TOTAL ORGANIC CARBON	1.7	0.62	2.5	5	5.1	0.26

SITE 36, CAMP GEIGER AREA DUMP
SEDIMENT TOTAL ORGANIC CARBON RESULTS
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

LOCATION	36-SD04-06	36-SD04-612	36-SD05-06	36-SD05-612	36-SD06-06	36-SD06-612
DATE_SAMPLED	08/08/95	08/08/95	08/07/95	08/07/95	08/07/95	08/07/95
DEPTH	0-6"	6-12"	0-6"	6-12"	0-6"	6-12"
UNITS	%	%	%	%	%	%
TOTAL ORGANIC CARBON	1.5	1.8	0.98	0.7	0.26	0.21

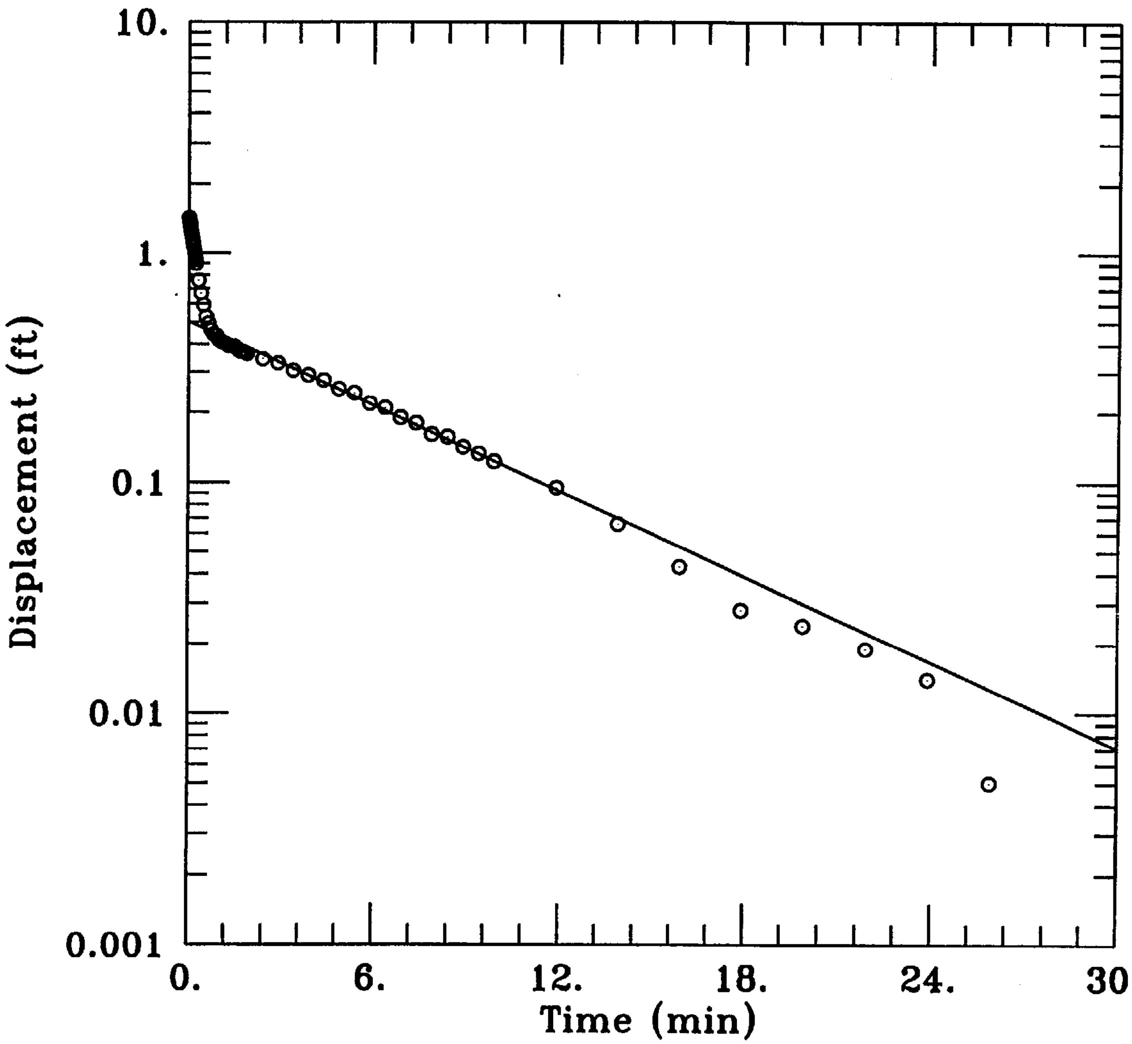
SITE 36, CAMP GEIGER AREA DUMP
SEDIMENT TOTAL ORGANIC CARBON RESULTS
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

LOCATION	36-SD07-06	36-SD07-612
DATE_SAMPLED	08/07/95	08/07/95
DEPTH	0-6"	6-12"
UNITS	%	%
TOTAL ORGANIC CARBON	12.5	17.6

APPENDIX N
AQUIFER TEST RESULTS

Client: **LANTDIV**	Company: **BAKER ENVIRONMENTAL, INC.**
Location: **SITE 36, CAMP LEJEUNE**	Project: **CTO-303**

36-GW06 RISING HEAD TEST



DATA SET:
36GW06R.DAT
05/26/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: APRIL 5, 1995

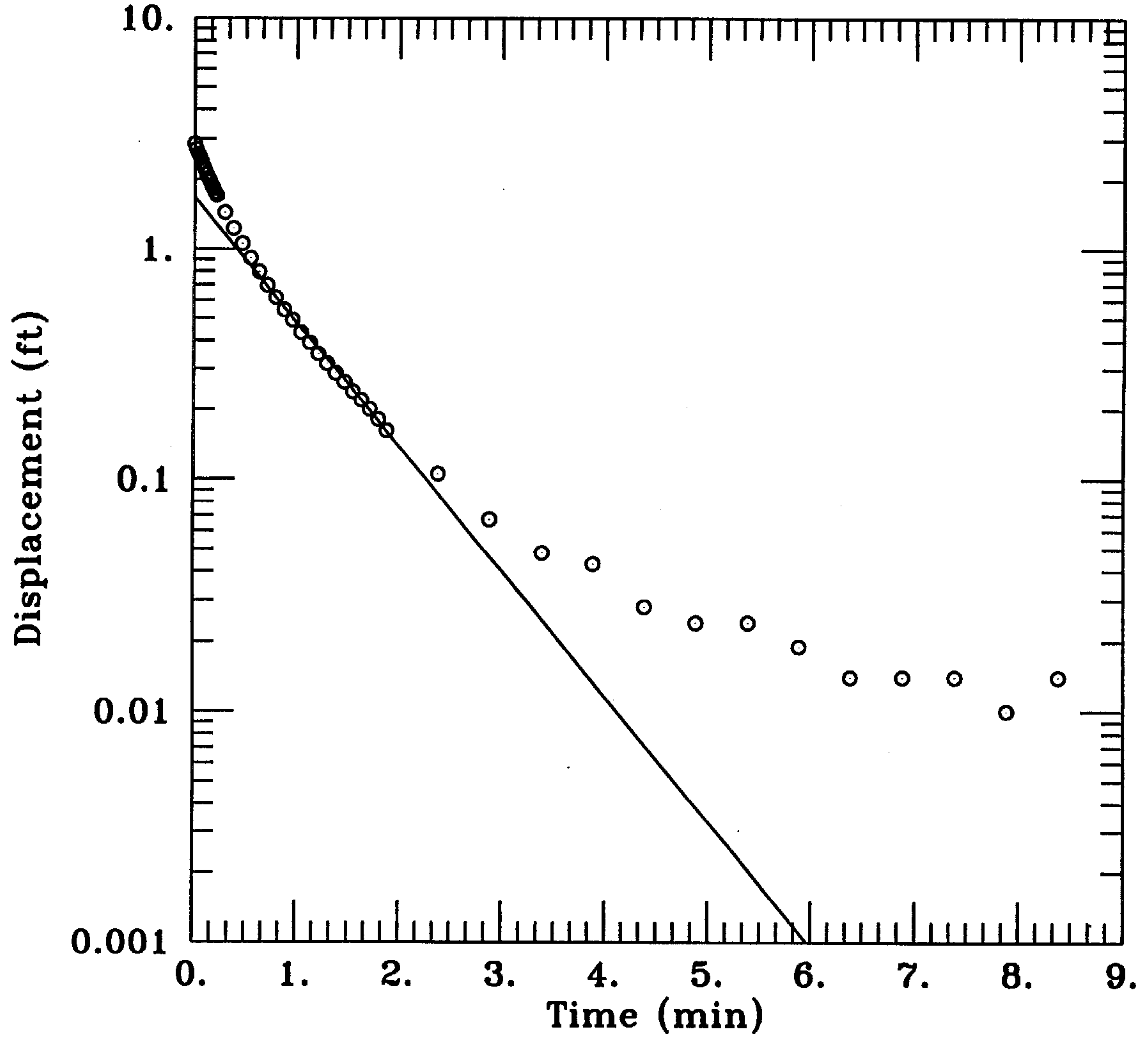
TEST DATA:
H0 = 1.421 ft
rc = 0.0833 ft
rw = 0.33 ft
L = 15. ft
b = 30. ft
H = 12.94 ft

PARAMETER ESTIMATES:
K = 0.6312 ft/day
y0 = 0.5034 ft

AQTESOLV

Client: **LANTDIV**	Company: **BAKER ENVIRONMENTAL, INC.**
Location: **SITE 36, CAMP LEJEUNE**	Project: **CTO-303**

36-GW06DW RISING HEAD TEST



DATA SET:
36GW06DR.DAT
05/30/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: APRIL 5, 1995

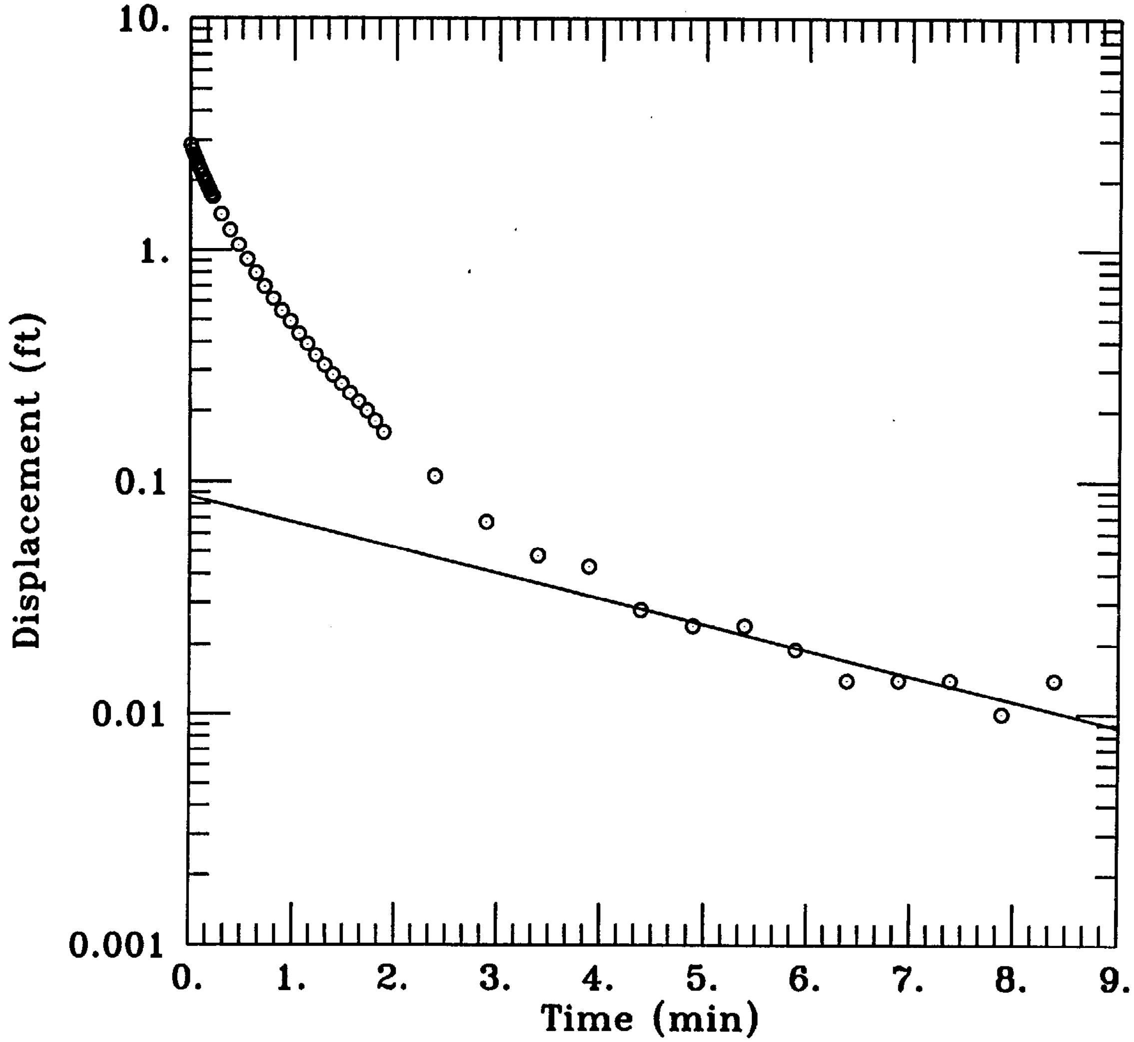
TEST DATA:
H0 = 2.855 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 5. ft
b = 160. ft
H = 61.08 ft

PARAMETER ESTIMATES:
K = 10.37 ft/day
y0 = 1.675 ft

AQTESOLV

Client: LANTDIV	Company: BAKER ENVIRONMENTAL, INC.
Location: SITE 36, CAMP LEJEUNE	Project: CTO-303

36-GW06DW RISING HEAD TEST



DATA SET:
36GW06DR.DAT
05/30/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: APRIL 5, 1995

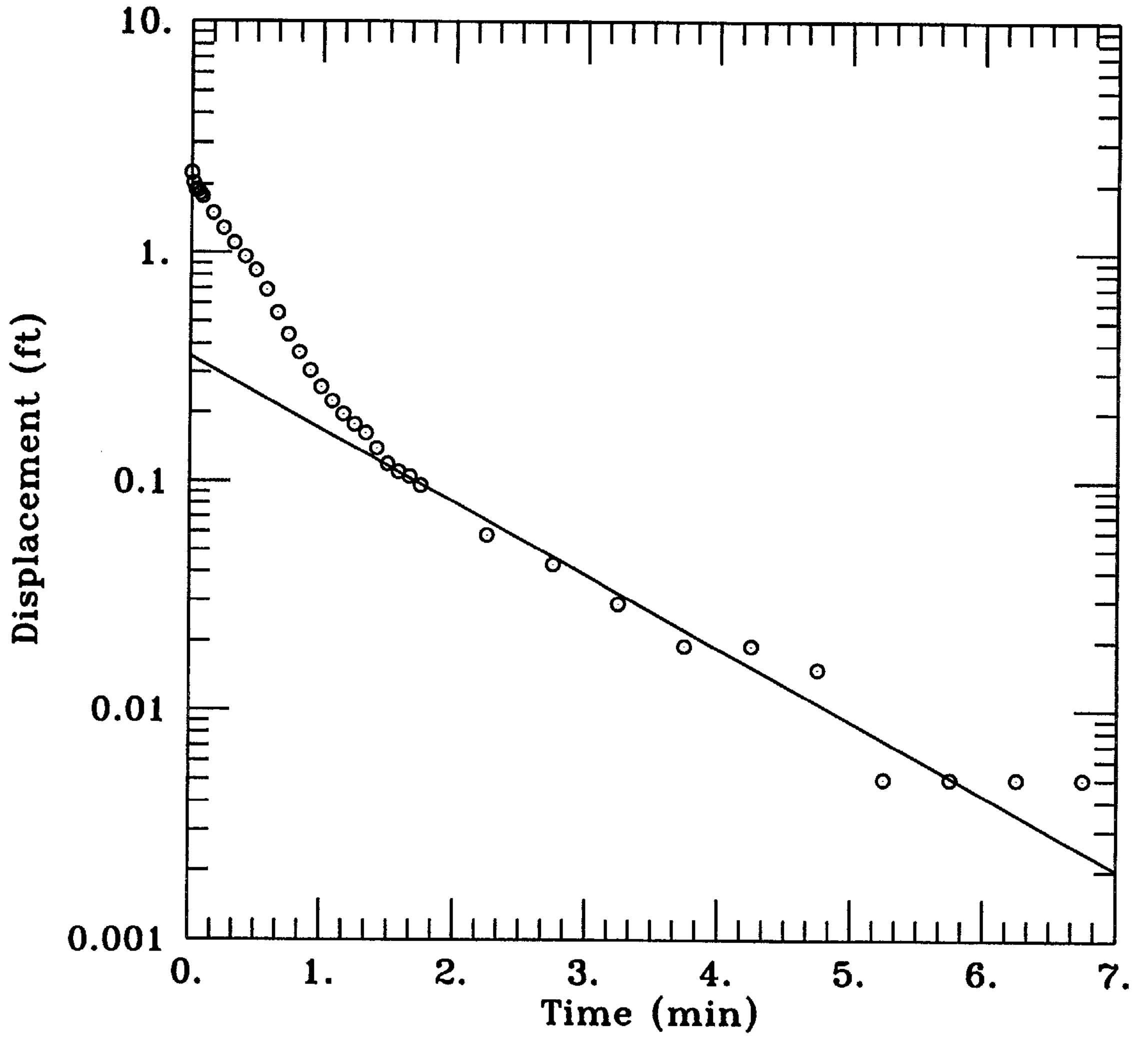
TEST DATA:
H0 = 2.855 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 5. ft
b = 160. ft
H = 61.08 ft

PARAMETER ESTIMATES:
K = 2.116 ft/day
y0 = 0.08626 ft

AQTESOLV

Client: LANTDIV	Company: BAKER ENVIRONMENTAL, INC.
Location: SITE 36, CAMP LEJEUNE	Project: CTO-303

36-GW06DW FALLING HEAD TEST



DATA SET:
36GW06DF.DAT
05/31/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: APRIL 5, 1995

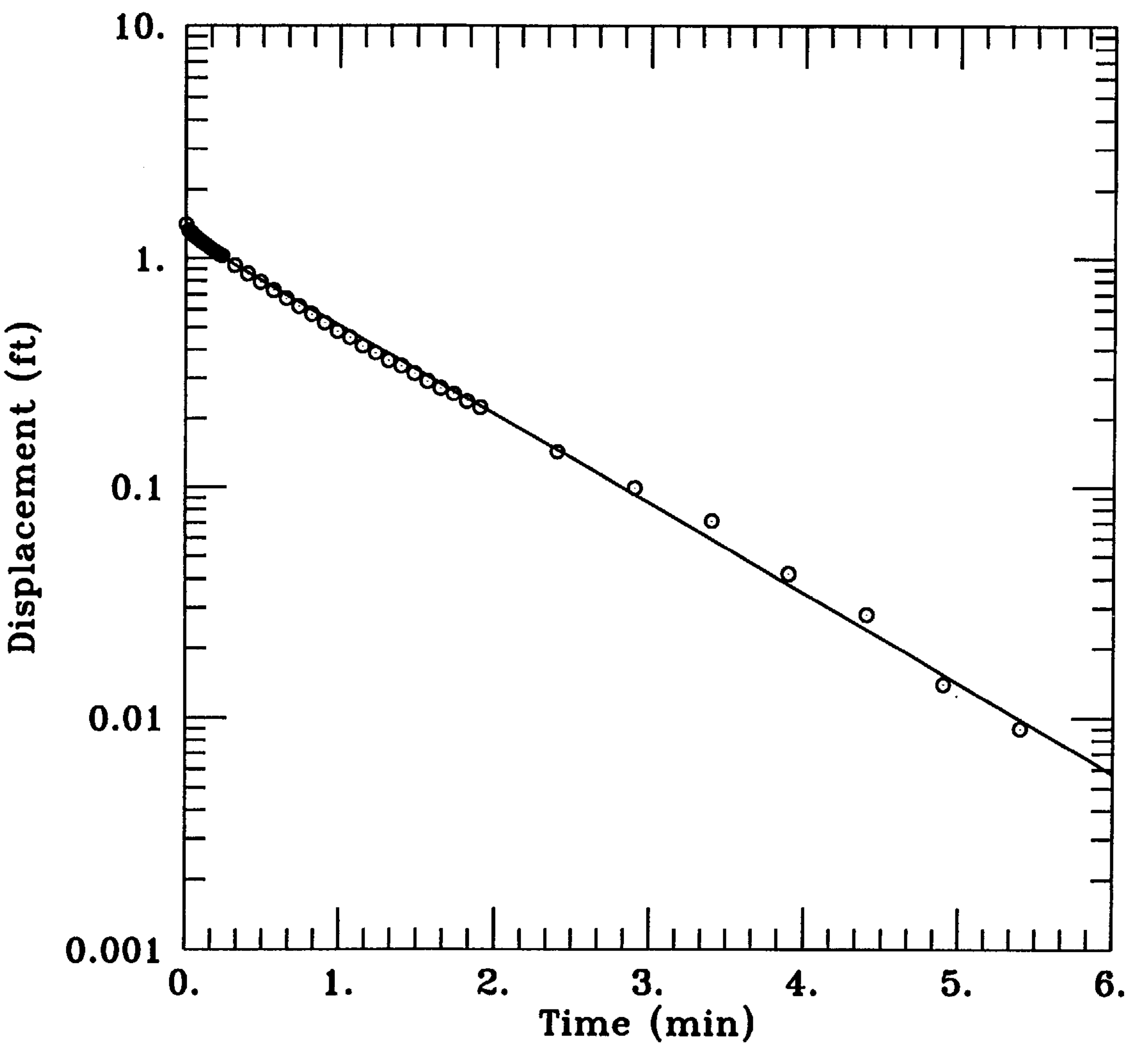
TEST DATA:
H0 = 2.232 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 5. ft
b = 160. ft
H = 61.08 ft

PARAMETER ESTIMATES:
K = 6.138 ft/day
y0 = 0.3527 ft

AQTESOLV

Client: **LANTDIV**	Company: **BAKER ENVIRONMENTAL, INC.**
Location: **SITE 36, CAMP LEJEUNE**	Project: **CTO-303**

36-GW07 RISING HEAD TEST



DATA SET:
36GW07R.DAT
05/26/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: APRIL 5, 1995

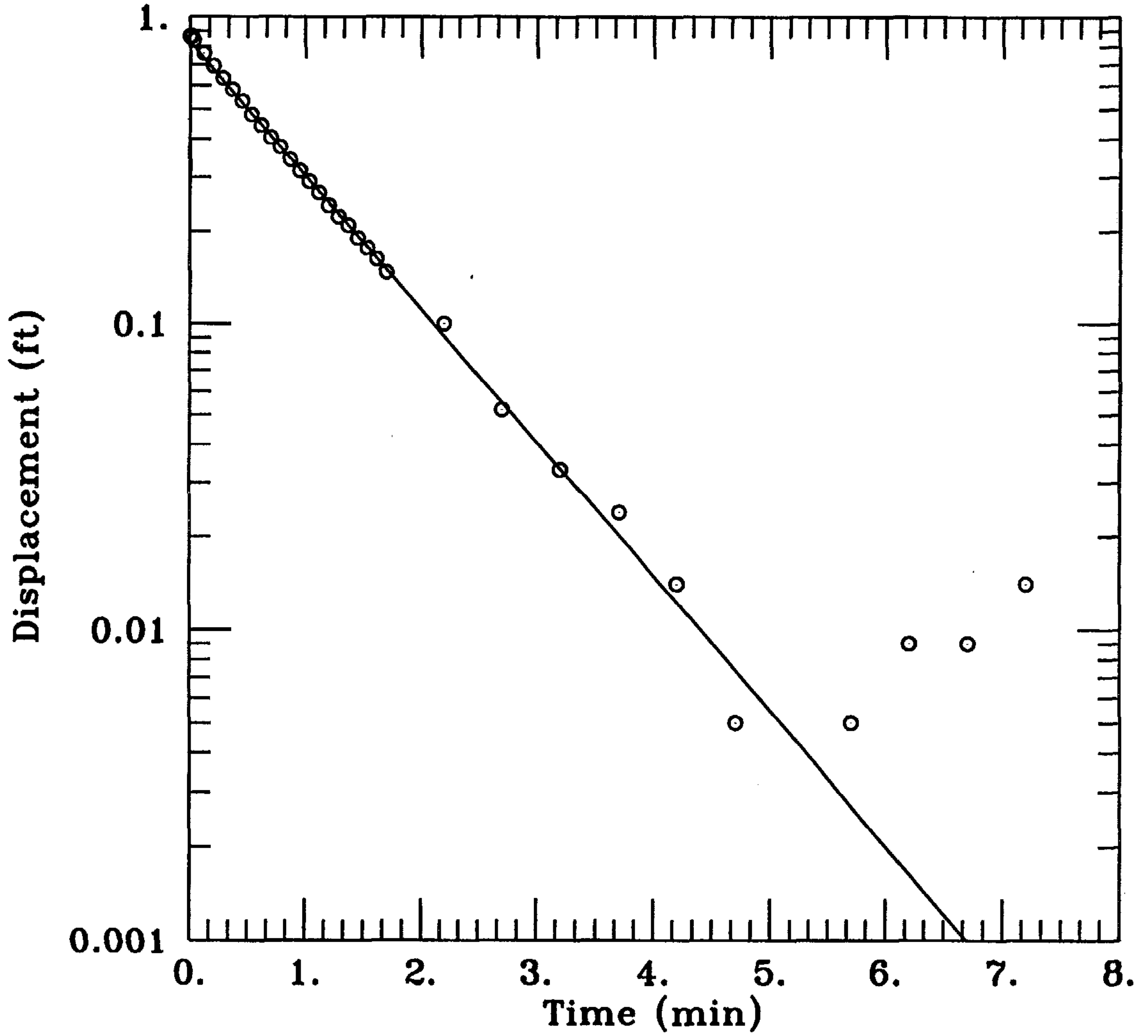
TEST DATA:
H0 = 1.416 ft
rc = 0.0833 ft
rw = 0.33 ft
L = 15. ft
b = 30. ft
H = 16.65 ft

PARAMETER ESTIMATES:
K = 4.212 ft/day
y0 = 1.245 ft

AQTESOLV

Client: LANTDIV	Company: BAKER ENVIRONMENTAL, INC.
Location: SITE 36, CAMP LEJEUNE	Project: CTO-303

36-GW07 FALLING HEAD TEST



DATA SET:
36GW07F.DAT
05/26/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: APRIL 5, 1995

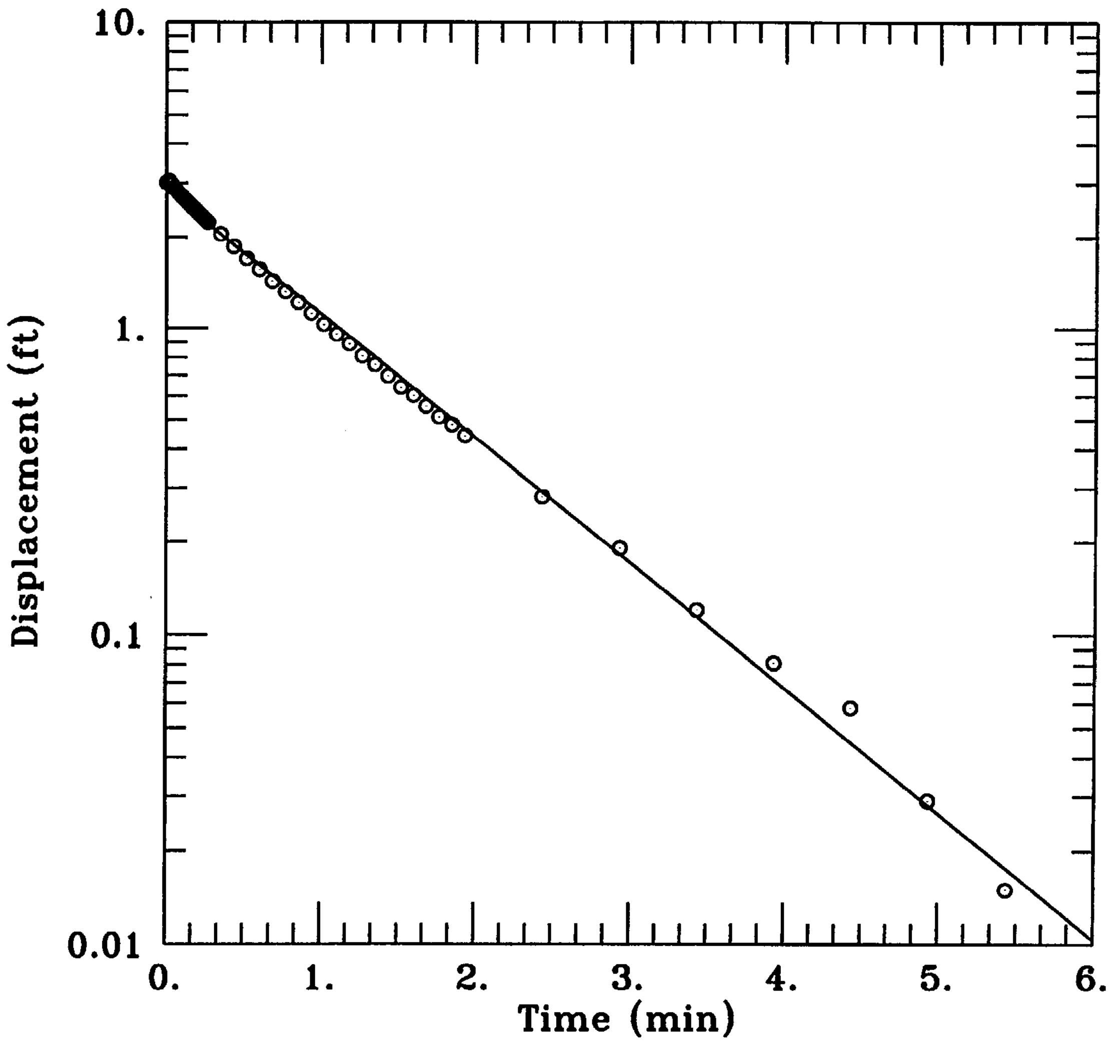
TEST DATA:
H0 = 0.865 ft
rc = 0.0833 ft
rw = 0.33 ft
L = 15. ft
b = 30. ft
H = 16.65 ft

PARAMETER ESTIMATES:
K = 4.712 ft/day
y0 = 0.8257 ft

AQTESOLV

Client: **LANTDIV**	Company: **BAKER ENVIRONMENTAL, INC.**
Location: **SITE 36, CAMP LEJEUNE**	Project: **CTO-303**

36-GW07DW RISING HEAD TEST



DATA SET:
36GW07DR.DAT
05/26/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: APRIL 5, 1995

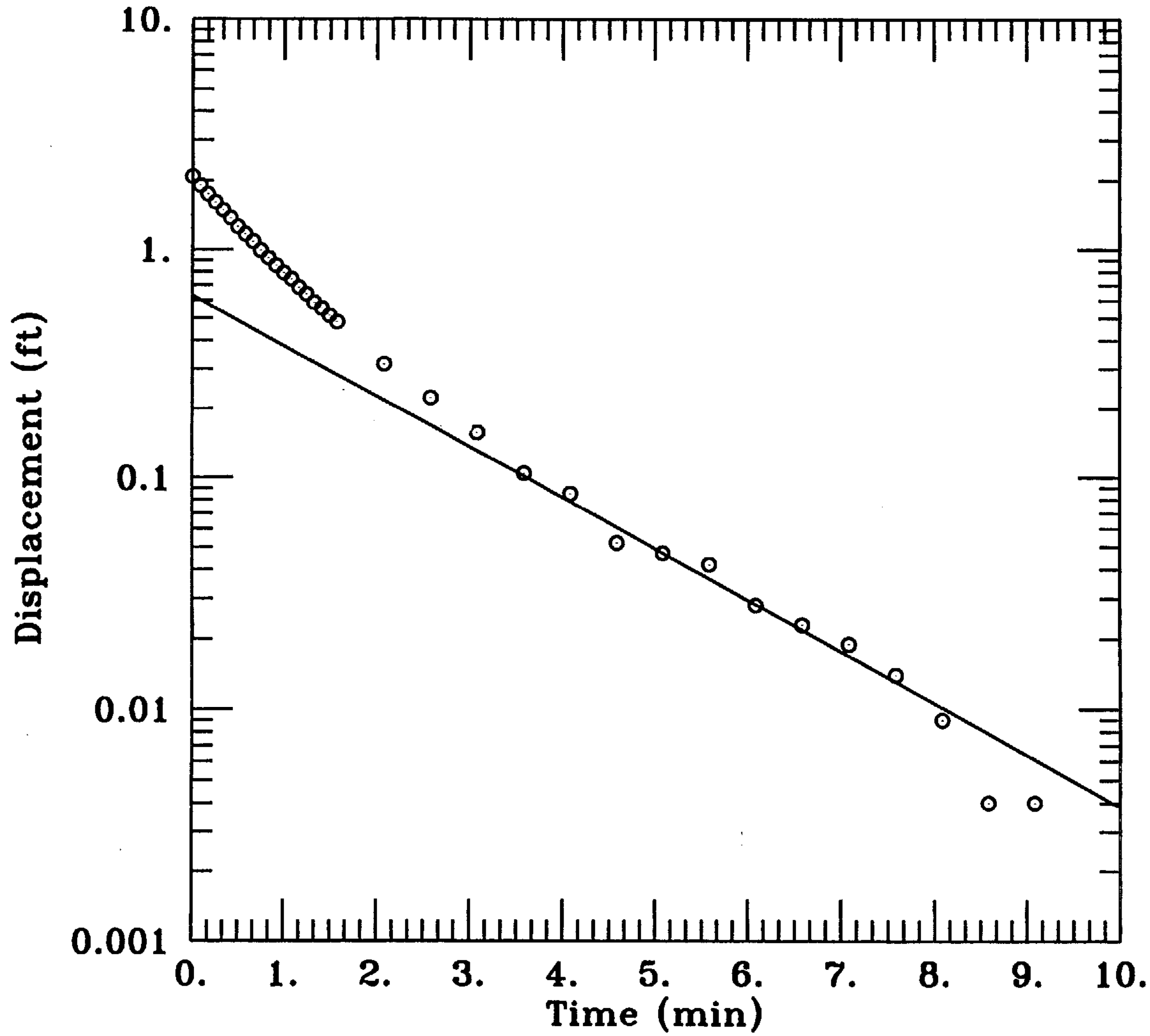
TEST DATA:
H0 = 3.003 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 5. ft
b = 160. ft
H = 61.34 ft

PARAMETER ESTIMATES:
K = 7.789 ft/day
y0 = 2.832 ft

AQTESOLV

Client: LANTDIV	Company: BAKER ENVIRONMENTAL, INC.
Location: SITE 36, CAMP LEJEUNE	Project: CTO-303

36-GW07DW FALLING HEAD TEST



DATA SET:
36GW07DF.DAT
05/26/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: APRIL 5, 1995

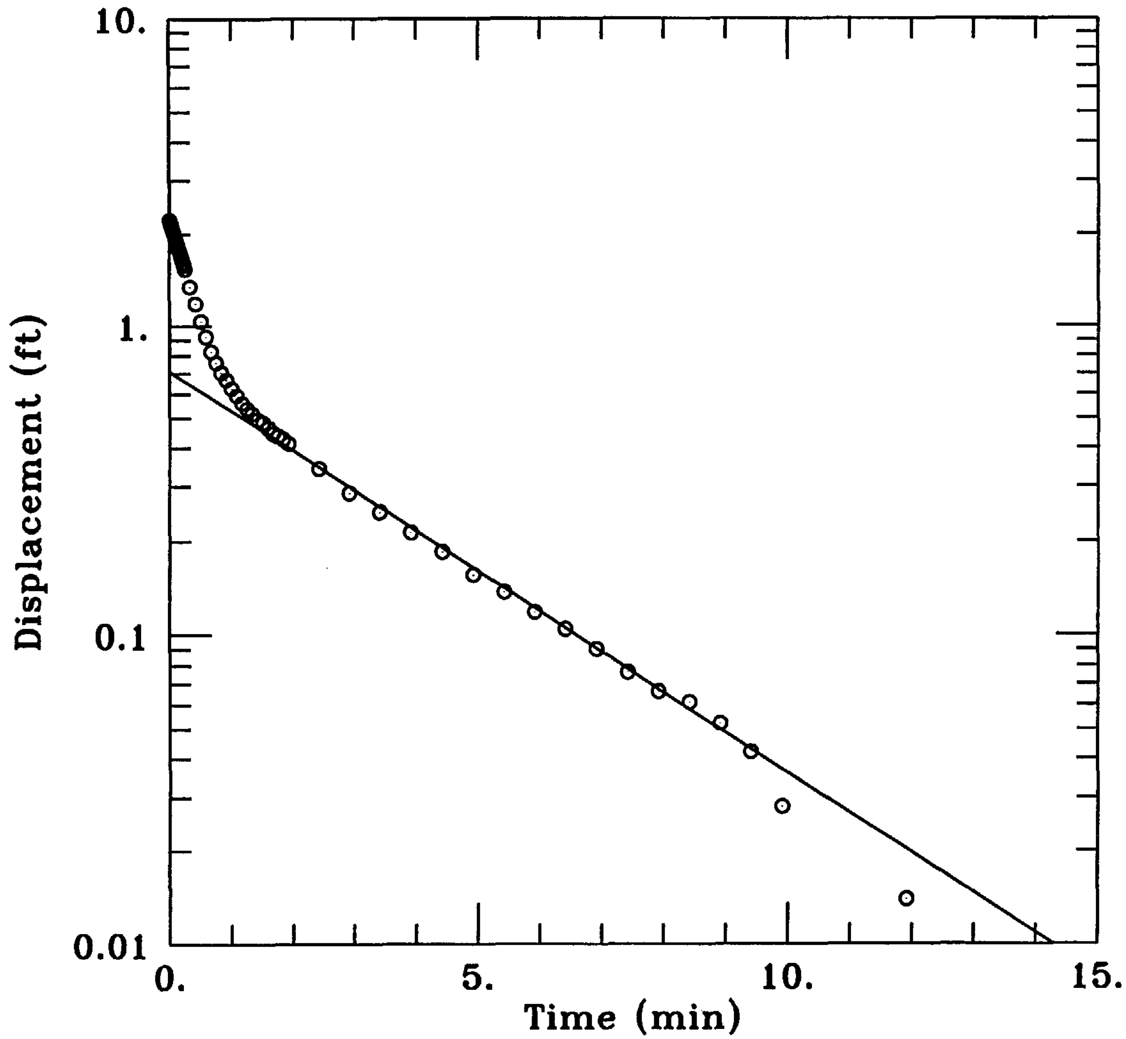
TEST DATA:
H0 = 2.077 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 5. ft
b = 160. ft
H = 61.34 ft

PARAMETER ESTIMATES:
K = 4.253 ft/day
y0 = 0.6302 ft

AQTESOLV

Client: **LANTDIV**	Company: **BAKER ENVIRONMENTAL, INC.**
Location: **SITE 36, CAMP LEJEUNE**	Project: **CTO-303**

36-GW09 RISING HEAD TEST



DATA SET:
36GW09R.DAT
05/26/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: APRIL 5, 1995

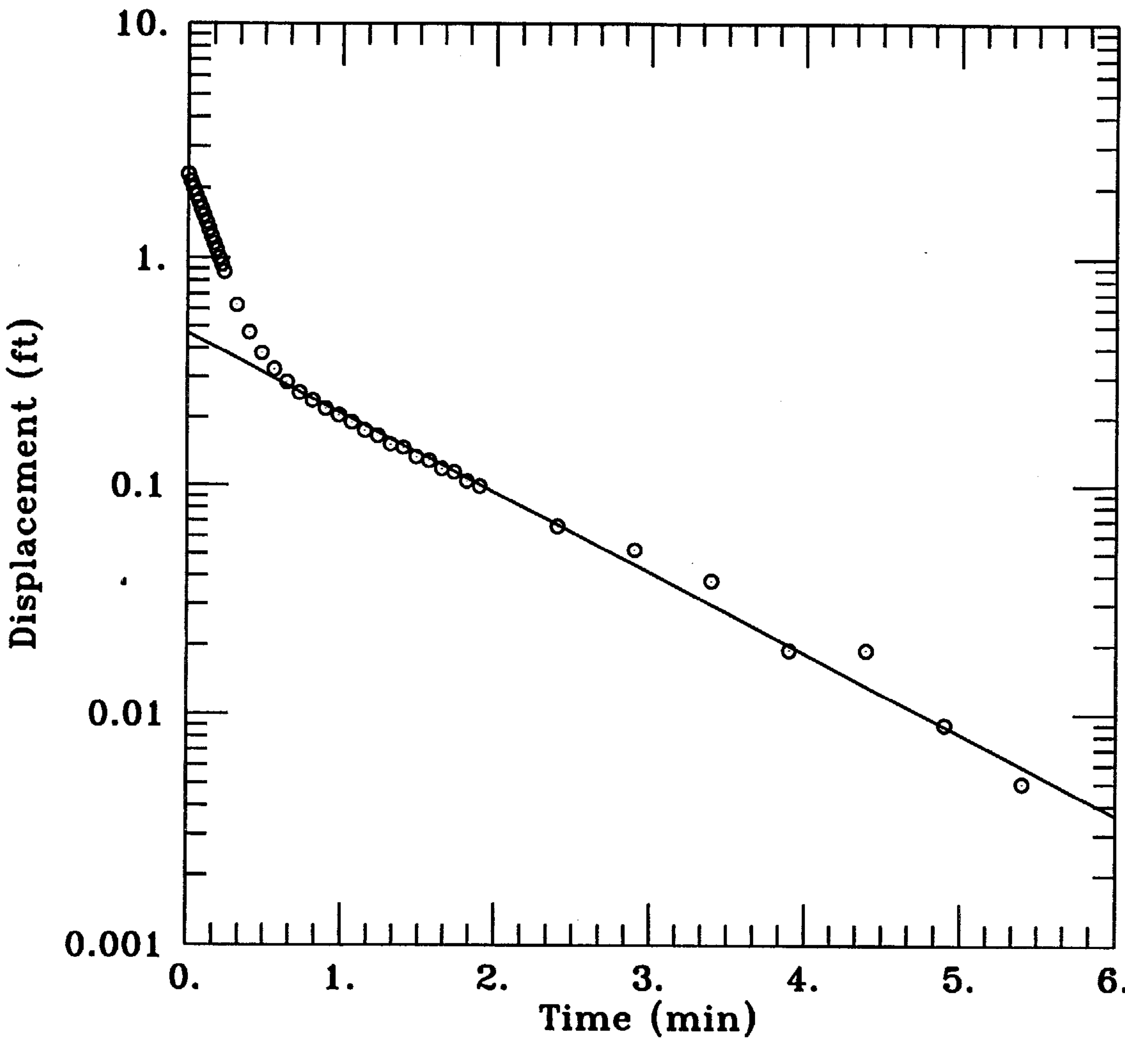
TEST DATA:
H0 = 2.223 ft
rc = 0.0833 ft
rw = 0.33 ft
L = 15. ft
b = 30. ft
H = 13.69 ft

PARAMETER ESTIMATES:
K = 1.341 ft/day
y0 = 0.7107 ft

AQTESOLV

Client: LANTDIV	Company: BAKER ENVIRONMENTAL, INC.
Location: SITE 36, CAMP LEJEUNE	Project: CTO-303

36-GW11 RISING HEAD TEST



DATA SET:
36GW11R.DAT
05/26/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: APRIL 5, 1995

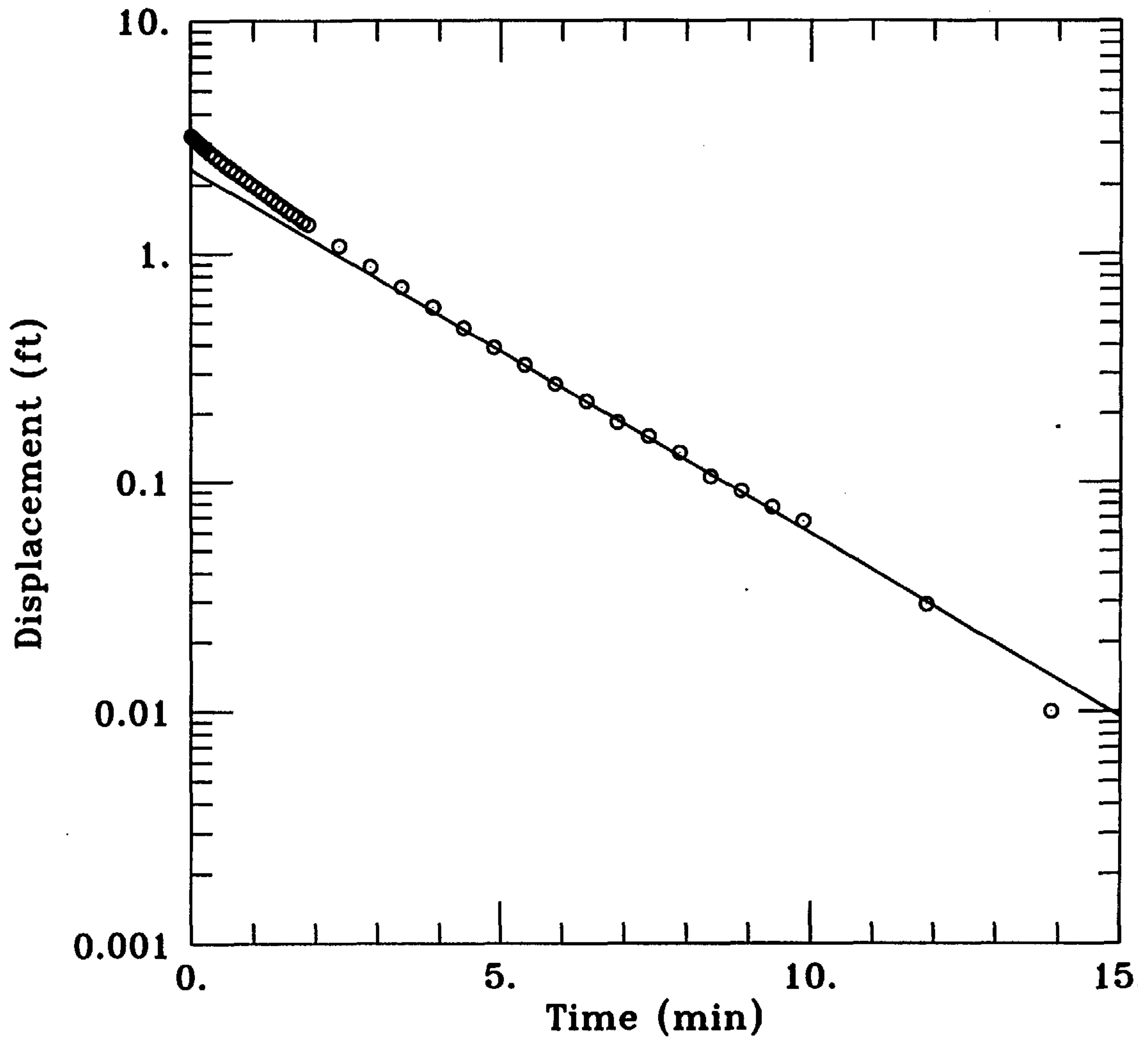
TEST DATA:
H0 = 2.273 ft
rc = 0.0833 ft
rw = 0.33 ft
L = 15. ft
b = 30. ft
H = 10.36 ft

PARAMETER ESTIMATES:
K = 3.422 ft/day
y0 = 0.4677 ft

AQTESOLV

Client: LANTDIV	Company: BAKER ENVIRONMENTAL, INC.
Location: SITE 36, CAMP LEJEUNE	Project: CTO-303

36-GW11DW RISING HEAD TEST



DATA SET:
36GW11DR.DAT
05/26/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: APRIL 5, 1995

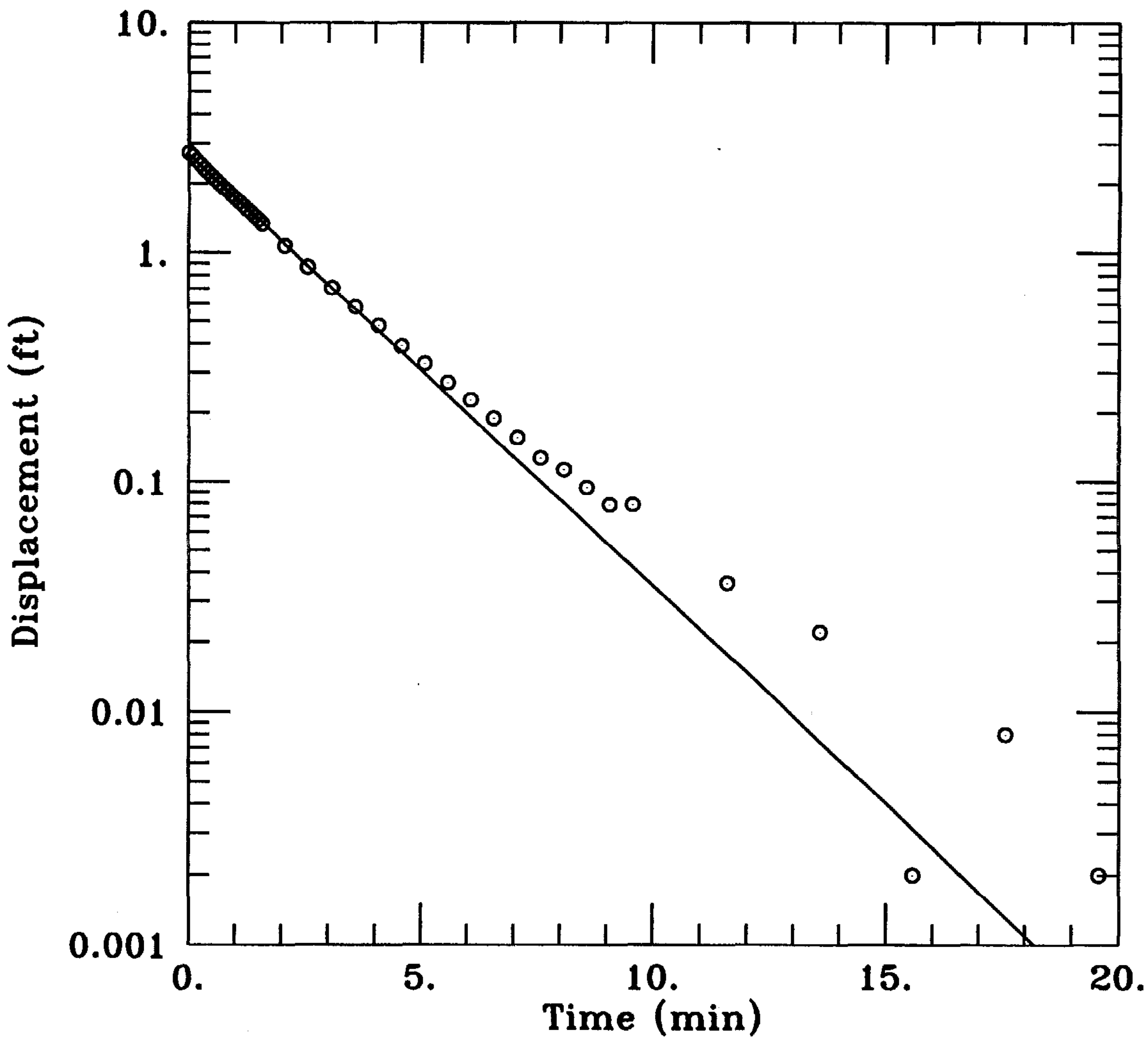
TEST DATA:
H0 = 3.212 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 5. ft
b = 160. ft
H = 58.11 ft

PARAMETER ESTIMATES:
K = 3.038 ft/day
y0 = 2.327 ft

AQTESOLV

Client: **LANTDIV**	Company: **BAKER ENVIRONMENTAL, INC.**
Location: **SITE 36, CAMP LEJEUNE**	Project: **CTO-303**

36-GW11DW FALLING HEAD TEST



DATA SET:
36GW11DF.DAT
05/26/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: APRIL 5, 1995

TEST DATA:
H0 = 2.725 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 5. ft
b = 160. ft
H = 58.11 ft

PARAMETER ESTIMATES:
K = 3.588 ft/day
y0 = 2.672 ft

AQTESOLV

APPENDIX O
AQUIFER PROPERTY CALCULATIONS

S.O. No. 62470-303

Subject: GROUNDWATER FLOW GRADIENT SITE 36

Sheet No. 1 of 1

Drawing No.

Computed by MKO Checked By

Date JAN 10, 1996

Baker

EQUATION - $i = \Delta E / D$ WHERE: ΔE = CHANGE IN GROUNDWATER ELEVATION

D = DISTANCE OVER WHICH CHANGE OCCURS

SHALLOW WELLS

- BETWEEN 36-GW06 & 36-GW14

$\Delta E = 2.0$ ft $\quad i = 2.0$ ft / 100 ft

$D = 100$ ft $\quad = 0.02$ ft/ft

- BETWEEN WELLS 36-GW09 & 36-GW15

$\Delta E = 1.5$ ft $\quad i = 1.5$ ft / 290 ft

$D = 290$ ft $\quad \approx 0.005$

- IN VICINITY OF 36-GW07

$\Delta E = 1.0$ ft $\quad i = 1.0$ ft / 230 ft

$D = 230$ ft $\quad \approx 0.004$ ft/ft

- BETWEEN 36-GW10 & 36-GW12

$\Delta E = 0.14$ ft $\quad i = 0.14$ ft / 330 ft

$D = 330$ ft $\quad \approx 0.0004$ ft/ft

DEEP WELLS

$\Delta E = 1.0$ ft $\quad i = 1.0$ ft / 340 ft

$D = 340$ ft $\quad \approx 0.003$ ft/ft

S.O. No. 62470-303

Subject: GROUNDWATER FLOW VELOCITY CALCULATIONS

SITE 36

Sheet No. 1 of 2

Drawing No. N/A

Computed by MKD Checked By ______ Date Nov. 30, 1995

Baker

$V = Ki / n_e$ WHERE V = VELOCITY

K = HYDRAULIC CONDUCTIVITY

i = GRADIENT

n_e = EFFECTIVE POROSITY

36-GW06

$K = 0.6$ ft/day

$i = 0.02$ ft/ft

n_e = ASSUME 0.30

$V = (0.6 \text{ ft/day}) \times (0.02 \text{ ft/ft}) / 0.30$

≈ 0.04 ft/day

36-GW07

$K = 4.2$ ft/day

$i = 0.004$ ft/ft

n_e = ASSUME 0.30

$V = (4.2 \text{ ft/day}) \times (0.004 \text{ ft/ft}) / 0.30$

≈ 0.06 ft/day

36-GW09

$K = 1.3$ ft/day

$i = 0.005$ ft/ft

n_e = ASSUME 0.30

$V = (1.3 \text{ ft/day}) \times (0.005 \text{ ft/ft}) / 0.30$

≈ 0.02 ft/day

36-GW11

$K = 3.4$ ft/day

$i = 0.005$ ft/ft

n_e = ASSUME 0.30

$V = (3.4 \text{ ft/day}) \times (0.005 \text{ ft/ft}) / 0.30$

≈ 0.06 ft/day

S.O. No.

Subject: SITE 36 CONTINUED

Sheet No. 2 of 2

Drawing No.

Computed by Checked By Date

Baker

36-GW06DW

$K = 6.3$ ft/day

$i = 0.003$ ft/ft

n_e = ASSUME 0.30

$V = (6.3 \text{ ft/day}) \times (0.003 \text{ ft/ft}) / 0.30$

$\simeq 0.06$ ft/day

36-GW07DW

$K = 7.8$ ft/day

$i = 0.003$ ft/ft

n_e = ASSUME 0.30

$V = (7.8 \text{ ft/day}) \times (0.003 \text{ ft/ft}) / 0.30$

$\simeq 0.08$ ft/day

36-GW11DW

$K = 3.0$ ft/day

$i = 0.003$ ft/ft

n_e = ASSUME 0.30

$V = (3.0 \text{ ft/day}) \times (0.003 \text{ ft/ft}) / 0.30$

$\simeq 0.03$ ft/day

NOTE: "i" WAS DETERMINED BY CONTOUR SPACING AROUND A GIVEN WELL.

S.O. No. 62470-303

Subject: VERTICAL FLOW GRADIENT CALCULATIONS SITE 36

Sheet No. 1 of 1

Drawing No.

Computed by MKD Checked By Date DEC 29, 1995

Baker

VERTICAL GRADIENT $i_v = \Delta SWE^{(1)} /$ CONFINING UNIT THICKNESS

WELL	SWE(2)	Δ SWE	CONFINING UNIT AVG THICK.	i_v
36-GW06	10.47	3.53	20 ft	0.18 ft/ft
36-GW06DW	6.94			
36-GW07	6.13	0.18	20	0.009 ft/ft
36-GW07 DW	6.31			
36-GW10	1.53	0.53	20	0.03 ft/ft
36-GW10 DW	2.09			
36-GW11	1.89	0.01	20	0.0005 ft/ft
36-GW11 DW	1.90			

NOTES: (1) Δ SWE = CHANGE IN STATIC WATER ELEVATION (FT ABOVE MSL)
(2) SWE = STATIC WATER ELEVATION (FT ABOVE MSL)

RETARDATION ESTIMATES
SITE 36
REMEDIAL INVESTIGATION CTO-0303

Equation: $R=1+(Pb/n)x(Kd)$ Where: Pb=Bulk density (Dry)
n=porosity
Kd=Distribution coefficient
(Koc x TOC Fraction)

Distribution Coefficient Estimates

Solute	Koc(1) (mL/g)	TOC(2) (%)	Kd
1,2-Dichloroethene (total)	49	0.0043	0.2107
Trichloroethene	126	0.0043	0.5418
Tetrachloroethene	364	0.0043	1.5652
1,1,2,2-Tetrachloroethane	118	0.0043	0.5074

Retardation Factor Estimates

Solute	Pb(3) (g/mL)	n(4) (%)	Kd	R
1,2-Dichloroethene (cis)	1.0	0.3	0.2107	1.70
Trichloroethene	1.0	0.3	0.5418	2.81
Tetrachloroethene	1.0	0.3	1.5652	6.22
1,1,2,2-Tetrachloroethane	1.0	0.3	0.5074	2.69

NOTES: (1) Koc values taken from Table 5-1
(2) TOC data average of 4,263 (0.43%), from:

9-AST-SB19	3,600	mg/Kg
78-B903-SB03-02	5,200	mg/Kg
65-SB06	3,290	mg/Kg
35-MW21S-02	4,960	mg/Kg

(3) Bulk Density of Baymeade soil estimated from USDA-SCS "Soil Survey Camp Lejeune, NC", 1984.
(4) A porosity of 30%, based on a silty fine sand - taken from Fetter, 1988.

APPENDIX P
BASE BACKGROUND ANALYTICAL RESULTS AND EVALUATION REPORT

This appendix provides background concentration values for inorganic elements in the following media: surface and subsurface soils, groundwater, surface water, and sediment. These background samples were collected in areas not known to have been impacted by site operations and have been collected during Baker Remedial Investigations since 1993. The following information regarding base background samples is provided in the back of each media section:

- minimum concentration per inorganic analyte
- maximum concentration per inorganic analyte
- average concentration per inorganic analyte
- twice the average concentration per inorganic analyte (soils only).

The minimum and maximum concentrations are used for comparison bases only. Whereas twice the average concentration is used to compare the inorganic analytical results from on-site soil samples to what is considered to be naturally occurring by USEPA Region IV.

SOIL

BASE BACKGROUND
SURFACE SOILS
TAL INORGANICS
MCB CAMP LEJEUNE, NORTH CAROLINA

	6-201N-SB11-00	6-201N-SB12-00	6-201C-SB38-00	6-201C-SB39-00	78-BB-SB-00	41-BB-SB01-00	41-BB-SB02-00
Aluminum	1120	45.25	748	245	1490	528	1430
Antimony	4.7	4.8	1.4	1.3	0.33	2.07	0.865
Arsenic	0.28	0.29	0.91	0.28	0.22	0.356	0.317
Barium	2	2.05	16.5	3.5	8.6	1.525	4.06
Beryllium	0.095	0.1	0.03	0.03	0.11	0.1	0.09
Cadmium	0.285	0.295	0.58	0.175	0.55	0.392	0.349
Calcium	178	108	10700	402	941	18.3	54.6
Chromium	0.475	0.49	1.6	0.33	2.2	1.02	0.91
Cobalt	0.85	0.9	0.195	0.185	1.8	1.965	1.75
Copper	0.55	0.6	3.1	0.75	2	2	87.2
Iron	525	160	684	238	1020	83	970
Lead	2	3	62.9	25.1	20.4	2.59	10.9
Magnesium	11.65	10.1	200	26	118	8.85	39.1
Manganese	3.1	1	16	4.5	11.1	0.87	10.2
Mercury	0.01	0.01	0.05	0.06	0.05	0.0305	0.078
Nickel	1.6	1.65	0.8	0.75	2.2	3.55	3.15
Potassium	36.55	37.5	54.5	30.6	102	91.5	81.5
Selenium	0.47	0.485	0.5	0.465	0.31	0.311	0.277
Silver	0.95	1	0.195	0.185	0.33	0.1965	0.175
Sodium	19.65	15.85	14	4.7	67.5	44.1	39.3
Thallium	0.19	0.195	0.205	0.185	0.11	0.565	0.505
Vanadium	1.05	0.8	2.8	1.6	5.3	2.505	2.23
Zinc	0.55	0.8	23.1	4.6	28.3	2.66	6.11
Cyanide					0.265	1.23	1.09

Concentrations are in millograms per kilogram (mg/kg).
Qualifiers have been removed per Baker's standards.
Qualifiers R, U, and UJ have been given one-half the detection value.
Qualifiers J, NJ, and B have been removed with no detection value change.

BASE BACKGROUND
SURFACE SOILS
TAL INORGANICS
MCB CAMP LEJEUNE, NORTH CAROLINA

	41-BB-SB03-00	41-BB-SB04-00	69-BB-SB01-00	69-BB-SB02-00	69-BB-SB03-00	69-BB-SB04-00	74-BB-SB01-00
Aluminum	2100	5370	1310	4150	9570	5360	3110
Antimony	0.87	0.94	0.85	0.95	0.95	0.95	0.905
Arsenic	0.3205	0.345	0.31	0.345	0.79	0.35	0.3325
Barium	4.53	13.4	5.6	15.4	19.6	20.8	11.1
Beryllium	0.09	0.095	0.14	0.155	0.155	0.155	0.148
Cadmium	0.3525	0.38	0.26	0.285	0.29	0.29	0.2695
Calcium	79.2	46.3	28.2	43.6	282	53	181
Chromium	2.64	3.24	0.75	4	12.5	5.8	0.84
Cobalt	1.77	1.905	2.1	2.3	2.35	2.35	2.225
Copper	1.8	1.94	1.75	1.9	1.95	1.95	4.56
Iron	1120	2160	425	1430	9640	3890	1740
Lead	9.98	6.61	2.8	6	5.3	5.6	5.19
Magnesium	74	144	37.3	91.8	610	247	70
Manganese	11.6	11.8	15.1	12.7	12.3	8.3	9.44
Mercury	0.057	0.08	0.015	0.06	0.045	0.025	0.04
Nickel	3.2	3.45	2.9	1.6	1.65	1.65	1.56
Potassium	190	177	32.25	35.5	361	106	87.5
Selenium	0.2795	0.301	0.27	0.295	0.3	0.3	0.29
Silver	0.177	0.1905	0.045	0.045	4.3	0.39	0.046
Sodium	39.65	42.75	20	22	22.4	22.3	70.4
Thallium	0.51	0.55	0.495	0.55	0.55	0.55	0.53
Vanadium	2.255	2.43	1.8	1.95	13.5	5.6	5.21
Zinc	5.97	7.15	3.1	5.2	10.8	7.9	1.27
Cyanide	1.1	1.19	2.2	2.4	2.4	2.4	1.15

Concentrations are in millograms per kilogram (mg/kg).
Qualifiers have been removed per Baker's standards.
Qualifiers R, U, and UJ have been given one-half the detection value.
Qualifiers J, NJ, and B have been removed with no detection value change.

BASE BACKGROUND
SURFACE SOILS
TAL INORGANICS
MCB CAMP LEJEUNE, NORTH CAROLINA

	74-BB-SB02-00	74-BB-SB03-00	74-BB-SB04-00	1-BB-SB38-00	1-BB-SB39-00	1-GW13-00	28-BB-SB37-00	28-BB-SB38-00
Aluminum	1730	1000	2100	3920	4930	1600	2840	379
Antimony	0.925	0.855	0.96	3.6	3.15	8.0	3.55	2.9
Arsenic	0.339	0.314	0.352	0.315	0.28	0.29	0.31	0.255
Barium	1.6	3.12	16	9.6	9.3	2.8	5.1	1.8
Beryllium	0.151	0.14	0.1565	0.105	0.10	0.095	0.105	0.085
Cadmium	0.275	0.2545	0.285	0.315	0.28	0.285	0.31	0.255
Calcium	46.9	43.9	377	538	353	248	114	13.10
Chromium	2.7	0.795	1.98	3.5	4.7	4.1	2.0	0.60
Cobalt	2.27	2.1	2.355	0.42	0.375	0.38	0.415	0.34
Copper	3.92	1.755	1.965	1.6	0.6	1.9	0.6	0.50
Iron	401	787	1640	2270	1470	1000	1210	444
Lead	3.79	1.14	142	5.9	4.5	4.2	2.8	1.7
Magnesium	37.5	16.1	52.5	152	183	47.2	68.8	12.9
Manganese	3.13	7.37	4.61	10.6	4.2	5.9	2.7	3.3
Mercury	0.048	0.0305	0.05	0.03	0.025	0.03	0.025	0.025
Nickel	1.59	1.475	1.65	0.8	0.65	0.65	0.750	0.6
Potassium	89	82.5	92.5	149	153	20.650	29.75	8.35
Selenium	0.296	0.274	0.307	0.42	0.375	0.38	0.415	0.34
Silver	0.047	0.0435	0.0485	0.5	0.465	0.475	0.5	0.425
Sodium	71.8	87.6	122	11.0	17.2	7.25	28.5	18.2
Thallium	0.54	0.4985	0.56	0.42	0.38	0.38	0.415	0.34
Vanadium	1.94	1.8	4.69	7.9	6.1	3.5	3.6	2.1
Zinc	1.15	1.97	2.87	7.2	4.0	1.4	0.9	0.71
Cyanide	1.17	1.08	1.21					

Concentrations are in millograms per kilogram (mg/kg).
Qualifiers have been removed per Baker's standards.
Qualifiers R, U, and UJ have been given one-half the detection value.
Qualifiers J, NJ, and B have been removed with no detection value change.

BASE BACKGROUND
SURFACE SOILS
TAL INORGANICS
MCB CAMP LEJEUNE, NORTH CAROLINA

	28-GW09DW-00	30-BB-SB12-00	30-BB-SB13-00	30-BB-SB14-00	30-BB-SB15-00	30-BB-SB16-00	30-GW03-00	35-SS01-00
Aluminum	5460	54.6	24.9	49.2	37.5	196	17.7	2220.0
Antimony	3.35	3.2	3.2	3.3	3.5	3.650	3.9	2.45
Arsenic	1.8	0.28	0.29	0.29	0.31	0.325	0.34	0.065
Barium	11.6	1.8	0.7	0.7	0.7	3.100	0.8	15.6
Beryllium	0.10	0.095	0.10	0.10	0.10	0.110	0.12	0.11
Cadmium	0.295	0.28	0.29	0.29	0.31	0.325	0.34	0.04
Calcium	368	11.45	4.3	9.9	9.0	172	5.2	605.0
Chromium	6.0	1.6	0.7	1.9	0.7	0.75	0.8	1.9
Cobalt	0.91	0.375	0.38	0.38	0.41	0.43	0.45	0.60
Copper	2.9	0.55	0.6	0.6	0.6	0.65	0.7	3.9
Iron	2250	276	102	218	69.7	167	80.4	1250.0
Lead	11.6	3.3	0.47	2.4	0.73	4.4	0.86	3.60
Magnesium	157	6.5	2.6	2.6	2.8	37.1	3.1	71.6
Manganese	4.1	11.9	4.4	9.5	1.3	2.5	2.3	5.5
Mercury	0.025	0.06	0.02	0.03	0.05	0.03	0.03	0.065
Nickel	1.9	0.65	0.7	0.7	1.7	0.9	0.8	1.3
Potassium	158	8.25	11.1	3.8	1.0	29.6	1.2	129.5
Selenium	0.94	0.375	0.38	0.38	0.41	0.43	0.45	0.075
Silver	0.49	0.47	0.47	0.48	0.5	0.6	0.6	0.16
Sodium	15.0	14.8	26.0	4.9	5.2	18.2	5.8	126.00
Thallium	0.395	0.375	0.38	0.38	0.41	0.43	0.45	0.06
Vanadium	8.3	1.7	0.75	1.7	0.31	0.76	0.34	3.60
Zinc	6.6	0.35	0.30	0.48	1.7	2.0	1.2	7.4
Cyanide								

Concentrations are in milligrams per kilogram (mg/kg).
Qualifiers have been removed per Baker's standards.
Qualifiers R, U, and UJ have been given one-half the detection value.
Qualifiers J, NJ, and B have been removed with no detection value change.

BASE BACKGROUND
SURFACE SOILS
TAL INORGANICS
MCB CAMP LEJEUNE, NORTH CAROLINA

	BB-SB02-00	BB-SB03-00	16-BB-SB01-00	16-BB-SB02-00	16-BB-SB03-00	80-BB-SB01-00	80-BB-SB02-00	80-BB-SB03-00
Aluminum	3630.0	1950.0	1710.0	3630	1950	2240.0	7770.0	2850.0
Antimony	5.00	5.55	5.05	5	5.55	1.35	1.40	1.40
Arsenic	1.000	1.100	1.000	1	1.1	0.250	3.200	0.265
Barium	7.4	7.0	4.1	7.4	7	9.9	13.0	11.6
Beryllium	0.10	0.11	0.23	0.1	0.11	0.020	0.10	0.06
Cadmium	0.50	0.55	1.00	0:5	0.55	0.165	0.175	0.175
Calcium	113.0	227.0	96.8	113	227	505	997.0	239.0
Chromium	3.3	2.5	1.0	3.3	2.5	1.200	10.0	2.0
Cobalt	1.00	1.10	1.00	1	1.1	0.205	1.30	0.45
Copper	1.0	1.1	1.0	1	1.1	1.3	2.2	0.92
Iron	2150.0	1610.0	1260.0	2150	1610	604.0	5550.0	1450.0
Lead	5.20	10.20	7.40	5.2	10.2	7.5	8.90	8.30
Magnesium	99.1	69.4	42.9	99.1	69.4	94.8	289.0	94.2
Manganese	7.4	5.5	6.9	7.4	5.5	66.0	30.7	12.8
Mercury	0.055	0.055	0.055	0.055	0.055	0.050	0.050	0.060
Nickel	2.0	2.25	2.00	2	2.25	1.4	2.70	1.40
Potassium	1.0	111.5	101.0	100	111.5	163.0	416.0	90.9
Selenium	0.500	0.550	0.500	0.5	0.55	0.285	0.300	0.300
Silver	0.50	0.55	0.50	0.5	0.55	0.220	0.23	0.23
Sodium	25.20	26.20	35.90	25.2	26.2	24.1	77.10	72.70
Thallium	1.00	1.10	1.00	1	1.1	0.435	0.46	0.465
Vanadium	5.40	3.10	4.50	5.4	3.1	2.3	14.70	4.30
Zinc	8.7	22.1	9.2	4.35	22.1	6.1	12.9	3.5
Cyanide								

Concentrations are in millograms per kilogram (mg/kg).
Qualifiers have been removed per Baker's standards.
Qualifiers R, U, and UJ have been given one-half the detection value.
Qualifiers J, NJ, and B have been removed with no detection value change.

BASE BACKGROUND
SURFACE SOILS
TAL INORGANICS
MCB CAMP LEJEUNE, NORTH CAROLINA

	7-BB-SB01-00	7-BB-SB02-00	7-BB-SB03-00	36-BB-SB01-00	36-BB-SB02-00	36-BB-SB03-00	43-BB-SB01-00	43-BB-SB02-00
Aluminum	7180.0	3770.0	5800.0	6950	2300	2380	3520	2510
Antimony	6.05	5.50	5.60	1.15	1.2	1.75	2.35	2.3
Arsenic	1.200	1.100	3.900	0.42	0.205	0.17	0.51	0.55
Barium	12.0	10.2	9.7	13.2	12.4	14	6.3	10.8
Beryllium	0.26	0.11	0.11	0.03	0.035	0.075	0.105	0.1
Cadmium	0.600	0.550	0.550	0.31	0.3	0.235	0.335	0.31
Calcium	397.0	69.5	615.0	462	897	1690	1180	908
Chromium	8.4	3.8	10.6	7.9	2.7	3.1	2.8	2.8
Cobalt	1.20	1.10	1.10	0.245	0.255	0.255	0.345	0.335
Copper	1.20	1.10	2.30	2.8	2.8	4.9	0.7	11.2
Iron	3050.0	2170.0	7510.0	6670	1750	1560	1050	2050
Lead	7.10	6.40	8.70	10.3	17.5	39.6	6.6	13.6
Magnesium	104.0	50.5	79.5	185	105	86	68.9	56.4
Manganese	3.25	3.1	1.8	6.9	14.3	21.4	3	5
Mercury	0.060	0.060	0.060	0.045	0.05	0.045	0.13	0.12
Nickel	2.40	2.20	2.25	0.45	1.6	0.9	1.25	1.2
Potassium	121.0	110.0	111.5	138	60.2	58	78.5	76
Selenium	0.600	0.550	1.300	0.12	0.16	0.135	0.195	0.17
Silver	0.60	0.55	0.55	0.265	0.275	0.255	0.345	0.335
Sodium	15.80	15.25	17.30	13.1	14.1	14.05	14.45	9.9
Thallium	1.200	1.100	1.100	0.055	0.075	0.1	0.12	0.105
Vanadium	9.70	5.40	18.20	15.4	8.3	6.4	1.6	3.7
Zinc	5.3	2.9	3.8	6	12.7	20.8	2.6	16.7
Cyanide								

Concentrations are in millograms per kilogram (mg/kg).
Qualifiers have been removed per Baker's standards.
Qualifiers R, U, and UJ have been given one-half the detection value.
Qualifiers J, NJ, and B have been removed with no detection value change.

BASE BACKGROUND
SURFACE SOILS
TAL INORGANICS
MCB CAMP LEJEUNE, NORTH CAROLINA

	43-BB-SB03-00	44-BB-SB01-00	54-BB-SB01-00	54-BB-SB02-00	86-BB-SB01-00	MIN	MAX	AVG	2Xaverage
Aluminum	2730	4950	8990	4950	6590	17.7	9570	2970.297	5940.594
Antimony	2.2	1.2	1.25	1.3	1.95	0.33	8	2.672	5.344
Arsenic	0.67	1.3	1.1	1.2	0.45	0.065	3.9	0.652	1.305
Barium	13	14.9	18.7	13.3	13.9	0.65	20.8	8.680	17.360
Beryllium	0.095	0.08	0.0345	0.0375	0.085	0.02	0.26	0.103	0.205
Cadmium	0.3	0.325	0.335	0.34	0.265	0.04	1	0.344	0.688
Calcium	1610	668	1020	3590	3960	4.25	10700	698.394	1396.788
Chromium	2.9	5.9	9.2	6.8	6.5	0.33	12.5	3.346	6.693
Cobalt	0.32	0.43	0.375	0.41	0.285	0.185	2.355	0.961	1.923
Copper	0.75	2.5	2.1	4.2	2.2	0.5	87.2	3.600	7.200
Iron	1110	3220	4700	2780	4030	69.7	9640	1877.531	3755.063
Lead	13.8	19.6	3.95	12.3	21.5	0.47	142	11.875	23.749
Magnesium	60.5	189	371	259	233	2.55	610	102.875	205.751
Manganese	6.5	6.7	14.8	19.9	11.5	0.87	66	9.248	18.497
Mercury	0.05	0.06	0.041	0.04	0.04	0.01	0.13	0.047	0.094
Nickel	1.15	1.7	1.3	1.6	7.2	0.45	7.2	1.717	3.434
Potassium	73.5	220	223	175	160	1	416	99.805	199.610
Selenium	0.185	0.34	0.145	0.13	0.43	0.075	1.3	0.373	0.746
Silver	0.32	0.28	0.285	0.295	0.285	0.0435	4.3	0.438	0.875
Sodium	12.7	12.75	8.3	9.55	18.3	4.7	126	29.649	59.298
Thallium	0.11	0.065	0.065	0.06	0.13	0.055	1.2	0.450	0.899
Vanadium	4	11.8	13.4	9.1	48.6	0.305	48.6	5.814	11.628
Zinc	4.5	7.4	7.2	9.1	18.4	0.3	28.3	6.940	13.880
Cyanide						0.265	2.4	1.453	2.905

Concentrations are in millograms per kilogram (mg/kg).
Qualifiers have been removed per Baker's standards.
Qualifiers R, U, and UJ have been given one-half the detection value.
Qualifiers J, NJ, and B have been removed with no detection value change.

BASE BACKGROUND
SUBSURFACE SOIL
TAL INORGANICS
MCB CAMP LEJEUNE, NORTH CAROLINA

	6-201N-SB11-07	6-201N-SB12-02	6-201C-SB38-01	6-201C-SB39-04	78-BB-SB-01	2-GW09-01	1-BB-SB38-05	1-BB-SB39-04	1-BB-SB39-06	1-GW13-04
Aluminum	672	857	3620	2970	10200	8520	4580	6180	5980	4160
Antimony	4.7	4.85	1.4	1.25	0.355	1.6	4.2	3.25	2.95	6.9
Arsenic	0.31	0.315	0.033	0.305	0.24	0.47	1.1	0.29	0.26	0.285
Barium	2	2.05	7.6	6.5	10.9	6.6	7.5	11.800	8.600	7.500
Beryllium	0.095	0.1	0.03	0.025	0.12	0.23	0.125	0.095	0.085	0.095
Cadmium	0.285	0.295	0.57	0.17	0.6	1.2	0.370	0.290	0.260	0.285
Calcium	5.35	5.4	4410	12.1	81.3	10.6	35.600	12.250	19.700	52.400
Chromium	1.6	1.85	6	2.2	5.7	8.7	10.5	5.5	5.3	7.1
Cobalt	0.65	0.9	0.235	0.175	0.95	1.9	0.495	0.385	0.350	0.380
Copper	0.475	0.6	1.7	0.65	0.95	0.47	6.6	0.6	0.5	2.1
Iron	257	126	456	833	822	2840	4940	1510	1210	567
Lead	1.2	1.6	11.5	2.7	6.1	4.3	5.1	3.8	3.1	3.3
Magnesium	13.1	12.7	133	86.8	188	260	222	189	217	131
Manganese	0.475	0.395	7.5	2.6	2.4	5.2	4.1	4.9	5.4	2.0
Mercury	0.01	0.01	0.04	0.015	0.045	0.11	0.025	0.025	0.020	0.050
Nickel	1.6	1.7	0.8	0.7	2.4	4.7	0.850	2.300	0.600	0.650
Potassium	48.9	40.8	84.7	187	123	184	409	191	268	98
Selenium	0.5	0.5	0.55	0.5	0.29	0.115	0.495	0.385	0.350	0.380
Silver	0.95	1	0.195	0.175	0.355	0.7	0.600	0.480	0.435	0.475
Sodium	12.7	12.15	13.25	7.25	44.9	31.5	12.850	21.6	9.2	9.6
Thallium	0.205	0.21	0.22	0.2	0.12	0.23	0.495	0.385	0.350	0.380
Vanadium	0.75	1	3	4.7	7.4	13.4	12.200	6.500	6.100	3.500
Zinc	0.475	0.395	11.6	0.9	2.1	1.4	4.700	2.900	2.400	1.000

BASE BACKGROUND
SUBSURFACE SOIL
TAL INORGANICS
MCB CAMP LEJEUNE, NORTH CAROLINA

	1-GW13-08	28-BB-SB37-03	28-BB-SB38-04	28-GW09DW-01	30-BB-SB12-03	30-BB-SB13-01	30-BB-SB14-01	30-BB-SB15-01	30-BB-SB16-02	30-GW03-01
Aluminum	6600	5170	2830	5730	2970	17.1	25.7	42.6	777	16.9
Antimony	3.2	3.55	3.55	3.75	3.9	3.1	3.6	3.6	3.4	3.9
Arsenic	0.280	0.315	0.315	1.500	0.34	0.28	0.32	0.32	0.30	0.34
Barium	8.400	9.700	5.000	11.700	0.8	0.7	0.8	0.8	3.5	0.8
Beryllium	0.095	0.105	0.105	0.110	0.12	0.09	0.11	0.11	0.10	0.12
Cadmium	0.280	0.315	0.315	0.330	0.34	0.28	0.32	0.32	0.30	0.34
Calcium	92.600	23.450	6.850	441.000	7.0	6.9	4.8	6.3	116	6.6
Chromium	8.3	7.3	3.4	4.7	3.9	0.7	0.8	0.8	0.7	0.8
Cobalt	0.375	0.42	0.42	0.93	0.45	0.37	0.42	0.43	0.40	0.46
Copper	1.6	0.65	0.65	0.65	0.7	0.6	0.7	0.7	0.6	0.7
Iron	959	2090	749	2780	908	95.9	155	63.3	514	74.5
Lead	4.0	4.1	2.3	7.4	0.7	0.47	1.9	0.91	3.2	0.59
Magnesium	262	153	66	157	24.7	7.5	2.9	2.9	30.2	3.1
Manganese	4.5	3.2	1.5	5.3	1.7	4.3	6.7	1.1	3.7	1.7
Mercury	0.025	0.025	0.025	0.025	0.03	0.03	0.08	0.25	0.03	0.68
Nickel	0.650	0.750	0.750	1	0.8	0.7	0.8	2.2	1.7	0.8
Potassium	308	122	91.3	136	13.2	6.3	1.1	21.3	21.9	1.2
Selenium	0.375	0.420	0.420	0.440	0.45	0.37	0.42	0.43	0.40	0.46
Silver	0.470	0.500	0.550	0.550	0.6	0.46	0.6	0.6	0.50	0.6
Sodium	10.9	33.8	28.6	20.3	12.5	11.1	19.3	5.4	14.4	5.8
Thallium	0.375	0.420	0.420	0.440	0.45	0.37	0.42	0.43	0.40	0.46
Vanadium	10.100	6.4	2.8	8.5	6.2	0.73	1.0	0.84	1.6	0.34
Zinc	2.700	1.9	1.0	4.2	0.35	0.32	0.39	1.2	1.7	1.3

BASE BACKGROUND
SUBSURFACE SOIL
TAL INORGANICS
MCB CAMP LEJEUNE, NORTH CAROLINA

	35-GWDS01-03	BB-SB02-07	BB-SB03-05	80-BB-SB01-06	80-SS-SB01-03	80-BB-SB2-03	80-BB-SB02-06	80-BB-SB03-03	80-BB-SB03-06	7-BB-SB01-05
Aluminum	2910	888	2330	11000	2520	5950	9600	9500	1060	1400
Antimony	2.750	5.000	5.600	6.200	1.300	1.350	1.650	3.500	1.300	5.150
Arsenic	0.12	1.00	1.10	15.40	0.245	1.60	4.70	1.80	0.24	1.05
Barium	5.5	1.6	3.8	22.3	4.5	9.9	13.5	10.9	4.3	16.1
Beryllium	0.06	0.10	0.11	0.31	0.01	0.04	0.20	0.09	0.01	0.105
Cadmium	0.30	0.50	0.55	0.205	0.16	0.165	0.205	0.16	0.155	0.50
Calcium	456.0	74.2	290.0	257.0	105.0	323.0	210.0	142.0	34.2	38.95
Chromium	2.2	2.4	4.2	66.4	2.1	10.0	22.0	12.0	2.9	5.0
Cobalt	0.65	1	1.1	7	0.42	0.71	1.40	0.75	0.20	1.05
Copper	0.550	1	1.1	9.5	0.670	1.6	4.4	2.2	0.630	1.05
Iron	442	1220	1870	90500	795	2920	12800	3350	557	571
Lead	8.1	2.4	3.8	21.4	2.9	5	11.7	7.8	5.4	3
Magnesium	63.5	35.7	115.0	852.0	76.0	282.0	455.0	357.0	50.7	30.6
Manganese	5.6	2.7	2.4	14.9	1.8	19.9	7.4	6.2	5.4	1.95
Mercury	0.03	0.055	0.06	0.07	0.045	0.055	0.07	0.045	0.045	0.055
Nickel	1.050	2	2.250	0.600	0.455	1.4	0.6	2.2	0.450	2.050
Potassium	145	100.5	228	1250	161	297	1020	458	130	103
Selenium	0.085	0.500	0.550	2.400	0.275	0.285	0.355	0.275	0.275	0.50
Silver	0.39	0.50	0.55	0.275	0.21	0.22	0.275	0.21	0.21	0.50
Sodium	141.0	20.6	28.2	124.0	63.4	25.5	47.1	73.2	18.3	16.85
Thallium	0.06	1.00	1.10	2.70	0.425	0.44	0.55	0.42	0.42	1.05
Vanadium	3.0	3.9	4.9	69.4	2.3	10.8	18.4	13.5	2.4	2.3
Zinc	2.6	8.7	4.9	26.6	2.0	3.5	8.1	4.8	1.7	3.1

BASE BACKGROUND
SUBSURFACE SOIL
TAL INORGANICS
MCB CAMP LEJEUNE, NORTH CAROLINA

	7-BB-SB02-05	7-BB-SB03-09	16-BB-SB01-07	16-BB-SB02-07	16-BB-SB03-05	36-BB-SB01-02	36-BB-SB02-02	36-BB-SB03-03	43-BB-SB01-02	43-BB-SB02-01
Aluminum	1700	581	1940	888	2330	4480	8700	3810	4320	959
Antimony	5.150	5.750	5.8	5	5.6	1.15	1.2	1.9	2.3	1.75
Arsenic	1.05	1.15	1.15	1	1.1	0.155	0.69	0.185	0.44	0.115
Barium	22.6	10.8	3.7	0.8	3.8	13.9	13.7	5.5	8.9	2.2
Beryllium	0.105	0.115	0.115	0.1	0.11	0.032	0.035	0.08	0.1	0.075
Cadmium	0.50	0.550	0.6	0.5	0.55	0.31	0.315	0.255	0.31	0.235
Calcium	41.55	32.15	135	74.2	290	116	225	48.2	76.9	77.6
Chromium	6.2	3.9	4.7	2.4	4.2	4.2	13.5	3.7	5.5	1.2
Cobalt	1.05	1.15	1.15	1	1.1	0.245	0.25	0.275	0.335	0.255
Copper	1.05	1.15	1.15	1	1.1	0.43	0.98	0.175	0.21	0.16
Iron	709	1620	1150	1220	1870	2690	4080	976	2370	414
Lead	1.8	1.1	2.9	2.4	3.8	5.4	6.6	4	6.1	1.6
Magnesium	44.1	12.25	104	35.7	115	78.6	292	110	121	17.9
Manganese	2.65	2.1	5	2.7	2.4	2.5	6.7	3.6	3	1.3
Mercury	0.050	0.060	0.06	0.055	0.06	0.06	0.06	0.045	0.045	0.05
Nickel	2.050	2.300	2.3	2	2.25	1	9.1	1	1.2	0.9
Potassium	102.5	114.5	116	100.5	228	91.3	222	62.5	76	57.5
Selenium	0.50	0.55	0.6	0.5	0.55	0.12	0.175	0.145	0.185	0.155
Silver	0.50	0.55	0.6	0.5	0.55	0.27	0.27	0.275	0.335	0.255
Sodium	13.6	15.65	29.8	10.3	28.2	11.3	25.6	6.1	36.65	4.2
Thallium	1.05	1.15	1.15	1	1.1	0.055	0.085	0.105	0.11	0.095
Vanadium	3.1	2.5	4	3.9	4.9	8.2	17	2.05	5.9	0.9
Zinc	2.1	3.15	15	4.35	2.45	0.82	2.6	0.89	2.3	0.76

BASE BACKGROUND
SUBSURFACE SOIL
TAL INORGANICS
MCB CAMP LEJEUNE, NORTH CAROLINA

	43-BB-SB03-02	44-BB-SB01-03	54-BB-SB01-04	54-BB-SB02-04	86-BB-SB01-02	MIN	MAX	AVG	2Xaverage
Aluminum	2260	10300	1100	1040	2460	16.900	11000.000	3687.651	7375.302
Antimony	2.25	1.15	1.25	1.25	2	0.355	6.900	3.205	6.409
Arsenic	0.31	1.2	0.16	0.195	0.22	0.033	15.400	0.984	1.968
Barium	9.1	12.5	1.15	1.05	4.4	0.650	22.600	7.102	14.204
Beryllium	0.1	0.065	0.06	0.0345	0.09	0.010	0.310	0.095	0.191
Cadmium	0.305	0.305	0.325	0.335	0.275	0.155	1.200	0.356	0.712
Calcium	295	20.9	24.6	14.7	50.8	4.750	4410.000	195.754	391.509
Chromium	2	11	1.15	1	3.1	0.650	66.400	6.281	12.562
Cobalt	0.33	0.495	0.26	0.305	0.29	0.175	7.000	0.752	1.504
Copper	0.265	0.86	0.45	0.46	0.185	0.160	9.500	1.208	2.416
Iron	507	4720	392	319	3160	63.300	90500.000	3626.038	7252.076
Lead	2.8	4.15	0.8	1.75	2.4	0.465	21.400	4.164	8.327
Magnesium	49.3	302	16.4	17.35	71.3	2.850	852.000	130.359	260.718
Manganese	2.5	3.9	0.5	0.6	1.8	0.395	19.900	3.959	7.919
Mercury	0.055	0.0425	0.11	0.05	0.055	0.010	0.680	0.065	0.130
Nickel	1.2	0.92	9.2	7.7	1.05	0.450	9.200	1.857	3.714
Potassium	75	207	29.9	14.45	66.5	1.050	1250.000	173.618	347.236
Selenium	0.17	0.155	0.145	0.17	0.175	0.085	2.400	0.401	0.801
Silver	0.33	0.26	0.28	0.29	0.29	0.175	1.000	0.433	0.866
Sodium	8.75	86.4	4.4	2.2	6.8	2.200	141.000	26.338	52.676
Thallium	0.105	0.07	0.065	0.08	0.13	0.055	2.700	0.477	0.955
Vanadium	1.7	17.1	0.85	0.8	1.85	0.340	69.400	6.727	13.454
Zinc	1.6	2.5	0.92	1.3	0.37	0.320	26.600	3.331	6.662

GROUNDWATER

DRAFT

EVALUATION OF METALS IN GROUNDWATER

MARINE CORPS BASE, CAMP LEJEUNE, NORTH CAROLINA

CONTRACT TASK ORDER 0177

JUNE 3, 1994

Prepared for:

DEPARTMENT OF THE NAVY
ATLANTIC DIVISION
NAVAL FACILITIES
ENGINEERING COMMAND
Norfolk, Virginia

Under the:

LANTDIV CLEAN Program
Contract N62470-89-D-4814

Prepared by:

BAKER ENVIRONMENTAL, INC.
Coraopolis, Pennsylvania

TABLE OF CONTENTS

1.0 INTRODUCTION

Numerous groundwater investigations have been conducted at Marine Corps Base (MCB), Camp Lejeune under the Department of the Navy (DON) Installation Restoration Program (IRP). These studies have identified elevated levels of total metals in shallow groundwater at almost every site. The degree of contamination, based on dissolved metals analysis of groundwater samples, is limited. It is believed that the presence of elevated metals are not always related to past disposal activities for several reasons, which is the basis of this study.

Currently, Records of Decision (ROD) are being prepared for Operable Units No. 1 (Sites 21, 24, and 78) and No. 5 (Site 2). Both RODs are proposing to not remediate shallow groundwater which contains elevated levels of total metals above State groundwater standards (i.e., North Carolina Water Quality Standards) and/or Federal drinking water standards (i.e., Maximum Contaminant Levels). Specifically, remediation of shallow groundwater due to elevated total metals is not cost effective, or practical, due to the following: (1) the shallow aquifer is not used for potable supply; (2) the source of metals in groundwater cannot be correlated with soil data or previous disposal practices; (3) the extent of shallow groundwater contamination (based on total metals analysis) is widespread and in many cases undefinable, since there are no apparent contaminant plumes or patterns associated with the metals; and (4) deep groundwater, which is the source of potable water, is not significantly contaminated with metals above the standards.

2.0 STUDY OBJECTIVES

The DON/Marine Corps initiated a study on inorganics in groundwater throughout MCB Camp Lejeune to assess whether total metals in groundwater are related to disposal practices or to other factors. The overall goal of this study is to provide information that would be used in consideration of not remediating shallow groundwater at Operable Units No. 1 and No. 5, and possibly other operable units where total metals are elevated without cause. The following study objectives were identified:

(1) Determine whether the elevated total metals detected in the shallow aquifer are related to past disposal practices, well construction factors, sampling techniques, or suspended particulates in the samples;

(2) Determine whether total metals in shallow groundwater are elevated throughout the region or MCB Camp Lejeune;

(3) Determine whether there is a correlation between elevated total metals in groundwater and metals in soil; and

(4) Determine whether the concentrations of total metals (i.e., low versus high) is related to shallow and deep aquifer characteristics.

3.0 SCOPE OF WORK

Groundwater and soil data from a total of 21 sites were compiled as part of the overall study. Three of the 21 sites are located outside the boundary of the base. These sites include the ABC Cleaners Superfund Site, located along Route 24 in Jacksonville, and two sites located along Highway 17 (Off-site Properties No. 1 and No. 2). The two sites along Route 17 were investigated by the DON/Marine Corps as part of a real estate survey. The other 18 sites are located throughout various portions of MCB Camp Lejeune (see Figure 1).

Information from studies conducted by Baker and other consultants were obtained to evaluate metal concentrations in groundwater. The study focused on 14 metals of potential concern to human health and the environment. Some of the information was collected under the IR Program whereas other information was obtained during other investigations (e.g., ABC Cleaners RI/FS). The following data tables were then prepared to determine why total metals are generally elevated in shallow groundwater.

Table 1 - Total Metal Concentrations in Shallow Groundwater by Site

Table 2 - Summary of Repeat Sampling of Shallow Wells (Sites 2 and 78)

Table 3 - Dissolved Metal Concentrations in Shallow Groundwater by Site

Table 4 - Summary of Total Metal Concentrations in Upgradient Wells

Table 5 - Comparison of Subsurface Metal Concentrations in Uncontaminated and Contaminated Wells

Table 6 - Total Metal Concentrations in Deep Groundwater by Site

Table 7 - Summary of Field Parameters in Shallow Monitoring Wells, Deep Monitoring Wells, and Supply Wells

The tables are presented at the end of this report.

4.0 DATA ANALYSIS

The following discussion represents an analysis of the information contained in each of the previously mentioned tables.

Table 1 (Total Metal Concentrations in Shallow Groundwater)

All of the sites had at least one (and in most cases several) metal which exceeded either State water quality standards or Federal drinking water standards. The most frequently detected metals included chromium, lead, and manganese, which were detected at almost every site above drinking water standards. Other frequently detected metals which exceeded drinking water standards included arsenic, beryllium, cadmium, and nickel.

An analysis of the data from Table 1 indicates that elevated total metals are present in shallow groundwater at every site, including the three sites which are located off base. The two sites which did not exhibit significant contamination include the ABC Cleaners site (only chromium exceeded the standards) and Site 48 (only manganese exceeded the standards).

Total metals detected in shallow groundwater at Site 2 exceeded State and/or Federal standards in seven of the 11 shallow monitoring wells. Manganese was the most frequently detected metal (7/11). Lead (3/11), chromium (2/11), and cadmium (1/11) were also detected above the standards,, but less frequently (see Figure 2).

With the exception of Wells 78GW03 and 78GW19, total metals were detected at Site 78 (Hadnot Point Industrial Area) above Federal MCLs or NCWQS in every shallow well (see Figure 3). The extent of elevated total metals in groundwater is widespread, encompassing approximately one square mile (or approximately 660 acres) in total area. The distribution and concentration of total metals in shallow groundwater makes it virtually impossible to identify or illustrate contaminant plumes (see Figure 3).

An analysis of the total metals results indicates the following pattern. Samples exhibiting elevated levels of lead, chromium, or other contaminants of concern, also exhibited elevated levels of other metals such as aluminum, antimony, iron, and zinc. Samples which did not exhibit elevated levels of lead, chromium, or manganese also did not exhibit elevated levels of other metals. This pattern indicates that the elevated total metals are not limited to one or two contaminants, which would be the case if a lead or chromium plume in the groundwater truly existed. In other words, if a site is impacted by a particular metal due to disposal activities (say chromium for example), then other metals such as aluminum, lead, or zinc should not be consistently elevated as in the case of samples collected from the shallow aquifer at MCB Camp Lejeune. This point is depicted in the data summary tables provided in Appendix A for Sites 2 and 78. These tables were taken from the Remedial Investigation Reports for Operable Units No. 1 and No. 5. As an example, note that sample numbers 78-MW08, 78-MW10, 78-MW11, and 78-MW12 all had elevated levels of total metals when compared to samples 78-MW09-2 and 78-MW09-3. It is clear that most of the metal concentrations in a particular sample follow a consistent pattern throughout.

Table 2 (Comparison of Repeat Sampling of Shallow Wells

Five wells from Sites 2 and 78 were randomly chosen to evaluate total metals concentrations between sampling rounds. The comparison was limited to only chromium, lead, and manganese since these contaminants were frequently detected throughout MCB Camp Lejeune. In several cases, metal concentrations were significantly different between the sampling rounds. If the shallow aquifer was impacted due to former disposal activities, a contaminant plume would be present and concentrations would not significantly deviate. The deviation in metal concentrations may indicate that sampling results are biased due to suspended particulates in the samples.

Table 3 (Dissolved Metal Concentration in Shallow Groundwater by Site)

The data base for Table 3 was limited to 12 sites since many of the previous investigations (i.e., prior to Navy CLEAN) did not analyze for dissolved metals. Nevertheless, an analysis of the 12 sites revealed that elevated levels of dissolved metals in groundwater is limited. Manganese was the most frequently detected metal above drinking water standards (10 of 12 sites exhibited elevated levels). Lead was detected at only one site (Site 21) above drinking water standards. Chromium was also detected at only one site (Site 78) above drinking water standards. No other metal was detected above the standards.

Literature searches have indicated that manganese is a naturally occurring metal in North Carolina. Therefore, the presence of manganese may not be attributable to site-related activities (Greenhorne & O'Mara, 1992).

An analysis of the data from Table 3 clearly shows a significant reduction in metal concentrations when compared to Table 1 (total metals in shallow groundwater). One possible reason for this reduction is that suspended solids or particles are not being introduced into the analysis of the sample due to filtering. A second possibility is that the metals are not significantly present in a dissolved state in shallow groundwater due to the species of metals under site conditions. It should be noted that calcium and sodium did not exhibit such a pattern since the salts of these metals are more soluble in water. For example, the concentrations of total calcium and total sodium versus dissolved calcium and dissolved sodium are similar and are not affected by the removal of the particulates during filtering. The fact that these salts do not exhibit the pattern that the other metals show supports the possibility that total metal concentrations are influenced by particulates in the sample.

Table 4 (Total Metals in Upgradient Shallow Wells)

The data base for Table 4 consists of groundwater results from 14 upgradient shallow monitoring wells (i.e., one well per site). These wells were installed to determine baseline groundwater quality to which on-site groundwater conditions could be compared. In some cases, the upgradient wells were located in areas where other base activities may have influenced groundwater quality.

The analysis of this data shows that manganese was the most frequently detected metal above Federal or State standards in upgradient shallow wells. Manganese was detected in 7 of the 14 upgradient wells above drinking water standards. Chromium and lead were also frequently detected above drinking water standards in upgradient (background) wells. These contaminants were detected in 6 of the 14 upgradient wells. At Site 2, samples collected from an upgradient well (2GW9) exhibited elevated levels of chromium (83µ/l), lead (27.2µ/l) and manganese (747µ/l). At Site 78, samples collected from upgradient wells 96W4 and 78GW26 did not exhibit elevated levels of total metals. The concentration range for metals detected above NC WQS and/of Federal MCLs in upgradient wells is provided below:

- beryllium (ND-46.5 µ/l)
- cadmium (ND-10 µ/l)
- chromium (ND-198 µ/l)
- lead (ND-78.8 µ/l)
- manganese (ND-747 µ/l)
- mercury (ND-1.6J µ/l)

Based on the above range representing upgradient wells, none of the on-site wells at Site 2 exhibited total metals above the maximum background concentrations. However, at Site 78, lead and chromium were detected above the maximum background in several on-site wells.

An analysis of the data from Table 4 indicates that shallow groundwater upgradient of some sites contains total metals above drinking water standards. A comparison of Table 4 data against Table 1 data indicates that shallow groundwater samples from upgradient wells are less contaminated than samples collected from on-site monitoring wells. However, it should be noted that the data base for Table 4 consists of only 14 wells whereas the data base for Table 1 consists of over 130 wells. Therefore, to assume that upgradient groundwater quality is better than on-site groundwater quality may not be justified due to the different data bases.

Table 5 (Comparison of Subsurface Metal Concentrations in Uncontaminated and Contaminated Wells)

The purpose of this table is to determine whether metal concentrations in soils correlate with the elevated levels of metals in shallow groundwater.

To evaluate this, metals in subsurface soils, representing an area of groundwater contamination, were compared to metals in subsurface soil in areas which did not exhibit groundwater contamination. If the elevated total metals in shallow groundwater are present due to former disposal activities, subsurface metals in soil representing an area of groundwater contamination would be expected to be elevated or higher than metals in subsurface soil representing a non-contaminated area. This evaluation assumes that the well exhibiting elevated total metals is within a source area and that the soil sample is representative of soil impacted by metal contamination.

As shown on Table 5, there is no clear pattern or correlation which indicates that elevated total metals are due to soil contamination. Note that in many cases, the concentration of metals which represent "non-contaminated" areas are greater than the metals which represent "contaminated" areas. Also note that the metals in subsurface soil are within or close to background subsurface metal concentrations. Therefore, this supports the possibility that in many cases at MCB Camp Lejeune, the elevated total metals in shallow groundwater cannot be attributable to a source or to past disposal practices.

Table 6 (Total Metals in Deep Monitoring Wells)

Table 6 presents total metal concentrations in deep groundwater for each site. The data base is limited to only 8 sites. Metal concentrations in supply wells were also included for comparison purposes.

As shown on Table 6, total metals in deep groundwater are below drinking water standards with a few exceptions. Arsenic and cadmium were detected above the standards in one deep monitoring well at Site 78 (see Figure 4). Manganese was detected in deep groundwater at three sites and a few of the supply wells. Lead was detected in one supply well at 16 µ/l, which is slightly above the drinking water standard of 15 µ/l.

Elevated total metals are not widespread in deep groundwater for two possible reasons. First, most metals are not very mobile in the environment. Second, deep groundwater samples may not have significant amounts of suspended particulates due to different geologic conditions. Soils in the deeper aquifer are more compacted and consist primarily of calcareous sands, clays, and limestone fragments. Soils in the shallow aquifer are loosely compacted and consist primarily of fine-grained sands, silts, and clays. This classification may support the possibility that suspended solids are collected during sampling, thereby influencing the analysis for total metals.

Table 7 (Summary of Field Parameters in Shallow, Deep, and Supply Wells)

Table 7 provides a range of pH and specific conductivity values representative of shallow and deep groundwater. In general, lower pH values were noted more often in shallow wells than in deep wells (including the supply wells). This condition may influence the leachability and speciation of metals in groundwater.

Deep groundwater usually exhibited higher specific conductivity values. High specific conductivity values are representative of high dissolved conditions. The fact that deep groundwater generally exhibited higher specific conductivity values indicates that most of the metals, if present, are in a dissolved state. The high specific conductivity values could also indicate less suspended particulates due to the geologic conditions of the deep aquifer. The lower specific conductivity values observed in shallow wells indicates that the metals in the shallow aquifer are not in a dissolved state. This also supports the possibility that suspended particulates in the shallow aquifer are influencing the analysis of total metals.

5.0 ANALYSIS OF THE STUDY OBJECTIVES

Each of the objectives identified for this study are analyzed below based on the information collected.

Objective No. 1 (Determine whether the elevated total metals in the shallow aquifer are related to past disposal practices, well construction factors, sampling techniques, or suspended particulates in the samples)

Based on the analysis of information provided in Tables 1 through 7 and Appendix A, it appears that suspended particulates in groundwater samples could influence the concentration of total metals in groundwater. Well construction factors and sampling techniques are probably not a significant factor since the data base is representative of data obtained by Baker, ESE (Site 28 and 30), Roy F. Weston (ABC Cleaners), and Halliburton NUS (Site 7). No particular pattern was noted between sites which Baker obtained the samples versus sites in which other consultants obtained the data. Sampling methods were also considered. For Sites 63 and 65 for example, samples were collected with a bailer. At Sites 2 and 78, samples were collected with a low flow pump. All four sites exhibited elevated levels of total metals in groundwater samples. In addition, due to the fact that deep groundwater quality is not significantly impacted with metals indicates that well construction or sampling techniques are probably not factors related to elevated total metals in groundwater.

With respect to past disposal practices, Table 5 clearly shows that soil concentrations do not correlate with elevated total metals in groundwater. Based on this analysis, and on many of the sites previously investigated, the source of total metals in groundwater cannot be attributable to soil contamination or disposal practices in many cases. This is based on both the history of the site as well as the analytical soil results. In some cases, total metals were detected at elevated levels even when the site history did not correlate with the contaminants found. For example, Sites 2 and 21 have a history of pesticide storage and handling, and there are no known disposal areas (i.e., buried debris) within the site boundary. Nevertheless, both of these sites exhibited several metals above drinking water standards that would not be expected to be present at high concentrations based on the historical use of the site. These metals included lead, chromium, beryllium, cadmium, and manganese.

Objective No. 2 (Determine whether total metals in shallow groundwater are elevated throughout the region or MCB Camp Lejeune)

Based on groundwater data obtained from both upgradient wells and off base wells, total metals were detected above drinking water standards in shallow groundwater in areas that would not be influenced by former disposal activities at the sites. Given that some of the upgradient wells are contaminated, it is apparent that total metals in shallow groundwater are elevated in certain areas of the base outside of the influence of site-related disposal activities. However, it is unknown whether the shallow aquifer upgradient of the sites is contaminated due to other base-related activities or whether the levels in groundwater samples are also elevated due to the influence of suspended fines in the samples.

Objective No. 3 (Determine whether there is a correlation between elevated total metals in groundwater and metals in soil)

An evaluation of the data presented in Table 5 shows that metals in soil samples collected in areas of groundwater contamination are not elevated when compared to metals in soil samples collected in areas that did not exhibit groundwater contamination. This supports the possibility that in many cases, elevated levels of total metals in shallow groundwater are not related to the disposal history at the site. As previously mentioned, sites which did not exhibit soil contamination (when compared to background soil levels) or did not have a history of disposal indicative of metals contamination still exhibited elevated levels of total metals in groundwater. Since there is no apparent correlation between metals in soil and total metals in groundwater, then the possibility exists that the elevated total metals in groundwater are biased high due to suspended particulates.

Objective No. 4 (Determine whether the concentrations of total metals in groundwater is related to shallow and deep aquifer characteristics)

There is some evidence that the geologic conditions of the shallow and deep aquifers influence the amount of total metals detected in groundwater samples. The fact that the deep aquifer generally exhibited higher specific conductivity values indicates that there is more dissolved constituents in the deep aquifer when compared to the shallow aquifer. This was evident when comparing Table 1 (total metals in shallow groundwater) to Table 6 (total metals in deep groundwater). Table 6 did not indicate significant levels of total metals in deep groundwater throughout MCB Camp Lejeune.

The geologic conditions of the shallow aquifer would tend to result in samples that may contain suspended particulates. The suspended particulates could influence the total metals concentrations in the samples.

6.0 CONCLUSIONS

1. Elevated levels of total metals in the shallow aquifer are probably influenced to some degree by the geologic conditions of the site.

2. There is no correlation between metal levels in soil and total metals in groundwater. Therefore, elevated total metals in groundwater cannot be attributable to soil contamination of past disposal practices.

3. Elevated levels of total metals in the shallow aquifer may be biased high due to suspended particulates in the samples.

4. Dissolved metals in groundwater were generally below Federal MCLs and NC WQS and therefore, do not present a significant problem at MCB Camp Lejeune.

5. Total and dissolved metal concentrations in the Castle Hayne aquifer were generally below drinking water standards and therefore, do not present a significant problem at MCB Camp Lejeune.

6. The presence of manganese in shallow and deep groundwater may be due to naturally occurring geologic conditions.

7.0 RECOMMENDATIONS

1. Remediation of total metals in the shallow aquifer at Operable Units 1 and 5 is not recommended based on the following:

   - Elevated metals in groundwater at both operable units does not appear to be related to soil contamination or past disposal practices;
   - The distribution of total metals in groundwater is not characteristic of a plume that would be present due to a source of contamination;
   - Remediation of total metals would not be practical from an engineering or cost standpoint; and
   - Currently, there is no human or environmental exposure to shallow groundwater.

2. Additional background wells should be installed at all sites in order to provide a baseline for comparing on-site groundwater quality.

Tables

TABLE 1
TOTAL METALS BY SITE
SHALLOW MONITORING WELLS
MCB, CAMP LEJEUNE, NORTH CAROLINA

Site Number / Units	NCWQS ug/L	FEDERAL MCL ug/L	Site 1 ug/L	Site 2 ug/L	Site 6 ug/L	Site 7 ug/L	Site 9 ug/L	Site 21 ug/L	Site 24 ug/L	Site 28 ug/L	Site 30 ug/L	Site 41 ug/L	Site 43 ug/L	Site 44 ug/L
Arsenic	50	50	7.2 - 57.4	2.2 - 23.6	ND - 23.3	ND - 43.4J	ND	ND - 101	ND - 116J	5.4 - 13J	6.4 - 12J	2.4 - 36.3	ND - 23.4	ND - 570
Barium	2000	2000	335 - 833	46 - 1420	ND - 1020	427 - 641	ND - 1060	ND - 647	ND - 1120	78.8 - 576	60.1 - 396	55.2 - 999	220 - 745	315 - 3180
Beryllium	NE	4	2.7 J - 43.4	1 - 3	ND - 7.5	ND - 10.3J	ND	ND - 8	ND - 19	ND - 1.2J	ND - 2.4	0.80 - 42.8	1.5 - 4.2	1.4 - 36.6
Cadmium	5	5	ND - 12.9	7	ND	ND	ND	ND	ND - 12	3.3J - 17.3J	ND - 10.7J	3.2 - 110	ND - 6.9	ND - 32
Calcium	NA	NA	8850 - 726000	5710 - 450000	5430 - 64900	5050 - 51300	16100 - 90700	6130J - 63000J	ND - 151000	20200 - 160000	1730 - 11900	8750 - 828000	10300 - 91900	2430 - 191000
Chromium	50	100	172 - 627	11 - 117	ND - 201	47.8 - 220	ND - 214	ND - 348J	19 - 316	9.0J - 140	42.8 - 106J	10.5 - 244	161 - 249	126 - 895
Copper	1000	1300	44.6 - 117	3 - 23	ND - 175	17.7 - 36.4	ND - 39.7	ND - 84	ND - 52	18.8J - 75.4	15.8 - 42.5	16.3 - 1030	64.2 - 104	28.6 - 313
Lead	15	15	40.8J - 176J	2.7 - 44.8	ND - 200	23 - 37.3	ND - 127	ND - 2000J	5.1 - 89	20.3J - 234J	7.7J - 115J	4.8 - 9340	16.5 - 28.8	15.8 - 508
Manganese	50	50 (1)	125 - 1720	21 - 190	ND - 362	56.9 - 220	ND - 91.3	59 - 276J	29 - 518	82.2 - 304	78.5 - 578	56.6 - 2110	72.6 - 297	88 - 1730
Mercury	1.1	2	ND - 1.2J	ND	ND - .46	0.2 - 0.36	ND - 1.4	ND - 2.4J	ND - 3.2	ND - 1.4J	0.88J - 0.9J	0.13 - 0.92	ND - 0.24	ND - 1.1
Nickel	100	100	28.5 - 426	ND	ND - 41.9	ND	ND	ND - 123	ND - 140	ND - 59.8	17.1J - 52.6J	28.8 - 137	20.5 - 143	21.9 - 486
Sodium	NA	NA	9090 - 19000	ND - 103000	1110 - 68700	7040 - 156000	1390 - 4170	7950 - 15700	5230 - 19200	9480 - 74700	5320 - 8100	2080 - 40200	9160 - 22100	4060 - 12600
Vanadium	NE	NE	214 - 640	9 - 184	ND - 330	37.8 - 423	ND - 175	ND - 419	ND - 408	6.1 - 164	57 - 101	20.4 - 244	122 - 233	184 - 759
Zinc	2100	5000 (1)	ND - 1110	6 - 146	ND - 1620	83.6 - 133	ND - 118	27J - 487J	20 - 650	ND	79.2 - 104	25.7 - 5180	19 J - 661J	87.3 - 2800J

Site Number / Units	Site 48 ug/L	Site 63 ug/L	Site 65 ug/L	Site 69 ug/L	Site 78 ug/L	Site 82 ug/L	ABC Cleaners ug/L	Offsite Property #1 ug/L	Offsite Property #2 ug/L
Arsenic	ND	ND - 23.4	ND - 308	2.9 - 29.0	ND - 405J	ND - 67.8	ND - 12	10.3 - 160	ND
Barium	18 - 51.3	56.1 - 5410	105 - 638	46.5 - 850	ND - 1250	ND - 540	35 - 220	ND - 468	ND
Beryllium	ND	ND - 3.1	ND	1.3 - 10.6	ND - 19	ND	NA	ND - 8.5	ND
Cadmium	2.2 - 3.3	ND	ND	2.4 - 11.4	ND - 21	ND	NA	ND	ND
Calcium	30600 - 115000	2830 - 24300	33300 - 181000	2010 - 38700	ND - 642000	6580 - 60800	790 - 16000	ND - 22800	ND - 5200
Chromium	5.8 - 17.5	4.4 - 134	50.1 - 364	15.1 - 159	ND - 858J	ND - 174	ND - 57	52.8 - 636	ND - 94
Copper	3.1 - 13.5	10.7 - 126	28.2 - 127	16.2 - 70.8	ND - 699	ND - 29.3	ND - 89	ND - 140	ND
Lead	ND	4.3 J - 369	19.1 - 132	7.8 - 188	ND - 360J	ND - 89	ND - 10	12.3 - 345	6.3 - 62.3
Manganese	38.1 - 585	50.3 - 1020	56.2 - 474	13.0 - 912	26 - 714	26.9 - 283	4 - 44	56 - 973	ND - 60.1
Mercury	0.04 - 0.09	ND - 0.20	ND - 0.29	0.10 - 0.94	ND - 1.5	ND - 0.66	NA	ND	ND
Nickel	ND	19.8 - 54.2	19.4 - 84.3	13.6 - 99.8	ND - 234	ND - 34.6	ND - 77	40.2 - 380	ND
Sodium	5750 - 8760	3150 - 7100	3850 - 11700	4790 - 41300	ND - 42500	5670 - 36500	5800 - 33000	ND - 9390	ND - 7630
Vanadium	3.4 - 12.8	7.9 - 163	59.8 - 433	17.3 - 210	ND - 1700	ND - 256	ND - 45	70 - 739	ND - 64.7
Zinc	ND - 30.3	58.5J - 1110J	148J - 406J	36.2 - 12100	6J - 967J	ND - 204	14 - 220	ND - 736	ND - 40.8

NOTES:
J - Value is estimated.
JB - Value is estimated below the CRDL, but greater than the IDL.
NE - Not established.
NA - Not analyzed.
ND - Not detected.
NCWQS - North Carolina Water Quality Standard
MCL - Maximum Contaminant Level
(1) - Secondary MCL

TABLE 2
COMPARISON OF REPEAT SAMPLING OF SHALLOW WELLS
MCB, CAMP LEJEUNE, NORTH CAROLINA

Well	2GW01		2GW03		2GW06		2GW08		2GW09	
Date	5/1993	3/1994	5/1993	3/1994	5/1993	3/1994	5/1993	3/1994	5/1993	3/1994
Chromium	18	ND	11	ND	15	ND	ND	ND	25	83
Lead	15.5 J	ND	3.5 J	ND	6.7 J	ND	ND	3.4	27.2 J	23.6
Manganese	55	47	21	ND	79	140	53	415	290	747

Well	78GW05		78GW08		78GW15		78GW16		78GW19	
Date	1/1991	4/1994	1/1991	4/1994	1/1991	4/1994	1/1991	4/1994	1/1991	4/1994
Chromium	ND	17 J	91.8	491 J	21.4	215 J	209	353 J	13.8	ND
Lead	13.6	13.1 J	54.1	131 J	16.6	53	100	224	31.7	8.3
Manganese	162	161 J	46.5	213 J	18.3	115	98.3	150	79	26

NOTES:
J - Value is estimated..
ND - Not detected.

TABLE 3
DISSOLVED METALS BY SITE
SHALLOW MONITORING WELLS
MCB, CAMP LEJEUNE, NORTH CAROLINA

Site Number / Units	NCWQS ug/L	FEDERAL MCL ug/L	Site 1 ug/L	Site 2 ug/L	Site 6 ug/L	Site 7 ug/L	Site 9 ug/L	Site 21 ug/L	Site 24 ug/L	Site 28 ug/L	Site 30 ug/L	Site 41 ug/L	Site 43 ug/L	Site 44 ug/L
Arsenic	50	50	NA	2.2 - 7.1	ND	NA	ND	ND - 10.6	ND - 16.3	NA	NA	2.2 - 4.7	NA	NA
Barium	2000	2000	NA	25 - 149	ND	NA	ND	ND	ND	NA	NA	12.4 - 451	NA	NA
Beryllium	NE	4	NA	1	ND	NA	ND	ND	ND	NA	NA	0.80 - 3.2	NA	NA
Cadmium	5	5	NA	ND	ND	NA	ND	ND - 5	ND	NA	NA	3.2 - 4.2	NA	NA
Calcium	NA	NA	NA	5800 - 441000	6230 - 57400	NA	15800 - 82400	35900	ND - 113000	NA	NA	4710 - 138000	NA	NA
Chromium	50	100	NA	10	ND	NA	ND	ND	ND	NA	NA	8.3 - 9.6	NA	NA
Copper	1000	1300	NA	2 - 9	ND	NA	ND	ND	ND	NA	NA	16.3 - 23.9	NA	NA
Lead	15	15	NA	2.1	ND	NA	ND	ND - 94	ND	NA	NA	1.0	NA	NA
Manganese	50	50 (1)	NA	17 - 129	ND - 92.7	NA	ND	40 - 134	ND - 320	NA	NA	7.1 - 521	NA	NA
Mercury	1.1	2	NA	ND	ND	NA	ND	ND	ND - 0.5	NA	NA	0.13 - 0.20	NA	NA
Nickel	100	100	NA	ND	ND	NA	ND	ND	ND - 57	NA	NA	28.8 - 31.2	NA	NA
Sodium	NA	NA	NA	ND - 103000	1420 - 70500	NA	1280 - 3860	16200	ND - 183000	NA	NA	2500 - 34200	NA	NA
Vanadium	NE	NE	NA	43	ND	NA	ND	ND	ND	NA	NA	20.4	NA	NA
Zinc	2100	5000 (1)	NA	8 - 35	ND - 350	NA	ND	6B - 50	ND - 437	NA	NA	10.6 - 125	NA	NA

Site Number / Units	Site 48 ug/L	Site 63 ug/L	Site 65 ug/L	Site 69 ug/L	Site 78 ug/L	Site 82 ug/L	ABC Cleaners ug/L	Offsite Property #1 ug/L	Offsite Property #2 ug/L
Arsenic	ND	NA	NA	2.9	ND - 21.6	ND	NA	ND - 18.8	ND
Barium	16.8 - 27.6	NA	NA	13.7 - 35.8	ND	ND	NA	ND	ND
Beryllium	ND	NA	NA	1.3	ND	ND	NA	ND	ND
Cadmium	ND - 3.1	NA	NA	2.4	ND	ND	NA	ND	ND
Calcium	72600 - 80700	NA	NA	764 - 10600	ND - 296000	15200 - 58500	NA	ND - 7710	ND
Chromium	ND	NA	NA	7.2	ND - 59	ND	NA	ND - 30.0	ND
Copper	2.6 - 7.6	NA	NA	16.2	ND - 121	ND	NA	ND - 10.7	ND
Lead	ND	NA	NA	1	ND - 17.2	ND	NA	ND - 15.8	ND
Manganese	39.7 - 539	NA	NA	8.5 - 139	ND - 152	21 - 127	NA	ND - 63.8	ND - 21.3
Mercury	0.05 - 0.09	NA	NA	0.1	ND - 0.6	ND	NA	ND	ND
Nickel	ND	NA	NA	13.6	ND	ND	NA	ND	ND
Sodium	6430 - 8920	NA	NA	5170 - 41100	ND - 42200	5980 - 36000	NA	ND - 9540	ND - 6750
Vanadium	ND	NA	NA	16.6	ND	ND	NA	ND	ND
Zinc	ND	NA	NA	7.0 - 7670	ND - 58	ND - 119	NA	ND - 468	ND - 222

NOTES:
J - Value is estimated.
JB - Value is estimated below the CRDL, but greater than the IDL.
NE - Not established.
NA - Not analyzed.
ND - Not detected.
NCWQS - North Carolina Water Quality Standard
MCL - Maximum Contaminant Level
(1) - Secondary MCL

TABLE 4
SUMMARY OF TOTAL METALS IN UPGRADIENT WELLS
SHALLOW MONITORING WELLS
MCB, CAMP LEJEUNE, NORTH CAROLINA

			Upgradient of Site 1	Upgradient of Site 2	Upgradient of Site 6	Upgradient of Site 7	Upgradient of Site 9	Upgradient of Sites 21 and 78	Upgradient of Site 24	Upgradient of Site 28	Upgradient of Site 30	Upgradient of Site 41	Upgradient of Site 43	Upgradient of Site 44
Well Number	NCWQS	FEDERAL MCL	1GW06	2GW09	6BP6S	7GW03	9GW4S	78GW26	24GW07	28GW04		41GW05		
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L		ug/L		
Arsenic	50	50	17.8 J	12.9	ND	ND	ND	ND	3.7 J	7.4 J	No Upgradient Well Sites	13.1	No Upgradient Well Sites	No Upgradient Well Sites
Barium	2000	2000	548	328	257	428	71.3	ND	ND	576		55.7		
Beryllium	NE	4	3.2 J	3	ND	ND	ND	ND	ND	9.3 J		1.6		
Cadmium	5	5	ND	ND	ND	ND	ND	not reported	ND	3.3 J		10		
Chromium	50	100	193	75	198	124	ND	13	37	122		54.4		
Copper	1000	1300	64.8	25	35.6	36.4	ND	ND	ND	20.7 J		27		
Lead	15	15	78.8 J	27.2	64.4	30.3 J	ND	9	11.4	22.4 J		23.7		
Manganese	50	50 (1)	202	747	84.5	56.9 J	ND	ND	39	206		203		
Mercury	1.1	2	1.6 J	ND	ND	0.36	ND	ND	ND	ND		0.16		
Nickel	100	100	51.6	ND	ND	ND	ND	ND	ND	59.8		38		
Vanadium	NE	NE	214	86	209	152	ND	149	64	85.3		38.1		
Zinc	2100	5000 (1)	ND	103	56.6	86.4 J	ND	68.1	41	ND		173		

	Upgradient of Site 48	Upgradient of Site 63	Upgradient of Site 65	Upgradient of Site 69	Upgradient of Site 78	Upgradient of Site 82	Upgradient of ABC Cleaners	Upgradient of Offsite Property #1	Upgradient of Offsite Property #2
Well Number	48GW1			69GW07	9GW04	6MW3S	MW-S01		
Units	ug/L			ug/L	ug/L	ug/L	ug/L		
Arsenic	ND	No Upgradient Well Sites	No Upgradient Well Sites	2.9	ND	ND	ND	No Upgradient Well Sites	No Upgradient Well Sites
Barium	29.4 J			46.5	ND	ND	35		
Beryllium	ND			1.3	ND	ND	NA		
Cadmium	2.5 J			2.4	ND	ND	NA		
Chromium	ND			15.8	ND	ND	ND		
Copper	ND			16.2	ND	ND	ND		
Lead	ND			7.8	ND	ND	3		
Manganese	70.6			13	ND	ND	10		
Mercury	ND			0.1	ND	ND	NA		
Nickel	ND			13.6	ND	ND	ND		
Vanadium	3.4 J			17.3	ND	ND	9		
Zinc	ND			36.2	ND	ND	23		

NOTES:
J - Value is estimated.
JB - Value is estimated below the CRDL, but greater than the IDL.
NE - Not established.
NA - Not analyzed.
ND - Not detected.
NCWQS - North Carolina Water Quality Standard
MCL - Maximum Contaminant Level
(1) - Secondary MCL

TABLE 5
COMPARISON OF INORGANIC SUBSURFACE SOIL CONCENTRATIONS IN "CLEAN" AND "CONTAMINATED" WELLS
MCB, CAMP LEJEUNE, NORTH CAROLINA

	Camp Lejeune Background Subsurface Soil Data	Site 1		Site 2		Site 6		Site 7		Site 9		Site 21	
		"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Well Number		--	--	2GW07	2GW09	6GW18	6GW15	7GW03	7GW02	9GW5	9GW1	21GW03	21GW02
Soil Sample Number		--	--	2-GW07-01	2 - GW09-02	6-GW18-0303	6-GW15-03	GW03-002	GW02-7595	9-GW5-03	9-SB35-03	21-GW03	·21-GW02
Arsenic	0.03 - 0.47	NA	NA	1.7 J	ND	ND	ND	1.5	ND	ND	ND	ND	0.55 J
Barium	2 - 11	NA	NA	12.5 J	ND	ND	ND	6.6	71	ND	ND	ND	4.4 J
Beryllium	0.03 - 0.23	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	0.17 - 1.2	NA	NA	ND	ND	ND	ND	1.3	4.5	ND	ND	ND	ND
Chromium	2 - 9	NA	NA	10.9 J	4.6	ND	1.6	5.2	6	ND	2.6 J	15.2	3.2 J
Copper	0.47 - 2	NA	NA	0.97 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lead	1 - 12	NA	NA	8 J	4.3	3.3 J	12	2.5	34.4	1.6	83	7.1	6.9 J
Manganese	0.40 - 8	NA	NA	4.3 J	4.1	ND	1.8 B	3	116	ND	3.7 J	9.8	3.4 J
Mercury	0.01 - 0.11	NA	NA	0.3 J	ND	ND	ND	10.13	0.48	ND	ND	ND	ND
Nickel	0.70 - 5.0	NA	NA	ND	ND	ND	ND	3.4	11.8	ND	ND	ND	ND
Vanadium	0.75 - 13	NA	NA	13.8 J	ND	ND	2.9 B	5.5	4.5	ND	ND	15.5	4.4 J
Zinc	0.40 - 12	NA	NA	ND	ND	ND	ND	1.3	ND	ND	6.1 J	5.7	3 J

NOTES:
Shaded area indicates inorganic which exceeded a MCL and/or NCWQS in groundwater sample.
J - Value is estimated.
JB - Value is estimated below the CRDL, but greater than the IDL.
NA - No available wells to compare OR compound was not analyzed.
ND - Not detected.
NCWQS - North Carolina Water Quality Standard
MCL - Maximum Contaminant Level
(1) - Secondary MCL

TABLE 5
COMPARISON OF INORGANIC SUBSURFACE SOIL CONCENTRATIONS IN "CLEAN" AND "CONTAMINATED" WELLS
MCB, CAMP LEJEUNE, NORTH CAROLINA

	Site 24		Site 28		Site 30		Site 41		Site 43		Site 44	
	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Well Number	24GW10	24GW02	--	--	--	--	41GW04	41-GW11	43GW01	43GW02	44GW02	44GW01
Soil Sample Number	24-GW10	24-BDA-SB09	--	--	--	--	41-GW04-DW	41-GW11-01	43-GW01-00	43-GW02-00	44-GW02-035	--
Arsenic	ND	ND	NA	NA	NA	NA	0.51	1.6	ND	ND	ND	1.7
Barium	ND	ND	NA	NA	NA	NA	9.4	22.6	ND	ND	ND	17.9
Beryllium	ND	ND	NA	NA	NA	NA	0.18	0.18	ND	ND	ND	ND
Cadmium	ND	ND	NA	NA	NA	NA	0.73	0.73	8.3	ND	ND	ND
Chromium	11.2	9 J	NA	NA	NA	NA	3.6	11.2	3.3	6.7	3.6 J	10 J
Copper	ND	ND	NA	NA	NA	NA	3.7	22 J	3.4	ND	6.2 J	25.4 J
Lead	4.6 J	6.2 J	NA	NA	NA	NA	4.8	110	9.8	6.1	4.5	10.7
Manganese	4.7	8.4 J	NA	NA	NA	NA	3.7	15.9	312	8.2	3.5	20.4
Mercury	ND	ND	NA	NA	NA	NA	0.06	0.31	ND	ND	ND	ND
Nickel	ND	ND	NA	NA	NA	NA	6.6	6.6	7.6	[illegible]	3.1	5.4
Vanadium	18.4	10	NA	NA	NA	NA	6.8	9.3	7.2	5.8	5	14.7
Zinc	ND	7.8	NA	NA	NA	NA	7.7	130	20.1	3	3.2	34.9

NOTES:
Shaded area indicates inorganic which exceeded a MCL and/or NCWQS in groundwater sample.
J - Value is estimated.
JB - Value is estimated below the CRDL, but greater than the IDL.
NA - No available wells to compare OR compound was not analyzed.
ND - Not detected.
NCWQS - North Carolina Water Quality Standard
MCL - Maximum Contaminant Level
(1) - Secondary MCL

TABLE 5
COMPARISON OF INORGANIC SUBSURFACE SOIL CONCENTRATIONS IN "CLEAN" AND "CONTAMINATED" WELLS
MCB, CAMP LEJEUNE, NORTH CAROLINA

	Site 48		Site 63		Site 65		Site 69		Site 78		Site 82	
	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Well Number	48-GW01	48-GW03	63MW03	63MW02	65MW03	65MW02	69-GW11	69-GW03	78GW34	78GW24-1	6-GW28	82MW3
Soil Sample Number	48-GW1A-01	48-C3-03	63-MW03-04	63-MW02-06	65-MW03-11	65-MW02-06	69-GW11-04	69-CSA-SB23-00	78-GW34	78-B903-SB03	6-GW28-09	6-GW27D-06
Arsenic	1.3	0.77 J	ND	ND	ND	11.3	0.68	0.63	ND	ND	0.31	15.9
Barium	21.1	15	ND	ND	3.4	6.8	5.6	3	ND	ND	ND	ND
Beryllium	0.2	0.19	ND	ND	ND	ND	0.3	0.28	ND	ND	ND	ND
Cadmium	1.4	1.8 J	ND	ND	NA	NA	0.56	0.52	ND	ND	ND	ND
Chromium	18.2	18.6	7.7	ND	3.9	15.7	6.8	17	18.5	9.1	2.6	1
Copper	3.5	3.8	ND	ND	1.5	3.1	3.8	3.5	3.4 B	ND	ND	ND
Lead	32.3	14.3	4.2	2.6	17	23.7	4.3	11	4.5 J	2.6 J	2.7	4.3
Manganese	411	7	4.9	18.8	3.5	6.9	4	12	9.2	ND	ND	ND
Mercury	ND	ND	ND	ND	NA	NA	0.06	0.05	ND	ND	ND	ND
Nickel	2.2	1.9 J	ND	ND	ND	ND	3.2	3	ND	ND	ND	ND
Vanadium	28.3	20.8 J	ND	ND	4.4	3	4.4	3.6	18.7	19.2	ND	ND
Zinc	ND	ND	ND	ND	2.7	5	3.2	15	7.9	ND	ND	ND

NOTES:
Shaded area indicates inorganic which exceeded a MCL and/or NCWQS in groundwater sample.
J - Value is estimated.
JB - Value is estimated below the CRDL, but greater than the IDL.
NA - No available wells to compare OR compound was not analyzed.
ND - Not detected.
NCWQS - North Carolina Water Quality Standard
MCL - Maximum Contaminant Level
(1) - Secondary MCL

TABLE 5
COMPARISON OF INORGANIC SUBSURFACE SOIL CONCENTRATIONS IN "CLEAN" AND "CONTAMINATED" WELLS
MCB, CAMP LEJEUNE, NORTH CAROLINA

	ABC Cleaners		Offsite Property #1		Offsite Property #2	
	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Well Number	--	--	--	--	--	--
Soil Sample Number	--	--	--	--	--	--
Arsenic	NA	NA	NA	NA	NA	NA
Barium	NA	NA	NA	NA	NA	NA
Beryllium	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA

NOTES:
Shaded area indicates inorganic which exceeded a MCL and/or NCWQS in groundwater sample.
J - Value is estimated.
JB - Value is estimated below the CRDL, but greater than the IDL.
NA - No available wells to compare OR compound was not analyzed.
ND - Not detected.
NCWQS - North Carolina Water Quality Standard
MCL - Maximum Contaminant Level
(1) - Secondary MCL

TABLE 6
TOTAL METALS BY SITE
DEEP MONITORING WELLS
MCB, CAMP LEJEUNE, NORTH CAROLINA

	Site 1	Site 2	Site 6	Site 7	Site 9	Site 21	Site 24	Site 28	Site 30	Site 41	Site 43	Site 44	Site 48	Site 63	Site 65	Site 69	Site 78	Site 82	ABC Cleaners	Base Supply Wells (1)
Arsenic	No Deep Wells	ND	ND	No Deep Wells	ND	No Deep Wells	No Deep Wells	No Deep Wells	No Deep Wells	2.2 - 9.6	No Deep Wells	No Deep Wells	No Deep Wells	No Deep Wells	No Deep Wells	2.2 - 3.5	2 - 118 J	ND	ND - 14	ND
Barium		1420	ND		ND					22.6 - 186						42.3 - 58.0	ND - 547	ND	4 - 36	ND
Beryllium		ND	ND		ND					3.2						0.80 - 0.89	ND	ND	NA	NA
Cadmium		ND	ND		ND					4.2 - 4.7						3.2	ND - 21	ND	NA	ND
Chromium		16	ND		ND					9.6 - 40.5						8.3 - 20.7	ND - 10	ND	ND - 32	ND
Copper		ND	ND		ND					23.9						16.3	ND	ND	ND - 41	ND - 130
Lead		ND	ND		ND					1.0 - 11.1						3.1 - 6.8	ND	ND	ND - 10	ND - 16
Manganese		ND	ND - 33.5		ND					16.9 - 101						53.7 - 114	ND - 591	ND - 21.6	ND - 45	10 - 120
Mercury		ND	ND		ND					0.15 - 0.17						0.16 - 0.17	ND - 0.3	ND	NA	ND
Nickel		ND	ND		ND					31.2						28.8	ND	ND	ND - 14	NA
Vanadium		ND	ND		ND					20.4 - 49.8						20.4	ND - 24 J	ND	ND - 15	NA
Zinc		ND	ND		ND					17.8 - 83.8						31.1 - 48.7	ND - 181 J	ND	58 - 390	ND - 120

NOTES:
J - Value is estimated.
NA - Not analyzed.
ND - Not detected.
(1) - Range is based on 67 supply wells located throughout MCB, Camp Lejeune, NC.

TABLE 7
SUMMARY OF FIELD PARAMETERS IN SHALLOW, DEEP, AND SUPPLY WELLS MCB, CAMP LEJEUNE, NORTH CAROLINA

	Shallow Wells		Deep Wells		Supply Wells	
	Range (1)	Average Maximum	Range (2)	Average Maximum	Range (3)	Average Maximum
pH (standard units)	4.5 - 7.28	6.08	7.52 - 11.34	8.88	6.91 - 7.45	7.32
Specific Conductivity (micromhos/cm)	40 - 580	267	149 - 525	350	212 - 511	353

(1) - Based on data from 11 sites.
(2) - Based on data from 6 sites.
(3) - Based on data from 9 supply wells.

Appendix A
Data Summary Tables for Sites 2 and 78

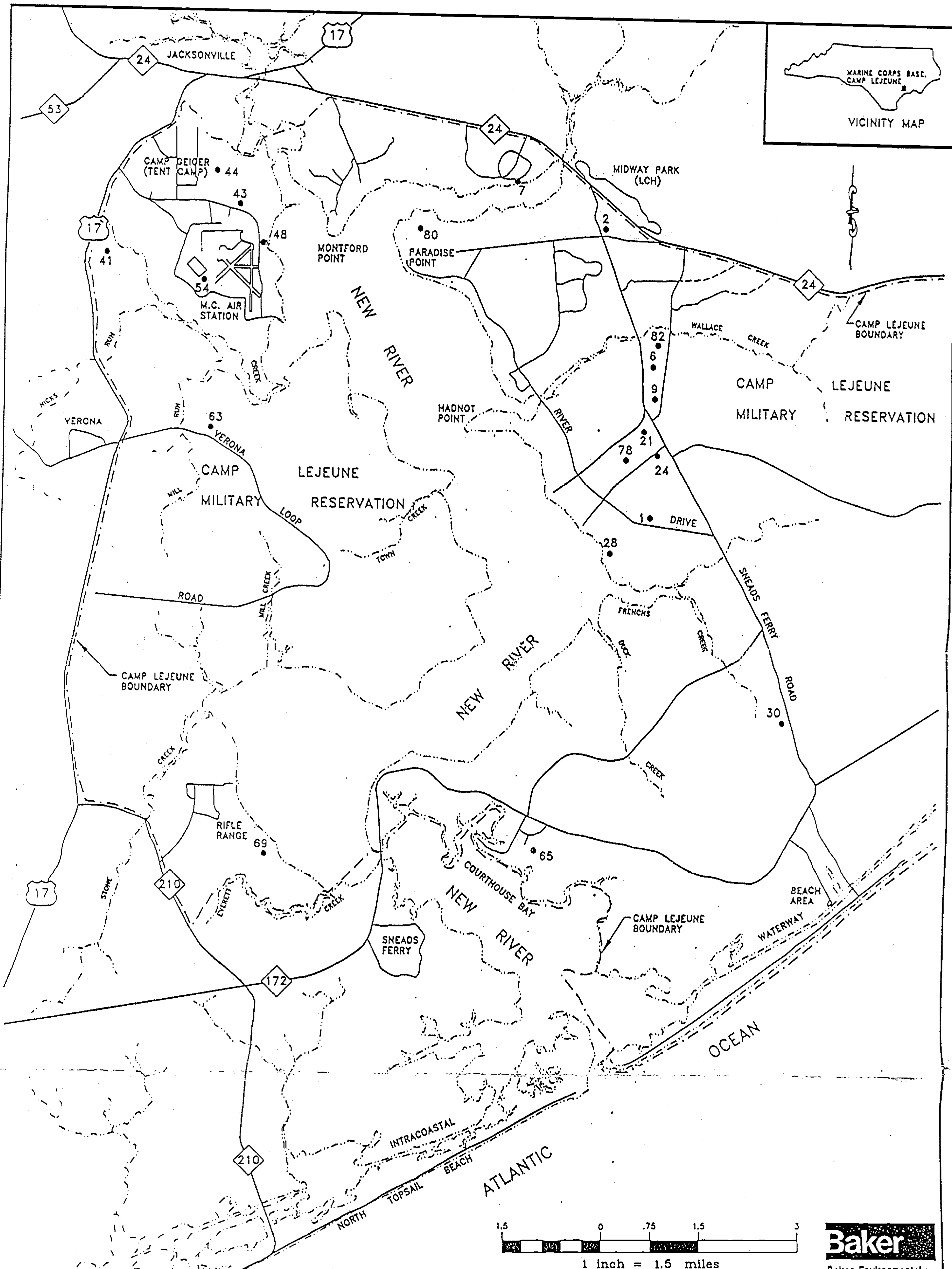
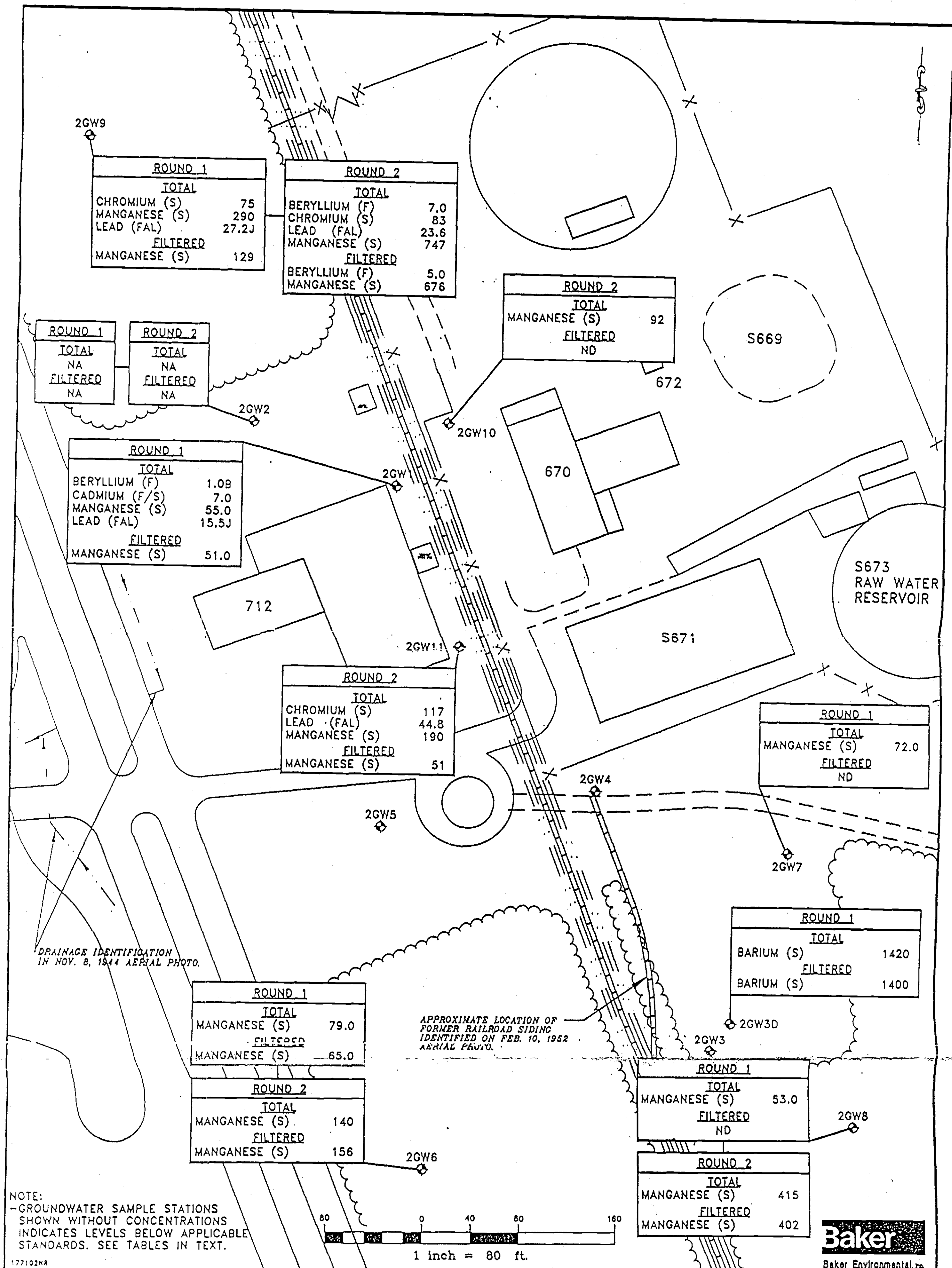


FIGURE 1
SITE LOCATION MAP
INORGANIC GROUNDWATER STUDY

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

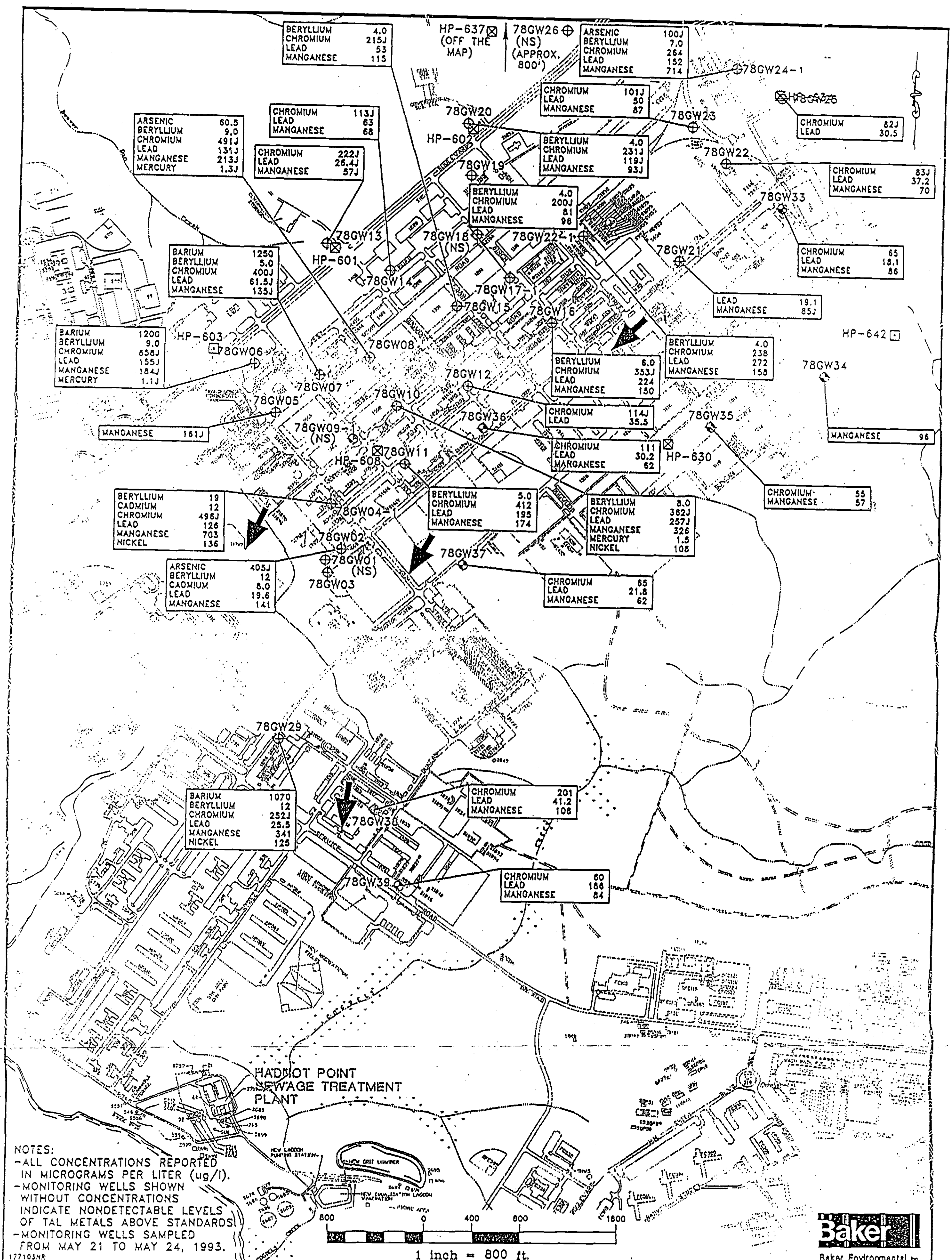
01712Y B12



LEGEND

2GW1 GROUNDWATER WELL
(F) EXCEEDS FEDERAL STANDARD
(S) EXCEEDS STATE STANDARD
(FAL) FEDERAL ACTION LEVEL
ND NOT DETECTED ABOVE APPLICABLE STANDARDS
NA NOT ANALYZED
J ESTIMATED CONCENTRATIONS
CONCENTRATIONS EXPRESSED IN ug/l(ppb)
SOURCE: LANTDIV, FEB. 1992

FIGURE 2
POSITIVE DETECTIONS ABOVE APPLICABLE FEDERAL AND STATE STANDARDS FOR TOTAL AND FILTERED INORGANIC ANALYTES IN GROUNDWATER
SITE 2
REMEDIAL INVESTIGATION CTO-0174
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



NOTES:
- ALL CONCENTRATIONS REPORTED IN MICROGRAMS PER LITER (ug/l).
- MONITORING WELLS SHOWN WITHOUT CONCENTRATIONS INDICATE NONDETECTABLE LEVELS OF TAL METALS ABOVE STANDARDS.
- MONITORING WELLS SAMPLED FROM MAY 21 TO MAY 24, 1993.

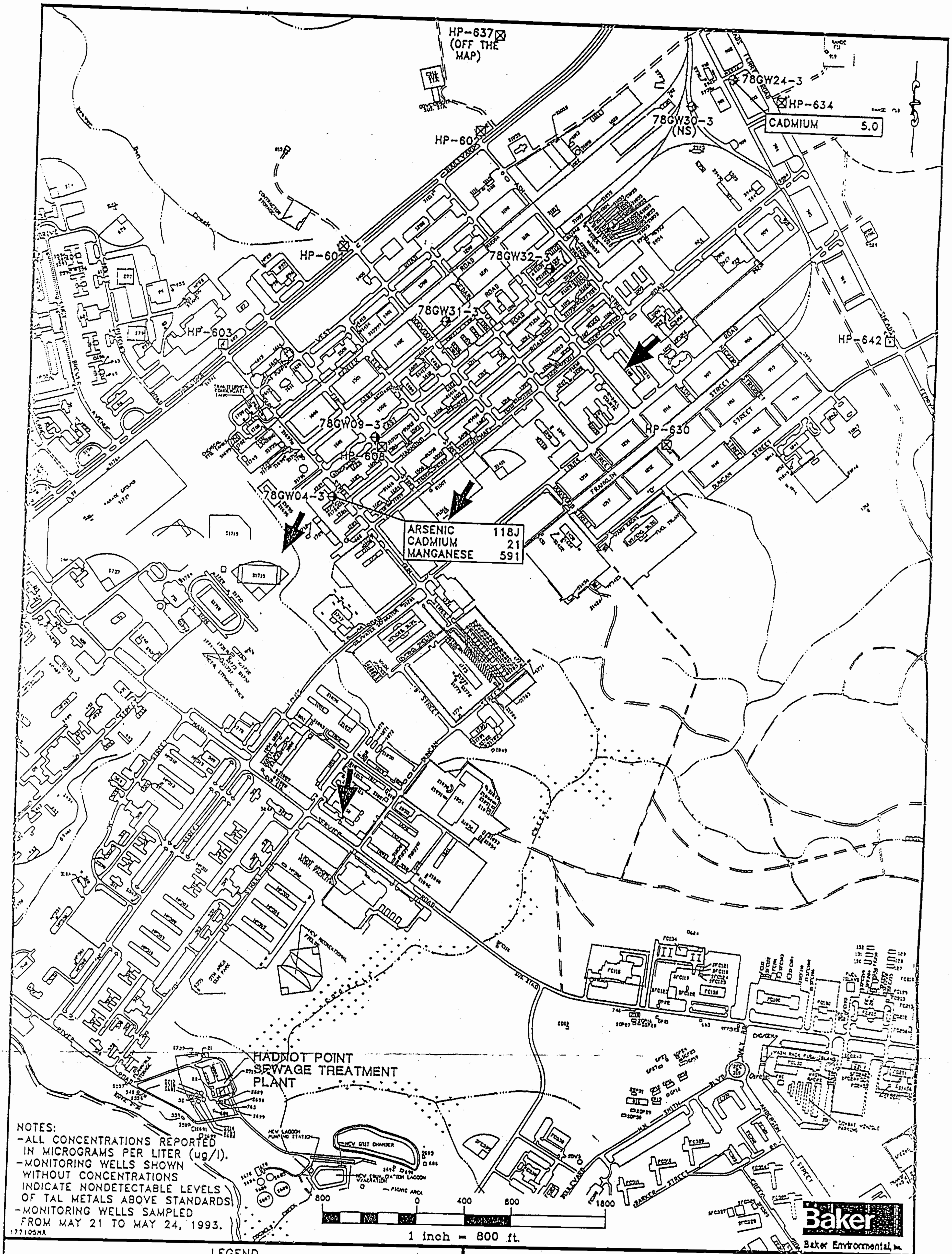
177103NR

LEGEND

78GW02	EXISTING SHALLOW MONITORING WELL INSTALLED BY ESE, 1984-1991
78GW33	SHALLOW MONITORING WELL INSTALLED BY BAKER ENVIRONMENTAL, INC., 1993
→	APPROXIMATE DIRECTION OF GROUNDWATER FLOW
(NS)	NOT SAMPLED FOR TAL METALS
HP-603	WATER SUPPLY WELL (ACTIVE)-NOT SAMPLED
HP-601	WATER SUPPLY WELL (INACTIVE)-NOT SAMPLED

SOURCE: LANTDIV, FEBRUARY 1992

FIGURE 3
POSITIVE DETECTIONS OF TAL METALS ABOVE FEDERAL MCLs AND/OR NCWQS IN SHALLOW WELLS
SITE 78
REMEDIAL INVESTIGATION CTO-0177
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



NOTES:
- ALL CONCENTRATIONS REPORTED IN MICROGRAMS PER LITER (ug/l).
- MONITORING WELLS SHOWN WITHOUT CONCENTRATIONS INDICATE NONDETECTABLE LEVELS OF TAL METALS ABOVE STANDARDS.
- MONITORING WELLS SAMPLED FROM MAY 21 TO MAY 24, 1993.

177105NA

LEGEND

78GW04-3	EXISTING DEEP MONITORING WELL INSTALLED BY ESE, 1991
→	APPROXIMATE DIRECTION OF GROUNDWATER FLOW
(NS)	NOT SAMPLED FOR TAL METALS
HP-603	WATER SUPPLY WELL (ACTIVE)-NOT SAMPLED
HP-601	WATER SUPPLY WELL (INACTIVE)-NOT SAMPLED

SOURCE: LANTDIV, FEBRUARY 1992

FIGURE 4
POSITIVE DETECTIONS OF TAL METALS ABOVE FEDERAL MCLs AND/OR NCWQS IN DEEP WELLS
SITE 78
REMEDIAL INVESTIGATION CTO-0177
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

OPERABLE UNIT NO. 1 - SITES 21, 24, 78
SHALLOW, INTERMEDIATE AND DEEP MONITORING WELLS
GROUNDWATER DATA AND FREQUENCY SUMMARY
REMEDIAL INVESTIGATION CTO - 19177
MCB CAMP LEJEUNE, NORTH CAROLINA
TAL METALS AND CYANIDE

	MINIMUM NONDETECTED UG/L	MAXIMUM NONDETECTED UG/L	MINIMUM DETECTED UG/L	MAXIMUM DETECTED UG/L	LOCATION OF MAXIMUM DETECTED	FREQUENCY OF DETECTION
ALUMINUM	NA	NA	68 J	542000 J	78-GW06-01	59 / 59
ANTIMONY	3 U	20 U	3.3 B	169 J	78-GW02-01	7 / 33
ARSENIC	2 U	10 U	2.3 J	405 J	78-GW02-01	44 / 48
BARIUM	NA	NA	17 B	1250	78-GW07-01	59 / 59
BERYLLIUM	1 U	4 U	1 B	19	24-GW02-01	52 / 59
CADMIUM	5 U	25 U	5	21	78-GW04-3-01	9 / 59
CALCIUM	NA	NA	2420 B	642000	78-GW04-1-01	59 / 59
CHROMIUM	10 U	50 U	10	858 J	78-GW06-01	46 / 59
COBALT	8 U	8 U	8 B	170	78-GW22-2-01	25 / 59
COPPER	2 U	2 U	3 B	699	78-GW39-01	58 / 59
IRON	NA	NA	32 B	523000	78-GW04-3-01	59 / 59
LEAD	1.8 U	4.9 U	2.9 B	2000 J	21-GW0B-01	50 / 59
MAGNESIUM	NA	NA	88 B	37100	24-GW03-01	59 / 59
MANGANESE	2 U	2 U	2 B	714	78-GW24-1-01	57 / 59
MERCURY	0.2 U	0.2 U	0.23 J	3.2	24-GW06-01	24 / 52
NICKEL	20 U	20 U	20 B	234	78-GW22-2-01	31 / 59
POTASSIUM	NA	NA	982 B	67300	78-GW32-3-01	59 / 59
SELENIUM	1 U	5 U	1.1 J	99.5 J	78-GW32-2-01	41 / 54
SILVER	3 U	15 U	5 J	5 J	78-GW09-3-01	1 / 59
SODIUM	NA	NA	2450 B	42500	78-GW32-3-01	59 / 59
THALLIUM	1 U	1 U	1 B	7.3 J	78-GW32-2-01	16 / 59
VANADIUM	4 U	4 U	4 J	1700	78-GW08-01	55 / 59
ZINC	6 U	6 U	6 J	967 J	78-GW22-2-01	57 / 59
CYANIDE	10 U	10 U	ND	ND	ND	0 / 54

OPERABLE UNIT NO. 1 - SITES 21, 24, 78
SHALLOW, INTERMEDIATE AND DEEP MONITORING WELLS
GROUNDWATER DATA AND FREQUENCY SUMMARY
REMEDIAL INVESTIGATION CTO - 19177
MCB CAMP LEJEUNE, NORTH CAROLINA
TAL METALS AND CYANIDE

SAMPLE NO.	21-GW0C-01	24-GW01-01	24-GW02-01	24-GW03-01	24-GW04-01	24-GW06-01
UNITS	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
ALUMINUM	209000 J	262000	93700	50200	58900	19800
ANTIMONY	7 U	3 U	3 UJ	3 U	4.6 B	3.5 B
ARSENIC	101	10 UJ	2.3 J	4.7 J	116 J	10.1 J
BARIUM	467	380	1120	480	290	159 B
BERYLLIUM	8	3 B	19	5	2 B	9
CADMIUM	10 U	5 U	12	5 U	5 U	5
CALCIUM	35200 J	4120 B	2420 B	124000	65600	151000
CHROMIUM	291 J	296	316	110	153	78
COBALT	60	8 U	41 B	66	8 U	35 B
COPPER	84	49	52	22 B	31	15 B
IRON	106000 J	58600	395000	16300	70500	69500
LEAD	92.5 J	89	17.9	21.6	23.6	7.4
MAGNESIUM	16300	12200	7240	37100	7690	4320 B
MANGANESE	273 J	117	518	393	66	431
MERCURY	0.23 J	0.23	2.6	0.2 U	0.2 U	3.2
NICKEL	123	38 B	140	85	20 U	93
POTASSIUM	11800	12000	7550	15400	6130	3370 B
SELENIUM	4.3 B	1.3 J	1.1 J	16.2 J	4.3 J	1 UJ
SILVER	3 U	3 UJ	15 UJ	3 UJ	3 UJ	3 UJ
SODIUM	15200	6030	11600	19200	5230	7280
THALLIUM	1 U	1 U	1 U	2.4 B	1 U	1 B
VANADIUM	419	304	408	92	202	83
ZINC	487 J	118	461	650	80	489
CYANIDE	10 U					

XLS

OPERABLE UNIT NO. 1 - SITES 21, 24, 78
SHALLOW, INTERMEDIATE AND DEEP MONITORING WELLS
GROUNDWATER DATA AND FREQUENCY SUMMARY
REMEDIAL INVESTIGATION CTO - 19177
MCB CAMP LEJEUNE, NORTH CAROLINA
TAL METALS AND CYANIDE

SAMPLE NO.	78-GW04-1-01	78-GW04-2-01	78-GW04-3-01	78-GW05-01	78-GW06-01	78-GW07-01
UNITS	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
ALUMINUM	297000 J	286	115 B	23000 J	542000 J	207000 J
ANTIMONY	7 R	7 R	7 R	7 U	7 U	7 U
ARSENIC	18.6 J	2 R	118 J	5.2 J	26 B	16.2
BARIUM	728	519	547	54 B	1200	1250
BERYLLIUM	19	1 B	1 B	2 B	9	5
CADMIUM	12	5 U	21	5 U	5 U	5 U
CALCIUM	642000	170000	105000	90200 J	7180 J	18700 J
CHROMIUM	496 J	10 U	50 U	17 J	858 J	400 J
COBALT	28 B	8 U	8 U	8 U	11 B	20 B
COPPER	87	4 B	7 B	8 B	127	53
IRON	267000 J	32 B	523000	14900 J	142000 J	96700 J
LEAD	126	2 U	2 U	13.1 J	155 J	61.5 J
MAGNESIUM	25500	88 B	3210 B	12700	24000	20000
MANGANESE	703	51	591	161 J	184 J	135 J
MERCURY	0.75	0.2 U	0.3	0.2 R	1.1 J	0.44 J
NICKEL	136	20 B	20 U	20 U	86	54
POTASSIUM	18800	21800	11300	4770 B	25600	13200
SELENIUM	9 J	1 R	1 R	6.4	5.5 B	9.1
SILVER	6 UJ	3 U	15 U	3 U	3 U	3 U
SODIUM	8870	11500	9290	23900	5090	9260
THALLIUM	1.2 J	1 U	1 U	1 UJ	1.1 B	1 UJ
VANADIUM	591	4 UJ	24 J	28 B	811	406
ZINC	373 J	7 J	79 J	32 J	223 J	158 J
CYANIDE	10 U	10 U	10 U	10 U	10 U	10 U

OPERABLE UNIT NO. 1 - SITES 21, 24, 78
SHALLOW, INTERMEDIATE AND DEEP MONITORING WELLS
GROUNDWATER DATA AND FREQUENCY SUMMARY
REMEDIAL INVESTIGATION CTO - 19177
MCB CAMP LEJEUNE, NORTH CAROLINA
TAL METALS AND CYANIDE

SAMPLE NO.	78-GW13-01	78-GW14-01	78-GW15-01	78-GW16-01	78-GW17-1-01	78-GW17-2-01
UNITS	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
ALUMINUM	61800 J	103000 J	205000 J	341000 J	168000 J	541 J
ANTIMONY	7 U	7 R	7 R	7 R	7 R	7 R
ARSENIC	38.3	18.4 J	4 R	19 J	11.6 J	2 R
BARIUM	236	321	469	511	261	57 B
BERYLLIUM	3 B	1 B	4 B	6	4 B	1 B
CADMIUM	5 U	10 U	5 U	5 U	10 U	5 U
CALCIUM	4040 J	5300	29100	62700	86900	144000
CHROMIUM	222 J	113 J	215 J	353 J	200 J	10 UJ
COBALT	20 B	8 U	9 B	13 B	9 B	8 U
COPPER	18 B	33	49	80	40	5 B
IRON	61800 J	49600 J	43300 J	80900 J	48700 J	2120 J
LEAD	26.4 J	63	53	224	81	5.9
MAGNESIUM	11800	10600	13400	10800	9940	2570 B
MANGANESE	57 J	68	115	150	96	33
MERCURY	0.3 J	0.38	0.2 U	0.38	0.2 U	0.2 U
NICKEL	40	34 B	29 B	61	30 B	20 U
POTASSIUM	8210	6460	12000	14000	11600	1630 B
SELENIUM	4.7 B	12.4 J	2.1 J	14.5 J	5 UJ	1 UJ
SILVER	3 U	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ
SODIUM	15000	15400	6410	4120 B	3180 B	9480
THALLIUM	1 U	1 UJ	1 J	1.4 J	1 J	1 UJ
VANADIUM	158	122	248	371	289	4 U
ZINC	96 J	51 J	116 J	157 J	98 J	6 UJ
CYANIDE	10 U	10 U	10 U	10 U	10 U	10 U

OPERABLE UNIT NO. 1 - SITES 21, 24, 78
SHALLOW, INTERMEDIATE AND DEEP MONITORING WELLS
GROUNDWATER DATA AND FREQUENCY SUMMARY
REMEDIAL INVESTIGATION CTO - 19177
MCB CAMP LEJEUNE, NORTH CAROLINA
TAL METALS AND CYANIDE

SAMPLE NO.	78-GW23-01	78-GW24-1-01	78-GW24-2-01	78-GW24-3-01	78-GW25-01	78-GW29-01
UNITS	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
ALUMINUM	111000 J	160000	1340	304	101000 J	78800 J
ANTIMONY	7 R	7 R	7 R	7 R	7 R	7 R
ARSENIC	7.6 J	100 J	2 R	2 R	11.4 J	19 J
BARIUM	230	396	34 B	17 B	119 B	1070
BERYLLIUM	2 B	7	1 B	1 U	2 B	12
CADMIUM	5 U	5 U	5	5	5 U	5 U
CALCIUM	10800	34400	107000	73400	37800	41600
CHROMIUM	101 J	264	10	10 U	82 J	252 J
COBALT	8 B	39 B	8 U	8 U	8 U	17 B
COPPER	25	71	6 B	5 B	26	34
IRON	30800 J	159000	2320	2370	26300 J	125000 J
LEAD	50	152	3.3	2.9 B	30.5	25.5
MAGNESIUM	7110	11600	1740 B	1500 B	4500 B	21900
MANGANESE	87	714	21	41	33	341
MERCURY	0.3	0.75	0.2 U	0.2 U	0.2 U	0.2 U
NICKEL	42	91	20 U	20 U	20 U	125
POTASSIUM	5450	9090	1050 B	982 B	4950 B	11600
SELENIUM	4.4 J	17.6 J	1 R	1 R	1.6 J	2.5 J
SILVER	3 UJ	3 U	3 U	3 U	3 UJ	3 UJ
SODIUM	7450	10800	8350	7050	16400	21200
THALLIUM	1.7 J	1.5 B	1 U	1 U	1.3 J	1 UJ
VANADIUM	108	436	4 J	4 UJ	144	183
ZINC	67 J	291 J	11 J	16 J	34 J	330 J
CYANIDE	10 U	10 U	10 U	10 U	10 U	10 U

OPERABLE UNIT NO. 1 - SITES 21, 24, 78
SHALLOW, INTERMEDIATE AND DEEP MONITORING WELLS
GROUNDWATER DATA AND FREQUENCY SUMMARY
REMEDIAL INVESTIGATION CTO - 19177
MCB CAMP LEJEUNE, NORTH CAROLINA
TAL METALS AND CYANIDE

SAMPLE NO.	78-GW35-01	78-GW36-01	78-GW37-01	78-GW38-01	78-GW39-01
UNITS	UG/L	UG/L	UG/L	UG/L	UG/L
ALUMINUM	47100	120000	73500	102000	60000
ANTIMONY	3 U	20 U	3 U	20 U	20 U
ARSENIC	2 UJ	3.1 J	4 J	33.6 J	4 UJ
BARIUM	261	152 B	123 B	420	256
BERYLLIUM	1 B	2 U	2 B	4 U	1 U
CADMIUM	5 U	5 U	5 U	25 U	5 U
CALCIUM	7480	35400	10100	62200	16800
CHROMIUM	55	111	65	201	60
COBALT	8 U	8 U	8 U	8 U	10 B
COPPER	15 B	29	22 B	110	699
IRON	11800	21200	18800	67500	28800
LEAD	13.2	30.2	21.8	41.2	186
MAGNESIUM	5680	5740	4600 B	17500	14300
MANGANESE	57	62	62	106	84
MERCURY	0.2 U	0.3	0.2 U	0.2 U	0.52
NICKEL	20 U	24 B	20 U	32 B	32 B
POTASSIUM	6150	5820	5990	8180	3840 B
SELENIUM	3.5 J	1.7 J	1.1 J	1.3 J	4.3 J
SILVER	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ
SODIUM	10300	2450 B	7270	10300	19500
THALLIUM	1 U	1 U	1 U	1 U	1 U
VANADIUM	59	98	106	235	67
ZINC	30	57	58	134	138
CYANIDE	10 U	10 U	10 U	10 U	10 U

OPERABL .IT NO. 5 - SITE 2
SHALLOW AND DEEP MONITORING WELLS
GROUNDWATER STATISTICAL SUMMARY
REMEDIAL INVESTIGATION CTO - 19174
MCB CAMP LEJEUNE, NORTH CAROLINA
TAL METALS AND CYANIDE

SAMPLE NO.	2-GW01-01	2-GW02-01	2-GW03-01	2-GW03DW-01	2-GW04-01	2-GW05-01
UNITS	UG/L		UG/L	UG/L	UG/L	UG/L
ALUMINUM	36000		5200	269	16800	4050
ANTIMONY	10 U		10 U	3.5 U	10 U	10 U
ARSENIC	21.2		2.5 B	1 UJ	23.6	2.2 B
BARIUM	52 B		46 B	1420	95 B	100 B
BERYLLIUM	1 B		0.5 U	0.5 U	2 B	0.5 U
CADMIUM	7		2.5 U	2.5 U	2.5 U	2.5 U
CALCIUM	23700		8460	450000	11100	21000
CHROMIUM	18		11	16	5 U	5 U
COBALT	10 B		4 U	4 U	4 U	4 U
COPPER	10 B		4 B	8 B	5 B	3 B
IRON	10300		7190	127	28100	12700
LEAD	15.5 L		3.5 J	1.1 UJ	2.7 J	0.5 UJ
MAGNESIUM	5660		1600 B	75 B	1920 B	4800 B
MANGANESE	55		21	2 U	21	46
MERCURY	0.1 U		0.1 U	0.1 U	0.1 U	0.1 U
NICKEL	10 U		10 U	10 U	10 U	10 U
POTASSIUM	2560 B		1030 B	187000	1210 B	2130 B
SELENIUM	4.2 B		0.5 U	0.5 U	0.5 U	0.5 U
SILVER	1.5 U		1.5 U	1.5 U	1.5 U	1.5 U
SODIUM	4040 B		5490	103000	5560	10100
THALLIUM	0.5 U		0.5 U	0.5 UJ	0.5 U	0.5 U
VANADIUM	72		10 B	2 U	89	9 B
ZINC	146		13 B	9 B	16 B	6 B
CYANIDE	5 U		5 U	5 U	5 U	5 U

OPERABLE UNIT NO. 5 - SITE 2
SHALLOW AND DEEP MONITORING WELLS
GROUNDWATER STATISTICAL SUMMARY
REMEDIAL INVESTIGATION CTO - 19174
MCB CAMP LEJEUNE, NORTH CAROLINA
DISSOLVED METALS

SAMPLE NO.	2-GW01D-01	2-GW02D-01	2-GW03D-01	2-GW03DWD-01	2-GW04D-01	2-GW05D-01
UNITS	UG/L		UG/L	UG/L	UG/L	UG/L
ALUMINUM	1930		66 B	89 B	60 B	1990
ANTIMONY	10 U		10 U	3.5 UJ	10 U	10 U
ARSENIC	2.2 B		1 U	1 UJ	6.1 B	1 U
BARIUM	42 B		25 B	1400	64 B	98 B
BERYLLIUM	1 B		0.5 U	0.5 U	0.5 U	1 B
CADMIUM	2.5 U		2.5 U	2.5 U	2.5 U	2.5 U
CALCIUM	24400		7100	441000	11300	21800
CHROMIUM	5 U		5 U	11	5 U	5 U
COBALT	4 U		4 U	4 U	4 U	4 U
COPPER	4 B		2 B	6 B	9 B	4 B
IRON	2560		2170	10 U	2720	7400
LEAD	2.1 J		0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ
MAGNESIUM	5220		1030 B	26 B	1840 B	4900 B
MANGANESE	51		4.5 U	1 U	17	46
MERCURY	0.1 U		0.1 U	0.1 U	0.1 U	0.1 U
NICKEL	10 U		10 U	10 U	10 U	10 U
POTASSIUM	2140 B		589 B	188000	1130 B	2170 B
SELENIUM	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U
SILVER	1.5 U		1.5 U	1.5 U	1.5 U	1.5 U
SODIUM	3590 B		5400	103000	5710	9970
THALLIUM	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U
VANADIUM	2 U		2 U	2 U	2 U	2 U
ZINC	28		3 U	3 U	8 B	9 B
CYANIDE						

SURFACE WATER

BASE BACKGROUND
SURFACE WATER
MCB, CAMP LEJEUNE, NORTH CAROLINA
TAL INORGANICS

Sample ID:	6-BH01-SW-06B		6-BH01-SW-06M		6-BH02-SW-06M		6-WC01-SW-06B		6-WC01-SW-06M		6-WC02-SW-06B		6-WC03-SW-06B	
ALUMINUM	1210		1230		868		1350		1220		633		747	
ANTIMONY	17.2	UJ	14	U	14	U	14	U	14	U	16.2	UJ	49	U
ARSENIC	3	U	3	U	3	UJ	3	UJ	3	UJ	2	U	2	U
BARIUM	13.4	JB	14	JB	25.1	JB	16	JB	16.2	JB	19.3	B	21	U
BERYLLIUM	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	1	U
CADMIUM	1.9	UJ	2.6	UJ	1.9	U	1.9	U	1.9	U	1.9	U	3	U
CALCIUM	612	B	600	B	16100		3640	B	3670	B	9990		9360	
CHROMIUM	3.6	U	3.6	U	7	U	3.6	UJ	3.6	UJ	3.6	U	5	U
COBALT	2	U	2	U	3	UJ	2	U	2	U	2	U	6	U
COPPER	3.2	UJ	3	UJ	7	UJ	1.9	U	1.9	U	1.9	U	4	U
CYANIDE	10	U	10	U	10	U	10	U	10	U	10	UJ	10	U
IRON	958		818		921		1050		941		844		849	
LEAD	1	U	1	U	3	U	2.3	JB	1.9	JB	1.2	B	5	
MAGNESIUM	588	B	612	B	1010	B	632	B	639	B	1110	B	916	B
MANGANESE	6.5	B	6.2	B	14	JB	9	UJ	8.9	UJ	8.8	B	9.8	JB
MERCURY	0.04	U	0.05	U	0.04	U	0.04	U	0.04	U	0.07	U	0.2	U
NICKEL	7.9	UJ	7.9	UJ	7.9	U	7.9	UJ	7.9	UJ	7.9	U	17	U
POTASSIUM	117	UJ	146	UJ	685	B	376	B	341	B	604	B	610	B
SELENIUM	5	U	5	U	5	U	5	UJ	5	UJ	5	U	5	U
SILVER	2	UJ	2	UJ	4	UJ	2	UJ	2	UJ	3.8	UJ	10	U
SODIUM	4680	B	4850	B	5250		3930	B	3980	B	7790		6240	
THALLIUM	2	UJ	2	UJ	2	UJ	2	U	2	UJ	2	UJ	2	UJ
VANADIUM	1.8	UJ	1.8	UJ	2	JB	3.3	JB	1.9	JB	2.1	JB	5	U
ZINC	4.5	U	4.9	U	13.1	U	8.7	U	7.6	U	7.5	U	7.4	U

Concentrations presented in micrograms per liter (UG/L)

BASE BACKGROUND
SURFACE WATER
MCB, CAMP LEJEUNE, NORTH CAROLINA
TAL INORGANICS

Sample ID:	6-WC03-SW-06M		6-WC03-SW-312M		41-TC-SW06		41-UN-SW01		41-NE-SW05		2-OC-SW01		69-UT1-SW-06	
ALUMINUM	633		676		390.0		447.0	J	178.0		556		1110	
ANTIMONY	49	U	49	U	7.60	U	7.60	U	7.60	U	7	U	49	U
ARSENIC	2	U	2	U	2.90	U	2.20	U	2.90	U	2	U	3	U
BARIUM	21	U	21	U	23.6		23.3		27.2		18	B	23	B
BERYLLIUM	1	U	1	U	0.760	U	0.760	U	0.760	U	1	U	1	U
CADMIUM	3	U	3	U	3.19	U	3.19	U	3.19	U	5	U	3	JB
CALCIUM	8890		9430		18900.0		41600.0		40300.0		22900		1380	B
CHROMIUM	5	U	5	U	8.31	U	8.31	U	8.31	U	10	U	5	U
COBALT	6	U	6	U	16.0	U	16.0	U	16.0	U	8	U	8	JB
COPPER	4	U	129		16.3	U	16.3	U	16.3	U	4	B	7	JB
CYANIDE	10	U	10	U	NZ		NZ		NZ		NZ		10	U
IRON	756		830		1460.0		1300.0	J	469.0		413		1000	
LEAD	5		10.4		1.40		1.85		1.17		2	U	2	B
MAGNESIUM	883	B	936	B	1620.0		1770.0		2410.0		1960	B	846	B
MANGANESE	8.2	JB	9.2	JB	25.7		17.5		40.0		24		9	JB
MERCURY	0.2	U	0.52		0.171	U	0.182	UJ	0.160	U	0.2	U	0.2	U
NICKEL	17	U	1380		17.4	U	28.8	U	17.4	U	20	U	17	U
POTASSIUM	603	B	640	B	2210		1860		1620		809	B	385	B
SELENIUM	5	U	5	U	1.60	UJ	1.60	UJ	1.60	UJ	1	U	5	U
SILVER	10	U	10	U	1.60	U	1.60	U	1.60	U	3	UJ	10	U
SODIUM	6100		6500		15000		22100		12300		6190		4790	JB
THALLIUM	2	UJ	2	UJ	3.00	U	3.00	U	3.00	U	1	U	2	UJ
VANADIUM	5	U	5	U	20.4	U	20.4	U	20.4	U	4	U	10	JB
ZINC	10.4	U	111		21.4		24.9		33.2		23	UJ	18	B

Concentrations presented in micrograms per liter (UG/L)

BASE BACKGROUND
SURFACE WATER
MCB, CAMP LEJEUNE, NORTH CAROLINA
TAL INORGANICS

	Minumum (ug/L)	Maximum (ug/L)	Average (ug/L)
ALUMINUM	178	1350	803.4
ANTIMONY	ND	ND	NA
ARSENIC	ND	ND	NA
BARIUM	13.4	27.2	17.9
BERYLLIUM	ND	ND	NA
CADMIUM	3	3	1.5
CALCIUM	600	41600	13383.7
CHROMIUM	ND	ND	NA
COBALT	8	8	3.7
COPPER	4	129	12.7
CYANIDE	ND	ND	NA
IRON	413	1460	900.6
LEAD	1.17	10.4	2.6
MAGNESIUM	588	2410	1138.0
MANGANESE	6.2	40	13.4
MERCURY	0.52	0.52	0.1
NICKEL	1380	1380	105.1
POTASSIUM	341	2210	776.8
SELENIUM	ND	ND	NA
SILVER	ND	ND	NA
SODIUM	3930	22100	7835.7
THALLIUM	ND	ND	NA
VANADIUM	1.9	10	4.4
ZINC	18	111	18.0

Qualifiers have been removed per Baker's standards.
Qualifiers U and UJ have been given one-half the detection value.
Qualifiers J, NJ, and B have been removed with no detection value change.

SEDIMENT

BASE BACKGROUND
SEDIMENT
MCB, CAMP LEJEUNE, NORTH CAROLINA
TAL INORGANICS

Sample ID:	2-OCSD01-06	2-OCSD01-612	6-BH01-SD-612B	6-BH01-SD-612M	6-BH01-SD-6B	6-BH01-SD-6M	6-BH02-SD-06M
ALUMINUM	8680	9090	6760	7790	5610	6360	3010
ANTIMONY	R	R	4.7 UJ	5.9 U	4.9 UJ	4.8 U	3.8 U
ARSENIC	0.56 UJ	0.57 UJ	1 U	1.1 U	1.1 U	0.93 U	0.77 U
BARIUM	30.5 B	30 B	9.7 JB	14.4 B	8.5 UJ	9.9 JB	12.5 B
BERYLLIUM	0.85 B	0.86 B	0.13 B	0.17 B	0.14 B	0.1 U	0.08 U
CADMIUM	1.4 U	1.4 U	0.51 UJ	0.8 UJ	0.86 UJ	0.65 UJ	0.54 JB
CALCIUM	6320	6180	59.3 U	82.8 U	61.9 U	70.2 U	1410
CHROMIUM	9.9	10	5.1	4.7	4.9	3.6	3.3 U
COBALT	2.3 U	2.3 U	0.53 U	0.84 U	0.55 U	0.69 U	1.1 UJ
COPPER	1.1 B	0.86 B	3.2 JB	10.1 JB	4.2 JB	6.2 JB	2.5 UJ
IRON	842	845	765	1590	638	956	1240
LEAD	8.8	8	8.9	12.3	11.3	10.2	6.9
MAGNESIUM	322 B	307 B	128 B	160 B	103 B	130 B	77.9 B
MANGANESE	4.8	5.7	4.9	6 B	4.7	4.9 B	4.4 J
MERCURY	0.14 U	0.14 U	0.05 U	0.05 U	0.05 U	0.04 UJ	0.03 U
NICKEL	5.6 U	5.7 U	2.1 UJ	3.3 UJ	2.2 UJ	2.7 UJ	2.7 UJ
POTASSIUM	229 B	237 B	125 B	163 B	122 B	140 B	76.8 UJ
SELENIUM	1.7 J	2.1 J	1.7 UJ	1.9 U	1.8 UJ	1.6 UJ	1.3 U
SILVER	0.85 UJ	0.86 UJ	0.53 UJ	0.84 UJ	0.55 UJ	0.69 UJ	0.82 UJ
SODIUM	86.2 B	78.9 B	35.5 UJ	42.8 UJ	41.5 UJ	39.4 UJ	25.4 UJ
THALLIUM	0.31 J	0.29 J	0.69 U	0.76 U	0.73 U	0.62 U	0.51 U
VANADIUM	6.8 B	6.6 B	5.7 B	6.5 B	4.8 B	4.9 B	3.3 JB
ZINC	18.9	18.9	2.1 U	1.4 U	1.6 U	1.8 U	12

Concentrations presented in milligrams per kilogram (mg/kg).

BASE BACKGROUND
SEDIMENT
MCB, CAMP LEJEUNE, NORTH CAROLINA
TAL INORGANICS

Sample ID:	6-BH02-SD-612M	6-WC01-SD-06B	6-WC01-SD-612B	6-WC02-SD-06B	6-WC02-SD-612B	6-WC03-SD-06B	6-WC03-SD-06M
ALUMINUM	7780	2090 J	2510	6540 J	5390 J	6480 J	4780 J
ANTIMONY	4.6 U	3.3 U	3.1 U	3.1 U	4.1 U	6.8 UJ	3.4 U
ARSENIC	1.6 JB	1.2 JB	0.73 UJ	0.81 U	0.64 U	1.4 UJ	0.82 UJ
BARIUM	30 B	5.2 JB	15.3 B	19.6 JB	23.7 JB	15.8 JB	37.1 JB
BERYLLIUM	0.33 B	0.07 U	0.07 U	0.26 U	0.33 U	0.27 U	0.32 U
CADMIUM	1.3 JB	0.45 U	0.42 U	0.42 U	0.74 UJ	1.2 UJ	0.46 U
CALCIUM	3890	329 B	1060 B	1090 JB	1790 J	2850 J	22200 J
CHROMIUM	9.9	3 UJ	2.5 UJ	4.2	3.4	6.2	6.4
COBALT	2.6 UJ	0.48 U	0.44 U	0.6 JB	0.87 JB	0.94 U	1.3 JB
COPPER	2.3 UJ	0.86 UJ	0.64 UJ	0.43 JB	0.62 JB	5.8 JB	53200
IRON	3150	724 J	1430 J	1200 J	1570 J	6870 J	6940 J
LEAD	8.9	9.7 J	2.3 J	4.8 J	4.8 J	9 J	314 J
MAGNESIUM	187 B	50.5 B	57 B	372 JB	356 JB	440 JB	852 JB
MANGANESE	8.6 J	2.4 UJ	4.7 J	8.8	6.5	9.7	23
MERCURY	0.07 U	0.03 U	0.04 U	0.08 U	0.06 U	0.11 U	0.06 U
NICKEL	7.2 UJ	1.9 UJ	1.8 UJ	1.7 UJ	2.8 B	3.7 UJ	1.9 UJ
POTASSIUM	151 U	92.1 B	98.1 B	145 B	97 U	220 B	360 B
SELENIUM	2.9	1.4 UJ	1.2 UJ	1 U	1.3 U	2.7 U	1 UJ
SILVER	1.3 UJ	0.48 UJ	0.44 UJ	0.52 UJ	1.2 UJ	1.5 UJ	7.3
SODIUM	39.9 UJ	38.3 UJ	27 UJ	491 JB	469 JB	277 UJ	489 JB
THALLIUM	0.65 UJ	0.55 U	0.49 U	0.4 UJ	0.5 UJ	1.1 UJ	0.4 UJ
VANADIUM	14.1 B	5.7 B	4.4 B	5.8 B	7 B	11.6 B	9.1 B
ZINC	12.6	3.1 U	3.1 U	1.6 U	2.4 U	16.3 U	926

Concentrations presented in milligrams per kilogram (mg/kg).

BASE BACKGROUND
SEDIMENT
MCB, CAMP LEJEUNE, NORTH CAROLINA
TAL INORGANICS

Sample ID:	6-WC03-SD-612B	41-UN-SD01-06	41-UN-SD01-612	41-NE-SD05-06	41-NE-SD05-612	41-TC-SD06-06
ALUMINUM	7040 J	1720.0	2780.0	437 J	351 J	2580.0 J
ANTIMONY	6.8 U	2.15 U	2.09 U	1.91 U	1.88 U	2.28 U
ARSENIC	1.3 JB	0.789 U	0.768 U	0.542 U	0.532 U	0.702
BARIUM	25.2 JB	5.24	7.66	3.2 U	3.14 U	13.5
BERYLLIUM	0.26 U	0.351 U	0.342 U	0.196 U	0.193 U	0.234 U
CADMIUM	0.92 U	0.639 U	0.622 U	0.823 U	0.809 U	0.982 U
CALCIUM	4500 J	1250.0	1660.0	314 J	216 J	1090.0 J
CHROMIUM	8.3	4.81 U	3.18 U	2.42 J	2.11 UJ	3.42 J
COBALT	0.97 U	2.65 U	2.58 U	4.13 U	4.06 U	4.92 U
COPPER	79.6	4.41 U	4.29 U	4.21 U	4.13 U	5.02 U
IRON	6050 J	924.0 J	1160.0 J	354 J	262 J	2840.0 J
LEAD	10.3 J	13.8 J	12.6 J	1.94	2.19	18.7
MAGNESIUM	333 JB	62.5	59.4	21.5	18.2 U	99.8
MANGANESE	8.3	2.94	2.67	1.96 J	1.79 UJ	8.72 J
MERCURY	0.11 U	0.068 U	0.066 U	0.064 U	0.063 U	0.077 U
NICKEL	3.8 UJ	5.97	3.79	7.4 U	7.3 U	8.90 U
POTASSIUM	457 B	136.0 U	132.0 U	197 U	193 U	235.0 U
SELENIUM	2.3 U	0.688 U	0.670 U	0.387 UJ	0.38 UJ	0.462 UJ
SILVER	1.3 UJ	0.435 U	0.424 U	0.413 UJ	0.406 UJ	0.492 UJ
SODIUM	382 UJ	73.6 J	49.3 UJ	95 U	117	347.0
THALLIUM	0.93 UJ	1.25 U	1.22 U	0.748 UJ	0.735 UJ	0.892 UJ
VANADIUM	15.7 B	4.52 U	4.40 U	5.26 U	5.17 U	6.28 U
ZINC	12.3 U	10.5 U	15.2 U	7.41 U	13.6	18.0

Concentrations presented in milligrams per kilogram (mg/kg).

BASE BACKGROUND
SEDIMENT
MCB, CAMP LEJEUNE, NORTH CAROLINA
TAL INORGANICS

Sample ID:	410TC-SD06-612	69-UT1-SD-06
ALUMINUM	6600.0 J	1240
ANTIMONY	2.11 U	9.4 U
ARSENIC	0.864	0.62 U
BARIUM	25.3	4 U
BERYLLIUM	0.377	0.19 U
CADMIUM	0.909 U	0.58 U
CALCIUM	1230.0 J	264 B
CHROMIUM	8.72 J	3.3
COBALT	4.56 U	1.2 UJ
COPPER	4.64 U	1.5 UJ
IRON	6030.0 J	3530
LEAD	13.6	1
MAGNESIUM	235.0	48.9 B
MANGANESE	13.7 J	2.9 J
MERCURY	0.071 U	0.11 U
NICKEL	8.20 U	3.3 U
POTASSIUM	381.0	81.1 B
SELENIUM	0.862 J	1 U
SILVER	0.456 UJ	1.9 U
SODIUM	105.0 U	122 JB
THALLIUM	0.826 UJ	0.42 UJ
VANADIUM	12.7	4 UJ
ZINC	19.9	4.4 U

Concentrations presented in milligrams per kilogram (mg/kg).

BASE BACKGROUND
SEDIMENT
MCB CAMP LEJEUNE, NORTH CAROLINA
TAL INORGANICS

	Minimum (mg/kg)	Maximum (mg/kg)	Average (mg/kg)
ALUMINUM	351	9090	4800.8
ANTIMONY	ND	ND	NA
ARSENIC	0.702	1.6	0.6
BARIUM	5.2	37.1	15.5
BERYLLIUM	0.13	0.86	0.2
CADMIUM	0.54	1.3	0.4
CALCIUM	216	22200	2626.4
CHROMIUM	2.42	10	4.7
COBALT	0.6	1.3	1.0
COPPER	0.43	53200	2424.1
IRON	262	6940	2268.6
LEAD	1	314	22.5
MAGNESIUM	21.5	852	200.5
MANGANESE	1.96	23	6.4
MERCURY	ND	ND	NA
NICKEL	2.8	5.97	2.4
POTASSIUM	81.1	457	157.2
SELENIUM	0.862	2.9	0.9
SILVER	7.3	7.3	0.7
SODIUM	73.6	491	130.6
THALLIUM	0.29	0.31	0.4
VANADIUM	3.3	15.7	6.3
ZINC	12	926	49.2

Qualifiers have been removed per Baker's standards.
Qualifiers U and UJ have been given one-half the detection limit.
Qualifiers J, NJ, and B have been removed with no detection value change.

APPENDIX Q
SHOWER MODEL

APPENDIX Q
SHOWER INHALATION MODEL

INHALATION OF CONTAMINANTS VOLATILIZED FROM SHOWER WATER

In the model developed by Foster and Chrostowski (1986), inhalation exposures to volatile organic chemicals (VOCs) while showering are modeled by estimating the rate of chemical releases into the air (generation rate), the buildup of VOCs in the shower room air while the shower is on, and the decay of VOCs in the shower room air after the shower is turned off, and the quantity of airborne VOCs inhaled while the shower is both on and off.

Estimation of the rate of VOC release into the air is based upon Liss and Slater's (1974) adaptation of the two-film gas-liquid mass transfer theory. The two-film boundary theory provides the basis for estimating the overall mass transfer coefficient (K_L) for each VOC of interest, according to the following equation:

$$K_L = (1/k_1 + RT/Hk_g)^{-1} \qquad (1)$$

where,

K_L	=	overall mass transfer coefficient (centimeter per hour [cm/hr]),
H	=	Henry's law constant (atm-m^3/mol-K),
RT	=	2.4×10^{-2} atm-m^3/mole (gas constant of 8.2×10^{-5} atm-m^3/mole-K times absolute temperature of 293 K),
kg	=	gas-film mass transfer coefficient (cm/hr), and
k_l	=	liquid-film mass transfer coefficient (cm/hr).

Equation 1 describes the mass transfer rate of a compound at an air-water interface where diffusion may be limited by both liquid- and gas-phase resistances.

Typical values of k_l (20 cm/hr) and k_g (3,000 cm/hr), which have been measured for CO_2 and H_2O, respectively, may be used to estimate VOC-specific values for these parameters (Liss and Slater, 1974):

$$k_g(VOC) = k_g(H_2O(18/MW_{VOC})^{0.5} \qquad (2)$$

$$k_1(VOC) = k_1(CO_2(44/MW_{VOC})^{0.5} \qquad (3)$$

where,

MW	=	molecular weight (g/mol).

The mass transfer coefficient, K_L, is adjusted to the shower water temperature, T_s, according to a semi-empirical equation developed to estimate the effect of temperature on oxygen mass-transfer rate (O'Connor and Dobbins, 1956):

$$K_{aL}=K_L(T_{1\mu s}/T_{s\mu 1})^{-0.5} \quad (4)$$

where,

K_aL	=	adjusted overall mass transfer coefficient (cm/hr),
T_1	=	calibration water temperature of K_L (K),
T_s	=	shower water temperature (K),
$\mu 1$	=	water viscosity at T_1 (cp), and
μs	=	water viscosity at T_s (cp).

The concentration leaving the shower droplet, C_{wd}, is obtained from an integrated rate equation based on a mass-balance approach:

$$C_{wd}=C_{w0}(1-\exp[-K_{aL}t_s/60d]) \quad (5)$$

where,

C_{wd}	=	concentration leaving shower droplet after time t_s (µg/ℓ),
C_{w0}	=	shower water concentration (µg/ℓ),
d	=	shower droplet diameter (mm), and
t_s	=	shower droplet drop time (sec).

The term K_{aL}/60d combines both the rate transfer and the available interfacial area across which volatilization can occur. The value 1/60d equals the specific interfacial area, 6/d, for a special shower droplet of diameter "d" multiplied by conversion factors (hr/3,600 sec and 10 mm/cm).

The VOC generation rate in the shower room, S, can then be calculated by the equation:

$$S=C_{wd}(Fr)/SV \quad (6)$$

where,

s	=	indoor VOC generation rate (µg/m^3-min),
FR	=	shower water flow rate (liter/min), and
SV	=	shower room air volume (m^3).

A simple one-box indoor air pollution model was used to estimate VOC air concentrations in the shower room. This model can be expressed as a differential equation describing the rate of change of the indoor pollutant concentration with time:

$$dC_a/dt=RC_a+S \tag{7}$$

where,

C_a	=	indoor VOC air concentration (μg/m^3, and
R	=	air exchange rate (min^{-1}).

When Equation 7 is integrated, the time-dependent indoor concentration can be estimated as follows:

$$C_a(t)=(S/R)\ (1-\exp[-Rt])\ for\ t = D_s$$

and

$$C_a(t)=(S/R)\ (\exp[RDs]-1)\exp(-Rt])\quad t > D_s$$

where,

C_a(t)	=	indoor air VOC concentration at time t (μg/m^2),
D_s	=	shower duration (min), and
t	=	time (min).

The inhalation exposure per shower can then be calculated according to the equation:

$$E_{inh}=[VR/(BW)\ (10^6)\,]\int_0^{D_t} C_a(t)\,dt$$

where,

E_{inh}	=	inhalation exposure per shower (mg/kg/shower),
VR	=	ventilation rate (liter/min),
BW	=	body weight (kg), and
D_t	=	total duration in shower room (min.)

This equation can be solved as:

$$E_{inh}=(VR)\ (S)/[(BW)\ (R)\ (10^6)\,]\ \ [D_s\ -\ 1/R\ +\ \exp(-RD_s)/R]$$

for the duration of the shower, and as

$$E_{inh}=(VR)\ (S)/[(BW)\ (R)\ (10^6)\,]\ \ x\ \ ([D_s+\frac{\exp(-RD_t)}{R}]\ -\ \frac{[\exp[R(D_s-D_t]}{R})$$

for both the duration of the shower and the duration in the room after the shower is turned off.

Assuming that an individual showers daily, E_{inh} is then equivalent to the chronic daily intake.

Table Q-1 lists the input parameters to the shower model.

Molecular weights and Henry's Law constants for the contaminants of potential concern are provided in Section 6.0 of this report in Table 6-1 and Appendix T, the CDI calculation spreadsheets.

LIST OF REFERENCES

Foster, S. A. and P. C. Chrostowski, 1986. Integrated Household Exposure Model for Use of Tap Water Contaminated with Volatile Organic Chemicals, presented at the 79th Annual Meeting of the Air Pollution Control Association, Minneapolis, Minnesota, June 22-17, 1986.

Liss, P. S. and P. G. Slater, 1974. Flux of Gases Across the Air-Sea Interface. Nature 247:181-184.

O'Connor, D. J. and W. Dobbins, 1956. The Mechanics of Reaeration in Natural Streams, J. Sanit, Eng. Div., ASCE 82:SA6, In Schroeder, E. D. Water and Wastewater Treatment, Chapter 4: Gas Transfer. McGraw-Hill, 1977.

TABLE Q-1

PARAMETERS USED IN THE CALCULATION OF SHOWER DOSE

PARAMETER	UNITS	VALUE
Calibration water temperature, T_1	K	293
Shower water temperature, T_s	K	318
Water viscosity at T_1, μ_1	Centipoise	1.002
Water viscosity at T_s, μ_s	Centipoise	0.596
Shower water droplet diameter, d	mm	1.0
Shower droplet drop time, t_s	sec	2
Shower water flow rate, FR	liter/min	10
Shower room air volume, SV	m^3	6
Air exchange rate, R	min^{-1}	0.0083
Shower duration, D_s	min	12
Total duration in shower room, D_t	min	15
Ventilation rate, VR (adult)	liter/min	10
Ventilation rate, VR (child)	liter/min	13.3
Body weight, BW (Adult)	kg	70
Body weight, BW (Child)	kg	15

APPENDIX Q

CALCULATION OF PERMEABILITY CONSTANTS

Chemical-specific permeability constants (PCs or k_p) were calculated using the following equation. (Reference: USEPA, 1992)

$$\textbf{Log kp} = -2.72 + 0.71 \log k_{ow} - 0.0061\ MW$$

Where,

k_p = permeability constant (cm/hr)
k_{ow} = octanol/water coefficient (unitless)
MW = molecular weight (g/mole)

Parameter	Log k_{ow}	MW	k_p
acenapthene	4	154	0.01
2-methylnaphthalene	3.86	142.2	$1.5x10^{-3}$

APPENDIX R
LEAD UBK MODEL

APPENDIX R
LEAD UBK MODEL

Lead exposure at the project site was evaluated using USEPA's lead UBK model. This model incorporates exposure from six different media (air, soil, drinking water, diet, indoor dust, and paint) to estimate blood lead levels in infants and young children. The lead UBK model addresses the lowest age groups because children are exceptionally sensitive to the adverse effects of lead. Factors contributing to this sensitivity include: 1) an apparent intrinsic sensitivity of developing organ systems, 2) behavioral traits that result in increased contact with dust and soil, 3) certain physiological factors that result in greater deposition of lead in the respiratory tract and higher absorption rate from the gastrointestinal tract in children, and 4) sufficient transplacental transfer of lead to result in a fetal burden (USEPA, 1990). In contrast to typical exposure estimation techniques, the UBK model predicts blood lead levels in younger children.

The UBK model is flexible in that the user can apply site-specific exposure parameters to estimate blood lead levels. In evaluating exposure at the project site, it was assumed that infants and younger children are exposed to lead in soil, drinking water, diet, air, and indoor dust. The following is a discussion of lead exposure via these five pathways and a description of the exposure parameters used for each pathway.

Soil and Indoor Dust

Soil concentrations of lead at the site were entered into the UBK model to establish the soil and indoor dust contribution to blood lead levels. The UBK model assumes that infants and younger children ingestion both soil and indoor dust that is contaminated with lead. For the site, the maximum concentration of lead in soil were modeled. These values are presented in Appendix H. The following section discusses the exposure parameters used in estimating the blood lead levels from soil and indoor dust exposure.

The UBK model estimates the indoor lead dust concentration as a percentage of the outdoor soil lead concentration. A conversion factor of 0.28 is used in the model for establishing the indoor lead dust concentration from an outdoor soil source. This value is derived from a study by Davis et al. (1990) where they identified a 0.28 dust/soil ration for aluminum and silicon. Because site-specific data are not available for the site, the default factor of 0.28 was utilized. The model also distributes the infant and young child's exposure between the soil and indoor dust. This soil/dust ingestion weighting factor is dependent on the amount of time spent indoors and outdoors. It is expected that the amount of time spent indoors is greater than the amount of time spent outdoors for infants and younger children (USEPA, 1990). As a result, the USEPA has selected a default value of 45 (i.e., 45% of lead intake from soil and dust is derived from ingestion of soil, 55% from ingestion of indoor dust).

Soil ingestion rates for the various age groups are required in the prediction of blood lead levels. The default values in Version 0.4 UBK model are 100 mg/day for each of the age groups. These values are unrealistic in that they assume a relatively high ingestion rate for the lower age groups (e.g., 0-1 and 1-2 yr.). As a result, the ingestion rate of 100 mg/day, especially in the lower age groups (0-2 years), is not representative for the site. USEPA's Exposure Factors Handbook (USEPA, 1989) presents values for soil ingestion for the various age groups. In particular, soil ingestion values that represent an intermediate tendency to ingest soil are presented. These values are more representative of the exposure at the site and were used in calculating the blood lead levels. Table R-1 presents the values for each of the age groups.

Drinking Water

Typically, the UBK model assumes that infants and younger children will be exposed to lead via consumption of drinking water at their place of residence. it was assumed that the younger children and infants will be exposed via direct ingestion of the groundwater at their place of residence. An ingestion rate of 1 L/day, which is consistent with the groundwater pathway, was used in estimating the blood lead contribution of surface water. Both the RME and average groundwater concentrations were used in estimating an overall blood lead level.

Diet

In creating the UBK model, the USEPA assumed a dietary contribution of lead based on Food and Drug Administration Market Basket Surveys and analysis of food lead content (USEPA, 1990). As a result , the default exposure parameters do not vary based on medium-specific concentrations (i.e., air, soil, water) at the site. The rationale is that foods are harvested from geographically diverse regions of the country and, for the most part, are not produced locally. Consequently, the lead concentrations in the food are not related to the lead levels in the local media. The default values supplied in the UBK model were used in estimating the blood lead contributions from dietary intake.

Air

Generation of wind blown dust is expected to occur to some extent at the project site. The modelled air concentrations were used as input parameters for the UBK model. These values were used in estimating the blood lead contribution of the air pathway at the project site. The indoor air concentration was calculated as a portion of the outdoor lead level. A default conversion factor of 0.3 was applied to the outdoor concentration to derive an indoor air lead level. Default values also were used for the amount of time spent indoors versus outdoors and the daily breathing volumes for each of the age groups.

TABLE R-1

UBK SOIL INGESTION RATES

AGE (Years)	SOIL INGESTION RATES (mg/day)	
	Default UBK Values	Site Specific Values*
0-1	100	0
1-2	100	50
2-3	100	200
3-4	100	200
4-5	100	50
5-6	100	10
6-7	100	10

* Intermediate tendence ingestion rate values from the Exposure Factors Handbook (USEPA, 1989).

REFERENCES
APPENDIX R

Davis, et. al., 1990. Davis, S., P. Waller, R. Buschborn, J. Ballou and P. White. Quantitative Estimates of Soil Ingestion in Normal Children Between the Ages of 2 and 7 years: Population-Based Estimates Using Aluminum, Silicon, and Titanium as Soil Tracer Elements. Arch. Environ. Health. 1990.

USEPA, 1990. U.S. Environmental Protection Agency. Technical Support Document on Lead. ECAO-CIN-757. Office of Health and Environmental Assessment. Cincinnati, Ohio: September, 1990.

USEPA, 1989. U.S. Environmental Protection Agency. Exposure Factors Handbook. EPA/600/8-89-043. Office of Health and Environmental Assessment. Washington, D.C.: July, 1989.

APPENDIX S
SITE CONCEPTUAL MODEL

PRELIMINARY HUMAN HEALTH RISK ASSESSMENT CONCEPTUAL EVALUATION MODEL

OPERABLE UNIT NO. 6
SITES 36, 43, 44, 86, AND 54

MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

CONTRACT TASK ORDER 0303

AUGUST 3, 1995

Prepared for:

DEPARTMENT OF THE NAVY
ATLANTIC DIVISION
NAVAL FACILITIES
ENGINEERING COMMAND
Norfolk, Virginia

Under:

LANTDIV CLEAN Program
Contract N62470-89-D-4814

Prepared by:

BAKER ENVIRONMENTAL, INC.
Coraopolis, Pennsylvania

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

As part of the review of available site information for use in a risk assessment (RA) and feasibility study (FS), a conceptual evaluation model has been formulated for the sites. Originally developed to assist in planning site activities for the remedial investigation (RI), the conceptual site model also can be used to identify the key elements in a risk assessment, such as: potential exposure pathways, exposure points and data needs.

As part of the RA, a conceptual evaluation model has been developed for Operable Unit (OU) No. 6, which includes sites 36, 43, 44, 54 and 86. The conceptual models briefly describe each site and present potential sources of contamination, constituents present at the site, potentially contaminated media, constituent migration routes, potential receptors and exposure pathways. Ecological receptors are addressed in the conceptual evaluation model for ecological risk assessment. The model was developed in accordance with the guidance provided in USEPA Data Quality Objectives for Remedial Response Activities Development Process (USEPA, 1987).

APPROACH

For the baseline human health risk assessment, both current and future land use exposure scenarios will be assumed for each site. A reasonable maximum exposure (RME) case scenario (i.e., worst case or upper bound risk estimate) will be utilized in the assessments. Consequently, the exposure scenarios presented will include RME assumptions for the input parameters in the exposure dose equations. Table 1 is a summary of these values.

The baseline risk assessment for each site will be conducted in concordance with the United States Environmental Protection Agency (USEPA) documents: Risk Assessment Guidance for Superfund: Human Health Evaluation Manual, Part A (USEPA, 1989) and Region IV Supplemental Risk Guidance (USEPA, 1992). The documents to be used in the assessment include, but are not limited to the following references: Risk Assessment Guidance for Superfund: Development of Risk-based Preliminary Remediation Goals, Part B (USEPA, 1991); "Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors" (USEPA, 1991); Exposure Factors Handbook (USEPA, 1989); Dermal Exposure Assessment: Principles and Applications, Interim Report (USEPA, 1992); and Superfund Exposure Assessment Manual (USEPA, 1988).

Toxicity values will be obtained from USEPA's Integrated Risk Information System (IRIS, 1995), the Health Effects Assessment Summary Tables (HEAST, 1994), and provisional or recommended USEPA toxicity values (i.e., values provided by the USEPA Environmental Criteria and Assessment Office [ECAO]), in accordance with Region IV and North Carolina Department of Environmental Health and Natural Resources (NCDEHNR) recommendations.

A mathematical model will be used to estimate exposure point concentrations. To estimate exposure from the inhalation of volatile contaminants in groundwater while showering, the "Integrated Household Exposure Model for Use of Tap Water Contaminated with Volatile Organic Chemicals" developed by S.A. Foster and P.C. Chrostowski will be applied. To evaluate the health effects of lead, the USEPA lead uptake/biokinetic model will be used.

The acceptable cancer risk range, as stipulated by the USEPA, is $1x10^{-4}$ to $1x10^{-6}$. Cancer risks that fall above the upper end of this risk range will be considered unacceptable as protective of human health. The total noncarcinogenic acceptable risk level is a hazard index (HI) less than or equal to

1.0. This value depicts a level at or below which adverse systemic effects are not expected to occur in the exposed population.

SITE 36 - CAMP GEIGER AREA DUMP

The Camp Geiger Area Dump (Site 36) is located approximately 1,000 feet east of Camp Geiger and 500 feet west of the New River, adjacent to the Camp Geiger Sewage Treatment Plant (STP). Camp Geiger is situated in the northwestern portion of MCB Camp Lejeune, approximately 3 miles southwest of Jacksonville, North Carolina.

During an initial assessment of potential sites at MCB Camp Lejeune, Site 36 was estimated to be approximately 1.5 acres in size. Based upon a review of aerial photographs and observations recorded during the RI scoping site visit, however, the size of the site was adjusted to include nearly 20 acres. The site is comprised primarily of open fields and wooded areas with dense understory. A gravel road bisects the site and provides access to Jack's Point Recreation Area, located approximately one-quarter mile east of the study area. The site is bordered to the north by Brinson Creek, to the east by woods, to the south by an unnamed tributary to the New River, and to the west by an improved (i.e., coarse gravel) road. Further to the west of the improved road lies an abandoned railroad right-of-way, once part of the Seaboard Coastline Railroad.

Background

From the late 1940s to the late 1950s, Site 36 was used for the disposal of municipal wastes and mixed industrial wastes, including garbage, waste oils, solvents, and hydraulic fluids from the air station. Disposal records indicate that all waste solvents and oils were burned at this site. Previous investigations have indicated that most of this material was initially burned and then buried. However, unburned material was also reportedly buried.

According to interviews conducted by Water and Air Research, Inc. (WAR) during the Initial Assessment Study (IAS), less than five percent of all waste hydrocarbon material generated at the air station was disposed of at Site 36. The remaining waste oil was reportedly used for dust control on roads or went directly into storm drains (WAR, 1983).

During a site visit conducted in March, 1994, scattered debris (i.e., trees, glass, and metal) , buried wire, and general litter was noted on-site. In addition, a few partially buried containers and 55-gallon drums and several mounds of construction debris were located in a swampy area southwest of the former dump. Fifty-five gallon drums containing unidentifiable material and 5-gallon pails labeled with "alkaline material" and "lubrication oil" were found south of the area where the unnamed tributary crosses the main access road.

A site investigation was performed by Water and Air Research, Inc. (WAR) in 1984. Additional investigations were conducted in 1986 and 1987 by Environmental Science and Engineering, Inc. (ESE). Levels of cadmium, chromium, lead, and phenols were detected in the groundwater (i.e., at both downgradient and upgradient wells) during the 1984 investigation. These levels exceeded federal and state groundwater criteria. Trans-1,2-dichloroethene (i.e., 2 μg/L), was detected at a low concentration, in the upgradient well only. The surface water and sediment from Brinson Creek and the unnamed tributary were also sampled. Trace levels of trans-1,2-dichloroethane, lead, and total phenols were detected in surface water and sediment. Chromium, lead, oil and grease, and phenols were detected in sediment.

The most recent sampling event included investigations of the following environmental media: background surface and subsurface soil, on-site surface and subsurface soil, shallow and deep groundwater, and surface water and sediment from Brinson Creek and the unnamed tributary. In addition, aquatic organisms were collected from Brinson Creek. A preliminary review of the unvalidated laboratory data indicates the presence of organic solvent constituents in the groundwater (i.e., trichloroethane [TCE], 1,2-dichloroethene [1,2-DCE], and 1,1,2,2-tetrachloroethene [1,1,2,2-PCE]) and soil, pesticides and PCBs in the surface soil, and metals, namely lead, in the soil and sediment.

Current and Future Exposure Scenarios

At present, the site is used for military training exercises and recreation (i.e., fishing, swimming, jogging, etc.) for off-site visitors from nearby residences. Dirt roads are located throughout the site, which may contribute to fugitive dust generation from vehicular traffic. The majority of the site is heavily wooded and vegetated.

Current receptors include on-site military personnel, off-site trespassers from nearby residences (i.e., child and adult receptors), construction workers, and fishermen. For military receptors and trespassers, potential exposure pathways are surface soil incidental ingestion, dermal contact and inhalation of fugitive dust, and surface water and sediment incidental ingestion and dermal contact from the surrounding surface water. Fishermen will be similarly evaluated for surface water and sediment exposure via incidental ingestion and dermal contact. These receptors will also be assessed for exposure to contaminants in fish tissue via ingestion. Presently, a pipeline is being installed on the eastern portion of Site 36, so current subsurface soil exposure will be evaluated for construction workers. Workers are exposed to subsurface soil when it is excavated during groundbreaking for construction activities.

At present, groundwater at the site is not used for potable purposes. Consequently, current exposure to groundwater will not be evaluated.

In the future case, it is expected that the site will remain a military restricted area. As stated previously, groundwater is not currently used for potable purposes. It is assumed that this will continue into the future. As a result, groundwater exposure will not be assessed for future military personnel. Although it is unlikely that a future residence will be implemented at this site, in accordance with conservative guidance, it is assumed that a private well will be installed on-site in the future case. Consequently, groundwater exposure to a future residential child and adult receptor will be assessed. The potential groundwater exposure pathways are ingestion, dermal contact and inhalation while showering.

Figure 1 presents a flowchart of the potential exposure pathways and receptors at this site.

SITE 43 - AGAN STREET DUMP

The Agan Street Dump (Site 43) is comprised of approximately 11 acres and is located within the operations area of Marine Corps Air Station (MCAS) New River, 2 miles west of the main entrance (see Figure 1-1). There is vehicle access to the site via Agan Street, from Curtis Road. Site 43 is located at the northern terminus of Agan Street, adjacent to an abandoned sewage disposal facility. The site is bordered to the north by Edwards Creek, to the east and south by Strawhorn Creek, and to the west by Agan Street and the former sewage disposal facility. Strawhorn Creek discharges into Edwards Creek at Site 43. Edwards Creek then discharges into the New River approximately 2,000 feet north of the study area, near Site 36.

Much of the study area is heavily vegetated with dense understory and trees greater than three inches in diameter. Marsh areas prone to flooding line both Strawhorn and Edwards Creeks. An improved gravel loop road provides access to the main portion of the study area, other unimproved paths extend outward from this road. Presently, Site 43 is unrestricted.

Background

Reportedly, municipal waste, fiberglass and sewage treatment plant sludge were dumped on the ground surface at Site 43; however, it is not known exactly how long Site 43 was officially used as a dump (Halliburton/NUS, 1991). It has also been reported that other solid wastes may have been disposed at this site. The particular types and quantities of these wastes, however, are not known.

Baker Environmental, Inc. (Baker) conducted an SI at Site 43 in 1991. Soil samples contained polynuclear aromatic hydrocarbons (PAHs) and inorganic concentrations exceeding twice the base-specific background levels. Groundwater samples did not contain PAHs; however, they did contain carbon disulfide. Inorganics were also detected in groundwater and surface water at concentrations exceeding state and federal criteria. Sediment contained PAHs at locations downgradient from soil sample locations exhibiting PAH contamination at the confluence of Edwards Creek and at Strawhorn Creek. The presence of PAHs in sediment samples confirms the presence of PAHs in soil, as sediment contamination may be caused by surface runoff. Pesticides were also detected in sediment samples; however, there were no pesticides present in soil samples. Recent investigations indicate the presence of PAHs in soil (Baker, 1995).

Current and Future Exposure Scenarios

Site 43 no longer serves as a waste dump. Presently, Site 43 has no official use.

Receptors exposed to surface soil include: future residents (i.e., children and adults), current military personnel, and current trespassers (i.e., children and adults) from adjacent, off-site residences. Surface soil exposure pathways for these receptors include incidental ingestion, dermal contact, and inhalation of fugitive dust.

Future construction workers are the only receptors exposed to subsurface soil. Exposure to subsurface soil exposure may occur during ground excavation for on-site construction activities. Exposure pathways include: incidental ingestion of subsurface soil, dermal contact with subsurface soil and inhalation of fugitive dust.

Presently, groundwater at Site 43 is not used for potable supplies. For this reason, current groundwater exposure is not evaluated. In a future scenario, it is possible that residential developments may be constructed at Site 43. Consequently, future groundwater exposure will be assessed for residential children and adults. Groundwater exposure pathways include: ingestion, dermal contact with groundwater and inhalation of volatilized organics while showering.

Groundwater exposure will not be evaluated for future military personnel, for the same reasons it is not evaluated for these receptors at Site 36.

Receptors exposed to surface water and sediment are current on-site trespassers and future residents. Exposure pathways for these receptors are incidental ingestion of surface water/sediment and dermal contact with surface water/sediment.

Figure 2 presents a flowchart of the potential exposure pathways and receptors at Site 43.

SITE 44 - JONES STREET DUMP

The Jones Street Dump (Site 44) encompasses approximately 5 acres and is situated within the operations area of MCAS New River. There is vehicle access to the site via Baxter Street, from Curtis Road. Site 44 is located at the northern terminus of Baxter Street, behind base housing units along Jones Street. The site is partially surrounded by a six-foot chain-link fence, and a portion of the site lies to the east of the fenced compound. The site is bordered to the north and west by Edwards Creek, to the south by base housing units along Jones Street, and to the east by woods and an unnamed tributary to Edwards Creek. Edwards Creek flows east from the study area toward Site 43, which is located about 2,000 feet to the east of Site 44.

A majority of the site is comprised of a gently dipping open field that slopes toward Edwards Creek. The field is covered with high grass, weeds, and small pine trees that are less than two inches in diameter. Surrounding the open field is a mature wooded area with dense understory.

Background

The Jones Street Dump reportedly operated in the 1950's. Site 44 served as a dump for municipal waste and various debris. It has also been reported that some potentially hazardous materials may have been disposed at this site. The particular types and quantities of these wastes, however, are not known.

WAR conducted an IAS at Site 44 in 1983. This study produced evidence that construction debris and small quantities of potentially hazardous waste were disposed at the dump.

Baker conducted an SI at Site 44 in 1991. Soil samples contained low levels of PAHs and specific pesticides (i.e., 4,4'-DDE and 4,4'-DDD). Inorganics were detected in soil samples at concentrations exceeding twice the base-specific background levels. Groundwater contained inorganics at concentrations exceeding state and federal criteria. Low concentrations of PAHs were detected in one well, and toluene and ethylbenzene were detected in another well at concentrations below state and federal standards. Surface water samples contained inorganics at low levels. Sediment samples contained trace levels of pesticides and semivolatiles, as well as slightly elevated concentrations of copper, lead and zinc.

Current and Future Exposure Scenarios

Site 44 no longer serves as a dump. Presently, Site 44 has no official use.

Receptors exposed to surface soil include: future residents, (i.e., children and adults) current military personnel and on-site trespassers (i.e., children and adults) from adjacent, off-site residences. Soil exposure pathways for these receptors include: incidental ingestion of surface soil, dermal contact with surface soil and inhalation of fugitive dust.

Future construction workers are the only receptors exposed to subsurface soil. Exposure to subsurface soil exposure may occur during ground excavation for on-site construction activities. Exposure pathways include: incidental ingestion of subsurface soil, dermal contact with subsurface soil and inhalation of fugitive dust.

Presently, Site 44 groundwater is not tapped for potable supplies. For this reason, current groundwater exposure is not evaluated. In a future scenario, it is possible that residential developments may be constructed at Site 44. Consequently, future groundwater exposure will be assessed for residential children and adults. Groundwater exposure pathways include: ingestion of groundwater, dermal contact with groundwater and inhalation of volatilized organics while showering.

Groundwater exposure will not be evaluated for future military personnel, for the same reasons it is not evaluated for these receptors at Site 36.

Receptors exposed to surface water and sediment are current on-site trespassers and future residents. Exposure pathways for these receptors are incidental ingestion of surface water/sediment and dermal contact with surface water/sediment.

Figure 3 presents a flowchart of the potential exposure pathways and receptors at this site.

SITE 54 - CRASH CREW FIRE TRAINING BURN PIT

The Crash Crew Fire Training Burn Pit (Site 54) is located near the southwest end of runway 5-23, within the operations area of MCAS New River. The burn pit is approximately 50 feet in diameter and is situated at the center of this 1.5 acre site. An 8,000-gallon underground storage tank (UST) lies to the northwest of the burn pit. Fire training exercises are conducted within the burn pit using JP-type fuel, which is stored in the nearby UST. An oil and water separator, located approximately 100 feet to the southeast of the burn pit, is used for temporary storage and collection of the spent fuel.

An improved gravel surface surrounds the burn pit, the remaining portion of the site is comprised of maintained lawn area. The ground surface slopes away from the central portion of the study area toward the south, southwest, and southeast. Two drainage ditches lead away from the burn pit area toward the south, on either side of an improved road. During periods of heavy precipitation, the ditches serve as channels for surface water runoff.

Background

Site 54 has served as a fire training burn pit since the mid-1950s. Waste fuels, oils, and solvents were used to simulate fire conditions that would result from aircraft crashes. Fire training at Site 54 was originally conducted on the ground surface, within a bermed area. In 1975 a lined burn pit was constructed (WAR, 1983). The same burn pit remains in operation today, however, only JP-type fuels are currently used during training exercises.

The site media (i.e, soil, groundwater, surface water, and sediment) were previously investigated by WAR in 1983, and by ESE in 1986 and 1987. POL contamination was noted in the soil at depth. The 1984 groundwater results indicated levels of chromium, oil and grease, and phenols. In later studies, these same chemicals were detected in the groundwater; no VOCs were detected. Total phenols were found in surface water. Chromium, lead, oil and grease, and total phenols were detected in sediment.

During a recent site visit conducted in March, 1994, fuel odor and residue on standing water were observed in the pit. A stressed vegetated area, which may have been used as a burn area, was identified southwest of the burn pit. Broken glass and metal debris were scattered on the ground along Perimeter Road. A small spill area was also noted in this area.

The most recent sampling event investigated these same site media. A preliminary assessment of the unvalidated laboratory results indicates PAHs in the soil and VOCs, including benzene, toluene, ethylbenzene, xylenes (BTEX), and 1,2-DCE, in the groundwater.

Current and Future Scenarios

Site 54 is currently used for emergency fire response training. Current receptors include on-site military personnel and trespassers (i.e., child and adult receptors). Exposure pathways for these receptors include surface soil incidental ingestion, dermal contact, and inhalation of fugitive dust.

At present, groundwater is not utilized for potable purposes. As a result, current groundwater exposure will not be assessed. Exposure to subsurface soil in the current scenario is unlikely for the receptor population. Consequently, subsurface soil is not considered to be a viable medium for exposure.

In the future case, it is unlikely that a residential scenario will be implemented at the site. It is assumed that the present activities will continue into the foreseeable future. However, to be conservative, groundwater exposure to a residential child and adult receptor will be assessed. Surface soil exposure, as calculated in the current scenario for the child and adult trespassers, is expected to remain the same in the future case.

Groundwater exposure for future on-site military personnel will not be assessed, for the same reasons it is not evaluated for the other sites. However, a construction worker will be evaluated in the future case. It is assumed that subsurface soil exposure may occur as a result of excavation for potential construction activities at the site. In addition, subsurface soil exposure will be assessed for future residents (i.e., child and adult receptor). The exposure pathways for these receptors are incidental ingestion, dermal contact, and inhalation.

Figure 4 presents a flowchart of the potential exposure pathways and receptors at this site.

SITE 86 - ABOVEGROUND STORAGE TANK AREA

Site 86 is located on the southwest corner of the Foster and Campbell Street intersection, within the operations area of MCAS New River. The site is comprised of a lawn area surrounded by buildings, asphalt roads, and parking lots. Concrete pylons, upon which electric and steam overhead utilities are mounted, line the northern, western, and southern boundaries of the site. Campbell Street borders the site to the north and Foster Street lies adjacent to the east. Immediately to the south of the study area is Building AS-502, the MCAS fire station. The entrance road to the fire station borders the study area to the west.

The ground surface at Site 86 gently slopes to the south, toward a drainage ditch and culvert. Storm water drains that are located along Campbell Street receive runoff from only the northernmost portion of the study area. Stormwater from Site 86 eventually discharges into the New River, which lies approximately three quarters of a mile to the east.

Background

Site 86 served as a storage area for petroleum products from 1954 to 1988. In 1954, three 25,000-gallon above ground storage tanks (ASTs) were installed within an earthen berm. Additionally, a small pump house was constructed to transfer fuel oil to and from the ASTs. The three tanks were reportedly used for No.6 fuel oil storage until 1979. From 1979 to 1988 the tanks were then used for temporary storage of waste oil (O'Brien & Gere, 1992). The three tanks were emptied in 1988 and are believed to have been removed in 1992. Today, the former location of the tanks is grass-covered and only a very slight depression remains.

A preliminary site investigation was conducted in 1990 by Dewberry and Davis. Several VOCs were found in the subsurface soil, including chloroform, methylene chloride, 1,1,1-trichloroethane (TCA), and 1,1,2-trichlorofluoroethane. These detections were attributed to localized surface spills. In 1992, O'Brien and Gere conducted a site assessment, investigating soil and groundwater at this site. Soil samples were analyzed for TPH and TCLP compounds. Most of the samples showed detections that did not exceed regulatory criteria for these parameters.

In the groundwater, several organic compounds were found: benzene, toluene, 1,1-dichloroethane (1,1-DCA), 1,2-dichloroethene (1,2-DCE), TCE, tetrachloroethene (PCE), chloroethane, and TCA. The detections of benzene, TCE, and PCE exceeded North Carolina groundwater criteria in a few samples. Toluene and TCA were detected below the state groundwater criteria. There are no criteria available for chloroethane, 1,1-DCA, and 1,2-DCE.

Baker conducted the latest investigation at this site in 1995, addressing soil and groundwater. A preliminary assessment of the unvalidated data indicated the presence of VOCs (i.e., TCE, 1,2-dichloroethane [1,2-DCA], 1,2-DCE, benzene, and PCE) in soil and groundwater.

Current and Future Scenarios

Site 86 currently has no official uses. Current receptors include on-site military personnel and trespassers (i.e., child and adult receptors). Exposure pathways for these receptors include surface soil incidental ingestion, dermal contact, and inhalation of fugitive dust.

At present, groundwater is not utilized for potable purposes. As a result, current groundwater exposure will not be assessed. Exposure to subsurface soil in the current scenario is unlikely for the receptor population. Consequently, subsurface soil exposure is not considered to be viable.

In the future case, it is unlikely that a residential scenario will be implemented at the site. It is assumed that the present activities will continue into the foreseeable future. However, to be conservative, groundwater exposure to a residential child and adult receptor will be assessed. Surface soil exposure, as calculated in the current scenario for the child and adult trespassers, is expected to remain the same in the future case.

Like the previous sites, groundwater exposure for future on-site military personnel will not be assessed. However, a construction worker will be evaluated in the future case. It is assumed that subsurface soil exposure may occur as a result of excavation for potential construction activities at the site. In addition, subsurface soil exposure will be assessed for future residents (i.e., child and adult receptor). The exposure pathways for these receptors are incidental ingestion, dermal contact, and inhalation.

Figure 5 presents a flowchart of the potential exposure pathways and receptors at this site.

TABLES

TABLE 1

SUMMARY OF PRELIMINARY EXPOSURE DOSE INPUT PARAMETERS FOR SITES 36, 43, 44, 54, AND 86

Input Parameter	Units	Receptor					
		Trespasser Child	Trespasser Adult	Military Personnel	Construction Worker	Residential Child	Residential Adult
Soil (mg/kg)							
Ingestion Rate, IR	mg/d	100	50	100	480	200	100
Fraction Ingested, FI	unitless	1	1	1	1	1	1
Exposure Frequency, EF	d/y	43	130	250	90	350	350
Exposure Duration, ED	y	6	30	4	1	6	30
Surface Area, SA	cm^2	2,000	5,000	4,300	4,300	2,300	5,800
Absorption Factor, AF	mg/cm^3	1	1	1	1	1	1
Averaging Time, Noncarc., ATnc	d	2,190	10,950	1,460	365	2,190	10,950
Averaging Time, Carc., ATcarc	d	25,550	25,550	25,550	25,550	25,550	25,550
Body Weight, BW	kg	15	70	70	70	15	70
Conversion Factor, CF	kg/mg	$1x10^{-6}$	$1x10^{-6}$	$1x10^{-6}$	$1x10^{-6}$	$1x10^{-6}$	$1x10^{-6}$
Absorbance Factor, ABS	unitless	Organics = 0.01; Inorganics = 0.001					
Groundwater (mg/L)							
Ingestion Rate, IR	L/d	NA	NA	NA	NA	1	2
Exposure Frequency, EF	d/y	NA	NA	NA	NA	350	350
Exposure Duration, ED	y	NA	NA	NA	NA	6	30
Exposure Time, ET	h/d	NA	NA	NA	NA	0.25	0.25
Surface Area, SA	cm^2	NA	NA	NA	NA	10,000	23,000
Averaging Time, Noncarc., ATnc	d	NA	NA	NA	NA	2,190	10,950
Averaging Time, Carc., ATcarc	d	NA	NA	NA	NA	25,550	25,550
Conversion Factor, CF	L/cm^3	NA	NA	NA	NA	0.001	0.001
Body Weight, BW	kg	NA	NA	NA	NA	15	70
Sediment (mg/kg)							
Ingestion Rate, IR	mg/d	200	100	NA	NA	200	100
Fraction Ingested, FI	unitless	1	1	NA	NA	1	1

TABLE 1 (Continued)

SUMMARY OF PRELIMINARY EXPOSURE DOSE INPUT PARAMETERS
FOR SITES 36, 43, 44, 54, AND 86

Input Parameter	Units	Receptor					
		Trespasser Child	Trespasser Adult	Military Personnel	Construction Worker	Residential Child	Residential Adult
Exposure Frequency, EF	d/y	45	45	NA	NA	45	45
Exposure Duration, ED	y	6	30	NA	NA	6	30
Surface Area, SA	cm^2	2,000	5,000	NA	NA	2,300	5,800
Absorption Factor, AF	mg/cm^3	1	1	NA	NA	1	1
Averaging Time, Noncarc., ATnc	d	2,190	10,950	NA	NA	2,190	10,950
Averaging Time, Carc., ATcarc	d	25,550	25,550	NA	NA	25,550	25,550
Body Weight, BW	kg	15	70	NA	NA	15	70
Conversion Factor, CF	kg/mg	$1x10^{-6}$	$1x10^{-6}$	NA	NA	$1x10^{-6}$	$1x10^{-6}$
Absorbance Factor, ABS	unitless	Organics = 0.01; Inorganics = 0.001					
Surface Water (mg/L)							
Ingestion Rate, IR	L/d	0.005	0.005	NA	NA	0.005	0.005
Exposure Time, ET	h/d	2.6	2.6	NA	NA	2.6	2.6
Exposure Frequency, EF	d/y	45	45	NA	NA	45	45
Exposure Duration, ED	y	6	30	NA	NA	6	30
Surface Area, SA	cm^2	2,000	5,000	NA	NA	2,300	5,800
Averaging Time, Noncarc., ATnc	d	2,190	10,950	NA	NA	2,190	10,950
Averaging Time, Carc., ATcarc	d	25,550	25,550	NA	NA	25,550	25,550
Conversion Factor, CF	L/cm^3	0.001	0.001	NA	NA	0.001	0.001
Air (mg/m^3)							
Outdoor Air							
Inhalation Rate, IR	m^3/d	10	20	30	20	10	20
Exposure Frequency, EF	d/y	43	130	250	90	350	350
Exposure Duration, ED	y	6	30	4	1	6	30
Averaging Time, Noncarc., ATnc	d	2,190	10,950	1,460	365	2,190	10,950
Averaging Time, Carc,. ATcarc	d	25,550	25,550	25,550	25,550	25,550	25,550

TABLE 1 (Continued)

SUMMARY OF PRELIMINARY EXPOSURE DOSE INPUT PARAMETERS
FOR SITES 36, 43, 44, 54, AND 86

Input Parameter	Units	Receptor					
		Trespasser Child	Trespasser Adult	Military Personnel	Construction Worker	Residential Child	Residential Adult
Body Weight, BW	kg	15	70	70	70	15	70
Shower Air							
Inhalation Rate, IR	m^3/h	NA	NA	NA	NA	0.6	0.6
Exposure Time, ET	h/d	NA	NA	NA	NA	0.25	0.25
Exposure Frequency, EF	d/y	NA	NA	NA	NA	350	350
Exposure Duration, ED	y	NA	NA	NA	NA	6	30
Averaging Time, Noncarc., ATnc	d	NA	NA	NA	NA	2,190	10,950
Averaging Time, Carc., ATcarc	d	NA	NA	NA	NA	25,550	25,550
Body Weight, BW	kg	NA	NA	NA	NA	15	70
Fish (mg/kg)							
Ingestion rate, IR	kg/d	NA	NA	NA	NA	NA	0.284
Fraction Ingested, FI	unitless	NA	NA	NA	NA	NA	1
Exposure Frequency, EF	meals/yr	NA	NA	NA	NA	NA	48
Exposure Duration, ED	y	NA	NA	NA	NA	NA	30
Averaging Time, Noncarc., ATnc	d	NA	NA	NA	NA	NA	10,950
Averaging Time, Carc, ATcarc	d	NA	NA	NA	NA	NA	25,550
Body Weight, BW	kg	NA	NA	NA	NA	NA	70

References:

USEPA Risk Assessment For Superfund Volume I. Human Health Manual (Part A) Interim Final, December, 1989.
USEPA Exposure Factors Handbook, July, 1989.
USEPA Risk Assessment For Superfund Volume I. Human Health Evaluation Manual Supplemental Guidance. "Standard Default Exposure Factors" Interim Final. March 25, 1991.
USEPA Dermal Exposure Assessment: Principles and Applications. Interim Report. January, 1992.
USEPA Region IV Guidance for Soil Absorbance. (USEPA, 1992)

TABLE 1 (Continued)

SUMMARY OF PRELIMINARY EXPOSURE DOSE INPUT PARAMETERS
FOR SITES 36, 43, 44, 54, AND 86

Notes:
The exposure frequency for the trespasser receptors is based on the typical exposure pattern (i.e., more time spent outdoors in the warmer months vs. the cooler months) for people who actively garden or play outdoors. It is an upper-bound estimate (USEPA, 1992).

The skin surface area for the trespasser receptors is based on approximately 25 percent of the total surface body area for a child and adult receptor. These values are upper-bound estimates.

FIGURES

FIGURE 1

FLOWCHART OF POTENTIAL EXPOSURE PATHWAYS AND RECEPTORS
SITE 36: CAMP GEIGER AREA DUMP

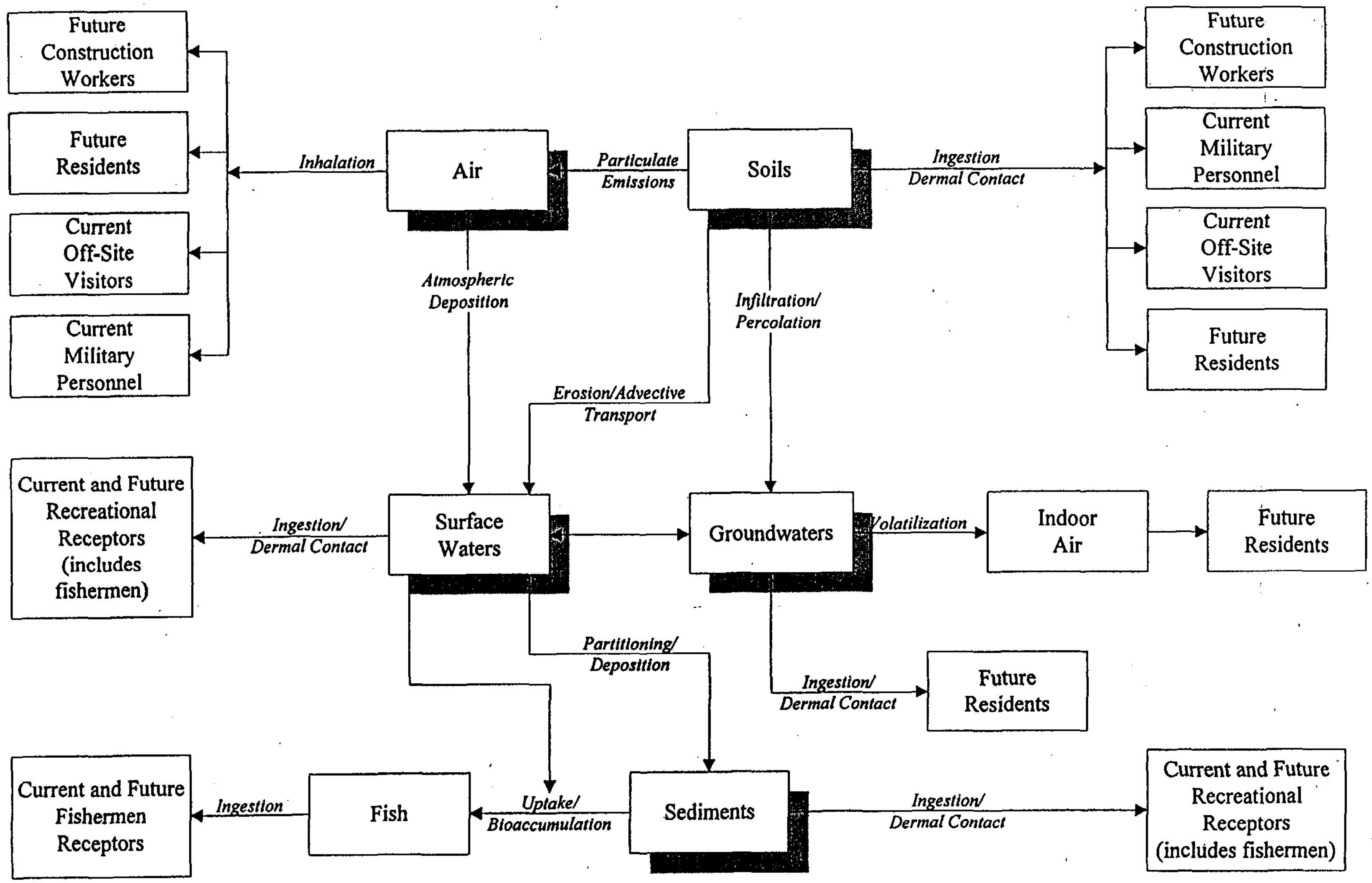


FIGURE 2

FLOWCHART OF POTENTIAL EXPOSURE PATHWAYS AND RECEPTORS
SITE 43: AGAN STREET DUMP

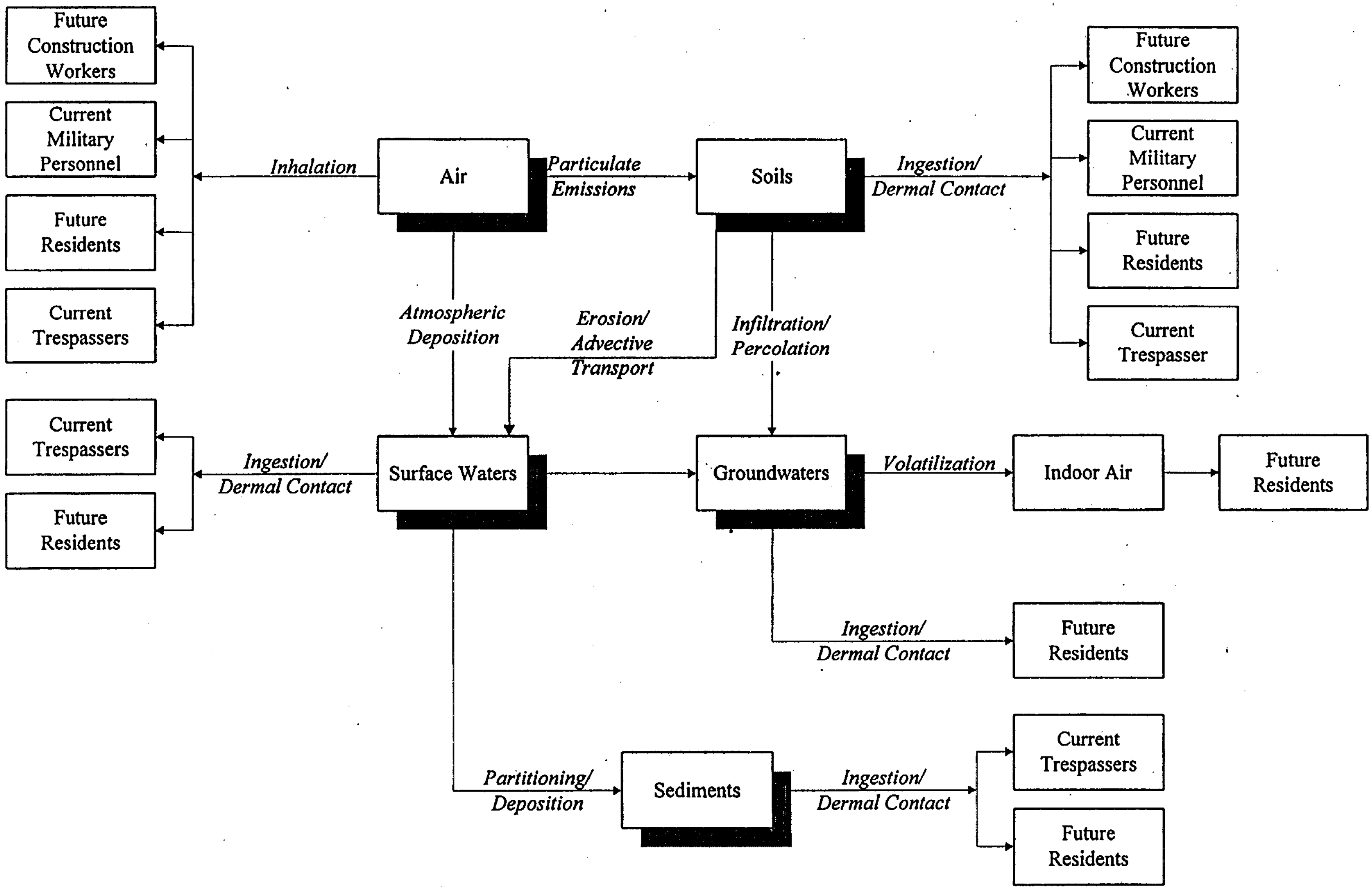


FIGURE 3

FLOWCHART OF POTENTIAL EXPOSURE PATHWAYS AND RECEPTORS
SITE 44: JONES STREET DUMP

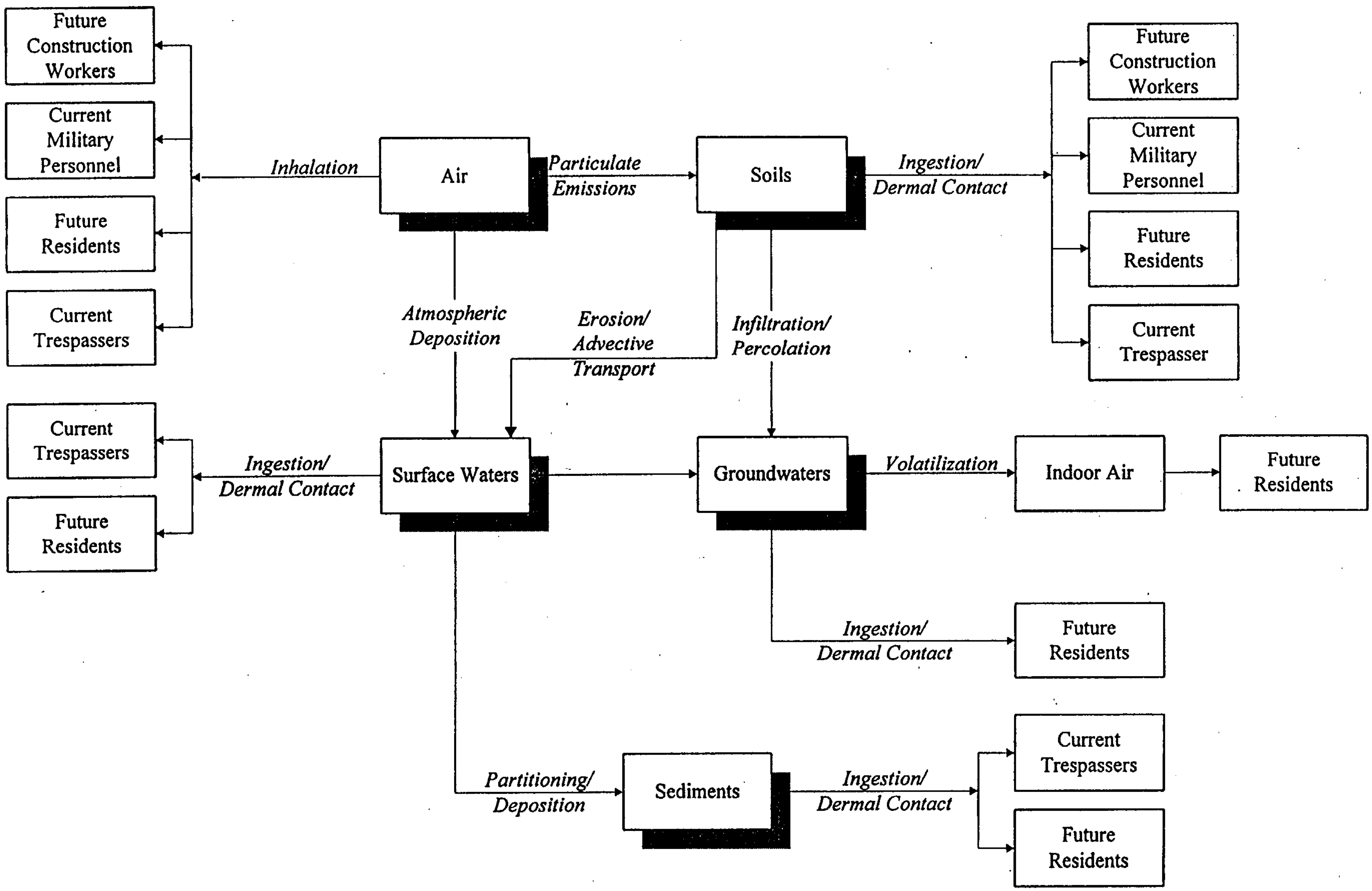


FIGURE 4

FLOWCHART OF POTENTIAL EXPOSURE PATHWAYS AND RECEPTORS
SITE 54: CRASH CREW FIRE TRAINING BURN PIT

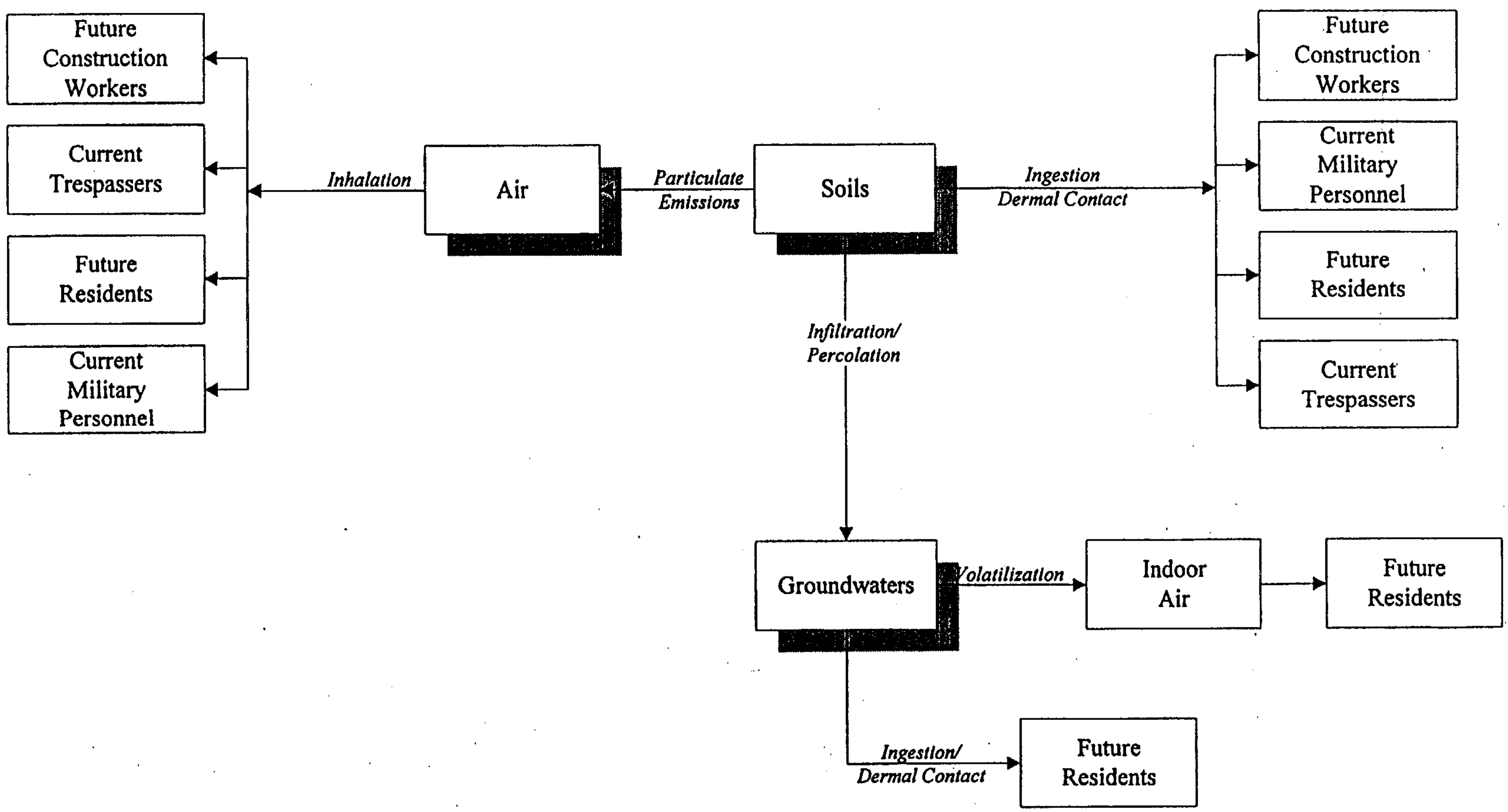
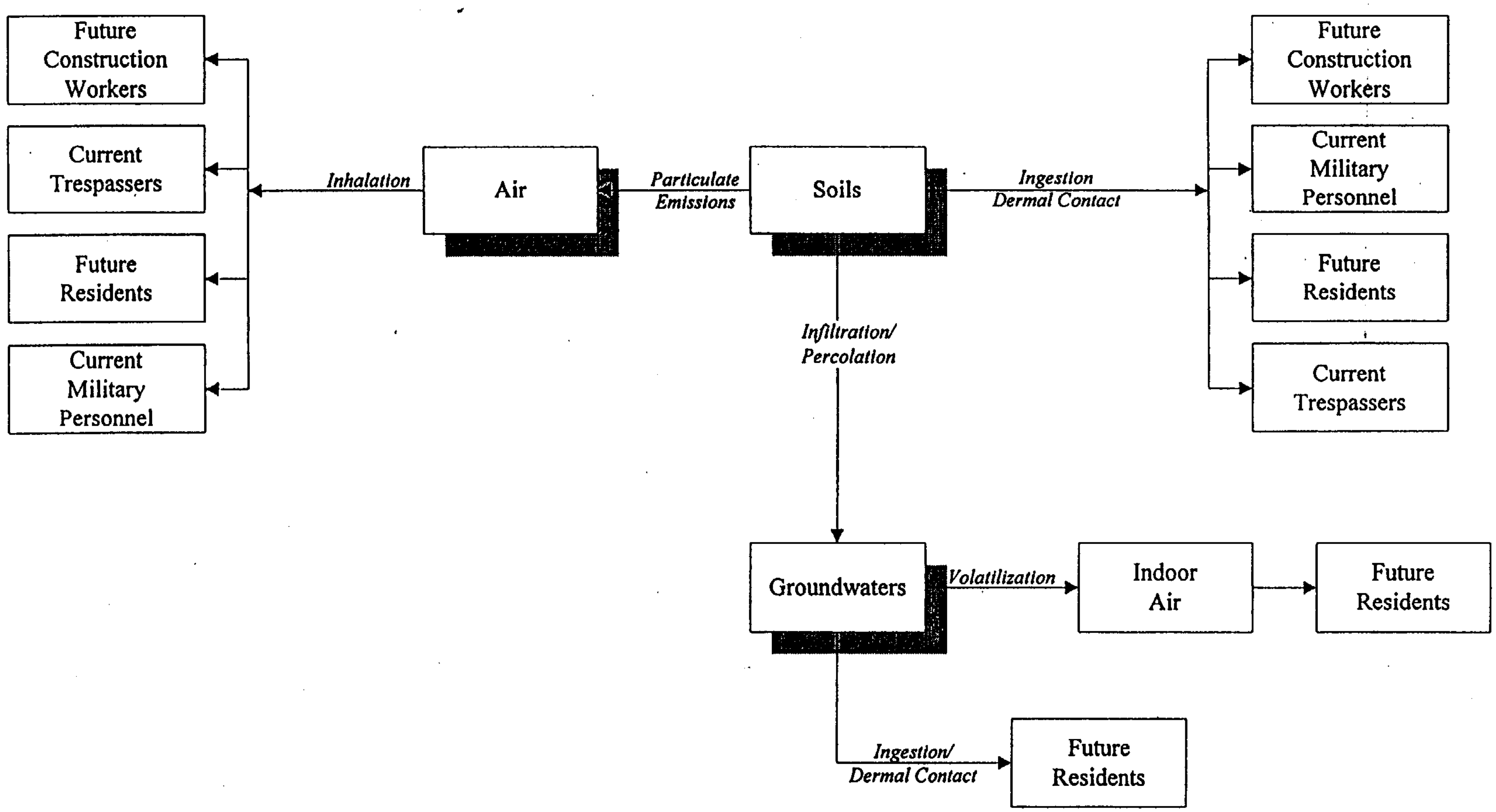


FIGURE 5

FLOWCHART OF POTENTIAL EXPOSURE PATHWAYS AND RECEPTORS
SITE 86: ABOVEGROUND STORAGE TANK AREA



APPENDIX T
CDI CALCULATIONS

SAMPLE CALCULATIONS

Computed by: RSP | Checked by: KTW | Date: 1/96

EXAMPLE SOIL* INGESTION CALCULATIONS
OPERABLE UNIT NO. 6
CONTRACT TASK ORDER 0303

Purpose: Estimate intake/risk from ingestion of soil

$$Intake\ (mg/kg{\cdot}day) = \frac{C\ x\ CF\ x\ EF\ x\ ED\ x\ IR}{BW\ x\ AT}$$

Where:	C	=	Contaminant concentration in soil (mg/kg)
	CF	=	Conversion factor (kg/mg)
	EF	=	Exposure frequency (days/year)
	ED	=	Exposure duration (years)
	IR	=	Ingestion rate (mg/day)
	BW	=	Body weight (kg)
	AT_c	=	Averaging time carcinogen (days)
	AT_{nc}	=	Averaging time noncarcinogen (days)

Risks:

Carcinogens = Intake (mg/kg·day) x CSF $(mg/kg{\cdot}day)^{-1}$
Noncarcinogens = Intake (mg/kg·day)/RfD (mg/kg·day)

Example Carcinogen: Benzo(a)anthracene

$$Intake\ (mg/kg{\cdot}day) = \frac{0.266\ mg/kg\ x\ 100\ mg/day\ x\ 350\ days/yr\ x\ 30\ yrs\ x\ 1.0E{-}6\ kg/mg}{70\ kg\ x\ 25{,}550\ days}$$

= 1.6E-07

Risk = 1.6E-07 mg/kg·day x 0.73 $mg/kg{\cdot}day^{-1}$ = 1.1E-07

Example Noncarcinogen: Aluminum

$$Intake\ (mg/kg{\cdot}day) = \frac{5{,}808.7\ mg/kg\ x\ 100\ mg/day\ x\ 350\ days/yr\ x\ 30\ yrs\ x\ 1.0E{-}6\ kg/mg}{70\ kg\ x\ 10{,}950\ days}$$

= 8E-03

$$Risk = \frac{8E{-}03\ mg/kg{\cdot}day}{1.0\ mg/kg{\cdot}day} = 8.0E{-}03$$

* This example calculation also is applicable for sediment ingestion.
Re: Site 36 Future Residential Adult - Surface Soil

Computed by: RSP Checked by: KTW Date: 1/96

EXAMPLE DERMAL CONTACT WITH SOIL* CALCULATIONS
OPERABLE UNIT NO. 6
CONTRACT TASK ORDER 0303

Purpose: Estimate intake/risk from dermal contact with soil

$$Intake\ (mg/kg{\cdot}day) = \frac{C\ x\ CF\ x\ SA\ x\ AF\ x\ ABS\ x\ EF\ x\ ED}{BW\ x\ AT}$$

Where:

C	=	Contaminant concentration in soil (mg/kg)
CF	=	Conversion factor (kg/mg)
SA	=	Surface available for contact (cm^2/event)
AF	=	Soil to skin adherence factor (mg/cm^2)
ABS	=	Fraction absorbed (percent) - 0.01 organics, 0.001 inorganics
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
BW	=	Body weight (kg)
AT_c	=	Averaging time carcinogen (days)
AT_{nc}	=	Averaging time noncarcinogen (days)

Risks:

Carcinogens = Intake (mg/kg·day) x dermally - adjusted CSF $(mg/kg{\cdot}day)^{-1}$
Noncarcinogens = Intake (mg/kg·day)/ dermally - adjusted RfD (mg/kg·day)

Example Carcinogen: Benzo(a)anthracene

$$Intake\ (mg/kg{\cdot}day) = \frac{0.266\ mg/kg\ x\ 1.0E{-}06\ kg/mg\ x\ 5{,}800\ cm^2/event\ x\ 0.01\ x\ 1\ mg/cm^2\ x\ 350\ days/yr\ x\ 30\ yrs}{70\ kg\ x\ 25{,}550\ days}$$

= 9.1E-08

Risk = 9.1E-08 mg/kg·day x 1.5 $mg/kg{\cdot}day^{-1}$ = 1.3E-07

Example Noncarcinogen: Aluminum

$$Intake\ (mg/kg{\cdot}day) = \frac{5{,}808.7\ mg/kg\ x\ 1.0E{-}06\ kg/mg\ x\ 5{,}800\ cm^2/event\ x\ 1\ mg/cm^2\ x\ 0.001\ x\ 350\ days/yr\ x\ 30\ yrs}{70\ kg\ x\ 10{,}950\ days}$$

= 4.6E-04

$$Risk = \frac{4.6E{-}04\ mg/kg{\cdot}day}{2.0E{-}01\ mg/kg{\cdot}day} = 2.3E{-}03$$

* This example calculation also is applicable for sediment dermal contact.
Re: Site 36 Future Residential Adult - Surface Soil

Computed by: RSP | Checked by: KTW | Date: 1/96

EXAMPLE INHALATION OF PARTICULATES CALCULATIONS
OPERABLE UNIT NO. 6
CONTRACT TASK ORDER 0303

Purpose: Estimate intake/risk from the inhalation of soil particulates

$$Intake\ (mg/kg \cdot day) = \frac{C \ x \ IR \ x \ EF \ x \ ED \ x \ 1/PEF}{BW \ x \ AT}$$

Where:	C	=	Contaminant concentration in soil (mg/kg)
	IR	=	Inhalation rate (m^3/day)
	EF	=	Exposure frequency (days/year)
	ED	=	Exposure duration (years)
	PEF	=	Particulate Emission Factor (m^3/kg)
	BW	=	Body weight (kg)
	AT_c	=	Averaging time carcinogen (days)
	AT_{nc}	=	Averaging time noncarcinogen (days)

Risks:

Carcinogens = Intake (mg/kg·day) x CSF $(mg/kg \cdot day)^{-1}$
Noncarcinogens = Intake (mg/kg·day)/RfD (mg/kg·day)

Example Carcinogen: Arsenic

$$Intake\ (mg/kg \cdot day) = \frac{2.339 \ mg/kg \ x \ 20 \ m^3/day \ x \ 350 \ days/yr \ x \ 30 \ yrs \ x \ 1/1.32E{+}09 \ m^3/kg}{70 \ kg \ x \ 25{,}550 \ days}$$

= 2.1E-10

Risk = 2.1E-10 mg/kg·day x 15.1 mg/kg·day^{-1} = 3.9E-09

Example Noncarcinogen: Mercury

$$Intake\ (mg/kg \cdot day) = \frac{0.37 \ mg/kg \ x \ 20 \ m^3/day \ x \ 350 \ days/yr \ x \ 30 \ yrs \ x \ 1/1.32E{+}09 \ m^3/kg}{70 \ kg \ x \ 10{,}950 \ days}$$

= 7.7E-11

$$Risk = \frac{7.7E{-}11 \ mg/kg \cdot day}{8.6E{-}05 \ mg/kg \cdot day} = 9.0E{-}07$$

Re: Site 36 Future Residential Adult - Surface Soil

EXAMPLE GROUNDWATER INGESTION CALCULATIONS
OPERABLE UNIT NO. 6
CONTRACT TASK ORDER 0303

Purpose: Estimate intake/risk from ingestion of groundwater

$$Intake\ (mg/kg{\cdot}day) = \frac{C \times IR \times EF \times ED}{BW \times AT}$$

Where:	C	=	Contaminant concentration in groundwater (mg/L)
	IR	=	Daily intake ingestion rate (L/day)
	EF	=	Exposure frequency (days/year)
	ED	=	Exposure duration (years)
	BW	=	Body weight (kg)
	AT_c	=	Averaging time carcinogen (days)
	AT_{nc}	=	Averaging time noncarcinogen (days)

Risks:

Carcinogens = Intake (mg/kg·day) x CSF $(mg/kg{\cdot}day)^{-1}$
Noncarcinogens = Intake (mg/kg·day)/RfD (mg/kg·day)

Example Carcinogen: Arsenic

$$Intake\ (mg/kg{\cdot}day) = \frac{0.001\ mg/L \times 1\ L/day \times 350\ days/yr \times 6\ yrs}{15\ kg \times 25{,}550\ days}$$

= 7.1E-06

Risk = 7.1E-06 mg/kg·day x 1.5 $mg/kg{\cdot}day^{-1}$ = 1.1E-05

Example Noncarcinogen: 1,2-Dichloroethene (total)

$$Intake\ (mg/kg{\cdot}day) = \frac{0.009\ mg/L \times 1\ L/day \times 350\ days/yr \times 6\ yrs}{70\ kg \times 2{,}190\ days}$$

= 5.8E-04

$$Risk = \frac{5.8E-04\ mg/kg{\cdot}day}{9E-03\ mg/kg{\cdot}day} = 6.4E-02$$

Re: Site 36 Future Residential Child

Computed by: RSP   Checked by: KTW   Date: 1/96

EXAMPLE DERMAL CONTACT WITH GROUNDWATER CALCULATIONS
OPERABLE UNIT NO. 6
CONTRACT TASK ORDER 0303

Purpose: Estimate intake/risk from dermal contact with groundwater

$$Intake\ (mg/kg{\cdot}day) = \frac{C\ x\ CF\ x\ SA\ x\ PC\ x\ ET\ x\ EF\ x\ ED}{BW\ x\ AT}$$

Where:

	C	=	Contaminant concentration in groundwater (mg/L)
	CF	=	Conversion factor (1 L/1,000 cm^3)
	SA	=	Exposed skin surface available for contact (cm^2)
	PC	=	Chemical-specific dermal permeability constant (cm/hr)
	ET	=	Exposure time (hr/day)
	EF	=	Exposure frequency (days/year)
	ED	=	Exposure duration (years)
	BW	=	Body weight (kg)
	AT_c	=	Averaging time carcinogen (days)
	AT_{nc}	=	Averaging time noncarcinogen (days)

Risks:

Carcinogens = Intake (mg/kg·day) x CSF $(mg/kg{\cdot}day)^{-1}$
Noncarcinogens = Intake (mg/kg·day)/RfD (mg/kg·day)

Example Carcinogen: Arsenic

$$Intake\ (mg/kgday) = \frac{0.001\ mg/L\ x\ 1.0E{-}03\ L/cm^3\ x\ 10{,}000\ cm^2/event\ x\ 1.0E{-}03\ cm/hr\ x\ 0.25\ hr/day\ x\ 350\ days/yr\ x\ 6\ yrs}{15\ kg\ x\ 25{,}550\ days}$$

= 1.8E-08

Risk = 1.8E-08 mg/kg·day x 7.5 $mg/kg{\cdot}day^{-1}$ = 1.3E-07

Example Noncarcinogen: 1,2-Dichloroethene (total)

$$Intake\ (mg/kg{\cdot}day) = \frac{0.009\ mg/L\ x\ 1.0E{-}03\ L/cm^3\ x\ 10{,}000\ cm^2/event\ x\ 1.0E{-}03\ cm/hr\ x\ 0.25\ hr/day\ x\ 350\ days/yr\ x\ 6\ yrs}{15\ kg\ x\ 2{,}190\ days}$$

= 1.4E-05

$$Risk = \frac{1.4E{-}05\ mg/kg{\cdot}day}{7.2E{-}03\ mg/kg{\cdot}day} = 2.0E{-}03$$

Re: Site 36 Future Residential Child

Computed by: RSP Checked by: KTW Date: 1/96

EXAMPLE INHALATION OF GROUNDWATER VOLATILES CALCULATIONS
OPERABLE UNIT NO. 6
CONTRACT TASK ORDER 0303

Purpose: Estimate intake/risk from the inhalation of groundwater volatiles

$$Intake\ (mg/kg{\cdot}day) = \frac{C\ x\ EF\ x\ ED}{AT}$$

Where:	C	=	Contaminant concentration in shower air (mg/kg/shower) - Foster Model (Appendix Q)
	EF	=	Exposure frequency (days/year)
	ED	=	Exposure duration (years)
	AT_c	=	Averaging time carcinogen (days)
	AT_{nc}	=	Averaging time noncarcinogen (days)

Risks:

Carcinogens = Intake (mg/kg·day) x CSF $(mg/kg{\cdot}day)^{-1}$
Noncarcinogens = Intake (mg/kg·day)/RfD (mg/kg·day)

Example Carcinogen: Trichloroethene

$$Intake\ (mg/kg{\cdot}day) = \frac{6.84E{-04}\ mg/kg/shower\ x\ 350\ days/yr\ x\ 24\ yrs}{25{,}550\ days}$$

= 5.6E-05

Risk = 5.6E-05 mg/kg·day x 6E-03 $mg/kg{\cdot}day^{-1}$ = 3.4E-07

Example Noncarcinogen: None identified as a COPC

Computed by: RSP Checked by: KTW Date: 1/96

EXAMPLE SURFACE WATER INGESTION CALCULATIONS
OPERABLE UNIT NO. 6
CONTRACT TASK ORDER 0303

Purpose: Estimate intake/risk from ingestion of surface water

$$Intake\ (mg/kg{\cdot}day) = \frac{C\ x\ IR\ x\ EF\ x\ ED\ x\ ET}{BW\ x\ AT}$$

Where:

	C	=	Contaminant concentration in surface water (mg/L)
	IR	=	Daily intake ingestion rate (kg/meal)
	EF	=	Exposure frequency (meal/year)
	ED	=	Exposure duration (years)
	ET	=	Exposure time (hrs/day)
	BW	=	Body weight (kg)
	AT_c	=	Averaging time carcinogen (days)
	AT_{nc}	=	Averaging time noncarcinogen (days)

Risks:

Carcinogens = Intake (mg/kg·day) x CSF $(mg/kg{\cdot}day)^{-1}$
Noncarcinogens = Intake (mg/kg·day)/RfD (mg/kg·day)

Example Carcinogen: No carcinogenic COPCs were identified.

Example Noncarcinogen: Iron

$$Intake\ (mg/kgday) = \frac{3.99E\ mg/L\ x\ 0.005\ L/day\ x\ 48\ days/yr\ x\ 30\ yrs\ x\ 2.6\ hrs/day}{70\ kg\ x\ 10{,}950\ days}$$

= 9.7E-05

$$Risk = \frac{9.7E-05\ mg/kgday}{0.3\ mg/kgday} = 3.2E-04$$

Re: Site 36 Current and Future Fisherman

EXAMPLE SURFACE WATER DERMAL CONTACT CALCULATIONS
OPERABLE UNIT NO. 6
CONTRACT TASK ORDER 0303

Purpose: Estimate intake/risk from dermal contact with surface water

$$Intake\ (mg/kgday) = \frac{C\ x\ SA\ x\ CF\ x\ EF\ x\ ED\ x\ ET\ x\ PC}{BW\ x\ AT}$$

Where:	C	=	Contaminant concentration in surface water (mg/L)
	SA	=	Skin surface area (cm^2)
	CF	=	Conversion factor (1 L/1,000 cm^3)
	EF	=	Exposure frequency (days/year)
	ED	=	Exposure duration (years)
	ET	=	Exposure time (hrs/day)
	PC	=	Chemical-specific dermal permeability constant (cm/hr)
	BW	=	Body weight (kg)
	AT_c	=	Averaging time carcinogen (days)
	AT_{nc}	=	Averaging time noncarcinogen (days)

Risks:

Carcinogens = Intake (mg/kg·day) x CSF $(mg/kg{\cdot}day)^{-1}$
Noncarcinogens = Intake (mg/kg·day)/RfD (mg/kg·day)

Example Carcinogen: No carcinogenic COPCs were identified.

Example Noncarcinogen: Iron

$$Intake\ (mg/kgday) = \frac{3.99\ mg/L\ x\ 5{,}800\ cm^2\ x\ 48\ days/yr\ x\ 30\ yrs\ x\ 2.6\ hrs/day\ x\ 1.0E{-}3\ L/cm^3}{70\ kg\ x\ 10{,}950\ days}$$

= 1.1E-04

$$Risk = \frac{1.1E{-}04\ mg/kgday}{6E{-}02\ mg/kgday} = 1.9E{-}03$$

Computed by: RSP   Checked by: KTW   Date: 1/96

EXAMPLE FISH* INGESTION CALCULATIONS
OPERABLE UNIT NO. 6
CONTRACT TASK ORDER 0303

Purpose: Estimate intake/risk from ingestion of soil

$$Intake\ (mg/kgday) = \frac{C\ x\ FI\ x\ EF\ x\ ED\ x\ IR}{BW\ x\ AT}$$

Where:	C	=	Contaminant concentration in surface water (mg/L)
	FI	=	Fraction ingested
	EF	=	Exposure frequency (days/year)
	ED	=	Exposure duration (years)
	IR	=	Ingestion rate (kg/meal)
	BW	=	Body weight (kg)
	AT_c	=	Averaging time carcinogen (days)
	AT_{nc}	=	Averaging time noncarcinogen (days)

Risks:

Carcinogens = Intake (mg/kg·day) x CSF $(mg/kg{\cdot}day)^{-1}$
Noncarcinogens = Intake (mg/kg·day)/RfD (mg/kg·day)

Example Carcinogen: 4,4'-DDD

$$Intake\ (mg/kgday) = \frac{0.121\ mg/kg\ x\ 0.284\ kg/meal\ x\ 48\ days/yr\ x\ 30\ yrs\ x\ 1.0}{70\ kg\ x\ 25{,}550\ days}$$

= 2.8E-05

Risk = 2.8E-05 mg/kg·day x 2.45E-01 $mg/kg{\cdot}day^{-1}$ = 6.7E-06

Example Noncarcinogen: Mercury

$$Intake\ (mg/kgday) = \frac{1.0\ mg/kg\ x\ 0.284\ kg/meal\ x\ 48\ days/yr\ x\ 30\ yrs\ x\ 1.0}{70\ kg\ x\ 10{,}950\ days}$$

= 5.4E-04

$$Risk = \frac{5.4E-04\ mg/kgday}{3E-04\ mg/kgday} = 1.8$$

*Calculations also applicable to crab ingestion.

Re: Site 36 Current and Future Fisherman

CURRENT MILITARY RECEPTOR

SURFACE SOIL INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT MILITARY PERSONNEL

Intake from ingestion of soil is calculated as follows:

Intake (mg/kg-day) = C * CF * EF * ED * IR/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	
CF = conversion for kg to mg	1E-06
EF = adult exposure frequency (days/yr)	250
ED = adult exposure duration (yr)	4
IR = adult soil ingestion rate (mg/day)	100
BW = adult body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	4
DY = days per year (days/year)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

COPC	Concentration Carcinogen (mg/kg)	Exposure Frequency (days/yr) Adult	Exposure Duration (yr) Adult	Conversio Factor (kg/mg)	Ingestion Rate (mg/day) Adult	Body Weight (kg) Adult	Average Carc Tim (days)	Carc Dose (mg/kg/day) Adult	Slope Factor (mg/kg/day)-1	Carcinogenic Risk Adult	Percent Carcinogenic Risk Adult	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day) Adult	Reference Dose (mg/kg/day)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
n-Nitroso-di-n-propylamine	0.218	250	4	1E-06	100	70	25550	1.2E-08	7.0E+00	8.5E-08	12%	1460	2.1E-07	0.0E+00	0.0E+00	0%
Benzo(a)anthracene	0.266	250	4	1E-06	100	70	25550	1.5E-08	7.3E-01	1.1E-08	1%	1460	2.6E-07	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	0.262	250	4	1E-06	100	70	25550	1.5E-08	7.3E-01	1.1E-08	1%	1460	2.6E-07	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	0.263	250	4	1E-06	100	70	25550	1.5E-08	7.3E+00	1.1E-07	15%	1460	2.6E-07	0.0E+00	0.0E+00	0%
Dibenzo(a,h)anthracene	0.228	250	4	1E-06	100	70	25550	1.3E-08	7.3E+00	9.3E-08	13%	1460	2.2E-07	0.0E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	0.257	250	4	1E-06	100	70	25550	1.4E-08	7.3E-01	1.0E-08	1%	1460	2.5E-07	0.0E+00	0.0E+00	0%
Aldrin	0.004	250	4	1E-06	100	70	25550	2.5E-10	1.7E+01	4.2E-09	1%	1460	4.3E-09	3.0E-05	1.4E-04	0%
Dieldrin	0.049	250	4	1E-06	100	70	25550	2.7E-09	1.6E+01	4.4E-08	6%	1460	4.8E-08	5.0E-05	9.5E-04	1%
4,4'-DDE	0.440	250	4	1E-06	100	70	25550	2.5E-08	3.4E-01	8.4E-09	1%	1460	4.3E-07	0.0E+00	0.0E+00	0%
4,4'-DDT	0.241	250	4	1E-06	100	70	25550	1.3E-08	3.4E-01	4.6E-09	1%	1460	2.4E-07	5.0E-04	4.7E-04	1%
alpha-Chlordane	0.014	250	4	1E-06	100	70	25550	7.9E-10	1.3E+00	1.0E-09	0%	1460	1.4E-08	6.0E-05	2.3E-04	0%
gamma-Chlordane	0.006	250	4	1E-06	100	70	25550	3.6E-10	1.3E+00	4.7E-10	0%	1460	6.3E-09	6.0E-05	1.1E-04	0%
Aroclor-1248	0.291	250	4	1E-06	100	70	25550	1.6E-08	7.7E+00	1.3E-07	17%	1460	2.9E-07	0.0E+00	0.0E+00	0%
Aroclor-1254	0.051	250	4	1E-06	100	70	25550	2.8E-09	7.7E+00	2.2E-08	3%	1460	5.0E-08	2.0E-05	2.5E-03	4%
Aluminum	5808.712	250	4	1E-06	100	70	25550	3.2E-04	0.0E+00	0.0E+00	0%	1460	5.7E-03	1.0E+00	5.7E-03	8%
Antimony	3.379	250	4	1E-06	100	70	25550	1.9E-07	0.0E+00	0.0E+00	0%	1460	3.3E-06	4.0E-04	8.3E-03	12%
Arsenic	2.399	250	4	1E-06	100	70	25550	1.3E-07	1.5E+00	2.0E-07	28%	1460	2.3E-06	3.0E-04	7.8E-03	11%
Cadmium (soil)	0.713	250	4	1E-06	100	70	25550	4.0E-08	0.0E+00	0.0E+00	0%	1460	7.0E-07	1.0E-03	7.0E-04	1%
Chromium	11.294	250	4	1E-06	100	70	25550	6.3E-07	0.0E+00	0.0E+00	0%	1460	1.1E-05	5.0E-03	2.2E-03	3%
Copper	98.217	250	4	1E-06	100	70	25550	5.5E-06	0.0E+00	0.0E+00	0%	1460	9.6E-05	4.0E-02	2.4E-03	3%
Iron	11299.700	250	4	1E-06	100	70	25550	6.3E-04	0.0E+00	0.0E+00	0%	1460	1.1E-02	3.0E-01	3.7E-02	53%
Lead	110.524	250	4	1E-06	100	70	25550	6.2E-06	0.0E+00	0.0E+00	0%	1460	1.1E-04	0.0E+00	0.0E+00	0%
Mercury	0.370	250	4	1E-06	100	70	25550	2.1E-08	0.0E+00	0.0E+00	0%	1460	3.6E-07	3.0E-04	1.2E-03	2%
TOTAL										7.3E-07					7.0E-02	

SURFACE SOIL DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT MILITARY PERSONNEL

Dermal contact with soil is calculated as follows:

Intake (mg/kg-day) = C * CF * SA * AF * Abs * EF * ED/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	
CF = conversion factor (kg/mg)	1E-06
SA = adult exposed skin surface area (cm2)	4300
AF = soil to skin adherence factor (mg/cm2)	1
Abs = fraction absorbed (unitless)	Specific
EF = adult exposure frequency (events/yr)	250
ED = adult exposure duration (years)	4
BW = adult body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	4
DY = day per year (day/yr)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

COPC	Concentration Carcinogen (mg/kg)	Conversion Factor (kg/mg)	Surface Area (cm2) Adult	Adherence Factor (mg/cm2)	Fraction Absorbed (%)	Exposure Frequency (events/yr) Adult	Exposure Duration (yrs) Adult	Body Weight (kg) Adult	Average Carc Time (days)	Carc Dose (mg/kg/day) Adult	Dermal Adjust. Slope Factor (mg/kg-day)-1	Carcinogenic Risk Adult	Percent Carcinogenic Risk Adult	Average Noncarc Tim (days)	Noncarc Dose (mg/kg/day) Adult	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
n-Nitroso-di-n-propylamine	0.218	1E-06	4300	1	0.01	250	4	70	25550	5.2E-09	1.40E+01	7.3E-08	15%	1460	9.2E-08	0.00E+00	0.0E+00	0%
Benzo(a)anthracene	0.266	1E-06	4300	1	0.01	250	4	70	25550	6.4E-09	1.46E+00	9.3E-09	2%	1460	1.1E-07	0.00E+00	0.0E+00	0%
Benzo(b)fluoranthene	0.262	1E-06	4300	1	0.01	250	4	70	25550	6.3E-09	1.46E+00	9.2E-09	2%	1460	1.1E-07	0.00E+00	0.0E+00	0%
Benzo(a)pyrene	0.263	1E-06	4300	1	0.01	250	4	70	25550	6.3E-09	1.46E+01	9.2E-08	19%	1460	1.1E-07	0.00E+00	0.0E+00	0%
Dibenzo(a,h)anthracene	0.228	1E-06	4300	1	0.01	250	4	70	25550	5.5E-09	1.46E+01	8.0E-08	16%	1460	9.6E-08	0.00E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	0.257	1E-06	4300	1	0.01	250	4	70	25550	6.2E-09	1.46E+00	9.0E-09	2%	1460	1.1E-07	0.00E+00	0.0E+00	0%
Aldrin	0.004	1E-06	4300	1	0.01	250	4	70	25550	1.1E-10	3.40E+01	3.6E-09	1%	1460	1.9E-09	1.50E-05	1.2E-04	1%
Dieldrin	0.049	1E-06	4300	1	0.01	250	4	70	25550	1.2E-09	3.20E+01	3.7E-08	8%	1460	2.1E-08	2.50E-05	8.2E-04	5%
4,4'-DDE	0.440	1E-06	4300	1	0.01	250	4	70	25550	1.1E-08	6.80E-01	7.2E-09	1%	1460	1.9E-07	0.00E+00	0.0E+00	0%
4,4'-DDT	0.241	1E-06	4300	1	0.01	250	4	70	25550	5.8E-09	6.80E-01	3.9E-09	1%	1460	1.0E-07	2.50E-04	4.0E-04	2%
alpha-Chlordane	0.014	1E-06	4300	1	0.01	250	4	70	25550	3.4E-10	2.60E+00	8.8E-10	0%	1460	5.9E-09	3.00E-05	2.0E-04	1%
gamma-Chlordane	0.006	1E-06	4300	1	0.01	250	4	70	25550	1.6E-10	2.60E+00	4.0E-10	0%	1460	2.7E-09	3.00E-05	9.0E-05	1%
Aroclor-1248	0.291	1E-06	4300	1	0.01	250	4	70	25550	7.0E-09	1.54E+01	1.1E-07	22%	1460	1.2E-07	0.00E+00	0.0E+00	0%
Aroclor-1254	0.051	1E-06	4300	1	0.01	250	4	70	25550	1.2E-09	1.54E+01	1.9E-08	4%	1460	2.1E-08	1.00E-05	2.1E-03	12%
Aluminum	5808.712	1E-06	4300	1	0.001	250	4	70	25550	1.4E-05	0.00E+00	0.0E+00	0%	1460	2.4E-04	2.00E-01	1.2E-03	7%
Antimony	3.379	1E-06	4300	1	0.001	250	4	70	25550	8.1E-09	0.00E+00	0.0E+00	0%	1460	1.4E-07	8.00E-05	1.8E-03	10%
Arsenic	2.399	1E-06	4300	1	0.001	250	4	70	25550	5.8E-09	7.50E+00	4.3E-08	9%	1460	1.0E-07	6.00E-05	1.7E-03	9%
Cadmium (soil)	0.713	1E-06	4300	1	0.001	250	4	70	25550	1.7E-09	0.00E+00	0.0E+00	0%	1460	3.0E-08	2.00E-04	1.5E-04	1%
Chromium	11.294	1E-06	4300	1	0.001	250	4	70	25550	2.7E-08	0.00E+00	0.0E+00	0%	1460	4.8E-07	1.00E-03	4.8E-04	3%
Copper	98.217	1E-06	4300	1	0.001	250	4	70	25550	2.4E-07	0.00E+00	0.0E+00	0%	1460	4.1E-06	8.00E-03	5.2E-04	3%
Iron	11299.700	1E-06	4300	1	0.001	250	4	70	25550	2.7E-05	0.00E+00	0.0E+00	0%	1460	4.8E-04	6.00E-02	7.9E-03	45%
Lead	110.524	1E-06	4300	1	0.001	250	4	70	25550	2.7E-07	0.00E+00	0.0E+00	0%	1460	4.7E-06	0.00E+00	0.0E+00	0%
Mercury	0.370	1E-06	4300	1	0.001	250	4	70	25550	8.9E-10	0.00E+00	0.0E+00	0%	1460	1.6E-08	6.00E-05	2.6E-04	1%
TOTAL												5.0E-07					1.8E-02	

SURFACE SOIL PARTICULATE INHALATION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT MILITARY PERSONNEL

Intake from the inhalation of particulates is calculated as follows:

Intake (mg/kg-day) = (C * EF * ED * IR * 1/PEF)/(BW * ATc or ATnc * DY)

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	Calculated
CSF = carcinogenic slope factor	Specific
RfD = reference dose for noncarcinogen	Specific
IR = inhalation rate (m3)	30
EF = adult exposure frequency (days)	250
ED = adult exposure duration (years)	4
BW = adult body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	4
DY = day per year (day/yr)	365
PEF = particulate emission factor (m3/kg)	1.32E+09

COPC	Concentration Carcinogen (mg/kg)	Particulate Emission Factor (m3/kg)	Exposure Frequency (events/yr)	Inhalation Rate (m3/day)	Exposure Duration (yrs)	Body Weight (kg)	Average Carc Tim (days)	Carc Dose (mg/kg/day)	Slope Factor (mg/kg-day)-1	Carcinogenic Risk	Percent Contribution to Risk	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day)	Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
n-Nitroso-di-n-propylamine	0.218	1.3E+09	250	30	4	70	25550	2.8E-12	0.00E+00	0.0E+00	0%	1460	4.9E-11	0.00E+00	0.0E+00	0%
Benzo(a)anthracene	0.266	1.3E+09	250	30	4	70	25550	3.4E-12	6.10E-01	2.1E-12	0%	1460	5.9E-11	0.00E+00	0.0E+00	0%
Benzo(b)fluoranthene	0.262	1.3E+09	250	30	4	70	25550	3.3E-12	6.10E-01	2.0E-12	0%	1460	5.8E-11	0.00E+00	0.0E+00	0%
Benzo(a)pyrene	0.263	1.3E+09	250	30	4	70	25550	3.3E-12	6.10E+00	2.0E-11	0%	1460	5.9E-11	0.00E+00	0.0E+00	0%
Dibenzo(a,h)anthracene	0.228	1.3E+09	250	30	4	70	25550	2.9E-12	6.10E+00	1.8E-11	0%	1460	5.1E-11	0.00E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	0.257	1.3E+09	250	30	4	70	25550	3.3E-12	6.10E-01	2.0E-12	0%	1460	5.7E-11	0.00E+00	0.0E+00	0%
Aldrin	0.004	1.3E+09	250	30	4	70	25550	5.6E-14	1.72E+01	9.7E-13	0%	1460	9.9E-13	0.00E+00	0.0E+00	0%
Dieldrin	0.049	1.3E+09	250	30	4	70	25550	6.2E-13	1.61E+01	1.0E-11	0%	1460	1.1E-11	0.00E+00	0.0E+00	0%
4,4'-DDE	0.440	1.3E+09	250	30	4	70	25550	5.6E-12	0.00E+00	0.0E+00	0%	1460	9.8E-11	0.00E+00	0.0E+00	0%
4,4'-DDT	0.241	1.3E+09	250	30	4	70	25550	3.1E-12	3.40E-01	1.0E-12	0%	1460	5.3E-11	0.00E+00	0.0E+00	0%
alpha-Chlordane	0.014	1.3E+09	250	30	4	70	25550	1.8E-13	1.29E+00	2.3E-13	0%	1460	3.1E-12	0.00E+00	0.0E+00	0%
gamma-Chlordane	0.006	1.3E+09	250	30	4	70	25550	8.2E-14	1.29E+00	1.1E-13	0%	1460	1.4E-12	0.00E+00	0.0E+00	0%
Aroclor-1248	0.291	1.3E+09	250	30	4	70	25550	3.7E-12	0.00E+00	0.0E+00	0%	1460	6.5E-11	0.00E+00	0.0E+00	0%
Aroclor-1254	0.051	1.3E+09	250	30	4	70	25550	6.4E-13	0.00E+00	0.0E+00	0%	1460	1.1E-11	0.00E+00	0.0E+00	0%
Aluminum	5808.712	1.3E+09	250	30	4	70	25550	7.4E-08	0.00E+00	0.0E+00	0%	1460	1.3E-06	0.00E+00	0.0E+00	0%
Antimony	3.379	1.3E+09	250	30	4	70	25550	4.3E-11	0.00E+00	0.0E+00	0%	1460	7.5E-10	0.00E+00	0.0E+00	0%
Arsenic	2.399	1.3E+09	250	30	4	70	25550	3.0E-11	1.51E+01	4.6E-10	7%	1460	5.3E-10	0.00E+00	0.0E+00	0%
Cadmium (soil)	0.713	1.3E+09	250	30	4	70	25550	9.1E-12	0.00E+00	0.0E+00	0%	1460	1.6E-10	0.00E+00	0.0E+00	0%
Chromium	11.294	1.3E+09	250	30	4	70	25550	1.4E-10	4.20E+01	6.0E-09	92%	1460	2.5E-09	0.00E+00	0.0E+00	0%
Copper	98.217	1.3E+09	250	30	4	70	25550	1.2E-09	0.00E+00	0.0E+00	0%	1460	2.2E-08	0.00E+00	0.0E+00	0%
Iron	11299.700	1.3E+09	250	30	4	70	25550	1.4E-07	0.00E+00	0.0E+00	0%	1460	2.5E-06	0.00E+00	0.0E+00	0%
Lead	110.524	1.3E+09	250	30	4	70	25550	1.4E-09	0.00E+00	0.0E+00	0%	1460	2.5E-08	0.00E+00	0.0E+00	0%
Mercury	0.370	1.3E+09	250	30	4	70	25550	4.7E-12	0.00E+00	0.0E+00	0%	1460	8.2E-11	8.57E-05	9.6E-07	100%
TOTAL										6.5E-09					9.6E-07	

CURRENT CHILD TRESPASSER

SURFACE SOIL INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CHILD TRESPASSER

Intake from ingestion of soil is calculated as follows:

Intake (mg/kg-day) = C * CF * EF * ED * IR/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	
CF = conversion for kg to mg	1E-06
EF = child exposure frequency (days/yr)	130
ED = child exposure duration (yr)	6
IR = child soil ingestion rate (mg/day)	100
BW = child body weight (kg)	15
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	6
DY = days per year (days/year)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

COPC	Concentration (mg/kg)	Exposure Frequency (days/yr) Child	Exposure Duration (yr) Child	Conversion Factor (kg/mg)	Ingestion Rate (mg/day) Child	Body Weight (kg) Child	Average Carc Tim (days)	Carc Dose (mg/kg/day) Child	Slope Factor (mg/kg/day)-1	Carcinogenic Risk Child	Percent Carcinogenic Risk Child	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day) Child	Reference Dose (mg/kg/day)	Noncarcinogenic Risk Child	Percent Noncarcinogenic Risk Child
n-Nitroso-di-n-propylamine	0.218	130	6	1E-06	100	15	25550	4.4E-08	7.00E+00	3.1E-07	12%	2190	5.2E-07	0.00E+00	0.0E+00	0%
Benzo(a)anthracene	0.266	130	6	1E-06	100	15	25550	5.4E-08	7.30E-01	4.0E-08	1%	2190	6.3E-07	0.00E+00	0.0E+00	0%
Benzo(b)fluoranthene	0.262	130	6	1E-06	100	15	25550	5.3E-08	7.30E-01	3.9E-08	1%	2190	6.2E-07	0.00E+00	0.0E+00	0%
Benzo(a)pyrene	0.263	130	6	1E-06	100	15	25550	5.4E-08	7.30E+00	3.9E-07	15%	2190	6.2E-07	0.00E+00	0.0E+00	0%
Dibenzo(a,h)anthracene	0.228	130	6	1E-06	100	15	25550	4.6E-08	7.30E+00	3.4E-07	13%	2190	5.4E-07	0.00E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	0.257	130	6	1E-06	100	15	25550	5.2E-08	7.30E-01	3.8E-08	1%	2190	6.1E-07	0.00E+00	0.0E+00	0%
Aldrin	0.004	130	6	1E-06	100	15	25550	9.0E-10	1.70E+01	1.5E-08	1%	2190	1.1E-08	3.00E-05	3.5E-04	0%
Dieldrin	0.049	130	6	1E-06	100	15	25550	9.9E-09	1.60E+01	1.6E-07	6%	2190	1.2E-07	5.00E-05	2.3E-03	1%
4,4'-DDE	0.440	130	6	1E-06	100	15	25550	9.0E-08	3.40E-01	3.0E-08	1%	2190	1.0E-06	0.00E+00	0.0E+00	0%
4,4'-DDT	0.241	130	6	1E-06	100	15	25550	4.9E-08	3.40E-01	1.7E-08	1%	2190	5.7E-07	5.00E-04	1.1E-03	1%
alpha-Chlordane	0.014	130	6	1E-06	100	15	25550	2.9E-09	1.30E+00	3.7E-09	0%	2190	3.3E-08	6.00E-05	5.6E-04	0%
gamma-Chlordane	0.006	130	6	1E-06	100	15	25550	1.3E-09	1.30E+00	1.7E-09	0%	2190	1.5E-08	6.00E-05	2.6E-04	0%
Aroclor-1248	0.291	130	6	1E-06	100	15	25550	5.9E-08	7.70E+00	4.6E-07	17%	2190	6.9E-07	0.00E+00	0.0E+00	0%
Aroclor-1254	0.051	130	6	1E-06	100	15	25550	1.0E-08	7.70E+00	7.9E-08	3%	2190	1.2E-07	2.00E-05	6.0E-03	4%
Aluminum	5808.712	130	6	1E-06	100	15	25550	1.2E-03	0.00E+00	0.0E+00	0%	2190	1.4E-02	1.00E+00	1.4E-02	8%
Antimony	3.379	130	6	1E-06	100	15	25550	6.9E-07	0.00E+00	0.0E+00	0%	2190	8.0E-06	4.00E-04	2.0E-02	12%
Arsenic	2.399	130	6	1E-06	100	15	25550	4.9E-07	1.50E+00	7.3E-07	28%	2190	5.7E-06	3.00E-04	1.9E-02	11%
Cadmium (soil)	0.713	130	6	1E-06	100	15	25550	1.5E-07	0.00E+00	0.0E+00	0%	2190	1.7E-06	1.00E-03	1.7E-03	1%
Chromium	11.294	130	6	1E-06	100	15	25550	2.3E-06	0.00E+00	0.0E+00	0%	2190	2.7E-05	5.00E-03	5.4E-03	3%
Copper	98.217	130	6	1E-06	100	15	25550	2.0E-05	0.00E+00	0.0E+00	0%	2190	2.3E-04	4.00E-02	5.8E-03	3%
Iron	11299.700	130	6	1E-06	100	15	25550	2.3E-03	0.00E+00	0.0E+00	0%	2190	2.7E-02	3.00E-01	8.9E-02	53%
Lead	110.524	130	6	1E-06	100	15	25550	2.2E-05	0.00E+00	0.0E+00	0%	2190	2.6E-04	0.00E+00	0.0E+00	0%
Mercury	0.370	130	6	1E-06	100	15	25550	7.5E-08	0.00E+00	0.0E+00	0%	2190	8.8E-07	3.00E-04	2.9E-03	2%
TOTAL										2.7E-06					1.7E-01	

SURFACE SOIL DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CHILD TRESPASSER

Dermal contact with soil is calculated as follows:

Intake (mg/kg-day) = C * CF * SA * AF * Abs * EF * ED/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	
CF = conversion factor (kg/mg)	1E-06
SA = child exposed skin surface area (cm2)	2000
AF = soil to skin adherence factor (mg/cm2)	1
Abs = fraction absorbed (unitless)	Specific
EF = child exposure frequency (events/yr)	130
ED = child exposure duration (years)	6
BW = child body weight (kg)	15
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	6
DY = day per year (day/yr)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

COPC	Concentration (mg/kg)	Conversion Factor (kg/mg)	Surface Area (cm2) Child	Adherence Factor (mg/cm2)	Fraction Absorbed (%)	Exposure Frequency (events/yr) Child	Exposure Duration (yrs) Child	Body Weight (kg) Child	Average Carc Time (days)	Carc Dose (mg/kg/day) Child	Dermal Adjust. Slope Factor (mg/kg-day)-1	Carcinogenic Risk Child	Percent Carcinogenic Risk Child	Average Noncarc Tim (days)	Noncarc Dose (mg/kg/day) Child	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarcinogenic Risk Child	Percent Noncarcinogenic Risk Child
n-Nitroso-di-n-propylamine	0.218	1E-06	2000	1	0.01	130	6	15	25550	8.9E-09	1.4E+01	1.2E-07	15%	2190	1.0E-07	0.0E+00	0.0E+00	0%
Benzo(a)anthracene	0.266	1E-06	2000	1	0.01	130	6	15	25550	1.1E-08	1.5E+00	1.6E-08	2%	2190	1.3E-07	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	0.262	1E-06	2000	1	0.01	130	6	15	25550	1.1E-08	1.5E+00	1.6E-08	2%	2190	1.2E-07	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	0.263	1E-06	2000	1	0.01	130	6	15	25550	1.1E-08	1.5E+01	1.6E-07	19%	2190	1.2E-07	0.0E+00	0.0E+00	0%
Dibenzo(a,h)anthracene	0.228	1E-06	2000	1	0.01	130	6	15	25550	9.3E-09	1.5E+01	1.4E-07	16%	2190	1.1E-07	0.0E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	0.257	1E-06	2000	1	0.01	130	6	15	25550	1.0E-08	1.5E+00	1.5E-08	2%	2190	1.2E-07	0.0E+00	0.0E+00	0%
Aldrin	0.004	1E-06	2000	1	0.01	130	6	15	25550	1.8E-10	3.4E+01	6.1E-09	1%	2190	2.1E-09	1.5E-05	1.4E-04	1%
Dieldrin	0.049	1E-06	2000	1	0.01	130	6	15	25550	2.0E-09	3.2E+01	6.3E-08	8%	2190	2.3E-08	2.5E-05	9.3E-04	5%
4,4'-DDE	0.440	1E-06	2000	1	0.01	130	6	15	25550	1.8E-08	6.8E-01	1.2E-08	1%	2190	2.1E-07	0.0E+00	0.0E+00	0%
4,4'-DDT	0.241	1E-06	2000	1	0.01	130	6	15	25550	9.8E-09	6.8E-01	6.7E-09	1%	2190	1.1E-07	2.5E-04	4.6E-04	2%
alpha-Chlordane	0.014	1E-06	2000	1	0.01	130	6	15	25550	5.7E-10	2.6E+00	1.5E-09	0%	2190	6.7E-09	3.0E-05	2.2E-04	1%
gamma-Chlordane	0.006	1E-06	2000	1	0.01	130	6	15	25550	2.6E-10	2.6E+00	6.8E-10	0%	2190	3.1E-09	3.0E-05	1.0E-04	1%
Aroclor-1248	0.291	1E-06	2000	1	0.01	130	6	15	25550	1.2E-08	1.5E+01	1.8E-07	22%	2190	1.4E-07	0.0E+00	0.0E+00	0%
Aroclor-1254	0.051	1E-06	2000	1	0.01	130	6	15	25550	2.1E-09	1.5E+01	3.2E-08	4%	2190	2.4E-08	1.0E-05	2.4E-03	12%
Aluminum	5808.712	1E-06	2000	1	0.001	130	6	15	25550	2.4E-05	0.0E+00	0.0E+00	0%	2190	2.8E-04	2.0E-01	1.4E-03	7%
Antimony	3.379	1E-06	2000	1	0.001	130	6	15	25550	1.4E-08	0.0E+00	0.0E+00	0%	2190	1.6E-07	8.0E-05	2.0E-03	10%
Arsenic	2.399	1E-06	2000	1	0.001	130	6	15	25550	9.8E-09	7.5E+00	7.3E-08	9%	2190	1.1E-07	6.0E-05	1.9E-03	9%
Cadmium (soil)	0.713	1E-06	2000	1	0.001	130	6	15	25550	2.9E-09	0.0E+00	0.0E+00	0%	2190	3.4E-08	2.0E-04	1.7E-04	1%
Chromium	11.294	1E-06	2000	1	0.001	130	6	15	25550	4.6E-08	0.0E+00	0.0E+00	0%	2190	5.4E-07	1.0E-03	5.4E-04	3%
Copper	98.217	1E-06	2000	1	0.001	130	6	15	25550	4.0E-07	0.0E+00	0.0E+00	0%	2190	4.7E-06	8.0E-03	5.8E-04	3%
Iron	11299.700	1E-06	2000	1	0.001	130	6	15	25550	4.6E-05	0.0E+00	0.0E+00	0%	2190	5.4E-04	6.0E-02	8.9E-03	45%
Lead	110.524	1E-06	2000	1	0.001	130	6	15	25550	4.5E-07	0.0E+00	0.0E+00	0%	2190	5.2E-06	0.0E+00	0.0E+00	0%
Mercury	0.370	1E-06	2000	1	0.001	130	6	15	25550	1.5E-09	0.0E+00	0.0E+00	0%	2190	1.8E-08	6.0E-05	2.9E-04	1%
TOTAL												8.4E-07					2.0E-02	

SURFACE SOIL PARTICULATE INHALATION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CHILD TRESPASSER

Intake from the inhalation of particulates is calculated as follows:

Intake (mg/kg-day) = (C * EF * ED * IR * 1/PEF)/(BW * ATc or ATnc * DY)

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	Calculated
CSF = carcinogenic slope factor	Specific
RfD = reference dose for noncarcinogen	Specific
IR = inhalation rate (m3/day)	15
EF = child exposure frequency (days)	130
ED = child exposure duration (years)	6
BW = child body weight (kg)	15
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	6
DY = day per year (day/yr)	365
PEF = particulate emission factor (m3/kg)	1.32E+09

COPC	Concentration (mg/kg)	Particulate Emission Factor (m3/kg)	Exposure Frequency (events/yr)	Inhalation Rate (m3/day)	Exposure Duration (yrs)	Body Weight (kg)	Average Carc Tim (days)	Carc Dose (mg/kg/day)	Slope Factor (mg/kg-day)-1	Carcinogenic Risk	Percent Contribution to Risk	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day)	Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinogeni Risk
n-Nitroso-di-n-propylamine	0.218	1.3E+09	130	15	6	15	25550	5.0E-12	0.0E+00	0.0E+00	0%	2190	5.9E-11	0.0E+00	0.0E+00	0%
Benzo(a)anthracene	0.266	1.3E+09	130	15	6	15	25550	6.2E-12	6.1E-01	3.8E-12	0%	2190	7.2E-11	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	0.262	1.3E+09	130	15	6	15	25550	6.1E-12	6.1E-01	3.7E-12	0%	2190	7.1E-11	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	*0.263*	1.3E+09	130	15	6	15	25550	6.1E-12	6.1E+00	3.7E-11	0%	2190	7.1E-11	0.0E+00	0.0E+00	0%
Dibenzo(a,h)anthracene	0.228	1.3E+09	130	15	6	15	25550	5.3E-12	6.1E+00	3.2E-11	0%	2190	6.2E-11	0.0E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	0.257	1.3E+09	130	15	6	15	25550	5.9E-12	6.1E-01	3.6E-12	0%	2190	6.9E-11	0.0E+00	0.0E+00	0%
Aldrin	0.004	1.3E+09	130	15	6	15	25550	1.0E-13	1.7E+01	1.8E-12	0%	2190	1.2E-12	0.0E+00	0.0E+00	0%
Dieldrin	0.049	1.3E+09	130	15	6	15	25550	1.1E-12	1.6E+01	1.8E-11	0%	2190	1.3E-11	0.0E+00	0.0E+00	0%
4,4'-DDE	0.440	1.3E+09	130	15	6	15	25550	1.0E-11	0.0E+00	0.0E+00	0%	2190	1.2E-10	0.0E+00	0.0E+00	0%
4,4'-DDT	0.241	1.3E+09	130	15	6	15	25550	5.6E-12	3.4E-01	1.9E-12	0%	2190	6.5E-11	0.0E+00	0.0E+00	0%
alpha-Chlordane	0.014	1.3E+09	130	15	6	15	25550	3.2E-13	1.3E+00	4.2E-13	0%	2190	3.8E-12	0.0E+00	0.0E+00	0%
gamma-Chlordane	0.006	1.3E+09	130	15	6	15	25550	1.5E-13	1.3E+00	1.9E-13	0%	2190	1.7E-12	0.0E+00	0.0E+00	0%
Aroclor-1248	0.291	1.3E+09	130	15	6	15	25550	6.7E-12	0.0E+00	0.0E+00	0%	2190	7.9E-11	0.0E+00	0.0E+00	0%
Aroclor-1254	0.051	1.3E+09	130	15	6	15	25550	1.2E-12	0.0E+00	0.0E+00	0%	2190	1.4E-11	0.0E+00	0.0E+00	0%
Aluminum	5808.712	1.3E+09	130	15	6	15	25550	1.3E-07	0.0E+00	0.0E+00	0%	2190	1.6E-06	0.0E+00	0.0E+00	0%
Antimony	3.379	1.3E+09	130	15	6	15	25550	7.8E-11	0.0E+00	0.0E+00	0%	2190	9.1E-10	0.0E+00	0.0E+00	0%
Arsenic	2.399	1.3E+09	130	15	6	15	25550	5.5E-11	1.5E+01	8.4E-10	7%	2190	6.5E-10	0.0E+00	0.0E+00	0%
Cadmium (soil)	0.713	1.3E+09	130	15	6	15	25550	1.6E-11	0.0E+00	0.0E+00	0%	2190	1.9E-10	0.0E+00	0.0E+00	0%
Chromium	11.294	1.3E+09	130	15	6	15	25550	2.6E-10	4.2E+01	1.1E-08	92%	2190	3.0E-09	0.0E+00	0.0E+00	0%
Copper	98.217	1.3E+09	130	15	6	15	25550	2.3E-09	0.0E+00	0.0E+00	0%	2190	2.7E-08	0.0E+00	0.0E+00	0%
Iron	11299.700	1.3E+09	130	15	6	15	25550	2.6E-07	0.0E+00	0.0E+00	0%	2190	3.0E-06	0.0E+00	0.0E+00	0%
Lead	110.524	1.3E+09	130	15	6	15	25550	2.6E-09	0.0E+00	0.0E+00	0%	2190	3.0E-08	0.0E+00	0.0E+00	0%
Mercury	0.370	1.3E+09	130	15	6	15	25550	8.6E-12	0.0E+00	0.0E+00	0%	2190	1.0E-10	8.6E-05	1.2E-06	100%
TOTAL										1.2E-08					1.2E-06	

SURFACE WATER INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CHILD TRESPASSER

The intake from the ingestion of surface water is calculated as follows:

Intake (mg/kg-day) = Cw * CR * ET * EF * ED/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUT
Cw = contaminant concentration in surface water (mg/l)	
CR = contact rate (Liter/hour)	0.005
ET = child exposure time (hours/event)	2.6
EF = child exposure frequency (events/yr)	45
ED = child exposure duration (yrs)	6
BW = child body weight (kg)	15
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	6
DY = days per year (days)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

COPC	Concentration (mg/l)	Contact Rate (l/hour)	Exposure Time (hrs/event) Child	Exposure Frequency (events/yr) Child	Exposure Duration (years) Child	Body Weight (kg) Child	Averaging Carc. Time (days)	Carc Dose (mg/kg-day) Child	Cancer Slope Factor (mg/kg-day)-1	Carcinogenic Risk Child	Percent Carcinogenic Risk Child	Averaging Time Noncarc (days)	Noncarc Dose (mg/kg-day) Child	Reference Dose (mg/kg-day)	Noncarcinogenic Risk Child	Percent Noncarcinogenic Risk Child
1,2-Dichloroethene (total)	0.006	0.005	2.6	45	6	15	25550	5.4E-08	0.0E+00	0.0E+00	0%	2190	6.3E-07	9.0E-03	7.0E-05	1%
Antimony	0.004	0.005	2.6	45	6	15	25550	3.6E-08	0.0E+00	0.0E+00	0%	2190	4.2E-07	4.0E-04	1.0E-03	10%
Barium	0.032	0.005	2.6	45	6	15	25550	3.0E-07	0.0E+00	0.0E+00	0%	2190	3.5E-06	7.0E-02	4.9E-05	0%
Iron	3.990	0.005	2.6	45	6	15	25550	3.7E-05	0.0E+00	0.0E+00	0%	2190	4.3E-04	3.0E-01	1.4E-03	14%
Manganese (water)	0.126	0.005	2.6	45	6	15	25550	1.2E-06	0.0E+00	0.0E+00	0%	2190	1.3E-05	1.4E-01	9.6E-05	1%
Molybdenum	0.065	0.005	2.6	45	6	15	25550	6.0E-07	0.0E+00	0.0E+00	0%	2190	6.9E-06	5.0E-03	1.4E-03	14%
Vanadium	0.387	0.005	2.6	45	6	15	25550	3.5E-06	0.0E+00	0.0E+00	0%	2190	4.1E-05	7.0E-03	5.9E-03	59%
TOTAL										0.0E+00					1.0E-02	

SURFACE WATER DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION - CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CHILD TRESPASSER

The intake from dermal contact with surface water is calculated as follows:

Intake (mg/kg-day) = Cw * SA * PC * ET * EF * ED * CF/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
CW = contaminant concentration in water (mg/l)	SPECIFIC
SA = child skin surface available for contact (cm2)	2000
PC = contaminant specific dermal permability (cm/hr)	Specific
ET = child exposure time (hours/day)	2.6
EF = child exposure frequency (days/yr)	45
ED = child exposure duration (years)	6
CF = volumetric conversion factor for water (1liter/1000 cm3)	0.001
BW = child body weight (kg)	15
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	6
DY = days per year (days)	365
CSF = cancer slope factor (mg/kg-day)-1	Specific
RfD = reference dose (mg/kg-day)	Specific

COPC	Concentration Carcinogen (mg/l)	Surface Area (cm2) Child	Dermal Permeability (cm/hr)	Exposure Time (hours/day) Child	Exposure Frequency (days/yr) Child	Exposure Duration (years) Child	Volumetric Conversion (L/m3)	Body Weight (kg) Child	Averaging Carc Time (days)	Carc Dose (mg/kg-day) Child	Dermal Adjust. Slope Factor (mg/kg-day)-1	Carcinogenic Risk Child	Percent Carcinogenic Risk Child	Average Noncarc Time (days)	Noncarc Dose (mg/kg-day) Child	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarc. Risk Child	Percent Noncarcinogenic Risk Child
1,2-Dichloroethene (total)	0.006	2000	1.0E-02	2.6	45	6	0.001	15	25550	2.1E-07	0.0E+00	0.0E+00	0%	2190	2.5E-06	7.2E-03	3.5E-04	1%
Antimony	0.004	2000	1.0E-03	2.6	45	6	0.001	15	25550	1.4E-08	0.0E+00	0.0E+00	0%	2190	1.7E-07	8.0E-05	2.1E-03	7%
Barium	0.032	2000	1.0E-03	2.6	45	6	0.001	15	25550	1.2E-07	0.0E+00	0.0E+00	0%	2190	1.4E-06	1.4E-02	9.9E-05	0%
Iron	3.990	2000	1.0E-03	2.6	45	6	0.001	15	25550	1.5E-05	0.0E+00	0.0E+00	0%	2190	1.7E-04	6.0E-02	2.8E-03	9%
Manganese (water)	0.126	2000	1.0E-03	2.6	45	6	0.001	15	25550	4.6E-07	0.0E+00	0.0E+00	0%	2190	5.4E-06	2.8E-02	1.9E-04	1%
Molybdenum	0.065	2000	5.0E-03	2.6	45	6	0.001	15	25550	1.2E-06	0.0E+00	0.0E+00	0%	2190	1.4E-05	1.0E-03	1.4E-02	44%
Vanadium	0.387	2000	1.0E-03	2.6	45	6	0.001	15	25550	1.4E-06	0.0E+00	0.0E+00	0%	2190	1.7E-05	1.4E-03	1.2E-02	38%
TOTAL												0.0E+00					3.1E-02	

SEDIMENT INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CHILD TRESPASSER

Intake from ingestion of sediment is calculated as follows:

Intake (mg/kg-day) = C * IR * CF * EF * ED/ BW * ATC or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in sediment (mg/kg)	
CF = conversion for kg to mg	1E-06
EF = exposure frequency for child (days/yr)	45
ED = exposure duration for child (yr)	6
IR = sediment ingestion rate for child (mg/day)	200
BW = body weight for child (kg)	15
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	6
DY = days per year (days/year)	365
CSF = cancer slope factor (mg/kg-day)-1	Specific
RfD = reference dose (mg/kg-day)	Specific

COPC	Concentration (mg/kg)	Exposure Frequency (days/yr) Child	Exposure Duration (yr) Child	Ingestion Rate (mg/day) Child	Conversio Factor (kg/mg)	Body Weight (kg) Child	Average Carc Tim (days)	Carc Dose (mg/kg/day) Child	Slope Factor (mg/kg/day)-1	Carcinogenic Risk Child	Percent Carcinogenic Risk Child	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day) Child	Reference Dose (mg/kg/day)	Noncarcinogenic Risk Child	Percent Noncarcinogenic Risk Child
Tetrachloroethene	0.004	45	6	200	1E-06	15	25550	5.6E-10	5.2E-02	2.9E-11	0%	2190	6.6E-09	1.0E-02	6.6E-07	0%
Diethylphthalate	1.110	45	6	200	1E-06	15	25550	1.6E-07	0.0E+00	0.0E+00	0%	2190	1.8E-06	8.0E-01	2.3E-06	0%
Anthracene	0.046	45	6	200	1E-06	15	25550	6.5E-09	0.0E+00	0.0E+00	0%	2190	7.6E-08	3.0E-01	2.5E-07	0%
Di-n-butylphthalate	0.218	45	6	200	1E-06	15	25550	3.1E-08	0.0E+00	0.0E+00	0%	2190	3.6E-07	1.0E-01	3.6E-06	0%
Bis(2-ethylhexyl)phthalate	0.328	45	6	200	1E-06	15	25550	4.6E-08	1.4E-02	6.5E-10	0%	2190	5.4E-07	2.0E-02	2.7E-05	0%
Dieldrin	0.052	45	6	200	1E-06	15	25550	7.3E-09	1.6E+01	1.2E-07	17%	2190	8.5E-08	5.0E-05	1.7E-03	1%
4,4'-DDE	1.200	45	6	200	1E-06	15	25550	1.7E-07	3.4E-01	5.7E-08	8%	2190	2.0E-06	0.0E+00	0.0E+00	0%
Endrin	0.007	45	6	200	1E-06	15	25550	9.3E-10	0.0E+00	0.0E+00	0%	2190	1.1E-08	3.0E-04	3.6E-05	0%
4,4'-DDD	1.140	45	6	200	1E-06	15	25550	1.6E-07	2.4E-01	3.9E-08	5%	2190	1.9E-06	0.0E+00	0.0E+00	0%
Endosulfan sulfate	0.003	45	6	200	1E-06	15	25550	4.2E-10	0.0E+00	0.0E+00	0%	2190	4.9E-09	6.0E-03	8.2E-07	0%
4,4'-DDT	0.046	45	6	200	1E-06	15	25550	6.5E-09	3.4E-01	2.2E-09	0%	2190	7.6E-08	5.0E-04	1.5E-04	0%
Endrin ketone	0.011	45	6	200	1E-06	15	25550	1.5E-09	0.0E+00	0.0E+00	0%	2190	1.8E-08	3.0E-04	6.0E-05	0%
Endrin aldehyde	0.008	45	6	200	1E-06	15	25550	1.1E-09	0.0E+00	0.0E+00	0%	2190	1.2E-08	3.0E-04	4.2E-05	0%
alpha-Chlordane	0.013	45	6	200	1E-06	15	25550	1.8E-09	1.3E+00	2.4E-09	0%	2190	2.1E-08	6.0E-05	3.6E-04	0%
Aluminum	19389.170	45	6	200	1E-06	15	25550	2.7E-03	0.0E+00	0.0E+00	0%	2190	3.2E-02	1.0E+00	3.2E-02	22%
Barium	68.510	45	6	200	1E-06	15	25550	9.7E-06	0.0E+00	0.0E+00	0%	2190	1.1E-04	7.0E-02	1.6E-03	1%
Beryllium	0.810	45	6	200	1E-06	15	25550	1.1E-07	4.3E+00	4.9E-07	69%	2190	1.3E-06	5.0E-03	2.7E-04	0%
Cadmium (soil)	3.750	45	6	200	1E-06	15	25550	5.3E-07	0.0E+00	0.0E+00	0%	2190	6.2E-06	1.0E-03	6.2E-03	4%
Cobalt	4.200	45	6	200	1E-06	15	25550	5.9E-07	0.0E+00	0.0E+00	0%	2190	6.9E-06	6.0E-02	1.2E-04	0%
Copper	19.880	45	6	200	1E-06	15	25550	2.8E-06	0.0E+00	0.0E+00	0%	2190	3.3E-05	4.0E-02	8.2E-04	1%
Iron	11661.090	45	6	200	1E-06	15	25550	1.6E-03	0.0E+00	0.0E+00	0%	2190	1.9E-02	3.0E-01	6.4E-02	43%
Lead	3422.990	45	6	200	1E-06	15	25550	4.8E-04	0.0E+00	0.0E+00	0%	2190	5.6E-03	0.0E+00	0.0E+00	0%
Manganese (soil)	45.170	45	6	200	1E-06	15	25550	6.4E-06	0.0E+00	0.0E+00	0%	2190	7.4E-05	1.4E-01	5.3E-04	0%
Mercury	0.660	45	6	200	1E-06	15	25550	9.3E-08	0.0E+00	0.0E+00	0%	2190	1.1E-06	3.0E-04	3.6E-03	2%
Nickel	25.810	45	6	200	1E-06	15	25550	3.6E-06	0.0E+00	0.0E+00	0%	2190	4.2E-05	2.0E-02	2.1E-03	1%
Selenium	0.710	45	6	200	1E-06	15	25550	1.0E-07	0.0E+00	0.0E+00	0%	2190	1.2E-06	5.0E-03	2.3E-04	0%
Thallium	0.650	45	6	200	1E-06	15	25550	9.2E-08	0.0E+00	0.0E+00	0%	2190	1.1E-06	8.0E-05	1.3E-02	9%
Vanadium	83.120	45	6	200	1E-06	15	25550	1.2E-05	0.0E+00	0.0E+00	0%	2190	1.4E-04	7.0E-03	2.0E-02	13%
Zinc	140.000	45	6	200	1E-06	15	25550	2.0E-05	0.0E+00	0.0E+00	0%	2190	2.3E-04	3.0E-01	7.7E-04	1%
TOTAL										7.1E-07					1.5E-01	

SEDIMENT DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CHILD TRESPASSER

The intake from dermal contact to sediment is calculated as follows:

Intake (mg/kg-day) = C * CF * SA * AF * Abs * EF * ED/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	Specific
CF = conversion factor (kg/mg)	1.00E-06
SA = child exposed skin surface area (cm2)	2000
AF = sediment to skin adherence factor (mg/cm2)	1
Abs = fraction absorbed (unitless) (contaminant specific)	Specific
EF = child exposure frequency (events/yr)	45
ED = child expsosure duration (years)	6
BW = child body weight (kg)	15
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	6
DY = day per year (day/yr)	365
CSF = cancer slope factor (mg/kg-day)-1	Specific
RfD = reference dose (mg/kg-day)	Specific

COPC	Concentration Carcinogen (mg/kg)	Conversion Factor (kg/mg)	Surface Area (cm2) Child	Adherenc Factor (mg/cm2)	ABS Factor (%)	Exposure Frequency (events/yr Child	Exposure Duration (yrs) Child	Body Weight (kg) Child	Average Carc Time (days)	Carc Dose (mg/kg/day) Child	Dermal Adjust. Slope Factor (mg/kg-day)-1	Carcinogenic Risk Child	Percent Carcinogenic Risk Child	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day) Child	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarcinogenic Risk Child	Percent Noncarcinogenic Risk Child
Tetrachloroethene	0.004	1E-06	2000	1	0.01	45	6	15	25550	5.6E-11	6.5E-02	3.7E-12	0%	2190	6.6E-10	8.0E-03	8.2E-08	0%
Diethylphthalate	1.110	1E-06	2000	1	0.01	45	6	15	25550	1.6E-08	0.0E+00	0.0E+00	0%	2190	1.8E-07	4.0E-01	4.6E-07	0%
Anthracene	0.046	1E-06	2000	1	0.01	45	6	15	25550	6.5E-10	0.0E+00	0.0E+00	0%	2190	7.6E-09	1.5E-01	5.0E-08	0%
Di-n-butylphthalate	0.218	1E-06	2000	1	0.01	45	6	15	25550	3.1E-09	0.0E+00	0.0E+00	0%	2190	3.6E-08	5.0E-02	7.2E-07	0%
Bis(2-ethylhexyl)phthalate	0.328	1E-06	2000	1	0.01	45	6	15	25550	4.6E-09	2.8E-02	1.3E-10	0%	2190	5.4E-08	1.0E-02	5.4E-06	0%
Dieldrin	0.052	1E-06	2000	1	0.01	45	6	15	25550	7.3E-10	3.2E+01	2.3E-08	34%	2190	8.5E-09	2.5E-05	3.4E-04	4%
4,4'-DDE	1.200	1E-06	2000	1	0.01	45	6	15	25550	1.7E-08	6.8E-01	1.1E-08	17%	2190	2.0E-07	0.0E+00	0.0E+00	0%
Endrin	0.007	1E-06	2000	1	0.01	45	6	15	25550	9.3E-11	0.0E+00	0.0E+00	0%	2190	1.1E-09	1.5E-04	7.2E-06	0%
4,4'-DDD	1.140	1E-06	2000	1	0.01	45	6	15	25550	1.6E-08	4.8E-01	7.7E-09	11%	2190	1.9E-07	0.0E+00	0.0E+00	0%
Endosulfan sulfate	0.003	1E-06	2000	1	0.01	45	6	15	25550	4.2E-11	0.0E+00	0.0E+00	0%	2190	4.9E-10	3.0E-03	1.6E-07	0%
4,4'-DDT	0.046	1E-06	2000	1	0.01	45	6	15	25550	6.5E-10	6.8E-01	4.4E-10	1%	2190	7.6E-09	2.5E-04	3.0E-05	0%
Endrin ketone	0.011	1E-06	2000	1	0.01	45	6	15	25550	1.5E-10	0.0E+00	0.0E+00	0%	2190	1.8E-09	1.5E-04	1.2E-05	0%
Endrin aldehyde	0.008	1E-06	2000	1	0.01	45	6	15	25550	1.1E-10	0.0E+00	0.0E+00	0%	2190	1.2E-09	1.5E-04	8.3E-06	0%
alpha-Chlordane	0.013	1E-06	2000	1	0.01	45	6	15	25550	1.8E-10	2.6E+00	4.8E-10	1%	2190	2.1E-09	3.0E-05	7.1E-05	1%
Aluminum	19389.170	1E-06	2000	1	0.001	45	6	15	25550	2.7E-05	0.0E+00	0.0E+00	0%	2190	3.2E-04	2.0E-01	1.6E-03	21%
Barium	68.510	1E-06	2000	1	0.001	45	6	15	25550	9.7E-08	0.0E+00	0.0E+00	0%	2190	1.1E-06	1.4E-02	8.0E-05	1%
Beryllium	0.810	1E-06	2000	1	0.001	45	6	15	25550	1.1E-09	2.1E+01	2.5E-08	36%	2190	1.3E-08	1.0E-03	1.3E-05	0%
Cadmium (soil)	3.750	1E-06	2000	1	0.001	45	6	15	25550	5.3E-09	0.0E+00	0.0E+00	0%	2190	6.2E-08	2.0E-04	3.1E-04	4%
Cobalt	4.200	1E-06	2000	1	0.001	45	6	15	25550	5.9E-09	0.0E+00	0.0E+00	0%	2190	6.9E-08	1.2E-02	5.8E-06	0%
Copper	19.880	1E-06	2000	1	0.001	45	6	15	25550	2.8E-08	0.0E+00	0.0E+00	0%	2190	3.3E-07	8.0E-03	4.1E-05	1%
Iron	11661.090	1E-06	2000	1	0.001	45	6	15	25550	1.6E-05	0.0E+00	0.0E+00	0%	2190	1.9E-04	6.0E-02	3.2E-03	41%
Lead	3422.990	1E-06	2000	1	0.001	45	6	15	25550	4.8E-06	0.0E+00	0.0E+00	0%	2190	5.6E-05	0.0E+00	0.0E+00	0%
Manganese (soil)	45.170	1E-06	2000	1	0.001	45	6	15	25550	6.4E-08	0.0E+00	0.0E+00	0%	2190	7.4E-07	2.8E-02	2.7E-05	0%
Mercury	0.660	1E-06	2000	1	0.001	45	6	15	25550	9.3E-10	0.0E+00	0.0E+00	0%	2190	1.1E-08	6.0E-05	1.8E-04	2%
Nickel	25.810	1E-06	2000	1	0.001	45	6	15	25550	3.6E-08	0.0E+00	0.0E+00	0%	2190	4.2E-07	4.0E-03	1.1E-04	1%
Selenium	0.710	1E-06	2000	1	0.001	45	6	15	25550	1.0E-09	0.0E+00	0.0E+00	0%	2190	1.2E-08	1.0E-03	1.2E-05	0%
Thallium	0.650	1E-06	2000	1	0.001	45	6	15	25550	9.2E-10	0.0E+00	0.0E+00	0%	2190	1.1E-08	1.6E-05	6.7E-04	9%
Vanadium	83.120	1E-06	2000	1	0.001	45	6	15	25550	1.2E-07	0.0E+00	0.0E+00	0%	2190	1.4E-06	1.4E-03	9.8E-04	13%
Zinc	140.000	1E-06	2000	1	0.001	45	6	15	25550	2.0E-07	0.0E+00	0.0E+00	0%	2190	2.3E-06	6.0E-02	3.8E-05	0%
TOTAL												6.8E-08					7.7E-03	

FUTURE CHILD RESIDENT

SURFACE SOIL INGES. XPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT RESIDENTIAL CHILD

Intake from ingestion of soil is calculated as follows:

Intake (mg/kg-day) = C * CF * EF * ED * IR/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	
CF = conversion for kg to mg	1E-06
EF = child exposure frequency (days/yr)	350
ED = child exposure duration (yr)	6
IR = child soil ingestion rate (mg/day)	200
BW = child body weight (kg)	15
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	6
DY = days per year (days/year)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

COPC	Concentration (mg/kg)	Exposure Frequency (days/yr) Child	Exposure Duration (yr) Child	Conversio Factor (kg/mg)	Ingestion Rate (mg/day) Child	Body Weight (kg) Child	Average Carc Time (days)	Carc Dose (mg/kg/day) Child	Slope Factor (mg/kg/day)	Carcinogenic Risk Child	Percent Carcinogenic Risk Child	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day) Child	Reference Dose (mg/kg/day)	Noncarcinogenic Risk Child	Percent Noncarcinogenic Risk Child
n-Nitroso-di-n-propylamine	0.218	350	6	1E-06	200	15	25550	2.4E-07	7.00E+00	1.7E-06	12%	2190	2.8E-06	0.00E+00	0.0E+00	0%
Benzo(a)anthracene	0.266	350	6	1E-06	200	15	25550	2.9E-07	7.30E-01	2.1E-07	1%	2190	3.4E-06	0.00E+00	0.0E+00	0%
Benzo(b)fluoranthene	0.262	350	6	1E-06	200	15	25550	2.9E-07	7.30E-01	2.1E-07	1%	2190	3.4E-06	0.00E+00	0.0E+00	0%
Benzo(a)pyrene	0.263	350	6	1E-06	200	15	25550	2.9E-07	7.30E+00	2.1E-06	15%	2190	3.4E-06	0.00E+00	0.0E+00	0%
Dibenzo(a,h)anthracene	0.228	350	6	1E-06	200	15	25550	2.5E-07	7.30E+00	1.8E-06	13%	2190	2.9E-06	0.00E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	0.257	350	6	1E-06	200	15	25550	2.8E-07	7.30E-01	2.1E-07	1%	2190	3.3E-06	0.00E+00	0.0E+00	0%
Aldrin	0.004	350	6	1E-06	200	15	25550	4.9E-09	1.70E+01	8.3E-08	1%	2190	5.7E-08	3.00E-05	1.9E-03	0%
Dieldrin	0.049	350	6	1E-06	200	15	25550	5.3E-08	1.60E+01	8.5E-07	6%	2190	6.2E-07	5.00E-05	1.2E-02	1%
4,4'-DDE	0.440	350	6	1E-06	200	15	25550	4.8E-07	3.40E-01	1.6E-07	1%	2190	5.6E-06	0.00E+00	0.0E+00	0%
4,4'-DDT	0.241	350	6	1E-06	200	15	25550	2.6E-07	3.40E-01	9.0E-08	1%	2190	3.1E-06	5.00E-04	6.2E-03	1%
alpha-Chlordane	0.014	350	6	1E-06	200	15	25550	1.5E-08	1.30E+00	2.0E-08	0%	2190	1.8E-07	6.00E-05	3.0E-03	0%
gamma-Chlordane	0.006	350	6	1E-06	200	15	25550	7.1E-09	1.30E+00	9.2E-09	0%	2190	8.2E-08	6.00E-05	1.4E-03	0%
Aroclor-1248	0.291	350	6	1E-06	200	15	25550	3.2E-07	7.70E+00	2.5E-06	17%	2190	3.7E-06	0.00E+00	0.0E+00	0%
Aroclor-1254	0.051	350	6	1E-06	200	15	25550	5.5E-08	7.70E+00	4.3E-07	3%	2190	6.5E-07	2.00E-05	3.2E-02	4%
Aluminum	5808.712	350	6	1E-06	200	15	25550	6.4E-03	0.00E+00	0.0E+00	0%	2190	7.4E-02	1.00E+00	7.4E-02	8%
Antimony	3.379	350	6	1E-06	200	15	25550	3.7E-06	0.00E+00	0.0E+00	0%	2190	4.3E-05	4.00E-04	1.1E-01	12%
Arsenic	2.399	350	6	1E-06	200	15	25550	2.6E-06	1.50E+00	3.9E-06	28%	2190	3.1E-05	3.00E-04	1.0E-01	11%
Cadmium (soil)	0.713	350	6	1E-06	200	15	25550	7.8E-07	0.00E+00	0.0E+00	0%	2190	9.1E-06	1.00E-03	9.1E-03	1%
Chromium	11.294	350	6	1E-06	200	15	25550	1.2E-05	0.00E+00	0.0E+00	0%	2190	1.4E-04	5.00E-03	2.9E-02	3%
Copper	98.217	350	6	1E-06	200	15	25550	1.1E-04	0.00E+00	0.0E+00	0%	2190	1.3E-03	4.00E-02	3.1E-02	3%
Iron	11299.700	350	6	1E-06	200	15	25550	1.2E-02	0.00E+00	0.0E+00	0%	2190	1.4E-01	3.00E-01	4.8E-01	53%
Lead	110.524	350	6	1E-06	200	15	25550	1.2E-04	0.00E+00	0.0E+00	0%	2190	1.4E-03	0.00E+00	0.0E+00	0%
Mercury	0.370	350	6	1E-06	200	15	25550	4.1E-07	0.00E+00	0.0E+00	0%	2190	4.7E-06	3.00E-04	1.6E-02	2%
TOTAL										1.4E-05					9.1E-01	

SURFACE SOIL DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT RESIDENTIAL CHILD

Dermal contact with soil is calculated as follows:

Intake (mg/kg-day) = C * CF * SA * AF * Abs * EF * ED/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	
CF = conversion factor (kg/mg)	1E-06
SA = child exposed skin surface area (cm2)	2300
AF = soil to skin adherence factor (mg/cm2)	1
Abs = fraction absorbed (unitless)	Specific
EF = child exposure frequency (events/yr)	350
ED = child exposure duration (years)	6
BW = child body weight (kg)	15
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	6
DY = day per year (day/yr)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

COPC	Concentration (mg/kg)	Conversion Factor (kg/mg)	Surface Area (cm2) Child	Adherenc Factor (mg/cm2)	Fraction Absorbed (%)	Exposure Frequency (events/yr) Child	Exposure Duration (yrs) Child	Body Weight (kg) Child	Average Carc Time (days)	Carc Dose (mg/kg/day) Child	Dermal Adjust Slope Factor (mg/kg-day)-1	Carcinogenic Risk Child	Percent Carcinogenic Risk Child	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day) Child	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarcinogenic Risk Child	Percent Noncarcinogenic Risk Child
n-Nitroso-di-n-propylamine	0.218	1E-06	2300	1	0.01	350	6	15	25550	2.7E-08	1.4E+01	3.8E-07	15%	2190	3.2E-07	0.0E+00	0.0E+00	0%
Benzo(a)anthracene	0.266	1E-06	2300	1	0.01	350	6	15	25550	3.4E-08	1.5E+00	4.9E-08	2%	2190	3.9E-07	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	0.262	1E-06	2300	1	0.01	350	6	15	25550	3.3E-08	1.5E+00	4.8E-08	2%	2190	3.9E-07	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	0.263	1E-06	2300	1	0.01	350	6	15	25550	3.3E-08	1.5E+01	4.8E-07	19%	2190	3.9E-07	0.0E+00	0.0E+00	0%
Dibenzo(a,h)anthracene	0.228	1E-06	2300	1	0.01	350	6	15	25550	2.9E-08	1.5E+01	4.2E-07	16%	2190	3.4E-07	0.0E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	0.257	1E-06	2300	1	0.01	350	6	15	25550	3.2E-08	1.5E+00	4.7E-08	2%	2190	3.8E-07	0.0E+00	0.0E+00	0%
Aldrin	0.004	1E-06	2300	1	0.01	350	6	15	25550	5.6E-10	3.4E+01	1.9E-08	1%	2190	6.5E-09	1.5E-05	4.4E-04	1%
Dieldrin	0.049	1E-06	2300	1	0.01	350	6	15	25550	6.1E-09	3.2E+01	2.0E-07	8%	2190	7.2E-08	2.5E-05	2.9E-03	5%
4,4'-DDE	0.440	1E-06	2300	1	0.01	350	6	15	25550	5.5E-08	6.8E-01	3.8E-08	1%	2190	6.5E-07	0.0E+00	0.0E+00	0%
4,4'-DDT	0.241	1E-06	2300	1	0.01	350	6	15	25550	3.0E-08	6.8E-01	2.1E-08	1%	2190	3.5E-07	2.5E-04	1.4E-03	2%
alpha-Chlordane	0.014	1E-06	2300	1	0.01	350	6	15	25550	1.8E-09	2.6E+00	4.6E-09	0%	2190	2.1E-08	3.0E-05	6.9E-04	1%
gamma-Chlordane	0.006	1E-06	2300	1	0.01	350	6	15	25550	8.1E-10	2.6E+00	2.1E-09	0%	2190	9.5E-09	3.0E-05	3.2E-04	1%
Aroclor-1248	0.291	1E-06	2300	1	0.01	350	6	15	25550	3.7E-08	1.5E+01	5.7E-07	22%	2190	4.3E-07	0.0E+00	0.0E+00	0%
Aroclor-1254	0.051	1E-06	2300	1	0.01	350	6	15	25550	6.4E-09	1.5E+01	9.8E-08	4%	2190	7.4E-08	1.0E-05	7.4E-03	12%
Aluminum	5808.712	1E-06	2300	1	0.001	350	6	15	25550	7.3E-05	0.0E+00	0.0E+00	0%	2190	8.5E-04	2.0E-01	4.3E-03	7%
Antimony	3.379	1E-06	2300	1	0.001	350	6	15	25550	4.3E-08	0.0E+00	0.0E+00	0%	2190	5.0E-07	8.0E-05	6.2E-03	10%
Arsenic	2.399	1E-06	2300	1	0.001	350	6	15	25550	3.0E-08	7.5E+00	2.3E-07	9%	2190	3.5E-07	6.0E-05	5.9E-03	9%
Cadmium (soil)	0.713	1E-06	2300	1	0.001	350	6	15	25550	9.0E-09	0.0E+00	0.0E+00	0%	2190	1.0E-07	2.0E-04	5.2E-04	1%
Chromium	11.294	1E-06	2300	1	0.001	350	6	15	25550	1.4E-07	0.0E+00	0.0E+00	0%	2190	1.7E-06	1.0E-03	1.7E-03	3%
Copper	98.217	1E-06	2300	1	0.001	350	6	15	25550	1.2E-06	0.0E+00	0.0E+00	0%	2190	1.4E-05	8.0E-03	1.8E-03	3%
Iron	11299.700	1E-06	2300	1	0.001	350	6	15	25550	1.4E-04	0.0E+00	0.0E+00	0%	2190	1.7E-03	6.0E-02	2.8E-02	45%
Lead	110.524	1E-06	2300	1	0.001	350	6	15	25550	1.4E-06	0.0E+00	0.0E+00	0%	2190	1.6E-05	0.0E+00	0.0E+00	0%
Mercury	0.370	1E-06	2300	1	0.001	350	6	15	25550	4.7E-09	0.0E+00	0.0E+00	0%	2190	5.4E-08	6.0E-05	9.1E-04	1%
TOTAL												2.6E-06					6.2E-02	

SURFACE SOIL PARTICULATE INHALATION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT RESIDENTIAL CHILD

Intake from the inhalation of particulates is calculated as follows:

Intake (mg/kg-day) = (C * EF * ED * IR * 1/PEF)/(BW * ATc or ATnc * DY)

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	Calculated
CSF = carcinogenic slope factor	Specific
RfD = reference dose for noncarcinogen	Specific
IR = inhalation rate (m3)	15
EF = child exposure frequency (days)	350
ED = child exposure duration (years)	6
BW = child body weight (kg)	15
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	6
DY = day per year (day/yr)	365
PEF = particulate emission factor (m3/kg)	1.32E+09

COPC	Concentration (mg/kg)	Particulate Emission Factor (m3/kg)	Exposure Frequency (events/yr)	Inhalation Rate (m3/day)	Exposure Duration (yrs)	Body Weight (kg)	Average Carc Time (days)	Carc Dose (mg/kg/day)	Slope Factor (mg/kg-day)	Carcinogenic Risk	Percent Conrtribution to Risk	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day)	Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
n-Nitroso-di-n-propylamine	0.218	1.3E+09	350	15	6	15	25550	1.4E-11	0.0E+00	0.0E+00	0%	2190	1.6E-10	0.0E+00	0.0E+00	0%
Benzo(a)anthracene	0.266	1.3E+09	350	15	6	15	25550	1.7E-11	6.1E-01	1.0E-11	0%	2190	1.9E-10	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	0.262	1.3E+09	350	15	6	15	25550	1.6E-11	6.1E-01	1.0E-11	0%	2190	1.9E-10	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	0.263	1.3E+09	350	15	6	15	25550	1.6E-11	6.1E+00	1.0E-10	0%	2190	1.9E-10	0.0E+00	0.0E+00	0%
Dibenzo(a,h)anthracene	0.228	1.3E+09	350	15	6	15	25550	1.4E-11	6.1E+00	8.7E-11	0%	2190	1.7E-10	0.0E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	0.257	1.3E+09	350	15	6	15	25550	1.6E-11	6.1E-01	9.8E-12	0%	2190	1.9E-10	0.0E+00	0.0E+00	0%
Aldrin	0.004	1.3E+09	350	15	6	15	25550	2.8E-13	1.7E+01	4.8E-12	0%	2190	3.2E-12	0.0E+00	0.0E+00	0%
Dieldrin	0.049	1.3E+09	350	15	6	15	25550	3.0E-12	1.6E+01	4.9E-11	0%	2190	3.5E-11	0.0E+00	0.0E+00	0%
4,4'-DDE	0.440	1.3E+09	350	15	6	15	25550	2.7E-11	0.0E+00	0.0E+00	0%	2190	3.2E-10	0.0E+00	0.0E+00	0%
4,4'-DDT	0.241	1.3E+09	350	15	6	15	25550	1.5E-11	3.4E-01	5.1E-12	0%	2190	1.7E-10	0.0E+00	0.0E+00	0%
alpha-Chlordane	0.014	1.3E+09	350	15	6	15	25550	8.7E-13	1.3E+00	1.1E-12	0%	2190	1.0E-11	0.0E+00	0.0E+00	0%
gamma-Chlordane	0.006	1.3E+09	350	15	6	15	25550	4.0E-13	1.3E+00	5.2E-13	0%	2190	4.7E-12	0.0E+00	0.0E+00	0%
Aroclor-1248	0.291	1.3E+09	350	15	6	15	25550	1.8E-11	0.0E+00	0.0E+00	0%	2190	2.1E-10	0.0E+00	0.0E+00	0%
Aroclor-1254	0.051	1.3E+09	350	15	6	15	25550	3.2E-12	0.0E+00	0.0E+00	0%	2190	3.7E-11	0.0E+00	0.0E+00	0%
Aluminum	5808.712	1.3E+09	350	15	6	15	25550	3.6E-07	0.0E+00	0.0E+00	0%	2190	4.2E-06	0.0E+00	0.0E+00	0%
Antimony	3.379	1.3E+09	350	15	6	15	25550	2.1E-10	0.0E+00	0.0E+00	0%	2190	2.5E-09	0.0E+00	0.0E+00	0%
Arsenic	2.399	1.3E+09	350	15	6	15	25550	1.5E-10	1.5E+01	2.3E-09	7%	2190	1.7E-09	0.0E+00	0.0E+00	0%
Cadmium (soil)	0.713	1.3E+09	350	15	6	15	25550	4.4E-11	0.0E+00	0.0E+00	0%	2190	5.2E-10	0.0E+00	0.0E+00	0%
Chromium	11.294	1.3E+09	350	15	6	15	25550	7.0E-10	4.2E+01	3.0E-08	92%	2190	8.2E-09	0.0E+00	0.0E+00	0%
Copper	98.217	1.3E+09	350	15	6	15	25550	6.1E-09	0.0E+00	0.0E+00	0%	2190	7.1E-08	0.0E+00	0.0E+00	0%
Iron	11299.700	1.3E+09	350	15	6	15	25550	7.0E-07	0.0E+00	0.0E+00	0%	2190	8.2E-06	0.0E+00	0.0E+00	0%
Lead	110.524	1.3E+09	350	15	6	15	25550	6.9E-09	0.0E+00	0.0E+00	0%	2190	8.0E-08	0.0E+00	0.0E+00	0%
Mercury	0.370	1.3E+09	350	15	6	15	25550	2.3E-11	0.0E+00	0.0E+00	0%	2190	2.7E-10	8.6E-05	3.1E-06	100%
TOTAL										3.2E-08					3.1E-06	

SUBSURFACE SOIL INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
FUTURE RESIDENTIAL CHILD

Intake from ingestion of soil is calculated as follows:

Intake (mg/kg-day) = C * CF * EF * ED * IR/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	
CF = conversion for kg to mg	1E-06
EF = child exposure frequency (days/yr)	350
ED = child exposure duration (yr)	6
IR = child soil ingestion rate (mg/day)	200
BW = child body weight (kg)	15
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	6
DY = days per year (days/year)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

COPC	Concentration (mg/kg)	Exposure Frequency (days/yr) Child	Exposure Duration (yr) Child	Conversion Factor (kg/mg)	Ingestion Rate (mg/day) Child	Body Weight (kg) Child	Average Carc Time (days)	Carc Dose (mg/kg/day) Child	Slope Factor (mg/kg/day)-1	Carcinogenic Risk Child	Percent Carcinogenic Risk Child	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day) Child	Reference Dose (mg/kg/day)	Noncarcinogenic Risk Child	Percent Noncarcinogenic Risk Child
Benzo(a)pyrene	0.210	350	6	1E-06	200	15	25550	2.3E-07	7.30E+00	1.7E-06	12%	2190	2.7E-06	0.00E+00	0.0E+00	0%
Dieldrin	0.010	350	6	1E-06	200	15	25550	1.1E-08	1.60E+01	1.8E-07	1%	2190	1.3E-07	5.00E-05	2.7E-03	0%
4,4'-DDT	0.061	350	6	1E-06	200	15	25550	6.6E-08	3.40E-01	2.3E-08	0%	2190	7.8E-07	5.00E-04	1.6E-03	0%
alpha-Chlordane	0.005	350	6	1E-06	200	15	25550	5.9E-09	1.30E+00	7.6E-09	0%	2190	6.9E-08	6.00E-05	1.1E-03	0%
gamma-Chlordane	0.005	350	6	1E-06	200	15	25550	5.3E-09	1.30E+00	6.9E-09	0%	2190	6.2E-08	6.00E-05	1.0E-03	0%
Aroclor-1248	0.043	350	6	1E-06	200	15	25550	4.8E-08	7.70E+00	3.7E-07	3%	2190	5.5E-07	0.00E+00	0.0E+00	0%
Aluminum	7190.019	350	6	1E-06	200	15	25550	7.9E-03	0.00E+00	0.0E+00	0%	2190	9.2E-02	1.00E+00	9.2E-02	4%
Antimony	3.715	350	6	1E-06	200	15	25550	4.1E-06	0.00E+00	0.0E+00	0%	2190	4.7E-05	4.00E-04	1.2E-01	5%
Arsenic	6.837	350	6	1E-06	200	15	25550	7.5E-06	1.50E+00	1.1E-05	80%	2190	8.7E-05	3.00E-04	2.9E-01	13%
Beryllium	0.100	350	6	1E-06	200	15	25550	1.1E-07	4.30E+00	4.7E-07	3%	2190	1.3E-06	5.00E-03	2.6E-04	0%
Cadmium (soil)	2.109	350	6	1E-06	200	15	25550	2.3E-06	0.00E+00	0.0E+00	0%	2190	2.7E-05	1.00E-03	2.7E-02	1%
Chromium	15.919	350	6	1E-06	200	15	25550	1.7E-05	0.00E+00	0.0E+00	0%	2190	2.0E-04	5.00E-03	4.1E-02	2%
Copper	344.565	350	6	1E-06	200	15	25550	3.8E-04	0.00E+00	0.0E+00	0%	2190	4.4E-03	4.00E-02	1.1E-01	5%
Iron	31266.800	350	6	1E-06	200	15	25550	3.4E-02	0.00E+00	0.0E+00	0%	2190	4.0E-01	3.00E-01	1.3E+00	61%
Lead	473.537	350	6	1E-06	200	15	25550	5.2E-04	0.00E+00	0.0E+00	0%	2190	6.1E-03	0.00E+00	0.0E+00	0%
Manganese (soil)	506.623	350	6	1E-06	200	15	25550	5.6E-04	0.00E+00	0.0E+00	0%	2190	6.5E-03	1.40E-01	4.6E-02	2%
Mercury	0.326	350	6	1E-06	200	15	25550	3.6E-07	0.00E+00	0.0E+00	0%	2190	4.2E-06	3.00E-04	1.4E-02	1%
Zinc	2580.000	350	6	1E-06	200	15	25550	2.8E-03	0.00E+00	0.0E+00	0%	2190	3.3E-02	3.00E-01	1.1E-01	5%
TOTAL										1.4E-05					2.2E+00	

SUBSURFACE SOIL DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
FUTURE RESIDENTIAL CHILD

Dermal contact with soil is calculated as follows:

Intake (mg/kg-day) = C * CF * SA * AF * Abs * EF * ED/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	
CF = conversion factor (kg/mg)	1E-06
SA = child exposed skin surface area (cm2)	2300
AF = soil to skin adherence factor (mg/cm2)	1
Abs = fraction absorbed (unitless)	Specific
EF = child exposure frequency (events/yr)	350
ED = child exposure duration (years)	6
BW = child body weight (kg)	15
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	6
DY = day per year (day/yr)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

COPC	Concentration (mg/kg)	Conversion Factor (kg/mg)	Surface Area (cm2) Child	Adherence Factor (mg/cm2)	Fraction Absorbed (%)	Exposur Frequen (events/ Child	Exposure Duration (yrs) Child	Body Weight (kg) Child	Average Carc Time (days)	Carc Dose (mg/kg/day) Child	Dermal Adjust. Slope Factor (mg/kg-day)-1	Carcinogenic Risk Child	Percent Carcinogenic Risk Child	Average Noncarc Tim (days)	Noncarc Dose (mg/kg/day) Child	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarcinogenic Risk Child	Percent Noncarcinogenic Risk Child
Benzo(a)pyrene	0.210	1E-06	2300	1	0.01	350	6	15	25550	2.6E-08	1.5E+01	3.9E-07	32%	2190	3.1E-07	0.0E+00	0.0E+00	0%
Dieldrin	0.010	1E-06	2300	1	0.01	350	6	15	25550	1.3E-09	3.2E+01	4.2E-08	4%	2190	1.5E-08	2.5E-05	6.1E-04	0%
4,4'-DDT	0.061	1E-06	2300	1	0.01	350	6	15	25550	7.6E-09	6.8E-01	5.2E-09	0%	2190	8.9E-08	2.5E-04	3.6E-04	0%
alpha-Chlordane	0.005	1E-06	2300	1	0.01	350	6	15	25550	6.8E-10	2.6E+00	1.8E-09	0%	2190	7.9E-09	3.0E-05	2.6E-04	0%
gamma-Chlordane	0.005	1E-06	2300	1	0.01	350	6	15	25550	6.1E-10	2.6E+00	1.6E-09	0%	2190	7.1E-09	3.0E-05	2.4E-04	0%
Aroclor-1248	0.043	1E-06	2300	1	0.01	350	6	15	25550	5.5E-09	1.5E+01	8.4E-08	7%	2190	6.4E-08	0.0E+00	0.0E+00	0%
Aluminum	7190.019	1E-06	2300	1	0.001	350	6	15	25550	9.1E-05	0.0E+00	0.0E+00	0%	2190	1.1E-03	2.0E-01	5.3E-03	4%
Antimony	3.715	1E-06	2300	1	0.001	350	6	15	25550	4.7E-08	0.0E+00	0.0E+00	0%	2190	5.5E-07	8.0E-05	6.8E-03	5%
Arsenic	6.837	1E-06	2300	1	0.001	350	6	15	25550	8.6E-08	7.5E+00	6.5E-07	54%	2190	1.0E-06	6.0E-05	1.7E-02	13%
Beryllium	0.100	1E-06	2300	1	0.001	350	6	15	25550	1.3E-09	2.1E+01	2.7E-08	2%	2190	1.5E-08	1.0E-03	1.5E-05	0%
Cadmium (soil)	2.109	1E-06	2300	1	0.001	350	6	15	25550	2.7E-08	0.0E+00	0.0E+00	0%	2190	3.1E-07	2.0E-04	1.6E-03	1%
Chromium	15.919	1E-06	2300	1	0.001	350	6	15	25550	2.0E-07	0.0E+00	0.0E+00	0%	2190	2.3E-06	1.0E-03	2.3E-03	2%
Copper	344.565	1E-06	2300	1	0.001	350	6	15	25550	4.3E-06	0.0E+00	0.0E+00	0%	2190	5.1E-05	8.0E-03	6.3E-03	5%
Iron	31266.800	1E-06	2300	1	0.001	350	6	15	25550	3.9E-04	0.0E+00	0.0E+00	0%	2190	4.6E-03	6.0E-02	7.7E-02	60%
Lead	473.537	1E-06	2300	1	0.001	350	6	15	25550	6.0E-06	0.0E+00	0.0E+00	0%	2190	7.0E-05	0.0E+00	0.0E+00	0%
Manganese (soil)	506.623	1E-06	2300	1	0.001	350	6	15	25550	6.4E-06	0.0E+00	0.0E+00	0%	2190	7.4E-05	2.8E-02	2.7E-03	2%
Mercury	0.326	1E-06	2300	1	0.001	350	6	15	25550	4.1E-09	0.0E+00	0.0E+00	0%	2190	4.8E-08	6.0E-05	8.0E-04	1%
Zinc	2580.000	1E-06	2300	1	0.001	350	6	15	25550	3.3E-05	0.0E+00	0.0E+00	0%	2190	3.8E-04	6.0E-02	6.3E-03	5%
TOTAL												1.2E-06					1.3E-01	

SUBSURFACE SOIL PARTICULATE INHALATION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
FUTURE RESIDENTIAL CHILD

Intake from the inhalation of particulates is calculated as follows:

Intake (mg/kg-day) = (C * EF * ED * IR * 1/PEF)/(BW * ATc or ATnc * DY)

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	Calculated
CSF = carcinogenic slope factor	Specific
RfD = reference dose for noncarcinogen	Specific
IR = inhalation rate (m3)	15
EF = child exposure frequency (days)	350
ED = child exposure duration (years)	6
BW = child body weight (kg)	15
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	6
DY = day per year (day/yr)	365
PEF = particulate emission factor (m3/kg)	1.32E+09

COPC	Concentration (mg/kg)	Particulate Emission Factor (m3/kg)	Exposure Frequency (events/yr)	Inhalation Rate (m3/day)	Exposure Duration (yrs)	Body Weight (kg)	Average Carc Time (days)	Carc Dose (mg/kg/day)	Slope Factor (mg/kg-day)-1	Carcinogenic Risk	Percent Conrtribution to Risk	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day)	Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
Benzo(a)pyrene	0.210	1.3E+09	350	15	6	15	25550	1.3E-11	6.1E+00	8.0E-11	0%	2190	1.5E-10	0.0E+00	0.0E+00	0%
Dieldrin	0.010	1.3E+09	350	15	6	15	25550	6.5E-13	1.6E+01	1.0E-11	0%	2190	7.5E-12	0.0E+00	0.0E+00	0%
4,4'-DDT	0.061	1.3E+09	350	15	6	15	25550	3.8E-12	3.4E-01	1.3E-12	0%	2190	4.4E-11	0.0E+00	0.0E+00	0%
alpha-Chlordane	0.005	1.3E+09	350	15	6	15	25550	3.3E-13	1.3E+00	4.3E-13	0%	2190	3.9E-12	0.0E+00	0.0E+00	0%
gamma-Chlordane	0.005	1.3E+09	350	15	6	15	25550	3.0E-13	1.3E+00	3.9E-13	0%	2190	3.5E-12	0.0E+00	0.0E+00	0%
Aroclor-1248	0.043	1.3E+09	350	15	6	15	25550	2.7E-12	0.0E+00	0.0E+00	0%	2190	3.2E-11	0.0E+00	0.0E+00	0%
Aluminum	7190.019	1.3E+09	350	15	6	15	25550	4.5E-07	0.0E+00	0.0E+00	0%	2190	5.2E-06	0.0E+00	0.0E+00	0%
Antimony	3.715	1.3E+09	350	15	6	15	25550	2.3E-10	0.0E+00	0.0E+00	0%	2190	2.7E-09	0.0E+00	0.0E+00	0%
Arsenic	6.837	1.3E+09	350	15	6	15	25550	4.3E-10	1.5E+01	6.4E-09	13%	2190	5.0E-09	0.0E+00	0.0E+00	0%
Beryllium	0.100	1.3E+09	350	15	6	15	25550	6.2E-12	8.4E+00	5.2E-11	0%	2190	7.3E-11	0.0E+00	0.0E+00	0%
Cadmium (soil)	2.109	1.3E+09	350	15	6	15	25550	1.3E-10	0.0E+00	0.0E+00	0%	2190	1.5E-09	0.0E+00	0.0E+00	0%
Chromium	15.919	1.3E+09	350	15	6	15	25550	9.9E-10	4.2E+01	4.2E-08	86%	2190	1.2E-08	0.0E+00	0.0E+00	0%
Copper	344.565	1.3E+09	350	15	6	15	25550	2.1E-08	0.0E+00	0.0E+00	0%	2190	2.5E-07	0.0E+00	0.0E+00	0%
Iron	31266.800	1.3E+09	350	15	6	15	25550	1.9E-06	0.0E+00	0.0E+00	0%	2190	2.3E-05	0.0E+00	0.0E+00	0%
Lead	473.537	1.3E+09	350	15	6	15	25550	2.9E-08	0.0E+00	0.0E+00	0%	2190	3.4E-07	0.0E+00	0.0E+00	0%
Manganese (soil)	508.623	1.3E+09	350	15	6	15	25550	3.2E-08	0.0E+00	0.0E+00	0%	2190	3.7E-07	0.0E+00	0.0E+00	0%
Mercury	0.326	1.3E+09	350	15	6	15	25550	2.0E-11	0.0E+00	0.0E+00	0%	2190	2.4E-10	8.6E-05	2.8E-06	100%
Zinc	2580.000	1.3E+09	350	15	6	15	25550	1.6E-07	0.0E+00	0.0E+00	0%	2190	1.9E-06	0.0E+00	0.0E+00	0%
TOTAL										4.8E-08					2.8E-06	

GROUNDWATER INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
FUTURE RESIDENTIAL CHILD

Intake from drinking water is calculated as follows:

Intake (mg/kg-day) = C * IRw * EF * ED/BW * AT or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in water (mg/l)	
IRw = child daily water ingestion rate (L/D	1
EF = child exposure frequency (days/yr)	350
ED = child exposure duration (yr)	6
BW = child body weight (kg)	15
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen	6
DY = days per year (day/year)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

SHALLOW AND DEEP GROUNDWATER

COPC	Concentration Carcinogen (mg/l)	Ingestion Rate (L/day) Child	Exposure Frequency (day/year) Child	Exposure Duration (year) Child	Body Weight (kg) Child	Average Carc Time (days)	Carc Dose (mg/kg-day) Child	Slope Factor (mg/kg-day)-1	Carcinogenic Risk Child	Percent Carcinogenic Risk Child	Average Noncarc Time (days)	Noncarc Dose (mg/kg-day) Child	Reference Dose (mg/kg-day)	Noncarcinogenic Risk Child	Percent Noncarcinogenic Risk Child
1,2-Dichloroethene (total)	0.009	1	350	6	15	25550	5.0E-05	0.0E+00	0.0E+00	0%	2190	5.8E-04	9.0E-03	6.4E-02	1%
Trichloroethene	0.012	1	350	6	15	25550	6.3E-05	1.1E-02	6.9E-07	4%	2190	7.4E-04	6.0E-03	1.2E-01	2%
Tetrachloroethene	0.002	1	350	6	15	25550	1.1E-05	5.2E-02	5.7E-07	3%	2190	1.3E-04	1.0E-02	1.3E-02	0%
1,1,2,2-Tetrachloroethane	0.006	1	350	6	15	25550	3.0E-05	2.0E-01	6.1E-06	33%	2190	3.5E-04	0.0E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	0.005	1	350	6	15	25550	2.7E-05	1.4E-02	3.8E-07	2%	2190	3.2E-04	2.0E-02	1.6E-02	0%
Aluminum	0.314	1	350	6	15	25550	1.7E-03	0.0E+00	0.0E+00	0%	2190	2.0E-02	1.0E+00	2.0E-02	0%
Arsenic	0.001	1	350	6	15	25550	7.1E-06	1.5E+00	1.1E-05	58%	2190	8.3E-05	3.0E-04	2.8E-01	5%
Barium	0.219	1	350	6	15	25550	1.2E-03	0.0E+00	0.0E+00	0%	2190	1.4E-02	7.0E-02	2.0E-01	4%
Cadmium (water)	0.002	1	350	6	15	25550	9.8E-06	0.0E+00	0.0E+00	0%	2190	1.1E-04	5.0E-04	2.3E-01	5%
Iron	16.900	1	350	6	15	25550	9.3E-02	0.0E+00	0.0E+00	0%	2190	1.1E+00	3.0E-01	3.6E+00	71%
Manganese (water)	1.200	1	350	6	15	25550	6.6E-03	0.0E+00	0.0E+00	0%	2190	7.7E-02	1.4E-01	5.5E-01	11%
TOTAL									1.8E-05					5.1E+00	

GROUNDWATER DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
FUTURE RESIDENTIAL CHILD

Dermal Contact from groundwater is calcuated as follows:

Intake (mg/kg-day) = CW * SA * PC * ET * EF * ED * CF/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
CW = contaminant concentration in water (mg/l)	
SA = child skin surface available for contact (cm2)	10000
PC = contaminant specific dermal permability (cm/hr)	Specific
ET = child exposure time (hours/day)	0.25
EF = child exposure frequency (days/yr)	350
ED = child exposure duration (years)	6
CF = volumetric conversion factor for water (1liter/1000 cm3)	0.001
BW = child body weight (kg)	15
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	6
DY = days per year (days)	365

SHALLOW AND DEEP GROUNDWATER

COPC	Concentration Carcinogen (mg/l)	Surface Area (cm2) Child	Dermal Permeability (cm/hr)	Exposure Time (hours/day) Child	Exposure Frequency (days/yr) Child	Exposure Duration (years) Child	Volumetric Conversion (L/m3)	Body Weight (kg) Child	Averaging Carc Time (days)	Carc Dose (mg/kg-day) Child	Dermal Adjust. Slope Factor (mg/kg-day)-1	Carcinogenic Risk Child	Percent Carcinogenic Risk Child	Average Noncarc Time (days)	Noncarc Dose (mg/kg-day) Child	Dermal. Adjust. Reference Dose (mg/kg-day)	Noncarc Risk Child	Percent Noncarcinogenic Risk Child
1,2-Dichloroethene (total)	0.009	10000	1.00E-02	0.25	350	6	0.001	15	25550	1.2E-06	0.0E+00	0.0E+00	0%	2190	1.4E-05	7.2E-03	2.0E-03	3%
Trichloroethene	0.012	10000	1.60E-02	0.25	350	6	0.001	15	25550	2.5E-06	1.4E-02	3.5E-08	7%	2190	2.9E-05	4.8E-03	6.1E-03	8%
Tetrachloroethene	0.002	10000	4.50E-02	0.25	350	6	0.001	15	25550	1.2E-06	6.5E-02	8.0E-08	17%	2190	1.4E-05	8.0E-03	1.8E-03	2%
1,1,2,2-Tetrachloroethane	0.006	10000	9.00E-03	0.25	350	6	0.001	15	25550	6.8E-07	2.5E-01	1.7E-07	35%	2190	8.0E-06	0.0E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	0.005	10000	3.30E-02	0.25	350	6	0.001	15	25550	2.3E-06	2.8E-02	6.3E-08	13%	2190	2.6E-05	1.0E-02	2.6E-03	4%
Aluminum	0.314	10000	1.00E-03	0.25	350	6	0.001	15	25550	4.3E-06	0.0E+00	0.0E+00	0%	2190	5.0E-05	2.0E-01	2.5E-04	0%
Arsenic	0.001	10000	1.00E-03	0.25	350	6	0.001	15	25550	1.8E-08	7.5E+00	1.3E-07	28%	2190	2.1E-07	6.0E-05	3.5E-03	5%
Barium	0.219	10000	1.00E-03	0.25	350	6	0.001	15	25550	3.0E-06	0.0E+00	0.0E+00	0%	2190	3.5E-05	1.4E-02	2.5E-03	3%
Cadmium (water)	0.002	10000	1.00E-03	0.25	350	6	0.001	15	25550	2.5E-08	0.0E+00	0.0E+00	0%	2190	2.9E-07	1.0E-04	2.9E-03	4%
Iron	16.900	10000	1.00E-03	0.25	350	6	0.001	15	25550	2.3E-04	0.0E+00	0.0E+00	0%	2190	2.7E-03	6.0E-02	4.5E-02	61%
Manganese (water)	1.200	10000	1.00E-03	0.25	350	6	0.001	15	25550	1.6E-05	0.0E+00	0.0E+00	0%	2190	1.9E-04	2.8E-02	6.8E-03	9%
TOTAL												4.8E-07					7.4E-02	

GROUNDWATER INHALATION - RME CASE
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
FUTURE RESIDENTIAL CHILD

CHILD CHEMICAL	C rme mg/kg/shwr	ED y	EF shwr/y	AT d	ATC d	CDI mg/kg/d	CDIC mg/kg/d	RFDinh mg/kg/d	PFinh (mg/kg/d)^-1	HI	CR	% CONTRIB NC RISK	% CONTRIB CARC RISK
1,2-Dichloroethene (total)	5.39E-04	6	350	2190	25550	5.2E-04	4.4E-05	0.0E+00	0.0E+00	---	0.0E+00	0%	0%
Trichloroethene	6.34E-04	6	350	2190	25550	6.1E-04	5.2E-05	0.0E+00	6.0E-03	---	3.1E-07	0%	63%
Tetrachloroethene	7.26E-05	6	350	2190	25550	7.0E-05	6.0E-06	0.0E+00	2.0E-03	---	1.2E-08	0%	2%
1,1,2,2-Tetrachloroethane	1.05E-05	6	350	2190	25550	1.0E-05	8.6E-07	0.0E+00	2.0E-01	---	1.7E-07	0%	35%
										0.0E+00	5.0E-07		

SURFACE WATER INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO.6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT AND FUTURE CHILD RESIDENT

The intake from the ingestion of surface water is calculated as follows:

Intake (mg/kg-day) = Cw * CR * ET * EF * ED/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:		INPUT
Cw = contaminant concentration in surface water (mg/l)		
CR = contact rate (Liter/hour)		0.005
ET = child exposure time (hours/event)		2.6
EF = child exposure frequency (events/yr)		45
ED = child exposure duration (yrs)		6
BW = child body weight (kg)		15
ATc = averaging time for carcinogen (yr)		70
ATnc = averaging time for noncarcinogen (yr)		6
DY = days per year (days)		365
CSF = cancer slope factor (mg/kg-day)-1	specific	
RfD = reference dose (mg/kg-day)	specific	

COPC	Concentration Carcinogen (mg/l)	Contact Rate (l/hour)	Exposure Time (hrs/event) Child	Exposure Frequency (events/yr) Child	Exposure Duration (years) Child	Body Weight (kg) Child	Averaging Carc. Time (days)	Carc Dose (mg/kg-day) Child	Cancer Slope Factor (mg/kg-day)-1	Carcinogenic Risk Child	Percent Carcinogenic Risk Child	Averaging Time Noncarc (days)	Noncarc Dose (mg/kg-day) Child	Reference Dose (mg/kg-day)	Noncarcinogenic Risk Child	Percent Noncarcinogenic Risk Child
1,2-Dichloroethene (total)	0.006	0.005	2.6	45	6	15	25550	5.4E-08	0.0E+00	0.0E+00	0%	2190	6.3E-07	9.0E-03	7.0E-05	1%
Antimony	0.004	0.005	2.6	45	6	15	25550	3.6E-08	0.0E+00	0.0E+00	0%	2190	4.2E-07	4.0E-04	1.0E-03	10%
Barium	0.032	0.005	2.6	45	6	15	25550	3.0E-07	0.0E+00	0.0E+00	0%	2190	3.5E-06	7.0E-02	4.9E-05	0%
Iron	3.990	0.005	2.6	45	6	15	25550	3.7E-05	0.0E+00	0.0E+00	0%	2190	4.3E-04	3.0E-01	1.4E-03	14%
Manganese (water)	0.126	0.005	2.6	45	6	15	25550	1.2E-06	0.0E+00	0.0E+00	0%	2190	1.3E-05	1.4E-01	9.6E-05	1%
Molybdenum	0.065	0.005	2.6	45	6	15	25550	6.0E-07	0.0E+00	0.0E+00	0%	2190	6.9E-06	5.0E-03	1.4E-03	14%
Vanadium	0.387	0.005	2.6	45	6	15	25550	3.5E-06	0.0E+00	0.0E+00	0%	2190	4.1E-05	7.0E-03	5.9E-03	59%
TOTAL										0.0E+00					1.0E-02	

SURFACE WATER DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION - CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT AND FUTURE CHILD RESIDENT

The intake from dermal contact with surface water is calculated as follows:

Intake (mg/kg-day) = Cw * SA * PC * ET * EF * ED * CF/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
CW = contaminant concentration in water (mg/l)	
SA = child skin surface available for contact (cm2)	2300
PC = contaminant specific dermal permability (cm/hr)	Specific
ET = child exposure time (hours/day)	2.6
EF = child exposure frequency (days/yr)	45
ED = child exposure duration (years)	6
CF = volumetric conversion factor for water (1liter/1000 cm3)	0.001
BW = child body weight (kg)	15
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	6
DY = days per year (days)	365
CSF = cancer slope factor (mg/kg-day)-1	Specific
RfD = reference dose (mg/kg-day)	Specific

COPC	Concentration Carcinogen (mg/l)	Surface Area (cm2) Child	Dermal Permeability (cm/hr)	Exposure Time (hours/day) Child	Exposure Frequency (days/yr) Child	Exposure Duration (years) Child	Volumetric Conversion (L/m3)	Body Weight (kg) Child	Averaging Carc Time (days)	Carc Dose (mg/kg-day) Child	Dermal Adjust. Slope Factor (mg/kg-day)-1	Carcinogenic Risk Child	Percent Carcinogenic Risk Child	Average Noncarc Time (days)	Noncarc Dose (mg/kg-day) Child	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarc. Risk Child	Percent Noncarcinogenic Risk Child
1,2-Dichloroethene (total)	0.006	2300	1.0E-02	2.6	45	6	0.001	15	25550	2.5E-07	0.0E+00	0.0E+00	0%	2190	2.9E-06	7.2E-03	4.0E-04	2%
Antimony	0.004	2300	1.0E-03	2.6	45	6	0.001	15	25550	1.6E-08	0.0E+00	0.0E+00	0%	2190	1.9E-07	8.0E-05	2.4E-03	10%
Barium	0.032	2300	1.0E-03	2.6	45	6	0.001	15	25550	1.4E-07	0.0E+00	0.0E+00	0%	2190	1.6E-06	1.4E-02	1.1E-04	0%
Iron	3.990	2300	1.0E-03	2.6	45	6	0.001	15	25550	1.7E-05	0.0E+00	0.0E+00	0%	2190	2.0E-04	6.0E-02	3.3E-03	14%
Manganese (water)	0.126	2300	1.0E-03	2.6	45	6	0.001	15	25550	5.3E-07	0.0E+00	0.0E+00	0%	2190	6.2E-06	2.8E-02	2.2E-04	1%
Molybdenum	0.065	2300	1.0E-03	2.6	45	6	0.001	15	25550	2.7E-07	0.0E+00	0.0E+00	0%	2190	3.2E-06	1.0E-03	3.2E-03	14%
Vanadium	0.387	2300	1.0E-03	2.6	45	6	0.001	15	25550	1.6E-06	0.0E+00	0.0E+00	0%	2190	1.9E-05	1.4E-03	1.4E-02	59%
TOTAL												0.0E+00					2.3E-02	

SEDIMENT INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT AND FUTURE RESIDENTIAL CHILD

Intake from ingestion of sediment is calculated as follows:

Intake (mg/kg-day) = C * IR * CF * EF * ED/ BW * ATC or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in sediment (mg/kg)	
CF = conversion for kg to mg	1E-06
EF = exposure frequency for child (days/yr)	45
ED = exposure duration for child (yr)	6
IR = soil ingestion rate for child (mg/day)	200
BW = body weight for child (kg)	15
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	6
DY = days per year (days/year)	365
CSF = cancer slope factor (mg/kg-day)-1	Specific
RfD = reference dose (mg/kg-day)	Specific

COPC	Concentration (mg/kg)	Exposure Frequency (days/yr) Child	Exposure Duration (yr) Child	Ingestion Rate (mg/day) Child	Conversion Factor (kg/mg)	Body Weight (kg) Child	Average Carc Tim (days)	Carc Dose (mg/kg/day) Child	Slope Factor (mg/kg/day)-1	Carcinogenic Risk Child	Percent Carcinogenic Risk Child	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day) Child	Reference Dose (mg/kg/day)	Noncarcinogenic Risk Child	Percent Noncarcinogeni Risk Child
Tetrachloroethene	0.004	45	6	200	1E-06	15	25550	5.6E-10	5.2E-02	2.9E-11	0%	2190	6.6E-09	1.0E-02	6.6E-07	0%
Diethylphthalate	1.110	45	6	200	1E-06	15	25550	1.6E-07	0.0E+00	0.0E+00	0%	2190	1.8E-06	8.0E-01	2.3E-06	0%
Anthracene	0.046	45	6	200	1E-06	15	25550	6.5E-09	0.0E+00	0.0E+00	0%	2190	7.6E-08	3.0E-01	2.5E-07	0%
Di-n-butylphthalate	0.218	45	6	200	1E-06	15	25550	3.1E-08	0.0E+00	0.0E+00	0%	2190	3.6E-07	1.0E-01	3.6E-06	0%
Bis(2-ethylhexyl)phthalate	0.328	45	6	200	1E-06	15	25550	4.6E-08	1.4E-02	6.5E-10	0%	2190	5.4E-07	2.0E-02	2.7E-05	0%
Dieldrin	0.052	45	6	200	1E-06	15	25550	7.3E-09	1.6E+01	1.2E-07	17%	2190	8.5E-08	5.0E-05	1.7E-03	1%
4,4'-DDE	1.200	45	6	200	1E-06	15	25550	1.7E-07	3.4E-01	5.7E-08	8%	2190	2.0E-06	0.0E+00	0.0E+00	0%
Endrin	0.007	45	6	200	1E-06	15	25550	9.3E-10	0.0E+00	0.0E+00	0%	2190	1.1E-08	3.0E-04	3.6E-05	0%
4,4'-DDD	1.140	45	6	200	1E-06	15	25550	1.6E-07	2.4E-01	3.9E-08	5%	2190	1.9E-06	0.0E+00	0.0E+00	0%
Endosulfan sulfate	0.003	45	6	200	1E-06	15	25550	4.2E-10	0.0E+00	0.0E+00	0%	2190	4.9E-09	6.0E-03	8.2E-07	0%
4,4'-DDT	0.046	45	6	200	1E-06	15	25550	6.5E-09	3.4E-01	2.2E-09	0%	2190	7.6E-08	5.0E-04	1.5E-04	0%
Endrin ketone	0.011	45	6	200	1E-06	15	25550	1.5E-09	0.0E+00	0.0E+00	0%	2190	1.8E-08	3.0E-04	6.0E-05	0%
Endrin aldehyde	0.008	45	6	200	1E-06	15	25550	1.1E-09	0.0E+00	0.0E+00	0%	2190	1.2E-08	3.0E-04	4.2E-05	0%
alpha-Chlordane	0.013	45	6	200	1E-06	15	25550	1.8E-09	1.3E+00	2.4E-09	0%	2190	2.1E-08	6.0E-05	3.6E-04	0%
Aluminum	19389.170	45	6	200	1E-06	15	25550	2.7E-03	0.0E+00	0.0E+00	0%	2190	3.2E-02	1.0E+00	3.2E-02	22%
Barium	68.510	45	6	200	1E-06	15	25550	9.7E-06	0.0E+00	0.0E+00	0%	2190	1.1E-04	7.0E-02	1.6E-03	1%
Beryllium	0.810	45	6	200	1E-06	15	25550	1.1E-07	4.3E+00	4.9E-07	69%	2190	1.3E-06	5.0E-03	2.7E-04	0%
Cadmium (soil)	3.750	45	6	200	1E-06	15	25550	5.3E-07	0.0E+00	0.0E+00	0%	2190	6.2E-06	1.0E-03	6.2E-03	4%
Cobalt	4.200	45	6	200	1E-06	15	25550	5.9E-07	0.0E+00	0.0E+00	0%	2190	6.9E-06	6.0E-02	1.2E-04	0%
Copper	19.880	45	6	200	1E-06	15	25550	2.8E-06	0.0E+00	0.0E+00	0%	2190	3.3E-05	4.0E-02	8.2E-04	1%
Iron	11661.090	45	6	200	1E-06	15	25550	1.6E-03	0.0E+00	0.0E+00	0%	2190	1.9E-02	3.0E-01	6.4E-02	43%
Lead	3422.990	45	6	200	1E-06	15	25550	4.8E-04	0.0E+00	0.0E+00	0%	2190	5.6E-03	0.0E+00	0.0E+00	0%
Manganese (soil)	45.170	45	6	200	1E-06	15	25550	6.4E-06	0.0E+00	0.0E+00	0%	2190	7.4E-05	1.4E-01	5.3E-04	0%
Mercury	0.660	45	6	200	1E-06	15	25550	9.3E-08	0.0E+00	0.0E+00	0%	2190	1.1E-06	3.0E-04	3.6E-03	2%
Nickel	25.810	45	6	200	1E-06	15	25550	3.6E-06	0.0E+00	0.0E+00	0%	2190	4.2E-05	2.0E-02	2.1E-03	1%
Selenium	0.710	45	6	200	1E-06	15	25550	1.0E-07	0.0E+00	0.0E+00	0%	2190	1.2E-06	5.0E-03	2.3E-04	0%
Thallium	0.650	45	6	200	1E-06	15	25550	9.2E-08	0.0E+00	0.0E+00	0%	2190	1.1E-06	8.0E-05	1.3E-02	9%
Vanadium	83.120	45	6	200	1E-06	15	25550	1.2E-05	0.0E+00	0.0E+00	0%	2190	1.4E-04	7.0E-03	2.0E-02	13%
Zinc	140.000	45	6	200	1E-06	15	25550	2.0E-05	0.0E+00	0.0E+00	0%	2190	2.3E-04	3.0E-01	7.7E-04	1%
TOTAL										7.1E-07					1.5E-01	

SEDIMENT DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT AND FUTURE RESIDENTIAL CHILD

The intake from dermal contact to sediment is calculated as follows:

Intake (mg/kg-day) = C * CF * SA * AF * Abs * EF * ED/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	
CF = conversion factor (kg/mg)	1.00E-06
SA = child exposed skin surface area (cm2)	2300
AF = sediment to skin adherence factor (mg/cm2)	1
Abs = fraction absorbed (unitless) (contaminant specific)	Specific
EF = child exposure frequency (events/yr)	45
ED = child expsosure duration (years)	6
BW = child body weight (kg)	15
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	6
DY = day per year (day/yr)	365
CSF = cancer slope factor (mg/kg-day)-1	Specific
RfD = reference dose (mg/kg-day)	Specific

COPC	Concentration Carcinogen (mg/kg)	Conversion Factor (kg/mg)	Surface Area (cm2) Child	Adherence Factor (mg/cm2)	ABS Factor (%)	Exposure Frequency (events/yr) Child	Exposure Duration (yrs) Child	Body Weight (kg) Child	Average Carc Time (days)	Carc Dose (mg/kg/day) Child	Dermal Adjust. Slope Factor (mg/kg-day)-1	Carcinogenic Risk Child	Percent Carcinogenic Risk Child	Average Noncarc Tim (days)	Noncarc Dose (mg/kg/day) Child	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarcinogeni Risk Child	Percent Noncarcinogenic Risk Child
Tetrachloroethene	0.004	1E-06	2300	1	0.01	45	6	15	25550	6.5E-11	6.5E-02	4.2E-12	0%	2190	7.6E-10	8.0E-03	9.5E-08	0%
Diethylphthalate	1.110	1E-06	2300	1	0.01	45	6	15	25550	1.8E-08	0.0E+00	0.0E+00	0%	2190	2.1E-07	4.0E-01	5.2E-07	0%
Anthracene	0.046	1E-06	2300	1	0.01	45	6	15	25550	7.5E-10	0.0E+00	0.0E+00	0%	2190	8.7E-09	1.5E-01	5.8E-08	0%
Di-n-butylphthalate	0.218	1E-06	2300	1	0.01	45	6	15	25550	3.5E-09	0.0E+00	0.0E+00	0%	2190	4.1E-08	5.0E-02	8.2E-07	0%
Bis(2-ethylhexyl)phthalate	0.328	1E-06	2300	1	0.01	45	6	15	25550	5.3E-09	2.8E-02	1.5E-10	0%	2190	6.2E-08	1.0E-02	6.2E-06	0%
Dieldrin	0.052	1E-06	2300	1	0.01	45	6	15	25550	8.4E-10	3.2E+01	2.7E-08	34%	2190	9.8E-09	2.5E-05	3.9E-04	4%
4,4'-DDE	1.200	1E-06	2300	1	0.01	45	6	15	25550	1.9E-08	6.8E-01	1.3E-08	17%	2190	2.3E-07	0.0E+00	0.0E+00	0%
Endrin	0.007	1E-06	2300	1	0.01	45	6	15	25550	1.1E-10	0.0E+00	0.0E+00	0%	2190	1.2E-09	1.5E-04	8.3E-06	0%
4,4'-DDD	1.140	1E-06	2300	1	0.01	45	6	15	25550	1.8E-08	4.8E-01	8.9E-09	11%	2190	2.2E-07	0.0E+00	0.0E+00	0%
Endosulfan sulfate	0.003	1E-06	2300	1	0.01	45	6	15	25550	4.9E-11	0.0E+00	0.0E+00	0%	2190	5.7E-10	3.0E-03	1.9E-07	0%
4,4'-DDT	0.046	1E-06	2300	1	0.01	45	6	15	25550	7.5E-10	6.8E-01	5.1E-10	1%	2190	8.7E-09	2.5E-04	3.5E-05	0%
Endrin ketone	0.011	1E-06	2300	1	0.01	45	6	15	25550	1.8E-10	0.0E+00	0.0E+00	0%	2190	2.1E-09	1.5E-04	1.4E-05	0%
Endrin aldehyde	0.008	1E-06	2300	1	0.01	45	6	15	25550	1.2E-10	0.0E+00	0.0E+00	0%	2190	1.4E-09	1.5E-04	9.6E-06	0%
alpha-Chlordane	0.013	1E-06	2300	1	0.01	45	6	15	25550	2.1E-10	2.6E+00	5.5E-10	1%	2190	2.5E-09	3.0E-05	8.2E-05	1%
Aluminum	19389.170	1E-06	2300	1	0.001	45	6	15	25550	3.1E-05	0.0E+00	0.0E+00	0%	2190	3.7E-04	2.0E-01	1.8E-03	21%
Barium	68.510	1E-06	2300	1	0.001	45	6	15	25550	1.1E-07	0.0E+00	0.0E+00	0%	2190	1.3E-06	1.4E-02	9.3E-05	1%
Beryllium	0.810	1E-06	2300	1	0.001	45	6	15	25550	1.3E-09	2.1E+01	2.8E-08	36%	2190	1.5E-08	1.0E-03	1.5E-05	0%
Cadmium (soil)	3.750	1E-06	2300	1	0.001	45	6	15	25550	6.1E-09	0.0E+00	0.0E+00	0%	2190	7.1E-08	2.0E-04	3.5E-04	4%
Cobalt	4.200	1E-06	2300	1	0.001	45	6	15	25550	6.8E-09	0.0E+00	0.0E+00	0%	2190	7.9E-08	1.2E-02	6.6E-06	0%
Copper	19.880	1E-06	2300	1	0.001	45	6	15	25550	3.2E-08	0.0E+00	0.0E+00	0%	2190	3.8E-07	8.0E-03	4.7E-05	1%
Iron	11661.090	1E-06	2300	1	0.001	45	6	15	25550	1.9E-05	0.0E+00	0.0E+00	0%	2190	2.2E-04	6.0E-02	3.7E-03	41%
Lead	3422.990	1E-06	2300	1	0.001	45	6	15	25550	5.5E-06	0.0E+00	0.0E+00	0%	2190	6.5E-05	0.0E+00	0.0E+00	0%
Manganese (soil)	45.170	1E-06	2300	1	0.001	45	6	15	25550	7.3E-08	0.0E+00	0.0E+00	0%	2190	8.5E-07	2.8E-02	3.0E-05	0%
Mercury	0.660	1E-06	2300	1	0.001	45	6	15	25550	1.1E-09	0.0E+00	0.0E+00	0%	2190	1.2E-08	6.0E-05	2.1E-04	2%
Nickel	25.810	1E-06	2300	1	0.001	45	6	15	25550	4.2E-08	0.0E+00	0.0E+00	0%	2190	4.9E-07	4.0E-03	1.2E-04	1%
Selenium	0.710	1E-06	2300	1	0.001	45	6	15	25550	1.2E-09	0.0E+00	0.0E+00	0%	2190	1.3E-08	1.0E-03	1.3E-05	0%
Thallium	0.650	1E-06	2300	1	0.001	45	6	15	25550	1.1E-09	0.0E+00	0.0E+00	0%	2190	1.2E-08	1.6E-05	7.7E-04	9%
Vanadium	83.120	1E-06	2300	1	0.001	45	6	15	25550	1.3E-07	0.0E+00	0.0E+00	0%	2190	1.6E-06	1.4E-03	1.1E-03	13%
Zinc	140.000	1E-06	2300	1	0.001	45	6	15	25550	2.3E-07	0.0E+00	0.0E+00	0%	2190	2.6E-06	6.0E-02	4.4E-05	0%
TOTAL												7.8E-08					8.9E-03	

CURRENT ADULT TRESPASSER

SURFACE SOIL INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
ADULT TRESPASSER

Intake from ingestion of soil is calculated as follows:

Intake (mg/kg-day) = C * CF * EF * ED * IR/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	
CF = conversion for kg to mg	1E-06
EF = adult exposure frequency (days/yr)	43
ED = adult exposure duration (yr)	30
IR = adult soil ingestion rate (mg/day)	50
BW = adult body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	30
DY = days per year (days/year)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

COPC	Concentration (mg/kg)	Exposure Frequency (days/yr) Adult	Exposure Duration (yr) Adult	Conversion Factor (kg/mg)	Ingestion Rate (mg/day) Adult	Body Weight (kg) Adult	Average Carc Tim (days)	Carc Dose (mg/kg/day) Adult	Slope Factor (mg/kg/day)-1	Carcinogenic Risk Adult	Percent Carcinogenic Risk Adult	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day) Adult	Reference Dose (mg/kg/day)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
n-Nitroso-di-n-propylamine	0.218	43	30	1E-06	50	70	25550	7.9E-09	7.0E+00	5.5E-08	12%	10950	1.8E-08	0.0E+00	0.0E+00	0%
Benzo(a)anthracene	0.266	43	30	1E-06	50	70	25550	9.6E-09	7.3E-01	7.0E-09	1%	10950	2.2E-08	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	0.262	43	30	1E-06	50	70	25550	9.5E-09	7.3E-01	6.9E-09	1%	10950	2.2E-08	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	0.263	43	30	1E-06	50	70	25550	9.5E-09	7.3E+00	6.9E-08	15%	10950	2.2E-08	0.0E+00	0.0E+00	0%
Dibenzo(a,h)anthracene	0.228	43	30	1E-06	50	70	25550	8.2E-09	7.3E+00	6.0E-08	13%	10950	1.9E-08	0.0E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	0.257	43	30	1E-06	50	70	25550	9.3E-09	7.3E-01	6.8E-09	1%	10950	2.2E-08	0.0E+00	0.0E+00	0%
Aldrin	0.004	43	30	1E-06	50	70	25550	1.6E-10	1.7E+01	2.7E-09	1%	10950	3.7E-10	3.0E-05	1.2E-05	0%
Dieldrin	0.049	43	30	1E-06	50	70	25550	1.8E-09	1.6E+01	2.8E-08	6%	10950	4.1E-09	5.0E-05	8.2E-05	1%
4,4'-DDE	0.440	43	30	1E-06	50	70	25550	1.6E-08	3.4E-01	5.4E-09	1%	10950	3.7E-08	0.0E+00	0.0E+00	0%
4,4'-DDT	0.241	43	30	1E-06	50	70	25550	8.7E-09	3.4E-01	2.9E-09	1%	10950	2.0E-08	5.0E-04	4.0E-05	1%
alpha-Chlordane	0.014	43	30	1E-06	50	70	25550	5.1E-10	1.3E+00	6.6E-10	0%	10950	1.2E-09	6.0E-05	2.0E-05	0%
gamma-Chlordane	0.006	43	30	1E-06	50	70	25550	2.3E-10	1.3E+00	3.0E-10	0%	10950	5.4E-10	6.0E-05	9.0E-06	0%
Aroclor-1248	0.291	43	30	1E-06	50	70	25550	1.1E-08	7.7E+00	8.1E-08	17%	10950	2.5E-08	0.0E+00	0.0E+00	0%
Aroclor-1254	0.051	43	30	1E-06	50	70	25550	1.8E-09	7.7E+00	1.4E-08	3%	10950	4.3E-09	2.0E-05	2.1E-04	4%
Aluminum	5808.712	43	30	1E-06	50	70	25550	2.1E-04	0.0E+00	0.0E+00	0%	10950	4.9E-04	1.0E+00	4.9E-04	8%
Antimony	3.379	43	30	1E-06	50	70	25550	1.2E-07	0.0E+00	0.0E+00	0%	10950	2.8E-07	4.0E-04	7.1E-04	12%
Arsenic	2.399	43	30	1E-06	50	70	25550	8.7E-08	1.5E+00	1.3E-07	28%	10950	2.0E-07	3.0E-04	6.7E-04	11%
Cadmium (soil)	0.713	43	30	1E-06	50	70	25550	2.6E-08	0.0E+00	0.0E+00	0%	10950	6.0E-08	1.0E-03	6.0E-05	1%
Chromium	11.294	43	30	1E-06	50	70	25550	4.1E-07	0.0E+00	0.0E+00	0%	10950	9.5E-07	5.0E-03	1.9E-04	3%
Copper	98.217	43	30	1E-06	50	70	25550	3.5E-06	0.0E+00	0.0E+00	0%	10950	8.3E-06	4.0E-02	2.1E-04	3%
Iron	11299.700	43	30	1E-06	50	70	25550	4.1E-04	0.0E+00	0.0E+00	0%	10950	9.5E-04	3.0E-01	3.2E-03	53%
Lead	110.524	43	30	1E-06	50	70	25550	4.0E-06	0.0E+00	0.0E+00	0%	10950	9.3E-06	0.0E+00	0.0E+00	0%
Mercury	0.370	43	30	1E-06	50	70	25550	1.3E-08	0.0E+00	0.0E+00	0%	10950	3.1E-08	3.0E-04	1.0E-04	2%
TOTAL										4.7E-07					6.0E-03	

SURFACE SOIL DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
ADULT TRESPASSER

Dermal contact with soil is calculated as follows:

Intake (mg/kg-day) = C * CF * SA * AF * Abs * EF * ED/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	
CF = conversion factor (kg/mg)	1E-06
SA = adult exposed skin surface area (cm2)	5000
AF = soil to skin adherence factor (mg/cm2)	1
Abs = fraction absorbed (unitless)	Specific
EF = adult exposure frequency (events/yr)	43
ED = adult exposure duration (years)	30
BW = adult body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	30
DY = day per year (day/yr)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

COPC	Concentration (mg/kg)	Conversion Factor (kg/mg)	Surface Area (cm2) Adult	Adherence Factor (mg/cm2)	Fraction Absorbed (%)	Exposure Frequency (events/yr) Adult	Exposure Duration (yrs) Adult	Body Weight (kg) Adult	Average Carc Time (days)	Carc Dose (mg/kg/day) Adult	Dermal Adjust. Slope Factor (mg/kg-day)-1	Carcinogenic Risk Adult	Percent Carcinogenic Risk Adult	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day) Adult	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
n-Nitroso-di-n-propylamine	0.2181	1E-06	5000	1	0.01	43	30	70	25550	7.9E-09	1.4E+01	1.1E-07	15%	10950	1.8E-08	0.0E+00	0.0E+00	0%
Benzo(a)anthracene	0.2659	1E-06	5000	1	0.01	43	30	70	25550	9.6E-09	1.5E+00	1.4E-08	2%	10950	2.2E-08	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	0.2623	1E-06	5000	1	0.01	43	30	70	25550	9.5E-09	1.5E+00	1.4E-08	2%	10950	2.2E-08	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	0.2631	1E-06	5000	1	0.01	43	30	70	25550	9.5E-09	1.5E+01	1.4E-07	19%	10950	2.2E-08	0.0E+00	0.0E+00	0%
Dibenzo(a,h)anthracene	0.2281	1E-06	5000	1	0.01	43	30	70	25550	8.2E-09	1.5E+01	1.2E-07	16%	10950	1.9E-08	0.0E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	0.2572	1E-06	5000	1	0.01	43	30	70	25550	9.3E-09	1.5E+00	1.4E-08	2%	10950	2.2E-08	0.0E+00	0.0E+00	0%
Aldrin	0.0044	1E-06	5000	1	0.01	43	30	70	25550	1.6E-10	3.4E+01	5.4E-09	1%	10950	3.7E-10	1.5E-05	2.5E-05	1%
Dieldrin	0.0487	1E-06	5000	1	0.01	43	30	70	25550	1.8E-09	3.2E+01	5.6E-08	8%	10950	4.1E-09	2.5E-05	1.6E-04	5%
4,4'-DDE	0.4403	1E-06	5000	1	0.01	43	30	70	25550	1.6E-08	6.8E-01	1.1E-08	1%	10950	3.7E-08	0.0E+00	0.0E+00	0%
4,4'-DDT	0.2405	1E-06	5000	1	0.01	43	30	70	25550	8.7E-09	6.8E-01	5.9E-09	1%	10950	2.0E-08	2.5E-04	8.1E-05	2%
alpha-Chlordane	0.0140	1E-06	5000	1	0.01	43	30	70	25550	5.1E-10	2.6E+00	1.3E-09	0%	10950	1.2E-09	3.0E-05	3.9E-05	1%
gamma-Chlordane	0.0065	1E-06	5000	1	0.01	43	30	70	25550	2.3E-10	2.6E+00	6.0E-10	0%	10950	5.4E-10	3.0E-05	1.8E-05	1%
Aroclor-1248	0.2914	1E-06	5000	1	0.01	43	30	70	25550	1.1E-08	1.5E+01	1.6E-07	22%	10950	2.5E-08	0.0E+00	0.0E+00	0%
Aroclor-1254	0.0506	1E-06	5000	1	0.01	43	30	70	25550	1.8E-09	1.5E+01	2.8E-08	4%	10950	4.3E-09	1.0E-05	4.3E-04	12%
Aluminum	5808.7120	1E-06	5000	1	0.001	43	30	70	25550	2.1E-05	0.0E+00	0.0E+00	0%	10950	4.9E-05	2.0E-01	2.4E-04	7%
Antimony	3.3788	1E-06	5000	1	0.001	43	30	70	25550	1.2E-08	0.0E+00	0.0E+00	0%	10950	2.8E-08	8.0E-05	3.6E-04	10%
Arsenic	2.3989	1E-06	5000	1	0.001	43	30	70	25550	8.7E-09	7.5E+00	6.5E-08	9%	10950	2.0E-08	6.0E-05	3.4E-04	9%
Cadmium (soil)	0.7130	1E-06	5000	1	0.001	43	30	70	25550	2.6E-09	0.0E+00	0.0E+00	0%	10950	6.0E-09	2.0E-04	3.0E-05	1%
Chromium	11.2941	1E-06	5000	1	0.001	43	30	70	25550	4.1E-08	0.0E+00	0.0E+00	0%	10950	9.5E-08	1.0E-03	9.5E-05	3%
Copper	98.2169	1E-06	5000	1	0.001	43	30	70	25550	3.5E-07	0.0E+00	0.0E+00	0%	10950	8.3E-07	8.0E-03	1.0E-04	3%
Iron	11299.7000	1E-06	5000	1	0.001	43	30	70	25550	4.1E-05	0.0E+00	0.0E+00	0%	10950	9.5E-05	6.0E-02	1.6E-03	45%
Lead	110.5239	1E-06	5000	1	0.001	43	30	70	25550	4.0E-07	0.0E+00	0.0E+00	0%	10950	9.3E-07	0.0E+00	0.0E+00	0%
Mercury	0.3699	1E-06	5000	1	0.001	43	30	70	25550	1.3E-09	0.0E+00	0.0E+00	0%	10950	3.1E-09	6.0E-05	5.2E-05	1%
TOTAL												7.5E-07					3.6E-03	

SURFACE SOIL PARTICULATE INHALATION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
ADULT TRESPASSER

Intake from the inhalation of particulates is calculated as follows:

Intake (mg/kg-day) = (C * EF * ED * IR * 1/PEF)/(BW * ATc or ATnc * DY)

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	Specific
CSF = carcinogenic slope factor	Specific
RfD = reference dose for noncarcinogen	Specific
IR = inhalation rate (m3)	20
EF = adult exposure frequency (days)	43
ED = adult exposure duration (years)	30
BW = adult body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	30
DY = day per year (day/yr)	365
PEF = particulate emission factor (m3/kg)	1.32E+09

COPC	Concentration Carcinogen (mg/kg)	Particulate Emission Factor (m3/kg)	Exposure Frequency (events/yr)	Inhalation Rate (m3/day)	Exposure Duration (yrs)	Body Weight (kg)	Average Carc Tim (days)	Carc Dose (mg/kg/day)	Slope Factor (mg/kg-day)-1	Carcinogenic Risk	Percent Contribution to Risk	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day)	Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
n-Nitroso-di-n-propylamine	0.2181	1.3E+09	43	20	30	70	25550	2.4E-12	0.0E+00	0.0E+00	0%	10950	5.6E-12	0.0E+00	0.0E+00	0%
Benzo(a)anthracene	0.2659	1.3E+09	43	20	30	70	25550	2.9E-12	6.1E-01	1.8E-12	0%	10950	6.8E-12	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	0.2623	1.3E+09	43	20	30	70	25550	2.9E-12	6.1E-01	1.7E-12	0%	10950	6.7E-12	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	0.2631	1.3E+09	43	20	30	70	25550	2.9E-12	6.1E+00	1.8E-11	0%	10950	6.7E-12	0.0E+00	0.0E+00	0%
Dibenzo(a,h)anthracene	0.2281	1.3E+09	43	20	30	70	25550	2.5E-12	6.1E+00	1.5E-11	0%	10950	5.8E-12	0.0E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	0.2572	1.3E+09	43	20	30	70	25550	2.8E-12	6.1E-01	1.7E-12	0%	10950	6.6E-12	0.0E+00	0.0E+00	0%
Aldrin	0.0044	1.3E+09	43	20	30	70	25550	4.9E-14	1.7E+01	8.3E-13	0%	10950	1.1E-13	0.0E+00	0.0E+00	0%
Dieldrin	0.0487	1.3E+09	43	20	30	70	25550	5.3E-13	1.6E+01	8.6E-12	0%	10950	1.2E-12	0.0E+00	0.0E+00	0%
4,4'-DDE	0.4403	1.3E+09	43	20	30	70	25550	4.8E-12	0.0E+00	0.0E+00	0%	10950	1.1E-11	0.0E+00	0.0E+00	0%
4,4'-DDT	0.2405	1.3E+09	43	20	30	70	25550	2.6E-12	3.4E-01	8.9E-13	0%	10950	6.1E-12	0.0E+00	0.0E+00	0%
alpha-Chlordane	0.0140	1.3E+09	43	20	30	70	25550	1.5E-13	1.3E+00	2.0E-13	0%	10950	3.6E-13	0.0E+00	0.0E+00	0%
gamma-Chlordane	0.0065	1.3E+09	43	20	30	70	25550	7.0E-14	1.3E+00	9.1E-14	0%	10950	1.6E-13	0.0E+00	0.0E+00	0%
Aroclor-1248	0.2914	1.3E+09	43	20	30	70	25550	3.2E-12	0.0E+00	0.0E+00	0%	10950	7.4E-12	0.0E+00	0.0E+00	0%
Aroclor-1254	0.0506	1.3E+09	43	20	30	70	25550	5.5E-13	0.0E+00	0.0E+00	0%	10950	1.3E-12	0.0E+00	0.0E+00	0%
Aluminum	5808.7120	1.3E+09	43	20	30	70	25550	6.3E-08	0.0E+00	0.0E+00	0%	10950	1.5E-07	0.0E+00	0.0E+00	0%
Antimony	3.3788	1.3E+09	43	20	30	70	25550	3.7E-11	0.0E+00	0.0E+00	0%	10950	8.6E-11	0.0E+00	0.0E+00	0%
Arsenic	2.3989	1.3E+09	43	20	30	70	25550	2.6E-11	1.5E+01	4.0E-10	7%	10950	6.1E-11	0.0E+00	0.0E+00	0%
Cadmium (soil)	0.7130	1.3E+09	43	20	30	70	25550	7.8E-12	0.0E+00	0.0E+00	0%	10950	1.8E-11	0.0E+00	0.0E+00	0%
Chromium	11.2941	1.3E+09	43	20	30	70	25550	1.2E-10	4.2E+01	5.2E-09	92%	10950	2.9E-10	0.0E+00	0.0E+00	0%
Copper	98.2169	1.3E+09	43	20	30	70	25550	1.1E-09	0.0E+00	0.0E+00	0%	10950	2.5E-09	0.0E+00	0.0E+00	0%
Iron	11299.7000	1.3E+09	43	20	30	70	25550	1.2E-07	0.0E+00	0.0E+00	0%	10950	2.9E-07	0.0E+00	0.0E+00	0%
Lead	110.5239	1.3E+09	43	20	30	70	25550	1.2E-09	0.0E+00	0.0E+00	0%	10950	2.8E-09	0.0E+00	0.0E+00	0%
Mercury	0.3699	1.3E+09	43	20	30	70	25550	4.0E-12	0.0E+00	0.0E+00	0%	10950	9.4E-12	8.6E-05	1.1E-07	100%
TOTAL										5.6E-09					1.1E-07	

SURFACE WATER INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO.6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
ADULT TRESPASSER

The intake from the ingestion of surface water is calculated as follows:

Intake (mg/kg-day) = Cw * CR * ET * EF * ED/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUT
Cw = contaminant concentration in surface water (mg/l)	
CR = ingestion rate (Liter/hour)	0.005
ET = exposure time (hours/event)	2.6
EF = exposure frequency (events/yr)	45
ED = exposure duration (yrs)	30
BW = body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	30
DY = days per year (days)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

COPC	Concentration Carcinogen (mg/l)	Contact Rate (l/hour)	Exposure Time (hrs/event)	Exposure Frequency (events/yr)	Exposure Duration (years)	Body Weight (kg)	Average Carc Time (days)	Carc Dose (mg/kg-day)	Cancer Slope Factor (mg/kg-day)-1	Carcinogenic Risk	Percent Carcinogenic Risk	Averaging Time Noncarc. (days)	Noncarc Dose (mg/kg-day)	Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
1,2-Dichloroethene (total)	0.006	0.005	2.6	45	30	70	25550	5.8E-08	0.0E+00	0.0E+00	0%	10950	1.3E-07	9.0E-03	1.5E-05	1%
Antimony	0.004	0.005	2.6	45	30	70	25550	3.8E-08	0.0E+00	0.0E+00	0%	10950	8.9E-08	4.0E-04	2.2E-04	10%
Barium	0.032	0.005	2.6	45	30	70	25550	3.2E-07	0.0E+00	0.0E+00	0%	10950	7.4E-07	7.0E-02	1.1E-05	0%
Iron	3.990	0.005	2.6	45	30	70	25550	3.9E-05	0.0E+00	0.0E+00	0%	10950	9.1E-05	3.0E-01	3.0E-04	14%
Manganese (water)	0.126	0.005	2.6	45	30	70	25550	1.2E-06	0.0E+00	0.0E+00	0%	10950	2.9E-06	1.4E-01	2.1E-05	1%
Molybdenum	0.065	0.005	2.6	45	30	70	25550	6.4E-07	0.0E+00	0.0E+00	0%	10950	1.5E-06	5.0E-03	3.0E-04	14%
Vanadium	0.387	0.005	2.6	45	30	70	25550	3.8E-06	0.0E+00	0.0E+00	0%	10950	8.9E-06	7.0E-03	1.3E-03	59%
TOTAL										0.0E+00					2.1E-03	

SURFACE WATER DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION - CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
ADULT TRESPASSER

The intake from dermal contact with surface water is calculated as follows:

Intake (mg/kg-day) = Cw * SA * PC * ET * EF * ED * CF/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
CW = contaminant concentration in water (mg/l)	
SA = skin surface available for contact (cm2)	5000
PC = contaminant specific dermal permability (cm/hr)	Specific
ET = exposure time (hours/day)	2.6
EF = exposure frequency (days/yr)	45
ED = exposure duration (years)	30
CF = volumetric conversion factor for water (1liter/10	0.001
BW = body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	30
DY = days per year (days)	365
CSF = cancer slope factor (mg/kg-day)-1	Specific
RfD = reference dose (mg/kg-day)	Specific

COPC	Concentration (mg/l)	Surface Area (cm2)	Dermal Permeability (cm/hr)	Exposure Time (hours/day)	Exposure Frequency (days/yr)	Exposure Duration (years)	Volumetric Conversion (L/m3)	Body Weight (kg)	Averaging Carc Time (days)	Carc Dose (mg/kg-day)	Dermal Adjust. Slope Factor (mg/kg-day)-1	Carcinogenic Risk	Percent Carcinogenic Risk	Average Noncarc Time (days)	Noncarc Dose (mg/kg-day)	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarc Risk	Percent Noncarcinogenic Risk
1,2-Dichloroethene (total)	0.006	5000	1.0E-02	2.6	45	30	0.001	70	25550	5.8E-07	0.0E+00	0.0E+00	0%	10950	1.3E-06	7.2E-03	1.9E-04	1%
Antimony	0.004	5000	1.0E-03	2.6	45	30	0.001	70	25550	3.8E-08	0.0E+00	0.0E+00	0%	10950	8.9E-08	8.0E-05	1.1E-03	7%
Barium	0.032	5000	1.0E-03	2.6	45	30	0.001	70	25550	3.2E-07	0.0E+00	0.0E+00	0%	10950	7.4E-07	1.4E-02	5.3E-05	0%
Iron	3.990	5000	1.0E-03	2.6	45	30	0.001	70	25550	3.9E-05	0.0E+00	0.0E+00	0%	10950	9.1E-05	6.0E-02	1.5E-03	9%
Manganese (water)	0.126	5000	1.0E-03	2.6	45	30	0.001	70	25550	1.2E-06	0.0E+00	0.0E+00	0%	10950	2.9E-06	2.8E-02	1.0E-04	1%
Molybdenum	0.065	5000	5.0E-03	2.6	45	30	0.001	70	25550	3.2E-06	0.0E+00	0.0E+00	0%	10950	7.4E-06	1.0E-03	7.4E-03	44%
Vanadium	0.387	5000	1.0E-03	2.6	45	30	0.001	70	25550	3.8E-06	0.0E+00	0.0E+00	0%	10950	8.9E-06	1.4E-03	6.3E-03	38%
TOTAL												0.0E+00					1.7E-02	

SEDIMENT INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
ADULT TRESPASSER

Intake from ingestion of sediment is calculated as follows:

Intake (mg/kg-day) = C * IR * CF * EF * ED/ BW * ATC or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in sediment (mg/kg)	
CF = conversion for kg to mg	1E-06
EF = exposure frequency (days/yr)	45
ED = exposure duration (yr)	30
IR = soil ingestion rate (mg/day)	100
BW = body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	30
DY = days per year (days/year)	365
CSF = cancer slope factor (mg/kg-day)-1	Specific
RfD = reference dose (mg/kg-day)	Specific

COPC	Concentration (mg/kg)	Exposure Frequency (days/yr)	Exposure Duration (yr)	Ingestion Rate (mg/day)	Conversion Factor (kg/mg)	Body Weight (kg)	Average Carc Time (days)	Carc Dose (mg/kg/day)	Slope Factor (mg/kg/day)-1	Carcinogenic Risk	Percent Carcinogenic Risk	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day)	Reference Dose (mg/kg/day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
Tetrachloroethene	0.004	45	30	100	1E-06	70	25550	3.0E-10	5.2E-02	1.6E-11	0%	10950	7.0E-10	1.0E-02	7.0E-08	0%
Diethylphthalate	1.110	45	30	100	1E-06	70	25550	8.4E-08	0.0E+00	0.0E+00	0%	10950	2.0E-07	8.0E-01	2.4E-07	0%
Anthracene	0.046	45	30	100	1E-06	70	25550	3.5E-09	0.0E+00	0.0E+00	0%	10950	8.1E-09	3.0E-01	2.7E-08	0%
Di-n-butylphthalate	0.218	45	30	100	1E-06	70	25550	1.6E-08	0.0E+00	0.0E+00	0%	10950	3.8E-08	1.0E-01	3.8E-07	0%
Bis(2-ethylhexyl)phthalate	0.328	45	30	100	1E-06	70	25550	2.5E-08	1.4E-02	3.5E-10	0%	10950	5.8E-08	2.0E-02	2.9E-06	0%
Dieldrin	0.052	45	30	100	1E-06	70	25550	3.9E-09	1.6E+01	6.3E-08	17%	10950	9.2E-09	5.0E-05	1.8E-04	1%
4,4'-DDE	1.200	45	30	100	1E-06	70	25550	9.1E-08	3.4E-01	3.1E-08	8%	10950	2.1E-07	0.0E+00	0.0E+00	0%
Endrin	0.007	45	30	100	1E-06	70	25550	5.0E-10	0.0E+00	0.0E+00	0%	10950	1.2E-09	3.0E-04	3.9E-06	0%
4,4'-DDD	1.140	45	30	100	1E-06	70	25550	8.6E-08	2.4E-01	2.1E-08	5%	10950	2.0E-07	0.0E+00	0.0E+00	0%
Endosulfan sulfate	0.003	45	30	100	1E-06	70	25550	2.3E-10	0.0E+00	0.0E+00	0%	10950	5.3E-10	6.0E-03	8.8E-08	0%
4,4'-DDT	0.046	45	30	100	1E-06	70	25550	3.5E-09	3.4E-01	1.2E-09	0%	10950	8.1E-09	5.0E-04	1.6E-05	0%
Endrin ketone	0.011	45	30	100	1E-06	70	25550	8.3E-10	0.0E+00	0.0E+00	0%	10950	1.9E-09	3.0E-04	6.5E-06	0%
Endrin aldehyde	0.008	45	30	100	1E-06	70	25550	5.7E-10	0.0E+00	0.0E+00	0%	10950	1.3E-09	3.0E-04	4.5E-06	0%
alpha-Chlordane	0.013	45	30	100	1E-06	70	25550	9.8E-10	1.3E+00	1.3E-09	0%	10950	2.3E-09	6.0E-05	3.8E-05	0%
Aluminum	19389.170	45	30	100	1E-06	70	25550	1.5E-03	0.0E+00	0.0E+00	0%	10950	3.4E-03	1.0E+00	3.4E-03	22%
Barium	68.510	45	30	100	1E-06	70	25550	5.2E-06	0.0E+00	0.0E+00	0%	10950	1.2E-05	7.0E-02	1.7E-04	1%
Beryllium	0.810	45	30	100	1E-06	70	25550	6.1E-08	4.3E+00	2.6E-07	69%	10950	1.4E-07	5.0E-03	2.9E-05	0%
Cadmium (soil)	3.750	45	30	100	1E-06	70	25550	2.8E-07	0.0E+00	0.0E+00	0%	10950	6.6E-07	1.0E-03	6.6E-04	4%
Cobalt	4.200	45	30	100	1E-06	70	25550	3.2E-07	0.0E+00	0.0E+00	0%	10950	7.4E-07	6.0E-02	1.2E-05	0%
Copper	19.880	45	30	100	1E-06	70	25550	1.5E-06	0.0E+00	0.0E+00	0%	10950	3.5E-06	4.0E-02	8.8E-05	1%
Iron	11661.090	45	30	100	1E-06	70	25550	8.8E-04	0.0E+00	0.0E+00	0%	10950	2.1E-03	3.0E-01	6.8E-03	43%
Lead	3422.990	45	30	100	1E-06	70	25550	2.6E-04	0.0E+00	0.0E+00	0%	10950	6.0E-04	0.0E+00	0.0E+00	0%
Manganese (soil)	45.170	45	30	100	1E-06	70	25550	3.4E-06	0.0E+00	0.0E+00	0%	10950	8.0E-06	1.4E-01	5.7E-05	0%
Mercury	0.660	45	30	100	1E-06	70	25550	5.0E-08	0.0E+00	0.0E+00	0%	10950	1.2E-07	3.0E-04	3.9E-04	2%
Nickel	25.810	45	30	100	1E-06	70	25550	1.9E-06	0.0E+00	0.0E+00	0%	10950	4.5E-06	2.0E-02	2.3E-04	1%
Selenium	0.710	45	30	100	1E-06	70	25550	5.4E-08	0.0E+00	0.0E+00	0%	10950	1.3E-07	5.0E-03	2.5E-05	0%
Thallium	0.650	45	30	100	1E-06	70	25550	4.9E-08	0.0E+00	0.0E+00	0%	10950	1.1E-07	8.0E-05	1.4E-03	9%
Vanadium	83.120	45	30	100	1E-06	70	25550	6.3E-06	0.0E+00	0.0E+00	0%	10950	1.5E-05	7.0E-03	2.1E-03	13%
Zinc	140.000	45	30	100	1E-06	70	25550	1.1E-05	0.0E+00	0.0E+00	0%	10950	2.5E-05	3.0E-01	8.2E-05	1%
TOTAL										3.8E-07					1.6E-02	

SEDIMENT DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
ADULT TRESPASSER

The intake from dermal contact to sediment is calculted as follows:

Intake (mg/kg-day) = C * CF * SA * AF * Abs * EF * ED/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	
CF = conversion factor (kg/mg)	1.00E-06
SA = exposed skin surface area (cm2)	5000
AF = sediment to skin adherence factor (mg/cm2)	1
Abs = fraction absorbed (unitless) (contaminant specific)	Specific
EF = exposure frequency (events/yr)	45
ED = exposure duration (years)	30
BW = body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	30
DY = day per year (day/yr)	365
CSF = cancer slope factor (mg/kg-day)-1	Specific
RfD = reference dose (mg/kg-day)	Specific

COPC	Concentration (mg/kg)	Conversion Factor (kg/mg)	Surface Area (cm2)	Adherence Factor (mg/cm2)	ABS Factor (%)	Exposure Frequency (events/yr)	Exposure Duration (yrs)	Body Weight (kg)	Average Carc Time (days)	Carc Dose (mg/kg/day)	Dermal Adjust. Slope Factor (mg/kg-day)-1	Carcinogenic Risk	Percent Carcinogenic Risk	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day)	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
Tetrachloroethene	0.004	1E-06	5000	1	0.01	45	30	70	25550	1.5E-10	6.5E-02	9.8E-12	0%	10950	3.5E-10	8.0E-03	4.4E-08	0%
Diethylphthalate	1.110	1E-06	5000	1	0.01	45	30	70	25550	4.2E-08	0.0E+00	0.0E+00	0%	10950	9.8E-08	4.0E-01	2.4E-07	0%
Anthracene	0.046	1E-06	5000	1	0.01	45	30	70	25550	1.7E-09	0.0E+00	0.0E+00	0%	10950	4.1E-09	1.5E-01	2.7E-08	0%
Di-n-butylphthalate	0.218	1E-06	5000	1	0.01	45	30	70	25550	8.2E-09	0.0E+00	0.0E+00	0%	10950	1.9E-08	5.0E-02	3.8E-07	0%
Bis(2-ethylhexyl)phthalate	0.328	1E-06	5000	1	0.01	45	30	70	25550	1.2E-08	2.8E-02	3.5E-10	0%	10950	2.9E-08	1.0E-02	2.9E-06	0%
Dieldrin	0.052	1E-06	5000	1	0.01	45	30	70	25550	2.0E-09	3.2E+01	6.3E-08	34%	10950	4.6E-09	2.5E-05	1.8E-04	4%
4,4'-DDE	1.200	1E-06	5000	1	0.01	45	30	70	25550	4.5E-08	6.8E-01	3.1E-08	17%	10950	1.1E-07	0.0E+00	0.0E+00	0%
Endrin	0.007	1E-06	5000	1	0.01	45	30	70	25550	2.5E-10	0.0E+00	0.0E+00	0%	10950	5.8E-10	1.5E-04	3.9E-06	0%
4,4'-DDD	1.140	1E-06	5000	1	0.01	45	30	70	25550	4.3E-08	4.8E-01	2.1E-08	11%	10950	1.0E-07	0.0E+00	0.0E+00	0%
Endosulfan sulfate	0.003	1E-06	5000	1	0.01	45	30	70	25550	1.1E-10	0.0E+00	0.0E+00	0%	10950	2.6E-10	3.0E-03	8.8E-08	0%
4,4'-DDT	0.046	1E-06	5000	1	0.01	45	30	70	25550	1.7E-09	6.8E-01	1.2E-09	1%	10950	4.1E-09	2.5E-04	1.6E-05	0%
Endrin ketone	0.011	1E-06	5000	1	0.01	45	30	70	25550	4.2E-10	0.0E+00	0.0E+00	0%	10950	9.7E-10	1.5E-04	6.5E-06	0%
Endrin aldehyde	0.008	1E-06	5000	1	0.01	45	30	70	25550	2.9E-10	0.0E+00	0.0E+00	0%	10950	6.7E-10	1.5E-04	4.5E-06	0%
alpha-Chlordane	0.013	1E-06	5000	1	0.01	45	30	70	25550	4.9E-10	2.6E+00	1.3E-09	1%	10950	1.1E-09	3.0E-05	3.8E-05	1%
Aluminum	19389.170	1E-06	5000	1	0.001	45	30	70	25550	7.3E-05	0.0E+00	0.0E+00	0%	10950	1.7E-04	2.0E-01	8.5E-04	21%
Barium	68.510	1E-06	5000	1	0.001	45	30	70	25550	2.6E-07	0.0E+00	0.0E+00	0%	10950	6.0E-07	1.4E-02	4.3E-05	1%
Beryllium	0.810	1E-06	5000	1	0.001	45	30	70	25550	3.1E-09	2.1E+01	6.6E-08	36%	10950	7.1E-09	1.0E-03	7.1E-06	0%
Cadmium (soil)	3.750	1E-06	5000	1	0.001	45	30	70	25550	1.4E-08	0.0E+00	0.0E+00	0%	10950	3.3E-08	2.0E-04	1.7E-04	4%
Cobalt	4.200	1E-06	5000	1	0.001	45	30	70	25550	1.6E-08	0.0E+00	0.0E+00	0%	10950	3.7E-08	1.2E-02	3.1E-06	0%
Copper	19.880	1E-06	5000	1	0.001	45	30	70	25550	7.5E-08	0.0E+00	0.0E+00	0%	10950	1.8E-07	8.0E-03	2.2E-05	1%
Iron	11661.090	1E-06	5000	1	0.001	45	30	70	25550	4.4E-05	0.0E+00	0.0E+00	0%	10950	1.0E-04	6.0E-02	1.7E-03	41%
Lead	3422.990	1E-06	5000	1	0.001	45	30	70	25550	1.3E-05	0.0E+00	0.0E+00	0%	10950	3.0E-05	0.0E+00	0.0E+00	0%
Manganese (soil)	45.170	1E-06	5000	1	0.001	45	30	70	25550	1.7E-07	0.0E+00	0.0E+00	0%	10950	4.0E-07	2.8E-02	1.4E-05	0%
Mercury	0.660	1E-06	5000	1	0.001	45	30	70	25550	2.5E-09	0.0E+00	0.0E+00	0%	10950	5.8E-09	6.0E-05	9.7E-05	2%
Nickel	25.810	1E-06	5000	1	0.001	45	30	70	25550	9.7E-08	0.0E+00	0.0E+00	0%	10950	2.3E-07	4.0E-03	5.7E-05	1%
Selenium	0.710	1E-06	5000	1	0.001	45	30	70	25550	2.7E-09	0.0E+00	0.0E+00	0%	10950	6.3E-09	1.0E-03	6.3E-06	0%
Thallium	0.650	1E-06	5000	1	0.001	45	30	70	25550	2.5E-09	0.0E+00	0.0E+00	0%	10950	5.7E-09	1.6E-05	3.6E-04	9%
Vanadium	83.120	1E-06	5000	1	0.001	45	30	70	25550	3.1E-07	0.0E+00	0.0E+00	0%	10950	7.3E-07	1.4E-03	5.2E-04	13%
Zinc	140.000	1E-06	5000	1	0.001	45	30	70	25550	5.3E-07	0.0E+00	0.0E+00	0%	10950	1.2E-06	6.0E-02	2.1E-05	0%
TOTAL												1.8E-07					4.1E-03	

FUTURE ADULT RESIDENT

SURFACE SOIL INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT RESIDENTIAL ADULT

Intake from ingestion of soil is calculated as follows:

Intake (mg/kg-day) = C * CF * EF * ED * IR/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:		INPUTS
C = contaminant concentration in soil (mg/kg)		
CF = conversion for kg to mg		1E-06
EF = adult exposure frequency (days/yr)		350
ED = adult exposure duration (yr)		30
IR = adult soil ingestion rate (mg/day)		100
BW = adult body weight (kg)		70
ATc = averaging time for carcinogen (yr)		70
ATnc = averaging time for noncarcinogen (yr)		30
DY = days per year (days/year)		365
CSF = cancer slope factor (mg/kg-day)-1	specific	
RfD = reference dose (mg/kg-day)	specific	

COPC	Concentration (mg/kg)	Exposure Frequency (days/yr) Adult	Exposure Duration (yr) Adult	Conversion Factor (kg/mg)	Ingestion Rate (mg/day) Adult	Body Weight (kg) Adult	Average Carc Time (days)	Carc Dose (mg/kg/day) Adult	Slope Factor (mg/kg/day)-1	Carcinogenic Risk Adult	Percent Carcinogenic Risk Adult	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day) Adult	Reference Dose (mg/kg/day)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
n-Nitroso-di-n-propylamine	0.218	350	30	1E-06	100	70	25550	1.3E-07	7.0E+00	9.0E-07	12%	10950	3.0E-07	0.0E+00	0.0E+00	0%
Benzo(a)anthracene	0.266	350	30	1E-06	100	70	25550	1.6E-07	7.3E-01	1.1E-07	1%	10950	3.6E-07	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	0.262	350	30	1E-06	100	70	25550	1.5E-07	7.3E-01	1.1E-07	1%	10950	3.6E-07	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	0.263	350	30	1E-06	100	70	25550	1.5E-07	7.3E+00	1.1E-06	15%	10950	3.6E-07	0.0E+00	0.0E+00	0%
Dibenzo(a,h)anthracene	0.228	350	30	1E-06	100	70	25550	1.3E-07	7.3E+00	9.8E-07	13%	10950	3.1E-07	0.0E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	0.257	350	30	1E-06	100	70	25550	1.5E-07	7.3E-01	1.1E-07	1%	10950	3.5E-07	0.0E+00	0.0E+00	0%
Aldrin	0.004	350	30	1E-06	100	70	25550	2.6E-09	1.7E+01	4.4E-08	1%	10950	6.1E-09	3.0E-05	2.0E-04	0%
Dieldrin	0.049	350	30	1E-06	100	70	25550	2.9E-08	1.6E+01	4.6E-07	6%	10950	6.7E-08	5.0E-05	1.3E-03	1%
4,4'-DDE	0.440	350	30	1E-06	100	70	25550	2.6E-07	3.4E-01	8.8E-08	1%	10950	6.0E-07	0.0E+00	0.0E+00	0%
4,4'-DDT	0.241	350	30	1E-06	100	70	25550	1.4E-07	3.4E-01	4.8E-08	1%	10950	3.3E-07	5.0E-04	6.6E-04	1%
alpha-Chlordane	0.014	350	30	1E-06	100	70	25550	8.2E-09	1.3E+00	1.1E-08	0%	10950	1.9E-08	6.0E-05	3.2E-04	0%
gamma-Chlordane	0.006	350	30	1E-06	100	70	25550	3.8E-09	1.3E+00	4.9E-09	0%	10950	8.8E-09	6.0E-05	1.5E-04	0%
Aroclor-1248	0.291	350	30	1E-06	100	70	25550	1.7E-07	7.7E+00	1.3E-06	17%	10950	4.0E-07	0.0E+00	0.0E+00	0%
Aroclor-1254	0.051	350	30	1E-06	100	70	25550	3.0E-08	7.7E+00	2.3E-07	3%	10950	6.9E-08	2.0E-05	3.5E-03	4%
Aluminum	5808.712	350	30	1E-06	100	70	25550	3.4E-03	0.0E+00	0.0E+00	0%	10950	8.0E-03	1.0E+00	8.0E-03	8%
Antimony	3.379	350	30	1E-06	100	70	25550	2.0E-06	0.0E+00	0.0E+00	0%	10950	4.6E-06	4.0E-04	1.2E-02	12%
Arsenic	2.399	350	30	1E-06	100	70	25550	1.4E-06	1.5E+00	2.1E-06	28%	10950	3.3E-06	3.0E-04	1.1E-02	11%
Cadmium (soil)	0.713	350	30	1E-06	100	70	25550	4.2E-07	0.0E+00	0.0E+00	0%	10950	9.8E-07	1.0E-03	9.8E-04	1%
Chromium	11.294	350	30	1E-06	100	70	25550	6.6E-06	0.0E+00	0.0E+00	0%	10950	1.5E-05	5.0E-03	3.1E-03	3%
Copper	98.217	350	30	1E-06	100	70	25550	5.8E-05	0.0E+00	0.0E+00	0%	10950	1.3E-04	4.0E-02	3.4E-03	3%
Iron	11299.700	350	30	1E-06	100	70	25550	6.6E-03	0.0E+00	0.0E+00	0%	10950	1.5E-02	3.0E-01	5.2E-02	53%
Lead	110.524	350	30	1E-06	100	70	25550	6.5E-05	0.0E+00	0.0E+00	0%	10950	1.5E-04	0.0E+00	0.0E+00	0%
Mercury	0.370	350	30	1E-06	100	70	25550	2.2E-07	0.0E+00	0.0E+00	0%	10950	5.1E-07	3.0E-04	1.7E-03	2%
TOTAL										7.7E-06					9.7E-02	

SURFACE SOIL DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT RESIDENTIAL ADULT

Dermal contact with soil is calculated as follows:

Intake (mg/kg-day) = C * CF * SA * AF * Abs * EF * ED/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	
CF = conversion factor (kg/mg)	1E-06
SA = adult exposed skin surface area (cm2)	5800
AF = soil to skin adherence factor (mg/cm2)	1
Abs = fraction absorbed (unitless)	Specific
EF = adult exposure frequency (events/yr)	350
ED = adult exposure duration (years)	30
BW = adult body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	30
DY = day per year (day/yr)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

COPC	Concentration (mg/kg)	Conversion Factor (kg/mg)	Surface Area (cm2) Adult	Adherence Factor (mg/cm2)	Fraction Absorbed (%)	Exposure Frequency (events/yr) Adult	Exposure Duration (yrs) Adult	Body Weight (kg) Adult	Average Carc Time (days)	Carc Dose (mg/kg/day) Adult	Dermal Adjust. Slope Factor (mg/kg-day)-1	Carcinogenic Risk Adult	Percent Carcinogenic Risk Adult	Average Noncarc Tim (days)	Noncarc Dose (mg/kg/day) Adult	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
n-Nitroso-di-n-propylamine	0.218	1E-06	5800	1	0.01	350	30	70	25550	7.4E-08	1.4E+01	1.0E-06	15%	10950	1.7E-07	0.0E+00	0.0E+00	0%
Benzo(a)anthracene	0.266	1E-06	5800	1	0.01	350	30	70	25550	9.1E-08	1.5E+00	1.3E-07	2%	10950	2.1E-07	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	0.262	1E-06	5800	1	0.01	350	30	70	25550	8.9E-08	1.5E+00	1.3E-07	2%	10950	2.1E-07	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	0.263	1E-06	5800	1	0.01	350	30	70	25550	9.0E-08	1.5E+01	1.3E-06	19%	10950	2.1E-07	0.0E+00	0.0E+00	0%
Dibenzo(a,h)anthracene	0.228	1E-06	5800	1	0.01	350	30	70	25550	7.8E-08	1.5E+01	1.1E-06	16%	10950	1.8E-07	0.0E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	0.257	1E-06	5800	1	0.01	350	30	70	25550	8.8E-08	1.5E+00	1.3E-07	2%	10950	2.0E-07	0.0E+00	0.0E+00	0%
Aldrin	0.004	1E-06	5800	1	0.01	350	30	70	25550	1.5E-09	3.4E+01	5.1E-08	1%	10950	3.5E-09	1.5E-05	2.4E-04	1%
Dieldrin	0.049	1E-06	5800	1	0.01	350	30	70	25550	1.7E-08	3.2E+01	5.3E-07	8%	10950	3.9E-08	2.5E-05	1.5E-03	5%
4,4'-DDE	0.440	1E-06	5800	1	0.01	350	30	70	25550	1.5E-07	6.8E-01	1.0E-07	1%	10950	3.5E-07	0.0E+00	0.0E+00	0%
4,4'-DDT	0.241	1E-06	5800	1	0.01	350	30	70	25550	8.2E-08	6.8E-01	5.6E-08	1%	10950	1.9E-07	2.5E-04	7.6E-04	2%
alpha-Chlordane	0.014	1E-06	5800	1	0.01	350	30	70	25550	4.8E-09	2.6E+00	1.2E-08	0%	10950	1.1E-08	3.0E-05	3.7E-04	1%
gamma-Chlordane	0.006	1E-06	5800	1	0.01	350	30	70	25550	2.2E-09	2.6E+00	5.7E-09	0%	10950	5.1E-09	3.0E-05	1.7E-04	1%
Aroclor-1248	0.291	1E-06	5800	1	0.01	350	30	70	25550	9.9E-08	1.5E+01	1.5E-06	22%	10950	2.3E-07	0.0E+00	0.0E+00	0%
Aroclor-1254	0.051	1E-06	5800	1	0.01	350	30	70	25550	1.7E-08	1.5E+01	2.7E-07	4%	10950	4.0E-08	1.0E-05	4.0E-03	12%
Aluminum	5808.712	1E-06	5800	1	0.001	350	30	70	25550	2.0E-04	0.0E+00	0.0E+00	0%	10950	4.6E-04	2.0E-01	2.3E-03	7%
Antimony	3.379	1E-06	5800	1	0.001	350	30	70	25550	1.2E-07	0.0E+00	0.0E+00	0%	10950	2.7E-07	8.0E-05	3.4E-03	10%
Arsenic	2.399	1E-06	5800	1	0.001	350	30	70	25550	8.2E-08	7.5E+00	6.1E-07	9%	10950	1.9E-07	6.0E-05	3.2E-03	9%
Cadmium (soil)	0.713	1E-06	5800	1	0.001	350	30	70	25550	2.4E-08	0.0E+00	0.0E+00	0%	10950	5.7E-08	2.0E-04	2.8E-04	1%
Chromium	11.294	1E-06	5800	1	0.001	350	30	70	25550	3.8E-07	0.0E+00	0.0E+00	0%	10950	9.0E-07	1.0E-03	9.0E-04	3%
Copper	98.217	1E-06	5800	1	0.001	350	30	70	25550	3.3E-06	0.0E+00	0.0E+00	0%	10950	7.8E-06	8.0E-03	9.8E-04	3%
Iron	11299.700	1E-06	5800	1	0.001	350	30	70	25550	3.8E-04	0.0E+00	0.0E+00	0%	10950	9.0E-04	6.0E-02	1.5E-02	45%
Lead	110.524	1E-06	5800	1	0.001	350	30	70	25550	3.8E-06	0.0E+00	0.0E+00	0%	10950	8.8E-06	0.0E+00	0.0E+00	0%
Mercury	0.370	1E-06	5800	1	0.001	350	30	70	25550	1.3E-08	0.0E+00	0.0E+00	0%	10950	2.9E-08	6.0E-05	4.9E-04	1%
TOTAL												7.0E-06					3.4E-02	

SURFACE SOIL PARTICULATE INHALATION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT RESIDENTIAL ADULT

Intake from the inhalation of particulates is calculated as follows:

Intake (mg/kg-day) = (C * EF * ED * IR * 1/PEF)/(BW * ATc or ATnc * DY)

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	Calculated
CSF = carcinogenic slope factor	Specific
RfD = reference dose for noncarcinogen	Specific
IR = inhalation rate (m3)	20
EF = adult exposure frequency (days)	350
ED = adult exposure duration (years)	30
BW = adult body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	30
DY = day per year (day/yr)	365
PEF = particulate emission factor (m3/kg)	1.32E+09

COPC	Concentration (mg/kg)	Particulate Emission Factor (m3/kg)	Exposure Frequency (events/yr)	Inhalation Rate (m3/day)	Exposure Duration (yrs)	Body Weight (kg)	Average Carc Time (days)	Carc Dose (mg/kg/day)	Slope Factor (mg/kg-day)-1	Carcinogenic Risk	Percent Conrtribution to Risk	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day)	Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
n-Nitroso-di-n-propylamine	0.218	1.3E+09	350	20	30	70	25550	1.9E-11	0.0E+00	0.0E+00	0%	10950	4.5E-11	0.0E+00	0.0E+00	0%
Benzo(a)anthracene	0.266	1.3E+09	350	20	30	70	25550	2.4E-11	6.1E-01	1.4E-11	0%	10950	5.5E-11	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	0.262	1.3E+09	350	20	30	70	25550	2.3E-11	6.1E-01	1.4E-11	0%	10950	5.4E-11	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	0.263	1.3E+09	350	20	30	70	25550	2.3E-11	6.1E+00	1.4E-10	0%	10950	5.5E-11	0.0E+00	0.0E+00	0%
Dibenzo(a,h)anthracene	0.228	1.3E+09	350	20	30	70	25550	2.0E-11	6.1E+00	1.2E-10	0%	10950	4.7E-11	0.0E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	0.257	1.3E+09	350	20	30	70	25550	2.3E-11	6.1E-01	1.4E-11	0%	10950	5.3E-11	0.0E+00	0.0E+00	0%
Aldrin	0.004	1.3E+09	350	20	30	70	25550	3.9E-13	1.7E+01	6.8E-12	0%	10950	9.2E-13	0.0E+00	0.0E+00	0%
Dieldrin	0.049	1.3E+09	350	20	30	70	25550	4.3E-12	1.6E+01	7.0E-11	0%	10950	1.0E-11	0.0E+00	0.0E+00	0%
4,4'-DDE	0.440	1.3E+09	350	20	30	70	25550	3.9E-11	0.0E+00	0.0E+00	0%	10950	9.1E-11	0.0E+00	0.0E+00	0%
4,4'-DDT	0.241	1.3E+09	350	20	30	70	25550	2.1E-11	3.4E-01	7.3E-12	0%	10950	5.0E-11	0.0E+00	0.0E+00	0%
alpha-Chlordane	0.014	1.3E+09	350	20	30	70	25550	1.2E-12	1.3E+00	1.6E-12	0%	10950	2.9E-12	0.0E+00	0.0E+00	0%
gamma-Chlordane	0.006	1.3E+09	350	20	30	70	25550	5.7E-13	1.3E+00	7.4E-13	0%	10950	1.3E-12	0.0E+00	0.0E+00	0%
Aroclor-1248	0.291	1.3E+09	350	20	30	70	25550	2.6E-11	0.0E+00	0.0E+00	0%	10950	6.0E-11	0.0E+00	0.0E+00	0%
Aroclor-1254	0.051	1.3E+09	350	20	30	70	25550	4.5E-12	0.0E+00	0.0E+00	0%	10950	1.1E-11	0.0E+00	0.0E+00	0%
Aluminum	5808.712	1.3E+09	350	20	30	70	25550	5.2E-07	0.0E+00	0.0E+00	0%	10950	1.2E-06	0.0E+00	0.0E+00	0%
Antimony	3.379	1.3E+09	350	20	30	70	25550	3.0E-10	0.0E+00	0.0E+00	0%	10950	7.0E-10	0.0E+00	0.0E+00	0%
Arsenic	2.399	1.3E+09	350	20	30	70	25550	2.1E-10	1.5E+01	3.2E-09	7%	10950	5.0E-10	0.0E+00	0.0E+00	0%
Cadmium (soil)	0.713	1.3E+09	350	20	30	70	25550	6.3E-11	0.0E+00	0.0E+00	0%	10950	1.5E-10	0.0E+00	0.0E+00	0%
Chromium	11.294	1.3E+09	350	20	30	70	25550	1.0E-09	4.2E+01	4.2E-08	92%	10950	2.3E-09	0.0E+00	0.0E+00	0%
Copper	98.217	1.3E+09	350	20	30	70	25550	8.7E-09	0.0E+00	0.0E+00	0%	10950	2.0E-08	0.0E+00	0.0E+00	0%
Iron	11299.700	1.3E+09	350	20	30	70	25550	1.0E-06	0.0E+00	0.0E+00	0%	10950	2.3E-06	0.0E+00	0.0E+00	0%
Lead	110.524	1.3E+09	350	20	30	70	25550	9.8E-09	0.0E+00	0.0E+00	0%	10950	2.3E-08	0.0E+00	0.0E+00	0%
Mercury	0.370	1.3E+09	350	20	30	70	25550	3.3E-11	0.0E+00	0.0E+00	0%	10950	7.7E-11	8.6E-05	9.0E-07	100%
TOTAL										4.6E-08					9.0E-07	

SUBSURFACE SOIL INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
FUTURE RESIDENTIAL ADULT

Intake from ingestion of soil is calculated as follows:

Intake (mg/kg-day) = C * CF * EF * ED * IR/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	
CF = conversion for kg to mg	1E-06
EF = adult exposure frequency (days/yr)	350
ED = adult exposure duration (yr)	30
IR = adult soil ingestion rate (mg/day)	100
BW = adult body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	30
DY = days per year (days/year)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

COPC	Concentration (mg/kg)	Exposure Frequency (days/yr) Adult	Exposure Duration (yr) Adult	Conversion Factor (kg/mg)	Ingestion Rate (mg/day) Adult	Body Weight (kg) Adult	Average Carc Tim (days)	Carc Dose (mg/kg/day) Adult	Slope Factor (mg/kg/day)-	Carcinogenic Risk Adult	Percent Carcinogenic Risk Adult	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day) Adult	Reference Dose (mg/kg/day)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
Benzo(a)pyrene	0.210	350	30	1E-06	100	70	25550	1.2E-07	7.3E+00	9.0E-07	12%	10950	2.9E-07	0.0E+00	0.0E+00	0%
Dieldrin	0.010	350	30	1E-06	100	70	25550	6.1E-09	1.6E+01	9.8E-08	1%	10950	1.4E-08	5.0E-05	2.8E-04	0%
4,4'-DDT	0.061	350	30	1E-06	100	70	25550	3.6E-08	3.4E-01	1.2E-08	0%	10950	8.3E-08	5.0E-04	1.7E-04	0%
alpha-Chlordane	0.005	350	30	1E-06	100	70	25550	3.1E-09	1.3E+00	4.1E-09	0%	10950	7.3E-09	6.0E-05	1.2E-04	0%
gamma-Chlordane	0.005	350	30	1E-06	100	70	25550	2.9E-09	1.3E+00	3.7E-09	0%	10950	6.7E-09	6.0E-05	1.1E-04	0%
Aroclor-1248	0.043	350	30	1E-06	100	70	25550	2.5E-08	7.7E+00	2.0E-07	3%	10950	5.9E-08	0.0E+00	0.0E+00	0%
Aluminum	7190.019	350	30	1E-06	100	70	25550	4.2E-03	0.0E+00	0.0E+00	0%	10950	9.8E-03	1.0E+00	9.8E-03	4%
Antimony	3.715	350	30	1E-06	100	70	25550	2.2E-06	0.0E+00	0.0E+00	0%	10950	5.1E-06	4.0E-04	1.3E-02	5%
Arsenic	6.837	350	30	1E-06	100	70	25550	4.0E-06	1.5E+00	6.0E-06	80%	10950	9.4E-06	3.0E-04	3.1E-02	13%
Beryllium	0.100	350	30	1E-06	100	70	25550	5.9E-08	4.3E+00	2.5E-07	3%	10950	1.4E-07	5.0E-03	2.7E-05	0%
Cadmium (soil)	2.109	350	30	1E-06	100	70	25550	1.2E-06	0.0E+00	0.0E+00	0%	10950	2.9E-06	1.0E-03	2.9E-03	1%
Chromium	15.919	350	30	1E-06	100	70	25550	9.3E-06	0.0E+00	0.0E+00	0%	10950	2.2E-05	5.0E-03	4.4E-03	2%
Copper	344.565	350	30	1E-06	100	70	25550	2.0E-04	0.0E+00	0.0E+00	0%	10950	4.7E-04	4.0E-02	1.2E-02	5%
Iron	31266.800	350	30	1E-06	100	70	25550	1.8E-02	0.0E+00	0.0E+00	0%	10950	4.3E-02	3.0E-01	1.4E-01	61%
Lead	473.537	350	30	1E-06	100	70	25550	2.8E-04	0.0E+00	0.0E+00	0%	10950	6.5E-04	0.0E+00	0.0E+00	0%
Manganese (soil)	506.623	350	30	1E-06	100	70	25550	3.0E-04	0.0E+00	0.0E+00	0%	10950	6.9E-04	1.4E-01	5.0E-03	2%
Mercury	0.326	350	30	1E-06	100	70	25550	1.9E-07	0.0E+00	0.0E+00	0%	10950	4.5E-07	3.0E-04	1.5E-03	1%
Zinc	2580.000	350	30	1E-06	100	70	25550	1.5E-03	0.0E+00	0.0E+00	0%	10950	3.5E-03	3.0E-01	1.2E-02	5%
TOTAL										7.5E-06					2.3E-01	

SUBSURFACE SOIL DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
FUTURE RESIDENTIAL ADULT

Dermal contact with soil is calculated as follows:

Intake (mg/kg-day) = C * CF * SA * AF * Abs * EF * ED/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	
CF = conversion factor (kg/mg)	1E-06
SA = adult exposed skin surface area (cm2)	5800
AF = soil to skin adherence factor (mg/cm2)	1
Abs = fraction absorbed (unitless)	Specific
EF = adult exposure frequency (events/yr)	350
ED = adult exposure duration (years)	30
BW = adult body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	30
DY = day per year (day/yr)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

COPC	Concentration (mg/kg)	Conversion Factor (kg/mg)	Surface Area (cm2) Adult	Adherence Factor (mg/cm2)	Fraction Absorbed (%)	Exposure Frequency (events/yr) Adult	Exposure Duration (yrs) Adult	Body Weight (kg) Adult	Average Carc Time (days)	Carc Dose (mg/kg/day) Adult	Dermal Adjust. Slope Factor (mg/kg-day)-1	Carcinogenic Risk Adult	Percent Carcinogenic Risk Adult	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day) Adult	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
Benzo(a)pyrene	0.210	1E-06	5800	1	0.01	350	30	70	25550	7.1E-08	1.5E+01	1.0E-06	32%	10950	1.7E-07	0.0E+00	0.0E+00	0%
Dieldrin	0.010	1E-06	5800	1	0.01	350	30	70	25550	3.5E-09	3.2E+01	1.1E-07	4%	10950	8.3E-09	2.5E-05	3.3E-04	0%
4,4'-DDT	0.061	1E-06	5800	1	0.01	350	30	70	25550	2.1E-08	6.8E-01	1.4E-08	0%	10950	4.8E-08	2.5E-04	1.9E-04	0%
alpha-Chlordane	0.005	1E-06	5800	1	0.01	350	30	70	25550	1.8E-09	2.6E+00	4.7E-09	0%	10950	4.3E-09	3.0E-05	1.4E-04	0%
gamma-Chlordane	0.005	1E-06	5800	1	0.01	350	30	70	25550	1.7E-09	2.6E+00	4.3E-09	0%	10950	3.9E-09	3.0E-05	1.3E-04	0%
Aroclor-1248	0.043	1E-06	5800	1	0.01	350	30	70	25550	1.5E-08	1.5E+01	2.3E-07	7%	10950	3.4E-08	0.0E+00	0.0E+00	0%
Aluminum	7190.019	1E-06	5800	1	0.001	350	30	70	25550	2.4E-04	0.0E+00	0.0E+00	0%	10950	5.7E-04	2.0E-01	2.9E-03	4%
Antimony	3.715	1E-06	5800	1	0.001	350	30	70	25550	1.3E-07	0.0E+00	0.0E+00	0%	10950	3.0E-07	8.0E-05	3.7E-03	5%
Arsenic	6.837	1E-06	5800	1	0.001	350	30	70	25550	2.3E-07	7.5E+00	1.7E-06	54%	10950	5.4E-07	6.0E-05	9.1E-03	13%
Beryllium	0.100	1E-06	5800	1	0.001	350	30	70	25550	3.4E-09	2.1E+01	7.3E-08	2%	10950	7.9E-09	1.0E-03	7.9E-06	0%
Cadmium (soil)	2.109	1E-06	5800	1	0.001	350	30	70	25550	7.2E-08	0.0E+00	0.0E+00	0%	10950	1.7E-07	2.0E-04	8.4E-04	1%
Chromium	15.919	1E-06	5800	1	0.001	350	30	70	25550	5.4E-07	0.0E+00	0.0E+00	0%	10950	1.3E-06	1.0E-03	1.3E-03	2%
Copper	344.565	1E-06	5800	1	0.001	350	30	70	25550	1.2E-05	0.0E+00	0.0E+00	0%	10950	2.7E-05	8.0E-03	3.4E-03	5%
Iron	31266.800	1E-06	5800	1	0.001	350	30	70	25550	1.1E-03	0.0E+00	0.0E+00	0%	10950	2.5E-03	6.0E-02	4.1E-02	60%
Lead	473.537	1E-06	5800	1	0.001	350	30	70	25550	1.6E-05	0.0E+00	0.0E+00	0%	10950	3.8E-05	0.0E+00	0.0E+00	0%
Manganese (soil)	506.623	1E-06	5800	1	0.001	350	30	70	25550	1.7E-05	0.0E+00	0.0E+00	0%	10950	4.0E-05	2.8E-02	1.4E-03	2%
Mercury	0.326	1E-06	5800	1	0.001	350	30	70	25550	1.1E-08	0.0E+00	0.0E+00	0%	10950	2.6E-08	6.0E-05	4.3E-04	1%
Zinc	2580.000	1E-06	5800	1	0.001	350	30	70	25550	8.8E-05	0.0E+00	0.0E+00	0%	10950	2.0E-04	6.0E-02	3.4E-03	5%
TOTAL												3.2E-06					6.9E-02	

SUBSURFACE SOIL PARTICULATE INHALATION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
FUTURE RESIDENTIAL ADULT

Intake from the inhalation of particulates is calculated as follows:

Intake (mg/kg-day) = (C * EF * ED * IR * 1/PEF)/(BW * ATc or ATnc * DY)

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	Calculated
CSF = carcinogenic slope factor	Specific
RfD = reference dose for noncarcinogen	Specific
IR = inhalation rate (m3)	20
EF = adult exposure frequency (days)	350
ED = adult exposure duration (years)	30
BW = adult body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	30
DY = day per year (day/yr)	365
PEF = particulate emission factor (m3/kg)	1.32E+09

COPC	Concentration (mg/kg)	Particulate Emission Factor (m3/kg)	Exposure Frequency (events/yr)	Inhalation Rate (m3/day)	Exposure Duration (yrs)	Body Weight (kg)	Average Carc Tim (days)	Carc Dose (mg/kg/day)	Slope Factor (mg/kg-day)-	Carcinogenic Risk	Percent Contribution to Risk	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day)	Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
Benzo(a)pyrene	0.210	1.3E+09	350	20	30	70	25550	1.9E-11	6.1E+00	1.1E-10	0%	10950	4.4E-11	0.0E+00	0.0E+00	0%
Dieldrin	0.010	1.3E+09	350	20	30	70	25550	9.2E-13	1.6E+01	1.5E-11	0%	10950	2.2E-12	0.0E+00	0.0E+00	0%
4,4'-DDT	0.061	1.3E+09	350	20	30	70	25550	5.4E-12	3.4E-01	1.8E-12	0%	10950	1.3E-11	0.0E+00	0.0E+00	0%
alpha-Chlordane	0.005	1.3E+09	350	20	30	70	25550	4.8E-13	1.3E+00	6.2E-13	0%	10950	1.1E-12	0.0E+00	0.0E+00	0%
gamma-Chlordane	0.005	1.3E+09	350	20	30	70	25550	4.3E-13	1.3E+00	5.6E-13	0%	10950	1.0E-12	0.0E+00	0.0E+00	0%
Aroclor-1248	0.043	1.3E+09	350	20	30	70	25550	3.9E-12	0.0E+00	0.0E+00	0%	10950	9.0E-12	0.0E+00	0.0E+00	0%
Aluminum	7190.019	1.3E+09	350	20	30	70	25550	6.4E-07	0.0E+00	0.0E+00	0%	10950	1.5E-06	0.0E+00	0.0E+00	0%
Antimony	3.715	1.3E+09	350	20	30	70	25550	3.3E-10	0.0E+00	0.0E+00	0%	10950	7.7E-10	0.0E+00	0.0E+00	0%
Arsenic	6.837	1.3E+09	350	20	30	70	25550	6.1E-10	1.5E+01	9.2E-09	13%	10950	1.4E-09	0.0E+00	0.0E+00	0%
Beryllium	0.100	1.3E+09	350	20	30	70	25550	8.9E-12	8.4E+00	7.5E-11	0%	10950	2.1E-11	0.0E+00	0.0E+00	0%
Cadmium (soil)	2.109	1.3E+09	350	20	30	70	25550	1.9E-10	0.0E+00	0.0E+00	0%	10950	4.4E-10	0.0E+00	0.0E+00	0%
Chromium	15.919	1.3E+09	350	20	30	70	25550	1.4E-09	4.2E+01	5.9E-08	86%	10950	3.3E-09	0.0E+00	0.0E+00	0%
Copper	344.565	1.3E+09	350	20	30	70	25550	3.1E-08	0.0E+00	0.0E+00	0%	10950	7.2E-08	0.0E+00	0.0E+00	0%
Iron	31266.800	1.3E+09	350	20	30	70	25550	2.8E-06	0.0E+00	0.0E+00	0%	10950	6.5E-06	0.0E+00	0.0E+00	0%
Lead	473.537	1.3E+09	350	20	30	70	25550	4.2E-08	0.0E+00	0.0E+00	0%	10950	9.8E-08	0.0E+00	0.0E+00	0%
Manganese (soil)	506.623	1.3E+09	350	20	30	70	25550	4.5E-08	0.0E+00	0.0E+00	0%	10950	1.1E-07	0.0E+00	0.0E+00	0%
Mercury	0.326	1.3E+09	350	20	30	70	25550	2.9E-11	0.0E+00	0.0E+00	0%	10950	6.8E-11	8.6E-05	7.9E-07	100%
Zinc	2580.000	1.3E+09	350	20	30	70	25550	2.3E-07	0.0E+00	0.0E+00	0%	10950	5.4E-07	0.0E+00	0.0E+00	0%
TOTAL										6.9E-08					7.9E-07	

GROUNDWATER INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
FUTURE RESIDENTIAL ADULT

Intake from drinking water is calculated as follows:

Intake (mg/kg-day) = C * IRw * EF * ED/BW * AT or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in water (mg/l)	
IRw = adult daily water ingestion rate (L/D	2
EF = adult exposure frequency (days/yr)	350
ED = adult exposure duration (yr)	30
BW = adult body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen	30
DY = days per year (day/year)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

Shallow and Deep Groundwater

COPC	Concentration (mg/l)	Ingestion Rate (L/day) Adult	Exposure Frequency (day/year) Adult	Exposure Duration (year) Adult	Body Weight (kg) Adult	Average Carc Time (days)	Carc Dose (mg/kg-day) Adult	Slope Factor (mg/kg-day)-1	Carcinogenic Risk Adult	Percent Carcinogenic Risk Adult	Average Noncarc Time (days)	Noncarc Dose (mg/kg-day) Adult	Reference Dose (mg/kg-day)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
1,2-Dichloroethene (total)	0.009	2	350	30	70	25550	1.1E-04	0.0E+00	0.0E+00	0%	10950	2.5E-04	9.0E-03	2.8E-02	1%
Trichloroethene	0.012	2	350	30	70	25550	1.4E-04	1.1E-02	1.5E-06	4%	10950	3.2E-04	6.0E-03	5.3E-02	2%
Tetrachloroethene	0.002	2	350	30	70	25550	2.3E-05	5.2E-02	1.2E-06	3%	10950	5.5E-05	1.0E-02	5.5E-03	0%
1,1,2,2-Tetrachloroethane	0.006	2	350	30	70	25550	6.5E-05	2.0E-01	1.3E-05	33%	10950	1.5E-04	0.0E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	0.005	2	350	30	70	25550	5.9E-05	1.4E-02	8.2E-07	2%	10950	1.4E-04	2.0E-02	6.8E-03	0%
Aluminum	0.314	2	350	30	70	25550	3.7E-03	0.0E+00	0.0E+00	0%	10950	8.6E-03	1.0E+00	8.6E-03	0%
Arsenic	0.001	2	350	30	70	25550	1.5E-05	1.5E+00	2.3E-05	58%	10950	3.6E-05	3.0E-04	1.2E-01	5%
Barium	0.219	2	350	30	70	25550	2.6E-03	0.0E+00	0.0E+00	0%	10950	6.0E-03	7.0E-02	8.6E-02	4%
Cadmium (water)	0.002	2	350	30	70	25550	2.1E-05	0.0E+00	0.0E+00	0%	10950	4.9E-05	5.0E-04	9.8E-02	5%
Iron	16.900	2	350	30	70	25550	2.0E-01	0.0E+00	0.0E+00	0%	10950	4.6E-01	3.0E-01	1.5E+00	71%
Manganese (water)	1.200	2	350	30	70	25550	1.4E-02	0.0E+00	0.0E+00	0%	10950	3.3E-02	1.4E-01	2.3E-01	11%
TOTAL									3.9E-05					2.2E+00	

GROUNDWATER DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
FUTURE RESIDENTIAL ADULT

Dermal Contact from groundwater is calcuated as follows:

Intake (mg/kg-day) = CW * SA * PC * ET * EF * ED * CF/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
CW = contaminant concentration in water (mg/l)	
SA = adult skin surface available for contact (cm2)	23000
PC = contaminant specific dermal permability (cm/hr)	Specific
ET = adult exposure time (hours/day)	0.25
EF = adult exposure frequency (days/yr)	350
ED = adult exposure duration (years)	30
CF = volumetric conversion factor for water (1liter/1000 cm3)	0.001
BW = adult body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	30
DY = days per year (days)	365

SHALLOW AND DEEP GROUNDWATER

COPC	Concentration Carcinogen (mg/l)	Surface Area (cm2) Adult	Dermal Permeability (cm/hr)	Exposure Time (hours/day) Adult	Exposure Frequency (days/yr) Adult	Exposure Duration (years) Adult	Volumetric Conversion (L/m3)	Body Weight (kg) Adult	Averaging Carc Time (years)	Carc Dose (mg/kg-day) Adult	Derm. Adj. Slope Factor (mg/kg-day)-1	Carcinogenic Risk Adult	Percent Carcinogenic Risk Adult	Average Noncarc Time (years)	Noncarc Dose (mg/kg-day) Adult	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarc Risk Adult	Percent Noncarcinogenic Risk Adult
1,2-Dichloroethene (total)	0.009	23000	1.00E-02	0.25	350	30	0.001	70	25550	3.1E-06	0.0E+00	0.0E+00	0%	10950	7.1E-06	7.2E-03	9.9E-04	3%
Trichloroethene	0.012	23000	1.60E-02	0.25	350	30	0.001	70	25550	6.2E-06	1.4E-02	8.5E-08	7%	10950	1.5E-05	4.8E-03	3.0E-03	8%
Tetrachloroethene	0.002	23000	4.50E-02	0.25	350	30	0.001	70	25550	3.0E-06	6.5E-02	2.0E-07	17%	10950	7.1E-06	8.0E-03	8.9E-04	2%
1,1,2,2-Tetrachloroethane	0.006	23000	9.00E-03	0.25	350	30	0.001	70	25550	1.7E-06	2.5E-01	4.2E-07	35%	10950	3.9E-06	0.0E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	0.005	23000	3.30E-02	0.25	350	30	0.001	70	25550	5.6E-06	2.8E-02	1.6E-07	13%	10950	1.3E-05	1.0E-02	1.3E-03	4%
Aluminum	0.314	23000	1.00E-03	0.25	350	30	0.001	70	25550	1.1E-05	0.0E+00	0.0E+00	0%	10950	2.5E-05	2.0E-01	1.2E-04	0%
Arsenic	0.001	23000	1.00E-03	0.25	350	30	0.001	70	25550	4.4E-08	7.5E+00	3.3E-07	28%	10950	1.0E-07	6.0E-05	1.7E-03	5%
Barium	0.219	23000	1.00E-03	0.25	350	30	0.001	70	25550	7.4E-06	0.0E+00	0.0E+00	0%	10950	1.7E-05	1.4E-02	1.2E-03	3%
Cadmium (water)	0.002	23000	1.00E-03	0.25	350	30	0.001	70	25550	6.1E-08	0.0E+00	0.0E+00	0%	10950	1.4E-07	1.0E-04	1.4E-03	4%
Iron	16.900	23000	1.00E-03	0.25	350	30	0.001	70	25550	5.7E-04	0.0E+00	0.0E+00	0%	10950	1.3E-03	6.0E-02	2.2E-02	61%
Manganese (water)	1.200	23000	1.00E-03	0.25	350	30	0.001	70	25550	4.1E-05	0.0E+00	0.0E+00	0%	10950	9.5E-05	2.8E-02	3.4E-03	9%
TOTAL												1.2E-06					3.6E-02	

GROUNDWATER INHALATION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
FUTURE RESIDENTIAL ADULT

ADULT CHEMICAL	C rme mg/kg/shwr	ED y	EF shwr/y	AT d	ATC d	CDI mg/kg/d	CDIC mg/kg/d	RFD mg/kg/d	PF (mg/kg/d)^-1	HI	CR	% CONTRIB NC RISK	% CONTRIB CARC RISK
1,2-Dichloroethene (total)	8.89E-05	30	350	10950	25550	8.5E-05	3.7E-05	0.0E+00	0.0E+00	---	0.0E+00	0%	0%
Trichloroethene	0.000104554	30	350	10950	25550	1.0E-04	4.3E-05	0.0E+00	6.0E-03	---	2.6E-07	0%	63%
Tetrachloroethene	1.19596E-05	30	350	10950	25550	1.1E-05	4.9E-06	0.0E+00	2.0E-03	---	1.0E-08	0%	2%
1,1,2,2-Tetrachloroethane	1.72389E-06	30	350	10950	25550	1.7E-06	7.1E-07	0.0E+00	2.0E-01	---	1.4E-07	0%	35%
									TOTAL	0.0E+00	4.1E-07		

SURFACE WATER INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO.6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT AND FUTURE ADULT RESIDENT

The intake from the ingestion of surface water is calculated as follows:

Intake (mg/kg-day) = Cw * CR * ET * EF * ED/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:		INPUT
Cw = contaminant concentration in surface water (mg/l)		
CR = ingestion rate (Liter/hour)		0.005
ET = exposure time (hours/event)		2.6
EF = exposure frequency (events/yr)		45
ED = exposure duration (yrs)		30
BW = body weight (kg)		70
ATc = averaging time for carcinogen (yr)		70
ATnc = averaging time for noncarcinogen (yr)		30
DY = days per year (days)		365
CSF = cancer slope factor (mg/kg-day)-1	specific	
RfD = reference dose (mg/kg-day)	specific	

COPC	Concentration Carcinogen (mg/l)	Contact Rate (l/hour)	Exposure Time (hrs/event)	Exposure Frequency (events/yr)	Exposure Duration (years)	Body Weight (kg)	Average Carc Time (days)	Carc Dose (mg/kg-da	Cancer Slope Factor (mg/kg-day)-1	Carcinogenic Risk	Percent Carcinogenic Risk	Averaging Tim Noncarc. (days)	Noncarc Dose (mg/kg-day)	Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
1,2-Dichloroethene (total)	0.006	0.005	2.6	45	30	70	25550	5.8E-08	0.0E+00	0.0E+00	0%	10950	1.3E-07	9.0E-03	1.5E-05	1%
Antimony	0.004	0.005	2.6	45	30	70	25550	3.8E-08	0.0E+00	0.0E+00	0%	10950	8.9E-08	4.0E-04	2.2E-04	10%
Barium	0.032	0.005	2.6	45	30	70	25550	3.2E-07	0.0E+00	0.0E+00	0%	10950	7.4E-07	7.0E-02	1.1E-05	0%
Iron	3.990	0.005	2.6	45	30	70	25550	3.9E-05	0.0E+00	0.0E+00	0%	10950	9.1E-05	3.0E-01	3.0E-04	14%
Manganese (water)	0.126	0.005	2.6	45	30	70	25550	1.2E-06	0.0E+00	0.0E+00	0%	10950	2.9E-06	1.4E-01	2.1E-05	1%
Molybdenum	0.065	0.005	2.6	45	30	70	25550	6.4E-07	0.0E+00	0.0E+00	0%	10950	1.5E-06	5.0E-03	3.0E-04	14%
Vanadium	0.387	0.005	2.6	45	30	70	25550	3.8E-06	0.0E+00	0.0E+00	0%	10950	8.9E-06	7.0E-03	1.3E-03	59%
TOTAL										0.0E+00					2.1E-03	

SURFACE WATER DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO.6 (SITE 36)
REMEDIAL INVESTIGATION - CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT AND FUTURE ADULT RESIDENT

The intake from dermal contact with surface water is calculated as follows:

Intake (mg/kg-day) = Cw * SA * PC * ET * EF * ED * CF/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
CW = contaminant concentration in water (mg/l)	
SA = skin surface available for contact (cm2)	5800
PC = contaminant specific dermal permability (cm/hr)	Specific
ET = exposure time (hours/day)	2.6
EF = exposure frequency (days/yr)	45
ED = exposure duration (years)	30
CF = volumetric conversion factor for water (1liter/1000 cm3)	0.001
BW = body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	30
DY = days per year (days)	365
CSF = cancer slope factor (mg/kg-day)-1	Specific
RfD = reference dose (mg/kg-day)	Specific

COPC	Concentration (mg/l)	Surface Area (cm2)	Dermal Permeability (cm/hr)	Exposure Time (hours/day)	Exposure Frequency (days/yr)	Exposure Duration (years)	Volumetric Conversion (L/m3)	Body Weight (kg)	Averaging Carc Time (days)	Carc Dose (mg/kg-day)	Dermal Adjust. Slope Factor (mg/kg-day)-1	Carcinogenic Risk	Percent Carcinogenic Risk	Average Noncarc Time (days)	Noncarc Dose (mg/kg-day)	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarc Risk	Percent Noncarcinogenic Risk
1,2-Dichloroethene (total)	0.006	5800	1.0E-02	2.6	45	30	0.001	70	25550	6.7E-07	0.0E+00	0.0E+00	0%	10950	1.6E-06	7.2E-03	2.2E-04	2%
Antimony	0.004	5800	1.0E-03	2.6	45	30	0.001	70	25550	4.4E-08	0.0E+00	0.0E+00	0%	10950	1.0E-07	8.0E-05	1.3E-03	10%
Barium	0.032	5800	1.0E-03	2.6	45	30	0.001	70	25550	3.7E-07	0.0E+00	0.0E+00	0%	10950	8.6E-07	1.4E-02	6.1E-05	0%
Iron	3.990	5800	1.0E-03	2.6	45	30	0.001	70	25550	4.5E-05	0.0E+00	0.0E+00	0%	10950	1.1E-04	6.0E-02	1.8E-03	14%
Manganese (water)	0.126	5800	1.0E-03	2.6	45	30	0.001	70	25550	1.4E-06	0.0E+00	0.0E+00	0%	10950	3.3E-06	2.8E-02	1.2E-04	1%
Molybdenum	0.065	5800	1.0E-03	2.6	45	30	0.001	70	25550	7.4E-07	0.0E+00	0.0E+00	0%	10950	1.7E-06	1.0E-03	1.7E-03	14%
Vanadium	0.387	5800	1.0E-03	2.6	45	30	0.001	70	25550	4.4E-06	0.0E+00	0.0E+00	0%	10950	1.0E-05	1.4E-03	7.3E-03	59%
TOTAL												0.0E+00					1.3E-02	

SEDIMENT INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT AND FUTURE RESIDENTIAL ADULT

Intake from ingestion of sediment is calculated as follows:

Intake (mg/kg-day) = C * IR * CF * EF * ED/ BW * ATC or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in sediment (mg/kg)	
CF = conversion for kg to mg	1E-06
EF = exposure frequency (days/yr)	45
ED = exposure duration (yr)	30
IR = soil ingestion rate (mg/day)	100
BW = body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	30
DY = days per year (days/year)	365
CSF = cancer slope factor (mg/kg-day)-1	Specific
RfD = reference dose (mg/kg-day)	Specific

COPC	Concentration (mg/kg)	Exposure Frequency (days/yr)	Exposure Duration (yr)	Ingestion Rate (mg/day)	Conversion Factor (kg/mg)	Body Weight (kg)	Average Carc Time (days)	Carc Dose (mg/kg/day)	Slope Factor (mg/kg/day)-1	Carcinogenic Risk	Percent Carcinogenic Risk	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day)	Reference Dose (mg/kg/day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
Tetrachloroethene	0.004	45	30	100	1E-06	70	25550	3.0E-10	5.2E-02	1.6E-11	0%	10950	7.0E-10	1.0E-02	7.0E-08	0%
Diethylphthalate	1.110	45	30	100	1E-06	70	25550	8.4E-08	0.0E+00	0.0E+00	0%	10950	2.0E-07	8.0E-01	2.4E-07	0%
Anthracene	0.046	45	30	100	1E-06	70	25550	3.5E-09	0.0E+00	0.0E+00	0%	10950	8.1E-09	3.0E-01	2.7E-08	0%
Di-n-butylphthalate	0.218	45	30	100	1E-06	70	25550	1.6E-08	0.0E+00	0.0E+00	0%	10950	3.8E-08	1.0E-01	3.8E-07	0%
Bis(2-ethylhexyl)phthalate	0.328	45	30	100	1E-06	70	25550	2.5E-08	1.4E-02	3.5E-10	0%	10950	5.8E-08	2.0E-02	2.9E-06	0%
Dieldrin	0.052	45	30	100	1E-06	70	25550	3.9E-09	1.6E+01	6.3E-08	17%	10950	9.2E-09	5.0E-05	1.8E-04	1%
4,4'-DDE	1.200	45	30	100	1E-06	70	25550	9.1E-08	3.4E-01	3.1E-08	8%	10950	2.1E-07	0.0E+00	0.0E+00	0%
Endrin	0.007	45	30	100	1E-06	70	25550	5.0E-10	0.0E+00	0.0E+00	0%	10950	1.2E-09	3.0E-04	3.9E-06	0%
4,4'-DDD	1.140	45	30	100	1E-06	70	25550	8.6E-08	2.4E-01	2.1E-08	5%	10950	2.0E-07	0.0E+00	0.0E+00	0%
Endosulfan sulfate	0.003	45	30	100	1E-06	70	25550	2.3E-10	0.0E+00	0.0E+00	0%	10950	5.3E-10	6.0E-03	8.8E-08	0%
4,4'-DDT	0.046	45	30	100	1E-06	70	25550	3.5E-09	3.4E-01	1.2E-09	0%	10950	8.1E-09	5.0E-04	1.6E-05	0%
Endrin ketone	0.011	45	30	100	1E-06	70	25550	8.3E-10	0.0E+00	0.0E+00	0%	10950	1.9E-09	3.0E-04	6.5E-06	0%
Endrin aldehyde	0.008	45	30	100	1E-06	70	25550	5.7E-10	0.0E+00	0.0E+00	0%	10950	1.3E-09	3.0E-04	4.5E-06	0%
alpha-Chlordane	0.013	45	30	100	1E-06	70	25550	9.8E-10	1.3E+00	1.3E-09	0%	10950	2.3E-09	6.0E-05	3.8E-05	0%
Aluminum	19389.170	45	30	100	1E-06	70	25550	1.5E-03	0.0E+00	0.0E+00	0%	10950	3.4E-03	1.0E+00	3.4E-03	22%
Barium	68.510	45	30	100	1E-06	70	25550	5.2E-06	0.0E+00	0.0E+00	0%	10950	1.2E-05	7.0E-02	1.7E-04	1%
Beryllium	0.810	45	30	100	1E-06	70	25550	6.1E-08	4.3E+00	2.6E-07	69%	10950	1.4E-07	5.0E-03	2.9E-05	0%
Cadmium (soil)	3.750	45	30	100	1E-06	70	25550	2.8E-07	0.0E+00	0.0E+00	0%	10950	6.6E-07	1.0E-03	6.6E-04	4%
Cobalt	4.200	45	30	100	1E-06	70	25550	3.2E-07	0.0E+00	0.0E+00	0%	10950	7.4E-07	6.0E-02	1.2E-05	0%
Copper	19.880	45	30	100	1E-06	70	25550	1.5E-06	0.0E+00	0.0E+00	0%	10950	3.5E-06	4.0E-02	8.8E-05	1%
Iron	11661.090	45	30	100	1E-06	70	25550	8.8E-04	0.0E+00	0.0E+00	0%	10950	2.1E-03	3.0E-01	6.8E-03	43%
Lead	3422.990	45	30	100	1E-06	70	25550	2.6E-04	0.0E+00	0.0E+00	0%	10950	6.0E-04	0.0E+00	0.0E+00	0%
Manganese (soil)	45.170	45	30	100	1E-06	70	25550	3.4E-06	0.0E+00	0.0E+00	0%	10950	8.0E-06	1.4E-01	5.7E-05	0%
Mercury	0.660	45	30	100	1E-06	70	25550	5.0E-08	0.0E+00	0.0E+00	0%	10950	1.2E-07	3.0E-04	3.9E-04	2%
Nickel	25.810	45	30	100	1E-06	70	25550	1.9E-06	0.0E+00	0.0E+00	0%	10950	4.5E-06	2.0E-02	2.3E-04	1%
Selenium	0.710	45	30	100	1E-06	70	25550	5.4E-08	0.0E+00	0.0E+00	0%	10950	1.3E-07	5.0E-03	2.5E-05	0%
Thallium	0.650	45	30	100	1E-06	70	25550	4.9E-08	0.0E+00	0.0E+00	0%	10950	1.1E-07	8.0E-05	1.4E-03	9%
Vanadium	83.120	45	30	100	1E-06	70	25550	6.3E-08	0.0E+00	0.0E+00	0%	10950	1.5E-05	7.0E-03	2.1E-03	13%
Zinc	140.000	45	30	100	1E-06	70	25550	1.1E-05	0.0E+00	0.0E+00	0%	10950	2.5E-05	3.0E-01	8.2E-05	1%
TOTAL										3.8E-07					1.6E-02	

SEDIMENT DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT AND FUTURE RESIDENTIAL ADULT

The intake from dermal contact to sediment is calculated as follows:

Intake (mg/kg-day) = C * CF * SA * AF * Abs * EF * ED/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	
CF = conversion factor (kg/mg)	1.00E-06
SA = exposed skin surface area (cm2)	5800
AF = sediment to skin adherence factor (mg/cm2)	1
Abs = fraction absorbed (unitless) (contaminant specific)	Specific
EF = exposure frequency (events/yr)	45
ED = exposure duration (years)	30
BW = body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	30
DY = day per year (day/yr)	365
CSF = cancer slope factor (mg/kg-day)-1	Specific
RfD = reference dose (mg/kg-day)	Specific

COPC	Concentration (mg/kg)	Conversion Factor (kg/mg)	Surface Area (cm2)	Adherence Factor (mg/cm2)	ABS Factor (%)	Exposure Frequency (events/yr)	Exposure Duration (yrs)	Body Weight (kg)	Average Carc Time (days)	Carc Dose (mg/kg/day)	Dermal Adjust. Slope Factor (mg/kg-day)-1	Carcinogenic Risk	Percent Carcinogenic Risk	Average Noncarc Tim (days)	Noncarc Dose (mg/kg/day)	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinogeni Risk
Tetrachloroethene	0.004	1E-06	5800	1	0.01	45	30	70	25550	1.8E-10	6.5E-02	1.1E-11	0%	10950	4.1E-10	8.0E-03	5.1E-08	0%
Diethylphthalate	1.110	1E-06	5800	1	0.01	45	30	70	25550	4.9E-08	0.0E+00	0.0E+00	0%	10950	1.1E-07	4.0E-01	2.8E-07	0%
Anthracene	0.046	1E-06	5800	1	0.01	45	30	70	25550	2.0E-09	0.0E+00	0.0E+00	0%	10950	4.7E-09	1.5E-01	3.1E-08	0%
Di-n-butylphthalate	0.218	1E-06	5800	1	0.01	45	30	70	25550	9.5E-09	0.0E+00	0.0E+00	0%	10950	2.2E-08	5.0E-02	4.5E-07	0%
Bis(2-ethylhexyl)phthalate	0.328	1E-06	5800	1	0.01	45	30	70	25550	1.4E-08	2.8E-02	4.0E-10	0%	10950	3.4E-08	1.0E-02	3.4E-06	0%
Dieldrin	0.052	1E-06	5800	1	0.01	45	30	70	25550	2.3E-09	3.2E+01	7.3E-08	34%	10950	5.3E-09	2.5E-05	2.1E-04	4%
4,4'-DDE	1.200	1E-06	5800	1	0.01	45	30	70	25550	5.3E-08	6.8E-01	3.6E-08	17%	10950	1.2E-07	0.0E+00	0.0E+00	0%
Endrin	0.007	1E-06	5800	1	0.01	45	30	70	25550	2.9E-10	0.0E+00	0.0E+00	0%	10950	6.7E-10	1.5E-04	4.5E-06	0%
4,4'-DDD	1.140	1E-06	5800	1	0.01	45	30	70	25550	5.0E-08	4.8E-01	2.4E-08	11%	10950	1.2E-07	0.0E+00	0.0E+00	0%
Endosulfan sulfate	0.003	1E-06	5800	1	0.01	45	30	70	25550	1.3E-10	0.0E+00	0.0E+00	0%	10950	3.1E-10	3.0E-03	1.0E-07	0%
4,4'-DDT	0.046	1E-06	5800	1	0.01	45	30	70	25550	2.0E-09	6.8E-01	1.4E-09	1%	10950	4.7E-09	2.5E-04	1.9E-05	0%
Endrin ketone	0.011	1E-06	5800	1	0.01	45	30	70	25550	4.8E-10	0.0E+00	0.0E+00	0%	10950	1.1E-09	1.5E-04	7.5E-06	0%
Endrin aldehyde	0.008	1E-06	5800	1	0.01	45	30	70	25550	3.3E-10	0.0E+00	0.0E+00	0%	10950	7.8E-10	1.5E-04	5.2E-06	0%
alpha-Chlordane	0.013	1E-06	5800	1	0.01	45	30	70	25550	5.7E-10	2.6E+00	1.5E-09	1%	10950	1.3E-09	3.0E-05	4.4E-05	1%
Aluminum	19389.170	1E-06	5800	1	0.001	45	30	70	25550	8.5E-05	0.0E+00	0.0E+00	0%	10950	2.0E-04	2.0E-01	9.9E-04	21%
Barium	68.510	1E-06	5800	1	0.001	45	30	70	25550	3.0E-07	0.0E+00	0.0E+00	0%	10950	7.0E-07	1.4E-02	5.0E-05	1%
Beryllium	0.810	1E-06	5800	1	0.001	45	30	70	25550	3.5E-09	2.1E+01	7.6E-08	36%	10950	8.3E-09	1.0E-03	8.3E-06	0%
Cadmium (soil)	3.750	1E-06	5800	1	0.001	45	30	70	25550	1.6E-08	0.0E+00	0.0E+00	0%	10950	3.8E-08	2.0E-04	1.9E-04	4%
Cobalt	4.200	1E-06	5800	1	0.001	45	30	70	25550	1.8E-08	0.0E+00	0.0E+00	0%	10950	4.3E-08	1.2E-02	3.6E-06	0%
Copper	19.880	1E-06	5800	1	0.001	45	30	70	25550	8.7E-08	0.0E+00	0.0E+00	0%	10950	2.0E-07	8.0E-03	2.5E-05	1%
Iron	11661.090	1E-06	5800	1	0.001	45	30	70	25550	5.1E-05	0.0E+00	0.0E+00	0%	10950	1.2E-04	6.0E-02	2.0E-03	41%
Lead	3422.990	1E-06	5800	1	0.001	45	30	70	25550	1.5E-05	0.0E+00	0.0E+00	0%	10950	3.5E-05	0.0E+00	0.0E+00	0%
Manganese (soil)	45.170	1E-06	5800	1	0.001	45	30	70	25550	2.0E-07	0.0E+00	0.0E+00	0%	10950	4.6E-07	2.8E-02	1.6E-05	0%
Mercury	0.660	1E-06	5800	1	0.001	45	30	70	25550	2.9E-09	0.0E+00	0.0E+00	0%	10950	6.7E-09	6.0E-05	1.1E-04	2%
Nickel	25.810	1E-06	5800	1	0.001	45	30	70	25550	1.1E-07	0.0E+00	0.0E+00	0%	10950	2.6E-07	4.0E-03	6.6E-05	1%
Selenium	0.710	1E-06	5800	1	0.001	45	30	70	25550	3.1E-09	0.0E+00	0.0E+00	0%	10950	7.3E-09	1.0E-03	7.3E-06	0%
Thallium	0.650	1E-06	5800	1	0.001	45	30	70	25550	2.8E-09	0.0E+00	0.0E+00	0%	10950	6.6E-09	1.6E-05	4.1E-04	9%
Vanadium	83.120	1E-06	5800	1	0.001	45	30	70	25550	3.6E-07	0.0E+00	0.0E+00	0%	10950	8.5E-07	1.4E-03	6.1E-04	13%
Zinc	140.000	1E-06	5800	1	0.001	45	30	70	25550	6.1E-07	0.0E+00	0.0E+00	0%	10950	1.4E-06	6.0E-02	2.4E-05	0%
TOTAL												2.1E-07					4.8E-03	

CURRENT/FUTURE FISHERMAN

SURFACE WATER INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
FISHERMAN

The intake from the ingestion of surface water is calculated as follows:

Intake (mg/kg-day) = Cw * CR * ET * EF * ED/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:		INPUT
Cw = contaminant concentration in surface water (mg/l)		
IR = ingestion rate (Liter/hour)		0.005
ET = exposure time (hours/event)		2.6
EF = exposure frequency (events/yr)		48
ED = exposure duration (yrs)		30
BW = body weight (kg)		70
ATc = averaging time for carcinogen (yr)		70
ATnc = averaging time for noncarcinogen (yr)		30
DY = days per year (days)		365
CSF = cancer slope factor (mg/kg-day)-1	specific	
RfD = reference dose (mg/kg-day)	specific	

COPC	Concentration (mg/l)	Contact Rate (l/hour)	Exposure Time (hrs/event)	Exposure Frequency (events/yr)	Exposure Duration (years)	Body Weight (kg)	Average Carc Time (days)	Carc Dose (mg/kg-day)	Cancer Slope Factor (mg/kg-day)-1	Carcinogenic Risk	Percent Carcinogenic Risk	Averaging Time Noncarc. (years)	Noncarc Dose (mg/kg-day)	Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
1,2-Dichloroethene (total)	0.006	0.005	2.6	48	30	70	25550	6.1E-08	0.00E+00	0.0E+00	0%	10950	1.4E-07	9.00E-03	1.6E-05	1%
Antimony	0.004	0.005	2.6	48	30	70	25550	4.1E-08	0.00E+00	0.0E+00	0%	10950	9.5E-08	4.00E-04	2.4E-04	10%
Barium	0.032	0.005	2.6	48	30	70	25550	3.4E-07	0.00E+00	0.0E+00	0%	10950	7.9E-07	7.00E-02	1.1E-05	0%
Iron	3.990	0.005	2.6	48	30	70	25550	4.2E-05	0.00E+00	0.0E+00	0%	10950	9.7E-05	3.00E-01	3.2E-04	14%
Manganese (water)	0.126	0.005	2.6	48	30	70	25550	1.3E-06	0.00E+00	0.0E+00	0%	10950	3.1E-06	1.40E-01	2.2E-05	1%
Molybdenum	0.065	0.005	2.6	48	30	70	25550	6.8E-07	0.00E+00	0.0E+00	0%	10950	1.6E-06	5.00E-03	3.2E-04	14%
Vanadium	0.387	0.005	2.6	48	30	70	25550	4.1E-06	0.00E+00	0.0E+00	0%	10950	9.5E-06	7.00E-03	1.4E-03	59%
TOTAL										0.0E+00					2.3E-03	

SURFACE WATER DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO.6 (SITE 36)
REMEDIAL INVESTIGATION - CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
FISHERMAN

The intake from dermal contact with surface water is calculated as follows:

Intake (mg/kg-day) = Cw * SA * PC * ET * EF * ED * CF/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
CW = contaminant concentration in water (mg/l)	
SA = skin surface available for contact (cm2)	5800
PC = contaminant specific dermal permability (cm/hr)	Specific
ET = exposure time (hours/day)	2.6
EF = exposure frequency (days/yr)	48
ED = exposure duration (years)	30
CF = volumetric conversion factor for water (1liter/1000 c	0.001
BW = body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	30
DY = days per year (days)	365
CSF = cancer slope factor (mg/kg-day)-1	Specific
RfD = reference dose (mg/kg-day)	Specific

COPC	Concentration Carcinogen (mg/l)	Surface Area (cm2)	Dermal Permeability (cm/hr)	Exposure Time (hours/day)	Exposure Frequency (days/yr)	Exposure Duration (years)	Volumetric Conversion (L/m3)	Body Weight (kg)	Averaging Carc Time (days)	Carc Dose (mg/kg-day)	Dermal Adjust. Slope Factor (mg/kg-day)-1	Carcinogenic Risk	Percent Carcinogenic Risk	Average Noncarc Time (days)	Noncarc Dose (mg/kg-day)	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarc. Risk	Percent Noncarcinogenic Risk
1,2-Dichloroethene (total)	0.006	5800	1.0E-02	2.6	48	30	0.001	70	25550	7.1E-07	0.00E+00	0.0E+00	0%	10950	1.7E-06	7.20E-03	2.3E-04	2%
Antimony	0.004	5800	1.0E-03	2.6	48	30	0.001	70	25550	4.7E-08	0.00E+00	0.0E+00	0%	10950	1.1E-07	8.00E-05	1.4E-03	10%
Barium	0.032	5800	1.0E-03	2.6	48	30	0.001	70	25550	3.9E-07	0.00E+00	0.0E+00	0%	10950	9.2E-07	1.40E-02	6.6E-05	0%
Iron	3.990	5800	1.0E-03	2.6	48	30	0.001	70	25550	4.8E-05	0.00E+00	0.0E+00	0%	10950	1.1E-04	6.00E-02	1.9E-03	14%
Manganese (water)	0.126	5800	1.0E-03	2.6	48	30	0.001	70	25550	1.5E-06	0.00E+00	0.0E+00	0%	10950	3.6E-06	2.80E-02	1.3E-04	1%
Molybdenum	0.065	5800	1.0E-03	2.6	48	30	0.001	70	25550	7.9E-07	0.00E+00	0.0E+00	0%	10950	1.8E-06	1.00E-03	1.8E-03	14%
Vanadium	0.387	5800	1.0E-03	2.6	48	30	0.001	70	25550	4.7E-06	0.00E+00	0.0E+00	0%	10950	1.1E-05	1.40E-03	7.8E-03	59%
TOTAL												0.0E+00					1.3E-02	

SEDIMENT INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
FISHERMAN

Intake from ingestion of sediment is calculated as follows:

Intake (mg/kg-day) = C * IR * CF * EF * ED/ BW * ATC or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in sediment (mg/kg)	
CF = conversion for kg to mg	1E-06
EF = exposure frequency (days/yr)	48
ED = exposure duration (yr)	30
IR = soil ingestion rate (mg/day)	100
BW = body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	30
DY = days per year (days/year)	365
CSF = cancer slope factor (mg/kg-day)-1	Specific
RfD = reference dose (mg/kg-day)	Specific

COPC	Concentration (mg/kg)	Exposure Frequency (days/yr)	Exposure Duration (yr)	Ingestion Rate (mg/day)	Conversio Factor (kg/mg)	Body Weight (kg)	Average Carc Tim (days)	Carc Dose (mg/kg/da	Slope Factor (mg/kg/day)-1	Carcinogenic Risk	Percent Carcinogenic Risk	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day)	Reference Dose (mg/kg/day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
Tetrachloroethene	0.004	48	30	100	1E-06	70	25550	3.2E-10	5.20E-02	1.7E-11	0%	10950	7.5E-10	1.00E-02	7.5E-08	0%
Diethylphthalate	1.110	48	30	100	1E-06	70	25550	8.9E-08	0.00E+00	0.0E+00	0%	10950	2.1E-07	8.00E-01	2.6E-07	0%
Anthracene	0.046	48	30	100	1E-06	70	25550	3.7E-09	0.00E+00	0.0E+00	0%	10950	8.6E-09	3.00E-01	2.9E-08	0%
Di-n-butylphthalate	0.218	48	30	100	1E-06	70	25550	1.8E-08	0.00E+00	0.0E+00	0%	10950	4.1E-08	1.00E-01	4.1E-07	0%
Bis(2-ethylhexyl)phthalate	0.328	48	30	100	1E-06	70	25550	2.6E-08	1.40E-02	3.7E-10	0%	10950	6.2E-08	2.00E-02	3.1E-06	0%
Dieldrin	0.052	48	30	100	1E-06	70	25550	4.2E-09	1.60E+01	6.7E-08	17%	10950	9.8E-09	5.00E-05	2.0E-04	1%
4,4'-DDE	1.200	48	30	100	1E-06	70	25550	9.7E-08	3.40E-01	3.3E-08	8%	10950	2.3E-07	0.00E+00	0.0E+00	0%
Endrin	0.007	48	30	100	1E-06	70	25550	5.3E-10	0.00E+00	0.0E+00	0%	10950	1.2E-09	3.00E-04	4.1E-06	0%
4,4'-DDD	1.140	48	30	100	1E-06	70	25550	9.2E-08	2.40E-01	2.2E-08	5%	10950	2.1E-07	0.00E+00	0.0E+00	0%
Endosulfan sulfate	0.003	48	30	100	1E-06	70	25550	2.4E-10	0.00E+00	0.0E+00	0%	10950	5.6E-10	6.00E-03	9.4E-08	0%
4,4'-DDT	0.046	48	30	100	1E-06	70	25550	3.7E-09	3.40E-01	1.3E-09	0%	10950	8.6E-09	5.00E-04	1.7E-05	0%
Endrin ketone	0.011	48	30	100	1E-06	70	25550	8.9E-10	0.00E+00	0.0E+00	0%	10950	2.1E-09	3.00E-04	6.9E-06	0%
Endrin aldehyde	0.008	48	30	100	1E-06	70	25550	6.1E-10	0.00E+00	0.0E+00	0%	10950	1.4E-09	3.00E-04	4.8E-06	0%
alpha-Chlordane	0.013	48	30	100	1E-06	70	25550	1.0E-09	1.30E+00	1.4E-09	0%	10950	2.4E-09	6.00E-05	4.1E-05	0%
Aluminum	19389.170	48	30	100	1E-06	70	25550	1.6E-03	0.00E+00	0.0E+00	0%	10950	3.6E-03	1.00E+00	3.6E-03	22%
Barium	68.510	48	30	100	1E-06	70	25550	5.5E-06	0.00E+00	0.0E+00	0%	10950	1.3E-05	7.00E-02	1.8E-04	1%
Beryllium	0.810	48	30	100	1E-06	70	25550	6.5E-08	4.30E+00	2.8E-07	69%	10950	1.5E-07	5.00E-03	3.0E-05	0%
Cadmium (soil)	3.750	48	30	100	1E-06	70	25550	3.0E-07	0.00E+00	0.0E+00	0%	10950	7.0E-07	1.00E-03	7.0E-04	4%
Cobalt	4.200	48	30	100	1E-06	70	25550	3.4E-07	0.00E+00	0.0E+00	0%	10950	7.9E-07	6.00E-02	1.3E-05	0%
Copper	19.880	48	30	100	1E-06	70	25550	1.6E-06	0.00E+00	0.0E+00	0%	10950	3.7E-06	4.00E-02	9.3E-05	1%
Iron	11661.090	48	30	100	1E-06	70	25550	9.4E-04	0.00E+00	0.0E+00	0%	10950	2.2E-03	3.00E-01	7.3E-03	43%
Lead	3422.990	48	30	100	1E-06	70	25550	2.8E-04	0.00E+00	0.0E+00	0%	10950	6.4E-04	0.00E+00	0.0E+00	0%
Manganese (soil)	45.170	48	30	100	1E-06	70	25550	3.6E-06	0.00E+00	0.0E+00	0%	10950	8.5E-06	1.40E-01	6.1E-05	0%
Mercury	0.660	48	30	100	1E-06	70	25550	5.3E-08	0.00E+00	0.0E+00	0%	10950	1.2E-07	3.00E-04	4.1E-04	2%
Nickel	25.810	48	30	100	1E-06	70	25550	2.1E-06	0.00E+00	0.0E+00	0%	10950	4.8E-06	2.00E-02	2.4E-04	1%
Selenium	0.710	48	30	100	1E-06	70	25550	5.7E-08	0.00E+00	0.0E+00	0%	10950	1.3E-07	5.00E-03	2.7E-05	0%
Thallium	0.650	48	30	100	1E-06	70	25550	5.2E-08	0.00E+00	0.0E+00	0%	10950	1.2E-07	8.00E-05	1.5E-03	9%
Vanadium	83.120	48	30	100	1E-06	70	25550	6.7E-06	0.00E+00	0.0E+00	0%	10950	1.6E-05	7.00E-03	2.2E-03	13%
Zinc	140.000	48	30	100	1E-06	70	25550	1.1E-05	0.00E+00	0.0E+00	0%	10950	2.6E-05	3.00E-01	8.8E-05	1%
TOTAL										4.1E-07					1.7E-02	

SEDIMENT DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
FISHERMAN

The intake from dermal contact to sediment is calculted as follows:

Intake (mg/kg-day) = C * CF * SA * AF * Abs * EF * ED/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	
CF = conversion factor (kg/mg)	1.00E-06
SA = exposed skin surface area (cm2)	5800
AF = sediment to skin adherence factor (mg/cm2)	1
Abs = fraction absorbed (unitless) (contaminant specific)	Specific
EF = exposure frequency (events/yr)	48
ED = expsosure duration (years)	30
BW = body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	30
DY = day per year (day/yr)	365
CSF = cancer slope factor (mg/kg-day)-1	Specific
RfD = reference dose (mg/kg-day)	Specific

COPC	Concentration (mg/kg)	Conversion Factor (kg/mg)	Surface Area (cm2)	Adherence Factor (mg/cm2)	ABS Factor (%)	Exposure Frequency (events/yr)	Exposure Duration (yrs)	Body Weight (kg)	Average Carc Time (days)	Carc Dose (mg/kg/day)	Dermal Adjust Slope Factor (mg/kg-day)-1	Carcinogenic Risk	Percent Carcinogenic Risk	Average Noncarc Tim (days)	Noncarc Dose (mg/kg/day)	Dermally-Adjusted Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
Tetrachloroethene	0.004	1E-06	5800	1	0.01	48	30	70	25550	1.9E-10	6.50E-02	1.2E-11	0%	10950	4.4E-10	8.00E-03	5.4E-08	0%
Diethylphthalate	1.110	1E-06	5800	1	0.01	48	30	70	25550	5.2E-08	0.00E+00	0.0E+00	0%	10950	1.2E-07	4.00E-01	3.0E-07	0%
Anthracene	0.046	1E-06	5800	1	0.01	48	30	70	25550	2.1E-09	0.00E+00	0.0E+00	0%	10950	5.0E-09	1.50E-01	3.3E-08	0%
Di-n-butylphthalate	0.218	1E-06	5800	1	0.01	48	30	70	25550	1.0E-08	0.00E+00	0.0E+00	0%	10950	2.4E-08	5.00E-02	4.8E-07	0%
Bis(2-ethylhexyl)phthalate	0.328	1E-06	5800	1	0.01	48	30	70	25550	1.5E-08	2.80E-02	4.3E-10	0%	10950	3.6E-08	1.00E-02	3.6E-06	0%
Dieldrin	0.052	1E-06	5800	1	0.01	48	30	70	25550	2.4E-09	3.20E+01	7.8E-08	34%	10950	5.7E-09	2.50E-05	2.3E-04	4%
4,4'-DDE	1.200	1E-06	5800	1	0.01	48	30	70	25550	5.6E-08	6.80E-01	3.8E-08	17%	10950	1.3E-07	0.00E+00	0.0E+00	0%
Endrin	0.007	1E-06	5800	1	0.01	48	30	70	25550	3.1E-10	0.00E+00	0.0E+00	0%	10950	7.2E-10	1.50E-04	4.8E-06	0%
4,4'-DDD	1.140	1E-06	5800	1	0.01	48	30	70	25550	5.3E-08	4.80E-01	2.6E-08	11%	10950	1.2E-07	0.00E+00	0.0E+00	0%
Endosulfan sulfate	0.003	1E-06	5800	1	0.01	48	30	70	25550	1.4E-10	0.00E+00	0.0E+00	0%	10950	3.3E-10	3.00E-03	1.1E-07	0%
4,4'-DDT	0.046	1E-06	5800	1	0.01	48	30	70	25550	2.1E-09	6.80E-01	1.5E-09	1%	10950	5.0E-09	2.50E-04	2.0E-05	0%
Endrin ketone	0.011	1E-06	5800	1	0.01	48	30	70	25550	5.1E-10	0.00E+00	0.0E+00	0%	10950	1.2E-09	1.50E-04	8.0E-06	0%
Endrin aldehyde	0.008	1E-06	5800	1	0.01	48	30	70	25550	3.5E-10	0.00E+00	0.0E+00	0%	10950	8.3E-10	1.50E-04	5.5E-06	0%
alpha-Chlordane	0.013	1E-06	5800	1	0.01	48	30	70	25550	6.1E-10	2.60E+00	1.6E-09	1%	10950	1.4E-09	3.00E-05	4.7E-05	1%
Aluminum	19389.170	1E-06	5800	1	0.001	48	30	70	25550	9.1E-05	0.00E+00	0.0E+00	0%	10950	2.1E-04	2.00E-01	1.1E-03	21%
Barium	68.510	1E-06	5800	1	0.001	48	30	70	25550	3.2E-07	0.00E+00	0.0E+00	0%	10950	7.5E-07	1.40E-02	5.3E-05	1%
Beryllium	0.810	1E-06	5800	1	0.001	48	30	70	25550	3.8E-09	2.15E+01	8.1E-08	36%	10950	8.8E-09	1.00E-03	8.8E-06	0%
Cadmium (soil)	3.750	1E-06	5800	1	0.001	48	30	70	25550	1.8E-08	0.00E+00	0.0E+00	0%	10950	4.1E-08	2.00E-04	2.0E-04	4%
Cobalt	4.200	1E-06	5800	1	0.001	48	30	70	25550	2.0E-08	0.00E+00	0.0E+00	0%	10950	4.6E-08	1.20E-02	3.8E-06	0%
Copper	19.880	1E-06	5800	1	0.001	48	30	70	25550	9.3E-08	0.00E+00	0.0E+00	0%	10950	2.2E-07	8.00E-03	2.7E-05	1%
Iron	11661.090	1E-06	5800	1	0.001	48	30	70	25550	5.4E-05	0.00E+00	0.0E+00	0%	10950	1.3E-04	6.00E-02	2.1E-03	41%
Lead	3422.990	1E-06	5800	1	0.001	48	30	70	25550	1.6E-05	0.00E+00	0.0E+00	0%	10950	3.7E-05	0.00E+00	0.0E+00	0%
Manganese (soil)	45.170	1E-06	5800	1	0.001	48	30	70	25550	2.1E-07	0.00E+00	0.0E+00	0%	10950	4.9E-07	2.80E-02	1.8E-05	0%
Mercury	0.660	1E-06	5800	1	0.001	48	30	70	25550	3.1E-09	0.00E+00	0.0E+00	0%	10950	7.2E-09	6.00E-05	1.2E-04	2%
Nickel	25.810	1E-06	5800	1	0.001	48	30	70	25550	1.2E-07	0.00E+00	0.0E+00	0%	10950	2.8E-07	4.00E-03	7.0E-05	1%
Selenium	0.710	1E-06	5800	1	0.001	48	30	70	25550	3.3E-09	0.00E+00	0.0E+00	0%	10950	7.7E-09	1.00E-03	7.7E-06	0%
Thallium	0.650	1E-06	5800	1	0.001	48	30	70	25550	3.0E-09	0.00E+00	0.0E+00	0%	10950	7.1E-09	1.60E-05	4.4E-04	9%
Vanadium	83.120	1E-06	5800	1	0.001	48	30	70	25550	3.9E-07	0.00E+00	0.0E+00	0%	10950	9.1E-07	1.40E-03	6.5E-04	13%
Zinc	140.000	1E-06	5800	1	0.001	48	30	70	25550	6.5E-07	0.00E+00	0.0E+00	0%	10950	1.5E-06	6.00E-02	2.5E-05	0%
TOTAL												2.3E-07					5.1E-03	

FISH INGESTION EXPOSURE ASSESSMENT
OU NO.6 SITE 36
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
FISHERMAN

Intake (mg/kg-day) = CF * IR * FI * EF * ED/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
CF = contaminant concentration in fish (mg/kg)	
IR = adult ingestion rate (kg/meal)	0.284
FI = fraction ingested from contaminated source (unitless)	1
EF = adult exposure frequency (meals/yr)	48
ED = adult exposure duration (years)	30
BW = adult body weight (kg)	70
ATc = averaging time for carcinogen (years)	70
ATnc = averaging time for noncarcinogen (years)	30
DY = days per year (days/yr)	365

COPC	Concentration Carcinogen (mg/kg)	Ingestion Rate (kg/meal) Adult	Fraction Ingestion (%)	Exposure Frequency (meals/yr) Adult	Exposure Duration (years) Adult	Body Weight (kg) Adult	Average Carc Tim (days)	Carc Dose (mg/kg-day) Adult	Slope Factor (mg/kg-day)-1	Carcinogenic Risk Adult	Percent Carcinogenic Risk Adult	Average Noncarc Time (days)	Noncarc Dose (mg/kg-day) Adult	Reference Dose (mg/kg-day)	Noncarcinogeni Risk Adult	Percent Noncarcinogenic Risk Adult
beta-BHC	0.008	0.284	1	48	30	70	25550	1.9E-06	1.8E+00	3.4E-06	1%	10950	4.4E-06	0.0E+00	0.0E+00	0%
gamma-BHC (Lindane)	0.006	0.284	1	48	30	70	25550	1.3E-06	1.3E+00	1.6E-06	0%	10950	2.9E-06	3.0E-04	9.8E-03	0%
Heptachlor	0.004	0.284	1	48	30	70	25550	9.8E-07	4.5E+00	4.4E-06	1%	10950	2.3E-06	5.0E-04	4.6E-03	0%
Aldrin	0.007	0.284	1	48	30	70	25550	1.5E-06	1.7E+01	2.6E-05	5%	10950	3.5E-06	3.0E-05	1.2E-01	2%
Heptachlor epoxide	0.004	0.284	1	48	30	70	25550	8.9E-07	9.1E+00	8.1E-06	2%	10950	2.1E-06	1.3E-05	1.6E-01	3%
Dieldrin	0.025	0.284	1	48	30	70	25550	5.7E-06	1.6E+01	9.1E-05	17%	10950	1.3E-05	5.0E-05	2.7E-01	5%
4,4'-DDE	0.336	0.284	1	48	30	70	25550	7.7E-05	3.4E-01	2.6E-05	5%	10950	1.8E-04	0.0E+00	0.0E+00	0%
Endrin	0.015	0.284	1	48	30	70	25550	3.5E-06	0.0E+00	0.0E+00	0%	10950	8.1E-06	3.0E-04	2.7E-02	1%
4,4'-DDD	0.121	0.284	1	48	30	70	25550	2.8E-05	2.4E-01	6.7E-06	1%	10950	6.5E-05	0.0E+00	0.0E+00	0%
4,4'-DDT	0.015	0.284	1	48	30	70	25550	3.4E-06	3.4E-01	1.2E-06	0%	10950	8.0E-06	5.0E-04	1.6E-02	0%
alpha-Chlordane	0.024	0.284	1	48	30	70	25550	5.4E-06	1.3E+00	7.0E-06	1%	10950	1.3E-05	6.0E-05	2.1E-01	4%
Arsenic	1.027	0.284	1	48	30	70	25550	2.3E-04	1.5E+00	3.5E-04	67%	10950	5.5E-04	3.0E-04	1.8E+00	35%
Cadmium (soil)	0.170	0.284	1	48	30	70	25550	3.9E-05	0.0E+00	0.0E+00	0%	10950	9.1E-05	1.0E-03	9.1E-02	2%
Chromium	2.004	0.284	1	48	30	70	25550	4.6E-04	0.0E+00	0.0E+00	0%	10950	1.1E-03	5.0E-03	2.1E-01	4%
Copper	3.295	0.284	1	48	30	70	25550	7.5E-04	0.0E+00	0.0E+00	0%	10950	1.8E-03	4.0E-02	4.4E-02	1%
Iron	47.300	0.284	1	48	30	70	25550	1.1E-02	0.0E+00	0.0E+00	0%	10950	2.5E-02	3.0E-01	8.4E-02	2%
Mercury	1.003	0.284	1	48	30	70	25550	2.3E-04	0.0E+00	0.0E+00	0%	10950	5.4E-04	3.0E-04	1.8E+00	34%
Selenium	1.076	0.284	1	48	30	70	25550	2.5E-04	0.0E+00	0.0E+00	0%	10950	5.7E-04	5.0E-03	1.1E-01	2%
Silver	1.420	0.284	1	48	30	70	25550	3.2E-04	0.0E+00	0.0E+00	0%	10950	7.6E-04	5.0E-03	1.5E-01	3%
Vanadium	1.246	0.284	1	48	30	70	25550	2.8E-04	0.0E+00	0.0E+00	0%	10950	6.6E-04	7.0E-03	9.5E-02	2%
Zinc	42.037	0.284	1	48	30	70	25550	9.6E-03	0.0E+00	0.0E+00	0%	10950	2.2E-02	3.0E-01	7.5E-02	1%
TOTAL										5.3E-04					5.3E+00	

CRAB INGESTION EXPOSURE ASSESSMENT
OU NO.6 SITE 36
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
FISHERMAN

Intake (mg/kg-day) = CF * IR * FI * EF * ED/BW * ATc or ATnc * DY
Risk = Intake * CSF or /RfD

Where:	INPUTS
CF = contaminant concentration in crab (mg/kg)	
IR = adult ingestion rate (kg/meal)	0.284
FI = fraction ingested from contaminated source (unitless)	1
EF = adult exposure frequency (meals/yr)	48
ED = adult exposure duration (years)	30
BW = adult body weight (kg)	70
ATc = averaging time for carcinogen (years)	70
ATnc = averaging time for noncarcinogen (years)	30
DY = days per year (days/yr)	365

COPC	Concentration Carcinogen (mg/kg)	Ingestion Rate (kg/meal) Adult	Fraction Ingestion (%)	Exposure Frequency (meals/yr) Adult	Exposure Duration (years) Adult	Body Weight (kg) Adult	Average Carc Tim (days)	Carc Dose (mg/kg-day) Adult	Slope Factor (mg/kg-day)-1	Carcinogenic Risk Adult	Percent Carcinogenic Risk Adult	Average Noncarc Time (days)	Noncarc Dose (mg/kg-day) Adult	Reference Dose (mg/kg-day)	Noncarcinogeni Risk Adult	Percent Noncarcinogenic Risk Adult
beta-BHC	0.0089	0.284	1	48	30	70	25550	2.0E-06	1.8E+00	3.7E-06	1%	10950	4.7E-06	0.0E+00	0.0E+00	0%
gamma-BHC (Lindane)	0.0036	0.284	1	48	30	70	25550	8.2E-07	1.3E+00	1.1E-06	0%	10950	1.9E-06	3.0E-04	6.4E-03	0%
Heptachlor	0.0026	0.284	1	48	30	70	25550	5.9E-07	4.5E+00	2.7E-06	0%	10950	1.4E-06	5.0E-04	2.8E-03	0%
Aldrin	0.0023	0.284	1	48	30	70	25550	5.3E-07	1.7E+01	8.9E-06	2%	10950	1.2E-06	3.0E-05	4.1E-02	1%
Dieldrin	0.0094	0.284	1	48	30	70	25550	2.1E-06	1.6E+01	3.4E-05	6%	10950	5.0E-06	5.0E-05	1.0E-01	3%
4,4'-DDE	0.101	0.284	1	48	30	70	25550	2.3E-05	3.4E-01	7.9E-06	1%	10950	5.4E-05	0.0E+00	0.0E+00	0%
4,4'-DDD	0.049	0.284	1	48	30	70	25550	1.1E-05	2.4E-01	2.7E-06	0%	10950	2.6E-05	0.0E+00	0.0E+00	0%
alpha-Chlordane	0.0037	0.284	1	48	30	70	25550	8.5E-07	1.3E+00	1.1E-06	0%	10950	2.0E-06	6.0E-05	3.3E-02	1%
Arsenic	1.4	0.284	1	48	30	70	25550	3.2E-04	1.5E+00	4.8E-04	89%	10950	7.5E-04	3.0E-04	2.5E+00	66%
Cadmium (soil)	0.8	0.284	1	48	30	70	25550	1.8E-04	0.0E+00	0.0E+00	0%	10950	4.3E-04	1.0E-03	4.3E-01	11%
Copper	27.5	0.284	1	48	30	70	25550	6.3E-03	0.0E+00	0.0E+00	0%	10950	1.5E-02	4.0E-02	3.7E-01	10%
Lead	0.61	0.284	1	48	30	70	25550	1.4E-04	0.0E+00	0.0E+00	0%	10950	3.3E-04	0.0E+00	0.0E+00	0%
Selenium	0.8	0.284	1	48	30	70	25550	1.8E-04	0.0E+00	0.0E+00	0%	10950	4.3E-04	5.0E-03	8.5E-02	2%
Zinc	130	0.284	1	48	30	70	25550	3.0E-02	0.0E+00	0.0E+00	0%	10950	6.9E-02	3.0E-01	2.3E-01	6%
TOTAL										5.4E-04					3.8E+00	

CURRENT/FUTURE CONSTRUCTION WORKER

SURFACE SOIL INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT CONSTRUCTION WORKER

Intake from ingestion of soil is calculated as follows:

Intake (mg/kg-day) = C * CF * EF * ED * IR/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	
CF = conversion for kg to mg	1E-06
EF = adult exposure frequency (days/yr)	90
ED = adult exposure duration (yr)	1
IR = adult soil ingestion rate (mg/day)	480
BW = adult body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	1
DY = days per year (days/year)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

COPC	Concentration Carcinogen (mg/kg)	Exposure Frequency (days/yr) Adult	Exposure Duration (yr) Adult	Conversion Factor (kg/mg)	Ingestion Rate (mg/day) Adult	Body Weight (kg) Adult	Average Carc Time (days)	Carc Dose (mg/kg/da Adult	Slope Factor (mg/kg/da	Carcinoge Risk Adult	Percent Carcinogenic Risk Adult	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day) Adult	Reference Dose (mg/kg/day)	Noncarcinogenic Risk Adult	Percent Noncarcinoge Risk Adult
n-Nitroso-di-n-propylamin	0.218	90	1	1E-06	480	70	25550	5.3E-09	7.0E+00	3.7E-08	12%	365	3.7E-07	0.0E+00	0.0E+00	0%
Benzo(a)anthracene	0.266	90	1	1E-06	480	70	25550	6.4E-09	7.3E-01	4.7E-09	1%	365	4.5E-07	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	0.262	90	1	1E-06	480	70	25550	6.3E-09	7.3E-01	4.6E-09	1%	365	4.4E-07	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	0.263	90	1	1E-06	480	70	25550	6.4E-09	7.3E+00	4.6E-08	15%	365	4.4E-07	0.0E+00	0.0E+00	0%
Dibenzo(a,h)anthracene	0.228	90	1	1E-06	480	70	25550	5.5E-09	7.3E+00	4.0E-08	13%	365	3.9E-07	0.0E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	0.257	90	1	1E-06	480	70	25550	6.2E-09	7.3E-01	4.5E-09	1%	365	4.3E-07	0.0E+00	0.0E+00	0%
Aldrin	0.004	90	1	1E-06	480	70	25550	1.1E-10	1.7E+01	1.8E-09	1%	365	7.5E-09	3.0E-05	2.5E-04	0%
Dieldrin	0.049	90	1	1E-06	480	70	25550	1.2E-09	1.6E+01	1.9E-08	6%	365	8.2E-08	5.0E-05	1.6E-03	1%
4,4'-DDE	0.440	90	1	1E-06	480	70	25550	1.1E-08	3.4E-01	3.6E-09	1%	365	7.4E-07	0.0E+00	0.0E+00	0%
4,4'-DDT	0.241	90	1	1E-06	480	70	25550	5.8E-09	3.4E-01	2.0E-09	1%	365	4.1E-07	5.0E-04	8.1E-04	1%
alpha-Chlordane	0.014	90	1	1E-06	480	70	25550	3.4E-10	1.3E+00	4.4E-10	0%	365	2.4E-08	6.0E-05	4.0E-04	0%
gamma-Chlordane	0.006	90	1	1E-06	480	70	25550	1.6E-10	1.3E+00	2.0E-10	0%	365	1.1E-08	6.0E-05	1.8E-04	0%
Aroclor-1248	0.291	90	1	1E-06	480	70	25550	7.0E-09	7.7E+00	5.4E-08	17%	365	4.9E-07	0.0E+00	0.0E+00	0%
Aroclor-1254	0.051	90	1	1E-06	480	70	25550	1.2E-09	7.7E+00	9.4E-09	3%	365	8.6E-08	2.0E-05	4.3E-03	4%
Aluminum	5808.712	90	1	1E-06	480	70	25550	1.4E-04	0.0E+00	0.0E+00	0%	365	9.8E-03	1.0E+00	9.8E-03	8%
Antimony	3.379	90	1	1E-06	480	70	25550	8.2E-08	0.0E+00	0.0E+00	0%	365	5.7E-06	4.0E-04	1.4E-02	12%
Arsenic	2.399	90	1	1E-06	480	70	25550	5.8E-08	1.5E+00	8.7E-08	28%	365	4.1E-06	3.0E-04	1.4E-02	11%
Cadmium (soil)	0.713	90	1	1E-06	480	70	25550	1.7E-08	0.0E+00	0.0E+00	0%	365	1.2E-06	1.0E-03	1.2E-03	1%
Chromium	11.294	90	1	1E-06	480	70	25550	2.7E-07	0.0E+00	0.0E+00	0%	365	1.9E-05	5.0E-03	3.8E-03	3%
Copper	98.217	90	1	1E-06	480	70	25550	2.4E-06	0.0E+00	0.0E+00	0%	365	1.7E-04	4.0E-02	4.2E-03	3%
Iron	11299.700	90	1	1E-06	480	70	25550	2.7E-04	0.0E+00	0.0E+00	0%	365	1.9E-02	3.0E-01	6.4E-02	53%
Lead	110.524	90	1	1E-06	480	70	25550	2.7E-06	0.0E+00	0.0E+00	0%	365	1.9E-04	0.0E+00	0.0E+00	0%
Mercury	0.370	90	1	1E-06	480	70	25550	8.9E-09	0.0E+00	0.0E+00	0%	365	6.3E-07	3.0E-04	2.1E-03	2%
TOTAL										3.1E-07					1.2E-01	

SURFACE SOIL DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT CONSTRUCTION WORKER

Dermal contact with soil is calculated as follows:

Intake (mg/kg-day) = C * CF * SA * AF * Abs * EF * ED/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	
CF = conversion factor (kg/mg)	1E-06
SA = adult exposed skin surface area (cm2)	4300
AF = soil to skin adherence factor (mg/cm2)	1
Abs = fraction absorbed (unitless)	Specific
EF = adult exposure frequency (events/yr)	90
ED = adult exposure duration (years)	1
BW = adult body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	1
DY = day per year (day/yr)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

COPC	Concentration Carcinogen (mg/kg)	Conversion Factor (kg/mg)	Surface Area (cm2) Adult	Adherence Factor (mg/cm2)	Fraction Absorbed (%)	Exposure Frequenc (events/yr Adult	Exposure Duration (yrs) Adult	Body Weight (kg) Adult	Average Carc Time (days)	Carc Dose (mg/kg/da Adult	Dermal Adjust Slope Factor (mg/kg-day)-1	Carcinogenic Risk Adult	Percent Carcinogenic Risk Adult	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day) Adult	Dermally-Adju Reference Dose (mg/kg-day)	Noncarcin Risk Adult	Percent Noncarcinogenic Risk Adult
n-Nitroso-di-n-propylamin	0.218	1E-06	4300	1	0.01	90	1	70	25550	4.7E-10	1.4E+01	6.6E-09	15%	365	3.3E-08	0.0E+00	0.0E+00	0%
Benzo(a)anthracene	0.266	1E-06	4300	1	0.01	90	1	70	25550	5.8E-10	1.5E+00	8.4E-10	2%	365	4.0E-08	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	0.262	1E-06	4300	1	0.01	90	1	70	25550	5.7E-10	1.5E+00	8.3E-10	2%	365	4.0E-08	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	0.263	1E-06	4300	1	0.01	90	1	70	25550	5.7E-10	1.5E+01	8.3E-09	19%	365	4.0E-08	0.0E+00	0.0E+00	0%
Dibenzo(a,h)anthracene	0.228	1E-06	4300	1	0.01	90	1	70	25550	4.9E-10	1.5E+01	7.2E-09	16%	365	3.5E-08	0.0E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	0.257	1E-06	4300	1	0.01	90	1	70	25550	5.6E-10	1.5E+00	8.1E-10	2%	365	3.9E-08	0.0E+00	0.0E+00	0%
Aldrin	0.004	1E-06	4300	1	0.01	90	1	70	25550	9.6E-12	3.4E+01	3.3E-10	1%	365	6.7E-10	1.5E-05	4.5E-05	1%
Dieldrin	0.049	1E-06	4300	1	0.01	90	1	70	25550	1.1E-10	3.2E+01	3.4E-09	8%	365	7.4E-09	2.5E-05	3.0E-04	5%
4,4'-DDE	0.440	1E-06	4300	1	0.01	90	1	70	25550	9.5E-10	6.8E-01	6.5E-10	1%	365	6.7E-08	0.0E+00	0.0E+00	0%
4,4'-DDT	0.241	1E-06	4300	1	0.01	90	1	70	25550	5.2E-10	6.8E-01	3.5E-10	1%	365	3.6E-08	2.5E-04	1.5E-04	2%
alpha-Chlordane	0.014	1E-06	4300	1	0.01	90	1	70	25550	3.0E-11	2.6E+00	7.9E-11	0%	365	2.1E-09	3.0E-05	7.1E-05	1%
gamma-Chlordane	0.006	1E-06	4300	1	0.01	90	1	70	25550	1.4E-11	2.6E+00	3.6E-11	0%	365	9.8E-10	3.0E-05	3.3E-05	1%
Aroclor-1248	0.291	1E-06	4300	1	0.01	90	1	70	25550	6.3E-10	1.5E+01	9.7E-09	22%	365	4.4E-08	0.0E+00	0.0E+00	0%
Aroclor-1254	0.051	1E-06	4300	1	0.01	90	1	70	25550	1.1E-10	1.5E+01	1.7E-09	4%	365	7.7E-09	1.0E-05	7.7E-04	12%
Aluminum	5808.712	1E-06	4300	1	0.001	90	1	70	25550	1.3E-06	0.0E+00	0.0E+00	0%	365	8.8E-05	2.0E-01	4.4E-04	7%
Antimony	3.379	1E-06	4300	1	0.001	90	1	70	25550	7.3E-10	0.0E+00	0.0E+00	0%	365	5.1E-08	8.0E-05	6.4E-04	10%
Arsenic	2.399	1E-06	4300	1	0.001	90	1	70	25550	5.2E-10	7.5E+00	3.9E-09	9%	365	3.6E-08	6.0E-05	6.1E-04	9%
Cadmium (soil)	0.713	1E-06	4300	1	0.001	90	1	70	25550	1.5E-10	0.0E+00	0.0E+00	0%	365	1.1E-08	2.0E-04	5.4E-05	1%
Chromium	11.294	1E-06	4300	1	0.001	90	1	70	25550	2.4E-09	0.0E+00	0.0E+00	0%	365	1.7E-07	1.0E-03	1.7E-04	3%
Copper	98.217	1E-06	4300	1	0.001	90	1	70	25550	2.1E-08	0.0E+00	0.0E+00	0%	365	1.5E-06	8.0E-03	1.9E-04	3%
Iron	11299.700	1E-06	4300	1	0.001	90	1	70	25550	2.4E-06	0.0E+00	0.0E+00	0%	365	1.7E-04	6.0E-02	2.9E-03	45%
Lead	110.524	1E-06	4300	1	0.001	90	1	70	25550	2.4E-08	0.0E+00	0.0E+00	0%	365	1.7E-06	0.0E+00	0.0E+00	0%
Mercury	0.370	1E-06	4300	1	0.001	90	1	70	25550	8.0E-11	0.0E+00	0.0E+00	0%	365	5.6E-09	6.0E-05	9.3E-05	1%
TOTAL												4.5E-08					6.4E-03	

SUBSURFACE SOIL PARTICULATE INHALATION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
FUTURE CONSTRUCTION WORKER

Intake from the inhalation of particulates is calculated as follows:

Intake (mg/kg-day) = (C * EF * ED * IR * 1/PEF)/(BW * ATc or ATnc * DY)

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	Specific
CSF = carcinogenic slope factor	Specific
RfD = reference dose for noncarcinogen	Specific
IR = inhalation rate (m3)	20
EF = adult exposure frequency (days)	90
ED = adult exposure duration (years)	1
BW = adult body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	1
DY = day per year (day/yr)	365
PEF = particulate emission factor (m3/kg)	1.32E+09

COPC	Concentration Carcinogen (mg/kg)	Particulate Emission Factor (m3/kg)	Exposure Frequency (events/yr)	Inhalation Rate (m3/day)	Exposure Duration (yrs)	Body Weight (kg)	Average Carc Time (days)	Carc Dose (mg/kg/da	Slope Factor (mg/kg-d	Carcinoge Risk	Percent Conrtribution to Risk	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day)	Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinoge Risk
n-Nitroso-di-n-propylamin	0.218	1.3E+09	90	20	1	70	25550	1.7E-13	0.0E+00	0.0E+00	0%	365	1.2E-11	0.0E+00	0.0E+00	0%
Benzo(a)anthracene	0.266	1.3E+09	90	20	1	70	25550	2.0E-13	6.1E-01	1.2E-13	0%	365	1.4E-11	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	0.262	1.3E+09	90	20	1	70	25550	2.0E-13	6.1E-01	1.2E-13	0%	365	1.4E-11	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	0.263	1.3E+09	90	20	1	70	25550	2.0E-13	6.1E+00	1.2E-12	0%	365	1.4E-11	0.0E+00	0.0E+00	0%
Dibenzo(a,h)anthracene	0.228	1.3E+09	90	20	1	70	25550	1.7E-13	6.1E+00	1.1E-12	0%	365	1.2E-11	0.0E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	0.257	1.3E+09	90	20	1	70	25550	2.0E-13	6.1E-01	1.2E-13	0%	365	1.4E-11	0.0E+00	0.0E+00	0%
Aldrin	0.004	1.3E+09	90	20	1	70	25550	3.4E-15	1.7E+01	5.8E-14	0%	365	2.4E-13	0.0E+00	0.0E+00	0%
Dieldrin	0.049	1.3E+09	90	20	1	70	25550	3.7E-14	1.6E+01	6.0E-13	0%	365	2.6E-12	0.0E+00	0.0E+00	0%
4,4'-DDE	0.440	1.3E+09	90	20	1	70	25550	3.4E-13	0.0E+00	0.0E+00	0%	365	2.4E-11	0.0E+00	0.0E+00	0%
4,4'-DDT	0.241	1.3E+09	90	20	1	70	25550	1.8E-13	3.4E-01	6.2E-14	0%	365	1.3E-11	0.0E+00	0.0E+00	0%
alpha-Chlordane	0.014	1.3E+09	90	20	1	70	25550	1.1E-14	1.3E+00	1.4E-14	0%	365	7.5E-13	0.0E+00	0.0E+00	0%
gamma-Chlordane	0.006	1.3E+09	90	20	1	70	25550	4.9E-15	1.3E+00	6.3E-15	0%	365	3.4E-13	0.0E+00	0.0E+00	0%
Aroclor-1248	0.291	1.3E+09	90	20	1	70	25550	2.2E-13	0.0E+00	0.0E+00	0%	365	1.6E-11	0.0E+00	0.0E+00	0%
Aroclor-1254	0.051	1.3E+09	90	20	1	70	25550	3.9E-14	0.0E+00	0.0E+00	0%	365	2.7E-12	0.0E+00	0.0E+00	0%
Aluminum	5808.712	1.3E+09	90	20	1	70	25550	4.4E-09	0.0E+00	0.0E+00	0%	365	3.1E-07	0.0E+00	0.0E+00	0%
Antimony	3.379	1.3E+09	90	20	1	70	25550	2.6E-12	0.0E+00	0.0E+00	0%	365	1.8E-10	0.0E+00	0.0E+00	0%
Arsenic	2.399	1.3E+09	90	20	1	70	25550	1.8E-12	1.5E+01	2.8E-11	7%	365	1.3E-10	0.0E+00	0.0E+00	0%
Cadmium (soil)	0.713	1.3E+09	90	20	1	70	25550	5.4E-13	0.0E+00	0.0E+00	0%	365	3.8E-11	0.0E+00	0.0E+00	0%
Chromium	11.294	1.3E+09	90	20	1	70	25550	8.6E-12	4.2E+01	3.6E-10	92%	365	6.0E-10	0.0E+00	0.0E+00	0%
Copper	98.217	1.3E+09	90	20	1	70	25550	7.5E-11	0.0E+00	0.0E+00	0%	365	5.2E-09	0.0E+00	0.0E+00	0%
Iron	11299.700	1.3E+09	90	20	1	70	25550	8.6E-09	0.0E+00	0.0E+00	0%	365	6.0E-07	0.0E+00	0.0E+00	0%
Lead	110.524	1.3E+09	90	20	1	70	25550	8.4E-11	0.0E+00	0.0E+00	0%	365	5.9E-09	0.0E+00	0.0E+00	0%
Mercury	0.370	1.3E+09	90	20	1	70	25550	2.8E-13	0.0E+00	0.0E+00	0%	365	2.0E-11	8.6E-05	2.3E-07	100%
TOTAL										3.9E-10					2.3E-07	

SUBSURFACE SOIL INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
FUTURE CONSTRUCTION WORKER

Intake from ingestion of soil is calculated as follows:

Intake (mg/kg-day) = C * CF * EF * ED * IR/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	
CF = conversion for kg to mg	1E-06
EF = adult exposure frequency (days/yr)	90
ED = adult exposure duration (yr)	1
IR = adult soil ingestion rate (mg/day)	480
BW = adult body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	1
DY = days per year (days/year)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

COPC	Concentration Carcinogen (mg/kg)	Exposure Frequency (days/yr) Adult	Exposure Duration (yr) Adult	Conversion Factor (kg/mg)	Ingestion Rate (mg/day) Adult	Body Weight (kg) Adult	Average Carc Time (days)	Carc Dose (mg/kg/day) Adult	Slope Factor (mg/kg/day)-1	Carcinogenic Risk Adult	Percent Carcinogenic Risk Adult	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day) Adult	Reference Dose (mg/kg/day)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
Benzo(a)pyrene	0.210	90	1	1E-06	480	70	25550	5.1E-09	7.3E+00	3.7E-08	12%	365	3.5E-07	0.0E+00	0.0E+00	0%
Dieldrin	0.010	90	1	1E-06	480	70	25550	2.5E-10	1.6E+01	4.0E-09	1%	365	1.8E-08	5.0E-05	3.5E-04	0%
4,4'-DDT	0.061	90	1	1E-06	480	70	25550	1.5E-09	3.4E-01	5.0E-10	0%	365	1.0E-07	5.0E-04	2.0E-04	0%
alpha-Chlordane	0.005	90	1	1E-06	480	70	25550	1.3E-10	1.3E+00	1.7E-10	0%	365	9.1E-09	6.0E-05	1.5E-04	0%
gamma-Chlordane	0.005	90	1	1E-06	480	70	25550	1.2E-10	1.3E+00	1.5E-10	0%	365	8.2E-09	6.0E-05	1.4E-04	0%
Aroclor-1248	0.043	90	1	1E-06	480	70	25550	1.0E-09	7.7E+00	8.1E-09	3%	365	7.3E-08	0.0E+00	0.0E+00	0%
Aluminum	7190.019	90	1	1E-06	480	70	25550	1.7E-04	0.0E+00	0.0E+00	0%	365	1.2E-02	1.0E+00	1.2E-02	4%
Antimony	3.715	90	1	1E-06	480	70	25550	9.0E-08	0.0E+00	0.0E+00	0%	365,	6.3E-06	4.0E-04	1.6E-02	5%
Arsenic	6.837	90	1	1E-06	480	70	25550	1.7E-07	1.5E+00	2.5E-07	80%	365	1.2E-05	3.0E-04	3.9E-02	13%
Beryllium	0.100	90	1	1E-06	480	70	25550	2.4E-09	4.3E+00	1.0E-08	3%	365	1.7E-07	5.0E-03	3.4E-05	0%
Cadmium (soil)	2.109	90	1	1E-06	480	70	25550	5.1E-08	0.0E+00	0.0E+00	0%	365	3.6E-06	1.0E-03	3.6E-03	1%
Chromium	15.919	90	1	1E-06	480	70	25550	3.8E-07	0.0E+00	0.0E+00	0%	365	2.7E-05	5.0E-03	5.4E-03	2%
Copper	344.565	90	1	1E-06	480	70	25550	8.3E-06	0.0E+00	0.0E+00	0%	365	5.8E-04	4.0E-02	1.5E-02	5%
Iron	31266.800	90	1	1E-06	480	70	25550	7.6E-04	0.0E+00	0.0E+00	0%	365	5.3E-02	3.0E-01	1.8E-01	61%
Lead	473.537	90	1	1E-06	480	70	25550	1.1E-05	0.0E+00	0.0E+00	0%	365	8.0E-04	0.0E+00	0.0E+00	0%
Manganese (soil)	506.623	90	1	1E-06	480	70	25550	1.2E-05	0.0E+00	0.0E+00	0%	365	8.6E-04	1.4E-01	6.1E-03	2%
Mercury	0.326	90	1	1E-06	480	70	25550	7.9E-09	0.0E+00	0.0E+00	0%	365	5.5E-07	3.0E-04	1.8E-03	1%
Zinc	2580.000	90	1	1E-06	480	70	25550	6.2E-05	0.0E+00	0.0E+00	0%	365	4.4E-03	3.0E-01	1.5E-02	5%
TOTAL										3.1E-07					2.9E-01	

SUBSURFACE SOIL DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
FUTURE CONSTRUCTION WORKER

Dermal contact with soil is calculated as follows:

Intake (mg/kg-day) = C * CF * SA * AF * Abs * EF * ED/BW * ATc or ATnc * DY

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	
CF = conversion factor (kg/mg)	1E-06
SA = adult exposed skin surface area (cm2)	4300
AF = soil to skin adherence factor (mg/cm2)	1
Abs = fraction absorbed (unitless)	Specific
EF = adult exposure frequency (events/yr)	90
ED = adult exposure duration (years)	1
BW = adult body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	1
DY = day per year (day/yr)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

COPC	Concentration Carcinogen (mg/kg)	Conversion Factor (kg/mg)	Surface Area (cm2) Adult	Adherence Factor (mg/cm2)	Fraction Absorbed (%)	Exposure Frequency (events/yr) Adult	Exposure Duration (yrs) Adult	Body Weight (kg) Adult	Average Carc Time (days)	Carc Dose (mg/kg/day) Adult	Dermal Adjust. Slope Factor (mg/kg-day)-1	Carcinogenic Risk Adult	Percent Carcinogenic Risk Adult	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day) Adult	Dermally-Adjusted Reference Dose (mg/kg-day)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
Benzo(a)pyrene	0.210	1E-06	4300	1	0.01	90	1	70	25550	4.5E-10	1.5E+01	6.6E-09	32%	365	3.2E-08	0.0E+00	0.0E+00	0%
Dieldrin	0.010	1E-06	4300	1	0.01	90	1	70	25550	2.2E-11	3.2E+01	7.2E-10	4%	365	1.6E-09	2.5E-05	6.3E-05	0%
4,4'-DDT	0.061	1E-06	4300	1	0.01	90	1	70	25550	1.3E-10	6.8E-01	8.9E-11	0%	365	9.2E-09	2.5E-04	3.7E-05	0%
alpha-Chlordane	0.005	1E-06	4300	1	0.01	90	1	70	25550	1.2E-11	2.6E+00	3.0E-11	0%	365	8.1E-10	3.0E-05	2.7E-05	0%
gamma-Chlordane	0.005	1E-06	4300	1	0.01	90	1	70	25550	1.1E-11	2.6E+00	2.7E-11	0%	365	7.4E-10	3.0E-05	2.5E-05	0%
Aroclor-1248	0.043	1E-06	4300	1	0.01	90	1	70	25550	9.4E-11	1.5E+01	1.4E-09	7%	365	6.6E-09	0.0E+00	0.0E+00	0%
Aluminum	7190.019	1E-06	4300	1	0.001	90	1	70	25550	1.6E-06	0.0E+00	0.0E+00	0%	365	1.1E-04	2.0E-01	5.4E-04	4%
Antimony	3.715	1E-06	4300	1	0.001	90	1	70	25550	8.0E-10	0.0E+00	0.0E+00	0%	365	5.6E-08	8.0E-05	7.0E-04	5%
Arsenic	6.837	1E-06	4300	1	0.001	90	1	70	25550	1.5E-09	7.5E+00	1.1E-08	54%	365	1.0E-07	6.0E-05	1.7E-03	13%
Beryllium	0.100	1E-06	4300	1	0.001	90	1	70	25550	2.2E-11	2.1E+01	4.7E-10	2%	365	1.5E-09	1.0E-03	1.5E-06	0%
Cadmium (soil)	2.109	1E-06	4300	1	0.001	90	1	70	25550	4.6E-10	0.0E+00	0.0E+00	0%	365	3.2E-08	2.0E-04	1.6E-04	1%
Chromium	15.919	1E-06	4300	1	0.001	90	1	70	25550	3.4E-09	0.0E+00	0.0E+00	0%	365	2.4E-07	1.0E-03	2.4E-04	2%
Copper	344.565	1E-06	4300	1	0.001	90	1	70	25550	7.5E-08	0.0E+00	0.0E+00	0%	365	5.2E-06	8.0E-03	6.5E-04	5%
Iron	31266.800	1E-06	4300	1	0.001	90	1	70	25550	6.8E-06	0.0E+00	0.0E+00	0%	365	4.7E-04	6.0E-02	7.9E-03	60%
Lead	473.537	1E-06	4300	1	0.001	90	1	70	25550	1.0E-07	0.0E+00	0.0E+00	0%	365	7.2E-06	0.0E+00	0.0E+00	0%
Manganese (soil)	506.623	1E-06	4300	1	0.001	90	1	70	25550	1.1E-07	0.0E+00	0.0E+00	0%	365	7.7E-06	2.8E-02	2.7E-04	2%
Mercury	0.326	1E-06	4300	1	0.001	90	1	70	25550	7.0E-11	0.0E+00	0.0E+00	0%	365	4.9E-09	6.0E-05	8.2E-05	1%
Zinc	2580.000	1E-06	4300	1	0.001	90	1	70	25550	5.6E-07	0.0E+00	0.0E+00	0%	365	3.9E-05	6.0E-02	6.5E-04	5%
TOTAL												2.1E-08					1.3E-02	

SUBSURFACE SOIL PARTICULATE INHALATION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
MCB CAMP LEJEUNE, NORTH CAROLINA
FUTURE CONSTRUCTION WORKER

Intake from the inhalation of particulates is calculated as follows:

Intake (mg/kg-day) = (C * EF * ED * IR * 1/PEF)/(BW * ATc or ATnc * DY)

Risk = Intake * CSF or /RfD

Where:	INPUTS
C = contaminant concentration in soil (mg/kg)	Specific
CSF = carcinogenic slope factor	Specific
RfD = reference dose for noncarcinogen	Specific
IR = inhalation rate (m3)	20
EF = adult exposure frequency (days)	90
ED = adult exposure duration (years)	1
BW = adult body weight (kg)	70
ATc = averaging time for carcinogen (yr)	70
ATnc = averaging time for noncarcinogen (yr)	1
DY = day per year (day/yr)	365
PEF = particulate emission factor (m3/kg)	1.32E+09

COPC	Concentration Carcinogen (mg/kg)	Particulate Emission Factor (m3/kg)	Exposure Frequency (events/yr)	Inhalation Rate (m3/day)	Exposure Duration (yrs)	Body Weight (kg)	Average Carc Time (days)	Carc Dose (mg/kg/day)	Slope Factor (mg/kg-day)-1	Carcinogenic Risk	Percent Contribution to Risk	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day)	Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
Benzo(a)pyrene	0.210	1.3E+09	90	20	1	70	25550	1.6E-13	6.1E+00	9.8E-13	0%	365	1.1E-11	0.0E+00	0.0E+00	0%
Dieldrin	0.010	1.3E+09	90	20	1	70	25550	7.9E-15	1.6E+01	1.3E-13	0%	365	5.5E-13	0.0E+00	0.0E+00	0%
4,4'-DDT	0.061	1.3E+09	90	20	1	70	25550	4.6E-14	3.4E-01	1.6E-14	0%	365	3.2E-12	0.0E+00	0.0E+00	0%
alpha-Chlordane	0.005	1.3E+09	90	20	1	70	25550	4.1E-15	1.3E+00	5.3E-15	0%	365	2.9E-13	0.0E+00	0.0E+00	0%
gamma-Chlordane	0.005	1.3E+09	90	20	1	70	25550	3.7E-15	1.3E+00	4.8E-15	0%	365	2.6E-13	0.0E+00	0.0E+00	0%
Aroclor-1248	0.043	1.3E+09	90	20	1	70	25550	3.3E-14	0.0E+00	0.0E+00	0%	365	2.3E-12	0.0E+00	0.0E+00	0%
Aluminum	7190.019	1.3E+09	90	20	1	70	25550	5.5E-09	0.0E+00	0.0E+00	0%	365	3.8E-07	0.0E+00	0.0E+00	0%
Antimony	3.715	1.3E+09	90	20	1	70	25550	2.8E-12	0.0E+00	0.0E+00	0%	365	2.0E-10	0.0E+00	0.0E+00	0%
Arsenic	6.837	1.3E+09	90	20	1	70	25550	5.2E-12	1.5E+01	7.9E-11	13%	365	3.6E-10	0.0E+00	0.0E+00	0%
Beryllium	0.100	1.3E+09	90	20	1	70	25550	7.6E-14	8.4E+00	6.4E-13	0%	365	5.3E-12	0.0E+00	0.0E+00	0%
Cadmium (soil)	2.109	1.3E+09	90	20	1	70	25550	1.6E-12	0.0E+00	0.0E+00	0%	365	1.1E-10	0.0E+00	0.0E+00	0%
Chromium	15.919	1.3E+09	90	20	1	70	25550	1.2E-11	4.2E+01	5.1E-10	86%	365	8.5E-10	0.0E+00	0.0E+00	0%
Copper	344.565	1.3E+09	90	20	1	70	25550	2.6E-10	0.0E+00	0.0E+00	0%	365	1.8E-08	0.0E+00	0.0E+00	0%
Iron	31266.800	1.3E+09	90	20	1	70	25550	2.4E-08	0.0E+00	0.0E+00	0%	365	1.7E-06	0.0E+00	0.0E+00	0%
Lead	473.537	1.3E+09	90	20	1	70	25550	3.6E-10	0.0E+00	0.0E+00	0%	365	2.5E-08	0.0E+00	0.0E+00	0%
Manganese (soil)	506.623	1.3E+09	90	20	1	70	25550	3.9E-10	0.0E+00	0.0E+00	0%	365	2.7E-08	0.0E+00	0.0E+00	0%
Mercury	0.326	1.3E+09	90	20	1	70	25550	2.5E-13	0.0E+00	0.0E+00	0%	365	1.7E-11	8.6E-05	2.0E-07	100%
Zinc	2580.000	1.3E+09	90	20	1	70	25550	2.0E-09	0.0E+00	0.0E+00	0%	365	1.4E-07	0.0E+00	0.0E+00	0%
TOTAL										5.9E-10					2.0E-07	

SHOWER MODEL CALCULATIONS

SHOWER EXPOSURE SCENARIO FOR THE LEACHATE (NONHOT SPOT)

CAS No.	TARGET COMPOUND LIST CONS	OVERALL MASS TRANSFER COEFFICIENT (KL) (cm/hr)	HENRY'S LAW CONSTANT (H) (atm-m3/mol-K)	GAS CONSTANT (R) (at.-m3/mol-K)	ABSOLUTE TEMP. (T1) (K)	GAS CONST. * ABS. TEMP (RT)	GAS-FILM MASS TRANSF. COEFFICIENT (kg) (cm/hr)	LIQUID-FILM MASS TRANS COEFFICIEN (kl) (cm/hr)	CARBON DIOXIDE TRANS. COEFF. (kl-CO2) (cm/hr)	WATER TRANS. COEFF. (kg-H2O) (cm/hr)	MOLECULAR WEIGHT (gram/mole)	RECIPROCAL OF (kl)	(RT)/ ((H)*(kg))	OVERALL M TRANSF. C TEMP. CO (KaL) (cm/hr)	WATER VISCOSITY (AT Ts) (Us) (cp)	WATER VISCOSITY (AT T1) (U1) (cp)	SHOWER WATER TEMP. (Ts) (K)	((T1)*(Us)) ((Ts)*(U1))	CONCENTRATIO LEAVING SHWR DROPLET Cwd (ug/l)	SHOWER WATER CONCENTRATI Cwo (ug/l)	SHOWER DROPLET DIAMETER d (mm)
adult																					
79-01-6	1,2-Dichloroethene (total)	1.13E+01	9.10E-03	8.20E-05	293.0	2.40E-02	1.11E+03	1.16E+01	20.0	3000.0	131.40	8.64E-02	2.38E-03	1.52E+01	0.596	1.002	318.0	5.48E-01	3.61E+00	9.07E+00	1.00
127-18-4	Trichloroethene	1.02E+01	2.90E-02	8.20E-05	293.0	2.40E-02	9.88E+02	1.03E+01	20.0	3000.0	165.80	9.71E-02	8.38E-04	1.38E+01	0.596	1.002	318.0	5.48E-01	4.24E+00	1.15E+01	1.00
79-34-5	Tetrachloroethene	6.17E+00	3.80E-04	8.20E-05	293.0	2.40E-02	9.82E+02	1.02E+01	20.0	3000.0	167.86	9.77E-02	6.44E-02	8.34E+00	0.596	1.002	318.0	5.48E-01	4.85E-01	2.00E+00	1.00
	1,1,2,2-Tetrachloroethane	2.82E-01	1.10E-05	8.20E-05	293.0	2.40E-02	6.44E+02	6.71E+00	20.0	3000.0	390.54	1.49E-01	3.39E+00	3.82E-01	0.596	1.002	318.0	5.48E-01	6.99E-02	5.53E+00	1.00
child																					
79-01-6	1,2-Dichloroethene (total)	1.13E+01	9.10E-03	8.20E-05	293.0	2.40E-02	1.11E+03	1.16E+01	20.0	3000.0	131.40	8.64E-02	2.38E-03	1.52E+01	0.596	1.002	318.0	5.48E-01	3.61E+00	9.07E+00	1.00
127-18-4	Trichloroethene	1.02E+01	2.90E-02	8.20E-05	293.0	2.40E-02	9.88E+02	1.03E+01	20.0	3000.0	165.80	9.71E-02	8.38E-04	1.38E+01	0.596	1.002	318.0	5.48E-01	4.24E+00	1.15E+01	1.00
79-34-5	Tetrachloroethene	6.17E+00	3.80E-04	8.20E-05	293.0	2.40E-02	9.82E+02	1.02E+01	20.0	3000.0	167.86	9.77E-02	6.44E-02	8.34E+00	0.596	1.002	318.0	5.48E-01	4.85E-01	2.00E+00	1.00
	1,1,2,2-Tetrachloroethane	2.82E-01	1.10E-05	8.20E-05	293.0	2.40E-02	6.44E+02	6.71E+00	20.0	3000.0	390.54	1.49E-01	3.39E+00	3.82E-01	0.596	1.002	318.0	5.48E-01	6.99E-02	5.53E+00	1.00

CAS No	TARGET COMPOUND LIST CONSTIT	SHOWER DROPLET DROP TIME ts (sec)	KaL*ts	60*d	-(KaL*ts)/(60*d)	exp [-KaL*ts/60*d]	INDOOR VOC GENERATION RATE (S) (ug/m3-min)	SHOWER WATER FLOW RATE (FR) (liter/min)	SHOWER ROOM AIR VOLUME (SV) (m3)	INDOOR AIR VOC CONC AT TIME t Ca(t) (ug/m3)	AIR EXCHANGE RATE R (min-1)	SHOWER DURATION Ds (min)	TOTAL TIME DURATION t (min)	exp(R(Ds)	exp(-R(t))	INHALATION EXPOSURE PER SHOWER Einh (mg/kg/shwr)	VENTILATION RATE VR (liter/min)	BODY WEIGHT BW (kg)	exp(-R(Dt))	DURATION IN THE SHOWER ROOM Dt (min)	Ds + exp(-RDt)/R	exp(R(Ds-Dt)) /R	(Ds-Dt)	(VR * S)/(BW)(R)(K)
adult																								
78-01-8	1,2-Dichloroethene (total)	2.00	3.04E+01	6.00E+01	-5.07E-01	6.0221E-01	6.01E+00	10	6	2.60E+02	0.0083	12	15	4.06E-01	8.83E-01	8.89E-05	10	70	8.83E-01	15	1.184E+02	1.175E+02	-3	1.03E-04
127-18-4	Trichloroethene	2.00	2.76E+01	6.00E+01	-4.60E-01	6.3132E-01	7.07E+00	10	6	3.06E+02	0.0083	12	15	4.06E-01	8.83E-01	1.05E-04	10	70	8.83E-01	15	1.184E+02	1.175E+02	-3	1.22E-04
79-34-5	Tetrachloroethene	2.00	1.67E+01	6.00E+01	-2.78E-01	7.5737E-01	8.09E-01	10	6	3.50E+01	0.0083	12	15	4.06E-01	8.83E-01	1.20E-05	10	70	8.83E-01	15	1.184E+02	1.175E+02	-3	1.39E-05
	1,1,2,2-Tetrachloroethane	2.00	7.63E-01	6.00E+01	-1.27E-02	9.8738E-01	1.17E-01	10	6	5.04E+00	0.0083	12	15	4.06E-01	8.83E-01	1.72E-06	10	70	8.83E-01	15	1.184E+02	1.175E+02	-3	2.01E-06
child																								
78-01-8	1,2-Dichloroethene (total)	2.00	3.04E+01	6.00E+01	-5.07E-01	6.0221E-01	6.01E+00	10	6	2.60E+02	0.0083	12	15	4.06E-01	8.83E-01	5.39E-04	13	15	8.83E-01	15	1.184E+02	1.175E+02	-3	6.28E-04
127-18-4	Trichloroethene	2.00	2.76E+01	6.00E+01	-4.60E-01	6.3132E-01	7.07E+00	10	6	3.06E+02	0.0083	12	15	4.06E-01	8.83E-01	6.34E-04	13	15	8.83E-01	15	1.184E+02	1.175E+02	-3	7.38E-04
79-34-5	Tetrachloroethene	2.00	1.67E+01	6.00E+01	-2.78E-01	7.5737E-01	8.09E-01	10	6	3.50E+01	0.0083	12	15	4.06E-01	8.83E-01	7.26E-05	13	15	8.83E-01	15	1.184E+02	1.175E+02	-3	8.45E-05
	1,1,2,2-Tetrachloroethane	2.00	7.63E-01	6.00E+01	-1.27E-02	9.8738E-01	1.17E-01	10	6	5.04E+00	0.0083	12	15	4.06E-01	8.83E-01	1.05E-05	13	15	8.83E-01	15	1.184E+02	1.175E+02	-3	1.22E-05

PC VALUES 11-Jan-96

FILE: PCVAL.WQ1

PARAMETER	[CM/HR] linked here	
1,1-Dichloroethane	0.0126	
1,1-Dichloroethene	0.0015	
1,2,4-Trichlorobenzene	0.1000	
1,2-Dichloroethane	0.0053	
1,2-Dichloroethene (total)	0.0100	
1,2-Dichloropropane	0.0225	
1,3-Dichlorobenzene	0.0573	
1,4-Dichlorobenzene	0.0804	
2,4-Dimethylphenol	0.0150	
2,4-Dinitrotoluene	0.1000	
2-Butanone	0.0060	
2-Chlorophenol	0.0300	
2-Methylnaphthalene	0.1422918415	
2-Methylphenol	0.0160	
2-methylnaphthalene	0.1422918415	
4,4'-DDD	0.28	
4,4'-DDE	0.24	
4,4'-DDT	0.43	
4-Methylphenol	0.0180	
Acenaphthene	0.1515653756	
Acenaphthene	1.50E-03	
Acenaphthylene	1.50E-03	
Acetone	0.0015	
Aldrin	0.0016	
Aluminum	0.0010	
Anthracene	0.0015	
Antimony	0.0010	
Arsenic	0.0010	
Barium	0.0010	
Benzene	0.0210	
Benzo(a)anthracene	0.0079	
Benzo(a)pyrene	0.9000	
Benzo(b)fluoranthene	0.6200	
Benzo(g,h,i)perylene	0.0015	
Benzo(k)fluoranthene	0.6200	
Benzoic acid	0.7120	
Beryllium	0.0010	
Bis(2-chloroethyl)ether	0.0021	
Bis(2-ethylhexyl)phthalate	3.30E-02	
Boron	0.0010	
Cadmium (soil)	0.0010	cadmium chloride
Cadmium (water)	0.0010	cadmium chloride
Carbon disulfide	0.5300	
Chlorobenzene	0.0404	
Chloroform	0.0089	
Chromium	0.0010	
Chrysene	0.6200	
Cis-1,2-Dichloroethene	0.0100	
Cobalt	0.0010	
Copper	0.0010	
Cyanide	0.0010	

PC VALUES FILE: PCVAL.WQ1

11-Jan-96

PARAMETER	[CM/HR] linked here	
Di-n-butylphthalate	2.3E-06	
Dibenz(a,h)anthracene	2.7	
Dibenzofuran	1.5E-03	
Diethyl phthalate	1.1E-05	
Dimethyl phthalate	3.3E-05	
Endosulfan sulfate	1.5E-03	
Endrin	0.0160	
Ethylbenzene	1.2000	
Fluoranthene	0.2970	
Fluorene	1.5E-03	
Heptachlor	0.0094	
Indeno(1,2,3-cd)pyrene	1.9000	
Iron	0.0010	
Isobutyl Alcohol	0.0015	
Kepone	0.0010	
Lead	4.0E-06	lead acetate
Magnesium	0.0010	
Manganese (soil)	0.0010	
Manganese (water)	0.0010	
Mercury	0.0010	
Molybdenum	0.0010	
Methylene Chloride	0.0051	
N-nitroso-di-n-propylamine	0.0028	
N-nitrosodiphenylamine	0.0005	
Naphthalene	0.0690	
Nickel	0.0001	nickel chloride
Pentachlorophenol	0.4900	
Phenanthrene	0.2700	
Phenol	0.0081	
Pyrene	0.0015	
Selenium	0.0010	
Silicon	0.0010	
Strontium	0.0010	
Styrene	0.6500	
Tetrachloroethene	0.0450	
1,1,2,2-Tetrachloroethane	0.009	
Thallium	0.001	
Tin	0.0010	
Toluene	1.0000	
Total Xylenes	0.0800	
Trichloroethene	0.0160	
Trichlorotrifluoroethane	0.0015	
Vanadium	0.0010	
Vinyl Chloride	0.0073	
Zinc	0.0006	zinc chloride
Acenapthene	0.1515653756	
beta-BHC	0.0015	
delta-BHC	0.0015	
gamma-BHC (Lindane)	0.0140	
p-Chloro-m-cresol	0.0500	
p-Cresol	0.0100	

Calculations

log Kp = -2.72 + 0.71 log Kw - 0.0061 MW

	Kp	log Kw	MW (g/mole)
acenapthene	0.1516	4	154
2-methylnaphthalene	0.1423	3.86	142.2

APPENDIX U
FIELD DATA SHEETS

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 36-SW/SD01 Date: 4-19-94 Time: 1435 (SW)

Samplers: AMB, MGM, WJT Date: 4-16-94 (SD) Time: 1800 (SD)

Water Body: Unnamed Trib to Brinson Ck. State: NC County: Onslow

Sample Type: Fish Benthic Macroinvertebrate Sediment Surface Water

SAMPLING EQUIPMENT: Seine Gill Net Ponar Kemmerer Sediment Corer Spoon Other: Dip method

Riparian Zone/Instream Features

Predominant Surrounding Land Use: Forest Urban Industrial Other: ~10' up from gravel road

Shore Vegetation: Upland Scrub/Shrub Forest w/ a cleared field to the west & Forest to the east. Domin. veg - sweet gum, loblolly pine, red cedar, some rhododendron, many vines

Aquatic Vegetation: switch cane along stream bed.

Estimated Stream Width: 2-3 ft Est. Stream Depth: 0.5 ft. Riffle: — ft Run: 100% ft Pool: — ft

Stream Type: Cold Water Warm Water Velocity: negligible Channelized: Yes X No _

Canopy Cover: Open Partly Open Partly Shaded Shaded

Sediment/Substrate:

Sediment Odors: Normal Sewage Petroleum Chemical Anaerobic Other:

Sediment Oils: Absent Slight Moderate Profuse ~~HNu~~

Ponar Grab: Number of Jars Filled with Sediments Replicate: #1: NA Replicate #2: NA Replicate #3: NA

Sediment Description: sandy silt w/ some clay in 6-12".

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	18.8	9.54	6.3	1287	0.75

Water Odors: Normal Sewage Petroleum Chemical Other:

Water Surface Oils: Slick Sheen None Secchi: ___ ft.

Turbidity: Clear Slightly Turbid Turbid Opaque Water Color: tonic

Weather Conditions: Tide: In Out

Comments: ~ 20' up from road

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 36-SW/SD-02 Date: 4-19-94 (SW) Time: 1405 (SW)

Samplers: AMB, WJJ, MGM Date: 4-16-94 (SD) Time: 1713 (SD)

Water Body: Unnamed Trib to Brinson Ck State: NC County: Onslow

Sample Type: Fish Benthic Macroinvertebrate **Sediment** **Surface Water**

SAMPLING EQUIPMENT: Seine Gill Net ~~Ponar~~ Kemmerer **Sediment Corer** Spoon Other: Dip Method

Riparian Zone/Instream Features

Predominant Surrounding Land Use: **Forest** Urban Industrial Other:

Shore Vegetation: Narrow strip of PSS on both sides of creek. Outside strip on north is a mixed conifer & decid. Forest (upland), outside of south strip is decid Forest w/ some

~~Aquatic Vegetation~~: loblolly pines. Dom. vegit. (speckled alder, coastal willow, red maple, some sweet gum & lob. pine). Very little herb veg.

Estimated Stream Width: 3-4 ft Est. Stream Depth: 0.5 ft. Riffle: — ft Run: 90% ft Pool: 10% ft

Stream Type: Cold Water **Warm Water** Velocity: Negligible Channelized: Yes _ No X

Canopy Cover: Open Partly Open **Partly Shaded** Shaded

Sediment/Substrate:

Sediment Odors: Normal Sewage Petroleum Chemical **Anaerobic** Other:

Sediment Oils: **Absent** Slight Moderate Profuse ~~HNG~~

Ponar Grab: Number of Jars Filled with Sediments Replicate: #1: NA Replicate #2: NA Replicate #3: NA

Sediment Description: Sandy/clay

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	20.0	7.02	4.5	596	0.0

Water Odors: **Normal** Sewage Petroleum Chemical Other:

Water Surface Oils: Slick Sheen **None** Secchi: NA ft.

Turbidity: Clear **Slightly Turbid** Turbid Opaque Water Color: tannic

Weather Conditions: Tide: NA ~~In~~ ~~Out~~

Comments:

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 36-SW/SD03 Date: 4-19-94 (SW) Time: 1335 (SW)

Samplers: AMB, NJJ, MGM Date: 4-16-94 (SD) Time: 1610 (SD)

Water Body: Unnamed Trib to Brunswick Ck State: NC County: Onslow

Sample Type: Fish Benthic Macroinvertebrate Sediment Surface Water

SAMPLING EQUIPMENT: Seine Gill Net Ponar — Kemmerer Sediment Corer Spoon Other: Dip Method

Riparian Zone/Instream Features

Predominant Surrounding Land Use: Forest Urban Industrial Other: Open Field to the North

Shore Vegetation: Red maple, speck. alder, unknown decid. shrub, + some short-needled pine. Upland decid. Forest south of wetland *

Aquatic Vegetation: NONE

Estimated Stream Width: 3.5 ft Est. Stream Depth: 0.3 ft. Riffle: – ft Run: 100% ft Pool: – ft

Stream Type: Cold Water Warm Water Velocity: Negligible Channelized: Yes _ No X

Canopy Cover: Open Partly Open Partly Shaded Shaded

Sediment/Substrate:

Sediment Odors: Normal Sewage Petroleum Chemical Anaerobic Other:

Sediment Oils: Absent Slight Moderate Profuse ~~HNd~~

Ponar Grab: Number of Jars Filled with Sediments Replicate: #1: NA Replicate #2: NA Replicate #3: NA

Sediment Description: 0-6" (Fine silt w/ some fine sand), 6-12" (little more sand)

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	21.9	6.8	2.4	518	0

Water Odors: Normal Sewage Petroleum Chemical Other:

Water Surface Oils: Slick Sheen None Secchi: NA ft.

Turbidity: Clear Slightly Turbid Turbid Opaque Water Color: Tannic

Weather Conditions: Tide: NA ~~In~~ ~~Out~~

Comments: * The station appears to be in a PSS wetland along the northeast of the stream. Also PSS wetland to the south

Station ≈ 25' north of phone line

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 36-SW/SD-04 Date: 4-19-94 Time: 1930

Samplers: AMB, WJJ, MGM Date: 4-19-94 Time: 1945

Water Body: Unnamed trib to Brinson Ck State: NC County: Onslow

Sample Type: Fish Benthic Macroinvertebrate Sediment Surface Water

SAMPLING EQUIPMENT: Seine Gill Net Ponar Kemmerer Sediment Corer Spoon Other: Dip method

Riparian Zone/Instream Features

Predominant Surrounding Land Use: Forest Urban Industrial Other: ____

Shore Vegetation: ____

Aquatic Vegetation: ____

Estimated Stream Width: 15-20 ft Est. Stream Depth: 0.5 ft Riffle: — ft Run: 100 ft Pool: — ft

Stream Type: Cold Water Warm Water Velocity: Negligible Channelized: Yes __ No X

Canopy Cover: Open Partly Open Partly Shaded Shaded

Sediment/Substrate:

Sediment Odors: Normal Sewage Petroleum Chemical Anaerobic Other: ____

Sediment Oils: Absent Slight Moderate Profuse ~~HNu~~

Ponar Grab: Number of Jars Filled with Sediments Replicate: #1: NA Replicate #2: NA Replicate #3: NA

Sediment Description: Fine silt

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	24.0	7.67	10.1	610	0.0

Water Odors: Normal Sewage Petroleum Chemical Other: ____

Water Surface Oils: Slick Sheen None Secchi: NA ft.

Turbidity: Clear Slightly Turbid Turbid Opaque Water Color: Tanic

Weather Conditions: ____ Tide: In Out

Comments: ~ 100' up from confluence w/ Brinson Creek

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 36-SW/SD05 Date: 4-18-94 (SW) Time: 1254 (SW)

Samplers: AMB, WJJ, MGM Date: 4-18-94 (SD) Time: 1306 (SD)

Water Body: Brinson Creek State: NC County: Onslow

Sample Type: Fish Benthic Macroinvertebrate Sediment Surface Water

SAMPLING EQUIPMENT: Seine Gill Net Ponar Kemmerer Sediment Corer Spoon Other: Dip method

Riparian Zone/Instream Features

Predominant Surrounding Land Use: Forest Urban Industrial Other:

Shore Vegetation: South Bank: Conifer, lowland scrub-shrub, dom veg: Red cedar, short needle pine, southern bayberry, some narrow leaf cattail along creek edge - outside of

Aquatic Vegetation: lowland (dec Forest); North Bank: emergent ISS wetland, Dom. veg: red cedar, narrow leaf cattail

Estimated Stream Width: 50 ft Est. Stream Depth: 3-4' ft Riffle: — ft Run: 100% ft Pool: — ft

Stream Type: Cold Water Warm Water Velocity: Negligible Channelized: Yes No X

Canopy Cover: Open Partly Open Partly Shaded Shaded

Sediment/Substrate:

Sediment Odors: Normal Sewage slight Petroleum Chemical Anaerobic Other:

Sediment Oils: Absent Slight Moderate Profuse ~~HNu~~

Ponar Grab: Number of Jars Filled with Sediments Replicate: #1: NA Replicate #2: NA Replicate #3: NA

Sediment Description: 0-1" muck, rest silty-sand

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	23.9	8.6	18.0	1088	0.7
Bottom	23	8.19	12.0	1044	0.6

Water Odors: Normal Sewage Petroleum Chemical Other:

Water Surface Oils: Slick Sheen – After SD None Secchi: NA ft.

Turbidity: Clear Slightly Turbid Turbid Opaque Water Color: Tannic

Weather Conditions: Tide: In Out

Comments: ~ 20' down from unnamed Trib

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 36-SW/SD-06 Date: 4-18-94 (SW) Time: 1401 (SW)

Samplers: AMB, WJJ, MGM Date: 4-18-94 (SD) Time: 1410 (SD)

Water Body: Brinson Creek State: NC County: Onslow

Sample Type: Fish Benthic Macroinvertebrate **Sediment** **Surface Water**

SAMPLING EQUIPMENT: Seine Gill Net ~~Ponar~~ Kemmerer **Sediment Corer** Spoon Other: Dip method

Riparian Zone/Instream Features

Predominant Surrounding Land Use: **Forest** Urban Industrial Other: ______

Shore Vegetation: South Bank: lined w/ southern bayberry - conif. forest along bank (sweet gum, red cedar, loblolly pine)

* ~~Aquatic Vegetation:~~ North Bank: Bank lined w/ emerg veg, scrub/shrub outside of narrow strip - mostly evergreens

Estimated Stream Width: 50 ft Est. Stream Depth: 4-5 ft. Riffle: — ft Run: 100% ft Pool: — ft

Stream Type: Cold Water **Warm Water** Velocity: Neglible Channelized: Yes __ No X

Canopy Cover: Open **Partly Open** Partly Shaded Shaded

Sediment/Substrate:

Sediment Odors: Normal Sewage **Petroleum** Chemical Anaerobic Other: ______

Sediment Oils: Absent **Slight** Moderate Profuse ~~HNu~~

Ponar Grab: Number of Jars Filled with Sediments Replicate: #1: NA Replicate #2: NA Replicate #3: NA

Sediment Description: Sandy - silt

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	25.2	7.93	10.3	906	0.5
Bottom	23.3	7.57	11.6	783	0.4

Water Odors: **Normal** Sewage Petroleum Chemical Other: ______

Water Surface Oils: Slick **Sheen** - After SD None Secchi: NA ft.

Turbidity: Clear **Slightly Turbid** Turbid Opaque Water Color: Tannic

Weather Conditions: ______ Tide: In Out

Comments: * No aquatic vegetation

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 36-SW/SD-07 Date: 4-18-94 (SW) Time: 1445 (SW)

Samplers: AMB, WJJ, MGM Date: 4-18-94 (SD) Time: 1458 (SD)

Water Body: Brinson Creek State: NC County: Onslow

Sample Type: Fish Benthic Macroinvertebrate **Sediment** **Surface Water**

SAMPLING EQUIPMENT: Seine Gill Net Ponar Kemmerer **Sediment Corer** Spoon Other: Dip Method

Riparian Zone/Instream Features

Predominant Surrounding Land Use: **Forest** Urban Industrial Other:

Shore Vegetation: Narrow strip of emergent veg (wetland), 35' wide - Past this is a mixed wood SS/Forest bottom land area, Freq. Flooded throughout the growing season

* ~~Aquatic Vegetation:~~ Dominant veg: narrow leaf cattail, S. bayberry, red maple, yellow poplar, some pines
North: Narrow strip of emerg. veg (SS). cattail, S. bayberry, then narrow Forest 30'-pines hardwood, then open Field!

Estimated Stream Width: 40 ft Est. Stream Depth: 3-4 ft. Riffle: — ft Run: 100% ft Pool: — ft

Stream Type: Cold Water **Warm Water** Velocity: Negligible Channelized: Yes __ No Y

Canopy Cover: Open **Partly Open** Partly Shaded Shaded

Sediment/Substrate:

Sediment Odors: Normal Sewage Petroleum Chemical **Anaerobic** Other:

Sediment Oils: **Absent** Slight Moderate Profuse ~~HNu~~

Ponar Grab: Number of Jars Filled with Sediments Replicate: #1: NA Replicate #2: NA Replicate #3: NA

Sediment Description: Fine silt / sand

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	23.9	8.0	13	681	0.3
Bottom	21.3	7.53	7.3	570	0.2

Water Odors: **Normal** Sewage Petroleum Chemical Other:

Water Surface Oils: Slick **Sheen** After SD None Secchi: NA ft.

Turbidity: Clear **Slightly Turbid** Turbid Opaque Water Color:

Weather Conditions: Tide: In Out

Comments: ~10' down from pipeline that crosses Brinson Creek,
* No aquatic vegetation

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 36-FS/BN01 Date: 4-19-94 (BN) Time: 1800

Samplers: AMB, WJJ, MGM Date: 4-17-94 - 4-20-94 (FS) Time: —

Water Body: Brinson Creek State: NC County: Onslow

Sample Type: Fish Benthic Macroinvertebrate Sediment Surface Water

SAMPLING EQUIPMENT: Seine Gill Net Ponar Kemmerer Sediment Corer Spoon Other: Hoop Net, minnow trap

Riparian Zone/Instream Features

Predominant Surrounding Land Use: Forest Urban Industrial Other: ______

Shore Vegetation: Same as 36-SW/SD07

Aquatic Vegetation: None

Estimated Stream Width: 40 ft Est. Stream Depth: 3-4' ft. Riffle: — ft Run: 100% ft Pool: — ft

Stream Type: Cold Water Warm Water Velocity: Negligible Channelized: Yes __ No X

Canopy Cover: Open Partly Open Partly Shaded Shaded

Sediment/Substrate:

Sediment Odors: Normal Sewage Petroleum Chemical Anaerobic Other: ______

Sediment Oils: Absent Slight Moderate Profuse ~~HNu~~

*

Ponar Grab: Number of Jars Filled with Sediments Replicate: #1: ___ Replicate #2: ___ Replicate #3: ___

Sediment Description: Rep #1: Fine silt; much organic debris (leaves, twigs)

Water:

	Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
	Surface	23.9	8.23	17.3	650	0.50
	Bottom	24.7	8.4	18.6	828	0.75
4-17-94 1632	Surface	24.2	7.73	10.5	881	0.5
	Bottom	21.9	7.38	6.9	866	0.5

Water Odors: Normal Sewage Petroleum Chemical Other: ______

Water Surface Oils: Slick Sheen None Secchi: NA ft.

Turbidity: Clear Slightly Turbid Turbid Opaque Water Color: tanic

Weather Conditions: ______ Tide: In Out

Comments: ~10' down from

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 36-FS/BN02 Date: 4-19-94 (BN) Time: 1730

Samplers: AMB, WJJ, MGM Date: 4-17-94 - 4-20-94 (FS) Time: ——

Water Body: Brinson Creek State: NC County: Onslow

Sample Type: Fish Benthic Macroinvertebrate Sediment Surface Water

SAMPLING EQUIPMENT: Seine Gill Net Ponar Kemmerer Sediment Corer Spoon Other: Hoop Net minnow trap.

Riparian Zone/Instream Features

Predominant Surrounding Land Use: Forest Urban Industrial Other:

Shore Vegetation: Same as 36-SW/SD 06

Aquatic Vegetation: None

Estimated Stream Width: 50 ft Est. Stream Depth: 4-5 ft Riffle: — ft Run: 100% ft Pool: — ft

Stream Type: Cold Water Warm Water Velocity: Neglible Channelized: Yes __ No ✓

Canopy Cover: Open Partly Open Partly Shaded Shaded

Sediment/Substrate:

Sediment Odors: Normal Sewage Petroleum Chemical Anaerobic Other:

Sediment Oils: Absent Slight Moderate Profuse ~~HNu~~

Ponar Grab: Number of Jars Filled with Sediments Replicate: #1: 4 Replicate #2: ___ Replicate #3: ___

Sediment Description: Rep #1: fine silty-sand, worms observed, sticks w/ some leaves; Rep #2 & #3 - similar to #1

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	24.8	8.6	17.9	1600	1.0
Bottom	25.3	8.8	17.4	1700	1.0

Water Odors: Normal Sewage Petroleum Chemical Other:

Water Surface Oils: Slick Sheen After Grab None Secchi: NA ft.

Turbidity: Clear Slightly Turbid Turbid Opaque Water Color: tanic

Weather Conditions: Tide: In Out

Comments:

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 36-FS/BN03 Date: 4-19-94 (BN) Time: 1640

Samplers: AMB, WJJ, MGM Date: 4-17-94 – 4-20-94 (FS) Time: ——

Water Body: Branson Creek State: NC County: Onslow

Sample Type: Fish Benthic Macroinvertebrate Sediment Surface Water

SAMPLING EQUIPMENT: Seine Gill Net Ponar Kemmerer Sediment Corer Spoon Other: Hoop net minnow traps

Riparian Zone/Instream Features

Predominant Surrounding Land Use: Forest Urban Industrial Other: ______

Shore Vegetation: Same as 36-SW/SD05

Aquatic Vegetation: None

Estimated Stream Width: 40 ft Est. Stream Depth: 3-4 ft Riffle: — ft Run: 100% ft Pool: — ft

Stream Type: Cold Water Warm Water Velocity: Neglible Channelized: Yes __ No X

Canopy Cover: Open Partly Open Partly Shaded Shaded

Sediment/Substrate:

Sediment Odors: Normal Sewage Petroleum Chemical Anaerobic Other: ______

Sediment Oils: Absent Slight Moderate Profuse ~~HNd~~

Ponar Grab: Number of Jars Filled with Sediments Replicate: #1: 5 Replicate #2: 2 Replicate #3: ______

Sediment Description: Rep #1: [illegible], much organic debris, silty sand; Rep #2: similar to #1 w/ less debris; Rep #3: Similar to #2

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	25.0	6.8	16.9	3,320	1.2

Water Odors: Normal Sewage Petroleum Chemical Other: ______

Water Surface Oils: Slick Sheen After Grab None Secchi: NA ft.

Turbidity: Clear Slightly Turbid Turbid Opaque Water Color: tannic

Weather Conditions: ______ Tide: In Out

Comments: ______

✓

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 35-SW/SD03 Date: April 12, 94 (sw) Time: 1245 (sw)

Samplers: AMB, MGM, WJJ Date: April 14, 94 (SD) Time: 1350 (SD)

Water Body: Brinson Creek State: NC County: Onslow

Sample Type: Fish Benthic Macroinvertebrate **Sediment** **Surface Water**

SAMPLING EQUIPMENT: Seine Gill Net Ponar Kemmerer **Sediment Corer** Spoon Other: Dip method

Riparian Zone/Instream Features

Predominant Surrounding Land Use: **Forest** Urban Industrial Other: ______

Shore Vegetation: West + East appear to be bottomland w/ mostly Deciduous trees scrub-shrub growth along both banks. Vegit (Southern red bay, bayberry, black willow, some coastal willow) very little herb

~~Aquatic Vegetation~~: growth due to thick Forest canopy - Dom. trees (red maple, yellow poplar, gray birch). Small PEM just beyond S/S on east bank (≈100' long × 4-6" wide)

Estimated Stream Width: 20-30 ft Est. Stream Depth: 2½ ft Riffle: — ft Run: 100± ft Pool: — ft

Stream Type: Cold Water **Warm Water** Velocity: Negligable Channelized: Yes __ No X

Canopy Cover: Open Partly Open **Partly Shaded** Shaded

Sediment/Substrate:

Sediment Odors: Normal Sewage very slight **Petroleum** Chemical Anaerobic Other: ______

Sediment Oils: **Absent** Slight Moderate Profuse ~~HNu~~

Ponar Grab: Number of Jars Filled with Sediments Replicate: #1: NA Replicate #2: NA Replicate #3: NA

Sediment Description: Sand w/ some silt + organic matter

Water:

	Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
SW	Surface	18.2	7.3	8.2	563	0
	2.5'	17.3	7.3	8.1	572	0
SD	Surface	21.0	7.3	8.1	510	0.1
	Bottom	21.0	7.3	8.1	515	0.1

Water Odors: **Normal** Sewage Petroleum Chemical Other: ______

Water Surface Oils: Slick * **Sheen** None Secchi: NA ft.

Turbidity: Clear **Slightly Turbid** Turbid Opaque Water Color: None

Weather Conditions: Partly Cloudy Tide: In **Out**

Comments: * Small oil globules on water. Sample collected on right bank looking downstream ~ 20-30' down from trib on left side

✓

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 35-SW/SD04 Date: April 12, 94 (SW) Time: 1315 (SW)

Samplers: AMB, WJJ, MGM Date: April 14, 94 (SD) Time: 1642 (SD)

Water Body: Brinson Creek State: NC County: Onslow

Sample Type: Fish Benthic Macroinvertebrate Sediment Surface Water

SAMPLING EQUIPMENT: Seine Gill Net Ponar Kemmerer Sediment Corer Spoon Other: Dip method

Riparian Zone/Instream Features

Predominant Surrounding Land Use: Forest Urban Industrial Other: ______

Shore Vegetation: thick Deciduous Forest on both sides of creek. Bank lined w/ Southern bayberry + coastal willow. Some herb cover along creek bank, very little in Forested area

~~Aquatic Vegetation~~: Dom. trees (yellow poplar, sweet gum, red maple, no pines observed) Dom. S/S. (southern bayberry, coastal willow)

Estimated Stream Width: 20-30 ft Est. Stream Depth: 1 1/2 ft Riffle: — ft Run: 100 ft Pool: — ft

Stream Type: Cold Water Warm Water Velocity: Negligible Channelized: Yes __ No X

Canopy Cover: Open Partly Open Partly Shaded Shaded

Sediment/Substrate:

Sediment Odors: Normal Sewage strong Petroleum Chemical Anaerobic Other: ______

Sediment Oils: Absent Slight Moderate Profuse ~~HNu~~

Ponar Grab: Number of Jars Filled with Sediments Replicate: #1: NA Replicate #2: NA Replicate #3: NA

Sediment Description: Sandy-silt, oils in water after sampling.

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface water	17.8	7.2	7.8	583	0
1 1/2 ft	16.7	7.1	7.8	547	0

Water Odors: Normal Sewage Petroleum Chemical Other: ______

Water Surface Oils: Slick *Sheen None Secchi: NA ft.

Turbidity: Clear Slightly Turbid Turbid Opaque Water Color: None

Weather Conditions: SW: Partly Cloudy; SD: Sunny Tide: In Out

Comments: Some small oil globules on water. Sample collected from right side of bank facing downstream, just downstream of Trib. adjacent to Site 35.

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 35-SW/SD05 Date: April 12, 94 (SW) Time: 1355 (SW)

Samplers: AMB, MGM, WJJ Date: April 13, 94 (SD) Time: 1325 (SD)

Water Body: Brinson Creek State: NC County: Onslow

Sample Type: Fish Benthic Macroinvertebrate Sediment Surface Water

SAMPLING EQUIPMENT: Seine Gill Net Ponar Kemmerer Sediment Corer Spoon Other: Dip Method

Riparian Zone/Instream Features

Predominant Surrounding Land Use: Forest Urban Industrial Other: ______

* Shore Vegetation: ______

Aquatic Vegetation: ______

Estimated Stream Width: 20-30 ft Est. Stream Depth: 2 1/2 ft Riffle: — ft Run: 100% ft Pool: — ft

Stream Type: Cold Water Warm Water Velocity: Negligible Channelized: Yes __ No X

Canopy Cover: Open Partly Open Partly Shaded Shaded

Sediment/Substrate:

Sediment Odors: Normal Sewage slight Petroleum Chemical strong Anaerobic Other: ______

Sediment Oils: Absent Slight Moderate Profuse ~~HNu~~

Ponar Grab: Number of Jars Filled with Sediments Replicate: #1: NA Replicate #2: NA Replicate #3: NA

Sediment Description: Silty-Sand w/ much organic debris. More sand in 06" sample. there was a slight oil sheen on the water after sampling

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	18.0	7.3	7.9	500	0.1
2 1/2 ft	16.5	7.2	7.8	450	0

Water Odors: Normal Sewage Petroleum Chemical Other: ______

Water Surface Oils: Slick Sheen None Secchi: NA ft.

Turbidity: Clear Slightly Turbid Turbid Opaque Water Color: None

Weather Conditions: SD: Rain/overcast ; SW: Partly Cloudy Tide: In Out

Comments: Sample collected from right bank facing downstream

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 35-SW/SD06 Date: April 12, 94 (SW) Time: 1114 (SW)

Samplers: AMB, MGM, WJJ Date: April 13, 94 (SD) Time: 1240 (SD)

Water Body: Brinson Creek State: NC County: Onslow

Sample Type: Fish Benthic Macroinvertebrate **Sediment** **Surface Water**

SAMPLING EQUIPMENT: Seine Gill Net Ponar Kemmerer **Sediment Corer** Spoon Other: Dip Method

Riparian Zone/Instream Features

Predominant Surrounding Land Use: **Forest** Urban Industrial Other:
(Bottomland Deciduous Forest)

Shore Vegetation: West Bank, scrub/shrub along bank (southern bayberry, red bay, coastal willow) narrow leaf latifolia line, outside of S. shrubs Dominated w/ Yellow poplar, sweet gum, loblolly pine (~50' from shore), spanish moss in trees

~~Aquatic Vegetation:~~ East Bank: Narrow strip latifola, sweet gum, red maple, spanish moss in trees

Estimated Stream Width: ~~40~~ 75 ft Est. Stream Depth: 3 1/2 ft Riffle: — ft Run: 1006 ft Pool: — ft

Stream Type: Cold Water **Warm Water** Velocity: Negligible Channelized: Yes _ No X

Canopy Cover: ~~Open~~ **Partly Open** Partly Shaded Shaded

Sediment/Substrate:

Sediment Odors: Normal Sewage strong **Petroleum** Chemical Anaerobic Other:

Sediment Oils: Absent **Slight** Moderate Profuse ~~HNu~~ NA

Ponar Grab: Number of Jars Filled with Sediments Replicate: #1: NA Replicate #2: NA Replicate #3: NA

Sediment Description: ~~Sample~~ Sediment was silty w/ some organic debris & some fine sand, very mucky more organic debris in 06" than 6-12"

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	18.5	~~3.84~~ 7.3	9.9	670	0
1.5 Ft	17.7	7.3	11	640	0

Water Odors: **Normal** Sewage Petroleum Chemical Other:

Water Surface Oils: Slick Sheen **None** Secchi: NA ft.

Turbidity: Clear **Slightly Turbid** Turbid Opaque Water Color: None

Weather Conditions: Overcast, Rain off & on during SD, Partly Cloudy during SW Tide: ~~?~~ In **Out**

Comments: Sample collected from right bank looking downstream ~50' upstream of RR bridge, along the bank

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 35-SW/SD07 Date: April 14, 94 (SW) Time: 1607 (SW)

Samplers: AMB, MGM, WJJ Date: April 14, 94 (SW) Time: 1615 (SD)

Water Body: Brinson Creek State: NC County: Onslow

Sample Type: Fish Benthic Macroinvertebrate **Sediment** **Surface Water**

SAMPLING EQUIPMENT: Seine Gill Net Ponar Kemmerer **Sediment Corer** Spoon Other: Dip Method

Riparian Zone/Instream Features

Predominant Surrounding Land Use: **Forest** Urban Industrial Other: ______

Shore Vegetation: ______

Aquatic Vegetation: ______

Estimated Stream Width: 20-30 ft Est. Stream Depth: 1 1/2 ft Riffle: — ft Run: 100 ft Pool: — ft

Stream Type: Cold Water **Warm Water** Velocity: Negligable Channelized: Yes __ No X

Canopy Cover: Open Partly Open **Partly Shaded** Shaded

Sediment/Substrate:

Sediment Odors: Normal Sewage **Petroleum**, strong Chemical Anaerobic Other: ______

Sediment Oils: Absent **Slight** Moderate Profuse ~~HNu~~

Ponar Grab: Number of Jars Filled with Sediments Replicate: #1: NA Replicate #2: NA Replicate #3: NA

Sediment Description: Very mucky, some sand

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	21.9	7.13	7.5	505	0.1
1 1/2 ft	21.6	7.09	7.4	505	0.2

Water Odors: **Normal** Sewage Petroleum Chemical Other: ______

Water Surface Oils: Slick Sheen **None** Secchi: NA ft.

Turbidity: Clear **Slightly Turbid** Turbid Opaque Water Color: None

Weather Conditions: SD/SW Sunny Tide: In Out

Comments: Sample was collected at a seep which was orange in color. On Right Side of bank facing downstream, ~ 150 ft downstream from 35-SW/SD04

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 35-FS/BN-02 Date: 4-12-94-4-17-94 (FS) Time: ——

Samplers: AMB, WTJ, MGM Date: 4-16-94 (BN) Time: 0830 (BN)

Water Body: Brinson Creek State: NC County: Onslow

Sample Type: Fish Benthic Macroinvertebrate Sediment Surface Water

SAMPLING EQUIPMENT: Seine Gill Net Ponar Kemmerer Sediment Corer Spoon Other: Minnow Trap, Hoop Net, Electrofish

Riparian Zone/Instream Features

Predominant Surrounding Land Use: Forest Urban Industrial Other: ____

Shore Vegetation: Same as 35-SW/SD 04

Aquatic Vegetation: ____

Estimated Stream Width: 20-30 ft Est. Stream Depth: 1 1/2 ft Riffle: — ft Run: 100 ft Pool: — ft

Stream Type: Cold Water Warm Water Velocity: Negligible Channelized: Yes __ No X

Canopy Cover: Open Partly Open Partly Shaded Shaded

Sediment/Substrate:

Sediment Odors: Normal Sewage Petroleum, very strong Chemical Anaerobic Other: ____

Sediment Oils: Absent Slight Moderate Profuse ~~HNu~~

Ponar Grab: Number of Jars Filled with Sediments Replicate: #1: 3 Replicate #2: 2 Replicate #3: 2

Sediment Description: Sandy/silt. some organic debris, observed benthics

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	19.4	6.95	6.0	269	0
Bottom	19.3	7.02	5.1	286	0

Water Odors: Normal Sewage Petroleum Chemical Other: ____

Water Surface Oils: Slick Sheen After grab None Secchi: ____ ft.

Turbidity: Clear Slightly Turbid Turbid Opaque Water Color: Tonic

Weather Conditions: ____ Tide: In Out

Comments: Collected on Right bank by 35-SW/SD 04

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 35-FS/BN03 Date: 4-12-94 - 4-17-94 (FS) Time: ——

Samplers: AMB, MBM, WJJ Date: 4-15-94 (BN) Time: 1015 (BN)

Water Body: Brinson Creek State: NC County: Onslow

Sample Type: Fish Benthic Macroinvertebrate Sediment Surface Water

SAMPLING EQUIPMENT: Seine Gill Net Ponar Kemmerer Sediment Corer Spoon Other: hoop net minnow trap Electrofish

Riparian Zone/Instream Features

Predominant Surrounding Land Use: Forest Urban Industrial Other:

Shore Vegetation: Same as 35-SW/SD06

Aquatic Vegetation:

Estimated Stream Width: 75 ft Est. Stream Depth: 3 1/2 ft Riffle: — ft Run: 100 ft Pool: — ft

Stream Type: Cold Water Warm Water Velocity: Negligible Channelized: Yes __ No X

Canopy Cover: Open Partly Open Partly Shaded Shaded

Sediment/Substrate:

Sediment Odors: Normal Sewage Petroleum Chemical Anaerobic Other:

Sediment Oils: Absent Slight Moderate Profuse ~~HNu~~

Ponar Grab: Number of Jars Filled with Sediments Replicate: #1: 4 Replicate #2: 2 Replicate #3:

Sediment Description: Silty w/ some organic debris, benthics observed

Water:

	Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
(BN)	Surface.	19.5	7.3	7.1	604	0
4-14-94	Surface	18.0	7.32	5.2	541	0.1
0845	Bottom	18.0	7.28	4.7	551	0.1

Water Odors: Normal Sewage Petroleum Chemical Other:

Water Surface Oils: Slick Sheen None Secchi: NA ft.

Turbidity: Clear Slightly Turbid Turbid Opaque Water Color: None

Weather Conditions: Tide: In Out

Comments: Collected on right bank by 35-SW/SD06

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 35-BW04 Date: 4-16-94 Time: 0830

Samplers: AMB, WJJ, MGM Date: ______ Time: ______

Water Body: Brinson Creek State: NC County: Onslow

Sample Type: Fish **Benthic Macroinvertebrate** Sediment Surface Water

SAMPLING EQUIPMENT: Seine Gill Net **Ponar** Kemmerer Sediment Corer Spoon Other: ______

Riparian Zone/Instream Features

Predominant Surrounding Land Use: **Forest** Urban Industrial Other: ______

Shore Vegetation: Same as 35-SW/SD07

Aquatic Vegetation: ______

Estimated Stream Width: 20-30 ft Est. Stream Depth: 1 1/2 ft Riffle: — ft Run: 100 ft Pool: — ft

Stream Type: Cold Water **Warm Water** Velocity: Negligible Channelized: Yes __ No X

Canopy Cover: Open Partly Open **Partly Shaded** Shaded

Sediment/Substrate:

Sediment Odors: Normal Sewage strong **Petroleum** Chemical Anaerobic Other: ______

Sediment Oils: Absent **Slight** Moderate Profuse ~~HNu~~

Ponar Grab: Number of Jars Filled with Sediments Replicate: #1: 1 Replicate #2: 1 Replicate #3: 1

Sediment Description: Fine silt and sand w/ some organic debris, benthics noted

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	19.2	7.29	5.9	291	0
Bottom	19.2	7.25	5.4	291	0

Water Odors: **Normal** Sewage Petroleum Chemical Other: ______

Water Surface Oils: Slick Sheen None Secchi: NA ft.

Turbidity: Clear Slightly Turbid **Turbid** **Opaque** Water Color: Tannic

Weather Conditions: ______ Tide: In **Out**

Comments: Collected at right bank by 35-SW/SD07

ECOLOGICAL EVALUATION
FIELD DATA SHEET - TERRESTRIAL

Project Name: OU No. 6, MCB Camp Lejeune, Jacksonville, NC

Location: Site 36 Camp Geiger Area Dump

Date: 3/22/95

Sampling Location: Site 36 Camp Geiger Area Dump

Data Collected By: LSS, CMC

Habitat Type: open area, along roads, in disposal area

Vegetation: ______

Trees:

Dominant Species:

1. ______ 6. ______
2. ______ 7. ______
3. none dominant 8. ______
4. ______ 9. ______
5. ______ 10. ______

Secondary Species:

1. Loblolly Pine - Pinus taeda 6. ______
2. Sweetgum - Liquidambar styraciflua 7. ______
3. Honeylocust - Gleditsia triacanthos 8. ______
4. Sassafras - Sassafras albidum 9. ______
5. ______ 10. ______

Saplings/Shrubs:

Dominant Species:

1. ______ 6. ______
2. none dominant 7. ______
3. ______ 8. ______
4. ______ 9. ______
5. ______ 10. ______

Secondary Species:

1. Privit - Ligustrum vulgare
2. blackberry - Rubus sp.
3. dewberry - Rubus hispidus
4. Shining Sumac - Rhus copallina
5. wild rose - Rosa ~~sp.~~ palustris
6. Sweetleaf - Symplocos tinctoria
7. ______
8. ______
9. ______
10. ______

Woody Vines:

Dominant Species:

1. ______ 6. ______
2. ______ 7. ______
3. none dominant 8. ______
4. ______ 9. ______
5. ______ 10. ______

Secondary Species:

1. Japanese honeysuckle - Lonicera japonica
2. Jasmine - Gelsemium sempervirens
3. Bullbriar - Smilax bona-nox
4. Trumpet Creeper - Campsis radicans
5. ______
6. ______
7. ______
8. ______
9. ______
10. ______

Herbs:

Dominant Species:

1. ______ 6. ______
2. ______ 7. ______
3. none dominant 8. ______
4. ______ 9. ______
5. ______ 10. ______

Secondary Species:

1. ~~grasses~~ Broom Sedge - Andropogon virginianus
2. narrow-leaved plantain Plantago lanceolata
3. sweet white clover - melilotus alba
4. dog fennel - Eupatorium capillifolium
5. vetch - Vicia sp.
6. Verbena - Verbena brasiliensis
7. Goldenrod - Solidago sp.
8. Andropogon glomeratus
9. Ebony Spleenwort - Asplenium platyneuron
10. Carolina geranium - Geranium carolinianum

Lyre-leaved Sage - Salvia lyrata
Coffee Senna - Cassia occidentalis
Mouse-ear chickweed - Cerastium vulgare
Peppergrass - Lepidium virginicum
Thistle - Cirsium sp.

Birds: ______

Time: ______

Weather Conditions:

Species	Sex	Feeding	Nesting	Approx. No.
1.				
2.				
3.				
4. listed with mixed forest				
5.				
6.				
7.				
8.				
9.				

10. ____________________

Mammals: ____________________

Time: __________

Weather Conditions:

Species	Observed	Sign	Adult/Juvenile	Sex

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. listed w. mixed forest
6. ____________________
7. ____________________
8. ____________________
9. ____________________
10. ____________________

Reptiles and Amphibians: ____________________

Time: __________

Weather Conditions:

Species	Observed	Sign	Adult/Juvenile	Sex

1. ____________________
2. ____________________
3. listed w. mixed forest
4. ____________________
5. ____________________
6. ____________________

7. ______________________________

8. ______________________________

9. ______________________________

10. ______________________________

Miscellaneous Notes:

ECOLOGICAL EVALUATION
FIELD DATA SHEET - TERRESTRIAL

Project Name: OU No. 6, MCB Camp Lejeune

Location: Jacksonville, NC

Date: 3/22/93

Sampling Location: Site 36 Camp Geiger Area Dump

Data Collected By: JSS, CMC

Habitat Type: Swamp grading to marsh

Vegetation:

Trees:

Dominant Species:

1.
2. none dominant
3.
4.
5.
6.
7.
8.
9.
10.

Secondary Species:

1. Loblolly - Pinus taeda
2. Red maple - Acer rubrum
3. Water Oak - Quercus nigra
4. Hornbeam - Carpinus caroliniana
5. Water Elm - Planera aquatica
6. Ash - Fraxinus sp.
7. Bald Cypress - Taxodium distichum
8.
9.
10.

Loblolly trunks are buttressed

Saplings/Shrubs:

Dominant Species:

1. ______ 6. ______
2. ______ 7. ______
3. none dominant 8. ______
4. ______ 9. ______
5. ______ 10. ______

Secondary Species:

1. Juniper - ~~virginiana~~ Juniperus virginianus 6. Sweet myrtle - Myrica cerifera
2. Sweetbay - Magnolia virginiana 7. ______
3. Groundseltree - Baccharis halimifolia 8. ______
4. Redbay - Persea borbonia 9. ______
5. Coastal Plain Willow - Salix caroliniana 10. ______

Woody Vines:

Dominant Species:

1. ______ 6. ______
2. ______ 7. ______
3. none dominant 8. ______
4. ______ 9. ______
5. ______ 10. ______

Secondary Species:

1. Trumpet Honeysuckle - Lonicera sempervirens 6. ______
2. ______ 7. ______
3. ______ 8. ______
4. ______ 9. ______
5. ______ 10. ______

Herbs:

Dominant Species:

1.
2.
3. none dominant
4.
5.
6.
7.
8.
9.
10.

Secondary Species:

1. Switch Cane - Arundinaria tecta
2. Giant Cane - Arundinaria gigantea
3. Swamp Dock - Rumex verticilliatus
4. Seaside Goldenrod - Solidago sempervirens
5. Hydrocotyl - Hydrocotyl americana
6. Arrow Arum - Peltandra virginica
7.
8.
9.
10.

Birds:

Time:

Weather Conditions:

Species	Sex	Feeding	Nesting	Approx. No.
1.				
2.				
3.				
4. listed w. mixed forest				
5.				
6.				
7.				
8.				
9.				

10. ______________________________

Mammals: ______________________

Time: __________

Weather Conditions:

Species	Observed	Sign	Adult/Juvenile	Sex

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. listed w. mixed forest
6. ______________________________
7. ______________________________
8. ______________________________
9. ______________________________
10. ______________________________

Reptiles and Amphibians: ______________________

Time: ______________

Weather Conditions:

Species	Observed	Sign	Adult/Juvenile	Sex

1. ______________________________
2. ______________________________
3. listed w. mixed forest
4. ______________________________
5. ______________________________
6. ______________________________

7. ____________________

8. ____________________

9. ____________________

10. ____________________

Miscellaneous Notes:

Swamp grades to salt marsh dominated by Spartina with big cordgrass, cattails, alder, and scattered cypress - marsh is found along creek

ECOLOGICAL EVALUATION
FIELD DATA SHEET - TERRESTRIAL

Project Name: OU No. 6, MCB Camp Lejeune, Jacksonville, NC

Location: Site 36 Camp Geiger Area Dump

Date: 3/22/95

Sampling Location: mixed forest

Data Collected By: YSS, CMC

Habitat Type: mixed forest

Vegetation:

Trees:

Dominant Species:

1.
2. Loblolly pine - Pinus taeda
3.
4.
5.
6.
7.
8.
9.
10.

Secondary Species:

1. Water oak - Quercus nigra
2. Tulip - Liriodendron tulipifera
3. White oak - Q. alba
4. Sweetgum - Liquidambar styraciflua
5. Southern Red Oak - Q. falcata
6. Longleaf Pine - Pinus australis
7.
8.
9.
10.

Saplings/Shrubs:

Dominant Species:

1.
2.
3. none dominant
4.
5.
6.
7.
8.
9.
10.

Secondary Species:

1. Juniper - Juniperus virginianus
2. Sweet myrtle - myrica cerifera
3. Albizzia - Albizzia julbrisin
4. Dogwood - Cornus florida
5. Sweetbay - magnolia virginiana
6.
7.
8.
9.
10.

Woody Vines:

Dominant Species:

1.
2. none dominant
3.
4.
5.
6.
7.
8.
9.
10.

Secondary Species:

1. Greenbriar - Smilax rotundifolia
2. Japanese honeysuckle - Lonicera japonica
3. Jasmine - Gelsemium Sempervirens
4.
5.
6.
7.
8.
9.
10.

Herbs:

Dominant Species:

1. ______ 6. ______
2. ______ 7. ______
3. none dominant 8. ______
4. ______ 9. ______
5. ______ 10. ______

Secondary Species:

1. Spotted wintergreen - Chimaphila maculata 6. ______
2. ______ 7. ______
3. ______ 8. ______
4. Little floor veg. 9. ______
5. ______ 10. ______

Birds: ______

Time: ______

Weather Conditions:

Species	Sex	Feeding	Nesting	Approx. No.
1. Crow - Corvus brachyrhynchos				
2. Carolina wren - Thryothorus ludovicianus				
3. Carolina chickadee Parus carolinensis				
4. red-bellied woodpecker - Melanerpes carolinus				
5. Small flycatchers - Empidonax ssp.			flock	
6. myrtle warbler - Dendroica coronata				
7. Canada ~~goose~~ goose - Branta canadensis				Brinson Creek
8. mourning dove - Zenaida macroura				
9. robin - Turdus migratorius				
brown pelican - Pelecanus occidentalis				Brinson Creek
cardinal - Richmondena cardinalis				
cedar waxwing - Bombycilla cedrorum				
blue-grey gnatcatcher - Polioptila caerulea				

yellowthroat Geothlypis trichas
grackle - Quiscalus quiscula
pied-billed grebe - ~~Poty~~ Podilymbus podiceps

yellow warbler - Dendroica petechia

10. red cockaded woodpecker - Picoides borealis

Mammals:

Time:

Weather Conditions:

Species	Observed	Sign	Adult/Juvenile	Sex

1. Deer - Odocoileus virginianus — tracks - buck rub, trail
2. Raccoon - Procyon lotor — tracks, droppings
3. Squirrel - Scuirus sp. — nest
4. Mole - Scalopus aquaticus — tunnels
5.
6.
7.
8.
9.
10.

Reptiles and Amphibians:

Time:

Weather Conditions:

Species	Observed	Sign	Adult/Juvenile	Sex

1. Green Tree Frog - Hyla cinera Anolis carolinensis
2. Anole -
3. Green Frog - Rana clamitans
4.
5.
6.

7. ______________________________

8. ______________________________

9. ______________________________

10. ______________________________

Miscellaneous Notes:

APPENDIX V
WHITE OAK RIVER BASIN REFERENCE STATIONS

WHITE OAK RIVER BASIN REFERENCE STATIONS

Water Body Description

Hadnot Creek, Holland Mill Creek (including Cartwheel Branch) and the section of the White Oak River that encompasses Hadnot Creek, Holland Mill Creek, and Webb Creek are classified as SA from their source to the White Oak River. The SA classifies the water body as a tidal saltwater with shellfishing for market purposes and the following uses: primary recreation, aquatic life propagation and survival, fishing, wildlife, and secondary recreation. Webb Creek is classified as C from its source to the White Oak River. The C classifies the water body as a fresh water with the following uses: aquatic life propagation and survival, fishing, wildlife, and secondary recreation. The section of the White Oak River that encompasses these three creeks is designated by the North Carolina Fisheries Rule as Class C - coastal fishing waters (NCMFC, 1993).

Biological Sampling

Biological samples collected at the background stations consisted of fish and benthic macroinvertebrate. The biological samples were collected to obtain population statistics for fish and benthic macroinvertebrates and to obtain fish tissue samples for chemical analysis (Hadnot Creek only). Prior to initiating the sampling event at each station, the following information describing the site was recorded in the field log book:

Average width, depth and velocity of the water body

Description of substrate

Description of "abiotic" characteristics of the reach such as pools, riffles, runs, channel shape, degree of bank erosion, and shade/sun exposure

Description of "biotic" characteristics of the reach including aquatic and riparian vegetation and wetlands

Water quality measurements were collected during the benthic macroinvertebrate sampling, at a minimum, and during collection of some of the fish samples. On-site water quality measurements at these stations consisted of temperature, pH, specific conductance, salinity and dissolved oxygen. These measurements were conducted prior to sample collection. The station locations and sampling procedures for the collection of the fish and benthic macroinvertebrates is discussed later in this appendix.

Fish and Shellfish

This section discusses collection of the fish and shellfish samples in the reference stations at Webb Creek, Hadnot Creek, and Holland Mill Creek.

A literature review was conducted to determine the fish species that may potentially be exposed to contaminants in the surface water/sediment exposure pathway. This review included compiling information from State and Federal natural resources agencies. In addition, Bakers experience in sampling similar areas formed a basis for a database of expected species for the area.

Sampling variability can prevent the same species of fish from being sampled at each station because either the preferred species was not captured, or adequate numbers of uniform-size individuals were not captured. Therefore, if the preferred species was not successfully collected to satisfy the above requirements, a substitute species was collected that, if possible, exhibiting a similar trophic position in the estuarine ecosystem.

The collected fish species were identified, measured, and counted. The small fish (less than 20 mm) were weighed in groups of 10 or 20 because of their low individual weight; the larger fish were weighed individually. The proportion of individuals as hybrids and the proportion of individuals with disease, tumors, fin damage, and skeletal anomalies was recorded at each station.

Fish that exhibited signs of being dead for an extended period of time (i.e., brown gills, bloating) were not retained for tissue analysis because of the potential for decomposition and leaching of contaminants from the organs into the edible portions of the fish.

Webb Creek

This section discusses collection of the fish samples in Webb Creek including the station locations and sampling procedures.

Station Location

The fish station WC02 was located on Webb Creek approximately 300 feet upstream from the Camp Lejeune railroad crossing. Station WC03 was located in the White Oak River approximately 25 feet downstream from its confluence with Webb Creek. See fish and benthic macroinvertebrate sampling station figure found later in this appendix for approximate sample locations.

Sampling Procedures

Fish were collected in Webb Creek using gill nets and hoop nets. All fish that were collected were processed for population statistics; no fish at these stations were collected for tissue analysis.

The gill nets were six feet deep by 50 to 100 feet long with a stretch mesh size ranging from two to four inches, and an approximate twine break strength of 29 pounds. The nets were deployed approximately at the locations shown on the figure found later in this appendix. Weights were attached to the nets to secure them on the bottom of the stream and yellow buoys marked with "Baker Environmental" were attached to the tops of the nets. The nets were deployed in the morning or evening, and they were checked for fish within twelve hours after deployment.

The hoop nets were three to four feet in diameter and fourteen to sixteen feet in length. Twenty-five foot wings were attached to the nets to help direct fish into the net. The nets were deployed in the middle of the channel with the wings stretched across the creek in a forty-five degree angle. The end of the net and the wings were secured using 6.5 foot wooden posts. The nets were checked at least once daily, as the fish usually survive when captured in these nets.

Hadnot Creek

This section discusses collection of the fish samples in Hadnot Creek including the station locations and sampling procedures.

Station Location

Fish were collected from four stations in Hadnot Creek (HC01, HC02, HC03 and HC04). HC01 was located approximately 100 feet upstream of Rt. 1104. Station HC02 was located approximately 2,500 feet upstream of Rt. 58. Station HC03 was located in the White Oak River approximately 100 feet upstream from its confluence with Hadnot Creek. Finally, station HC04 was located in Hadnot Creek by the road off of the Rt. 1105 crossing. In October, 1993, fish were collected by Baker in Hadnot Creek as part of another investigation (Baker, 1993). Fillet samples of these fish were chemically analyzed and the results are included in this ERA.

Sampling Procedures

Fish were collected at these stations for population statistics; fish were not collected at these stations for tissue analysis. Fish were collected in Hadnot Creek using hoop nets, gill nets, a haul seine, pole fishing, and the backpack electroshocker. The same sample collection and sample processing procedures used in Webb Creek were conducted at the Hadnot Creek stations for the gill nets and hoop nets. Pole fishing only was conducted during the October 1993 sampling.

Fish were collected in the furthest upstream stations using electrofishing, conducted with a Smith-Root, Inc., backpack electrofisher powered by a 300-watt portable generator. A DC current was applied utilizing a "rattail" as the cathode and a hand-held electrode as the anode. Blocking seines were placed downstream and upstream of the shocking areas to aid in the collection of the fish. The length of the shocking time per subsection was recorded as seconds of applied current. Stunned fish were collected with one-inch mesh or smaller dip nets handled by members of the field sampling team.

Holland Mill Creek

This section discusses collection of the fish samples in Holland Mill Creek including the station locations and sampling procedures.

Station Location

Fish were collected from three stations in Holland Mill Creek (HM01, HM02, and HM03). HM01 was located on Cartwheel Branch just upstream of Rt. 1444. Station HM02 was located at the confluence of Holland Mill Creek and Cartwheel Branch. Station HM03 was located in the White Oak River approximately 50 feet downstream from Holland Mill Creek.

Sampling Procedures

Fish were collected at these stations for population statistics. Fish were not collected at these stations for tissue analysis. Fish were collected in Holland Mill Creek using hoop nets, gill nets, a haul seine, and the backpack electroshocker. The same sample collection and sample processing procedures used in the Webb Creek and Hadnot Creek stations were conducted at the Holland Mill Creek stations.

Benthic Macroinvertebrates

This section discusses collection of benthic macroinvertebrate samples in the reference stations at Webb Creek, Hadnot Creek, and Holland Mill Creek.

Webb Creek

Benthic macroinvertebrates were collected in Webb Creek using the ponar grab deployed from the boat.

Benthic macroinvertebrates were collected from a boat using a standard ponar grab. The dimensions of the ponar are 23 x 23 cm (9 x 9 in.) for a sampling area of 529 cm^2 or 0.0523 m2 (81 in2).

The ponar was deployed from the boat, which was positioned in slightly different locations for each replicate to prevent re-sampling the same area. After retrieving the ponar with a sediment sample, it was opened into a clean tub and the sediments were removed with a teflon spatula. The sediments were transferred to a 0.5 mm sieve that was agitated (by hand) in water to remove the small particles. The remaining contents in the sieve were transferred into 16-ounce plastic sample jars. The jars were filled up to one-half full with sediments, and buffered formalin solution (10 percent by weight) was added to the remainder of the jar to preserve the benthic macroinvertebrates contained in the sediments. A 100 percent cotton paper label, marked in pencil with the sample number, was placed inside the jar. The outside of the jar was labeled with the sample number using a black permanent marker to identify the sample containers.

After all the benthic macroinvertebrate sampling at the New River was completed, the sample jars were transported to RMC Environmental Services, Inc. for sample sorting and taxonimic identification of the benthic macroinvertebrates.

Hadnot Creek

Benthic macroinvertebrates were collected in Hadnot Creek using the ponar grab deployed from the boat. The boat was not used at HC01 or HC04 because the water was too shallow. Benthic macroinvertebrates were collected using the same procedures used for collecting benthic macroinvertebrates in Webb Creek.

Holland Mill Creek

Benthic macroinvertebrates were collected in Holland Mill Creek using the ponar grab deployed from the boat. The boat was not used at HM01 because the water was too shallow. The same sample collection and sample processing procedures used in Webb Creek were conducted at the Holland Mill Creek stations.

Biological Tissue Sample Results

The analytical parameters included TCL VOCs, TCL SVOCs, TAL metals, and TCL pesticides/PCBs. Background fish fillet tissue were collected from Hadnot Creek and analyzed these results are discussed below.

Hadnot Creek

Several metals were detected in the Hadnot Creek fillet tissue samples. These metals included aluminum, arsenic, calcium, chromium, copper, magnesium, manganese, mercury, nickel, potassium, sodium and zinc in the fillet samples. The range of detected levels for these chemicals in the fish fillet tissue samples from Hadnot Creek are as follows:

	Minimum (mg/kg)	Maximum (mg/kg)
Aluminum	36.5	36.5
Arsenic	0.34	3.9
Calcium	154	1,170
Chromium	0.21	0.68
Copper	0.18	0.46
Magnesium	254	319
Manganese	0.008	0.38
Mercury	0.05	0.24
Nickel	0.45	0.45
Potassium	3,270	4,040
Sodium	505	1,060
Zinc	3.9	6.5

The maximum detect of manganese was in the southern flounder. The maximum detect of sodium was found in the red drum. Aluminum, calcium, chromium, magnesium, mercury, and potssium were detected at their highest concentrations in the largemouth bass. The maximum detects of arsenic, copper, nickel, and zinc were found in the longnose gar.

Two pesticides were detected in the fillet tissue samples, 4-4'-DDE and alpha-chlordane. 4,4'-DDE was detected twice, both in the longnose gar. Alpha-chlordane was detected once in the largemouth bass. The range of detected concentrations for these constituents were as follows:

	Minimum (ug/kg)	Maximum (ug/kg)
4-4'-DDE	9.7	12.0
alpha-Chlordane	0.17	0.17

Two VOCs and three SVOCs were detected in the fillet tissue samples. Common laboratory contaminants were the primary detections, which included methylene chloride, acetone, di-n-octyl phthalate and bis(2-ethylhexyl)phthalate. Phenol was also detected in the fillet tissue samples. The concentration ranges for these chemicals were the following:

	Minimum (ug/kg)	Maximum (ug/kg)
Methylene chloride	3.0	41.0
Acetone	16	130
di-n-octyl phthalate	61	500
bis(2-ethylhexyl) phthalate	820	17,000
Phenol	460	2,100

Field Chemistry Results

Samples from these surface water bodies were collected from the water surface and bottom.

Webb Creek

At Webb Creek, the salinity at station WC02 ranged from 0 to 7 ppt. Conductivity ranged from 850 to 10,500 micromhos/cm. Dissolved oxygen levels ranged from 4.4 to 9 mg/L. The pH at station WC02 in Webb Creek ranged from 6.85 to 7.48 S.U. in the surface water. The temperature of the water at WC02 ranged from 17.5 to 21 °C.

At WC03, the salinity ranged from 10 to 12.8 ppt. The conductivity ranged from 16,500 to 18,000 micromhos/cm. Dissolved oxygen levels ranged from 8.5 to 10 mg/L. The pH at WC03 in Webb Creek ranged from 7.33 to 7.56 S.U. in the surface water. The temperature of the water at WC03 ranged from 19 to 23 °C.

Hadnot Creek

In Hadnot Creek, the salinity at station HC01 was 0 ppt. The conductivity was 13.5 micromhos/cm. The dissolved oxygen level was 7.7 mg/L. The pH at HC01 was 6.89 S.U in the surface water, and the temperature of the Hadnot Creek water was 17 °C.

At station HC02, the salinity ranged from 0 to 16.5 ppt. The conductivity ranged from 720 to 22,800 micromhos/cm. The dissolved oxygen levels ranged from 1 to 7.3 mg/L. The pH at HC02 ranged from 6.7 to 7.2 S.U. in the surface water. The temperature of the water at HC02 ranged from 15.5 to 22 °C.

At station HC03, the salinity ranged from 17 to 17.9 ppt. The conductivity ranged from 25,500 to 26,500 micromhos/cm. The dissolved oxygen level was 12 mg/L. The pH at HC03 ranged from 7.69 to 7.79 S.U. in the surface water. The temperature of the water at HC03 ranged from 17.5 to 17.8 °C.

At station HC04, the salinity was 0 ppt. The conductivity was 65 micromhos/cm, and the dissolved oxygen level was 5.3 mg/L. The pH at HC04 was 6.16 S.U. in the surface water, and the temperature of the water was 17.3 °C.

Holland Mill Creek

In Holland Mill Creek, the salinity was 0 ppt at station HM01. The conductivity was 140 micromhos/cm, and the dissolved oxygen level was 8.0 mg/L. The pH at station HM01 was 6.9 S.U. in the surface water, and the temperature of the water was 17.5 °C.

At station HM02, the salinity ranged from 1 to 25 ppt. The conductivity ranged from 2,490 to 38,000 micromhos/cm. The dissolved oxygen levels ranged from 5.0 to 11.8 mg/L. The pH at station HM02 ranged from 6.72 to 7.9 S.U. in the surface water. The temperature of the water at HM02 ranged from 15.2 to 20 °C.

At station HM03, the salinity ranged from 13.5 to 22 ppt. The conductivity ranged from 19,000 to 32,000 micromhos. The dissolved oxygen levels ranged from 3.4 to 10.8 mg/L. The pH at station HM03 ranged from 6.81 to 7.90 S.U. in the surface water. The temperature of the water at HM03 ranged from 17.5 to 17.8 °C.

Statistical Summary of
Analytical Results
(Surface Water)

KEY TO STATISTICAL AND ANALYTICAL SUMMARY TABLES

U - Indicated analyte was analyzed for but not detected

J - Indicates an estimated value

UJ - Not detected, quantitation limit may be inaccurate or imprecise

R - Result is rejected and unusable

B - Not detected substantially above the level reported in laboratory or field blanks (organics)

P - There is greater than 25% difference for detected pesticide/PCB concentrations between the two GC columns, the lower of the two values is reported

L - Result is biased low

K - Result is biased high

ND - Analyte not detected

NZ - Analyte not analyzed

mg/L - Milligrams per liter

ug/L - Micrograms per liter

mg/kg - Milligrams per kilogram

ug/kg - Micrograms per kilogram

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - HADNOT CREEK
SURFACE WATER - METALS

PARAMETER	MINIMUM DETECTED VALUE (ug/L)	MAXIMUM DETECTED VALUE (ug/L)		SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (ug/L)	RME (ug/L)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (ug/L)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
Aluminum	692.00	692.00	+	HC-SW04	253.10	488.87	1019.72	1	5	20%
Arsenic	20.00	20.00	+	HC-SW03	5.30	13.35	3190.11	1	5	20%
Barium	9.00	26.00	+	HC-SW03	19.60	25.87	35.22	5	5	100%
Calcium	11600.00	107000.00	+	HC-SW03D	53760.00	92784.90	456379.04	5	5	100%
Chromium	125.00	130.00	+	HC-SW03	54.70	118.12	40374.07	2	5	40%
Iron	291.00	746.00	+	HC-SW01	492.00	666.33	793.41	5	5	100%
Magnesium	954.00	633000.00	+	HC-SW03	258640.80	576299.05	1.50E+16	5	5	100%
Potassium	14500.00	203000.00	+	HC-SW03	84234.00	187308.88	5.24E+12	3	5	60%
Selenium	6.00	6.00	+	HC-SW03	2.00	4.29	38.67	1	5	20%
Sodium	6090.00	2560000.00	+	HC-SW03D	1.01E+06	2.17E+06	4.80E+14	5	5	100%

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - HADNOT CREEK
SURFACE WATER - PESTICIDES/PCBs

PARAMETER	MINIMUM DETECTED VALUE (ug/L)	MAXIMUM DETECTED VALUE (ug/L)	SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (ug/L)	RME (ug/L)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (ug/L)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
NO PESTICIDES/PCBs WERE DETECTED									

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - HADNOT CREEK
SURFACE WATER - SEMIVOLATILE ORGANIC COMPOUNDS

PARAMETER	MINIMUM DETECTED VALUE (ug/L)	MAXIMUM DETECTED VALUE (ug/L)	SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (ug/L)	RME (ug/L)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (ug/L)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
NO SEMIVOLATILE ORGANIC COMPOUNDS WERE DETECTED									

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - HADNOT CREEK
SURFACE WATER - VOLATILE ORGANIC COMPOUNDS

PARAMETER	MINIMUM DETECTED VALUE (ug/L)	MAXIMUM DETECTED VALUE (ug/L)	SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (ug/L)	RME (ug/L)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (ug/L)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
NO VOLATILE ORGANIC COMPOUNDS WERE DETECTED									

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
\+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - HOLLAND MILL CREEK
SURFACE WATER - METALS

PARAMETER	MINIMUM DETECTED VALUE (ug/L)	MAXIMUM DETECTED VALUE (ug/L)	SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (ug/L)	RME (ug/L)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (ug/L)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
Aluminum	535.00	535.00	*+ HM-SW02	269.50	657.32	48037.76	1	3	33%
Barium	20.00	49.00	*+ HM-SW01	35.67	60.35	204.30	3	3	100%
Calcium	14100.00	302000.00	*+ HM-SW03	118766.67	387190.45	4.42E+14	3	3	100%
Chromium	36.00	158.00	*+ HM-SW03	66.33	202.69	3.67E+12	2	3	67%
Iron	320.00	559.00	*+ HM-SW02	434.67	636.62	843.56	3	3	100%
Lead	58.10	58.10	*+ HM-SW03	19.95	75.65	1.70E+27	1	3	33%
Magnesium	2830.00	754000.00	*+ HM-SW03	288610.00	973947.76	1.02E+35	3	3	100%
Potassium	41100.00	288000.00	*+ HM-SW03	109978.33	372096.67	1.33E+36	2	3	67%
Selenium	1.50	41.00	*+ HM-SW03	15.00	52.97	8.42E+13	2	3	67%
Silver	37.00	37.00	*+ HM-SW03	16.83	46.42	284713.62	1	3	33%
Sodium	16500.00	6750000.00	*+ HM-SW03	2501833.33	8733985.25	1.96E+44	3	3	100%

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - HOLLAND MILL CREEK
SURFACE WATER - PESTICIDES/PCBs

PARAMETER	MINIMUM DETECTED VALUE (ug/L)	MAXIMUM DETECTED VALUE (ug/L)	SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (ug/L)	RME (ug/L)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (ug/L)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
NO PESTICIDES/PCBs WERE DETECTED									

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
\+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - HOLLAND MILL CREEK
SURFACE WATER - SEMIVOLATILE ORGANIC COMPOUNDS

PARAMETER	MINIMUM DETECTED VALUE (ug/L)	MAXIMUM DETECTED VALUE (ug/L)	SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (ug/L)	RME (ug/L)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (ug/L)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
NO SEMIVOLATILE ORGANIC COMPOUNDS WERE DETECTED									

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - HOLLAND MILL CREEK
SURFACE WATER - VOLATILE ORGANIC COMPOUNDS

PARAMETER	MINIMUM DETECTED VALUE (ug/L)	MAXIMUM DETECTED VALUE (ug/L)	SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (ug/L)	RME (ug/L)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (ug/L)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
NO VOLATILE ORGANIC COMPOUNDS WERE DETECTED									

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - WEBB CREEK
SURFACE WATER - METALS

PARAMETER	MINIMUM DETECTED VALUE (ug/L)	MAXIMUM DETECTED VALUE (ug/L)	SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (ug/L)	RME (ug/L)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (ug/L)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
Barium	27.00	29.00	*+ WC-SW02	28.00	34.31	32.19	2	2	100%
Calcium	40500.00	46900.00	*+ WC-SW02	43700.00	63904.80	58284.51	2	2	100%
Chromium	97.00	97.00	*+ WC-SW03	52.25	334.80	1.32E+20	1	2	50%
Iron	321.00	660.00	*+ WC-SW02	490.50	1560.72	14358.69	2	2	100%
Magnesium	29000.00	44800.00	*+ WC-SW03	36900.00	86780.60	133710.58	2	2	100%
Potassium	10900.00	136000.00	*+ WC-SW03	73450.00	468390.70	1.01E+23	2	2	100%
Sodium	202000.00	895000.00	*+ WC-SW03	548500.00	2736301.00	6.83E+11	2	2	100%

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - WEBB CREEK
SURFACE WATER - PESTICIDES/PCBs

PARAMETER	MINIMUM DETECTED VALUE (ug/L)	MAXIMUM DETECTED VALUE (ug/L)		SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (ug/L)	RME (ug/L)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (ug/L)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
Aldrin	0.04	0.04	*+	WC-SW02	0.03	0.06	0.07	1	2	50%

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - WEBB CREEK
SURFACE WATER - SEMIVOLATILE ORGANIC COMPOUNDS

PARAMETER	MINIMUM DETECTED VALUE (ug/L)	MAXIMUM DETECTED VALUE (ug/L)	SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (ug/L)	RME (ug/L)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (ug/L)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
NO SEMIVOLATILE ORGANIC COMPOUNDS WERE DETECTED									

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - WEBB CREEK
SURFACE WATER - VOLATILE ORGANIC COMPOUNDS

PARAMETER	MINIMUM DETECTED VALUE (ug/L)	MAXIMUM DETECTED VALUE (ug/L)	SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (ug/L)	RME (ug/L)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (ug/L)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
NO VOLATILE ORGANIC COMPOUNDS WERE DETECTED									

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

Statistical Summary of
Analytical Results
(Sediment)

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - HADNOT CREEK
SEDIMENT - METALS

PARAMETER	MINIMUM DETECTED VALUE (mg/kg)	MAXIMUM DETECTED VALUE (mg/kg)		SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (mg/kg)	RME (mg/kg)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (mg/kg)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
Aluminum	780.00	14000.00	+	HC-SD03-612	5467.78	8305.91	20353.32	9	9	100%
Arsenic	0.26	1.90	*+	HC-SD02-612	1.71	2.67	8.56	6	9	67%
Barium	4.10	17.20	+	HC-SD03-612	9.75	13.11	21.84	8	9	89%
Beryllium	0.14	0.32	+	HC-SD02-612	0.16	0.24	4.60	3	6	50%
Cadmium	0.03	0.66		HC-SD03-06	0.11	0.24	0.42	7	9	78%
Calcium	1030.00	3620.00	+	HC-SD01-06	2645.56	3233.82	3840.09	9	9	100%
Chromium	1.30	41.60	+	HC-SD03-612	10.81	18.97	53.55	9	9	100%
Cobalt	4.50	5.00		HC-SD03-612	1.87	2.91	4.01	2	9	22%
Copper	0.66	1.50	*+	HC-SD02-06	1.35	1.75	2.01	6	9	67%
Iron	382.00	11100.00	+	HC-SD03-06D	3396.56	5709.65	28323.00	9	9	100%
Lead	3.70	5.30	*+	HC-SD03-06	4.50	9.55	305.02	2	2	100%
Magnesium	77.10	6540.00	+	HC-SD03-612	1977.79	3486.31	1292043.17	7	9	78%
Manganese	3.50	64.70		HC-SD03-612	16.54	29.38	62.63	9	9	100%
Mercury	0.25	0.42	*+	HC-SD03-612	0.34	0.48	11.17	3	3	100%
Nickel	1.80	12.10	+	HC-SD03-612	3.77	6.49	17.25	4	9	44%
Potassium	623.00	1840.00	+	HC-SD03-612	671.39	1079.26	2769.97	4	9	44%
Selenium	0.21	0.60		HC-SD02-06	0.30	0.39	0.48	5	9	56%
Sodium	1630.00	2750.00	+	HC-SD02-06	845.25	1750.35	183541390882.91	2	6	33%
Thallium	0.14	0.44	+	HC-SD03-612	0.23	0.31	0.46	6	9	67%
Vanadium	1.50	36.90	+	HC-SD03-612	11.11	18.54	56.26	9	9	100%
Zinc	20.80	40.00	+	HC-SD03-612	12.71	22.07	63.76	3	9	33%

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - HADNOT CREEK
SEDIMENT - PESTICIDES/PCBs

PARAMETER	MINIMUM DETECTED VALUE (ug/kg)	MAXIMUM DETECTED VALUE (ug/kg)	SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (ug/kg)	RME (ug/kg)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (ug/kg)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
beta-BHC	1.70	1.70	*+ HC-SD04-612	1.93	2.39	2.58	1	9	11%
delta-BHC	0.64	0.64	*+ HC-SD01-06	1.82	2.35	2.91	1	9	11%
Heptachlor	0.48	2.00	*+ HC-SD04-612	1.89	2.42	3.26	2	9	22%
4,4'-DDD	1.50	4.00	HC-SD03-612	2.16	3.11	3.50	3	9	33%
4,4'-DDT	1.20	1.20	*+ HC-SD03-06D	3.23	4.23	5.08	1	9	11%
Methoxychlor	0.94	0.94	*+ HC-SD04-06	17.66	23.58	92.52	1	9	11%
Endrin aldehyde	0.59	7.10	+ HC-SD02-06	3.56	5.02	10.80	3	9	33%

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - HADNOT CREEK
SEDIMENT - SEMIVOLATILE ORGANIC COMPOUNDS

PARAMETER	MINIMUM DETECTED VALUE (ug/kg)	MAXIMUM DETECTED VALUE (ug/kg)	SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (ug/kg)	RME (ug/kg)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (ug/kg)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
NO SEMIVOLATILE ORGANIC COMPOUNDS WERE DETECTED									

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - HADNOT CREEK
SEDIMENT - VOLATILE ORGANIC COMPOUNDS

PARAMETER	MINIMUM DETECTED VALUE (ug/kg)	MAXIMUM DETECTED VALUE (ug/kg)	SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (ug/kg)	RME (ug/kg)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (ug/kg)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
Acetone	70.00	70.00	HC-SD01-06	18.06	30.44	36.73	1	9	11%
Carbon Disulfide	14.00	19.00	HC-SD02-612	12.44	15.67	18.14	2	9	22%
2-Butanone	7.00	7.00	*+ HC-SD01-06	11.06	13.94	15.49	1	9	11%

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - HOLLAND MILL CREEK
SEDIMENT - METALS

PARAMETER	MINIMUM DETECTED VALUE (mg/kg)	MAXIMUM DETECTED VALUE (mg/kg)		SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (mg/kg)	RME (mg/kg)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (mg/kg)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
Aluminum	337.00	13600.00	+	HM-SD02-06	6181.29	10282.21	655067.62	7	7	100%
Barium	11.00	18.70	+	HM-SD02-06	8.71	13.92	68.49	4	7	57%
Cadmium	0.03	0.11		HM-SD01-06D	0.06	0.08	0.10	7	7	100%
Calcium	282.00	7860.00	+	HM-SD02-612	2952.86	4844.12	22431.34	7	7	100%
Chromium	1.10	38.40	+	HM-SD02-06	19.63	32.39	2021.73	7	7	100%
Cobalt	4.00	4.40	+	HM-SD02-06	2.02	3.18	6.18	2	7	29%
Iron	225.00	32400.00	+	HM-SD02-612	12262.43	21399.01	27918943.98	7	7	100%
Lead	0.62	9.20	+	HM-SD03-06	4.35	6.94	32.96	7	7	100%
Magnesium	26.70	5700.00	+	HM-SD03-06	2576.66	4422.69	136198282.35	7	7	100%
Manganese	1.30	67.20	+	HM-SD02-06	34.14	56.82	8851.72	7	7	100%
Mercury	0.09	0.35	+	HM-SD03-06	0.23	0.30	0.38	7	7	100%
Nickel	9.60	14.20	+	HM-SD03-06	6.76	11.07	359.48	4	7	57%
Potassium	1510.00	1760.00	+	HM-SD03-612	1007.00	1596.65	13233.89	4	7	57%
Selenium	0.25	0.40		HM-SD02-06	0.21	0.29	0.39	2	7	29%
Silver	0.49	0.49	*+	HM-SD01-06	0.39	0.49	0.60	1	7	14%
Thallium	0.13	0.37	+	HM-SD02-06	0.20	0.29	0.52	4	7	57%
Vanadium	0.66	30.00	+	HM-SD02-612	16.69	27.76	18094.26	6	7	86%
Zinc	6.70	43.10	+	HM-SD02-06	23.57	34.53	65.13	7	7	100%

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - HOLLAND MILL CREEK
SEDIMENT - PESTICIDES/PCBs

PARAMETER	MINIMUM DETECTED VALUE (ug/kg)	MAXIMUM DETECTED VALUE (ug/kg)		SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (ug/kg)	RME (ug/kg)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (ug/kg)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
beta-BHC	3.80	7.30		HM-SD01-06D	3.24	4.69	5.98	2	7	29%
Aldrin	0.56	0.72	*+	HM-SD01-612	1.84	2.60	4.20	2	7	29%
Dieldrin	0.58	1.50	*+	HM-SD01-612	3.55	5.13	12.37	2	7	29%
4,4'-DDE	1.00	4.30	*+	HM-SD01-612	4.01	5.37	8.82	2	7	29%
4,4'-DDD	0.87	3.10	*+	HM-SD01-612	2.85	4.16	6.44	4	7	57%
4,4'-DDT	1.70	1.70	*+	HM-SD01-612	3.79	5.13	6.75	1	7	14%
alpha-Chlordane	1.30	1.30	*+	HM-SD01-612	1.99	2.61	3.14	1	7	14%
gamma-Chlordane	3.00	3.00	+	HM-SD01-612	2.24	2.86	3.56	1	7	14%

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - HOLLAND MILL CREEK
SEDIMENT - SEMIVOLATILE ORGANIC COMPOUNDS

PARAMETER	MINIMUM DETECTED VALUE (ug/kg)	MAXIMUM DETECTED VALUE (ug/kg)		SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (ug/kg)	RME (ug/kg)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (ug/kg)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
Di-n-butylphthalate	534.00	619.00	+	HM-SD02-612	423.29	573.31	766.73	3	7	43%
bis(2-Ethylhexyl)phthalate	454.00	454.00	*+	HM-SD03-612	378.64	500.04	607.73	1	7	14%

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - HOLLAND MILL CREEK
SEDIMENT - VOLATILE ORGANIC COMPOUNDS

PARAMETER	MINIMUM DETECTED VALUE (ug/kg)	MAXIMUM DETECTED VALUE (ug/kg)	SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (ug/kg)	RME (ug/kg)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (ug/kg)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
NO VOLATILE ORGANIC COMPOUNDS WERE DETECTED									

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
\+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - WEBB CREEK
SEDIMENT - METALS

PARAMETER	MINIMUM DETECTED VALUE (mg/kg)	MAXIMUM DETECTED VALUE (mg/kg)	SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (mg/kg)	RME (mg/kg)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (mg/kg)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
Aluminum	8200.00	14800.00	*+ WC-SD02-06	12275.00	15932.10	19239.95	4	4	100%
Barium	13.30	28.20	+ WC-SD02-06	18.83	26.76	35.92	4	4	100%
Cadmium	0.06	0.26	+ WC-SD02-06	0.13	0.24	1.11	4	4	100%
Calcium	2190.00	4060.00	*+ WC-SD02-06	3222.50	4132.21	4914.08	4	4	100%
Chromium	8.70	42.60	+ WC-SD03-612	24.93	42.26	246.57	4	4	100%
Cobalt	3.50	3.90	*+ WC-SD03-612	2.44	4.16	21.71	2	4	50%
Iron	8120.00	20700.00	+ WC-SD03-612	13980.00	20133.62	29586.84	4	4	100%
Lead	5.10	16.90	+ WC-SD02-06	9.85	16.48	51.03	4	4	100%
Magnesium	618.00	6060.00	*+ WC-SD03-612	3197.00	6127.63	817766.37	4	4	100%
Manganese	26.00	47.80	*+ WC-SD03-612	39.35	50.44	60.95	4	4	100%
Mercury	0.23	0.40	*+ WC-SD02-06	0.31	0.41	0.48	4	4	100%
Nickel	3.80	11.40	+ WC-SD03-612	7.25	11.11	21.80	4	4	100%
Potassium	1410.00	1590.00	*+ WC-SD03-612	905.88	1719.51	81148.45	2	4	50%
Thallium	0.24	0.24	+ WC-SD03-06	0.16	0.23	0.31	1	4	25%
Vanadium	11.90	31.00	+ WC-SD03-612	21.33	30.50	45.84	4	4	100%
Zinc	27.20	52.00	+ WC-SD02-06	33.83	48.09	61.59	4	4	100%

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - WEBB CREEK
SEDIMENT - PESTICIDES/PCBs

PARAMETER	MINIMUM DETECTED VALUE (ug/kg)	MAXIMUM DETECTED VALUE (ug/kg)	SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (ug/kg)	RME (ug/kg)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (ug/kg)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
delta-BHC	0.79	0.79	*+ WC-SD02-612	1.99	3.02	9.99	1	4	25%
Aldrin	1.20	1.20	*+ WC-SD02-06	1.93	2.65	3.66	1	4	25%
Dieldrin	3.70	3.70	*+ WC-SD02-06	4.00	4.79	4.98	1	4	25%
4,4'-DDE	16.00	16.00	+ WC-SD02-06	7.08	14.12	97.81	1	4	25%
4,4'-DDD	12.00	12.00	+ WC-SD02-06	6.08	10.78	28.91	1	4	25%
4,4'-DDT	0.76	2.60	*+ WC-SD02-06	2.37	4.64	91.00	3	4	75%

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - WEBB CREEK
SEDIMENT - SEMIVOLATILE ORGANIC COMPOUNDS

PARAMETER	MINIMUM DETECTED VALUE (ug/kg)	MAXIMUM DETECTED VALUE (ug/kg)	SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (ug/kg)	RME (ug/kg)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (ug/kg)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
Benzo(a)pyrene	544.00	544.00	*+ WC-SD03-612	436.25	554.81	635.17	1	4	25%

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

MARINE CORPS BASE CAMP LEJEUNE
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
BACKGROUND - WEBB CREEK
SEDIMENT - VOLATILE ORGANIC COMPOUNDS

PARAMETER	MINIMUM DETECTED VALUE (ug/kg)	MAXIMUM DETECTED VALUE (ug/kg)	SAMPLE No. OF MAXIMUM DETECTED VALUE	ARITHMETIC AVERAGE (ug/kg)	RME (ug/kg)	LOG NORMAL UPPER 95% CONFIDENCE LEVEL (ug/kg)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
NO VOLATILE ORGANIC COMPOUNDS WERE DETECTED									

* = THE RME IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
*+ = BOTH THE RME AND LOG NORMAL 95% UCL ARE GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

Analytical Summary of Results
(Surface Water)

MARINE CORPS BASE CAMP LEJEUNE
ANALYTICAL SUMMARY OF RESULTS
BACKGROUND - HADNOT CREEK
SURFACE WATER - METALS

BAKER I.D.	HC-SW01		HC-SW02		HC-SW03		HC-SW03D		HC-SW04	
LABORATORY I.D.	5167-16		5162		5166		5163		5152	
DATE COLLECTED	08-MAY-1994		06-MAY-1994		06-MAY-1994		06-MAY-1994		08-MAY-1994	
UNITS	UG/L		UG/L		UG/L		UG/L		UG/L	
Aluminum	356	U	303	U	301	U	187	U	692	
Arsenic	1	U	1	UJ	20		10	UJ	1	U
Barium	19	J	20	J	26	J	24	J	9	J
Calcium	27000		36600		86600		107000		11600	
Chromium	9	U	19	U	130	J	125	J	9	U
Iron	746		528		339		291		556	
Magnesium	1450		44800		633000		613000		954	
Potassium	1670	U	14500		203000		202000		1670	U
Selenium	1	U	5	U	6	J	1	UJ	1	UJ
Sodium	6900		383000		2090000		2560000		6090	

MARINE CORPS BASE CAMP LEJEUNE
ANALYTICAL SUMMARY OF RESULTS
BACKGROUND - HADNOT CREEK
SURFACE WATER PESTICIDES AND PCBs

BAKER I.D.	HC-SW01	HC-SW02	HC-SW03	HC-SW03D	HC-SW04
LABORATORY I.D.	5167-16	5162	5166	5163	5152
DATE COLLECTED	08-MAY-1994	06-MAY-1994	06-MAY-1994	06-MAY-1994	08-MAY-1994
UNITS	ug/l	ug/l	ug/l	ug/l	ug/l

NO PESTICIDES OR PCBs WERE DETECTED

MARINE CORPS BASE CAMP LEJEUNE
ANALYTICAL SUMMARY OF RESULTS
BACKGROUND - HADNOT CREEK
SURFACE WATER - SEMIVOLATILE ORGANIC COMPOUNDS

BAKER I.D.	HC-SW01	HC-SW02	HC-SW03	HC-SW03D	HC-SW04
LABORATORY I.D.	5167-16	5162	5166	5163	5152
DATE COLLECTED	08-MAY-1994	06-MAY-1994	06-MAY-1994	06-MAY-1994	08-MAY-1994
UNITS	ug/l	ug/l	ug/l	ug/l	ug/l

NO SEMIVOLATILE ORGANIC COMPOUNDS WERE DETECTED

MARINE CORPS BASE CAMP LEJEUNE
ANALYTICAL SUMMARY OF RESULTS
BACKGROUND - HADNOT CREEK
SURFACE WATER - VOLATILE ORGANIC COMPOUNDS

BAKER I.D.	HC-SW01	HC-SW02	HC-SW03	HC-SW03D	HC-SW04
LABORATORY I.D.	5167-16	5162	5166	5163	5152
DATE COLLECTED	08-MAY-1994	06-MAY-1994	06-MAY-1994	06-MAY-1994	08-MAY-1994
UNITS	ug/l	ug/l	ug/l	ug/l	ug/l

NO VOLATILE ORGANIC COMPOUNDS WERE DETECTED

MARINE CORPS BASE CAMP LEJEUNE
ANALYTICAL SUMMARY OF RESULTS
BACKGROUND - HOLLAND MILL CREEK
SURFACE WATER - METALS

BAKER I.D.	HM-SW01		HM-SW02		HM-SW03	
LABORATORY I.D.	5167-18		5161		5160	
DATE COLLECTED	08-MAY-1994		06-MAY-1994		06-MAY-1994	
UNITS	UG/L		UG/L		UG/L	
Aluminum	259	U	535	J	288	U
Barium	49	J	38	J	20	J
Calcium	14100		40200		302000	
Chromium	10	U	36	J	158	J
Iron	425		559		320	
Lead	1	U	2.5	U	58.1	
Magnesium	2830		109000		754000	
Potassium	1670	U	41100		288000	
Selenium	1.5	J	5	U	41	J
Silver	10	U	17	U	37	J
Sodium	16500		739000		6750000	

MARINE CORPS BASE CAMP LEJEUNE
ANLAYTICAL SUMMARY OF RESULTS
BACKGROUND - HOLLAND MILL CREEK
SURFACE WATER - PESTICIDES AND PCBs

BAKER I.D.	HM-SW01	HM-SW02	HM-SW03
LABORATORY I.D.	5167-18	5161	5160
DATE COLLECTED	08-MAY-1994	06-MAY-1994	06-MAY-1994
UNITS	ug/l	ug/l	ug/l

NO PESTICIDES OR PCBs WERE DETECTED

MARINE CORPS BASE CAMP LEJEUNE
ANALYTICAL SUMMARY OF RESULTS
BACKGROUND - HOLLAND MILL CREEK
SURFACE WATER - SEMIVOLATILE ORGANIC COMPOUNDS

BAKER I.D.	HM-SW01	HM-SW02	HM-SW03
LABORATORY I.D.	5167-18	5161	5160
DATE COLLECTED	08-MAY-1994	06-MAY-1994	06-MAY-1994
UNITS	ug/l	ug/l	ug/l

NO SEMIVOLATILE ORGANIC COMPOUNDS WERE DETECTED

MARINE CORPS BASE CAMP LEJEUNE
ANALYTICAL SUMMARY OF RESULTS
BACKGROUND - HOLLAND MILL CREEK
SURFACE WATER - VOLATILE ORGANIC COMPOUNDS

BAKER I.D.	HM-SW01	HM-SW02	HM-SW03
LABORATORY I.D.	5167-18	5161	5160
DATE COLLECTED	08-MAY-1994	06-MAY-1994	06-MAY-1994
UNITS	ug/l	ug/l	ug/l

NO VOLATILE ORGANIC COMPOUNDS WERE DETECTED

MARINE CORPS BASE CAMP LEJEUNE
ANALYTICAL SUMMARY OF RESULTS
BACKGROUND - WEBB CREEK
SURFACE WATER - METALS

BAKER I.D.	WC-SW02		WC-SW03	
LABORATORY I.D.	5167-8		5158	
DATE COLLECTED	06-MAY-1994		06-MAY-1994	
UNITS	UG/L		UG/L	
Barium	29	J	27	J
Calcium	46900		40500	
Chromium	15	U	97	J
Iron	660		321	
Magnesium	29000		44800	
Potassium	10900		136000	
Sodium	202000		895000	

MARINE CORPS BASE CAMP LEJEUNE
ANALYTICAL SUMMARY OF RESULTS
BACKGROUND - WEBB CREEK
SURFACE WATER - PESTICIDES AND PCBs

BAKER I.D.	WC-SW02	WC-SW03
LABORATORY I.D.	5167-8	5158
DATE COLLECTED	06-MAY-1994	06-MAY-1994
UNITS	ug/l	ug/l
Aldrin	0.035 J	0.05 U

MARINE CORPS BASE CAMP LEJEUNE
ANALYTICAL SUMMARY OF RESULTS
BACKGROUND - WEBB CREEK
SURFACE WATER - SEMIVOLATILE ORGANIC COMPOUNDS

BAKER I.D.	WC-SW02	WC-SW03
LABORATORY I.D.	5167-8	5158
DATE COLLECTED	06-MAY-1994	06-MAY-1994
UNITS	ug/l	ug/l

NO SEMIVOLATILE ORGANIC COMPOUNDS WERE DETECTED

MARINE CORPS BASE CAMP LEJEUNE
ANALYTICAL SUMMARY OF RESULTS
BACKGROUND - WEBB CREEK
SURFACE WATER - VOLATILE ORGANIC COMPOUNDS

BAKER I.D.	WC-SW02	WC-SW03
LABORATORY I.D.	5167-8	5158
DATE COLLECTED	06-MAY-1994	06-MAY-1994
UNITS	ug/l	ug/l

NO VOLATILE ORGANIC COMPOUNDS WERE DETECTED

Analytical Summary of Results
(Sediment)

MARINE CORPS BASE CAMP LEJEUNE
ANALYTICAL SUMMARY OF RESULTS
BACKGROUND - HADNOT CREEK
SEDIMENT - METALS

BAKER I.D.	HC-SD01-06	HC-SD01-612	HC-SD02-06	HC-SD02-612	HC-SD03-06	HC-SD03-06D	HC-SD03-612	HC-SD04-06	HC-SD04-612
LABORATORY I.D	5050	5044	5057-2	5054	5238	5237	5236	5052	5051
DATE COLLECTED	8-MAY-1994	8-MAY-1994	6-MAY-1994	6-MAY-1994	07-MAY-1994	07-MAY-1994	07-MAY-1994	8-MAY-1994	8-MAY-1994
UNITS	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG
Aluminum	2940 J	1880 J	7820 J	10100 J	3120 J	7310 J	14000 J	780 J	1260 J
Arsenic	0.46 J	0.28 J	1.1 J	1.9 J	7.5 U	6.5 U	7.9 U	0.45 J	0.26 J
Barium	16.3 J	14.6 J	9.2 J	8.7 J	3.9 U	10.2	17.2	4.1 J	5.5 J
Beryllium	0.14 J	0.16 U	0.25 J	0.32 J	0.95 R	0.92 R	1.3 R	0.13 U	0.15 U
Cadmium	0.03 J	0.03 J	0.1 J	0.04 J	0.66	0.08	0.04 U	0.03 J	0.03 UJ
Calcium	3620 J	3330 J	2030 J	1610 J	3380 J	3350 J	3310 J	1030 J	2150 J
Chromium	2.3	3.2	6	6	16.1	18.8	41.6	2	1.3
Cobalt	1.6 U	1.8 U	2.7 U	1.8 U	3.7 U	4.5	5	1.5 U	1.6 U
Copper	1	1.1	1.5	0.81	4.9 U	4.3 U	3.5 U	0.66	0.73
Iron	648	586	3660	4630	7280 J	11100 J	1700 J	382	583
Lead	0.77 R	0.88 R	1.1 R	7.1 R	5.3	3.7	8.6 R	1 R	1.1 R
Magnesium	87.7	77.1	1450	1040	4420	4130	6540	48.2 U	62.5 U
Manganese	6.9	6.5	6.5	4.9	17.1	35.1	64.7	3.7	3.5
Mercury	0.19 R	0.13 R	0.42 R	0.24 R	0.34	0.25	0.42	0.11 R	0.08 R
Nickel	1.6 U	1.8 U	2.7 U	1.8	9.9	5.5	12.1	1.5 U	1.6 U
Potassium	349 U	396 U	623	395 U	1420	1250	1840	324 U	355 U
Selenium	0.27 J	0.34 J	0.6 J	0.47 J	0.48 UJ	0.41 UJ	0.51 UJ	0.21 J	0.2 UJ
Sodium	339 U	385 U	2750	1630	14100 R	9860 R	6620 R	315 U	344 U
Thallium	0.14	0.16	0.42	0.28	0.34 U	0.29	0.44	0.13 U	0.15 U
Vanadium	2.6	2.8	8.4	7	20.5	18.4	36.9	1.5	1.9
Zinc	4.9 U	4.5 U	9.7 U	6.6 U	20.8	34.3	40	4.5 U	8.3 U

MARINE COPRS BASE CAMP LEJEUNE
ANALYTICAL SUMMARY OF RESULTS
BACKGROUND - HADNOT CREEK
SEDIMENT - PESTICIDES AND PCBs

BAKER I.D.	HC-SD01-06	HC-SD01-612	HC-SD02-06	HC-SD02-612	HC-SD03-06	HC-SD03-06D	HC-SD03-612	HC-SD04-06	HC-SD04-612
LABORATORY I.D.	5057-7	5044	5055	5054	5238	5237	5236	5052	5051
DATE COLLECTED	8-MAY-1994	8-MAY-1994	6-MAY-1994	6-MAY-1994	07-MAY-1994	07-MAY-1994	07-MAY-1994	8-MAY-1994	8-MAY-1994
UNITS	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
beta-BHC	2.4 U	2.8 U	4.2 U	2.8 U	5.8 U	4.9 U	6.2 U	2.3 U	1.7 J
delta-BHC	0.64 J	2.8 U	4.2 U	2.8 U	5.8 U	4.9 U	6.2 U	2.3 U	2.5 U
Heptachlor	0.48 J	2.8 U	4.2 U	2.8 U	5.8 U	4.9 U	6.2 U	2.3 U	2 J
4,4'-DDD	2.4 U	2.8 U	1.5 J	2.8 U	11 U	2 J	4 J	2.3 U	2.5 U
4,4'-DDT	4.7 U	5.4 U	8.2 U	5.3 U	11 U	1.2 J	12 U	4.4 U	4.8 U
Methoxychlor	24 U	28 U	42 U	28 U	58 U	49 U	62 U	0.94 J	25 U
Endrin aldehyde	0.59 J	5.4 U	7.1 J	0.77 J	11 U	9.6 U	12 U	4.4 U	4.8 U

MARINE CORPS BASE CAMP LEJEUNE
ANALYTICAL SUMMARY OF RESULTS
BACKGROUND - HADNOT CREEK
SEDIMENT - SEMIVOLATILE ORGANIC COMPOUNDS

BAKER I.D.	HC-SD01-06	HC-SD01-612	HC-SD02-06	HC-SD02-612	HC-SD03-06	HC-SD03-06D	HC-SD03-612	HC-SD04-06	HC-SD04-612
LABORATORY I.D.	5057-7	5044	5055	5054	5238	5237	5236	5052	5051
DATE COLLECTED	8-MAY-1994	8-MAY-1994	6-MAY-1994	6-MAY-1994	07-MAY-1994	07-MAY-1994	07-MAY-1994	8-MAY-1994	8-MAY-1994
UNITS	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg

NO SEMIVOLATILE ORGANIC COMPOUNDS WERE DETECTED

MARINE CORPS BASE CAMP LEJEUNE
ANALYTICAL SUMMARY OF RESULTS
BACKGROUND - HADNOT CREEK
SEDIMENT - VOLATILE ORGANIC COMPOUNDS

BAKER I.D.	HC-SD01-06	HC-SD01-612	HC-SD02-06	HC-SD02-612	HC-SD03-06	HC-SD03-06D	HC-SD03-612	HC-SD04-06	HC-SD04-612
LABORATORY I.D.	5057-7	5044	5055	5054	5238	5237	5236	5052	5051
DATE COLLECTED	8-MAY-1994	8-MAY-1994	6-MAY-1994	6-MAY-1994	07-MAY-1994	07-MAY-1994	07-MAY-1994	8-MAY-1994	8-MAY-1994
UNITS	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
Acetone	70 J	16 UJ	25 UJ	16 UJ	34 UJ	29 UJ	37 UJ	13 UJ	15 UJ
Carbon Disulfide	14 U	16 U	14	19 J	34 U	29 U	37 U	13 U	15 U
2-Butanone	7 J	16 UJ	25 UJ	16 UJ	34 UJ	29 UJ	37 UJ	13 UJ	15 UJ

MARINE CORPS BASE CAMP LEJEUNE
ANALYTICAL SUMMARY OF RESULTS
BACKGROUND - HOLLAND MILL CREEK
SEDIMENT - METALS

BAKER I.D.	HM-SD01-06	HM-SD01-06D	HM-SD01-612	HM-SD02-06	HM-SD02-612	HM-SD03-06	HM-SD03-612
LABORATORY I.D.	5243-18	5220	5219	5242	5241	5240	5239
DATE COLLECTED	08-MAY-1994	08-MAY-1994	08-MAY-1994	07-MAY-1994	07-MAY-1994	07-MAY-1994	07-MAY-1994
UNITS	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG
Aluminum	457 J	337 J	505 J	13600 J	9850 J	8760 J	9760 J
Barium	3.4 U	2.1 U	3.9 U	18.7	13.7	11	12.9
Cadmium	0.03	0.11	0.03	0.08	0.06	0.05	0.03
Calcium	282 J	508 J	2850 J	4250 J	7860 J	2920 J	2000 J
Chromium	1.6	1.1	1.5	38.4	28.1	30.7	36
Cobalt	1.3 U	1.4 U	1.4 U	4.4	3.5 U	3.9 U	4
Iron	262 J	225 J	350 J	15800 J	32400 J	16900 J	19900 J
Lead	0.62 J	0.74 J	1	6	7.2	9.2	5.7
Magnesium	35.5	26.7	34.4	4940	3000	5700	4300
Manganese	1.9	1.3	1.6	67.2	55.5	50.2	61.3
Mercury	0.09	0.16	0.18	0.27	0.32	0.35	0.27
Nickel	1.3 U	1.4 U	1.4 U	11.2	9.6	14.2	10.3
Potassium	297 U	304 U	317 U	1510	1600	1720	1760
Selenium	0.17 U	0.17 U	0.25 J	0.4 J	0.45 UJ	0.5 UJ	0.37 UJ
Silver	0.49	0.37 U	0.39 U	0.85 U	0.95 U	1.1 U	0.79 U
Thallium	0.12 U	0.12 U	0.13	0.37	0.32	0.35 U	0.27
Vanadium	0.84	0.62 U	0.66	27.1	30	28.4	29.5
Zinc	9.7	6.7	8.3	43.1	33.2	34.1	29.9

MARINE CORPS BASE CAMP LEJEUNE
ANALYTICAL SUMMARY OF RESULTS
BACKGROUND - HOLLAND MILL CREEK
SEDIMENT - PESTICIDES AND PCBs

BAKER I.D.	HM-SD01-06		HM-SD01-06D		HM-SD01-612		HM-SD02-06		HM-SD02-612		HM-SD03-06		HM-SD03-612	
LABORATORY I.D.	5243-18		5220		5219		5242		5241		5240		5239	
DATE COLLECTED	08-MAY-1994		08-MAY-1994		08-MAY-1994		07-MAY-1994		07-MAY-1994		07-MAY-1994		07-MAY-1994	
UNITS	ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg	
beta-BHC	2.1	UJ	7.3	J	3.8		5.1	U	5.5	U	6	U	4.5	U
Aldrin	2.1	U	0.56	J	0.72	J	5.1	U	5.5	U	6	U	4.5	U
Dieldrin	4	U	0.58	J	1.5	J	9.8	U	11	U	12	U	8.8	U
4,4'-DDE	4	U	1	J	4.3		9.8	U	11	U	12	U	8.8	U
4,4'-DDD	4	U	0.87	J	3.1		9.8	U	11	U	2.5	J	1.1	J
4,4'-DDT	4	U	4.1	U	1.7	J	9.8	U	11	U	12	U	8.8	U
alpha-Chlordane	2.1	U	2.1	U	1.3	J	5.1	U	5.5	U	6	U	4.5	U
gamma-Chlordane	2.1	U	2.1	U	3		5.1	U	5.5	U	6	U	4.5	U

MARINE CORPS BASE CAMP LEJEUNE
ANALYTICAL SUMMARY OF RESULTS
BACKGROUND - HOLLAND MILL CREEK
SEDIMENT - SEMIVOLATILE ORGANIC COMPOUNDS

BAKER I.D.	HM-SD01-06		HM-SD01-06D		HM-SD01-612		HM-SD02-06		HM-SD02-612		HM-SD03-06		HM-SD03-612	
LABORATORY I.D.	5243-18		5220		5219		5242		5241		5240		5239	
DATE COLLECTED	08-MAY-1994		08-MAY-1994		08-MAY-1994		07-MAY-1994		07-MAY-1994		07-MAY-1994		07-MAY-1994	
UNITS	ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg	
Di-n-butylphthalate	401	U	412	U	429	U	614	J	619	J	1150	U	534	J
bis(2-Ethylhexyl)phthalate	401	UJ	412	UJ	429	UJ	943	U	1058	U	1150	U	454	J

MARINE CORPS BASE CAMP LEJEUNE
ANALYTICAL SUMMARY OF RESULTS
BACKGROUND - HOLLAND MILL CREEK
SEDIMENT - VOLATILE ORGANIC COMPOUNDS

BAKER I.D.	HM-SD01-06	HM-SD01-06D	HM-SD01-612	HM-SD02-06	HM-SD02-612	HM-SD03-06	HM-SD03-612
LABORATORY I.D.	5243-18	5220	5219	5242	5241	5240	5239
DATE COLLECTED	08-MAY-1994	08-MAY-1994	08-MAY-1994	07-MAY-1994	07-MAY-1994	07-MAY-1994	07-MAY-1994
UNITS	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg

NO VOLATILE ORGANIC COMPOUNDS WERE DETECTED

MARINE CORPS BASE CAMP LEJEUNE
ANALYTICAL SUMMARY OF RESULTS
BACKGROUND - WEBB CREEK
SEDIMENT - METALS

BAKER I.D.	WC-SD02-06		WC-SD02-612		WC-SD03-06		WC-SD03-612	
LABORATORY I.D.	5243-10		5232		5235		5234	
DATE COLLECTED	06-MAY-1994		06-MAY-1994		07-MAY-1994		07-MAY-1994	
UNITS	MG/KG		MG/KG		MG/KG		MG/KG	
Aluminum	14800	J	8200		11500	J	14600	J
Barium	28.2		13.3		14.6		19.2	
Cadmium	0.26		0.12		0.06		0.07	
Calcium	4060	J	3260	J	2190	J	3380	J
Chromium	18.1		8.7		30.3		42.6	
Cobalt	3.5		2.3	U	2.4	U	3.9	
Iron	14600	J	8120		12500	J	20700	J
Lead	16.9		11.9		5.1		5.5	
Magnesium	1690		618		4420		6060	
Manganese	40.2		26		43.4		47.8	
Mercury	0.4		0.36		0.23		0.26	
Nickel	5.7		3.8		8.1		11.4	
Potassium	739	U	508	U	1410		1590	
Thallium	0.3	U	0.21	U	0.24		0.32	U
Vanadium	21		11.9		21.4		31	
Zinc	52		27.8		28.3		27.2	

MARINE CORPS BASE CAMP LEJEUNE
ANALYTICAL SUMMARY OF RESULTS
BACKGROUND - WEBB CREEK
SEDIMENT - PESTICIDES AND PCBs

BAKER I.D.	WC-SD02-06		WC-SD02-612		WC-SD03-06		WC-SD03-612	
LABORATORY I.D.	5243-10		5232		5235		5234	
DATE COLLECTED	06-MAY-1994		06-MAY-1994		07-MAY-1994		07-MAY-1994	
UNITS	ug/kg		ug/kg		ug/kg		ug/kg	
delta-BHC	5.2	U	0.79	J	3.7	U	5.4	U
Aldrin	1.2	J	3.9	U	3.7	U	5.4	U
Dieldrin	3.7	J	7.5	U	7.1	U	10	U
4,4'-DDE	16		7.5	U	7.1	U	10	U
4,4'-DDD	12		7.5	U	7.1	U	10	U
4,4'-DDT	2.6	J	1.1	J	0.76	J	10	U

MARINE CORPS BASE CAMP LEJEUNE
ANALYTICAL SUMMARY OF RESULTS
BACKGROUND - WEBB CREEK
SEDIMENT - SEMIVOLATILE ORGANIC COMPOUNDS

BAKER I.D.	WC-SD02-06		WC-SD02-612		WC-SD03-06		WC-SD03-612	
LABORATORY I.D.	5243-10		5232		5235		5234	
DATE COLLECTED	06-MAY-1994		06-MAY-1994		07-MAY-1994		07-MAY-1994	
UNITS	ug/kg		ug/kg		ug/kg		ug/kg	
Benzo(a)pyrene	1000	U	688	U	714	U	544	J

MARINE CORPS BASE CAMP LEJEUNE
ANALYTICAL SUMMARY OF RESULTS
BACKGROUND - WEBB CREEK
SEDIMENT - VOLATILE ORGANIC COMPOUNDS

BAKER I.D.	WC-SD02-06	WC-SD02-612	WC-SD03-06	WC-SD03-612
LABORATORY I.D.	5243-10	5232	5235	5234
DATE COLLECTED	06-MAY-1994	06-MAY-1994	07-MAY-1994	07-MAY-1994
UNITS	ug/kg	ug/kg	ug/kg	ug/kg

NO VOLATILE ORGANIC COMPOUNDS WERE DETECTED

Field Chemistry Results

FIELD CHEMISTRY FROM BIOLOGICAL SAMPLES
HADNOT CREEK, HOLLAND MILL CREEK, AND WEBB CREEK
MCB CAMP LEJEUNE, NORTH CAROLINA

Sample Identification	Sample Location	Salinity (ppt)	Conductivity (micromhos/cm)	DO (mg/L)	pH (S.U.)	Temperature (deg. C)
HC01-SW/SD-FS/BN	surface	0	13.5	7.7	6.89	17
	bottom	NA	NA	NA	NA	NA
HC02-SW/SD	surface	0.8	1,810	5.9	6.71	16.1
	bottom	15.5	21,900	1.0	6.73	18.2
HC02-FS/BN	surface	0.3	1,200	NA	NA	20.5
	bottom	13.1	20,900	NA	NA	22
	surface	0	720	7.3	7.2	15.5
	bottom	10.5	17,200	1	6.7	20
	surface	0	1,050	NA	NA	20.5
	bottom	16.5	22,800	NA	NA	21
HC03-SW/SD	surface	17	25,500	12	7.79	17.5
	bottom	NA	NA	NA	NA	NA
HC03-FS/BN	surface	17.9	26,500	NA	7.69	17.8
	bottom	NA	NA	NA	NA	NA
HC04-SW/SD-FS/BN	surface	0	65	5.3	6.16	17.3
	bottom	NA	NA	NA	NA	NA
HM01-SW/SD-FS/BN	surface	0	140	8.0	6.9	17.5
	bottom	NA	NA	NA	NA	NA
HM02-SW/SD	surface	24	36,000	11.8	7.9	17.2
	bottom	25	38,000	11.6	7.6	17.6
HM02-FS/BN	surface	21	29,000	7.75	NA	21
	bottom	19	27,000	7.75	NA	20
	surface	2	3,810	NA	NA	19
	bottom	3.75	6,000	NA	NA	19.5
	surface	1	2,490	5.8	6.85	15.5
	bottom	1.1	2,700	5.0	6.72	15.2
HM03-SW/SD	surface	13.5	19,000	3.4	6.81	17.8
	bottom	NA	NA	NA	NA	NA
HM03-FS/BN	surface	22	32,000	10.8	7.90	17.5
	bottom	NA	NA	NA	NA	NA

Sample Identification	Sample Location	Salinity (ppt)	Conductivity (micromhos/cm)	DO (mg/L)	pH (S.U.)	Temperature (deg. C)
WC02-SW/SD	surface	4.5	9,000	9.0	7.48	21
	bottom	5.5	9,000	7.0	7.48	20.5
	surface	0	975	5.1	7.08	17.5
	bottom	0	1,250	4.4	7.15	17.5
WC02-FS/BN	surface	0	850	5.5	6.98	20.5
	bottom	7	10,500	6.1	6.85	21
WC03-SW/SD	surface	10	16,500	10	7.33	23
	bottom	10	16,500	8.5	7.36	22.4
WC03-FS/BN	surface	12	17,200	9.1	7.43	20
	bottom	12.8	18,000	9.6	7.56	19

ppt = parts per thousand
S.U. = Standard Units
NA = Not Analyzed
Sample Location = Water surface or water bottom
DO = Dissolved Oxygen level

FS = Fish sample
BN = Benthic Macroinvertebrate sample
SW/SD = Surface water/sediment sample

Positive Detection Summary
Fish Fillet Tissue Analysis

MARINE CORPS BASE CAMP LEJEUNE
BACKGROUND - HADNOT CREEK
POSITIVE DETECTIONS SUMMARY
FISH FILLET TISSUE SAMPLES

Parameter	HC1A-RD (Red Drum) (mg/kg)	HC1A-SF (Southern Flounder) (mg/kg)	HC1A-LBA (Largemouth Bass) (mg/kg)	HC1A-LBB (Largemouth Bass) (mg/kg)	HC1A-LBC (Largemouth Bass) (mg/kg)	HC1A-BCA (Blue Crab) (mg/kg)	HC1A-BCA (Blue Crab) (mg/kg)	HC1A-GA (Longnose Gar) (mg/kg)	HC1A-GB (Longnose Gar) (mg/kg)
Volatiles									
Acetone	0.13 J	0.056 J	0.077 J	0.07 J	0.037 J	0.11 J	0.099 J	0.028 J	0.016 J
Methylene Chloride	0.041	0.013 B	0.017 B	0.016 B	0.003 B	0.011 B	0.022 B	0.004 B	0.015 B
Semivolatiles									
Phenol	ND	0.46	ND	2.1	1.6	ND	ND	ND	ND
Di-n-octyl phthalate	ND	ND	0.061 J	ND	0.085	ND	ND	0.29 J	0.5 J
Bis(2-ethylhexyl)phthalate	1.1 B	0.82 B	3.6 B	3.2 B	4.8 B	ND	ND	11 J	17 J
Pesticides/PCBs									
4,4'-DDD	ND	ND	ND	ND	ND	0.0066	0.0056	ND	ND
4,4'-DDE	ND	ND	ND	ND	ND	0.0087	0.0046	0.012	0.0097
alpha-Chlordane	ND	ND	ND	ND	0.00017 P	0.0018	0.0012	ND	ND
Aroclor-1260	ND	ND	ND	ND	ND	ND	ND	ND	ND
Inorganics									
Aluminum	ND	ND	ND	36.5	ND	ND	ND	ND	ND
Arsenic	0.7 L	0.82	0.34 L	0.37 L	0.36 K	0.68	0.39	2.5	3.9 L
Barium	ND	ND	ND	ND	ND	ND	10.1	ND	ND
Cadmium	ND	ND	ND	ND	ND	0.14	0.11 J	ND	ND
Calcium	154	271	528	684	1170	4480	32200	493	520
Chromium	0.38 L	ND	0.23 L	0.68 L	0.63 L	ND	0.52 L	0.32 L	0.21 L
Copper	0.3 J	0.18 J	0.2 J	0.24 J	0.28 J	7.9	5.8	0.46 J	0.18 J
Iron	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lead	ND	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium	285	254	298	292	319	591	1800	286	300
Manganese	0.13	0.38	0.09 J	0.09 J	0.08 J	1.8	13.6	0.24 J	0.21 J
Mercury	0.07	0.05	0.22	0.24	0.17 K	0.08	0.02 J	0.22	0.14
Nickel	ND	ND	ND	ND	ND	ND	ND	0.45 L	ND
Potassium	3930	3700	3740	3610	4040	2170	1860	3410	3270
Sodium	1060	607	505	580	529	4060	4270	623	523
Zinc	5	5	3.9	4.4	4.6 L	25	17.9	6.5	4.6

Fish Distribution and Characterization

FISH DISTRIBUTION AND CHARACTERIZATION
BACKGROUND STATIONS - WEBB, HADNOT, AND HOLLAND MILL CREEKS

MCB CAMP LEJEUNE, NORTH CAROLINA

Common Name	Scientific Name	Length N.C. (cm)	Length Atlas (cm)	Water Type	Habitat	Spawning	Tolerance	Family	Sources
Atlantic Menhaden	Brevoortia tyrannus	20	46	Brackish or marine, enters freshwater	Rivers, streams	NA	Intermediate	Clupeidae	1,2,3,4
Spot	Leiostomas xanthurus	NA	NA	Brackish or marine, enters freshwater	NA	NA	NA	Sciaenidae	1
Stripped Mullet	Mugil cephalus	NA	23-35	Brackish or marine, enters freshwater	Rivers	NA	NA	Mugilidae	1,2
Pinfish	Lagodon rhomboides	NA	38	Marine, seldom enters freshwater	Shallow waters	NA	NA	Sparidae	1,2
Mud Catfish (Yellow Bullhead)	Ictalupus natalis	24	-38	Freshwater	Rivers Streams	April through May	Tolerant	Ictaluridae	1,2,3
Redbreast Sunfish	Lepomis auritus	18	6-15	Freshwater	Streams	April through June	NA	Centrarchidae	1,2,3
Atlantic Croaker	Micropogonias undulatus	NA	61	Estuaries, brackish-water or marine	NA	NA	NA	Sciaenidae	1,2
Pumpkinseed	Lepomis gibbosus	20	8-20	Freshwater	Streams Creeks	April through October	Moderately Tolerant	Centrarchidae	1,2,3,4
Longnose Gar	Lepisosteus osseus	80	-150	Freshwater; May enter brackish water	Rivers	April through May	Intermediate	Lepisosteidae	1,2,3
Summer Flounder	Paralichthys dentatus	NA	37	Brackish or marine, enters freshwater	Rivers	NA	NA	Bothidae	1
Flier	Centrarchus macropterus	12	7-19	Freshwater	Streams	April through May	NA	Centrarchidae	1,2,3
Chain Pickerel	Esox niger	44	38-45	Freshwater	Streams Creeks	February through March	Intermediate	Esocidae	1,2,3

FISH DISTRIBUTION AND CHARACTERIZATION
BACKGROUND STATIONS - WEBB, HADNOT, AND HOLLAND MILL CREEKS
REMEDIAL INVESTIGATION, CTO-0232
MCB CAMP LEJEUNE, NORTH CAROLINA

Common Name	Scientific Name	Length N.C. (cm)	Length Atlas (cm)	Water Type	Habitat	Spawning	Tolerance	Family	Sources
Redear Fish	Lepomis microlophus	18	14-25	Freshwater	Streams	May through August	Intermediate	Centrarchidae	1,2,3
Warmouth	Lepomis gulosus	16	8-26	Freshwater	Rivers Streams	May through August	Intermediate	Centrarchidae	1,2,3
White Perch	Morone americana	NA	to 48	Brackish water; Freshwater	Bays and estuaries; Rivers and lakes	NA	Intermediate	Percichthyidae	3,5
Bluefish	Pomatomus saltatrix	NA	NA	Coastal waters	Surface waters; Near shore and off shore	NA	NA	Pomatomidae	2
Bluegill	Lepomis macrochirus	25	18-20	Freshwater	Rivers Streams Creeks	May through October	Intermediate	Centrarchidae	1,2,3
White Catfish	Ictalurus catus	31	-46	Freshwater	Rivers	May through June	Intermediate	Ictaluridae	1,2,3
Largemouth Bass	Micropterus salmoides	48	12-70	Freshwater	Rivers Streams Creeks	May through June	Intermediate	Centrarchidae	1,2,3
Mummichog	Fundulus heterclitus	7	8-10	Shallow coastal waters	Rivers Streams	April through August	NA	Cyprinodontidae	1,2,3
Redfin Pickerel	Esox americanus	23	25-30	Freshwater	Streams Creeks	February through March	NA	Esocidae	1,2,3
Hog Choker	Trinectes maculatus	5	7-12	Shallow coastal waters; Occasionally enters freshwater	Rivers Streams	March through April	NA	Soleidae	1,2,3

FISH DISTRIBUTION AND CHARACTERIZATION
BACKGROUND STATIONS - WEBB, HADNOT, AND HOLLAND MILL CREEKS
REMEDIAL INVESTIGATION, CTO-0232
MCB CAMP LEJEUNE, NORTH CAROLINA

Common Name	Scientific Name	Length N.C. (cm)	Length Atlas (cm)	Water Type	Habitat	Spawning	Tolerance	Family	Sources
Pirate Perch	Aphredoderus sayanus	9	7-14	Freshwater	Streams Creeks	January through March	Intermediate	Aphredoderidae	1,2,3
Eastern Mosquito (Mosquitofish) –	Gambusia affinis	NA	NA	Fresh or brackish water	Ponds, lakes, ditches, backwaters, sluggish streams	NA	Intermediate	Poeciliidae	2,5

1 Menhinick, 1992.
2 Boschung, 1983.
3 USEPA, 1989d.
4 Raasch, 1991.
5 Kennish, 1986.
NA = Information not Available

TOTAL NUMBER AND PERCENT OF AQUATIC SPECIES IDENTIFIED PER AREA
WEBB CREEK AND HADNOT CREEK

MCB CAMP LEJEUNE, NORTH CAROLINA

SPECIES	WEBB CREEK		Total Detected	HADNOT CREEK				Total Detected
	WC02	WC03		HC01	HCO2	HC03	HC04	
FISH SPECIES								
Spot	4		4			12		12
Stripped Mullet	4		4			3		3
Pumpkinseed			0		3			3
Mudcat	3		3	3				3
Redbreast sunfish	1		1	2				2
Long-Nosed Gar	9	5	14					0
American flier			0	3				3
Chain pickerel			0	1				1
Redear fish			0	1				1
Atlantic croaker			0			5		5
Warmouth			0		1			1
Bluefish			0			3		3
Yellow Bullhead	3		3	2				2
Blue gill	4		4					0
White catfish	1		1					0
Largemouth bass	2		2					0
Summer flounder		1	1					0
Mummichog		3	3					0
Pinfish	25	24	49			5		5
Atlantic menhaden			0			2		2
Redfin pickerel			0				2	2
White perch			0			1		1
Hog choker			0			1		1
Pirate perch			0				8	8

TOTAL NUMBER AND PERCENT OF AQUATIC SPECIES IDENTIFIED PER AREA
WEBB CREEK AND HADNOT CREEK

MCB CAMP LEJEUNE, NORTH CAROLINA

SPECIES	WEBB CREEK		Total Detected	HADNOT CREEK				Total Detected
	WC02	WC03		HC01	HCO2	HC03	HC04	
NO. OF SPECIES	9	4	12	5	2	8	2	18
NO. OF INDIVIDUALS	53	33	86	10	4	32	10	56
OTHER AQUATIC SPECIES								
Grass shrimp		3	3					0
Crayfish			0				3	3
NUMBER OF SPECIES	0	1	1	0	0	0	1	1
NO. OF INDIVIDUALS	0	3	3	0	0	0	3	3

TOTAL NUMBER AND PERCENT OF AQUATIC SPECIES IDENTIFIED PER AREA
HOLLAND MILL CREEK

MCB CAMP LEJEUNE, NORTH CAROLINA

SPECIES	HOLLAND MILL CREEK (CARTWHEEL BRANCH)			Total Detected
	HM01	HM02	HM03	
Spot			8	8
Stripped Mullet		11	3	14
Pumpkinseed	16	2		18
Chain pickerel	2			2
Swamp darter	6			6
Mud sunfish	1			1
Black drum		1		1
Ligar		3		3
Gizzard Shad		2		2
Spotted sunfish		2		2
Blue gill	2	1		3
Atlantic menhaden			199	199
Largemouth bass		1		1
Hog choker			2	2
Summer flounder		1	17	18
Mummichog		6		6
Pinfish		7	4	11
Goby, freshwater	1	1		2
NUMBER OF SPECIES	6	12	6	18
NO. OF INDIVIDUALS	28	38	233	299

TOTAL NUMBER AND PERCENT OF AQUATIC SPECIES IDENTIFIED PER AREA
HOLLAND MILL CREEK

MCB CAMP LEJEUNE, NORTH CAROLINA

SPECIES	HOLLAND MILL CREEK (CARTWHEEL BRANCH)			Total Detected
	HM01	HM02	HM03	
OTHER AQUATIC SPECIES				
Unknown	1			1
Grass shrimp		13		13
Crayfish	3			3
NUMBER OF SPECIES	2	1	0	3
NO. OF INDIVIDUALS	4	13	0	17

HADNOT CREEK - BACKGROUND STATIONS

SPECIES	COC SAMPLE NO.	HC01 Fish Length (cm)	HC01 Mass Weight	HC01 Average Weight (g)	HC02 Fish Length (cm)	HC02 Mass Weight	HC02 Average Weight (g)	HC03 Fish Length (cm)	HC03 Mass Weight	HC03 Average Weight (g)	HC04 Fish Length (cm)	HC04 Mass Weight	HC04 Average Weight (g)
Strippet Mullet	HC03							15.25	45	45			
								12.5	20	20			
								12.5	20	20			
	COUNT							3		3			
	AVERAGE							13.416666667		28.333333333			
	MAXIMUM							15.25		45			
	MINIMUM							12.5		20			
								+1 collected, no length or weight					
Atlantic Menhaden	HC03							5	<5	2.5			
	COUNT							2		2			
	AVERAGE							5		2.5			
	MAXIMUM							5		2.5			
	MINIMUM							5		2.5			
Blue Fish	HC03							7	7	7			
								11	17	17			
								8	8	8			
	COUNT							3		3			
	AVERAGE							8.6666666667		10.666666667			
	MAXIMUM							11		17			
	MINIMUM							7		7			
Spot	HC03							12.5	22	22			
								5.5	<5.0	2.5			
								5.75	<5.0	2.5			
								5	<5.0	2.5			
								3.5	<5.0	2.5			
								5.5	<5.0	2.5			
								14	40	40			
								13.5	35	35			
								12	35	35			
								14	35	35			
								5.5	<5.0	2.5			
								11.5	20	20			
	COUNT							12		12			
	AVERAGE							9.0208333333		18.833333333			
	MAXIMUM							14		40			
	MINIMUM							3.5		2.5			

HADNOT CREEK - BACKGROUND STATIONS

SPECIES	COC SAMPLE NO.	HC01 Fish Length (cm)	Mass Weight	Average Weight (g)	HC02 Fish Length (cm)	Mass Weight	Average Weight (g)	HC03 Fish Length (cm)	Mass Weight	Average Weight (g)	HC04 Fish Length (cm)	Mass Weight	Average Weight (g)
White Perch	HC03							18.5	105	105			
	COUNT							1		1			
	AVERAGE							18.5		105			
	MAXIMUM							18.5		105			
	MINIMUM							18.5		105			
Hogchoker	HC03							5.5	5	5			
	COUNT							1		1			
	AVERAGE							5.5		5			
	MAXIMUM							5.5		5			
	MINIMUM							5.5		5			
Pinfish													
	HC03							13	35	35			
								10.8	25	25			
								11	22	22			
								10.5	25	25			
								13	37	37			
	COUNT							5		5			
	AVERAGE							11.66		28.8			
	MAXIMUM							13		37			
	MINIMUM							10.5		22			
Atlantic Croaker	HC03							11.5	20	20			
								10.5	16	16			
								9	10	10			
								10.5	14	14			
								7.5	<5	2.5			
	COUNT							5		5			
	AVERAGE							9.8		12.5			
	MAXIMUM							11.5		20			
	MINIMUM							7.5		2.5			
Redbreast Sunfish	HC01	23.5	265	265									
		20	175	175									
	COUNT	2		2									
	AVERAGE	21.75		220									
	MAXIMUM	23.5		265									
	MINIMUM	20		175									
American Flyer	HC01	16.5	65	65									
		9.5	15	15									
		+1 collected, no length or weight											
	COUNT	3		3									
	AVERAGE	13		40									
	MAXIMUM	16.5		65									
	MINIMUM	9.5		15									

HADNOT CREEK - BAC.. .UND STATIONS

SPECIES	COC SAMPLE NO.	HC01 Fish Length (cm)	Mass Weight	Average Weight (g)	HC02 Fish Length (cm)	Mass Weight	Average Weight (g)	HC03 Fish Length (cm)	Mass Weight	Average Weight (g)	HC04 Fish Length (cm)	Mass Weight	Average Weight (g)
Chain Pickerel	HC01	37	290	290									
	COUNT	1		1									
	AVERAGE	37		290									
	MAXIMUM	37		290									
	MINIMUM	37		290									
Yellow Bullhead	HC01	26.5	270	270									
		26.5	275	275									
	COUNT	2		2									
	AVERAGE	26.5		272.5									
	MAXIMUM	26.5		275									
	MINIMUM	26.5		270									
Pumpkinseed	HC02				13	50	50						
					17.5	125	125						
					16	100	100						
	COUNT				3		3						
	AVERAGE				15.5		91.666667						
	MAXIMUM				17.5		125						
	MINIMUM				13		50						
Warmouth	HC02				22	250	250						
	COUNT				1		1						
	AVERAGE				22		250						
	MAXIMUM				22		250						
	MINIMUM				22		250						
											+1 collected, no length or weight		
Redfin Pickerel	HC04										17	30	30
	COUNT										2		2
	AVERAGE										17		30
	MAXIMUM										17		30
	MINIMUM										17		30
Pirate Perch	HC04										5	>5	2.5
											4.5		2.5
											+6 collected, no length or weight		
	COUNT										8		8
	AVERAGE										4.75		2.5
	MAXIMUM										5		2.5
	MINIMUM										4.5		2.5
Crayfish	HC04										6	10	3.3
											4.5		3.3
											4		3.3
	COUNT										3		3
	AVERAGE										4.8333333		3.3
	MAXIMUM										6		3.3
	MINIMUM										4		3.3
Mudcat	3 collected at HC01, no length or weight												

HOLLAND MILL CREEK - BACKGROUND STATIONS

SPECIES	COC SAMPLE NO.	HM01 Fish Length (cm)	Mass Weight	Average Weight (g)	HM02 Fish Length (cm)	Mass Weight	Average Weight (g)	HM03 Fish Length (cm)	Mass Weight	Average Weight (g)
Strippet Mullet	HM02				38.5	640	640			
					39.5	600	600			
					34.5	400	400			
					34.5	400	400			
					33.5	360	360			
					34	340	340			
					37	460	460			
					35	520	520			
					33.5	410	410			
					32	320	320			
					31	370	370			
	HM03							14.5	40	40
								6.5	<5	2.5
								+1 collected, no length or weight		
	COUNT				11		11	3		3
	AVERAGE				34.81818182		438.1818182	10.5		21.25
	MAXIMUM				39.5		640	14.5		40
	MINIMUM				31		320	6.5		2.5
Atlantic Menhaden	HM03							6	24	4
								6		4
								5.7		4
								5.4		4
								5.5		4
								5.6		4
								5.7	22	2.2
								5.5		2.2
								5		2.2
								5.5		2.2
								5.5		2.2
								5.2		2.2
								5.5		2.2
								5.5		2.2
								5.6		2.2
								6.2		2.2
								6	25	2.5
								5.5		2.5
								5		2.5
								5.5		2.5
								5.5		2.5
								5.5		2.5
								6		2.5
								5		2.5
								5.5		2.5
								5.5	20	2
								5.7		2
								5		2
								5		2
								6		2
								5.5		2
								5.5		2
								6		2
								6		2
								5.5		2
								5.5	27	1.8
								5.6		1.8
								5.5		1.8
								5.7		1.8
								6		1.8
								6		1.8
								6.5		1.8
								5.5		1.8
								6.5		1.8
								5.5		1.8
								5.5		1.8
								5.5		1.8
								6		1.8
								5.5		1.8
								5.5		1.8
								5.5	20	2
								4.5		2
								5		2
								5.5		2
								5.5		2
								5.5		2
								5.5		2
								6		2
								5.5		2
								6		2
								6		2
								138 collected no length or weight		
	COUNT							199		61
	AVERAGE							5.6		2.2540984
	MAXIMUM							6.5		4
	MINIMUM							4.5		1.8

HOLLAND MILL CREEK - BACKGROUND STATIONS

SPECIES	COC SAMPLE NO.	HM01 Fish Length (cm)	Mass Weight	Average Weight (g)	HM02 Fish Length (cm)	Mass Weight	Average Weight (g)	HM03 Fish Length (cm)	Mass Weight	Average Weight (g)
Summer Flounder	HM02				29.5	250	250			
	HM03							33	400	400
								43	850	850
								20.5	90	90
								24	120	120
								+13 collected, no length or weight		
	COUNT				1		1	17		4
	AVERAGE				29.5		250	30.125		365
	MAXIMUM				29.5		250	43		850
	MINIMUM				29.5		250	20.5		90
Black Drum	HM02				28	350	350			
	COUNT				1		1			
	AVERAGE				28		350			
	MAXIMUM				28		350			
	MINIMUM				28		350			
Spotted Sunfish	HM02				15.5	65	65			
					17	110	110			
	COUNT				2		2			
	AVERAGE				16.25		87.5			
	MAXIMUM				17		110			
	MINIMUM				15.5		65			
Largemouth Bass	HM02				34	540	540			
	COUNT				1		1			
	AVERAGE				34		540			
	MAXIMUM				34		540			
	MINIMUM				34		540			
								+1 collected, no length or weight		
Hogchoker	HM03							6	10	10
	COUNT							2		1
	AVERAGE							6		10
	MAXIMUM							6		10
	MINIMUM							6		10
Spot	HM03							5	<5	2.5
								12	25	25
								5.8	20	4
								6		4
								6.2		4
								6.4		4
								6.4		4
								+1 collected, no length or weight		
	COUNT							8		7
	AVERAGE							6.82857143		6.78571429
	MAXIMUM							12		25
	MINIMUM							5		2.5
Blue Gill	HM02				17		105			
	HM01	10.5	10	10						
		+1 collected, no length or weight								
	COUNT	2		1	1		1			
	AVERAGE	10.5		10	17		105			
	MAXIMUM	10.5		10	17		105			
	MINIMUM	10.5		10	17		105			

HOLLAND MILL CREEK - BACKGROUND STATIONS

SPECIES	COC SAMPLE NO.	HM01 Fish Length (cm)	Mass Weight	Average Weight (g)	HM02 Fish Length (cm)	Mass Weight	Average Weight (g)	HM03 Fish Length (cm)	Mass Weight	Average Weight (g)
Pumpkinseed	HM02				15	50	50			
					11.5	30	30			
	HM01	7.5	45	4.5						
		6.5		4.5						
		7.5		4.5						
		7.5		4.5						
		6		4.5						
		6		4.5						
		4.5		4.5						
		8.5		4.5						
		8		4.5						
		5.5		4.5						
		8	50	8.3						
		8.5		8.3						
		6.5		8.3						
		8.5		8.3						
		11		8.3						
		7.5		8.3						
	COUNT	16		16	2		2			
	AVERAGE	7.34375		5.925	13.25		40			
	MAXIMUM	11		8.3	15		50			
	MINIMUM	4.5		4.5	11.5		30			
Long-nose Gar	HM02				73	1250	1250			
					83	2000	2000			
					72.5	1640	1640			
	COUNT				3		3			
	AVERAGE				76.16666667		1630			
	MAXIMUM				83		2000			
	MINIMUM				72.5		1250			
Pinfish	HM02				17.5	80	80			
	HM03							5	<5	2.5
					+6 collected, no length or weight			+3 collected, no length or weight		
	COUNT				7		1	4		1
	AVERAGE				17.5		80	5		2.5
	MAXIMUM				17.5		80	5		2.5
	MINIMUM				17.5		80	5		2.5
Gizzard Shad	HM02				33	480	480			
					34	460	460			
	COUNT				2		2			
	AVERAGE				33.5		470			
	MAXIMUM				34		480			
	MINIMUM				33		460			
Chain Pickerel	HM01	13	10	5						
		13.5		5						
	COUNT	2		2						
	AVERAGE	13.25		5						
	MAXIMUM	13.5		5						
	MINIMUM	13		5						
Unknown Fish	HM01	7.5	<5	2.5						
	COUNT	1		1						
	AVERAGE	7.5		2.5						
	MAXIMUM	7.5		2.5						
	MINIMUM	7.5		2.5						
Swamp Darter	HM01	6	18	3						
		6		3						
		6		3						
		6		3						
		6		3						
		6		3						
	COUNT	6		6						
	AVERAGE	6		3						
	MAXIMUM	6		3						
	MINIMUM	6		3						

HOLLAND MILL CREEK - BACKGROUND STATIONS

SPECIES	COC SAMPLE NO.	HM01 Fish Length (cm)	Mass Weight	Average Weight (g)	HM02 Fish Length (cm)	Mass Weight	Average Weight (g)	HM03 Fish Length (cm)	Mass Weight	Average Weight (g)
Crayfish	HM01	8.5	15	5						
		4.5		5						
		5.5		5						
	COUNT	3		3						
	AVERAGE	6.16666667		5						
	MAXIMUM	8.5		5						
	MINIMUM	4.5		5						

Mud Sunfish	1 collected at HM01, no length or weight
Mummichog	6 collected at HM02, no length or weight
Goby, freshwater	1 collected at HM01 and 1 collected at HM02, no length or weight
Gras shrimp	13 collected at HM02, no length or weight

WEBB CREEK - BACKGROUND STATIONS

SPECIES	COC SAMPLE NO.	WC02 Fish Length (cm)	Mass Weight	Average Weight (g)	WC03 Fish Length (cm)	Mass Weight	Average Weight (g)
Strippet Mullet	WC02	39.5	500	500			
		35.5	380	380			
		41.5	700	700			
		37	600	600			
	COUNT	4		4			
	AVERAGE	38.375		545			
	MAXIMUM	41.5		700			
	MINIMUM	35.5		380			
Summer Flounder	WC03				21	60	60
	COUNT				1		1
	AVERAGE				21		60
	MAXIMUM				21		60
	MINIMUM				21		60
Largemouth Bass	WC02	34	525	525			
		34	600	600			
	COUNT	2		2			
	AVERAGE	34		562.5			
	MAXIMUM	34		600			
	MINIMUM	34		525			
edbreast Sunfish	WC02	16	60	60			
	COUNT	1		1			
	AVERAGE	16		60			
	MAXIMUM	16		60			
	MINIMUM	16		60			
White Catfish	WC02	37	750	750			
	COUNT	1		1			
	AVERAGE	37		750			
	MAXIMUM	37		750			
	MINIMUM	37		750			
Spot	WC02	14.5	10	10			
		13	10	10			
		13	<10	5			
		+1 collected, no length or weight					
	COUNT	4		4			
	AVERAGE	13.5		8.33333333			
	MAXIMUM	14.5		10			
	MINIMUM	13		5			
Blue Gill	WC02	23	300	300			
		23.5	300	300			
		21.5	250	250			
		16.75	85	85			
	COUNT	4		4			
	AVERAGE	21.1875		233.75			
	MAXIMUM	23.5		300			
	MINIMUM	16.75		85			

WEBB CREEK - BACKGROUND STATIONS

SPECIES	COC SAMPLE NO.	WC02 Fish Length (cm)	Mass Weight	Average Weight (g)	WC03 Fish Length (cm)	Mass Weight	Average Weight (g)
Long-nose Gar	WC02	68	1100	1100			
		71.5	1220	1220			
		73.5	1350	1350			
		72.5	1220	1220			
		66.5	1120	1120			
		72.5	1260	1260			
		71.5	1340	1340			
		69.5	1240	1240			
		75	1420	1420			
	WC03				87	1900	1900
					83	1850	1850
					97	2850	2850
					71.5	1000	1000
					73	1580	1580
	COUNT	9		9	5		5
	AVERAGE	71.16667		1252.222	82.3		1836
	MAXIMUM	75		1420	97		2850
	MINIMUM	66.5		1100	71.5		1000
Pinfish	WC02	10.5	NA				
		+24 collected, no length or weight			24 collected, no length or weight		
	COUNT	25			24		
	AVERAGE	10.5					
	MAXIMUM	10.5					
	MINIMUM	10.5					
Yellow Bullhead Catfish	WC02	38.5	900	900			
		32.5	620	620			
		36.5	640	640			
	COUNT	3		3			
	AVERAGE	35.83333		720			
	MAXIMUM	38.5		900			
	MINIMUM	32.5		620			

Mudcat — 3 fish collected at WC02, no length or weight

Mummichog — 3 fish collected at WC03, no length or weight

Grass shrimp — 3 collected at WC03, no length or weight

Benthic Macroinvertebrate Characterization and Statistics

MARINE CORPS BASE CAMP LEJEUNE
BACKGROUND - WEBB CREEK
BENTHIC MACROINVERTEBRATES

	WC02-BN			WC03-BN		
	01	02	03	01	02	03
NEMERTEA						
Anopla						
Heteronemertea						
Lineidae						
Micrura leidyl				1	2	2
ANNELIDA						
Polychaeta						
Capitellida						
Capitellidae						
Capitella capitata	2					
Phyllodocida						
Nereidae						
Nereis succinea			1			
Spionida						
Spionidae						
Scolecolepides viridis						1
Terebellida						
Ampharetidae						
Hypaniola grayi		4	10			
ARTHROPODA						
Crustacea						
Amphipoda						
Gammaridae						
Gammarus tigrinus	10			1	1	
Insecta						
Diptera						
Chironomidae						
Chironomus decorus gr.	8	24	13	38	17	6
Procladius sp.	1	3		2		1
Tanytarsus sp.		2	1			
MOLLUSCA						
Bivalvia						
Veneroida						
Corbiculidae						
Polymesoda caroliniana					1	
Tellinidae						
Macoma tenta					1	
Total Taxa	4	4	4	4	5	4
Total Specimens	21	33	25	42	22	10
Replicate Specimens Average		26.33			24.67	
Standard Deviation	4.425	10.532	6.185	18.339	7.057	2.380
Brillouin's Diversity		0.518			0.279	
SPECIES DENSITY (#/M^2)	134	210	159	268	140	64
SPECIES DIVERSITY (Shannon-Wiener)	0.473	0.380	0.419	0.180	0.364	0.473

MARINE CORPS BASE CAMP LEJEUNE
BACKGROUND - HADNOT CREEK
BENTHIC MACROINVERTEBRATES

	HC01-BN			HC02-BN			HC03-BN			HC04-BN		
	01	02	03	01	02	03	01	02	03	01	02	03
NEMERTEA												
Anopla												
Heteronemertea												
Lineidae												
Micrura leidyi						6	5	3				
ANNELIDA												
Oligochaeta												
Lumbriculida												
Lumbriculidae												
Eclipidrilus sp.			1									
Tubificida												
Tubificidae												
Isochaetides freyi	77	42	36							21	21	8
Limnodrilus hoffmeisteri											1	
Spirosperma carolinensis		3									1	3
Polychaeta												
Capitellida												
Capitellidae												
Heteromastus filiformis							14	9				
Phyllodocida												
Nereidae												
Nereis succinea							6		18			
Phyllodocidae												
Eteone heteropoda									1			
Terebellida												
Ampharetidae												
Hypaniola grayi (ampharetid worm)				18	6	46						
ARTHROPODA												
Crustacea												
Amphipoda												
Corophiidae												
Corophium lacustre									82			
Gammaridae												
Crangonyx pseudogracilis					1	1					15	20
Gammarus tigrinus												
Tanaidacea												
Tanaidae												
Leptochelia rapax									80			
Insecta												
Coleoptera												
Dytiscidae												
Hydroporus sp.			1							5	2	6
Elmidae												
Dubiraphia sp.		1										
Diptera												
Ceratopogonidae												
Palpomyia/sphaeromias sp. (biting midges)	5	7	4			1						
Chironomidae												
Ablabesmyia annulata	2	7	1									
Ablabesmyia rhamphe gr.	4	7	9									
Clinotanypus pinguis											1	
Cryptochironomus fulvus gr.		2	3									
Epoicladius sp.			1									
Glyptotendipes sp.												1
Nilothauma sp.		2	1									
Paralauterborniella nigrohalteralis	1	5	2									
Polypedilum illinoense	3	1										
Procladius sp. (midges)		1										
Tanytarsus sp.	2	9	2									
Tribelos jucundum	4	6	8								9	8
Tipulidae												
Pseudolimnophila sp.											1	2
Ephemeroptera												
Ephemeridae												
Hexagenia bilineata	3	3	1									
Megaloptera												
Sialidae												
Sialis sp.										1		
Odonata												
Coenagrionidae												
Argia sp.		1										
Libellulidae												
Pachydiplax longipennis											1	
Trichoptera												
Polycentropodidae												
Phylocentropus sp.	1	5	7							17	13	4
MOLLUSCA												
Bivalvia												
Mytiloida												
Mytilidae												
Geukensia demissa									1			
Veneroida												
Sphaeriidae												
Pisidium casertanum		2	1								4	
Tellinidae												
Macoma tenta							5	19	1			
Total Taxa	10	17	15	1	2	4	4	3	6	4	11	8
Total Specimens	102	106	78	18	7	54	30	31	183	44	69	52
Replicate Specimens Average		95.33333			26.33333			81.33333			55	
Standard Deviation	23.50792	9.614833	8.981924	NA	3.535534	21.79449	4.358899	8.082904	39.67241	9.521905	7.128887	6.047432
Brillouin's Diversity		0.735			0.072			0.675			0.757	
SPECIES DENSITY (#/M^2)	650	676	497	115	45	344	191	198	1168	280	440	331
SPECIES DIVERSITY (Shannon-Wiener)	0.463	0.956	0.831	0.000	0.178	0.230	0.554	0.384	0.449	0.458	0.803	0.783

MARINE CORPS BASE CAMP LEJEUNE
BACKGROUND - HOLLAND MILL CREEK
BENTHIC MACROINVERTEBRATES

	HM01-BN			HM02-BN			HM03-BN		
	01	02	03	01	02	03	01	02	03
NEMERTEA									
Anopla									
Heteronemertea									
Lineidae									
Micrura leidyi							3	4	2
ANNELIDA									
Oligochaeta									
Tubificida									
Tubificidae									
Limnodrilus hoffmeisteri	3	1	3						
Polychaeta									
Ariciida									
Orbiniidae									
Scoloplos fragilis							3	20	8
Capitellida									
Capitellidae									
Heteromastus filiformis							1	1	1
Phyllodocida									
Nereidae									
Nereis succinea				7	9	6			
Spionida									
Spionidae									
Streblospio benedicti							1		
Terebellida									
Ampharetidae									
Hypaniola grayi (ampharetid worm)				3		2			
ARTHROPODA									
Crustacea									
Decapoda									
Palaemonidae									
Palaemonetes pugic						1			
Insecta									
Coleoptera									
Dytiscidae									
Hydroporus sp.	1								
Elmidae									
Dubiraphis sp.			8						
Diptera									
Chaoboridae									
Chaoborus sp.			1						
Chironomidae									
Ablabesmyia mallochi	1								
Chironomus decorus gr.	2	2	2	120	180	76	1		
Dicrotendipes nervosus	5		3						
Larsia sp.			1						
Polypedilum illinoense	12		7						
Polypedilum scalaenum	18		11						
Tanytarsus sp.	11		12						
Tribelos lucundum	50	159	31						
Megaloptera									
Sialidae									
Sialis sp.	1								
MOLLUSCA									
Bivalvia									
Veneroida									
Mactridae									
Mullinia lateralis							3		
Tellinidae									
Macoma tenta							17	23	9
Total Taxa	10	3	10	3	2	4	7	4	4
Total Specimens	104	162	79	130	189	85	29	48	20
Replicate Specimens Average		115			134.667			32.3333	
Standard Deviation	15.0864	90.934	9.06091	66.4254	120.915	36.5639	5.75698	11.1056	4.08248
Brillouin's Diversity		0.5			0.122			0.497	
SPECIES DENSITY (#/M^2)	663	1033	504	829	1205	542	185	306	127
SPECIES DIVERSITY (Shannon-Wiener)	0.695	0.045	0.793	0.138	0.083	0.186	0.593	0.436	0.480

SYSTEMATIC LIST OF BENTHIC MACROINVERTEBRATE SPECIES AT BACKGROUND STATIONS (WEBB, HADNOT, AND HOLLAND MILL CREEKS) MCB CAMP LEJEUNE, NORTH CAROLINA

Species	Systematic Listing
NERMERTEA	Phylum
Anopla	Class
Heteronemertea	Order
Lineidae	Family
Micrura leidyl	Genus Species
ANNELIDA	Phylum
Oligochaeta	Class
Lumbriculida	Order
Lumbriculiae	Family
Eclipidrillus sp.	Genus Species
Tubificida	Order
Tubificidae	Family
Isochaetides freyi	Genus Species
Limnodrilus hoffmeisteri	Genus Species
Spirosperma carolinensis	Genus Species
Polychaeta	Class
Ariciida	Order
Orbiniidae	Family
Scoloplos fragilis	Genus Species
Capitellida	Order
Capitellidae	Family
Heteromastus filiformis	Genus Species
Capitella capitata	Genus Species
Phyllodocida	Order
Nereidae	Family
Nereis succinea	Genus Species
Phyliodocidae	Family
Eteone heteropoda	Genus Species
Spionida	Order
Spionidae	Family
Scolecolepides virdis	Genus Species
Streblospio benedicti	Genus Species
Terebellida	Order

SYSTEMATIC LIST OF BENTHIC MACROINVERTEBRATE SPECIES AT BACKGROUND STATIONS (WEBB, HADNOT, AND HOLLAND MILL CREEKS) MCB CAMP LEJEUNE, NORTH CAROLINA

Species	Systematic Listing
Ampharetidae	Family
Hypaniola grayi	Genus Species
ARTHROPODA	Phylum
Crustacea	Class
Amphipoda	Order
Corophiidae	Family
Corophium lacuatre	Genus Species
Gammaridae	Family
Crangonyx pseudogracillus	Genus Species
Gammarus tigrinus	Genus Species
Tanaidacea	Order
Tanaidae	Family
Leptochelia rapox	Genus Species
Decapoda	Order
Palaemonidae	Family
Palaemonetes pugio	Genus Species
Insecta	Class
Coleoptera	Order
Dytiscidae	Family
Hydroporus sp.	Genus Species
Elmidae	Family
Dubiraphia sp.	Genus Species
Diptera	Order
Ceratopogonidae	Family
Palpomyia/sphaeromias sp.	Genus Species
Chaoboridae	Family
Chaoborus sp.	Genus Species
Chironomidae	Family
Ablabesmyia annulata	Genus Species
Ablabesmyia mallochi	Genus Species
Ablabesmyia ramphe gr.	Genus Species
Clinotanypus pinguis	Genus Species
Chironomus decorus gr.	Genus Species
Cryptochironomus fulvus gr	Genus Species

SYSTEMATIC LIST OF BENTHIC MACROINVERTEBRATE SPECIES AT BACKGROUND STATIONS (WEBB, HADNOT, AND HOLLAND MILL CREEKS) MCB CAMP LEJEUNE, NORTH CAROLINA

Species	Systematic Listing
Dicrotendipes nervosus	Genus Species
Epoicladius sp.	Genus Species
Glyptotendipes sp.	Genus Species
Larsia sp.	Genus Species
Nilothauma sp.	Genus Species
Paraiauterborniella nigrohaite	Genus Species
Polypedilum illinoense	Genus Species
Polypedilum scalaenum	Genus Species
Procladius sp.	Genus Species
Tanytarsus sp.	Genus Species
Tribelos jucundum	Genus Species
Tribelos lucundum	Genus Species
Tipulidae	Family
Psuedolimnophila sp.	Genus Species
Ephemeroptera	Order
Ephemeridae	Family
Hexagenia billineata	Genus Species
Megaloptera	Order
Sialidae	Family
Sialis sp.	Genus Species
Odonata	Order
Coenagrionidae	Family
Argia sp.	Genus Species
Libelluiidae	Family
Pechydiplax longipennis	Genus Species
Trichoptera	Order
Polycentropodidae	Family
Phylacentropus sp.	Genus Species
MOLLUSCA	Phylum
Bivalvia	Class
Mytiloida	Order
Mytilldae	Family
Geukensia demissa	Genus Species
Veneroida	Order

SYSTEMATIC LIST OF BENTHIC MACROINVERTEBRATE SPECIES AT BACKGROUND STATIONS (WEBB, HADNOT, AND HOLLAND MILL CREEKS) MCB CAMP LEJEUNE, NORTH CAROLINA

Species	Systematic Listing
Corbiculidae	Family
Polymesoda caroliniana	Genus Species
Mactridae	Family
Mullinia lateralis	Genus Species
Sphaeriidae	Family
Pisidium casertanum	Genus Species
Tellinidae	Family
Macoma tenta	Genus Species

USEPA SENSITIVITY TO METALS AND TOLERANCE TO ORGANIC WASTE AND BIOTIC INDEX FOR BENTHIC MACROINVERTEBRATE SPECIES AT BACKGROUND STATIONS (WEBB, HADNOT, AND HOLLAND MILL CREEKS) MCB CAMP LEJEUNE, NORTH CAROLINA

Species	USEPA[1] Metals	Organics	NCDEHNR[2] Biotic Index
NERMERTEA			
Anopla			
Heteronemertea			
Lineidae			
Micrura leidyl	NA	NA	NA
ANNELIDA			
Oligochaeta			
Lumbriculida			
Lumbriculiae			
Eclipidrillus sp.	NA	NA	NA
Tubificida			
Tubificidae			
Isochaetides freyi	NA	NA	8.6
Limnodrilus hoffmeisteri	NA	5	9.4
Spirosperma carolinensis	NA	3	NA
Polychaeta			
Ariciida			
Orbiniidae			
Scoloplos fragilis	NA	NA	NA
Capitellida			
Capitellidae			
Heteromastus filiformis	NA	NA	NA
Capitella capitata	NA	NA	NA
Phyllodocida			
Nereidae			
Nereis succinea	NA	NA	NA
Phyliodocidae			
Eteone heteropoda	NA	NA	NA
Spionida			
Spionidae			
Scolecolepides virdis	NA	NA	NA
Streblospio benedicti	NA	NA	NA

USEPA SENSITIVITY TO METALS AND TOLERANCE TO ORGANIC WASTE AND BIOTIC INDES FOR BENTHIC MACROINVERTEBRATE SPECIES AT BACKGROUND STATIONS (WEBB, HADNOT, AND HOLLAND MILL CREEKS) MCB CAMP LEJEUNE, NORTH CAROLINA

Species	USEPA[1] Metals	Organics	NCDEHNR[2] Biotic Index
Terebellida			
Ampharetidae			
Hypaniola grayi	NA	NA	NA
ARTHROPODA			
Crustacea			
Amphipoda			
Corophiidae			
Corophium lacuatre	NA	NA	NA
Gammaridae			
Crangonyx pseudogracillus	NA	NA	7.9
Gammarus tigrinus	NA	2	NA
Tanaidacea			
Tanaidae			
Leptochelia rapox	NA	NA	NA
Decapoda			
Palaemonidae			
Palaemonetes pugio	NA	NA	NA
Insecta			
Coleoptera			
Dytiscidae			
Hydroporus sp.	NA	NA	8.6
Elmidae			
Dubiraphia sp.	NA	NA	5.9
Diptera			
Ceratopogonidae			
Palpomyia/sphaeromias sp.	NA	NA	7.0
Chaoboridae			
Chaoborus sp.	NA	NA	8.5
Chironomidae			
Ablabesmyia annulata	NA	1	3.5
Ablabesmyia mallochi	S	2	7.2
Ablabesmyia ramphe gr.	NA	2	NA
Clinotanypus pinguis	S	3	8.7

USEPA SENSITIVITY TO METALS AND TOLERANCE TO ORGANIC WASTE AND BIOTIC INDES
FOR BENTHIC MACROINVERTEBRATE SPECIES AT BACKGROUND STATIONS
(WEBB, HADNOT, AND HOLLAND MILL CREEKS)
MCB CAMP LEJEUNE, NORTH CAROLINA

Species	USEPA[1] Metals	Organics	NCDEHNR[2] Biotic Index
Chironomus decorus gr.	NA	NA	9.6
Cryptochironomus fulvus gr	NA	3	6.4
Dicrotendipes nervosus	S	2	9.7
Epoicladius sp.	NA	NA	0.0
Glyptotendipes sp.	NA	NA	9.4
Larsia sp.	NA	2	9.3
Nilothauma sp.	NA	NA	5.0
Paraiauterborniella nigrohaite	NA	NA	NA
Polypedilum illinoense	NA	3	9.0
Polypedilum scalaenum	NA	2	8.4
Procladius sp.	NA	NA	9.1
Tanytarsus sp.	NA	NA	6.7
Tribelos jucundum	S	1	6.3
Tribelos lucundum	NA	NA	6.3
Tipulidae			
Psuedolimnophila sp.	NA	NA	7.2
Ephemeroptera			
Ephemeridae			
Hexagenia billineata	NA	2	NA
Megaloptera			
Sialidae			
Sialis sp.	T	4	7.2
Odonata			
Coenagrionidae			
Argia sp.	NA	NA	8.2
Libelluiidae			
Pechydiplax longipennis	NA	NA	NA
Trichoptera			
Polycentropodidae			
Phylacentropus sp.	NA	NA	6.2
MOLLUSCA			
Bivalvia			

USEPA SENSITIVITY TO METALS AND TOLERANCE TO ORGANIC WASTE AND BIOTIC INDES FOR BENTHIC MACROINVERTEBRATE SPECIES AT BACKGROUND STATIONS (WEBB, HADNOT, AND HOLLAND MILL CREEKS) MCB CAMP LEJEUNE, NORTH CAROLINA

Species	USEPA[1] Metals	Organics	NCDEHNR[2] Biotic Index
Mytiloida			
Mytilldae			
Geukensia demissa	NA	NA	NA
Veneroida			
Corbiculidae			
Polymesoda caroliniana	NA	NA	NA
Mactridae			
Mullinia lateralis	NA	NA	NA
Sphaeriidae			
Pisidium casertanum	NA	4	6.5
Tellinidae			
Macoma tenta	NA	NA	NA

(1) Macroinvertebrate Field and Laboratory Methods for Evaluating the Biological Integrity of Surface Waters

(2) Lenat, 1993

NA = Not Available

S = Sensitive to heavy metals

T = Tolerant to heavy metals

Organics Ranking = 0 to 5 with 0 being the least tolerant

SUMMARY STATISTICS OF BENTHIC MACROINVERTEBRATE SPECIES AT HADNOT CREEK, HOLLAND MILL CREEK, AND WEBB CREEK MCB CAMP LEJEUNE, NORTH CAROLINA

Station	Number of Species	Number of Organisms	Species Density (#/m^2)	Species Diversity (Shannon-Weiner)	Species Diversity (Brillouin's)	Macroinvertebrate Biotic Index
WC02	7	79	504	0.570	0.518	9.4
WC03	7	74	472	0.323	0.279	9.6
HC01	20	286	1,823	0.802	0.755	7.8
HC02	4	79	504	0.196	0.072	7.6
HC03	8	244	1,555	0.683	0.675	NA
HC04	13	165	1,052	0.807	0.757	7.6
HM01	13	345	2,199	0.525	0.500	6.9
HM02	4	404	2,575	0.128	0.122	9.6
HM03	7	97	618	0.538	0.497	9.6

WC = Webb Creek Stations
HC = Hadnot Creek Stations
HM = Holland Mill Creek Stations
BN = Benthic Macroinvertebrate Sample
NA = Not Applicable
Species Density (#m^2) is based on a sample area of 0.0523 m^2.

USEPA SENSITIVITY TO METALS AND TOLERANCE TO ORGANIC WASTE AND BIOTIC INDEX FOR BENTHIC MACROINVERTEBRATE SPECIES AT BACKGROUND STATIONS (WEBB, HADNOT, AND HOLLAND MILL CREEKS) MCB CAMP LEJEUNE, NORTH CAROLINA

Species	USEPA[1] Metals	Organics	NCDEHNR[2] Biotic Index
NERMERTEA			
Anopla			
Heteronemertea			
Lineidae			
Micrura leidyl	NA	NA	NA
ANNELIDA			
Oligochaeta			
Lumbriculida			
Lumbriculiae			
Eclipidrillus sp.	NA	NA	NA
Tubificida			
Tubificidae			
Isochaetides freyi	NA	NA	8.6
Limnodrilus hoffmeisteri	NA	5	9.4
Spirosperma carolinensis	NA	3	NA
Polychaeta			
Ariciida			
Orbiniidae			
Scoloplos fragilis	NA	NA	NA
Capitellida			
Capitellidae			
Capitella capitata	NA	NA	NA
Phyllodocida			
Nereidae			
Nereis succinea	NA	NA	NA
Phyliodocidae			
Eteone heteropoda	NA	NA	NA
Spionida			
Spionidae			
Scolecolepides virdis	NA	NA	NA
Streblospio benedicti	NA	NA	NA
Terebellida			

USEPA SENSITIVITY TO METALS AND TOLERANCE TO ORGANIC WASTE AND BIOTIC INDES FOR BENTHIC MACROINVERTEBRATE SPECIES AT BACKGROUND STATIONS (WEBB, HADNOT, AND HOLLAND MILL CREEKS) MCB CAMP LEJEUNE, NORTH CAROLINA

Species	USEPA[1] Metals	Organics	NCDEHNR[2] Biotic Index
Ampharetidae			
Hypaniola grayi	NA	NA	NA
ARTHROPODA			
Crustacea			
Amphipoda			
Corophiidae			
Corophium lacuatre	NA	NA	NA
Gammaridae			
Crangonyx pseudogracillus	NA	NA	7.9
Gammarus tigrinus	NA	2	NA
Tanaidacea			
Tanaidae			
Leptochelia rapox	NA	NA	NA
Decapoda			
Palaemonidae			
Palaemonetes pugio	NA	NA	NA
Insecta			
Coleoptera			
Dytiscidae			
Hydroporus sp.	NA	NA	8.6
Elmidae			
Dubiraphia sp.	NA	NA	5.9
Diptera			
Ceratopogonidae			
Palpomyia/sphaeromias sp.	NA	NA	7.0
Chaoboridae			
Chaoborus sp.	NA	NA	8.5
Chironomidae			
Ablabesmyia annulata	NA	1	3.5
Ablabesmyia mallochi	S	2	7.2
Ablabesmyia ramphe gr.	NA	2	NA
Clinotanypus pinguis	S	3	8.7
Chironomus decorus gr.	NA	NA	9.6

USEPA SENSITIVITY TO METALS AND TOLERANCE TO ORGANIC WASTE AND BIOTIC INDES FOR BENTHIC MACROINVERTEBRATE SPECIES AT BACKGROUND STATIONS (WEBB, HADNOT, AND HOLLAND MILL CREEKS) MCB CAMP LEJEUNE, NORTH CAROLINA

Species	USEPA[1] Metals	Organics	NCDEHNR[2] Biotic Index
Cryptochironomus fulvus gr	NA	3	6.4
Dicrotendipes nervosus	S	2	9.7
Epoicladius sp.	NA	NA	0.0
Glyptotendipes sp.	NA	NA	9.4
Larsia sp.	NA	2	9.3
Nilothauma sp.	NA	NA	5.0
Paraiauterborniella nigrohaite	NA	NA	NA
Polypedilum illinoense	NA	3	9.0
Polypedilum scalaenum	NA	2	8.4
Procladius sp.	NA	NA	9.1
Tanytarsus sp.	NA	NA	6.7
Tribelos jucundum	S	1	6.3
Tribelos lucundum	NA	NA	6.3
Tipulidae			
Psuedolimnophila sp.	NA	NA	7.2
Ephemeroptera			
Ephemeridae			
Hexagenia billineata	NA	2	NA
Megaloptera			
Sialidae			
Sialis sp.	T	4	7.2
Odonata			
Coenagrionidae			
Argia sp.	NA	NA	8.2
Libelluiidae			
Pechydiplax longipennis	NA	NA	NA
Trichoptera			
Polycentropodidae			
Phylacentropus sp.	NA	NA	6.2
MOLLUSCA			
Bivalvia			
Mytiloida			

USEPA SENSITIVITY TO METALS AND TOLERANCE TO ORGANIC WASTE AND BIOTIC INDES FOR BENTHIC MACROINVERTEBRATE SPECIES AT BACKGROUND STATIONS (WEBB, HADNOT, AND HOLLAND MILL CREEKS) MCB CAMP LEJEUNE, NORTH CAROLINA

Species	USEPA[1] Metals	Organics	NCDEHNR[2] Biotic Index
Mytilldae			
Geukensia demissa	NA	NA	NA
Veneroida			
Corbiculidae			
Polymesoda caroliniana	NA	NA	NA
Mactridae			
Mullinia lateralis	NA	NA	NA
Sphaeriidae			
Pisidium casertanum	NA	4	6.5
Tellinidae			
Macoma tenta	NA	NA	NA

(1) Macroinvertebrate Field and Laboratory Methods for Evaluating the Biological Integrity of Surface Waters

(2) Lenat, 1993

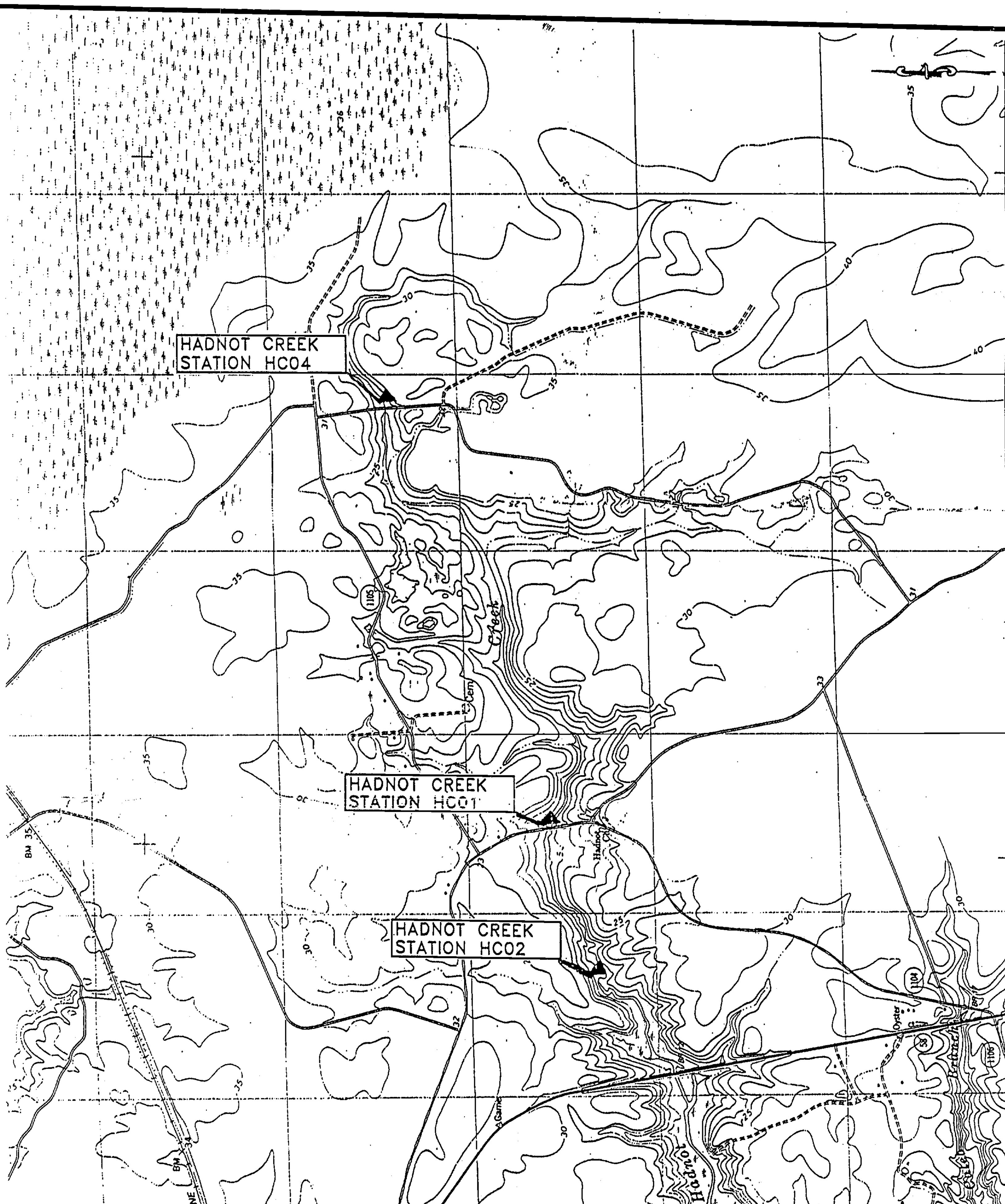
NA = Not Available

S = Sensitive to heavy metals

T = Tolerant to heavy metals

Organics Ranking = 0 to 5 with 0 being the least tolerant

Sampling Station
Location Maps



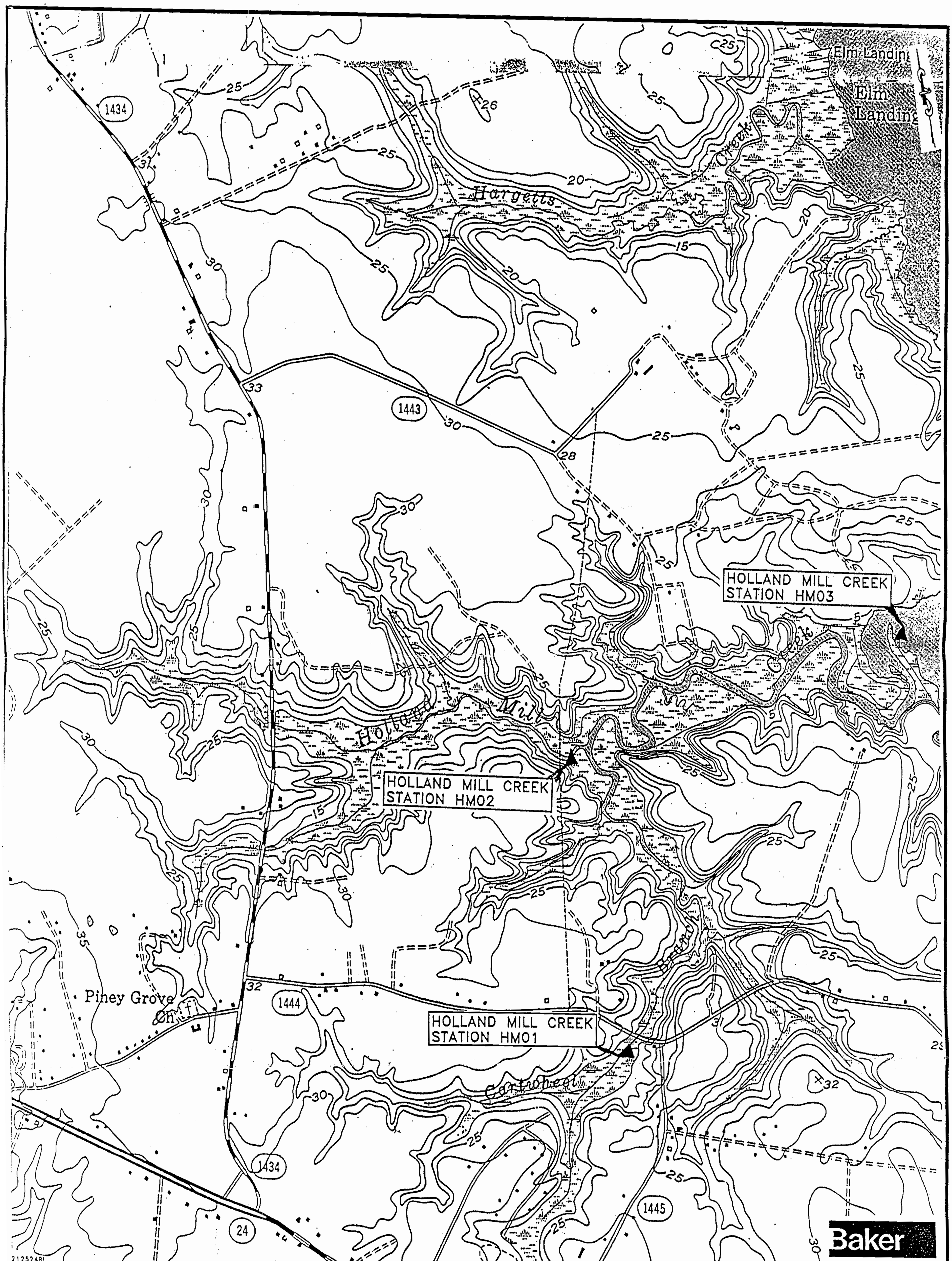
212508R1

FISH AND BENTHIC MACROINVERTERBRATE
SAMPLING LOCATION IN HADNOT CREEK

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

SOURCE: N.C. DIVISION OF MARINE FIDHERIES, REPORT AFC-9, NOV. 1975.

01712Y B22

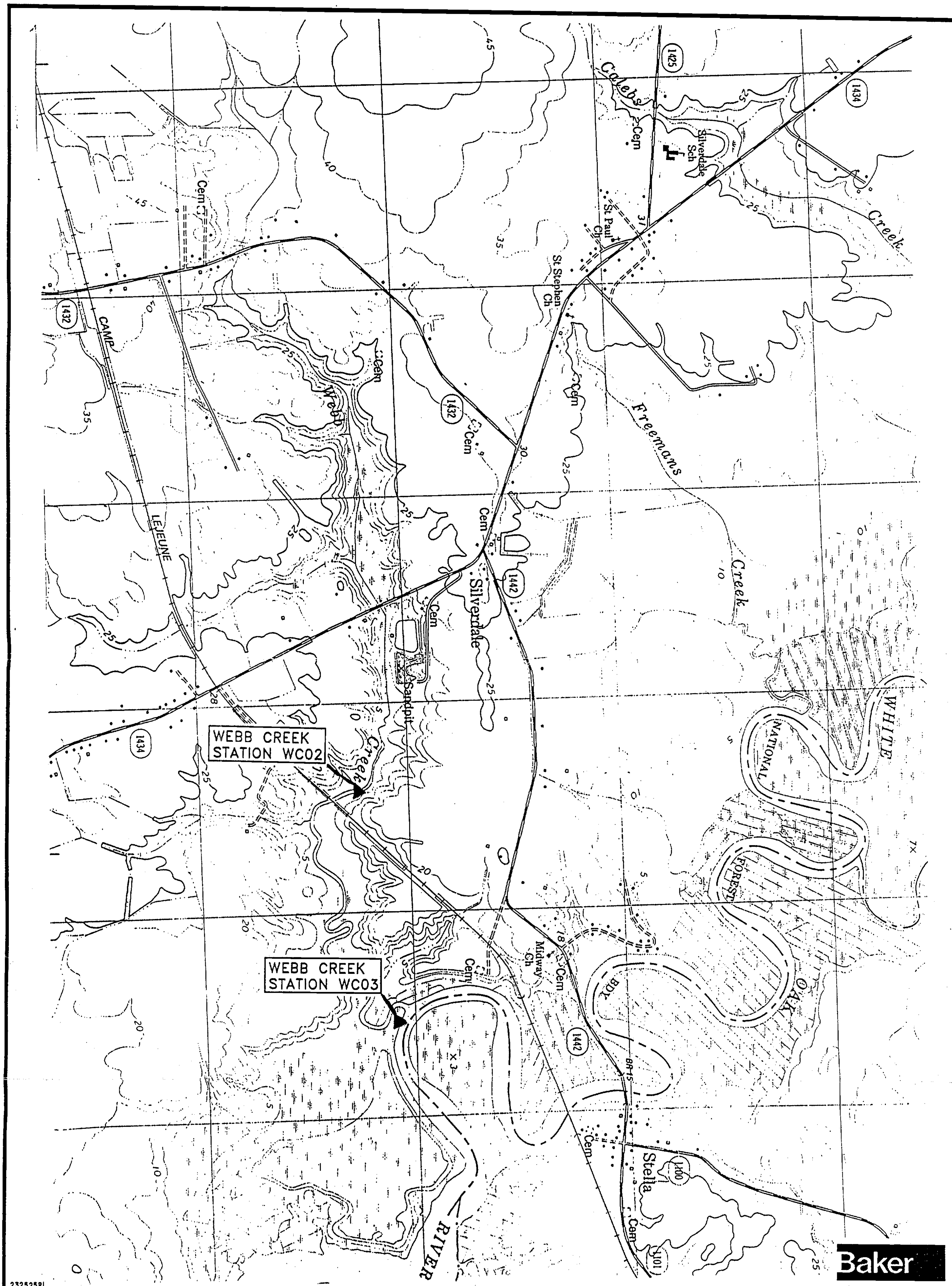


Baker
Baker Environmental, Inc.

FISH AND BENTHIC MACROINVERTERBRATE
SAMPLING LOCATION IN HOLLAND MILL CREEK

SOURCE: N.C. DIVISION OF MARINE FIDHERIES, REPORT AFC-9, NOV. 1975.

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



Baker
Baker Environmental, Inc.

FISH AND BENTHIC MACROINVERTERBRATE
SAMPLING LOCATION IN WEBB CREEK

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

SOURCE: N.C. DIVISION OF MARINE FISHERIES, REPORT AFC-9, NOV. 1975.

REFERENCE

Baker, 1994. Baker Environmental Inc., 1994. "Supplemental Aquatic Survey for Wallace Creek and Bearhead Creek". Prepared for the Department of the Navy, Naval Facilities Engineering Command, Atlantic Division, Norfork, Virginia.

APPENDIX W
POSITIVE DETECTION SUMMARY FOR UPSTREAM SURFACE WATER AND SEDIMENT SAMPLES

POSITIVE DETECTION SUMMARY
SURFACE WATER
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
UPSTREAM BRINSON CREEK STATIONS
MCB CAMP LEJEUNE, NORTH CAROLINA

Client Sample ID:	35-SW01	35-SW02	35-SW03	35-SW04	35-SW05	35-SW06
Lab Sample ID:	4120-12	4120-13	4120-1	4120-2	4120-3	4120-4
Date Sampled:	12-APR-1994	12-APR-1994	12-APR-1994	12-APR-1994	12-APR-1994	12-APR-1994
ANALYTES (ug/L)						
Aluminum	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1.2 UJ
Antimony	1 U	1 U	1.8	1.5	1 U	1 U
Arsenic	2 U	2 U	2 U	2 U	2 U	2 U
Barium	16.9	16.7	19.5	19	18.2	23.3
Calcium	58000	58100	59500	59300	58800	63900
Chromium	1 U	1 U	1 J	1 U	1 U	1.2 J
Cobalt	9 U	9 U	9.5 J	11.7 J	16.8 J	9 U
Iron	764 J	850 J	1060 J	1230 J	842 J	1750 J
Lead	1 U	1.4	2.1	2.1	1 U	2.4
Magnesium	2380	2390	3120	3140	3470	5180
Manganese	30.1	29.1	36.9	44.9	38.7	77.4
Mercury	3 J	0.2 U	0.2 U	3.2 J	0.2 U	0.2 U
Potassium	2460	2170	3210	2760	2810	3840
Selenium	1 UJ	1 UJ	1 UJ	1.3 J	1 UJ	1 UJ
Sodium	47000	42600	57000	59100	57300	68800
Thallium	1 U	1 U	1 U	1 U	1 U	1 U
Vanadium	4 U	4 U	4 U	4 U	4 U	4 U
Zinc	18.3 R	17.9 R	19.8 R	14 R	19.1 R	26.3 U

POSITIVE DETECTION SUMMARY
SURFACE WATER
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
UPSTREAM BRINSON CREEK STATIONS
MCB CAMP LEJEUNE, NORTH CAROLINA

Client Sample ID:	35-SW07	
Lab Sample ID:	4581-1	
Date Sampled:	20-APR-1994	
ANALYTES (ug/L)		
Aluminum	6580	
Antimony	39	U
Arsenic	2.7	J
Barium	48.5	J
Calcium	58500	
Chromium	17	U
Cobalt	9	J
Iron	9500	
Lead	97	J
Magnesium	4610	J
Manganese	113	
Mercury	0.1	UJ
Potassium	4780	J
Selenium	4.3	U
Sodium	59800	
Thallium	1	J
Vanadium	14.8	J
Zinc	129	J

POSITIVE DETECTION SUMMARY
SURFACE WATER
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
UPSTREAM BRINSON CREEK STATIONS
MCB CAMP LEJEUNE, NORTH CAROLINA

Client Sample ID: Lab Sample ID: Date Sampled:	MINIMUM NONDETECTED	MAXIMUM NONDETECTED	MINIMUM DETECTED	MAXIMUM DETECTED	LOCATION OF MAXIMUM DETECTED	FREQUENCY OF DETECTION
ANALYTES (ug/L)						
Aluminum	1 UJ	1.2 UJ	6580	6580	35-SW07	1/7
Antimony	1 U	39 U	1.5	1.8	35-SW03	2/7
Arsenic	2 U	2 U	2.7 J	2.7 J	35-SW07	1/7
Barium	NA	NA	16.7	48.5 J	35-SW07	7/7
Calcium	NA	NA	58000	63900	35-SW06	7/7
Chromium	1 U	17 U	1 J	1.2 J	35-SW06	2/7
Cobalt	9 U	9 U	9 J	16.8 J	35-SW05	4/7
Iron	NA	NA	764 J	9500	35-SW07	7/7
Lead	1 U	1 U	1.4	97 J	35-SW07	5/7
Magnesium	NA	NA	2380	5180	35-SW06	7/7
Manganese	NA	NA	29.1	113	35-SW07	7/7
Mercury	0.1 UJ	0.2 U	3 J	3.2 J	35-SW04	2/7
Potassium	NA	NA	2170	4780 J	35-SW07	7/7
Selenium	1 UJ	4.3 U	1.3 J	1.3 J	35-SW04	1/7
Sodium	NA	NA	42600	68800	35-SW06	7/7
Thallium	1 U	1 U	1 J	1 J	35-SW07	1/7
Vanadium	4 U	4 U	14.8 J	14.8 J	35-SW07	1/7
Zinc	26.3 U	26.3 U	129 J	129 J	35-SW07	1/2

POSITIVE DETECTION SUMMARY
SURFACE WATER
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
UPSTREAM BRINSON CREEK STATIONS
MCB CAMP LEJEUNE, NORTH CAROLINA

Client Sample ID:	35-SW01	35-SW02	35-SW03	35-SW04	35-SW05	35-SW06
Lab Sample ID:	4120-12	4120-13	4120-1	4120-2	4120-3	4120-4
Date Sampled:	12-APR-1994	12-APR-1994	12-APR-1994	12-APR-1994	12-APR-1994	12-APR-1994

No Detects

Client Sample ID:	35-SW07
Lab Sample ID:	4581-1
Date Sampled:	20-APR-1994

No Detects

POSITIVE DETECTION SUMMARY
SEDIMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
UPSTREAM BRINSON CREEK STATIONS
MCB CAMP LEJEUNE, NORTH CAROLINA

Client Sample ID:	35-SD01-06	35-SD01-612	35-SD02-06	35-SD02-612	35-SD03-06	35-SD03-612
Lab Sample ID:	4585-4	4585-5	4585-6	4585-8	5608-1	5608-2
Date Sampled:	20-APR-1994	20-APR-1994	20-APR-1994	20-APR-1994	17-MAY-1994	17-MAY-1994
VOLATILES (ug/kg)						
Acetone	19 U	128 J	13 UJ	121 U	14 UJ	15 U
Toluene	19 UJ	15 U	13 U	121 U	8 J	15 U
SEMIVOLATILES (ug/kg)						
Diethylphthalate	640 U	489 U	421 U	400 U	352 J	896
bis(2-Ethylhexyl)phthalate	640 UJ	489 UJ	421 UJ	400 UJ	452 UJ	485 UJ
PESTICIDE/PCBs (ug/kg)						
beta-BHC	3.3 U	2.5 U	2.2 U	2.1 U	12 U	12 U
delta-BHC	3.3 U	2.5 U	2.2 U	2.1 U	12 U	12 U
Heptachlor	3.3 U	2.5 U	2.2 U	2.1 U	2.3 J	12 U
Heptachlor epoxide	0.74 J	2.5 U	0.43 J	1.2 J	12 U	12 U
Dieldrin	6.4 U	4.9 U	4.2 U	1.7 J	23 U	24 U
4,4'-DDE	6.4 U	1 J	1.8 J	38	23 U	24 U
Endrin	3.3 U	2.5 U	2.2 U	0.44 J	12 U	12 U
Endosulfan II	6.4 U	4.9 U	4.2 U	1.4 J	23 U	24 U
4,4'-DDD	3.3 U	1.1 J	2.3 J	40	23 U	12 U
4,4'-DDT	6.4 U	0.73 J	0.66 J	1.6 J	23 U	24 U
Methoxychlor	2.7 J	0.65 J	0.49 J	2.2 J	116 U	124 U
Endrin ketone	6.4 U	4.9 U	4.2 U	4 U	23 U	24 U
Endrin aldehyde	6.4 U	4.9 U	4.2 U	4 U	23 U	24 U
alpha-Chlordane	3.3 U	2.5 U	0.51 J	6	12 U	12 U
gamma-Chlordane	3.3 U	2.5 U	2.2 UJ	6.7	12 U	12 U

POSITIVE DETECTION SUMMARY
SEDIMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
UPSTREAM BRINSON CREEK STATIONS
MCB CAMP LEJEUNE, NORTH CAROLINA

Client Sample ID:	35-SD04-06	35-SD04-612	35-SD05-06	35-SD05-612	35-SD06-06	35-SD06-612
Lab Sample ID:	4585-1	4585-3	5608-3	5608-4	5608-5	5608-6
Date Sampled:	20-APR-1994	20-APR-1994	17-MAY-1994	17-MAY-1994	17-MAY-1994	17-MAY-1994
VOLATILES (ug/kg)						
Acetone	879 UJ	781 UJ	29 UJ	15 UJ	21 U	83 U
Toluene	879 U	781 UJ	29 UJ	15 U	21 U	83 U
SEMIVOLATILES (ug/kg)						
Diethylphthalate	580 U	516 U	943 U	500 U	702 U	398 J
bis(2-Ethylhexyl)phthalate	580 UJ	625 J	704 J	469 J	702 U	550 U
PESTICIDE/PCBs (ug/kg)						
beta-BHC	2.9 U	2.7 U	4.9 U	2.6 U	3.6 U	2.8 U
delta-BHC	2.9 U	2.7 U	4.9 U	2.6 U	1 J	2.8 U
Heptachlor	2.9 U	2.7 U	4.9 U	2.6 U	3.6 U	2.8 U
Heptachlor epoxide	2.9 U	1.2 J	4.9 U	0.72 J	3.6 U	2.8 U
Dieldrin	1.6 J	3.1 J	9.5 U	5 U	7 U	5.5 U
4,4'-DDE	31 J	82	80	46	115	7.7
Endrin	2.9 U	0.59 J	4.9 U	0.85 J	0.77 J	2.8 U
Endosulfan II	1.3 J	3.5 J	1.6 J	0.84 J	2.2 J	5.5 U
4,4'-DDD	43	111	43	28	39	5.9
4,4'-DDT	4.9 J	5.2	3.7 J	1.3 J	1.7 J	5.5 U
Methoxychlor	0.86 J	27 U	49 U	26 U	36 U	28 U
Endrin ketone	5.6 U	2.8 J	3.1 J	5 U	7 U	5.5 U
Endrin aldehyde	5.6 U	5.2 U	1.5 J	1.1 J	2.2 J	1 J
alpha-Chlordane	4	5.6	9.3	4.8	3.6 U	2.8 U
gamma-Chlordane	3.6	7.6	4.9 U	5	3.6 U	2.8 U

POSITIVE DETECTION SUMMARY
SEDIMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
UPSTREAM BRINSON CREEK STATIONS
MCB CAMP LEJEUNE, NORTH CAROLINA

Client Sample ID:	35-SD07-06	35-SD07-612
Lab Sample ID:	4585-9	4585-10
Date Sampled:	20-APR-1994	20-APR-1994
VOLATILES (ug/kg)		
Acetone	16 UJ	500 UJ
Toluene	16 U	500 UJ
SEMIVOLATILES (ug/kg)		
Diethylphthalate	520 U	568 U
bis(2-Ethylhexyl)phthalate	520 UJ	318 UJ
PESTICIDE/PCBs (ug/kg)		
beta-BHC	0.59 J	2.9 U
delta-BHC	2.7 U	0.92 J
Heptachlor	0.91 J	2.9 U
Heptachlor epoxide	0.78 J	1.4 J
Dieldrin	1.4 J	2.6 J
4,4'-DDE	34	57
Endrin	2.7 U	0.7 J
Endosulfan II	1.3 J	0.88 J
4,4'-DDD	40	60
4,4'-DDT	2.3 J	2.1 J
Methoxychlor	27 U	3.4 J
Endrin ketone	5.2 U	5.7 U
Endrin aldehyde	5.2 U	5.7 U
alpha-Chlordane	7	8.5
gamma-Chlordane	6.1	9.7

POSITIVE DETECTION SUMMARY
SEDIMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
UPSTREAM BRINSON CREEK STATIONS
MCB CAMP LEJEUNE, NORTH CAROLINA

Client Sample ID: Lab Sample ID: Date Sampled:	MINIMUM NONDETECTED	MAXIMUM NONDETECTED	MINIMUM DETECTED	MAXIMUM DETECTED	LOCATION OF MAXIMUM DETECTED	FREQUENCY OF DETECTION
VOLATILES (ug/kg)						
Acetone	13 UJ	879 UJ	128 J	128 J	35-SD01-612	1/14
Toluene	13 U	879 U	8 J	8 J	35-SD03-06	1/14
SEMIVOLATILES (ug/kg)						
Diethylphthalate	400 U	943 U	352 J	896	35-SD03-612	3/14
bis(2-Ethylhexyl)phthalate	318 UJ	702 U	469 J	704 J	35-SD05-06	3/14
PESTICIDE/PCBs (ug/kg)						
beta-BHC	2.1 U	12 U	0.59 J	0.59 J	35-SD07-06	1/14
delta-BHC	2.1 U	12 U	0.92 J	1 J	35-SD06-06	2/14
Heptachlor	2.1 U	12 U	0.91 J	2.3 J	35-SD03-06	2/14
Heptachlor epoxide	2.5 U	12 U	0.43 J	1.4 J	35-SD07-612	7/14
Dieldrin	4.2 U	24 U	1.4 J	3.1 J	35-SD04-612	5/14
4,4'-DDE	6.4 U	24 U	1 J	115	35-SD06-06	11/14
Endrin	2.2 U	12 U	0.44 J	0.85 J	35-SD05-612	5/14
Endosulfan II	4.2 U	24 U	0.84 J	3.5 J	35-SD04-612	8/14
4,4'-DDD	3.3 U	23 U	1.1 J	111	35-SD04-612	11/14
4,4'-DDT	5.5 U	24 U	0.66 J	5.2	35-SD04-612	10/14
Methoxychlor	26 U	124 U	0.49 J	3.4 J	35-SD07-612	6/14
Endrin ketone	4 U	24 U	2.8 J	3.1 J	35-SD05-06	2/14
Endrin aldehyde	4 U	24 U	1 J	2.2 J	35-SD06-06	4/14
alpha-Chlordane	2.5 U	12 U	0.51 J	9.3	35-SD05-06	8/14
gamma-Chlordane	2.2 UJ	12 U	3.6	9.7	35-SD07-612	6/14

POSITIVE DETECTION SUMMARY
SEDIMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
UPSTREAM BRINSON CREEK STATIONS
MCB CAMP LEJEUNE, NORTH CAROLINA

Client Sample ID:	35-SD01-06	35-SD01-612	35-SD02-06	35-SD02-612	35-SD03-06	35-SD03-612
Lab Sample ID:	4585-4	4585-5	4585-6	4585-8	5608-1	5608-2
Date Sampled:	20-APR-1994	20-APR-1994	20-APR-1994	20-APR-1994	17-MAY-1994	17-MAY-1994
ANALYTES (mg/kg)						
Aluminum	37300	19200	484	903	1160	2010
Arsenic	2.3 J	1.5 UJ	0.46 J	0.34 J	0.27 R	0.69 R
Barium	129	58.8	3.8	6.5	7.8	10.9
Beryllium	1.6 R	1 R	0.18 R	0.12 U	0.14 U	0.15 U
Calcium	5040 J	3160 J	3831 J	4970 J	795 J	1360
Chromium	28.4 J	17 J	1.7 U	3.3 U	2.5	3.7
Cobalt	6.6	3.2	1.8	1.3 U	1.5 U	1.6 U
Copper	4.1	0.98 U	1.2 U	24.8	1.8 U	2.5 U
Iron	10400 J	6210 J	1050 J	1970 J	1130	2530
Lead	21.1 J	12.4 J	4.7 J	26.3 J	5.2	77.9
Magnesium	685	480	88.1	145	148	334
Manganese	29.7 J	13.1 J	3.2 J	5.2 J	4.1	6.6
Mercury	0.1 R	0.07 R	0.07 J	0.06 R	0.24 R	0.25 R
Nickel	9.5 U	5.3 U	1.4 U	1.6 U	2.2	2.1 B
Potassium	498	362 U	312 U	296 U	334 U	357 U
Selenium	1.6 J	1 UJ	0.23 J	0.17 UJ	0.41 U	0.6 U
Sodium	458 U	352 U	303 U	287 U	325 U	347 U
Thallium	0.66 J	0.43 J	0.13 U	0.12 U	0.15	0.15 U
Vanadium	24.2 J	14.5 J	0.94 J	1.9 J	2.1	3
Zinc	21.3 R	14.2 R	17.3 R	17.7 R	21 R	31.3 R

POSITIVE DETECTION SUMMARY
SEDIMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
UPSTREAM BRINSON CREEK STATIONS
MCB CAMP LEJEUNE, NORTH CAROLINA

Client Sample ID:	35-SD04-06	35-SD04-612	35-SD05-06	35-SD05-612	35-SD06-06	35-SD06-612
Lab Sample ID:	4585-1	4585-3	5608-3	5608-4	5608-5	5608-6
Date Sampled:	20-APR-1994	20-APR-1994	17-MAY-1994	17-MAY-1994	17-MAY-1994	17-MAY-1994
ANALYTES (mg/kg)						
Aluminum	1950 J	4240	11300	2580	16000	8430
Arsenic	0.97 J	1 J	2.3 J	0.91 J	3.7 J	0.33 R
Barium	10	30.1	43.7	15.8	36.7	19.2
Beryllium	0.18 U	0.16 R	0.4	0.15 U	0.59	0.27
Calcium	4940 J	4110 J	6490 J	5780 J	4500 J	4100 J
Chromium	5.7 U	14.8 J	16.3	4.3	20.9	9.1
Cobalt	1.9 U	1.7 U	3.2	1.7 U	2.9	4
Copper	4.2	8.4	18.1	5.2	21.2	4.6
Iron	3560 J	7110 J	13400	3910	10900	8350
Lead	32 J	34.4 J	92	54.2	82.6	19.8 R
Magnesium	260	405	1070	446	1140	715
Manganese	11 J	15.9 J	25.2	10.9	24.3	23.4
Mercury	0.09 R	0.08 R	0.53 R	0.31 R	1.2 R	0.4 R
Nickel	2.4 U	3.8 U	5.5	2.2	6.4	2.6
Potassium	429 U	381 U	701 U	370 U	812	407 U
Selenium	0.25 UJ	0.22 UJ	0.98 U	0.46 U	0.59 U	0.45 U
Sodium	518	461	729	360 U	706	712
Thallium	0.18 U	0.22 J	0.63	0.2	0.47	0.35
Vanadium	4.8 J	8.8 J	21.2	4.7	23.9	10.9
Zinc	45 R	101 J	124 R	48.2 R	139 R	35 R

POSITIVE DETECTION SUMMARY
SEDIMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
UPSTREAM BRINSON CREEK STATIONS
MCB CAMP LEJEUNE, NORTH CAROLINA

Client Sample ID:	35-SD07-06	35-SD07-612
Lab Sample ID:	4585-9	4585-10
Date Sampled:	20-APR-1994	20-APR-1994
ANALYTES (mg/kg)		
Aluminum	3960	8820
Arsenic	1.2 J	2.3 J
Barium	19.5	48.6
Beryllium	0.2 R	0.4 R
Calcium	2530 J	3800 J
Chromium	7.1 J	20 J
Cobalt	7.8	3.2
Copper	9.4	10.6
Iron	5340 J	7220 J
Lead	42 J	79 J
Magnesium	227	359
Manganese	28.8 J	37 J
Mercury	0.08 R	0.08 R
Nickel	6.4 U	7.3 U
Potassium	384 U	420 U
Selenium	0.25 J	0.28 J
Sodium	373 U	408 U
Thallium	0.22 J	0.38
Vanadium	8.7 J	15.9 J
Zinc	60.4 J	104 J

POSITIVE DETECTION SUMMARY
SEDIMENT
OPERABLE UNIT NO. 6 (SITE 36)
REMEDIAL INVESTIGATION CTO-0303
UPSTREAM BRINSON CREEK STATIONS
MCB CAMP LEJEUNE, NORTH CAROLINA

Client Sample ID: Lab Sample ID: Date Sampled:	MINIMUM NONDETECTED	MAXIMUM NONDETECTED	MINIMUM DETECTED	MAXIMUM DETECTED	LOCATION OF MAXIMUM DETECTED	FREQUENCY OF DETECTION
ANALYTES (mg/kg)						
Aluminum	NA	NA	484	37300	35-SD01-06	14/14
Arsenic	1.5 UJ	1.5 UJ	0.34 J	3.7 J	35-SD06-06	10/11
Barium	NA	NA	3.8	129	35-SD01-06	14/14
Beryllium	0.12 U	0.18 U	0.27	0.59	35-SD06-06	3/8
Calcium	NA	NA	795 J	6490 J	35-SD05-06	14/14
Chromium	1.7 U	5.7 U	2.5	28.4 J	35-SD01-06	11/14
Cobalt	1.3 U	1.9 U	1.8	7.8	35-SD07-06	8/14
Copper	0.98 U	2.5 U	4.1	24.8	35-SD02-612	10/14
Iron	NA	NA	1050 J	13400	35-SD05-06	14/14
Lead	NA	NA	4.7 J	92	35-SD05-06	13/13
Magnesium	NA	NA	88.1	1140	35-SD06-06	14/14
Manganese	NA	NA	3.2 J	37 J	35-SD07-612	14/14
Mercury	NA	NA	0.07 J	0.07 J	35-SD02-06	1/1
Nickel	1.4 U	9.5 U	2.2	6.4	35-SD06-06	5/14
Potassium	296 U	701 U	498	812	35-SD06-06	2/14
Selenium	0.17 UJ	1 UJ	0.23 J	1.6 J	35-SD01-06	4/14
Sodium	287 U	458 U	461	729	35-SD05-06	5/14
Thallium	0.12 U	0.18 U	0.15	0.66 J	35-SD01-06	10/14
Vanadium	NA	NA	0.94 J	24.2 J	35-SD01-06	14/14
Zinc	NA	NA	60.4 J	104 J	35-SD07-612	3/3

APPENDIX X
SCREENING VALUE AND QUOTIENT INDEX CALCULATIONS

HARDNESS CALCULATION FOR METALS
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

TOTAL METALS

	36-SW01		36-SW02		36-SW03	
	Acute (ug/L)	Chronic (ug/L)	Acute (ug/L)	Chronic (ug/L)	Acute (ug/L)	Chronic (ug/L)
Cadmium	2.79	0.89	4.91	1.31	5.27	1.38
Chromium	1357	162	2044	244	2153	257
Copper	13.35	9.14	21.38	14.01	22.70	14.80
Lead	55.65	2.17	105.16	4.10	114.02	4.44
Nickel	1099	122	1678	187	1771	197
Silver	2.42	NA	5.71	NE	6.37	NE
Zinc	91	82	138	125	146	132
Calcium	NA	NA	NA	NA	NA	NA
Magnesium	NA	NA	NA	NA	NA	NA
Sample Hardness	74	74	122	122	130	130

DISSOLVED METALS

	36-SW01		36-SW02		36-SW03	
	Acute (ug/L)	Chronic (ug/L)	Acute (ug/L)	Chronic (ug/L)	Acute (ug/L)	Chronic (ug/L)
Cadmium	0.88	0.40	4.21	1.18	3.19	0.97
Chromium	585	70	1828	218	1495	178
Copper	5.07	3.80	18.80	12.48	14.92	10.11
Lead	15.04	0.59	88.44	3.45	64.68	2.52
Nickel	461	51	1496	166	1215	135
Silver	0.41	NE	4.52	NE	2.96	NE
Zinc	38	34	123	112	100	91
Calcium	9.47	9.47	40.3	40.3	30.2	30.2
Magnesium	0.688	0.688	1.42	1.42	1.91	1.91
Sample Hardness	26.48	26.48	106.48	106.48	83.27	83.27

NOTE: All Water Quality Values are Region IV (USEPA, 1995a)
Sample Hardness Calculation = 2.497(Ca, mg/L) + 4.118(Mg, mg/L)

NE - Not Established
NA - Not Applicable Because Hardness Was Measured

CALCULATION OF SEDIMENT QUALITY CRITERIA
FRESHWATER SEDIMENT STATIONS
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Contaminant	Koc (mL/g)	SWSV (ug/L)	Sample No	SD01-06 SQC (ug/kg)	SD02-06 SQC (ug/kg)	SD02-612 SQC (ug/kg)	SD03-06 SQC (ug/kg)	SD03-612 SQC (ug/kg)
Aldrin	9.60E+04	0.002	(1)	3.26	1.19	4.80	9.60	0.50
Alpha-chlordane	1.40E+05	0.004	(1)	9.52	3.47	14.00	28.00	1.46
4,4'-DDD	7.70E+05	0.001	(3)	13.09	4.77	19.25	38.50	2.00
4,4'-DDE	4.40E+06	0.001	(3)	74.80	27.28	110.00	220.00	11.44
4,4'-DDT	2.43E+05	0.001	(1)	4.13	1.51	6.08	12.15	0.63
Dieldrin	1.78E+05	0.002	(1)	6.05	2.21	8.89	17.78	0.92
Endosulfan sulfate	3.16E+03	0.05	(4)	2.69	0.98	3.95	7.91	0.41
Endrin	6.92E+04	0.002	(1)	2.35	0.86	3.46	6.92	0.36
Endrin aldehyde	6.92E+04	0.002	(5)	2.35	0.86	3.46	6.92	0.36
Endrin ketone	6.92E+04	0.002	(5)	2.35	0.86	3.46	6.92	0.36
Bis(2-ethylhexyl)phthalate	1.00E+05	30	(2)	51000.00	18600.00	75000.00	150000.00	7800.00
Diethylphthalate	1.42E+02	3	(2)	7.24	2.64	10.65	21.30	1.11
Pyrene	3.80E+04	NA		NA	NA	NA	NA	NA
* SQC = (Koc*SWSV*Foc)/1000000			**Foc (mg/kg**	**17000**	**6200**	**25000**	**50000**	**2600**

NA - Not Available
SWSV - Surface Water Screening Value
SQC - Sediment Quality Criteria
Foc - Fraction of organic carbon in mg/kg
Koc - Organic-carbon partition coefficient
(1) North Carolina Water Quality Standards
(2) USEPA, 1995b (Region III Water Quality Screening Values)
(3) Used 4,4'-DDT Value
(4) Used endosulfan value
(5) Used endrin value

CALCULATION OF SEDIMENT QUALITY CRITERIA
SALTWATER SEDIMENT SAMPLES
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Contaminant	Koc (mL/g)	SWSV (ug/L)	Sample No	SD04-06 SQC (ug/kg)	SD04-612 SQC (ug/kg)	SD05-06 SQC (ug/kg)	SD05-612 SQC (ug/kg)	SD06-06 SQC (ug/kg)	SD06-612 SQC (ug/kg)	SD07-06 SQC (ug/kg)	SD07-612 SQC (ug/kg)
Dieldrin	1.78E+05	0.002	(1)	5.33	6.40	3.49	2.49	0.92	0.75	44.46	62.60
4,4'-DDD	7.70E+05	0.001	(3)	11.55	13.86	7.55	5.39	2.00	1.62	96.25	135.52
4,4'-DDE	4.40E+06	0.001	(3)	66.00	79.20	43.12	30.80	11.44	9.24	550.00	774.40
4,4'-DDT	2.43E+05	0.001	(1)	3.65	4.37	2.38	1.70	0.63	0.51	30.38	42.77
Alpha-chlordane	1.40E+05	0.004	(1)	8.40	10.08	5.49	3.92	1.46	1.18	70.00	98.56
Endrin aldehyde	6.92E+04	0.002	(4,5)	2.08	2.49	1.36	0.97	0.36	0.29	17.30	24.35
Diethylphthalate	1.42E+02	3.4	(2)	7.24	8.69	4.73	3.38	1.26	1.01	60.35	84.97
Di-n-butylphthalate	1.70E+05	3.4	(2)	8670.00	10404.00	5664.40	4046.00	1502.80	1213.80	72250.00	101728.00
Tetrachloroethene	3.64E+02	450	(2)	2457.00	2948.40	1605.24	1146.60	425.88	343.98	20475.00	28828.80
Anthracene	1.40E+04	NA	(2)	NA	NA	NA	NA	NA	NA	NA	NA
			Foc (mg/kg	**15000**	**18000**	**9800**	**7000**	**2600**	**2100**	**125000**	**176000**

SQC = (Koc*SWSV*Foc)/1000000

NA - Not Available
SWSV - Surface Water Screening Value
SQC - Sediment Quality Criteria
Foc - Fraction of organic carbon in mg/kg
Koc - Organic-carbon partition coefficient
(1) North Carolina Water Quality Standards
(2) USEPA, 1995b (Region III Water Quality Screening Values)
(3) Used 4,4'-DDT Value
(4) Used endrin value
(5) USEPA, 1993 (Sediment Quality Criteria for Endrin)

URFACE WATER QUOTIENT INDEX CALCULATIONS
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Contaminant	Station	Concentration (ug/L)	North Carolina WQS	USEPA WQSV Acute	USEPA WQSV Chronic	Quotient Index North Carolina WQS	Quotient Index USEPA SWSV Acute	Quotient Index Chronic
Total Inorganics (Freshwater)								
Barium	36-SW01	12.1	NE	69.1	3.8	NA	0.2	3.2
Barium	36-SW02	27.3	NE	69.1	3.8	NA	0.4	7.2
Barium	36-SW03	39.8	NE	69.1	3.8	NA	0.6	10.5
Copper	36-SW01	56.5	7	13.4	9.1	8.1	4.2	6.2
Iron	36-SW01	2710	1000	NE	1000	2.7	NA	2.7
Iron	36-SW02	2320	1000	NE	1000	2.3	NA	2.3
Iron	36-SW03	4840	1000	NE	1000	4.8	NA	4.8
Manganese	36-SW02	91.2	NE	1470	80.3	NA	0.1	1.1
Manganese	36-SW03	126	NE	1470	80.3	NA	0.1	1.6
Vanadium	36-SW01	387	NE	284	19.1	NA	1.4	20.3
Vanadium	36-SW02	131	NE	284	19.1	NA	0.5	6.9
Vanadium	36-SW03	79	NE	284	19.1	NA	0.3	4.1
Dissolved Inorganics (Freshwater)								
Barium	36-DSW01	5.3	NE	69.1	3.8	NA	0.1	1.4
Barium	36-DSW02	19.1	NE	69.1	3.8	NA	0.3	5.0
arium	36-DSW03	11.7	NE	69.1	3.8	NA	0.2	3.1
opper	36-DSW01	19	7	5.07	3.8	2.7	3.7	5.0
Copper	36-DSW02	4.9	7	18.8	12.48	0.7	0.3	0.4
Iron	36-DSW01	1340	1000	NE	1000	1.3	NA	1.3
Iron	36-DSW02	1630	1000	NE	1000	1.6	NA	1.6
Iron	36-DSW03	1240	1000	NE	1000	1.2	NA	1.2
Lead	36-DSW01	9.8	25	15.04	0.59	0.4	0.7	16.6
Lead	36-DSW02	15.6	25	88.44	3.45	0.6	0.2	4.5
Lead	36-DSW03	9.1	25	64.68	2.52	0.4	0.1	3.6
Vanadium	36-DSW01	243	NE	284	19.1	NA	0.9	12.7
Vanadium	36-DSW02	143	NE	284	19.1	NA	0.5	7.5
Vanadium	36-DSW03	81	NE	284	19.1	NA	0.3	4.2
Total Inorganics (Saltwater)								
Manganese	36-SW05	31.9	NE	NE	10	NA	NA	3.2
Manganese	36-SW06	29.5	NE	NE	10	NA	NA	3.0
Manganese	36-SW07	24.5	NE	NE	10	NA	NA	2.5
Nickel	36-SW04	23.2	8.3	75	8.3	2.8	0.3	2.8
Dissolved Inorganics (Saltwater)								
Copper	36-DSW05	4.8	3	2.9	2.9	1.6	1.7	1.7
Manganese	36-DSW04	50.9	NE	NE	10	NA	NA	5.1
Manganese	36-DSW05	23.8	NE	NE	10	NA	NA	2.4
Manganese	36-DSW06	26.6	NE	NE	10	NA	NA	2.7
Manganese	36-DSW07	27	NE	NE	10	NA	NA	2.7

SEDIMENT QUOTIENT INDEX CALCULATIONS
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Contaminant	Station	Sample Concentration	ER-L	ER-M	SQC	Quotient Index ER-L	Quotient Index ER-M	Quotient Index SQC
Pesticides (ug/kg) (Freshwater)								
Aldrin	36-SD01-06	0.93 J	10	NE	3.26	0.1	NA	0.3
4,4'-DDD	36-SD01-06	15	2	20	13.09	7.5	0.8	1.1
4,4'-DDD	36-SD02-06	130	2	20	4.77	65.0	6.5	27.3
4,4'-DDD	36-SD02-612	14 P	2	20	19.25	7.0	0.7	0.7
4,4'-DDD	36-SD03-06	606	2	20	38.5	303	30.3	15.7
4,4'-DDD	36-SD03-612	1030	2	20	2	515	51.5	515
4,4'-DDE	36-SD02-06	66 J	2.2	27	27.28	30.0	2.4	2.4
4,4'-DDE	36-SD03-06	169	2.2	27	220	76.8	6.3	0.8
4,4'-DDT	36-SD02-06	8.5 J	1	7	1.51	8.5	1.2	5.6
4,4'-DDT	36-SD02-612	7.4 J	1	7	6.08	7.4	1.1	1.2
4,4'-DDT	36-SD03-06	18 J	1	7	12.15	18.0	2.6	1.5
4,4'-DDT	36-SD03-612	11 J	1	7	0.63	11.0	1.6	17.5
Dieldrin	36-SD01-06	0.8 J	0.02	8	6.05	40.0	0.1	0.1
Endrin	36-SD02-612	6.6 J	0.02	45	3.46	330.0	0.1	1.9
Endrin aldehyde	36-SD02-612	3.5	0.02	45	3.46	175.0	0.1	1.0
Endrin ketone	36-SD02-612	11	0.02	45	3.46	550.0	0.2	3.2
Diethylphthalate	36-SD02-06	330 J	5300	NE	2.64	0.1	NA	125.0
Diethylphthalate	36-SD03-612	896 J	5300	NE	1.11	0.2	NA	807.2
Inorganics (mg/kg) (Freshwater)								
Beryllium	36-SD01-06	1.3	0.5	NE	NE	2.6	NA	NA
Beryllium	36-SD03-06	0.81	0.5	NE	NE	1.6	NA	NA
Cadmium	36-SD02-612	8.7	1.2	9.6	NE	7.3	0.9	NA
Copper	36-SD03-06	45.1	34	270	NE	1.3	0.2	NA
Lead	36-SD02-612	148	46.7	218	NE	3.2	0.7	NA
Lead	36-SD03-06	86.7	46.7	218	NE	1.9	0.4	NA
Nickel	36-SD01-06	21.4	20.9	51.6	NE	1.0	0.4	NA
Nickel	36-SD03-06	77.1	20.9	51.6	NE	3.7	1.5	NA
Thallium	36-SD01-06	0.42	0.24	NE	NE	1.8	NA	NA
Thallium	36-SD03-06	0.32	0.24	NE	NE	1.3	NA	NA
Pesticides (ug/kg) (Saltwater)								
Alpha-chlordane	36-SD07-06	13 J	0.5	6	70	26.0	2.2	0.2
Alpha-chlordane	36-SD07-612	6.5 J	0.5	6	98.56	13.0	1.1	0.1
4,4'-DDD	36-SD04-06	250	2	20	11.55	125.0	12.5	21.6
4,4'-DDD	36-SD05-06	223 J	2	20	7.55	112	11.2	29.5
4,4'-DDD	36-SD05-612	1140	2	20	5.39	570	57.0	212
4,4'-DDD	36-SD06-06	221	2	20	2	111	11.1	111
4,4'-DDD	36-SD06-612	159	2	20	1.62	79.5	8.0	98.1
4,4'-DDD	36-SD07-06	74	2	20	96.25	37.0	3.7	0.8
4,4'-DDD	36-SD07-612	41	2	20	135.52	20.5	2.1	0.3
4,4'-DDE	36-SD04-06	120 J	2.2	27	66	55	4.4	1.8
4,4'-DDE	36-SD05-06	242 J	2.2	27	43.12	110	9.0	5.6
4,4'-DDE	36-SD05-612	1200	2.2	27	30.8	545	44.4	39.0
4,4'-DDE	36-SD06-06	249	2.2	27	11.44	113	9.2	21.8
4,4'-DDE	36-SD06-612	179	2.2	27	9.24	81.4	6.6	19.4
4,4'-DDE	36-SD07-06	51	2.2	27	550	23.2	1.9	0.1
4,4'-DDE	36-SD07-612	32 J	2.2	27	774	14.5	1.2	0.0
4,4'-DDT	36-SD04-06	3 J	1	7	3.65	3.0	0.4	0.8
4,4'-DDT	36-SD04-612	27 J	1	7	4.37	27.0	3.9	6.2
4,4'-DDT	36-SD05-06	31 J	1	7	2.38	31.0	4.4	13.0
4,4'-DDT	36-SD05-612	46 J	1	7	1.7	46.0	6.6	27.1
4,4'-DDT	36-SD06-06	14 J	1	7	0.63	14.0	2.0	22.2
4,4'-DDT	36-SD06-612	8 J	1	7	0.51	8.0	1.1	15.7
4,4'-DDT	36-SD07-612	5.7 J	1	7	42.77	5.7	0.8	0.1
Dieldrin	36-SD06-06	52	0.02	8	0.92	2600	6.5	56.5
Dieldrin	36-SD07-612	14 J	0.02	8	62.6	700	1.8	0.2
Endrin aldehyde	36-SD05-06	7.6	0.02	45	1.36	380	0.2	5.6
Diethylphthalate	36-SD05-06	2135 J	NE	NE	4.73	NA	NA	451.4
Inorganics (mg/kg) (Saltwater)								
Beryllium	36-SD07-06	1.1	0.5	NE	NE	2.2	NA	NA
Cadmium	36-SD04-612	1.4	1.2	9.6	NE	1.2	0.1	NA
Lead	36-SD05-06	115	46.7	218	NE	2.5	0.5	NA
Lead	36-SD06-06	15100	46.7	218	NE	323.3	69.3	NA
Lead	36-SD04-612	131	46.7	218	NE	2.8	0.6	NA
Mercury	36-SD04-612	0.66	0.15	0.71	NE	4.4	0.9	NA
Mercury	36-SD08-01	0.31	0.15	0.71	NE	2.1	0.4	NA
Mercury	36-SD09-01	0.18	0.15	0.71	NE	1.2	0.3	NA
Thallium	36-SD05-06	0.89	0.24	NE	NE	3.7	NA	NA
Thallium	36-SD05-612	0.59	0.24	NE	NE	2.5	NA	NA
Thallium	36-SD07-06	0.96	0.24	NE	NE	4.0	NA	NA
Thallium	36-SD07-612	0.54	0.24	NE	NE	2.3	NA	NA

APPENDIX Y
FISH AND CRAB SAMPLE COLLECTION LOGS

FISH AND CRAB SAMPLES CHEMICALLY ANALYZED
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Station	Date	Time	Sample Number	Length (cm)	Weight (g)	New Sample No.	Sample Analysis
35-FS03	4-14-94	930	35-FS03-MC01	35.5	670	35-FS03-MC-F01	Fillet
35-FS03	4-17-94	825	35-FS03-MC02	36.5	700		
35-FS03	4-17-94	825	35-FS03-MC04	33	600		
35-FS03	4-17-94	825	35-FS03-MC08	35	620		
			Minimum	33	600		
			Maximum	36.5	700		
			Min/Max	0.90	NA		
			Average	35	647.5		
			Count	4			
35-FS03	4-17-94	825	35-FS03-MC03	32.5	500	35-FS03-MC-WB01	Whole Bod
35-FS03	4-17-94	825	35-FS03-MC06	36.5	720		
35-FS03	4-17-94	825	35-FS03-MC07	37.5	840		
35-FS03	4-17-94	825	35-FS03-MC09	35.5	460		
			Minimum	32.5	460		
			Maximum	37.5	840		
			Min/Max	0.87	NA		
			Average	35.5	630		
			Count	4			
35-FS03	4-15-94	940	35-FS03-WM01	17.5	140	35-FS03-WM-F01	Fillet
35-FS03	4-15-94	940	35-FS03-WM02	15	80		
			Minimum	15	80		
			Maximum	17.5	140		
			Min/Max	0.86	NA		
			Average	16.3	110		
			Count	2			

FISH AND CRAB SAMPLES CHEMICALLY ANALYZED
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Station	Date	Time	Sample Number	Length (cm)	Weight (g)	New Sample No.	Sample Analysis
35-FS03	4-14-94	930	35-FS03-SM01	38	530	35-FS03-SM-F01	Fillet
35-FS03	4-14-94	930	35-FS03-SM02	30.2	300		
35-FS03	4-17-94	825	35-FS03-SM03	34.5	425		
35-FS03	4-17-94	825	35-FS03-SM04	39.5	600		
			Minimum	30.2	300		
			Maximum	39.5	600		
			Min/Max	0.76	NA		
			Average	35.6	464		
			Count	4			
35-FS03	4-15-94	940	35-FS03-BG01	16	75	35-FS03-BG-F01	Fillet
35-FS03	4-15-94	940	35-FS03-BG02	13.5	50		
35-FS03	4-15-94	940	35-FS03-BG03	11	25		
35-FS03	4-15-94	940	35-FS03-BG04	12	40		
35-FS03	4-15-94	940	35-FS03-BG05	19	125		
35-FS03	4-15-94	940	35-FS03-BG06	15	40		
35-FS03	4-15-94	940	35-FS03-BG07	18.5	140		
			Minimum	11	25		
			Maximum	19	140		
			Min/Max	0.58	NA		
			Average	15	71		
			Count	7			

FISH AND CRAB SPECIES COLLECTED IN BRINSON CREEK
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Station	Fish Species	Date	Time	Sample Number	Length (cm)	Weight (g)
36-FSO1	Pumpkinseed	4-20-94	1000	36-FS01-PS01	16	100
36-FSO1	Pumpkinseed	4-20-94	1000	36-FS01-PS02	14	65
				Minimum	14	65
				Maximum	16	100
				Average	15	82.5
				Count	2	2
36-FSO1	Bluegill	4-20-94	1000	36-FS01-BG01	17	106
36-FSO1	Stripped Mullet	4-18-94	1000	36-FS01-SM01	33.5	395
36-FSO1	Stripped Mullet	4-18-94	1000	36-FS01-SM02	32.5	400
36-FSO1	Stripped Mullet	4-18-94	1000	36-FS01-SM03	32.5	345
36-FSO1	Stripped Mullet	4-18-94	1000	36-FS01-SM04	35.5	500
36-FSO1	Stripped Mullet	4-18-94	1000	36-FS01-SM05	37	500
36-FSO1	Stripped Mullet	4-18-94	1000	36-FS01-SM06	34.5	450
36-FSO1	Stripped Mullet	4-18-94	1000	36-FS01-SM07	34	405
36-FSO1	Stripped Mullet	4-18-94	1000	36-FS01-SM08	27.5	325
				Minimum	27.5	325
				Maximum	37	500
				Average	33.375	415
				Count	8	8
36-FSO1	White Catfish	4-18-94	1000	36-FS01-WC01	30.5	400
36-FSO1	White Catfish	4-18-94	1000	36-FS01-WC02	31	480
36-FSO1	White Catfish	4-18-94	1000	36-FS01-WC03	30	405
				Minimum	30	400
				Maximum	31	480
				Average	30.5	428
				Count	3	3
36-FSO1	Sheepshead Minnow	4-20-94	920	NA	21 individuals	NM
36-FSO1	Summer Flounder	4-20-94	920	NA	1 individual	NM
36-FSO1	Mummichog	4-20-94	920	NA	19 individuals	NM

FISH AND CRAB SPECIES COLLECTED IN BRINSON CREEK
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Station	Fish Species	Date	Time	Sample Number	Length (cm)	Weight (g)
36-FSO1	Pinfish	4-20-94	920	NA	1 individual	NM
36-FSO2	Stripped Mullet	4-18-94	800	36-FS02-SM01	30.5	305
36-FSO2	Stripped Mullet	4-18-94	800	36-FS02-SM02	35	420
36-FSO2	Stripped Mullet	4-18-94	800	36-FS02-SM03	32.5	355
36-FSO2	Stripped Mullet	4-18-94	800	36-FS02-SM04	31	370
				Minimum	30.5	305
				Maximum	35	420
				Average	32.3	363
				Count	4	4
36-FSO2	Largemouth Bass	4-18-94	800	36-FS02-LMB01	27	270
36-FSO2	Blue Crab	4-20-94	800	36-FS02-BC01	15	140
36-FSO2	Blue Crab	4-20-94	800	36-FS02-BC02	15	150
36-FSO2	Blue Crab	5-9-94	1800	36-FS02-CB01	16	165
36-FSO2	Blue Crab	5-9-94	1800	36-FS02-CB01	15.2	163
36-FSO2	Blue Crab	5-9-94	1800	36-FS02-CB02	14.3	140
36-FSO2	Blue Crab	5-9-94	1800	36-FS02-CB02	12.8	130
36-FSO2	Blue Crab	5-9-94	1800	36-FS02-CB03	13.3	130
36-FSO2	Blue Crab	5-9-94	1800	36-FS02-CB03	13.4	125
36-FSO2	Blue Crab	5-10-94	1010	36-FS02-CB04	14.5	195
36-FSO2	Blue Crab	5-10-94	1010	36-FS02-CB04	13.3	160
36-FSO2	Blue Crab	5-10-94	1010	36-FS02-CB05	14	140
				Minimum	12.8	125
				Maximum	16	195
				Average	14.3	149
				Count	11	11

FISH AND CRAB SPECIES COLLECTED IN BRINSON CREEK
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Station	Fish Species	Date	Time	Sample Number	Length (cm)	Weight (g)
36-FSO2	White Catfish	4-18-94	800	36-FS02-WC01	33.5	500
36-FSO2	White Catfish	4-18-94	800	36-FS02-WC02	30.5	350
36-FSO2	White Catfish	4-18-94	800	36-FS02-WC03	27.5	375
36-FSO2	White Catfish	4-18-94	800	36-FS02-WC04	30	305
36-FSO2	White Catfish	4-18-94	800	36-FS02-WC05	32.5	480
36-FSO2	White Catfish	4-20-94	800	36-FS02-WC06	34	650
36-FSO2	White Catfish	4-20-94	800	36-FS02-WC07	37	750
36-FSO2	White Catfish	4-20-94	800	36-FS02-WC08	37	890
				Minimum	27.5	305
				Maximum	37	890
				Average	32.8	538
				Count	8	8
36-FSO2	Sharptail Goby	4-20-94	845	NA	1 individual	NM
36-FSO2	Pinfish	4-20-94	845	NA	2 individuals	NM
36-FSO2	Eastern Mosquitofish	4-20-94	845	NA	1 individual	NM
36-FS03	Stripped Mullet	4-18-94	800	36-FS03-SMO1	39	675
36-FS03	Stripped Mullet	4-18-94	800	36-FS03-SMO2	37	550
36-FS03	Stripped Mullet	4-18-94	800	36-FS03-SMO3	32	375
36-FS03	Stripped Mullet	4-18-94	800	36-FS03-SMO4	38	540
36-FS03	Stripped Mullet	4-18-94	1600	36-FS03-SMO5	29	260
36-FS03	Stripped Mullet	4-20-94	820	NA	3 individuals	NM
				Minimum	29	260
				Maximum	39	675
				Average	35.0	480
				Count	8	8
36-FS03	Pumpkinseed	4-18-94	800	36-FS03-PS01	17	125
36-FS03	Largemouth Bass	4-18-94	800	36-FS03-LMB01	32	500
36-FS03	Largemouth Bass	4-20-94	800	36-FS03-LMB02	42	1350
				Minimum	32	500
				Maximum	42	1350
				Average	37	925

FISH AND CRAB SPECIES COLLECTED IN BRINSON CREEK
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Station	Fish Species	Date	Time	Sample Number	Length (cm)	Weight (g)
36-FS03	Warmouth	4-20-94	815	36-FS03-WM01	21	220
36-FS03	White Catfish	4-18-94	800	36-FS03-WCO1	34	400
36-FS03	White Catfish	4-18-94	800	36-FS03-WCO2	35.5	470
36-FS03	White Catfish	4-18-94	800	36-FS03-WCO3	34	600
36-FS03	White Catfish	4-18-94	800	36-FS03-WCO4	33.5	470
36-FS03	White Catfish	4-18-94	800	36-FS03-WCO5	31.5	365
36-FS03	White Catfish	4-18-94	800	36-FS03-WCO6	30	360
36-FS03	White Catfish	4-18-94	800	36-FS03-WCO7	32	315
36-FS03	White Catfish	4-18-94	800	36-FS03-WCO8	33.5	495
36-FS03	White Catfish	4-18-94	800	36-FS03-WCO9	32.5	450
36-FS03	White Catfish	4-18-94	800	36-FS03-WC10	33.5	510
				Minimum	30	315
				Maximum	35.5	600
				Average	33	444
				Count	10	10
36-FS03	Longnose Gar	4-20-94	800	36-FS03-LGO1	82	1700
36-FS03	Longnose Gar	4-20-94	800	36-FS03-LGO2	76	1200
				Minimum	76	1200
				Maximum	82	1700
				Average	79	1450
				Count	2	2
36-FS03	Blue Crab	5-9-94	1810	36-FS03-CB01	12.4	120
36-FS03	Blue Crab	5-9-94	1810	36-FS03-CB01	14	130
36-FS03	Blue Crab	5-9-94	1810	36-FS03-CB02	13.2	140
36-FS03	Blue Crab	5-9-94	1810	36-FS03-CB02	12.5	120
36-FS03	Blue Crab	5-9-94	1810	36-FS03-CB03	12.4	120
36-FS03	Blue Crab	5-9-94	1810	36-FS03-CB03	12.3	137
36-FS03	Blue Crab	5-9-94	1810	36-FS03-CB04	12.5	115
36-FS03	Blue Crab	5-9-94	1810	36-FS03-CB04	16.5	240
36-FS03	Blue Crab	5-9-94	1810	36-FS03-CB05	14.3	145
36-FS03	Blue Crab	5-9-94	1810	36-FS03-CB05	14.2	140
36-FS03	Blue Crab	5-9-94	1810	36-FS03-CB06	14	160
36-FS03	Blue Crab	5-9-94	1810	36-FS03-CB06	15.4	190

FISH AND CRAB SPECIES COLLECTED IN BRINSON CREEK
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Station	Fish Species	Date	Time	Sample Number	Length (cm)	Weight (g)
36-FS03	Blue Crab	5-9-94	1810	36-FS03-CB07	12.3	125
36-FS03	Blue Crab	5-9-94	1810	36-FS03-CB07	12	120
36-FS03	Blue Crab	5-10-94	1000	36-FS03-CB08	15.5	245
36-FS03	Blue Crab	5-10-94	1000	36-FS03-CB08	14.7	180
36-FS03	Blue Crab	5-10-94	1000	36-FS03-CB09	16.5	230
36-FS03	Blue Crab	5-10-94	1000	36-FS03-CB09	13.5	135
36-FS03	Blue Crab	5-10-94	1000	36-FS03-CB10	13	155
36-FS03	Blue Crab	5-10-94	1000	36-FS03-CB10	12	105
36-FS03	Blue Crab	5-10-94	1000	36-FS03-CB11	13.5	140
				Minimum	12	105
				Maximum	16.5	245
				Average	13.7	152
				Count	21	21
36-FS03	Mummichog	4-20-94	820	NA	2 individuals	NM
36-FS03	Pinfish	4-20-94	820	NA	7 individuals	NM
36-FS03	Eastern Mosquitofish	4-20-94	820	NA	1 individual	NM
36-FS03	Grass Shrimp	4-20-94	820	NA	21 individuals	NM

FISH AND CRAB SPECIES COLLECTED IN BRINSON CREEK
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Station	Fish Species	Date	Time	Sample Number	Length (cm)	Weight (g)
35-FS01	Green Sunfish	4-15-94	1530	35-FS01-GS01	9	15
35-FS01	American Eel	4-15-94	1530	35-FS01-AE01	5 individuals 11 to 18 cm	22.5
35-FS01	Pumpkinseed	4-15-94	1530	35-FS01-PS01	8	10
35-FS01	Spot	4-15-94	1530	NA	76 individuals	NM
35-FS01	Stripped Mullet	4-15-94	1530	NA	125 individuals	NM
35-FS01	Sharptail Goby	4-15-94	1530	NA	2 individuals 5.5 to 6.5 cm	NM
35-FS02	American Eel	4-14-94	1230	35-FS02-AE01	4 individuals 13 to 25 cm	70
35-FS02	Pumpkinseed	4-14-94	1230	35-FSO2-PS01	2 individuals	95
35-FS02	Pumpkinseed	4-14-94	1230	NA	4 individuals	55
35-FS02	Longnose Gar	4-14-94	900	35-FS02-LG01	95.5	2750
35-FS02	Mud Catfish	4-17-94	715	35-FS02-MC01	37.5	680
35-FS02	Mud Catfish	4-17-94	715	35-FS02-MC02	26.5	280
35-FS02	Mud Catfish	4-14-94	900	NA	15.5	20
				Minimum	15.5	20
				Maximum	37.5	680
				Average	26.5	326.7
				Count	3	3
35-FS02	Crayfish	4-14-94	900	35-FS02-CF01	12 individuals	50
35-FS02	Sheepshead Minnow	4-17-94	NA	NA	12 individuals	NM
35-FS02	Spot	4-14-94	1230	NA	216 individuals	70
35-FS02	Stripped Mullet	4-14-94	1230	NA	55 individuals	30
35-FS02	Banded Killfish	4-17-94	NA	NA	6	NM

FISH AND CRAB SPECIES COLLECTED IN BRINSON CREEK
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Station	Fish Species	Date	Time	Sample Number	Length (cm)	Weight (g)
35-FS02	Fat Sleeper	4-14-94	1230	NA	6	NM
35-FS02	Lesser Killfish	4-14-94	1230	NA	2 individuals 3.0 cm	NM
35-FS02	Brown Bullhead	4-14-94	1230	NA	1 individual	NM
35-FS02	Summer Flounder	4-14-94	1230	NA	2.5	NM
35-FS02	Mummichog	4-14-94	900	NA	3 individuals	NM
35-FS02	Pinfish	4-14-94	900	NA	4 individuals	NM
35-FS02	Eastern Mosquitofish	4-14-94	900	NA	2 individuals	NM
35-FS03	Warmouth	4-15-94	940	35-FS03-WM01	17.5	140
35-FS03	Warmouth	4-15-94	940	35-FS03-WM02	15	80
				Minimum	15	80
				Maximum	17.5	140
				Average	16.3	110.0
				Count	2	2
35-FS03	Longnose Gar	4-15-94	940	35-FS03-LG01	83.5	900
35-FS03	Longnose Gar	4-17-94	825	35-FS03-LG02	94	2950
35-FS03	Longnose Gar	4-17-94	825	35-FS03-LG03	88.5	2400
35-FS03	Longnose Gar	4-17-94	825	35-FS03-LG04	84.5	2000
35-FS03	Longnose Gar	4-17-94	825	35-FS03-LG05	74.5	1150
35-FS03	Longnose Gar	4-17-94	825	35-FS03-LG06	77.5	1350
35-FS03	Longnose Gar	4-17-94	825	35-FS03-LG07	65.5	750
35-FS03	Longnose Gar	4-17-94	825	35-FS03-LG08	75.5	1400
35-FS03	Longnose Gar	4-17-94	825	35-FS03-LG09	73	510
				Minimum	65.5	510
				Maximum	94	2950
				Average	79.6	1490
				Count	9	9

FISH AND CRAB SPECIES COLLECTED IN BRINSON CREEK
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Station	Fish Species	Date	Time	Sample Number	Length (cm)	Weight (g)
35-FS03	Stripped Mullet	4-14-94	930	35-FS03-SM01	38	530
35-FS03	Stripped Mullet	4-14-94	930	35-FS03-SM02	30.2	300
35-FS03	Stripped Mullet	4-17-94	825	35-FS03-SM03	34.5	425
35-FS03	Stripped Mullet	4-17-94	825	35-FS03-SM04	39.5	600
35-FS03	Stripped Mullet	4-14-94	930	NA	4 individuals	NM
				Minimum	30.2	300
				Maximum	39.5	600
				Average	35.6	463.8
				Count	8	8
35-FS03	Mud Catfish	4-14-94	930	35-FS03-MC01	35.5	670
35-FS03	Mud Catfish	4-17-94	825	35-FS03-MC02	36.5	700
35-FS03	Mud Catfish	4-17-94	825	35-FS03-MC03	32.5	500
35-FS03	Mud Catfish	4-17-94	825	35-FS03-MC04	33	600
35-FS03	Mud Catfish	4-17-94	825	35-FS03-MC05	48.5	920
35-FS03	Mud Catfish	4-17-94	825	35-FS03-MC06	36.5	720
35-FS03	Mud Catfish	4-17-94	825	35-FS03-MC07	37.5	840
35-FS03	Mud Catfish	4-17-94	825	35-FS03-MC08	35	620
35-FS03	Mud Catfish	4-17-94	825	35-FS03-MC09	35.5	460
35-FS03	Mud Catfish	4-17-94	825	35-FS03-MC10	29	280
				Minimum	29	280
				Maximum	48.5	920
				Average	36.0	631
				Count	10	10
35-FS03	American Eel	4-14-94	1900	35-FS03-AE01	31	50

FISH AND CRAB SPECIES COLLECTED IN BRINSON CREEK
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Station	Fish Species	Date	Time	Sample Number	Length (cm)	Weight (g)
35-FS03	Pumpkinseed	4-14-94	1845	35-FS03-PS01	15	65
35-FS03	Pumpkinseed	4-14-94	1845	35-FS03-PS02	12	40
35-FS03	Pumpkinseed	4-15-94	940	35-FS03-PS03	12	40
35-FS03	Pumpkinseed	4-15-94	940	35-FS03-PS04	10.5	25
35-FS03	Pumpkinseed	4-15-94	940	35-FS03-PS05	12	25
35-FS03	Pumpkinseed	4-15-94	940	35-FS03-PS06	11.5	25
35-FS03	Pumpkinseed	4-17-94	825	35-FS03-PS07	17.5	100
				Minimum	10.5	25
				Maximum	17.5	100
				Average	12.9	45.7
				Count	7	7
35-FS03	Bluegill	4-15-94	940	35-FS03-BG01	16	75
35-FS03	Bluegill	4-15-94	940	35-FS03-BG02	13.5	50
35-FS03	Bluegill	4-15-94	940	35-FS03-BG03	11	25
35-FS03	Bluegill	4-15-94	940	35-FS03-BG04	12	40
35-FS03	Bluegill	4-15-94	940	35-FS03-BG05	19	125
35-FS03	Bluegill	4-15-94	940	35-FS03-BG06	15	40
35-FS03	Bluegill	4-15-94	940	35-FS03-BG07	18.5	140
				Minimum	11	25
				Maximum	19	140
				Average	15.0	70.7
				Count	7	7
35-FS03	Spot	4-14-94	930	NA	95 individuals	NM
35-FS03	Pinfish	4-14-94	930	NA	7 individuals	NM
35-FS03	Eastern Mosquitofish	4-14-94	930	NA	1 individual	NM
35-FS03	Crayfish	4-14-94	930	NA	1 individual	NM

FISH AND CRAB SAMPLES CHEMICALLY ANALYZED
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Station	Date	Time	Sample Number	Length (cm)	Weight (g)	New Sample No.	Sample Analysis
36-FS01	4-18-94	1000	36-FS01-SM01	33.5	395	36-FS01-SM-WB01	Whole Bod
36-FS01	4-18-94	1000	36-FS01-SM04	35.5	500		
36-FS01	4-18-94	1000	36-FS01-SM06	34.5	450		
36-FS01	4-18-94	1000	36-FS01-SM08	27.5	325		
			Minimum	27.5	325		
			Maximum	35.5	500		
			Min/Max	0.77	NA		
			Average	32.8	417.5		
			Count	4			
36-FS01	4-18-94	1000	36-FS01-SM02	32.5	400	36-FS01-SM-F01	Fillet
36-FS01	4-18-94	1000	36-FS01-SM03	32.5	345		
36-FS01	4-18-94	1000	36-FS01-SM05	37	500		
36-FS01	4-18-94	1000	36-FS01-SM07	34	405		
			Minimum	32.5	345		
			Maximum	37	500		
			Min/Max	0.88	NA		
			Average	34	413		
			Count	4			
36-FS01	4-18-94	1000	36-FS01-WC01	30.5	400	36-FS01-WC-F01	Fillet
36-FS01	4-18-94	1000	36-FS01-WC02	31	480		
36-FS01	4-18-94	1000	36-FS01-WC03	30	405		
			Minimum	30	400		
			Maximum	31	480		
			Min/Max	0.97	NA		
			Average	30.5	428		
			Count	3			

FISH AND CRAB SAMPLES CHEMICALLY ANALYZED
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Station	Date	Time	Sample Number	Length (cm)	Weight (g)	New Sample No.	Sample Analysis
36-FS02	4-18-94	800	36-FS02-SM01	30.5	305	36-FS02-SM-F01	Fillet
36-FS02	4-18-94	800	36-FS02-SM02	35	420		
36-FS02	4-18-94	800	36-FS02-SM03	32.5	355		
36-FS02	4-18-94	800	36-FS02-SM04	31	370		
			Minimum	30.5	305		
			Maximum	35	420		
			Min/Max	0.87	NA		
			Average	32.3	363		
			Count	4			
36-FS02	4-18-94	800	36-FS02-WC02	30.5	350	36-FS02-WC-F01	Fillet
36-FS02	4-20-94	800	36-FS02-WC06	34	650		
36-FS02	4-20-94	800	36-FS02-WC07	37	750		
			Minimum	30.5	350		
			Maximum	37	750		
			Min/Max	0.82	NA		
			Average	33.8	583		
			Count	3			
36-FS02	4-18-94	800	36-FS02-WC01	33.5	500	36-FS02-WC-WB01	Whole Bod
36-FS02	4-18-94	800	36-FS02-WC05	32.5	480		
36-FS02	4-20-94	800	36-FS02-WC08	37	890		
			Minimum	32.5	480		
			Maximum	37	890		
			Min/Max	0.88	NA		
			Average	34.3	623		
			Count	3			
36-FS02	4-18-94	800	36-FS02-WC03	27.5	375	36-FS02-WC-WB02	Whole Bod
36-FS02	4-18-94	800	36-FS02-WC04	30	305		
36-FS03	4-18-94	800	36-FS03-WCO6	30	360		
			Minimum	27.5	305		
			Maximum	30	375		
			Min/Max	0.92	NA		
			Average	29.2	347		
			Count	3			

FISH AND CRAB SAMPLES CHEMICALLY ANALYZED
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Station	Date	Time	Sample Number	Length (cm)	Weight (g)	New Sample No.	Sample Analysis
36-FS02	4-18-94	800	36-FS02-LMB01	27	270	36-FS02-LMB-F01	Fillet
36-FS02	4-18-94	800	36-FS03-LMB01	32	500		
			Minimum	27	270		
			Maximum	32	500		
			Min/Max	0.84	NA		
			Average	29.5	385		
			Count	2			
36-FS02	5-9-94	1800	36-FS02-CB01	16	165		
36-FS02	5-9-94	1800	36-FS02-CB01	15.2	163		
36-FS02	5-9-94	1800	36-FS02-CB02	14.3	140		
36-FS02	5-9-94	1800	36-FS02-CB02	12.8	130		
36-FS02	5-9-94	1800	36-FS02-CB03	13.3	130		
36-FS02	5-9-94	1800	36-FS02-CB03	13.4	125		
36-FS02	5-10-94	1010	36-FS02-CB04	14.5	195		
36-FS02	5-10-94	1010	36-FS02-CB04	13.3	160		
36-FS02	4-20-94	800	36-FS02-BC01	15	140		
36-FS02	4-20-94	800	36-FS02-BC02	15	150		
			Minimum	12.8	125		
			Maximum	16	195		
			Min/Max	0.80	NA		
			Average	14.3	150		
			Count	10			
36-FS03	4-18-94	800	36-FS03-SMO1	39	675	36-FS03-SM-F01	Fillet
36-FS03	4-18-94	800	36-FS03-SMO2	37	550		
36-FS03	4-18-94	800	36-FS03-SMO3	32	375		
36-FS03	4-18-94	800	36-FS03-SMO4	38	540		
			Minimum	32	375		
			Maximum	39	675		
			Min/Max	0.82	NA		
			Average	36.5	535		
			Count	4			

FISH AND CRAB SAMPLES CHEMICALLY ANALYZED
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Station	Date	Time	Sample Number	Length (cm)	Weight (g)	New Sample No.	Sample Analysis
36-FS03	4-18-94	800	36-FS03-WCO2	35.5	470	36-FSO3-WC-F01	Fillet
36-FS03	4-18-94	800	36-FS03-WCO4	33.5	470		
36-FS03	4-18-94	800	36-FS03-WCO5	31.5	365		
			Minimum	31.5	365		
			Maximum	35.5	470		
			Min/Max	0.89	NA		
			Average	33.5	435		
			Count	3			
36-FS03	4-18-94	800	36-FS03-WCO1	34	400	36-FSO3-WC-F02	Fillet
36-FS03	4-18-94	800	36-FS03-WCO7	32	315		
36-FS03	4-18-94	800	36-FS03-WCO8	33.5	495		
			Minimum	32	315		
			Maximum	34	495		
			Min/Max	0.94	NA		
			Average	33.2	403		
			Count	3			
36-FS03	4-18-94	800	36-FS03-WCO3	34	600	36-FS03-WC-WB01	Whole Bod
36-FS03	4-18-94	800	36-FS03-WCO9	32.5	450		
36-FS03	4-18-94	800	36-FS03-WC10	33.5	510		
			Minimum	32.5	450		
			Maximum	34	600		
			Min/Max	0.96	NA		
			Average	33.3	520		
			Count	3			
36-FS03	4-20-94	800	36-FS03-LMB02	42	1350	36-FS03-LMB-FO1	Fillet
36-FS03	4-20-94	815	36-FS03-WM01	21	220	36-FS03-WM-F01	Fillet

FISH AND CRAB SAMPLES CHEMICALLY ANALYZED
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Station	Date	Time	Sample Number	Length (cm)	Weight (g)	New Sample No.	Sample Analysis
36-FS03	4-20-94	800	36-FS03-LGO1	82	1700	36-FS03-LG-F01	Fillet
36-FS03	4-20-94	800	36-FS03-LGO2	76	1200		
			Minimum	76	1200		
			Maximum	82	1700		
			Min/Max	0.93	NA		
			Average	79	1450		
			Count	2			
36-FS03	5-9-94	1810	36-FS03-CB01	12.4	120	36-FS03-BC01	Edible
36-FS03	5-9-94	1810	36-FS03-CB01	14	130		Portion
36-FS03	5-9-94	1810	36-FS03-CB02	13.2	140		
36-FS03	5-9-94	1810	36-FS03-CB02	12.5	120		
36-FS03	5-9-94	1810	36-FS03-CB03	12.4	120		
36-FS03	5-9-94	1810	36-FS03-CB03	12.3	137		
36-FS03	5-10-94	1000	36-FS03-CB08	15.5	245		
36-FS03	5-10-94	1000	36-FS03-CB08	14.7	180		
36-FS03	5-10-94	1000	36-FS03-CB09	16.5	230		
36-FS03	5-10-94	1000	36-FS03-CB09	13.5	135		
			Minimum	12.3	120		
			Maximum	16.5	245		
			Min/Max	0.75	NA		
			Average	13.7	156		
			Count	10			

FISH AND CRAB SAMPLES CHEMICALLY ANALYZED
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Station	Date	Time	Sample Number	Length (cm)	Weight (g)	New Sample No.	Sample Analysis
36-FS03	5-9-94	1810	36-FS03-CB04	12.5	115	36-FS03-BC02	Edible
36-FS03	5-9-94	1810	36-FS03-CB04	16.5	240		Portion
36-FS03	5-9-94	1810	36-FS03-CB05	14.3	145		
36-FS03	5-9-94	1810	36-FS03-CB05	14.2	140		
36-FS03	5-9-94	1810	36-FS03-CB06	14	160		
36-FS03	5-9-94	1810	36-FS03-CB06	15.4	190		
36-FS03	5-9-94	1810	36-FS03-CB07	12.3	125		
36-FS03	5-9-94	1810	36-FS03-CB07	12	120		
36-FS03	5-10-94	1000	36-FS03-CB10	13	155		
36-FS03	5-10-94	1000	36-FS03-CB10	12	105		
			Minimum	12	105		
			Maximum	16.5	240		
			Min/Max	0.73	NA		
			Average	13.6	150		
			Count	10			

FISH AND CRAB SAMPLES CHEMICALLY ANALYZED
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Station	Date	Time	Sample Number	Length (cm)	Weight (g)	New Sample No.	Sample Analysis
35-FS01	4-15-94	1530	35-FS01-AE01	Composite (5 indiv.)		35-FS01-AE-WB02	Whole Bod
35-FS02	4-14-94	1230	35-FS02-AE01	Composite (4 indiv.)	70	35-FS02-AE-WB02	Whole Bod
35-FS02	4-14-94	1230	35-FSO2-PS01	Composite (2 indiv.)	95	35-FS02-PS-WB01	Whole Bod
35-FS02	4-14-94	900	35-FS02-LG01	95.5	2750	35-FS02-LG-F01	Fillet
35-FS02	4-17-94	715	35-FS02-MC01	37.5	680	35-FS02-MC-F01	Fillet
35-FS02	4-17-94	715	35-FS02-MC02	26.5	280		
			Minimum	26.5	280		
			Maximum	37.5	680		
			Min/Max	0.71	NA		
			Average	32	480		
			Count	2			
35-FS02	4-14-94	900	35-FS02-CF01	Composite (12 indiv.)	50	35-FS02-CF-WB01	Whole Bod
35-FS03	4-14-94	1900	35-FS03-AE01	31	50	35-FS03-AE-WB01	Whole Bod
35-FS03	4-14-94	1845	35-FS03-PS01	15	65	35-FS03-PS-WB01	Whole Bod
35-FS03	4-17-94	825	35-FS03-PS07	17.5	100		
			Minimum	15	65		
			Maximum	17.5	100		
			Min/Max	0.86	NA		
			Average	16.3	83		
			Count	2			

FISH AND CRAB SAMPLES CHEMICALLY ANALYZED
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Station	Date	Time	Sample Number	Length (cm)	Weight (g)	New Sample No.	Sample Analysis
35-FS03	4-14-94	1845	35-FS03-PS02	12	40	35-FS03-PS-WB02	Whole Bod
35-FS03	4-15-94	940	35-FS03-PS03	12	40		
35-FS03	4-15-94	940	35-FS03-PS04	10.5	25		
35-FS03	4-15-94	940	35-FS03-PS05	12	25		
35-FS03	4-15-94	940	35-FS03-PS06	11.5	25		
			Minimum	10.5	25		
			Maximum	12	40		
			Min/Max	0.88	NA		
			Average	11.6	31		
			Count	5			
35-FS03	4-15-94	940	35-FS03-LG01	83.5	900	35-FS03-LG-F01	Fillet
35-FS03	4-17-94	825	35-FS03-LG07	65.5	750		
35-FS03	4-17-94	825	35-FS03-LG09	73	510		
			Minimum	65.5	510		
			Maximum	83.5	900		
			Min/Max	0.78	NA		
			Average	74	720		
			Count	3			
35-FS03	4-17-94	825	35-FS03-LG02	94	2950	35-FS03-LG-F02	Fillet
35-FS03	4-17-94	825	35-FS03-LG03	88.5	2400		
35-FS03	4-17-94	825	35-FS03-LG04	84.5	2000		
			Minimum	84.5	2000		
			Maximum	94	2950		
			Min/Max	0.90	NA		
			Average	89	2450		
			Count	3			
35-FS03	4-17-94	825	35-FS03-LG05	74.5	1150	35-FS03-LG-WB01	Whole Bod
35-FS03	4-17-94	825	35-FS03-LG06	77.5	1350		
35-FS03	4-17-94	825	35-FS03-LG08	75.5	1400		
			Minimum	74.5	1150		
			Maximum	77.5	1400		
			Min/Max	0.96	NA		
			Average	75.8	1300		
			Count	3			

APPENDIX Z
BENTHIC MACROINVERTEBRATE RAW DATA TABLES AND LABORATORY BENCH SHEETS

RAW DATA TABLE: BENTHIC MACROINVERTEBRATE SPECIES
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Species	**36-BN01**	**36-BN02**	**36-BN03**
ANNELIDA			
Oligochaeta			
Tubificida			
Naididae			
Dero digitata	1	1	
Tubificidae	1		1
Polychaeta			
Capitellida			
Capitellidae			
Heteromastus filiformis		2	1
Phyllodocida			
Nereidae			
Nereis succinea	18	221	184
Spionida			
Spionidae			
Polydora sp.		8	15
Terebellida			
Ampharetidae			
Hypaniola grayi	6	95	49
ARTHROPODA			
Crustacea			
Amphipoda			
Gammaridae			
Gammarus tigrinus		4	37
Decapoda			
Palaemonidae			
Palaemonetes pugio			1
Portunidae			
Callinectes sp.			1
Insecta			
Diptera			
Ceratopogonidae			
Palpomyia/sphaeromias sp. (biting midges)	1	1	1
Chironomidae			
Chironomus decorus gr.	4	12	79
Cricotopus ornatus	10	2	
Dicrotendipes modestus	1		
Prociadius sp.	1		1
Tanytarsus sp.		2	1
Tribelos lucundum			1
Tabanidae			
Chrysops sp.	1		
Total Taxa	**10**	**10**	**13**
Total Specimens	**44**	**348**	**372**
Brillouin's Diversity	**0.632**	**0.424**	**0.6**
SPECIES DENSITY (#/M^2)	**280**	**2218**	**2371**
SPECIES DIVERSITY (Shannon-Wiener)	**0.742**	**0.443**	**0.621**

PERCENT BENTHIC MACROINVERTEBRATE SPECIES PER STATION
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Species	36-BN01	36-BN02	36-BN03
ANNELIDA			
Oligochaeta			
Tubificida			
Naididae			
Dero digitata	2.3	0.3	
Tubificidae	2.3		0.3
Polychaeta			
Capitellida			
Capitellidae			
Heteromastus filiformis		0.6	0.3
Phyllodocida			
Nereidae			
Nereis succinea	40.9	63.5	49.5
Spionida			
Spionidae			
Polydora sp.		2.3	4.0
Terebellida			
Ampharetidae			
Hypaniola grayi	13.6	27.3	13.2
ARTHROPODA			
Crustacea			
Amphipoda			
Gammaridae			
Gammarus tigrinus		1.1	9.9
Decapoda			
Palaemonidae			
Palaemonetes pugio			0.3
Portunidae			
Callinectes sp.			0.3
Insecta			
Diptera			
Ceratopogonidae			
Palpomyia/sphaeromias sp.	2.3	0.3	0.3
Chironomidae			
Chironomus decorus gr.	9.1	3.4	21.2
Cricotopus ornatus	22.7	0.6	
Dicrotendipes modestus	2.3		
Prociadius sp.	2.3		0.3
Tanytarsus sp.		0.6	0.3
Tribelos lucundum			0.3
Tabanidae			
Chrysops sp.	2.3		
TOTAL PERCENT	**100**	**100**	**100**

SPECIES DIVERSITY CALCULATION (SHANNON-WEINER)
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

SPECIES	36-BN01	36-BN02	36-BN03
ANNELIDA			
Oligochaeta			
Tubificida			
Naididae			
Dero digitata	-0.0374	-0.0073	
Tubificidae	-0.0374		-0.0069
Polychaeta			
Capitellida			
Capitellidae			
Heteromastus filiformis		-0.0129	-0.0069
Phyllodocida			
Nereidae			
Nereis succinea	-0.1588	-0.1252	-0.1512
Spionida			
Spionidae			
Polydora sp.		-0.0377	-0.0562
Terebellida			
Ampharetidae			
Hypaniola grayi	-0.1180	-0.1539	-0.1160
ARTHROPODA			
Crustacea			
Amphipoda			
Gammaridae			
Gammarus tigrinus		-0.0223	-0.0997
Decapoda			
Palaemonidae			
Palaemonetes pugio			-0.0069
Portunidae			
Callinectes sp.			-0.0069
Insecta			
Diptera			
Ceratopogonidae			
Palpomyia/sphaeromias sp.	-0.0374	-0.0073	-0.0069
Chironomidae			
Chironomus decorus gr.	-0.0947	-0.0504	-0.1429
Cricotopus ornatus	-0.1462	-0.0129	
Dicrotendipes modestus	-0.0374		
Prociadius sp.	-0.0374		-0.0069
Tanytarsus sp.		-0.0129	-0.0069
Tribelos lucundum			-0.0069
Tabanidae			
Chrysops sp.	-0.0374		
DIVERSITY	**0.7418151**	**0.4427754**	**0.6212863**

MACROINVERTEBRATE BIOTIC INDEX CALCULATION
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Species	36-BN01	36-BN02	36-BN03	BI	36-BN01	36-BN02	36-BN03
ANNELIDA							
Oligochaeta							
Tubificida							
Naididae							
Dero digitata	1	1		10	10	10	
Tubificidae	1		1	NA	0		0
Polychaeta							
Capitellida							
Capitellidae							
Heteromastus filiformis		2	1	NA		0	0
Phyllodocida							
Nereidae							
Nereis succinea	18	221	184	NA	0	0	0
Spionida							
Spionidae							
Polydora sp.		8	15	NA		0	0
Terebellida							
Ampharetidae							
Hypaniola grayi	6	95	49	NA	0	0	0
ARTHROPODA							
Crustacea							
Amphipoda							
Gammaridae							
Gammarus tigrinus		4	37	NA		0	0
Decapoda							
Palaemonidae							
Palaemonetes pugio			1	NA			0
Portunidae							
Callinectes sp.			1	NA			0
Insecta							
Diptera							
Ceratopogonidae							
Palpomyia/sphaeromias sp. (biting midges)	1	1	1	7	7	7	7
Chironomidae							
Chironomus decorus gr.	4	12	79	9.6	38.4	115.2	758.4
Cricotopus ornatus	10	2		NA	0	0	
Dicrotendipes modestus	1			8.7	8.7		
Prociadius sp.	1		1	9.1	9.1		9.1
Tanytarsus sp.		2	1	6.7		13.4	6.7
Tribelos lucundum			1	6.3			6.3
Tabanidae							
Chrysops sp.	1			6.7	6.7		
Total Taxa	**10**	**10**	**13**				
Total Specimens	**44**	**348**	**372**		**9**	**16**	**83**
MBI					**8.88**	**9.10**	**9.49**

RAW DATA TABLE: BENTHIC MACROINVERTEBRATE SPECIES
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Species	**35-BN02**	**35-BN03**	**35-BN04**
ANNELIDA			
Oligochaeta			
Tubificida			
Naididae			
Dero digitata		27	
Stylaria lacustris		8	
Tubificidae			
Limnodrilus hoffmeisteri	3	1	18
ARTHROPODA			
Crustacea			
Amphipoda			
Gammaridae			
Gammarus tigrinus		1	
Insecta			
Coleoptera			
Elmidae			
Dubiraphia sp.	1		
Diptera			
Ceratopogonidae			
Bezzia/Palpomyia sp. (biting mid			1
Chironomidae			
Chironomus decorus gr. (midges)	58	41	79
Cricotopus bicinctus gr.	2	2	1
Cricotopus ornatus		5	
Dicrotendipes hervosus	1		
Polypedilum illinoense		1	
Polypedilum scalaenum		6	
Tanytarsus sp.		2	2
Thienemannimyia gr		1	
Tribelos jucundum		1	
Total Taxa	**5**	**12**	**5**
Total Specimens	**65**	**96**	**101**
Brillouin's Diversity	**0.176**	**0.649**	**0.266**
SPECIES DENSITY (#/M^2)	**414.27661**	**611.85468**	**643.72212**
SPECIES DIVERSITY (Shannon-Wiener)	**0.2081096**	**0.7180675**	**0.2903659**

PERCENT BENTHIC MACROINVERTEBRATE SPECIES PER STATION
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Species	35-BN02	35-BN03	35-BN04
ANNELIDA			
Oligochaeta			
Tubificida			
Naididae			
Dero digitata		28.13	
Stylaria lacustris		8.33	
Tubificidae			
Limnodrilus hoffmeisteri	4.62	1.04	17.82
ARTHROPODA			
Crustacea			
Amphipoda			
Gammaridae			
Gammarus tigrinus		1.04	
Insecta			
Coleoptera			
Elmidae			
Dubiraphia sp.	1.54		
Diptera			
Ceratopogonidae			
Bezzia/Palpomyia sp.			0.99
Chironomidae			
Chironomus decorus gr.	89.23	42.71	78.22
Cricotopus bicinctus gr.	3.08	2.08	0.99
Cricotopus ornatus		5.21	
Dicrotendipes hervosus	1.54		
Polypedilum illinoense		1.04	
Polypedilum scalaenum		6.25	
Tanytarsus sp.		2.08	1.98
Thienemannimyia gr		1.04	
Tribelos jucundum		1.04	
TOTAL PERCENT	**100**	**100**	**100**

SPECIES DIVERSITY CALCULATION (SHANNON-WEINER)
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

SPECIES	35-BN02	35-BN03	35-BN04
ANNELIDA			
Oligochaeta			
Tubificida			
Naididae			
Dero digitata		-0.155	
Stylaria lacustris		-0.090	
Tubificidae			
Limnodrilus hoffmeisteri	-0.062	-0.021	-0.133
ARTHROPODA			
Crustacea			
Amphipoda			
Gammaridae			
Gammarus tigrinus		-0.021	
Insecta			
Coleoptera			
Elmidae			
Dubiraphia sp.	-0.028		
Diptera			
Ceratopogonidae			
Bezzia/Palpomyia sp.			-0.020
Chironomidae			
Chironomus decorus gr.	-0.044	-0.158	-0.083
Cricotopus bicinctus gr.	-0.047	-0.035	-0.020
Cricotopus ornatus		-0.067	
Dicrotendipes hervosus	-0.028		
Polypedilum illinoense		-0.021	
Polypedilum scalaenum		-0.075	
Tanytarsus sp.		-0.035	-0.034
Thienemannimyia gr		-0.021	
Tribelos jucundum		-0.021	
SPECIES DIVERSITY	**0.208**	**0.718**	**0.290**

MACROINVERTEBRATE BIOTIC INDEX CALCULATION
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Species	35-BN02	35-BN03	35-BN04	BI	35-BN02	35-BN03	35-BN04
ANNELIDA							
Oligochaeta							
Tubificida							
Naididae							
Dero digitata		27		10.0		270	
Stylaria lacustris		8		9.3		74.4	
Tubificidae							
Limnodrilus hoffmeisteri	3	1	18	9.4	28.2	9.4	169.2
ARTHROPODA							
Crustacea							
Amphipoda							
Gammaridae							
Gammarus tigrinus		1		NA		0	
Insecta							
Coleoptera							
Elmidae							
Dubiraphia sp.	1			5.9	5.9		
Diptera							
Ceratopogonidae							
Bezzia/Palpomyia sp. (biting midg			1	7.0			7
Chironomidae							
Chironomus decorus gr. (midges)	58	41	79	9.6	556.8	393.6	758.4
Cricotopus bicinctus gr.	2	2	1	8.5	17	17	8.5
Cricotopus ornatus		5		NA		0	
Dicrotendipes hervosus	1			8.1	8.1		
Polypedilum illinoense		1		9.0		9	
Polypedilum scalaenum		6		8.4		50.4	
Tanytarsus sp.		2	2	6.7		13.4	13.4
Thienemannimyia gr		1		5.8		5.8	
Tribelos jucundum		1		6.3		6.3	
Total Taxa	**5**	**12**	**5**				
Total Specimens	**65**	**96**	**101**		**65**	**90**	**101**
MBI					**9.48**	**9.44**	**9.47**

Table 5. Benthic Macroinvertebrates collected with a Standard Ponar Grab during May 1994 from Site 35, New River Basin, North Carolina.

Station	35-BN02			35-BN03			35-BN04		
Replicate	01	02	03	01	02	03	01	02	03
Taxon									
Mollusca									
Bivalvia									
Veneroida									
Sphaeriidae									
<u>Pisidium</u> <u>casertanum</u>									
Gastropoda									
Basommatophora									
Physidae									
<u>Physella</u> sp.									
Total Taxa	4	2	2	4	9	8	3	4	2
Total Specimens	38	16	11	11	42	43	46	25	30
Replicate Specimens Average		21.7			32.0			33.7	
Standard Deviation		14.2			20.4			20.1	
Brillouin's Diversity (Base 10)		0.176			0.649			0.266	

Table 5. Benthic Macroinvertebrates collected with a Standard Ponar Grab during May 1994 from Site 35, New River Basin, North Carolina.

Station	35-BN02			35-BN03			35-BN04		
Replicate	01	02	03	01	02	03	01	02	03
Taxon									
Nematoda									
Annelida									
Oligochaeta									
Lumbricina									
Lumbricidae									
Tubificida									
Naididae									
Dero digitata					18	9			
Stylaria lacustris					6	2			
Tubificidae									
Limnodrilus hoffmeisteri	1		2	1				9	9
Arthropoda									
Crustacea									
Amphipoda									
Gammaridae									
Gammarus tigrinus					1				
Insecta									
Coleoptera									
Elmidae									
Dubiraphia sp.		1							
Macronychus glabratus									
Diptera									
Ceratopogonidae									
Bezzia/palpomyia sp.							1		
Chironomidae									
Cardiocladius sp.									
Chironomus decorus gr.	34	15	9	8	11	22	44	14	21
Cricotopus bicinctus gr.	2				1	1		1	
Cricotopus ornatus				1	1	3			
Dicrotendipes nervosus	1								
Paratanytarsus recens									
Polypedilum illinoense						1			
Polypedilum scalaenum				1	1	4			
Tanytarsus sp.					2		1	1	
Thienemannimyia gr.						1			
Tribelos jucundum					1				

Table 6. Benthic Macroinvertebrates collected with a Standard Ponar Grab during May 1994 from Site 36 New River Basin, North Carolina.

Taxon	Station: 36-BN01 Replicate 01	02	03	36-BN02 01	02	03	36-BN03 01	02	03
Annelida									
Oligochaeta									
Tubificida									
Naididae									
Dero digitata	1				1				
Tubificidae			1				1		
Polychaeta									
Capitellida									
Capitellidae									
Heteromastus filiformis				1		1			1
Phyllodocida									
Nereidae									
Nereis succinea	3	10	5	36	142	43	14	84	86
Spionida									
Spionidae									
Polydora sp.				6	2				15
Terebellida									
Ampharetidae									
Hypaniola grayi		4	2	20	52	23	6	23	20
Arthropoda									
Crustacea									
Amphipoda									
Gammaridae									
Gammarus tigrinus					4		12	22	3
Decapoda									
Palaemonidae									
Palaemonetes pugio								1	
Portunidae									
Callinectes sp.							1		
Insecta									
Diptera									
Ceratopogonidae									
Palpomyia/sphaeromias sp.	1				1			1	
Chironomidae									
Chironomus decorus gr.	2		2	8	4		34	9	36
Cricotopus ornatus	2	8			2				

Table 6. Benthic Macroinvertebrates collected with a Standard Ponar Grab during May 1994 from Site 36 New River Basin, North Carolina.

Station	36-BN01			36-BN02			36-BN03		
Replicate	01	02	03	01	02	03	01	02	03
Taxon									
Arthropoda									
Insecta									
Diptera									
Chironomidae									
Dicrotendipes modestus			1						
Procladius sp.		1							1
Tanytarsus sp.					1	1			1
Tribelos jucundum							1		
Tabanidae									
Chrysops sp.		1							
Total Taxa	5	5	5	5	9	4	7	6	8
Total Specimens	9	24	11	71	209	68	69	140	163
Replicate Specimens Average	14.7			116			124		
Standard Deviation	9.3			77.0			75.2		
Brillouin's Diversity (Base 10)	0.632			0.424			0.600		

INVERTEBRATE SECTION
LABORATORY IDENTIFICATION BENCH SHEET

Client: BAKER ENVIRONMENTAL
Location: NEW RIVER BASIN
Coll Date: 5/94 Prelim. Sorter: MJL Split Sorter: ______
Subsampled Taxa: ______
ID Time Budget: 2.0

Job Number/Task: 04919-01
Sample ID: 36 BN01 01

Presort ID Time: 0.5 Date-Identifier: 8/12/94 MJM
Split/Midge and worm ID Time: 1.0 Date-Identifier: 8/12/94 MJM
QA/QC Time: ______

QC Check	Taxonomic Order	Taxon	Total Number	=	Presort Number	+	Split/QA/QC Number	Comments
	TUBIFICIDA	Dero digitalis	1					
	PHYLLODOCIDA	Nereis succinea	3					
	DIPTERA	Palpomyia/sphaeromias sp.	1					
	"	Chironomus decorus gr.	2					
	"	Cricotopus ornatus	2					

Notes: ______

Page ____ of ____

INVERTEBRATE SECTION
LABORATORY IDENTIFICATION BENCH SHEET

Client: BAKER ENVIRONMENTAL　　Job Number/Task: 04919-01
Location: NEW RIVER BASIN NC BRINSON CK　　Sample ID: 36 BN01
Coll Date: 5/94　　Prelim. Sorter: MJG　　Split Sorter:
Subsampled Taxa: —
ID Time Budget: 2.0　　Presort ID Time: 0.5　　Date-Identifier: 8/12/94 MJM
Split/Midge and worm ID Time:　　Date-Identifier:
QA/QC Time:

QC Check	Taxonomic Order	Taxon	Total Number	=	Presort Number	+	Split/QA/QC Number	Comments
	PHYLLODOCIDA	Nereis succinea	10					
	TEREBELLIDA	Hypaniola grayi	4					
	DIPTERA	Chrysops sp.	1					✓
ortho	"	Cricotopus ornatus	8					
	"	Procladius sp.	1					

Notes:

Page ___ of ___

8/? 12:30 - 11:0?

INVERTEBRATE SECTION
LABORATORY IDENTIFICATION BENCH SHEET

Client: BAKER ENVIRONMENTAL
Job Number/Task: 04919-01
Location: NEW RIVER BASIN NC-BRINSON CK
Sample ID: 36 BN01 03
Coll Date: 5/94 Prelim. Sorter: MJG Split Sorter: ______
Subsampled Taxa: —
ID Time Budget: 2.0 Presort ID Time: 0.5 Date-Identifier: 8/12/94 MJM
Split/Midge and worm ID Time: 1.0 Date-Identifier: 8/12/94 MJM
QA/QC Time: ______

QC Check	Taxonomic Order	Taxon	Total Number =	Presort Number +	Split/QA/QC Number	Comments
	TUBIFICIDA	→	1			TUBIFICIDAE
	PHYLLODOCIDA	Nereis succinea	5			
	TEREBELLIDA	Hypaniola grayi	2			
	DIPTERA	Chironomus decorus gr.	2			
	"	Dicrotendipes modestus	1			

Notes: ______

Page ___ of ___

INVERTEBRATE SECTION
LABORATORY IDENTIFICATION BENCH SHEET

Client: BAKER ENVIRONMENTAL Job Number/Task: 04919-01
Location: NEW RIVER BASIN NC - BRINSON CK. Sample ID: 36 BN02
Coll Date: 5/94 Prelim. Sorter: MJG Split Sorter:
Subsampled Taxa: —
ID Time Budget: 2.0 Presort ID Time: 0.5 Date-Identifier: 8/12/94 MSM
Split/Midge and worm ID Time: Date-Identifier:
QA/QC Time:

QC Check	Taxonomic Order	Taxon	Total Number	=	Presort Number	+	Split/QA/QC Number	Comments
	CAPITELLIDA	Heteromastus filiformis	1					
	PHYLLODOCIDA	Nereis succinea	36					
	SPIONIDA	Polydora sp.	6					
	TEREBELLIDA	Hypaniola grayi	20					
	DIPTERA	Chironomus decorus gr.	8					

Notes:

Page ___ of ___

INVERTEBRATE SECTION
LABORATORY IDENTIFICATION BENCH SHEET

Client: BAKER ENVIRONMENTAL

Job Number/Task: 04919-01

Location: NEW RIVER BASIN, NC-BRINSON CK,

Sample ID: 36 BN02 02

Coll Date: 5/94 Prelim. Sorter: MJG Split Sorter:

Subsampled Taxa: —

ID Time Budget: 2.0 Presort ID Time: 1.0 Date-Identifier: 8/12/94 MSM

Split/Midge and worm ID Time: Date-Identifier:

QA/QC Time:

QC Check	Taxonomic Order	Taxon	Total Number	=	Presort Number	+	Split/QA/QC Number	Comments
	TUBIFICIDA	Dero digitata	1					
	PHYLLODOCIDA	Nereis succinea	142					
	SPIONIDA	Polydora sp.	2					
	TEREBELLIDA	Hypaniola grayi	52					
	AMPHIPODA	Gammarus tigrinus	4					
	DIPTERA	Palpomyia/Sphaeromias sp.	1					
	"	Chironomus decorus gr.	4					
	"	Tanytarsus sp.	1					
ORTHO	"	Cricotopus ornatus	2					

Notes:

Page ____ of ____

INVERTEBRATE SECTION
LABORATORY IDENTIFICATION BENCH SHEET

Client: BAKER ENVIRONMENTAL Job Number/Task: 04919-01
Location: NEW RIVER BASIN NC - BRINSON CK. Sample ID: 36 BN02
Coll Date: 5/94 Prelim. Sorter: MJL Split Sorter:
Subsampled Taxa: —
ID Time Budget: 2.0 Presort ID Time: 1.0 Date-Identifier: 8/12/94 MJM
Split/Midge and worm ID Time: Date-Identifier:
QA/QC Time:

QC Check	Taxonomic Order	Taxon	Total Number	=	Presort Number	+	Split/QA/QC Number	Comments
	CAPITELLIDA	Heteromastus filiformis	1					
	PHYLLODOCIDA	Nereis succinea	43					
	TEREBELLIDA	Hypaniola grayi	23					
	DIPTERA	Tanytarsus sp.	1					

Notes:

Page ____ of ____

INVERTEBRATE SECTION
LABORATORY IDENTIFICATION BENCH SHEET

Client: BAKER ENVIRONMENTAL
Job Number/Task: 04919-01
Location: NEW RIVER BASIN, NC - BRINSON CK.
Sample ID: 36 BN03 01
Coll Date: 5/94
Prelim. Sorter: MB
Split Sorter:
Subsampled Taxa:
ID Time Budget:
Presort ID Time: 1.0
Date-Identifier: 8/15/94
Split/Midge and worm ID Time:
Date-Identifier:
QA/QC Time:

QC Check	Taxonomic Order	Taxon	Total Number	=	Presort Number	+	Split/QA/QC Number	Comments
① 01	TUBIFICIDA	→	1					TUBIFICIDAE
	PHYLLODOCIDA	Nereis succinea	14					
	TEREBELLIDA	Hypaniola grayi	6					
	AMPHIPODA	Gammarus tigrinus	12					
	DECAPODA	Callinectes sp.	1					
	DIPTERA	Chironomus decorus gr.	34					
	"	Tribelos jucundum	1					

Notes:

Page ____ of ____

INVERTEBRATE SECTION
LABORATORY IDENTIFICATION BENCH SHEET

Client: BAKER ENVIRONMENTAL Job Number/Task: 04919-0
Location: NEW RIVER BASIN, NC - BRINSON Ck Sample ID: 36 BN03 0
Coll Date: 5/94 Prelim. Sorter: MJG Split Sorter:
Subsampled Taxa: —
ID Time Budget: 2.0 Presort ID Time: 1.0 Date-Identifier: 8/5/94 MSM
Split/Midge and worm ID Time: Date-Identifier:
CERAT QA/QC Time:

QC Check	Taxonomic Order	Taxon	Total Number	=	Presort Number	+	Split/QA/QC Number	Comments
	PHYLLODOCIDA	Nereis succinea	84					
	TEREBELLIDA	Hypaniola grayi	23					
	AMPHIPODA	Gammarus tigrinus	22					
	DECAPODA	Palaemonetes pugio	1					
	DIPTERA	Palpomyia/sphaeromias sp.	1					
	"	Chironomus decorus gr.	9					

Notes:

Page ___ of ___

INVERTEBRATE SECTION
LABORATORY IDENTIFICATION BENCH SHEET

Client: BAKER ENVIRONMENTAL
Job Number/Task: 04919-01
Location: NEW RIVER BASIN, NC - BRINSON Ck.
Sample ID: 36 BN03 03
Coll Date: 5/94
Prelim. Sorter: MJG
Split Sorter:
Subsampled Taxa: —
ID Time Budget: 2.0
Presort ID Time: 1.0
Date-Identifier: 8/15/94 MTM
Split/Midge and worm ID Time:
Date-Identifier:
QA/QC Time:

QC Check	Taxonomic Order	Taxon	Total Number	=	Presort Number	+	Split/QA/QC Number	Comments
	CAPITELLIDA	Heteromastus filiformis	1					
	PHYLLODOCIDA	Nereis succinea	86					
	SPIONIDA	Polydora sp.	15					
	TEREBELLIDA	Hypaniola grayi	20					
	AMPHIPODA	Gammarus tigrinus	3					
	DIPTERA	Chironomus decorus gr.	36					
	"	Tanytarsus sp.	7					
	"	Procladius sp.	1					

Notes:

Page ____ of ____

INVERTEBRATE SECTION
LABORATORY IDENTIFICATION BENCH SHEET

Client: BAKER ENVIRONMENTAL
Job Number/Task: 04919-01
Location: NEW RIVER NC. - BRINSON CK.
Sample ID: 35 BN02 07
Coll Date: 5/94
Prelim. Sorter: MJG
Split Sorter:
Subsampled Taxa: —
ID Time Budget: 2.0
Presort ID Time: 0.5
Date-Identifier: 6/28/94 MJM
Split/Midge and worm ID Time:
Date-Identifier:
QA/QC Time:

QC Check	Taxonomic Order	Taxon	Total Number	=	Presort Number	+	Split/QA/QC Number	Comments
	TUBIFICIDA	Limnodrilus hoffmeisteri	1					
	DIPTERA	Chironomus decorus gr.	34					
	"	Dicrotendipes nervosus	1					
	"	Cricotopus bicinctus gr.	2					

Notes:

Page ___ of ___

INVERTEBRATE SECTION
LABORATORY IDENTIFICATION BENCH SHEET

Client: BAKER ENVIRONMENTAL Job Number/Task: 04919-01
Location: NEW RIVER, NC - BRINSON CK. Sample ID: 35 BN02 02
Coll Date: 5/94 Prelim. Sorter: MSG Split Sorter:
Subsampled Taxa: —
ID Time Budget: 2.0 Presort ID Time: 0.5 Date-Identifier: 6/28/94 MON
Split/Midge and worm ID Time: Date-Identifier:
QA/QC Time:

QC Check	Taxonomic Order	Taxon	Total Number	=	Presort Number	+	Split/QA/QC Number	Comments
	COLEOPTERA	Dubiraphia sp.	1					
	DIPTERA	Chironomus decorus gr.	15					

Notes:

Page ____ of ____

INVERTEBRATE SECTION
LABORATORY IDENTIFICATION BENCH SHEET

Client: BAKER ENVIRONMENTAL Job Number/Task: 04919-01
Location: NEW RIVER, NC - BRINSON CR. Sample ID: 35 BN02
Coll Date: 5/94 Prelim. Sorter: MJG Split Sorter:
Subsampled Taxa:
ID Time Budget: 2.0 Presort ID Time: 0.25 Date-Identifier: 6/28/94
Split/Midge and worm ID Time: Date-Identifier:
QA/QC Time:

QC Check	Taxonomic Order	Taxon	Total Number	=	Presort Number	+	Split/QA/QC Number	Comments
	TUBIFICIDA	Limnodrilus hoffmeisteri	2					
	DIPTER	Chironomus decorus gr.	9					

Notes:

Page ___ of ___

INVERTEBRATE SECTION
LABORATORY IDENTIFICATION BENCH SHEET

Client: BAKER ENVIRONMENTAL

Job Number/Task: 04919-01

Location: NEW RIVER, NC -- BRINSON CK.

Sample ID: 35 BN03 01

Coll Date: 4/94 Prelim. Sorter: MJB Split Sorter: ______

Subsampled Taxa: ______

ID Time Budget: 2.0 Presort ID Time: 0.25 Date-Identifier: 6/28/94 MJM

Split/Midge and worm ID Time: ______ Date-Identifier: ______

QA/QC Time: ______

QC Check	Taxonomic Order	Taxon	Total Number	=	Presort Number	+	Split/QA/QC Number	Comments
	TUBIFICIDA	Limnodrilus hoffmeisteri	1					
	DIPTERA	Chironomus decorus gr.	8					
	"	Polypedilum scalaenum	1					
	"	Cricotopus ornatus	1					✓

Notes: ______

Page ____ of ____

INVERTEBRATE SECTION
LABORATORY IDENTIFICATION BENCH SHEET

Client: BAKER ENVIRONMENTAL Job Number/Task: 04919-01
Location: NEW RIVER, NC - BRINSON CK. Sample ID: 35 BN03
Coll Date: 4/94 Prelim. Sorter: ______ Split Sorter: ______
Subsampled Taxa: ______
ID Time Budget: 2.0 Presort ID Time: 0.25 Date-Identifier: 6/20/94 NOM
Split/Midge and worm ID Time: 3.0 Date-Identifier: 8/9/94 NOM
QA/QC Time: ______

QC Check	Taxonomic Order	Taxon	Total Number	=	Presort Number	+	Split/QA/QC Number	Comments
	TUBIFICIDA	Dero digitata	18					✓NAIDIDAE
	"	Stylaria lacustris	6					✓ "
	AMPHIPODA	Gammarus tigrinus	1					
	DIPTERA	Chironomus decorus gr.	11					
	"	Polypedilum scalaenum	1					
	"	Cricotopus bicinctus	1					
	"	Cricotopus ornatus	1					
	"	Tanytarsus sp.	2					
	"	Tribelos jucundum	1					

Notes: ______ Page ____ of ____

INVERTEBRATE SECTION
LABORATORY IDENTIFICATION BENCH SHEET

Client: BAKER ENVIRONMENTAL
Job Number/Task: 04909-01
Location: NEW RIVER, NC - BRINSON CK
Sample ID: 35 BN03 03
Coll Date: 4/94
Prelim. Sorter: MJC
Split Sorter:
Subsampled Taxa: —
ID Time Budget: 2.0
Presort ID Time: 0.25
Date-Identifier: 6/28/94 mjm
Split/Midge and worm ID Time: 1.50
Date-Identifier: 8/9/94 mjm
QA/QC Time:

QC Check	Taxonomic Order	Taxon	Total Number	=	Presort Number	+	Split/QA/QC Number	Comments
	TUBIFICIDA	Dero digitata	9					
	"	Stylaria lacustris	2					
	DIPTERA	Chironomus decorus gr	22					
	"	Polypedilum scalaenum	4					
	"	Cricotopus bicinctus gr.	1					
	"	Cricotopus ornatus	3					
	"	Polypedilum illinoense	1					
	"	Thienemanniayia gr.	1					

Notes:
6/... 7:45 - 3:00 CHIRON 7... 10:30 - 11:00 81 2:00 - 4:00

Page ___ of ___

INVERTEBRATE SECTION
LABORATORY IDENTIFICATION BENCH SHEET

Client: BAKER ENVIRONMENTAL Job Number/Task: 04919-01
Location: NEW RIVER ESTUARY, NC - BRINSON CK. Sample ID: 35 BN04
Coll Date: 5/94 Prelim. Sorter: MOF Split Sorter:
Subsampled Taxa: —
ID Time Budget: 2.0 Presort ID Time: 0.5 Date-Identifier: 8/11/94 MJM
Split/Midge and worm ID Time: Date-Identifier:
QA/QC Time:

QC Check	Taxonomic Order	Taxon	Total Number	=	Presort Number	+	Split/QA/QC Number	Comments
	DIPTERA	Chironomus decorus gr.	44					
	"	Tanytarsus sp.	1					
	"	Bezzia/palpomyia sp.	1					

Notes:

Page ____ of ____

INVERTEBRATE SECTION
LABORATORY IDENTIFICATION BENCH SHEET

Client: BAKER ENVIRONMENTAL
Job Number/Task: 04919-01
Location: NEW RIVER EST, NC BRINSON CK
Sample ID: 35 BN04 02
Coll Date: 5/94
Prelim. Sorter: MJL
Split Sorter:
Subsampled Taxa: –
ID Time Budget: 2.0
Presort ID Time: 0.5
Date-Identifier: 8/11/94 NWM
Split/Midge and worm ID Time: 1.0
Date-Identifier: 8/12/94 NWM
QA/QC Time:

QC Check	Taxonomic Order	Taxon	Total Number	=	Presort Number	+	Split/QA/QC Number	Comments
	TUBIFICIDA	Limnodrilus hoffmeisteri	9					
	DIPTERA	Chironomus decorus gr.	14					
	"	Tanytarsus sp.	1					
	"	Cricotopus bicinctus gr.	1					

Notes:

Page ____ of ____

INVERTEBRATE SECTION
LABORATORY IDENTIFICATION BENCH SHEET

Client: BAKER ENVIRONMENTAL **Job Number/Task:** 04919-01
Location: NEW RIVER BASIN, NC - BRINSON CK **Sample ID:** 35 BN04 0
Coll Date: 5/94 **Prelim. Sorter:** MJG **Split Sorter:**
Subsampled Taxa: –
ID Time Budget: 2.0 **Presort ID Time:** 0.5 **Date-Identifier:** 8/11/94 WJM
Split/Midge and worm ID Time: **Date-Identifier:**
QA/QC Time:

QC Check	Taxonomic Order	Taxon	Total Number	=	Presort Number	+	Split/QA/QC Number	Comments
	TUBIFICIDA	Limnodrilus hoffmeisteri	9					
	DIPTERA	Chironomus decorus gr	21					

Notes:
81 3:00 - 3:30

Page ____ of ____

APPENDIX AA
TERRESTRIAL REFERENCE VALUES AND CDI CALCULATIONS

EQUATIONS U... TO CALCULATE EXPOSURE FOR THE RACCOON
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Food Source ingestion of: lv=vegetation lf=fish lm=mammals lw=worms lfr=fruit	Feeding Rate (I in kg/d)	Incidental Soil Ingestion (Is in kg/d)	Rate of Drinking Water Ingestion (Iw in l/d)	Rate of Worm Ingestion (Iwo in kg/d)	Rate of Fruit Ingestion (Ifr in kg/d)	Rate of Fish Ingestion (If in kg/d)	Rate of Vegetation Ingestion (Iv in kg/d)	Body Weight (BW) (kg)	Home Range Size (acres)	Contaminate Area (acres)	H Ratio	Equation Used to Calculate Total Exposure E=total exposure Cw=constituent conc. in water Cs=constituent conc. in soil Cwo=constituent conc. in worms Cfr=constituent conc. in fruit H=ratio of home range area to site area
Vegetation lv=40% Fish lf=60%	0.214	0.0201	0.4224	NA	0.086	0.129	NA	5.120	256.984	26.3	0.102	$E = \frac{(Cw)(Iw) + (Cf)(If) + [(Cs)(Bv)(Iv) + (Cs)(Is)]\,[H]}{BW}$

Contaminant of Concern	Soil to Plant Transfer Coefficient (fruit) (Br)	Constituent Concentration in Water (mg/l) (Cw)	Constituent Concentration in Soil (mg/kg) (Cs)	Constituent Concentration in Worms (mg/kg) (Cwo)	Fish Bioconcentration Factor (BCF)	Constituent Concentration in Fishes (mg/kg) (Cf) (Whole-body fish tissue concentration)	Total Exposure (mg/kg/d)	TRV	RATIO
Acetone	53.299	ND	8.22E-03	NA	0.690	24.684	6.21E-01	4.09E+00	1.52E-01
1,2-Dichloroethene (total)	2.704	5.87E-03	ND	NA	5.600	ND	4.84E-04	2.04E+00	2.37E-04
Toluene	1.065	ND	9.50E-03	NA	10.700	0.02768	7.16E-04	9.12E+00	7.85E-05
Benzo(b)fluoranthene	0.006	ND	2.46E-01	NA	30.000	ND	1.01E-04	1.80E-01	5.62E-04
Bis(2-ethylhexyl)phthalate	0.044	ND	2.53E-01	NA	130.000	ND	1.21E-04	1.01E-01	1.20E-03
Butylbenzylphthalate	0.057	ND	2.20E-01	NA	414.000	ND	1.10E-04	6.50E+00	1.70E-05
Fluoranthene	0.044	ND	2.69E-01	NA	1150.000	ND	1.29E-04	2.25E+00	5.70E-05
Indeno(1,2,3-cd)pyrene	0.007	ND	2.57E-01	NA	30.000	ND	1.06E-04	1.80E-01	5.91E-04
Phenanthrene	0.097	ND	2.52E-01	NA	30.000	ND	1.43E-04	1.68E+01	8.55E-06
Pyrene	0.033	ND	2.89E-01	NA	30.000	ND	1.33E-04	1.35E+00	9.83E-05
Aldrin	0.714	ND	4.44E-03	NA	4670.000	0.00	7.25E-05	1.02E-02	7.09E-03
beta-BHC	0.246	ND	ND	NA	130.000	0.01	1.98E-04	2.04E+00	9.68E-05
gamma-BHC	0.246	ND	1.90E-03	NA	130.000	0.01	2.02E-04	2.04E+00	9.90E-05
Alpha-chlordane	0.026	ND	1.40E-02	NA	14100.000	0.06	1.51E-03	2.25E-02	6.73E-02
Gamma-chlordane	0.026	ND	6.45E-03	NA	14100.000	0.01	3.75E-04	2.25E-02	1.67E-02
4,4'-DDD	0.013	ND	5.28E-02	NA	53600.000	0.18	4.60E-03	3.27E-01	1.41E-02
4,4'-DDE	0.020	ND	4.40E-01	NA	53600.000	0.40806	1.04E-02	3.27E-01	3.19E-02
4,4'-DDT	0.008	ND	2.41E-01	NA	53600.000	0.03	7.40E-04	3.27E-01	2.26E-03
Dieldrin	0.032	ND	4.87E-02	NA	4670.000	0.05	1.26E-03	2.04E-03	6.17E-01
Endosulfan I	0.322	ND	4.13E-03	NA	270.000	ND	3.94E-06	2.45E-01	1.60E-05
Endosulfan II	0.322	ND	ND	NA	270	0.00	8.54E-05	2.45E-01	3.48E-04
Endrin	0.055	ND	3.85E-03	NA	3970.000	0.02	5.99E-04	1.02E-01	5.86E-03
Endrin aldehyde	0.055	ND	3.89E-03	NA	3970.000	0.0065	1.65E-04	1.02E-01	1.62E-03
Endrin ketone	0.055	ND	3.98E-03	NA	ND	0.014	3.54E-04	1.02E-01	3.46E-03
Heptachlor	0.127	ND	1.85E-03	NA	11200.000	0.0078	1.97E-04	6.13E-02	3.21E-03
Heptachlor epoxide	0.127	ND	3.67E-03	NA	11200.000	ND	2.27E-06	1.56E-04	1.46E-02
Aroclor-1248	0.022	ND	2.91E-01	NA	31200.000	ND	1.29E-04	2.34E-02	5.48E-03
Aroclor-1254	0.022	ND	5.06E-02	NA	31200.000	ND	2.23E-05	6.21E-01	3.59E-05
Aluminum	0.001	2.22E-03	5.81E+03	NA	231.000	45.61	3.49E+00	3.48E-01	1.00E+01
Antimony	0.030	3.90E-03	3.38E+00	NA	1.000	ND	1.86E-03	1.43E-02	1.30E-01
Arsenic	0.006	ND	2.40E+00	NA	44.000	ND	9.90E-04	2.27E-02	4.36E-02
Barium	0.015	3.24E-02	3.17E+01	NA	8.000	3	9.16E-02	1.02E-01	8.95E-01
Cadmium	0.150	ND	7.13E-01	NA	64.000	0.38	1.00E-02	1.64E-03	6.12E+00
Chromium	0.005	ND	1.13E+01	NA	16	2.88	7.69E-02	9.86E-01	7.80E-02
Cobalt	0.007	ND	8.15E-01	NA	40.000	ND	3.38E-04	3.61E-01	9.38E-04
Copper	0.250	5.65E-02	9.82E+01	NA	36.000	6.67	2.54E-01	7.49E+00	3.39E-02
Iron	0.001	3.99E+00	1.13E+04	NA	ND	197.79	9.86E+00	1.80E+01	5.47E-01
Lead	0.009	ND	1.11E+02	NA	49	1.41	8.16E-02	3.27E+00	2.49E-02
Manganese	0.050	1.26E-01	1.02E+02	NA	35.000	8.65	2.77E-01	3.60E+00	7.70E-02
Mercury	0.200	ND	3.70E-01	NA	5500.000	0.68	1.74E-02	1.31E-01	1.33E-01
Molybdenum	0.060	6.50E-02	ND	NA	ND	ND	5.36E-03	8.18E-03	6.55E-01
Nickel	0.060	3.14E-02	4.19E+00	NA	47.000	ND	4.71E-03	2.05E+00	2.30E-03
Selenium	0.025	ND	2.61E-01	NA	6	1	2.52E-02	1.64E-02	1.54E+00
Silver	0.100	ND	7.86E-01	NA	0.500	1.93	4.89E-02	3.26E-02	1.50E+00
Thallium	0.000	7.60E-04	ND	NA	119.000	ND	6.27E-05	9.40E-03	6.67E-03
Vanadium	0.003	3.87E-01	1.60E+01	NA	ND	ND	3.85E-02	2.66E-01	1.45E-01
Zinc	0.900	ND	3.46E+02	NA	47.000	78.21	2.64E+00	6.54E+01	4.03E-02
								SUM	2.29E+01

ND - Not Detected
NA - Not Applicable

EQUATIONS USED TO CALCULATE EXPOSURE FOR THE WHITETAILED DEER
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Food Source ingestion of: lv=vegetation lf=fish lm=mammals lw=worms lfr=fruit	Feeding Rate (I in kg/d)	Incidental Soil Ingestion (Is in kg/d)	Rate of Drinking Water Ingestion (Iw in l/d)	Rate of Worm Ingestion (Iwo in kg/d)	Rate of Fruit Ingestion (Ifr in kg/d)	Rate of Mammal Ingestion (Im in kg/d)	Rate of Vegetation Ingestion (Iv in kg/d)	Body Weight (BW) (kg)	Home Range Size (acres)	Contaminate Area (acres)	H Ratio	Equation Used to Calculate Total Exposure E=total exposure Cw=constituent conc. in water Cs=constituent conc. in soil Cwo=constituent conc. in worms Cfr=constituent conc. in fruit H=ratio of home range area to site area
Vegetation(Iv) 100 percent	1.600	1.85E-02	1.10E+00	NA	NA	NA	1.600	45.400	454.000	26.3	0.058	$E=\frac{(Cw)(Iw) + [(Cs)(Bv)(Iv) + (Cs)(Is)] [H]}{BW}$

Contaminant of Concern	Soil to Plant Transfer Coefficient (Bv)	Constituent Concentration in Water (mg/l) (Cw)	Constituent Concentration in Soil (mg/kg) (Cs)	Constituent Concentration in Worms (mg/kg) (Cwo)	Constituent Concentration in Fruit (mg/kg) (Cfr)	Constituent Concentration in Mammals (mg/kg) (Cm)	Total Exposure (mg/kg/d)	TRV	RATIO
Acetone	53.299	ND	8.22E-03	NA	NA	NA	8.95E-04	1.98E+00	4.53E-04
1,2-Dichloroethene (total)	2.704	5.87E-03	ND	NA	NA	NA	1.42E-04	9.88E-01	1.44E-04
Toluene	1.065	ND	9.50E-03	NA	NA	NA	2.09E-05	4.41E+00	4.74E-06
Benzo(b)fluoranthene	0.006	ND	2.46E-01	NA	NA	NA	8.77E-06	8.71E-02	1.01E-04
Bis(2-ethylhexyl)phthalate	0.044	ND	2.53E-01	NA	NA	NA	2.86E-05	4.89E-02	5.85E-04
Butylbenzylphthalate	0.057	ND	2.20E-01	NA	NA	NA	3.08E-05	3.14E+00	9.82E-06
Fluoranthene	0.044	ND	2.69E-01	NA	NA	NA	3.06E-05	1.09E+00	2.81E-05
Indeno(1,2,3-cd)pyrene	0.007	ND	2.57E-01	NA	NA	NA	9.58E-06	8.71E-02	1.10E-04
Phenanthrene	0.097	ND	2.52E-01	NA	NA	NA	5.58E-05	8.10E+00	6.89E-06
Pyrene	0.033	ND	2.89E-01	NA	NA	NA	2.66E-05	6.53E-01	4.07E-05
Aldrin	0.714	ND	4.44E-03	NA	NA	NA	6.58E-06	6.51E-01	1.01E-05
beta-BHC	0.246	ND	ND	NA	NA	NA	0.00E+00	9.88E-01	0.00E+00
gamma-BHC	0.246	ND	1.90E-03	NA	NA	NA	1.00E-06	9.88E-01	1.01E-06
Alpha-chlordane	0.026	ND	1.40E-02	NA	NA	NA	1.07E-06	1.30E+00	8.20E-07
Gamma-chlordane	0.026	ND	6.45E-03	NA	NA	NA	4.90E-07	1.30E+00	3.77E-07
4,4'-DDD	0.013	ND	5.26E-02	NA	NA	NA	2.66E-06	1.58E-01	1.68E-05
4,4'-DDE	0.020	ND	4.40E-01	NA	NA	NA	2.81E-05	1.58E-01	1.78E-04
4,4'-DDT	0.008	ND	2.41E-01	NA	NA	NA	9.48E-06	1.58E-01	6.00E-05
Dieldrin	0.032	ND	4.87E-02	NA	NA	NA	4.31E-06	6.51E-01	6.62E-06
Endosulfan I	0.322	ND	4.13E-03	NA	NA	NA	2.81E-06	1.19E-01	2.37E-05
Endosulfan II	0.322	ND	ND	NA	NA	NA	0.00E+00	1.19E-01	0.00E+00
Endrin	0.055	ND	3.85E-03	NA	NA	NA	5.27E-07	4.94E-02	1.07E-05
Endrin aldehyde	0.055	ND	3.89E-03	NA	NA	NA	5.33E-07	4.94E-02	1.08E-05
Endrin ketone	0.055	ND	3.98E-03	NA	NA	NA	5.45E-07	4.94E-02	1.10E-05
Heptachlor	0.127	ND	1.85E-03	NA	NA	NA	5.22E-07	2.96E-02	1.76E-05
Heptachlor epoxide	0.127	ND	3.67E-03	NA	NA	NA	1.04E-06	7.55E-05	1.37E-02
Aroclor-1248	0.022	ND	2.91E-01	NA	NA	NA	2.02E-05	1.13E-02	1.79E-03
Aroclor-1254	0.022	ND	5.06E-02	NA	NA	NA	3.51E-06	2.80E-02	1.25E-04
Aluminum	0.004	2.22E-03	5.81E+03	NA	NA	NA	1.85E-01	6.51E+00	2.84E-02
Antimony	0.200	3.90E-03	3.38E+00	NA	NA	NA	1.55E-03	6.91E-03	2.25E-01
Arsenic	0.040	ND	2.40E+00	NA	NA	NA	2.53E-04	3.25E-01	7.76E-04
Barium	0.150	3.24E-02	3.17E+01	NA	NA	NA	1.12E-02	1.30E-01	8.63E-02
Cadmium	0.550	ND	7.13E-01	NA	NA	NA	8.17E-04	3.25E-03	2.51E-01
Chromium	0.008	ND	1.13E+01	NA	NA	NA	4.40E-04	6.51E+00	6.76E-05
Cobalt	0.020	ND	8.15E-01	NA	NA	NA	5.25E-05	6.51E-02	8.06E-04
Copper	0.400	5.65E-02	9.82E+01	NA	NA	NA	8.39E-02	6.51E-01	1.29E-01
Iron	0.004	3.99E+00	1.13E+04	NA	NA	NA	4.56E-01	6.51E+00	7.00E-02
Lead	0.045	ND	1.11E+02	NA	NA	NA	1.28E-02	1.95E-01	6.54E-02
Manganese	0.250	1.26E-01	1.02E+02	NA	NA	NA	5.73E-02	1.30E+00	4.41E-02
Mercury	0.900	ND	3.70E-01	NA	NA	NA	6.88E-04	1.30E-02	5.29E-02
Molybdenum	0.250	6.50E-02	ND	NA	NA	NA	1.57E-03	3.95E-03	3.99E-01
Nickel	0.060	3.14E-02	4.19E+00	NA	NA	NA	1.37E-03	3.25E-01	4.22E-03
Selenium	0.025	ND	2.61E-01	NA	NA	NA	1.95E-05	1.30E-02	1.50E-03
Silver	0.400	ND	7.86E-01	NA	NA	NA	6.61E-04	1.58E-02	4.19E-02
Thallium	0.004	7.60E-04	ND	NA	NA	NA	1.84E-05	4.54E-03	4.05E-03
Vanadium	0.006	3.87E-01	1.60E+01	NA	NA	NA	9.93E-03	3.25E-01	3.05E-02
Zinc	1.500	ND	3.46E+02	NA	NA	NA	1.07E+00	3.25E+00	3.28E-01
								SUM	1.78E+00

ND - Not Dete
NA - Not Applic

EQUATIONS USE... CALCULATE EXPOSURE FOR THE EASTERN COTTONTAIL RABBIT
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Food Source ingestion of: lv=vegetation lf=fish lm=mammals lw=worms lfr=fruit	Feeding Rate (l in kg/d)	Incidental Soil Ingestion (ls in kg/d)	Rate of Drinking Water Ingestion (lw in l/d)	Rate of Worm Ingestion (lwo in kg/d)	Rate of Fruit Ingestion (lfr in kg/d)	Rate of Mammal Ingestion (lm in kg/d)	Rate of Vegetation Ingestion (lv in kg/d)	Body Weight (BW) (kg)	Home Range Size (acres)	Contaminated Area (acres)	H Ratio	Equation Used to Calculate Total Exposure E=total exposure Cw=constituent conc. in water Cs=constituent conc. in soil Cwo=constituent conc. in worms Cfr=constituent conc. in fruit H=ratio of home range area to site area
Vegetation (lv) 100 percent	0.237	5.69E-03	1.19E-01	NA	NA	NA	0.237	1.229	9.297	26.3	1.000	$E = \frac{(Cw)(lw) + [(Cs)(Bv)(lv) + (Cs)(ls)]\,[H]}{BW}$

Contaminant of Concern	Soil to Plant Transfer Coefficient (Bv)	Constituent Concentration in Water (mg/l) (Cw)	Constituent Concentration in Soil (mg/kg) (Cs)	Constituent Concentration in Worms (mg/kg) (Cwo)	Constituent Concentration in Fruit (mg/kg) (Cfr)	Constituent Concentration in Mammals (mg/kg) (Cm)	Total Exposure (mg/kg/d)	TRV	RATIO
Acetone	53.299	ND	8.22E-03	NA	NA	NA	8.46E-02	6.58E+00	1.29E-02
1,2-Dichloroethene (total)	2.704	5.87E-03	ND	NA	NA	NA	5.69E-04	3.29E+00	1.73E-04
Toluene	1.065	ND	9.50E-03	NA	NA	NA	2.00E-03	1.47E+01	1.36E-04
Benzo(b)fluoranthene	0.006	ND	2.46E-01	NA	NA	NA	1.42E-03	2.90E-01	4.89E-03
Bis(2-ethylhexyl)phthalate	0.044	ND	2.53E-01	NA	NA	NA	3.31E-03	1.63E-01	2.03E-02
Butylbenzylphthalate	0.057	ND	2.20E-01	NA	NA	NA	3.44E-03	1.05E+01	3.29E-04
Fluoranthene	0.044	ND	2.69E-01	NA	NA	NA	3.54E-03	3.63E+00	9.75E-04
Indeno(1,2,3-cd)pyrene	0.007	ND	2.57E-01	NA	NA	NA	1.52E-03	2.90E-01	5.25E-03
Phenanthrene	0.097	ND	2.52E-01	NA	NA	NA	5.88E-03	2.70E+01	2.18E-04
Pyrene	0.033	ND	2.89E-01	NA	NA	NA	3.20E-03	2.18E+00	1.47E-03
Aldrin	0.714	ND	4.44E-03	NA	NA	NA	6.33E-04	1.65E-02	3.85E-02
beta-BHC	0.246	ND	ND	NA	NA	NA	0.00E+00	3.29E+00	0.00E+00
gamma-BHC	0.246	ND	1.90E-03	NA	NA	NA	9.91E-05	3.29E+00	3.01E-05
Alpha-chlordane	0.026	ND	1.40E-02	NA	NA	NA	1.34E-04	3.62E-02	3.72E-03
Gamma-chlordane	0.026	ND	6.45E-03	NA	NA	NA	6.18E-05	3.62E-02	1.71E-03
4,4'-DDD	0.013	ND	5.26E-02	NA	NA	NA	3.78E-04	5.26E-01	7.17E-04
4,4'-DDE	0.020	ND	4.40E-01	NA	NA	NA	3.71E-03	5.26E-01	7.04E-03
4,4'-DDT	0.008	ND	2.41E-01	NA	NA	NA	1.47E-03	5.26E-01	2.80E-03
Dieldrin	0.032	ND	4.87E-02	NA	NA	NA	5.24E-04	3.29E-03	1.59E-01
Endosulfan I	0.322	ND	4.13E-03	NA	NA	NA	2.75E-04	3.95E-01	6.97E-04
Endosulfan II	0.322	ND	ND	NA	NA	NA	0.00E+00	3.95E-01	0.00E+00
Endrin	0.055	ND	3.85E-03	NA	NA	NA	5.90E-05	1.65E-01	3.59E-04
Endrin aldehyde	0.055	ND	3.89E-03	NA	NA	NA	5.97E-05	1.65E-01	3.63E-04
Endrin ketone	0.055	ND	3.98E-03	NA	NA	NA	6.10E-05	1.65E-01	3.71E-04
Heptachlor	0.127	ND	1.85E-03	NA	NA	NA	5.38E-05	9.87E-02	5.45E-04
Heptachlor epoxide	0.127	ND	3.67E-03	NA	NA	NA	1.07E-04	2.51E-04	4.24E-01
Aroclor-1248	0.022	ND	2.91E-01	NA	NA	NA	2.61E-03	2.80E-01	9.33E-03
Aroclor-1254	0.022	ND	5.06E-02	NA	NA	NA	4.53E-04	1.00E+00	4.53E-04
Aluminum	0.004	2.22E-03	5.81E+03	NA	NA	NA	3.14E+01	1.16E+01	2.70E+00
Antimony	0.200	3.90E-03	3.38E+00	NA	NA	NA	1.46E-01	4.06E+00	3.61E-02
Arsenic	0.040	ND	2.40E+00	NA	NA	NA	2.96E-02	2.90E+00	1.02E-02
Barium	0.150	3.24E-02	3.17E+01	NA	NA	NA	1.07E+00	1.16E+00	9.19E-01
Cadmium	0.550	ND	7.13E-01	NA	NA	NA	7.90E-02	2.90E-02	2.72E+00
Chromium	0.008	ND	1.13E+01	NA	NA	NA	6.86E-02	5.80E+01	1.18E-03
Cobalt	0.020	ND	8.15E-01	NA	NA	NA	6.92E-03	5.80E-01	1.19E-02
Copper	0.400	5.65E-02	9.82E+01	NA	NA	NA	8.04E+00	1.16E+01	6.92E-01
Iron	0.004	3.99E+00	1.13E+04	NA	NA	NA	6.14E+01	2.90E+01	2.12E+00
Lead	0.045	ND	1.11E+02	NA	NA	NA	1.47E+00	1.74E+00	8.46E-01
Manganese	0.250	1.26E-01	1.02E+02	NA	NA	NA	5.38E+00	2.32E+01	2.32E-01
Mercury	0.900	ND	3.70E-01	NA	NA	NA	6.59E-02	1.20E-01	5.49E-01
Molybdenum	0.250	6.50E-02	ND	NA	NA	NA	6.31E-03	1.32E-02	4.79E-01
Nickel	0.060	3.14E-02	4.19E+00	NA	NA	NA	7.10E-02	2.90E+00	2.45E-02
Selenium	0.025	ND	2.61E-01	NA	NA	NA	2.47E-03	1.20E-01	2.06E-02
Silver	0.400	ND	7.86E-01	NA	NA	NA	6.43E-02	5.25E-02	1.22E+00
Thallium	0.004	7.60E-04	ND	NA	NA	NA	7.37E-05	1.51E-02	4.87E-03
Vanadium	0.006	3.87E-01	1.60E+01	NA	NA	NA	1.29E-01	5.80E-02	2.22E+00
Zinc	1.500	ND	3.46E+02	NA	NA	NA	1.02E+02	2.90E+01	3.51E+00
								SUM	1.90E+01

ND - Not Detected
NA - Not Applicable

EQUATIONS USED TO CALCULATE EXPOSURE FOR THE BOBWHITE QUAIL
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Food Source ingestion of: lv=vegetation lf=fish lm=mammals lw=worms lfr=fruit	Feeding Rate (I in kg/d)	Incidental Soil Ingestion (Is in kg/d)	Rate of Drinking Water Ingestion (Iw in l/d)	Rate of Worm Ingestion (Iwo in kg/d)	Rate of Fruit Ingestion (Ifr in kg/d)	Rate of Mammal Ingestion (Im in kg/d)	Rate of Vegetation Ingestion (Iv in kg/d)	Body Weight (BW) (kg)	Home Range Size (acres)	Contaminated Area (acres)	H Ratio	Equation Used to Calculate Total Exposure E=total exposure Cw=constituent conc. in water Cs=constituent conc. in soil Cwo=constituent conc. in worms Cfr=constituent conc. in fruit H=ratio of home range area to site area
Vegetation (Iv) 100%	0.013	1.11E-03	1.91E-02	NA	NA	NA	0.013	0.174	26.242	26.3	1.000	$E=\frac{(Cw)(Iw)+[(Cs)(Bv)(Iv)+(Cs)(Is)][H]}{BW}$

Contaminant of Concern	Soil to Plant Transfer Coefficient (Bv)	Constituent Concentration in Water (mg/l) (Cw)	Constituent Concentration in Soil (mg/kg) (Cs)	Constituent Concentration in Worms (mg/kg) (Cwo)	Constituent Concentration in Fruit (mg/kg) (Cfr)	Constituent Concentration in Mammals (mg/kg) (Cm)	Total Exposure (mg/kg/d)	TRV	RATIO
Acetone	53.299	ND	8.22E-03	NA	NA	NA	0.034	2.72E+01	1.25E-03
1,2-Dichloroethene (total)	2.704	5.87E-03	ND	NA	NA	NA	0.001	1.36E+01	4.74E-05
Toluene	1.065	ND	9.50E-03	NA	NA	NA	0.001	6.06E+01	1.40E-05
Benzo(b)fluoranthene	0.006	ND	2.46E-01	NA	NA	NA	0.002	1.20E+00	1.40E-03
Bis(2-ethylhexyl)phthalate	0.044	ND	2.53E-01	NA	NA	NA	0.002	2.30E+00	1.08E-03
Butylbenzylphthalate	0.057	ND	2.20E-01	NA	NA	NA	0.002	4.32E+01	5.51E-05
Fluoranthene	0.044	ND	2.69E-01	NA	NA	NA	0.003	1.50E+01	1.76E-04
Indeno(1,2,3-cd)pyrene	0.007	ND	2.57E-01	NA	NA	NA	0.002	1.20E+00	1.48E-03
Phenanthrene	0.097	ND	2.52E-01	NA	NA	NA	0.004	1.12E+02	3.14E-05
Pyrene	0.033	ND	2.89E-01	NA	NA	NA	0.003	8.99E+00	2.89E-04
Aldrin	0.714	ND	4.44E-03	NA	NA	NA	0.000	6.80E-02	4.04E-03
beta-BHC	0.246	ND	ND	NA	NA	NA	0.000	1.36E+01	0.00E+00
gamma-BHC	0.246	ND	1.90E-03	NA	NA	NA	0.000	1.36E+01	3.57E-06
Alpha-chlordane	0.026	ND	1.40E-02	NA	NA	NA	0.000	3.30E+00	3.56E-05
Gamma-chlordane	0.026	ND	6.45E-03	NA	NA	NA	0.000	3.30E+00	1.63E-05
4,4'-DDD	0.013	ND	5.26E-02	NA	NA	NA	0.000	8.80E-02	4.43E-03
4,4'-DDE	0.020	ND	4.40E-01	NA	NA	NA	0.003	8.80E-02	3.95E-02
4,4'-DDT	0.008	ND	2.41E-01	NA	NA	NA	0.002	8.80E-02	1.91E-02
Dieldrin	0.032	ND	4.87E-02	NA	NA	NA	0.000	1.16E-01	3.72E-03
Endosulfan I	0.322	ND	4.13E-03	NA	NA	NA	0.000	2.84E+01	4.56E-06
Endosulfan II	0.322	ND	ND	NA	NA	NA	0.000	2.84E+01	0.00E+00
Endrin	0.055	ND	3.85E-03	NA	NA	NA	0.000	1.16E+00	3.56E-05
Endrin aldehyde	0.055	ND	3.89E-03	NA	NA	NA	0.000	1.16E+00	3.60E-05
Endrin ketone	0.055	ND	3.98E-03	NA	NA	NA	0.000	1.16E+00	3.68E-05
Heptachlor	0.127	ND	1.85E-03	NA	NA	NA	0.000	4.08E-01	7.36E-05
Heptachlor epoxide	0.127	ND	3.67E-03	NA	NA	NA	0.000	1.04E-03	5.73E-02
Aroclor-1248	0.022	ND	2.91E-01	NA	NA	NA	0.002	1.56E-01	1.52E-02
Aroclor-1254	0.022	ND	5.06E-02	NA	NA	NA	0.000	6.95E-01	5.92E-04
Aluminum	0.004	2.22E-03	5.81E+03	NA	NA	NA	38.840	3.06E+01	1.27E+00
Antimony	0.200	3.90E-03	3.38E+00	NA	NA	NA	0.075	9.52E-02	7.83E-01
Arsenic	0.040	ND	2.40E+00	NA	NA	NA	0.023	1.98E+01	1.15E-03
Barium	0.150	3.24E-02	3.17E+01	NA	NA	NA	0.575	3.06E+00	1.88E-01
Cadmium	0.550	ND	7.13E-01	NA	NA	NA	0.035	5.59E+00	6.27E-03
Chromium	0.008	ND	1.13E+01	NA	NA	NA	0.079	1.53E+02	5.14E-04
Cobalt	0.020	ND	8.15E-01	NA	NA	NA	0.006	1.53E+00	4.23E-03
Copper	0.400	5.65E-02	9.82E+01	NA	NA	NA	3.687	4.59E+01	8.03E-02
Iron	0.004	3.99E+00	1.13E+04	NA	NA	NA	75.994	1.53E+02	4.97E-01
Lead	0.045	ND	1.11E+02	NA	NA	NA	1.091	7.52E+00	1.45E-01
Manganese	0.250	1.26E-01	1.02E+02	NA	NA	NA	2.637	3.06E+02	8.62E-03
Mercury	0.900	ND	3.70E-01	NA	NA	NA	0.028	3.06E-01	9.23E-02
Molybdenum	0.250	6.50E-02	ND	NA	NA	NA	0.007	5.44E-02	1.31E-01
Nickel	0.060	3.14E-02	4.19E+00	NA	NA	NA	0.050	4.59E+01	1.08E-03
Selenium	0.025	ND	2.61E-01	NA	NA	NA	0.002	1.93E+00	1.13E-03
Silver	0.400	ND	7.86E-01	NA	NA	NA	0.029	1.53E+01	1.93E-03
Thallium	0.004	7.60E-04	ND	NA	NA	NA	0.000	6.26E-02	1.34E-03
Vanadium	0.006	3.87E-01	1.60E+01	NA	NA	NA	0.151	4.39E+01	3.45E-03
Zinc	1.500	ND	3.46E+02	NA	NA	NA	42.572	1.53E+02	2.78E-01
								SUM	3.64E+00

ND - Not Detected
NA - Not Applicab

EQUATIONS USE… …ALCULATE EXPOSURE FOR THE RED FOX
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Food Source ingestion of: Iv=vegetation If=fish Im=mammals Iw=worms Ifr=fruit	Feeding Rate (I in kg/d)	Incidental Soil Ingestion (Is in kg/d)	Rate of Drinking Water Ingestion (Iw in l/d)	Rate of Worm Ingestion (Iwo in kg/d)	Rate of Fruit Ingestion (Ifr in kg/d)	Rate of Mammal Ingestion (Im in kg/d)	Rate of Vegetation Ingestion (Iv in kg/d)	Body Weight (BW) (kg)	Home Range Size (acres)	Contaminated Area (acres)	H Ratio	Equation Used to Calculate Total Exposure E=total exposure Cw=constituent conc. in water Cs=constituent conc. in soil Cwo=constituent conc. in worms Cfr=constituent conc. in fruit H=ratio of home range area to site area
Small Mammals Im=80%	0.601	0.017	0.385	NA	NA	0.481	0.1202	4.535	1245.4	26.3	0.021	$E=\frac{(Cw)(Iw)+[(cm)(Im)+(Cs)(Bv)(Iv)+(Cs)(Is)][H]}{BW}$
Vegetation Iv=20%	0.112 Small Mammal	0.00269 Small Mammal	0.0652 Small Mammal	NA	NA	NA	0.112 Small Mammal	0.3725 Small Mammal				$Cm=\frac{[(Cw)(Iw)+((Cs)(Bv)(Iv)+(Cs)(Is))(H)](Bb)}{BW}$
								Small Mammal	0.032	1	All AOCs	

Contaminant of Concern	Soil to Plant Transfer Coefficient (Bv)	Constituent Concentration in Water (mg/l) (Cw)	Constituent Concentration in Soil (mg/kg) (Cs)	Constituent Concentration in Worms (mg/kg) (Cwo)	Ingestion-to-tissue Biotransfer Factor (Bb)	Constituent Concentration in Mammals (mg/kg) (Cm)	Total Exposure (mg/kg/d)	TRV	RATIO
Acetone	53.299	ND	8.22E-03	NA	1.45E-08	1.91E-09	2.46E-04	4.26E+00	5.77E-05
1,2-Dichloroethene (total)	2.704	5.87E-03	ND	NA	2.51E-06	2.58E-09	4.99E-04	2.13E+00	2.34E-04
Toluene	1.065	ND	9.50E-03	NA	1.26E-05	3.92E-08	6.41E-06	9.49E+00	6.75E-07
Benzo(b)fluoranthene	0.006	ND	2.46E-01	NA	1.00E-01	2.21E-04	2.05E-05	1.88E-01	1.09E-04
Bis(2-ethylhexyl)phthalate	0.044	ND	2.53E-01	NA	3.16E-03	1.63E-05	2.61E-05	1.05E-01	2.48E-04
Butylbenzylphthalate	0.057	ND	2.20E-01	NA	2.00E-03	1.07E-05	2.43E-05	6.77E+00	3.59E-06
Fluoranthene	0.044	ND	2.69E-01	NA	3.09E-03	1.70E-05	2.77E-05	2.35E+00	1.18E-05
Indeno(1,2,3-cd)pyrene	0.007	ND	2.57E-01	NA	8.13E-02	1.93E-04	2.15E-05	1.88E-01	1.15E-04
Phenanthrene	0.097	ND	2.52E-01	NA	7.94E-04	7.28E-06	3.34E-05	1.75E+01	1.91E-06
Pyrene	0.033	ND	2.89E-01	NA	5.01E-03	2.50E-05	2.81E-05	1.41E+00	2.00E-05
Aldrin	0.714	ND	4.44E-03	NA	2.51E-05	2.48E-08	2.12E-06	3.25E-02	6.53E-05
beta-BHC	0.246	ND	ND	NA	1.58E-04	0.00E+00	0.00E+00	2.13E+00	0.00E+00
gamma-BHC	0.246	ND	1.90E-03	NA	1.58E-04	2.45E-08	4.11E-07	2.13E+00	1.93E-07
Alpha-chlordane	0.026	ND	1.40E-02	NA	7.94E-03	1.67E-06	1.31E-06	9.76E-02	1.34E-05
Gamma-chlordane	0.026	ND	6.45E-03	NA	7.94E-03	7.65E-07	6.00E-07	9.76E-02	6.14E-06
4,4'-DDD	0.013	ND	5.26E-02	NA	2.51E-02	1.48E-05	4.55E-06	3.41E-01	1.33E-05
4,4'-DDE	0.020	ND	4.40E-01	NA	1.26E-02	7.28E-05	3.95E-05	3.41E-01	1.16E-04
4,4'-DDT	0.008	ND	2.41E-01	NA	6.31E-02	1.45E-04	2.02E-05	3.41E-01	5.93E-05
Dieldrin	0.032	ND	4.87E-02	NA	5.50E-03	4.49E-06	4.69E-06	6.51E-03	7.21E-04
Endosulfan I	0.322	ND	4.13E-03	NA	1.00E-04	4.29E-08	1.07E-06	7.42E-01	1.44E-06
Endosulfan II	0.322	ND	ND	NA	1.00E-04	0.00E+00	0.00E+00	7.42E-01	0.00E+00
Endrin	0.055	ND	3.85E-03	NA	2.09E-03	1.92E-07	4.22E-07	3.25E-02	1.30E-05
Endrin aldehyde	0.055	ND	3.89E-03	NA	2.09E-03	1.94E-07	4.26E-07	3.25E-02	1.31E-05
Endrin ketone	0.055	ND	3.98E-03	NA	2.09E-03	1.99E-07	4.36E-07	3.25E-02	1.34E-05
Heptachlor	0.127	ND	1.85E-03	NA	5.01E-04	4.20E-08	2.76E-07	6.39E-02	4.32E-06
Heptachlor epoxide	0.127	ND	3.67E-03	NA	5.01E-04	8.33E-08	5.49E-07	1.63E-04	3.37E-03
Aroclor-1248	0.022	ND	2.91E-01	NA	1.00E-02	4.07E-05	2.66E-05	1.81E-01	1.47E-04
Aroclor-1254	0.022	ND	5.06E-02	NA	1.00E-02	7.07E-06	4.62E-06	6.47E-01	7.13E-06
Aluminum	0.004	2.22E-03	5.81E+03	NA	1.50E-03	7.34E-02	4.68E-01	1.95E+01	2.40E-02
Antimony	0.200	3.90E-03	3.38E+00	NA	1.00E-03	2.28E-04	9.75E-04	1.49E-02	6.54E-02
Arsenic	0.040	ND	2.40E+00	NA	2.00E-03	9.23E-05	2.42E-04	2.37E-02	1.02E-02
Barium	0.150	3.24E-02	3.17E+01	NA	1.50E-04	2.49E-04	7.89E-03	1.07E-01	7.41E-02
Cadmium	0.550	ND	7.13E-01	NA	5.40E-04	6.65E-05	2.75E-04	9.76E-02	2.82E-03
Chromium	0.008	ND	1.13E+01	NA	5.50E-03	5.89E-04	9.34E-04	1.03E+00	9.09E-04
Cobalt	0.020	ND	8.15E-01	NA	2.00E-02	2.16E-04	7.35E-05	3.75E-01	1.96E-04
Copper	0.400	5.65E-02	9.82E+01	NA	1.00E-02	1.25E-01	3.48E-02	7.80E+00	4.46E-03
Iron	0.004	3.99E+00	1.13E+04	NA	2.00E-02	1.92E+00	1.25E+00	1.88E+01	6.67E-02
Lead	0.045	ND	1.11E+02	NA	3.00E-04	6.88E-04	1.14E-02	3.41E+00	3.36E-03
Manganese	0.250	1.26E-01	1.02E+02	NA	4.00E-04	3.36E-03	3.29E-02	3.75E+00	8.77E-03
Mercury	0.900	ND	3.70E-01	NA	2.50E-01	2.57E-02	2.73E-04	1.36E-01	2.00E-03
Molybdenum	0.250	6.50E-02	ND	NA	6.00E-03	6.83E-05	5.53E-03	8.52E-03	6.48E-01
Nickel	0.080	3.14E-02	4.19E+00	NA	6.00E-03	6.68E-04	3.14E-03	3.25E+01	9.65E-05
Selenium	0.025	ND	2.61E-01	NA	1.50E-02	5.77E-05	2.42E-05	1.70E-02	1.42E-03
Silver	0.400	ND	7.86E-01	NA	3.00E-03	3.01E-04	2.38E-04	3.40E-02	7.01E-03
Thallium	0.004	7.60E-04	ND	NA	4.00E-02	5.32E-06	6.46E-05	9.79E-03	6.60E-03
Vanadium	0.006	3.87E-01	1.60E+01	NA	2.50E-03	5.24E-04	3.42E-02	2.77E-01	1.24E-01
Zinc	1.500	ND	3.46E+02	NA	1.00E-01	1.59E+01	3.53E-01	1.30E+00	2.71E-01
								SUM	1.33E+00

ND - Not Detected
NA - Not Applicable

APPENDIX T
DERIVATION OF TERRESTRIAL REFERENCE VALUES
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

The following section discusses the procedures used to develop the terrestrial reference values (TRVs) used in the terrestrial portion of the ERA.

Most of the whitetailed deer, bobwhite quail, and cottontail rabbit TRVs for inorganic chemicals were derived from mineral tolerance values (MTLs) contained in the Mineral Tolerance of Domestic Animals (NAS, 1980). This book defines an MTL as "that dietary level that, when fed for a limited period, will not impair animal performance and should not produce unsafe residues in human food derived from the animal." (NAS, 1980) The values in this book were reported as mg mineral/kg feed. Therefore, these values were first converted to mg mineral/kg body weight-day using the following equation (Opresko et.al., 1993):

TRV = MTL * CR

where:

TRV = Terrestrial Reference Value (mg mineral/kg body weight-day)

MTL = Mineral Tolerance Value (mg mineral/kg food)

CR = consumption rate (kg food/kg body weight-day)

For the whitetailed deer TRVs derived from the cattle MTLs, a consumption rate of 0.05 kg food/kg body weight-day was used for the cow (O'Dell, 1971). Because the cattle MTL was developed primarily with cow studies that were conducted for less than 6 months, the new TRV was multiplied by 0.1 to account for subchronic to chronic uncertainty. The TRV for a cow then was adjusted to a TRV for a deer to account for differences in the body size using the following equation (Opresko et.al., 1993):

TRV (deer) = [TRV (cow)]*[bw (cow)/bw (deer)]^1/3

Where:

TRV (deer) = Deer Terrestrial Reference Value (mg mineral/kg body weight-day)

TRV (cow) = Cow Terrestrial Reference Value (mg mineral/kg body weight-day)

bw (cow) = body weight of a cow (100 kg)

bw (deer) = body weight of a deer (45.4 kg)

APPENDIX T
DERIVATION OF TERRESTRIAL REFERENCE VALUES
SITE 36, CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

For the bobwhite quail TRVs derived from the poultry MTLs, a consumption rate of 0.41 kg food/kg body weight was calculated based on an average poultry weighing 0.5 kg, and the following allometric model (Nagy, 1987):

CR (birds) = 0.648 (bw)^0.651
Where:
CR (birds) = consumption rate for birds (kg food/kg body weight-day)
bw = body weight for an average bird (0.5 kg)

The TRV for poultry then was adjusted to a TRV for a bobwhite quail to account for differences in the body size using the same equation that was used to adjust the cow to the deer. The body weight used for the bobwhite quail was 0.174 kg.

For the cottontail rabbit TRVs derived from the rabbit MTLs, a consumption rate of 0.081 was calculated using the following equation:

CR (rabbit) = FR/bw
Where:
CR (rabbit) = consumption rate for rabbits (kg food/kg body weight-day)
FR = feeding rate of a cottontail rabbit (0.237 kg/day)
bw = body weight of a cottontail rabbit (1.229 kg)

The TRV (rabbit) was not adjusted for body size since a rabbit was used in the TRV calculation.

The following procedures were used for deriving TRV for the whitetailed deer, bobwhite quail, and cottontail rabbit when MTLs were not available, and for species that did not have MTLs. Their TRVs were determined using No Observed Adverse Effects Levels (NOAELs) or Lowest Observed Effects Levels (LOAELs). When available, the NOAEL or LOAEL from the Integrated Risk Information System (IRIS) was used in the TRV development. However, if a toxicity value was not available from IRIS, then one was obtained from various literature sources including Agency for Toxic Substances Registry Toxicological Profiles, Toxicological Benchmarks for Wildlife (Opresko *et.al.*, 1994) and published articles. Chemicals that only had diet concentration (as opposed to NOAELS) were converted to TRVs using the above equation and the appropriate consumption rates and body weights. The attached table contains the respective body weights used in the TRV adjustments.

As is presented in the attached table, toxicity data from many species were used to develop the TRVs. The attached table presents which animal was used to develop a particular TRV in parentheses. When possible, the chronic reproductive or developmental NOAEL value was used in the development of the TRV. However, in some instances, only a subchronic NOAEL or a chronic or sub-chronic LOAEL for some chemicals were found in the literature. If a LOAEL was used, the number was divided by 10 as an uncertainty factor. If a subchronic value was used it also was divided by 10 as an uncertainty factor. Finally, toxicity values were not found for all the chemicals. Where possible, the toxicity or a similar chemical was used for these chemicals (i.e., using endrin for endrin aldehyde). The attached table identifies, in parentheses, which chemicals were used as surrogates.

TOXICITY DATA USED TO CALCULATE TERRESTRIAL REFERENCE VALUES
SITE 36 - CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Chemical	Substitute Chemical Used	Cattle (mg/kg/day)	Poultry (mg/kg/day)	Rabbit (mg/kg/day)	Dog (mg/kg/day)	Rat (mg/kg/day)	Mouse (mg/kg/day)	Guinea Pig (mg/kg/day)	Mink (mg/kg/day)
Aluminum		5 (1)	10 (1)	11.61 (1)	15 (1)	NA	1.93 (60)	NA	NA
Antimony		NA	NA	4.06 (1)	NA	0.035 (12)	NA	NA	NA
Arsenic		0.25 (1)	5.135 (61) Mallard	2.90 (1)	NA	NA	0.1261 (13)	NA	NA
Barium		0.1 (1)	1 (1)	1.16 (1)	NA	0.25 (4)	NA	NA	NA
Beryllium		NA	NA	NA	NA	0.54 (4)	NA	NA	NA
Cadmium		0.0025 (1)	1.45 (63) Mallard	0.03 (1)	0.075 (14)	0.004 (15)	NA	NA	NA
Chromium		5 (1)	50 (1)	58.03 (1)	NA	2.41 (5)	NA	NA	NA
Cobalt		0.05 (1)	0.5 (1)	0.58 (1)	NA	NA	NA	NA	NA
Copper		0.5 (1)	15 (1)	11.61 (1)	NA	NA	NA	NA	12.9 (17)
Iron		5 (1)	50 (1)	29.02 (1)	NA	NA	NA	NA	NA
Lead		0.15 (1)	3.85 (65) A. kestral	1.74 (1)	NA	8 (6)	NA	NA	NA
Manganese		1 (24)	100 (1)	23.21 (1)	NA	8.8 (66)	NA	NA	NA
Mercury		0.01 (1)	0.1 (1)	0.12 (1)	NA	0.32 (18)	NA	NA	NA
Molydenum		NA	NA	NA	NA	0.02 (82)	NA	NA	NA
Nickel		0.25 (1)	15 (1)	2.90 (1)	25 (2)	5 (2)	NA	NA	NA
Selenium		0.01 (1)	0.5 (67) Mallard	0.12 (1)	NA	0.04 (19)	NA	NA	NA
Silver		NA	5 (1)	NA	NA	NA	0.181 (20)	NA	NA
Thallium		NA	NA	NA	NA	0.023 (54)	NA	NA	NA
Vanadium		0.25 (1)	11.38 (68) Mallard	0.06 (1)	NA	0.65 (58)	NA	NA	NA
Zinc		2.5 (1)	50 (1)	29.02 (1)	1 (3)	160 (69)	NA	NA	NA
Cyanide		NA	4.5 (21)	NA	0.375 (22)	10.8 (23)	NA	NA	NA
Acenaphthene		NA	NA	NA	NA	17.5 (56)	NA	NA	NA
Acenaphthylene		NA	NA	NA	NA	17.5 Acen.	NA	NA	NA
Anthracene		NA	NA	NA	NA	NA	100 (33)	NA	NA
Benzo(a)anthracene	(Benzo(a)pyrene	NA	NA	NA	NA	NA	1	NA	NA
Benzo(b)fluoranthene	(Benzo(a)pyrene	NA	NA	NA	NA	NA	1	NA	NA
Benzo(k)fluoranthene	(Benzo(a)pyrene	NA	NA	NA	NA	NA	1	NA	NA
Benzo(ghi)perylene	(Benzo(a)pyrene	NA	NA	NA	NA	NA	1	NA	NA
Benzo(g,h,i)perylene	(Benzo(a)pyrene	NA	NA	NA	NA	NA	1	NA	NA
Benzo(a)pyrene		NA	NA	NA	NA	NA	1 (7)	NA	NA
beta-BHC		NA	NA	NA	NA	5 (51)	NA	NA	NA
gamma-BHC	(beta-BHC)	NA	NA	NA	NA	5 (51)	NA	NA	NA
Bis(2-ethylhexyl)phthalate		NA	1.11 (16) Ringed Dove	NA	NA	NA	NA	0.1833 (11)	NA
Butylbenzylphthalate		NA	NA	NA	NA	15.9 (52)	NA	NA	NA
Carbazole	(Benzo(a)pyrene	NA	NA	NA	NA	NA	1	NA	NA
Chrysene	(Benzo(a)pyrene	NA	NA	NA	NA	NA	1	NA	NA
Dibenzofuran	(Benzo(a)pyrene	NA	NA	NA	NA	NA	1	NA	NA
Dibenzo(a,h)anthracene	(Benzo(a)pyrene	NA	NA	NA	NA	NA	1	NA	NA
Dibenz(a,h)anthracene	(Benzo(a)pyrene	NA	NA	NA	NA	NA	1	NA	NA
Diethylphthalate		NA	NA	NA	NA	NA	4583 (53)	NA	NA
2,4-Dimethylphenol		NA	NA	NA	NA	NA	5 (85)	NA	NA
Di-n-butylphthalate		NA	0.11 (16) Ringed Dove	NA	NA	125 (63)	NA	NA	NA
Di-n-octylphthalate		NA	NA	NA	NA	17.5 (79)	NA	NA	NA
2,6-Dinitrotoluene		NA	NA	NA	0.4 (84)	NA	NA	NA	NA
Fluoranthene		NA	NA	NA	NA	NA	12.5 (8)	NA	NA
Fluorene		NA	NA	NA	NA	12.5 (56)	NA	NA	NA
Indeno(1,2,3-cd)pyrene	(Benzo(a)pyrene	NA	NA	NA	NA	NA	1	NA	NA
2-Methylnaphthalene	(Naphthalene)	NA	NA	NA	NA	41	NA	NA	NA
Naphthalene		NA	NA	NA	NA	41 (9)	NA	NA	NA
Nitrobenzene		NA	NA	NA	NA	0.25 (80)	NA	NA	NA
n-Nitrosodiphenylamine		NA	NA	NA	NA	50 (81)	NA	NA	NA
Phenanthrene	(Naphthalene)	NA	NA	NA	NA	41	NA	NA	NA
Phenol		NA	NA	NA	NA	6 (57)	NA	NA	NA
Pyrene		NA	NA	NA	NA	NA	7.5 (10)	NA	NA

TOXICITY DATA USED TO CALCULATE TERRESTRIAL REFERENCE VALUES
SITE 36 - CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Chemical	Substitute Chemical Used	Cattle (mg/kg/day)	Poultry (mg/kg/day)	Rabbit (mg/kg/day)		Dog (mg/kg/day)	Rat (mg/kg/day)		Mouse (mg/kg/day)	Guinea Pig (mg/kg/day)	Mink (mg/kg/day)
Aldrin		0.5 (24)	NA	NA		0.025 (77)	0.025	(77)	NA	NA	NA
Alpha-chlordane	(Chlordane)	1 (24)	2.14 (70) Blackbird	NA		0.075 (48)	0.055	(49)	NA	NA	NA
Gamma-chlordane	(Chlordane)	1 (24)	2.14 (70) Blackbird	NA		0.075 (48)	0.055	(49)	NA	NA	NA
Dieldrin		0.5 (24)	0.03 (71) Mallard	NA		0.005 (25)	0.005	(25)	NA	NA	NA
4,4'-DDD	(DDT)	NA	0.088 (DDT)	NA		NA	0.8	DDT	NA	NA	NA
4,4'-DDE		NA	0.088 (24) Quail	NA		NA	0.8	(47)	NA	NA	NA
4,4'-DDT		NA	0.088 (24) Quail	NA		NA	0.8	(47)	NA	NA	NA
Endosulfan		NA	10 (72) Partridge	NA		0.57 (26)	0.6	(26)	NA	NA	NA
Endosulfan I		NA	10 (72) Partridge	NA		0.57 (26)	0.6	(26)	NA	NA	NA
Endosulfan II	(Endosulfan)	NA	10 (72) Partridge	NA		0.57 (26)	0.6	(26)	NA	NA	NA
Endosulfan sulfate	(Endosulfan)	NA	10 (72) Partridge	NA		0.57 (26)	0.6	(26)	NA	NA	NA
Endrin		NA	0.3 (73) Mallard	NA		0.025 (27)	0.25	(28)	NA	NA	NA
Endrin aldehyde	(Endrin)	NA	0.3 (73) Mallard	NA		0.025 (27)	0.25	(28)	NA	NA	NA
Endrin ketone	(Endrin)	NA	0.3 (73) Mallard	NA		0.025 (27)	0.25	(28)	NA	NA	NA
Heptachlor		NA	NA	NA		NA	0.15	(45)	NA	NA	0.057 (29)
Heptachlor Epoxide		NA	NA	NA		0.000125 (24)	NA		NA	NA	NA
Aroclor-1221		NA	NA	NA		NA	3.5	(30)	NA	NA	NA
Aroclor-1232	(Aroclor-1242)	NA	0.41 (78) Owl	NA		NA	0.15	(31)	NA	NA	NA
Aroclor-1260		NA	NA	NA		NA	0.005	(32)	NA	NA	NA
Aroclor-1254		NA	0.18 (76) Pheasant	1	(75)	NA	NA		NA	NA	0.1 (50)
Aroclor-1248		NA	NA	0.28	(77)	NA	NA		0.13 (62)	NA	NA
Methylene chloride		NA	NA	NA		NA	5.85	(34)	NA	NA	NA
Carbon disulfide		NA	NA	1.1	(35)	NA	NA		NA	NA	NA
1,1-Dichloroethene		NA	NA	NA		NA	28	(59)	NA	NA	NA
1,2-Dichloroethene (total)		NA	NA	NA		NA	5	(44)	NA	NA	NA
Chloroform		NA	NA	NA		30 (36)	38	(37)	NA	NA	NA
2-Butanone		NA	NA	NA		NA	NA		NA	NA	NA
1,1,1-Trichloroethane		NA	NA	NA		NA	NA		1000 (38)	NA	NA
Trichloroethene		NA	NA	NA		NA	100	(39)	NA	NA	NA
1,1,2-Trichloroethane		NA	NA	NA		NA	NA		0.39 (40)	NA	NA
Benzene		NA	NA	NA		NA	0.1	(41)	NA	NA	NA
1,1,2,2-Tetrachloroethane		NA	NA	NA		NA	76	(85)	NA	NA	NA
Tetrachloroethene		NA	NA	NA		NA	1.4	(42)	NA	NA	NA
Toluene		NA	NA	NA		NA	22.3	(38)	NA	NA	NA
Ethylbenzene		NA	NA	NA		NA	9.71	(41)	NA	NA	NA
Xylenes		NA	NA	NA		NA	179	(43)	NA	NA	NA
Xylenes (total)		NA	NA	NA		NA	179	(43)	NA	NA	NA
Vinyl chloride		NA	NA	NA		NA	0.17	(83)	NA	NA	NA
Acetone		NA	NA	NA		NA	10	(46)	NA	NA	NA

(1) NAS, 1980
(2) Ambrose et.al., 1976
(3) Drinker et. al., 1927
(4) Schroder and Mitchner, 1975a,b
(5) Mackenzie et.al., 1958
(6) Azar et.al., 1973
(7) Mackenzie and Angevine, 1981
(8) USEPA, 1988a
(9) Schmall, 1955
(10) USEPA, 1989a
(11) Lamb, et.al., 1987
(12) Schroeder et.al., 1976
(13) Schroeder and Mitchner, 1971
(14) Loser and Lorke, 1977
(15) Kopp et.al., 1982
(16) Peakall et.al., 1974
(17) Aulerich et.al., 1982
(18) Fitzh[illegible]l., 1950
(19) Halverson et.al., 1966
(20) Rungby and Dansher, 19
(21) Gomez et.al., 1983, 1988
(22) USEPA, 1980
(23) Howard and Hanzal, 1955
(24) Ford et.al., 1991
(25) Walker et.al., 1969
(26) Hoechst, 1989
(27) Vesicol, 1969
(28) Treon et.al., 1955
(29) Aulerich et.al., 1990
(30) Wasserman and Culos, 1
(31) Bruckner et.al., 1974
(32) Byrne et.al., 1988
(33) USEPA, 1989b
(34) NCA., 1982
(35) Hardin et.al., 1981
(36) Heywood et.al., 1979
(37) Jorgenson et.al., 1985
(38) Lane, et.al., 1982
(39) NTP, 1985a
(40) White et.al., 1985
(41) Wolf et.al., 1956
(42) Buban, 1985
(43) NTP, 1986a
(44) Quast et.al., 1983
(45) Vesicol, 1955
(46) USEPA, 1986a
(47) Fitzhugh, 1948
(48) WHO, 1984 and NRCC, 1975
(49) Vesicol, 1983
(50) Ringer, 1983
(51) Ito et.al., 1975
(52) NTP, 1985b
(53) McClane and Hughs, 1980
(54) USEPA, 1986b
(55) NCI, 1978
(56) USEPA, 1989b
(57) NTP, 1983a
(58) Schroeder et.al., 1970
(59) Nitchke, et.al., 1983
(60) Ondreicka, et.al., 1966
(61) USFWS, 1964
(62) Thomas and Hinsdill, 1980
(63) White and Finely, 1978
(64) Smith, et.al., 1953
(65) Pattee, 1984
(66) Laskey, et.al., 1982
(67) Heinz, et.al., 1987
(68) White and Dieter, 1978
(69) Schlicker and Cox, 1968
(70) Stickel, e.al., 1983
(71) Nebeker et.al., 1992
(72) Abiola, 1992
(73) Spann, et.al., 1986
(74) Dow, 1958
(75) Villeneuve, et.al., 1972
(76) Dahlgren, et.al., 1972
(77) FAO/WHO, 1978
(78) McLane and Hughes, 1980
(79) Piekacz, 1971
(80) CIIT, 1984
(81) NCI, 1979
(82) Jeter et.al., 1954
(83) Til et.al., 1983
(84) Lee et.al., 1976
(85) USEPA, 1989c

BODY WEIGHTS FOR TERRESTRIAL REFERENCE VALUE CALCULATION
SITE 36 - CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Body Weight (kg)		
Cattle	100	(IT Corp, 1992)
Whitetailed Deer	45.4	(Dee, 1991)
Bobwhite Quail	0.0174	(USEPA, 1993b)
Eastern Cottontail	1.2285	(USEPA, 1993b)
Lab Rat	0.35	(USEPA, 1988)
Lab Dog	10	(USEPA, 1988)
Poultry	0.5	(IT Corp, 1992)
Red Fox	4.535	(Storm et.al., 1976)
Racoon	5.12	(USEPA, 1993b)
Lab Mouse	0.03	(USEPA, 1988)
Guinea pig	0.86	(USEPA, 1988)
Mink	1	(USEPA, 1993b)
Mallard Duck	1	(Heinze et.al., 1989)
Short-tailed Shrew	0.017	(Schlesinger and Potter, 1974)
Americal Kestral	0.13	(Pattee, 1984)
Blackbird	0.064	(Stickel, 1983)
Pheasant	1	(USEPA, 1993b)
Ringed Dove	0.155	(Terres, 1980)
Screech Owl	0.181	(Dunning, 1984)
Partridge	0.4	(Abiola, 1992)

REGION IV TERRESTRIAL REFERENCE VALUE CALCULATION
SITE 36 - CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Chemical	Whitetailed Deer (mg/kg/day)	Bobwhite Quail (mg/kg/day)	Eastern Cottontail (mg/kg/day)	Red Fox (mg/kg/day)	Racoon (mg/kg/day)
Aluminum	6.51E+00 (ct)	3.06E+01 (bi)	1.16E+01 (rb)	1.95E+01 (dg)	3.48E-01 (mo)
Antimony	6.91E-03 (rt)	9.52E-02 (rt)	4.06E+00 (rb)	1.49E-02 (rt)	1.43E-02 (rt)
Arsenic	3.25E-01 (ct)	1.98E+01 (bi)	2.90E+00 (rb)	2.37E-02 (mo)	2.27E-02 (mo)
Barium	1.30E-01 (ct)	3.06E+00 (bi)	1.16E+00 (rb)	1.07E-01 (rt)	1.02E-01 (rt)
Beryllium	1.07E-01 (rt)	1.47E+00 (rt)	3.55E-01 (rt)	2.30E-01 (rt)	2.21E-01 (rt)
Cadmium	3.25E-03 (ct)	5.59E+00 (bi)	2.90E-02 (rb)	9.76E-02 (dg)	1.64E-03 (rt)
Chromium	6.51E+00 (ct)	1.53E+02 (bi)	5.80E+01 (rb)	1.03E+00 (rt)	9.86E-01 (rt)
Cobalt	6.51E-02 (ct)	1.53E+00 (bi)	5.80E-01 (rb)	3.75E-01 (rb)	3.61E-01 (rb)
Copper	6.51E-01 (ct)	4.59E+01 (bi)	1.16E+01 (rb)	7.80E+00 (mk)	7.49E+00 (mk)
Iron	6.51E+00 (ct)	1.53E+02 (bi)	2.90E+01 (rb)	1.88E+01 (rb)	1.80E+01 (rb)
Lead	1.95E-01 (ct)	7.52E+00 (bi)	1.74E+00 (rb)	3.41E+00 (rt)	3.27E+00 (rt)
Manganese	1.30E+00 (ct)	3.06E+02 (bi)	2.32E+01 (rb)	3.75E+00 (rt)	3.60E+00 (rt)
Mercury	1.30E-02 (ct)	3.06E-01 (bi)	1.20E-01 (rb)	1.36E-01 (rt)	1.31E-01 (rt)
Molybdenum	3.95E-03 (rt)	5.44E-02 (rt)	1.32E-02 (rt)	8.52E-03 (rt)	8.18E-03 (rt)
Nickel	3.25E-01 (ct)	4.59E+01 (bi)	2.90E+00 (rb)	3.25E+01 (dg)	2.05E+00 (rt)
Selenium	1.30E-02 (ct)	1.93E+00 (bi)	1.20E-01 (rb)	1.70E-02 (rt)	1.64E-02 (rt)
Silver	1.58E-02 (mo)	1.53E+01 (bi)	5.25E-02 (mo)	3.40E-02 (mo)	3.26E-02 (mo)
Thallium	4.54E-03 (rt)	6.26E-02 (rt)	1.51E-02 (rt)	9.79E-03 (rt)	9.40E-03 (rt)
Vanadium	3.25E-01 (ct)	4.39E+01 (bi)	5.80E-02 (rb)	2.77E-01 (rt)	2.66E-01 (rt)
Zinc	3.25E+00 (ct)	1.53E+02 (bi)	2.90E+01 (rb)	1.30E+00 (dg)	6.54E+01 (rt)
Cyanide	2.13E+00 (rt)	1.38E+01 (bi)	7.11E+00 (rt)	4.88E-01 (dg)	4.42E+00 (rt)
Acenaphthene	3.46E+00 (rt)	4.76E+01 (rt)	1.15E+01 (rt)	7.45E+00 (rt)	7.16E+00 (rt)
Acenaphthylene	3.46E+00 (rt)	4.76E+01 (rt)	1.15E+01 (rt)	7.45E+00 (rt)	7.16E+00 (rt)
Anthracene	8.71E+00 (mo)	1.20E+02 (mo)	2.90E+01 (mo)	1.88E+01 (mo)	1.80E+01 (mo)
Benzo(a)anthracene	8.71E-02 (mo)	1.20E+00 (mo)	2.90E-01 (mo)	1.88E-01 (mo)	1.80E-01 (mo)
Benzo(b)fluoranthene	8.71E-02 (mo)	1.20E+00 (mo)	2.90E-01 (mo)	1.88E-01 (mo)	1.80E-01 (mo)
Benzo(k)fluoranthene	8.71E-02 (mo)	1.20E+00 (mo)	2.90E-01 (mo)	1.88E-01 (mo)	1.80E-01 (mo)
Benzo(ghi)perylene	8.71E-02 (mo)	1.20E+00 (mo)	2.90E-01 (mo)	1.88E-01 (mo)	1.80E-01 (mo)
Benzo(g,h,i)perylene	8.71E-02 (mo)	1.20E+00 (mo)	2.90E-01 (mo)	1.88E-01 (mo)	1.80E-01 (mo)
Benzo(a)pyrene	8.71E-02 (mo)	1.20E+00 (mo)	2.90E-01 (mo)	1.88E-01 (mo)	1.80E-01 (mo)
beta-BHC	9.88E-01 (rt)	1.36E+01 (rt)	3.29E+00 (rt)	2.13E+00 (rt)	2.04E+00 (rt)
gamma-BHC	9.88E-01 (rt)	1.36E+01 (rt)	3.29E+00 (rt)	2.13E+00 (rt)	2.04E+00 (rt)
Bis(2-ethylhexyl)phthalate	4.89E-02 (gp)	2.30E+00 (bi)	1.63E-01 (gp)	1.05E-01 (gp)	1.01E-01 (gp)
Bis(2-chloroethyl)ether	NA	NA	NA	NA	NA
Butylbenzylphthalate	3.14E+00 (rt)	4.32E+01 (rt)	1.05E+01 (rt)	6.77E+00 (rt)	6.50E+00 (rt)
Carbazole	8.71E-02 (mo)	1.20E+00 (mo)	2.90E-01 (mo)	1.88E-01 (mo)	1.80E-01 (mo)
Chrysene	8.71E-02 (mo)	1.20E+00 (mo)	2.90E-01 (mo)	1.88E-01 (mo)	1.80E-01 (mo)
Dibenzofuran	8.71E-02 (mo)	1.20E+00 (mo)	2.90E-01 (mo)	1.88E-01 (mo)	1.80E-01 (mo)
Dibenzo(a,h)anthracene	8.71E-02 (mo)	1.20E+00 (mo)	2.90E-01 (mo)	1.88E-01 (mo)	1.80E-01 (mo)
Dibenz(a,h)anthracene	8.71E-02 (mo)	1.20E+00 (mo).	2.90E-01 (mo)	1.88E-01 (mo)	1.80E-01 (mo)
Diethylphthalate	3.99E+02 (mo)	5.50E+03 (mo)	1.33E+03 (mo)	8.60E+02 (mo)	8.26E+02 (mo)
2,4-Dimethylphenol	4.36E-01 (mo)	6.00E+00 (mo)	1.45E+00 (mo)	9.39E-01 (mo)	9.01E-01 (mo)
Di-n-butylphthalate	2.47E+01 (rt)	2.28E-01 (bi)	8.23E+01 (rt)	5.32E+01 (rt)	5.11E+01 (rt)
Di-n-octylphthalate	3.46E+00 (rt)	4.76E+01 (bi)	1.15E+01 (rt)	7.45E+00 (rt)	7.16E+00 (rt)
2,6-Dinitrotoluene	2.42E-01 (dg)	3.33E+00 (dg)	8.05E-01 (dg)	5.20E-01 (dg)	5.00E-01 (dg)
Fluoranthene	1.09E+00 (mo)	1.50E+01 (mo)	3.63E+00 (mo)	2.35E+00 (mo)	2.25E+00 (mo)
Fluorene	2.47E+00 (rt)	3.40E+01 (rt)	8.23E+00 (rt)	5.32E+00 (rt)	5.11E+00 (rt)
Indeno(1,2,3-cd)pyrene	8.71E-02 (mo)	1.20E+00 (mo)	2.90E-01 (mo)	1.88E-01 (mo)	1.80E-01 (mo)
2-Methylnaphthalene	8.10E+00 (rt)	1.12E+02 (rt)	2.70E+01 (rt)	1.75E+01 (rt)	1.68E+01 (rt)
Naphthalene	8.10E+00 (rt)	1.12E+02 (rt)	2.70E+01 (rt)	1.75E+01 (rt)	1.68E+01 (rt)
Nitrobenzene	4.94E-02 (rt)	6.80E-01 (rt)	1.65E-01 (rt)	1.06E-01 (rt)	1.02E-01 (rt)
N-Nitrosodiphenylamine	9.88E+00 (rt)	1.36E+02 (rt)	3.29E+01 (rt)	2.13E+01 (rt)	2.04E+01 (rt)
Phenanthrene	8.10E+00 (rt)	1.12E+02 (rt)	2.70E+01 (rt)	1.75E+01 (rt)	1.68E+01 (rt)
Phenol	1.19E+00 (rt)	1.63E+01 (rt)	3.95E+00 (rt)	2.55E+00 (rt)	2.45E+00 (rt)
Pyrene	6.53E-01 (mo)	8.99E+00 (mo)	2.18E+00 (mo)	1.41E+00 (r[illegible]	1.35E+00 (mo)

REGION IV TERRESTRIAL REFERENCE VALUE CALCULATION
SITE 36 - CAMP GEIGER AREA DUMP
REMEDIAL INVESTIGATION, CTO-0303
MCB, CAMP LEJEUNE, NORTH CAROLINA

Chemical	Whitetailed Deer (mg/kg/day)	Bobwhite Quail (mg/kg/day)	Eastern Cottontail (mg/kg/day)	Red Fox (mg/kg/day)	Racoon (mg/kg/day)
Aldrin	6.51E-01 (ct)	6.80E-02 (rt)	1.65E-02 (rt)	3.25E-02 (dg)	1.02E-02 (rt)
Alpha-chlordane	1.30E+00 (ct)	3.30E+00 (bi)	3.62E-02 (rt)	9.76E-02 (dg)	2.25E-02 (rt)
Gamma-chlordane	1.30E+00 (ct)	3.30E+00 (bi)	3.62E-02 (rt)	9.76E-02 (dg)	2.25E-02 (rt)
Dieldrin	6.51E-01 (ct)	1.16E-01 (bi)	3.29E-03 (rt)	6.51E-03 (dg)	2.04E-03 (rt)
4,4'-DDD	1.58E-01 (rt)	8.80E-02 (bi)	5.26E-01 (rt)	3.41E-01 (rt)	3.27E-01 (rt)
4,4'-DDE	1.58E-01 (rt)	8.80E-02 (bi)	5.26E-01 (rt)	3.41E-01 (rt)	3.27E-01 (rt)
4,4'-DDT	1.58E-01 (rt)	8.80E-02 (bi)	5.26E-01 (rt)	3.41E-01 (rt)	3.27E-01 (rt)
Endosulfan	1.19E-01 (rt)	2.84E+01 (bi)	3.95E-01 (rt)	7.42E-01 (dg)	2.45E-01 (rt)
Endosulfan I	1.19E-01 (rt)	2.84E+01 (bi)	3.95E-01 (rt)	7.42E-01 (dg)	2.45E-01 (rt)
Endosulfan II	1.19E-01 (rt)	2.84E+01 (bi)	3.95E-01 (rt)	7.42E-01 (dg)	2.45E-01 (rt)
Endosulfan sulfate	1.19E-01 (rt)	2.84E+01 (bi)	3.95E-01 (rt)	7.42E-01 (dg)	2.45E-01 (rt)
Endrin	4.94E-02 (rt)	1.16E+00 (bi)	1.65E-01 (rt)	3.25E-02 (dg)	1.02E-01 (rt)
Endrin aldehyde	4.94E-02 (rt)	1.16E+00 (bi)	1.65E-01 (rt)	3.25E-02 (dg)	1.02E-01 (rt)
Endrin ketone	4.94E-02 (rt)	1.16E+00 (bi)	1.65E-01 (rt)	3.25E-02 (dg)	1.02E-01 (rt)
Heptachlor	2.96E-02 (rt)	4.08E-01 (rt)	9.87E-02 (rt)	6.39E-02 (rt)	6.13E-02 (rt)
Heptachlor epoxide	7.55E-05 (dg)	1.04E-03 (dg)	2.51E-04 (dg)	1.63E-04 (dg)	1.56E-04 (dg)
Aroclor-1221	6.91E-01 (rt)	9.52E+00 (rt)	2.30E+00 (rt)	1.49E+00 (rt)	1.43E+00 (rt)
Aroclor-1232	2.96E-02 (rt)	8.95E-01 (bi)	9.87E-02 (rt)	6.39E-02 (rt)	6.13E-02 (rt)
Aroclor-1260	9.88E-04 (rt)	1.36E-02 (rt)	3.29E-03 (rt)	2.13E-03 (rt)	2.04E-03 (rt)
Aroclor-1254	2.80E-02 (mk)	6.95E-01 (bi)	1.00E+00 (rb)	6.47E-01 (rb)	6.21E-01 (rb)
Aroclor-1248	1.13E-02 (mo)	1.56E-01 (mo)	2.80E-01 (rb)	1.81E-01 (rb)	2.34E-02 (mo)
Methylene chloride	1.16E+00 (rt)	1.59E+01 (rt)	3.85E+00 (rt)	2.49E+00 (rt)	2.39E+00 (rt)
Carbon disulfide	3.30E-01 (rb)	4.55E+00 (rb)	1.10E+00 (rb)	7.12E-01 (rb)	6.84E-01 (rb)
1,1-Dichloroethene	5.53E+00 (rt)	7.61E+01 (rt)	1.84E+01 (rt)	1.19E+01 (rt)	1.14E+01 (rt)
1,2-Dichloroethene (total)	9.88E-01 (rt)	1.36E+01 (rt)	3.29E+00 (rt)	2.13E+00 (rt)	2.04E+00 (rt)
Chloroform	7.51E+00 (rt)	1.03E+02 (rt)	2.50E+01 (rt)	3.90E+01 (dg)	1.55E+01 (rt)
2-Butanone	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	8.71E+01 (rt)	1.20E+03 (rt)	2.90E+02 (rt)	1.88E+02 (rt)	1.80E+02 (rt)
Trichloroethene	1.98E+01 (rt)	2.72E+02 (rt)	6.58E+01 (rt)	4.26E+01 (rt)	4.09E+01 (rt)
1,1,2-Trichloroethane	3.40E-02 (mo)	4.68E-01 (mo)	1.13E-01 (mo)	7.32E-02 (mo)	7.03E-02 (mo)
Benzene	1.98E-02 (rt)	2.72E-01 (rt)	6.58E-02 (rt)	4.26E-02 (rt)	4.09E-02 (rt)
1,1,2,2-Tetrachloroethane	1.50E+01 (rt)	2.07E+02 (rt)	5.00E+01 (rt)	3.24E+01 (rt)	3.11E+01 (rt)
Tetrachloroethene	2.77E-01 (rt)	3.81E+00 (rt)	9.21E-01 (rt)	5.96E-01 (rt)	5.72E-01 (rt)
Toluene	4.41E+00 (rt)	6.06E+01 (rt)	1.47E+01 (rt)	9.49E+00 (rt)	9.12E+00 (rt)
Ethylbenzene	1.92E+00 (rt)	2.64E+01 (rt)	6.39E+00 (rt)	4.13E+00 (rt)	3.97E+00 (rt)
Xylenes	3.54E+01 (rt)	4.87E+02 (rt)	1.18E+02 (rt)	7.62E+01 (rt)	7.32E+01 (rt)
Xylenes (total)	3.54E+01 (rt)	4.87E+02 (rt)	1.18E+02 (rt)	7.62E+01 (rt)	7.32E+01 (rt)
Vinyl chloride	3.36E-02 (rt)	4.62E-01 (rt)	1.12E-01 (rt)	7.24E-02 (rt)	6.95E-02 (rt)
Acetone	1.98E+00 (rt)	2.72E+01 (rt)	6.58E+00 (rt)	4.26E+00 (rt)	4.09E+00 (rt)
2-Hexanone	NA	NA	NA	NA	NA

Note: The following abbreviations indicate which species was used to develop the TRV

(ct) = cattle	(rb) = rabbit
(rt) = rat	(dg) = dog
(bi) = bird	(mo) = mouse
(gp) = guinea pig	(mk) = mink

NA - No Data Available

REFERENCES FOR TERRESTRIAL REFERENCE VALUES

Abiola, F.A. 1992. "Ecotoxicity of Organochloride Insecticides: Effects of Endosulfan on Birds Reproduction and Evaluation of its Induction Effects in Partridge, *Perdix perdix*". L. Rev. Vet. Med. 143:443-450.

Agency for Toxic Substances and Disease Registry (ASTDR). 1994. Toxicological Profile for Selenium. Prepared by Clement Associates for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1993. Toxicological Profile for Endosulfan. Prepared by Clement Associates for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1993. Toxicological Profile for Total Xylenes - Draft. Prepared by Clement Associates for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1991. Toxicological Profile for Arsenic - Draft. Prepared by Life Systems, Inc, for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1991. Toxicological Profile for Polychlorinated Biphenyls - Draft. Prepared by Syracuse Research Corporation for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1991. Toxicological Profile for Tetrachloroethylene- Draft. Prepared by Syracuse Research Corporation for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1991. Toxicological Profile for Benzene - Draft. Prepared by Clement Associates for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1991. Toxicological Profile for Beryllium - Draft. Prepared by Syracuse Research Corporation for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1991. Toxicological Profile for Cadmium - Draft. Prepared by Life Systems, Inc, for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1991. Toxicological Profile for Chromium - Draft. Prepared by Syracuse Research Corporation for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1991. Toxicological Profile for N-Nitrosodiphenylamine, Draft. Prepared by Clement Associates for the US Department of Health and Human Services.

REFERENCES FOR TERRESTRIAL REFERENCE VALUES

Agency for Toxic Substances and Disease Registry (ASTDR). 1991. Toxicological Profile for Cyanide - Draft. Prepared by Syracuse Research Corporation for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1991. Toxicological Profile for Chloroform - Draft. Prepared by Clement Associates for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1991. Toxicological Profile for Diethylphthalate - Draft. Prepared by Clement Associates for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1991. Toxicological Profile for Heptachlor/Heptachlor Epoxide - Draft. Prepared by Clement Associates for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1991. Toxicological Profile for Methylene Chloride - Draft. Prepared by Life Systems, Inc, for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1991. Toxicological Profile for Vinyl Chloride - Draft. Prepared by Clement Associates for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1989. Toxicological Profile for Copper - Draft. Prepared by Syracuse Research Corporation for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1989. Toxicological Profile for 1,1-Dichloroethene - Draft. Prepared by Clement Associates for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1989. Toxicological Profile for Endrin/Endrin Aldehyde - Draft. Prepared by Life Systems, Inc, for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1989. Toxicological Profile for Ethylbenzene - Draft. Prepared by Clement Associates for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1989. Toxicological Profile for Naphthalene/2-methynaphthalene - Draft. Prepared by Life Systems, Inc, for the US Department of Health and Human Services.

REFERENCES FOR TERRESTRIAL REFERENCE VALUES

Agency for Toxic Substances and Disease Registry (ASTDR). 1989. Toxicological Profile for Polycyclic Aromatic Hydrocarbons - Draft. Prepared by Clement Associates for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1989. Toxicological Profile for Silver - Draft. Prepared by Clement Associates for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1989. Toxicological Profile for 1,1-Dichloroethane - Draft. Prepared by Clement Associates for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1989. Toxicological Profile for 1,2-Dichloroethane. Prepared by Clement Associates for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1989. Toxicological Profile for 1,1-Dichloroethene. Prepared by Clement Associates for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1989. Toxicological Profile for Trichloroethylene. Prepared by Syracuse Research Corporation for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1988. Toxicological Profile for Mercury - Draft. Prepared by Clement Associates for the US Department of Health and Human Services

Agency for Toxic Substances and Disease Registry (ASTDR). 1988. Toxicological Profile for 1,1,2-Trichloroethane - Draft. Prepared by Clement Associates for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1988. Toxicological Profile for 1,1,1-Trichloroethane - Draft. Prepared by Syracuse Research Corporation for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1988. Toxicological Profile for Alpha, Beta, and gamma Isomers of Hexachlorocyclohexane - Draft. Prepared by Clement Associates for the US Department of Health and Human Services.

Alumot, E., E. Nachtomi, E. Mandel, et.al., 1976. "Tolerance and Acceptable Daily Intake of Chlorinated Fumigants in the Rat Diet". Food Cosmet. Toxicol. 14:105-110. Cited in ASTDR, 1989 (1,2-Dichloroethane).

Ambrose, A.M., D.S. Larson, J.R. Borzelleca and G.R. Hennigar, Jr. 1976. "Long-Term Toxologic Assessment of Nickel in Rats and Dogs". J. Food Science Technology. 13:181-187. Cited in IRIS, Accessed January 1995 (Nickel).

REFERENCES FOR TERRESTRIAL REFERENCE VALUES

Agency for Toxic Substances and Disease Registry (ASTDR). 1989. Toxicological Profile for Polycyclic Aromatic Hydrocarbons - Draft. Prepared by Clement Associates for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1989. Toxicological Profile for Silver - Draft. Prepared by Clement Associates for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1989. Toxicological Profile for 1,1-Dichloroethane - Draft. Prepared by Clement Associates for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1989. Toxicological Profile for 1,2-Dichloroethane. Prepared by Clement Associates for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1989. Toxicological Profile for 1,1-Dichloroethene. Prepared by Clement Associates for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1989. Toxicological Profile for Trichloroethylene. Prepared by Syracuse Research Corporation for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1988. Toxicological Profile for Mercury - Draft. Prepared by Clement Associates for the US Department of Health and Human Services

Agency for Toxic Substances and Disease Registry (ASTDR). 1988. Toxicological Profile for 1,1,2-Trichloroethane - Draft. Prepared by Clement Associates for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1988. Toxicological Profile for 1,1,1-Trichloroethane - Draft. Prepared by Syracuse Research Corporation for the US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ASTDR). 1988. Toxicological Profile for Alpha, Beta, and gamma Isomers of Hexachlorocyclohexane - Draft. Prepared by Clement Associates for the US Department of Health and Human Services.

Alumot, E., E. Nachtomi, E. Mandel, et.al., 1976. "Tolerance and Acceptable Daily Intake of Chlorinated Fumigants in the Rat Diet". Food Cosmet. Toxicol. 14:105-110. Cited in ASTDR, 1989 (1,2-Dichloroethane).

Ambrose, A.M., D.S. Larson, J.R. Borzelleca and G.R. Hennigar, Jr. 1976. "Long-Term Toxologic Assessment of Nickel in Rats and Dogs". J. Food Science Technology. 13:181-187. Cited in IRIS, Accessed January 1995 (Nickel).

REFERENCES FOR TERRESTRIAL REFERENCE VALUES

Aulerich, R.J., G.J. Bursian, and A.C. Napolitano. 1990. "Subacute Toxicity of Dietary Heptachlor to Mink (Mustela vison)". Arch. Environ. Contam. Toxicol 19(6):913-916. Cited in ASTDR, 1991 (Heptachlor).

Aulerich, R.J., R.K., Ringer, M.R., Bleavins, et al. 1982. "Effects of Supplemental Dietary Copper on Growth, Reproductive Performance and Kit Survival of Standard Dark Mink and the Acute Toxicity of Copper to Mink". J. Animal Sci. 55:337-343. Cited in ASDTR, 1989 (Copper).

Aulerich, R.J., and R.K., Ringer. 1980. "Toxicity of the Polychlorinated Biphenyl Aroclor-1016 to Mink". Environmental Research Laboratory, Office of Research and Development. Cited in Opresko, et.al., 1994.

Azar, A., H.J. Trochimowicz and M.E. Maxfield. 1973. "Review of Lead Studies in Animals Carried out at Haskell Laboratory - Two Year Feeding Study and Response to Hemorrhage Study". In Barth D., A. Berlin, R. Engel, P. Recht and J. Smeets, Ed. Environmental Health Aspects of Lead: Proceedings International Symposium; October 1972; Amsterdam, The Netherlands. Commission of the European Communities, Luxemberg. p. 199-208. Cited in IRIS, Accessed January 1995 (Lead).

Barnes, D.W., V.M. Sanders, K.L. White Jr., et.al. 1985. "Toxicology of Trans-1,2-Dichloroethylene in the Mouse". Drug. Chem. Toxicol. 8:373-392. Cited in IRIS Accessed After Jan. 1992 (Trans-1,2-Dichloroethylene).

Bleavins, M.R., C.S. Sisodia, and T.K. Mukkur. 1980. "The Effects of Methyl Mercury, Tetrethyl Lead, and Sodium Arsenite on the Humoral Immune Response in Mice". Toxicol. Appl. Pharmacol. 52:245-254. Cited in Opresko et.al., 1994.

Bornhauses, M. M.R. Nusch, and H. Greim. 1980. "Operant Behavior Performance Changes in Rats After Prenatal Methylmercury Exposure". Toxicol. Appl. Pharmacol. Cited in ASTDR, 1988 (Mercury).

Brown, D., K.R. Butterworth, I.F. Gaunt, P. Grasso, S.D. Gangolli. 1978. "Short-Term Oral Toxicity Study of Diethyl Phthalate in the Rat". Food Cosmet. Toxicol. 16:415-422. Cited in IRIS, Oct, 1992.

Bruckner, J.V., K.L. Khanna, and H.H. Cornish. 1974. Effect of Prolonged Ingestion of Polychlorinated Biphenyls on the Rat. Food Cosmet. Toxicol. 12:323. Cited in ASTDR, 1991 (PCBs).

Bruckner, J.V., W.F. MacKenzie, S. Muralidhara, R. Luthra, G.M. Kyle, and D. Acosta. 1986. "Oral Toxicity of Carbon Tetrachloride: Acute, Subacute, and Subchronic Studies in Rats". Fund. Appl. Toxicol. 6(1):16-34.

Buben, J.A., and E.J. O'Flaherty. 1985. "Delineation of the Role of Metabolism in the Hepatotoxicity of Trichloroethylene and Perchloroethylene: A Dose-Effect Study". Toxicol. Appl. Pharmacol. 78:105-122. Cited in ASTDR, 1991 (Tetrachloroethylene).

REFERENCES FOR TERRESTRIAL REFERENCE VALUES

Byrne, J.J., J.P. Carbone, and M.G. Pepe. 1988. "Supression of Serum Adrenal Cortex Hormones by Chronic Low-Dose Polychlorobyphenyl of Polybromobiphenyl Treatments". Arch. Environ. Contam. Toxicol. 17:47-53. Cited in ASTDR, 1991 (PCBs).

Cardy, R.H., W. Lijinski, and P.K. Hildebrant. 1979. "Neoplastic and Nonneoplastic Urinary Bladder Lesions Induced in Fischer 344 rats and B6C3F Hybrid Mice by N-Nitrosodiphenylamine." Ecotoxocol. Environ. Safety 3:29-37.

Carpenter, C.P., C.S. Weil, and H.F. Smyth, 1953. "Chronic Oral Toxicity of Di(2-ethylhexyl)phthalate for Rats and Guinea Pigs". Arch. Indust. Hyg. Occup. Med. 8:21 9-226. Cited in IRIS, Accessed Oct. 1994 (DEHP).

Chang, L.W., S. Yamaguchi, and J.A.W. Dudley. 1974. "Neurological Changes in Cats Following Long-Term Diet of Mercury Contaminated Tuna". Acta. Neuropathol. (Berlin) 27:171-176. Cited in ASTDR, 1988 (Mercury).

Chang, L.W., and H.A. Hartman. 1972. "Ultrastructural Studies of the Nervious System After Mercury Intoxication". Acta. Neuropathol. (Berlin) 20:122-138. Cited in ASTDR, 1988 (Mercury).

CIIT (Chemical Industry Institute of Toxicology). 1984. Ninty-day Inhalation Toxicity Study of Nitrobenzene in F344 Rats and B6C3F1 Mice. Research Triangle Park, NC. FYI-OTS-0874-0333.

Cody, T.E., S. Witherup, L. Hastings, K. Stemmes, and R.T. Christian. 1981. "1,3-Dinitrobenzene: Toxic Effects in Vivo and in Vitro". J. Toxicol. Environ. Health. 7(5): 829-847. Cited in IRIS, March 1995

Cox, G.E., D.E. Bailey, and K. Morgareidge. 1975. "Toxicity Studies in Rats with 2-Butanol Including Growth, Reproduction and Teratologic Observations". Food and Drug Research Laboratories, Inc., Waverly, NY, Report No. 91MR R 1673.

Dahlgren, R.B., R.L. Linder, and C.W. Carlson. 1972. "Polychlorinated Biphenyls: Their Effects on Penned Pheasants". Environ. Health Perspect. 1:89-101. Cited in Opresko et.al., 1994.

Dee, J.C. November, 1991. "Methodology For Assessing Potential Risks To Deer Populations: A Case Study at a Superfund Site". Paper presented at the 1991 Annual Meeting of the Society of Environmental Toxicology and Chemistry. Abstract No. 426.

Dikshith, T.S.S., R.B. Raizada, M.K. Srivastava, and B.S. Kaphalia. 1984. "Response of Rats to Repeated Oral Administration of Endosulfan". Ind. Health. 22:295-304. Cited in ASTDR 1993 (Endosulfan).

Domingo, J.L., J.L. Paternaia, J.M. Llobet, and J. Corbella. 1986. "Effects of Vanadium on Reproduction, Gestation, Parturition and Lactation in Rats upon Oral Administration". Life Sci. 39:819-824. Cited on Opresko et.al., 1994.

REFERENCES FOR TERRESTRIAL REFERENCE VALUES

Dow Chemical Company. 1958. MRID No. 00061912. Available from USEPA, Write to FOI, USEPA, Washington, DC 20460 (Heptachlor Epoxide)

Drinker, K.P., P.K. Thompson, and M. Marsh. 1927. "An Investigation of the Effects of the Long-Continued Ingestion of Zinc, in the Form of Zinc Oxide, by Cats and Dogs, Together with Observations Upon the Excretion and the Storage of Zinc". Am. J. Physiol. 80:31. Cited in NAS, 1980.

Dunning, J.B., 1984. Body Weights of 686 Species of North American Birds. West. Bird Banding Assoc. Monogr. No. 1. Eldon Publ. Co. Cave Crk, AZ. Cited in Opresko, et.al., 1984.

Duer, R.S., M.S. Bercegeay, and L.M. Mayo. 1988. "Acute Exposures to p-Xylene and Toluene Alter Visual Information Processing". Neurotoxicol Teratol 10:147-153. Cited in ASTDR, 1990 (Total Xylenes).

Eisler, R. 1990. Chlordane Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. U.S. Department of the Interior, Fish and Wildlife Service. Biological Report 85(1.21), July 1990.

Eisler, R. 1990. Cyanide Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. U.S. Department of the Interior, Fish and Wildlife Service. Biological Report 85(1.23), July 1991.

FAO/WHO (Food Agriculture Organization/World Health Organization). 1978. "Evaluation of Some Pesticides in Food." Food and Agric, Organ. Plant Production and Protection Paper. Suppl. 10, Rome. Cited in Newell et.al., 1987.

Fitzhugh, O.G., A.A. Nelson, and E.P. Laug et.al. 1950 "Chronic Oral Toxicies of Mercuri-Phenyl and Mercuric Salts". Arch. Ind. Hyg. Med. 2:433-442. Cited in ASTDR, 1989 (Mercury).

Fitzhugh, O.G., 1948. "Use of DDT Insecticides on Food Products". Ind. Eng. Chem. 40:704-705.

Formigli, L., R. Scelsi, P. Poggi, C. Gregotti, A. DiNucci, E. Sabbioni, L. Gottardi, and L. Manzo. 1986. "Thallium-Induced Testicular Toxicity in the Rat". Environ. Res. 40:531-539.

Ford, K.L., F.M. Applehans, and R. Ober. 1991. "Development of Toxicity Reference Values for Terrestrial Wildlife". In HMC-Northeast '91 Conference Proceedings, Sponserec by the Hazardous Materials Control Research Institute. July 10-12, 1991.

Fucik, K.W., H.W. Armstrong, and J.M. Neff. 1977. "The Uptake of Napthalenes by the Clam Rangia cuneata, in the Vicinity of an Oil-Separator Platform in Trinity Bay, Texas". Proc. 1977 Oil Spill Conference. Washington DC: American Petroleum Institute. Cited in USEPA, 1981.

Gasaway, W.C., and I.O. Buss. 1972. "Zinc Toxicity in the Mallard". J. Widl. Manage. 36: 1107-1117.

Gerhart, J.M. 1986. "Ninety-day Oral Toxicity Study of Copoper Cyanide (CuCN) in Sprague-Dawley Rats". Prepared for the Dynamac Coporation, Rockville, MD by IIT Research Institute, Chicago, IL. IITRI Project No. LO6183, Study No. 3. Cited in ASTDR, 1991 (Cyanide).

REFERENCES FOR TERRESTRIAL REFERENCE VALUES

Gomez, G., M.A. Aparicio, and C.C. Willhite. 1988. "Relationship Between Dietary Cassave Cyanide Levels and Broiler Performance". Nutr. Rep. Int. 37:63-75. Cited in Eisler, 1991 (Cyanide).

Gomez, G., M. Valdivieso, J. Santos, and C. Hoyos. 1983. "Evaluation of Cassava Root Meal Prepared from Low- or High-Cyanide Containing Cultivars in Pig and Broiler Diets." Nutr. Rep. Int. 28:693-704. Cited in Eisler, 1991 (Cyanide).

Good, E.E., and G.W. Ware. 1969. "Effects of Insecticides on Reproduction in the Laboratory Mouse, IV. Endrin and Dieldrin". Toxicol. Appl. Pharmacol. 14:201-203.

Gross, W.G., and V.G. Heller. 1946. "Chromates in Animal Nutrition". J. Ind. Hyg. Toxicol. 28:52-56. Cited in IRIS, Accessed January 1995 (Chromium).

Halverson, A.W., I.S. Palmer and P.L. Guss. 1966. "Toxicity of Selenium to Post-Weanling Rats." Toxicol. Appl. Pharmacol". 9:477-484. Cited in IRIS, Accessed January 1995 (Selenium).

Hardin B.D., G.P. Bond, M.R. Sikor, F.D. Andrew, R.P. Beliles, and R.W. Niemeir. 1981. "Testing of Selected Worlplace Chemicals for Teratogenic Potential". Scand J. Work Environ. Health. 7(Suppl 4):66-75. Cited in HEAST, March 1994.

Harr, J.R., J.F. Bone, Tinsley, I.J., et. al. 1967. "Selenium Toxicity in Rats. II. Histopathology". In; Muth OH, Oldfield J.E., P.H., Weswig, ed. Selenium Biomed Proc 1st Int. Symp. Oregon State Univ. 1966. Vol. II, Westport, Conn: AVI Publishing Co. 153-178. Cited in ASTDR, 1989 (Selenium).

Hazelton Labs. 1988. Subchronic Toxicity Study in Rats with m-Xylene. Report by Hazelton Laboratories America, Inc., Rockville MD for Dyanamic Corporation, Rockville, MD. Unpublished. Cited in ASTDR, 1993 (Total Xylenes).

Health Effects Assessment Summary Tables (HEAST). 1994. USEPA, Office of Solid Waste and Emergency Response. EPA 540/R-94/020.

Heath, R., J. Spann, and J. Kreitzer. 1969. "Marked DDE Impairment of Mallard Reproduction in Controlled Studies". Nature 224:47-48. Cited in Newell, 1987.

Heinz, G.H.., D.J. Hoffman, and L.G. Gold. 1989. "Impaired Reproduction of Mallards Fed and Organic Form of Selenium". J. Wildl. Mgmt. 53: 418-428. Cited in Opresko, et.al., 1994.

Heinz, G.H., D.J. Hoffman, A.J. Krynitsky, and D.M.G. Weller. 1987. "Reproduction in Mallards Fed Selenium". Environ. Toxicol. Chem. 6:423-433.

Heywood, R., R.J. Sortwell, PRB Noel, et. al. 1979. "Safety Evaluation of Toothpaste Containing Chloroform, III. Long-term Study on Beagle Dogs". J. Environ Pathol Toxicol 2:835-851. Cited in ASTDR, 1991 (Chloroform).

Hoechst. 1989. "Endosulfan-Beta - Substance Technical (code HOE 02671 0O ZD96 0002): Testing for Toxicity by Repeated Oral Administration (1-year feeding study) to Beagle Dogs". Conducted by Hoechst Aktiengesellschaft, Frankfurt, Germany. Project No. 87.0643. Cited in ASTDR, 1993 (Endosulfan).

REFERENCES FOR TERRESTRIAL REFERENCE VALUES

Howard, J.W., and R.F. Hanzal. 1955. "Chronic Toxicity for Rats of Food Treated with Hydrogen Cyanide". J. Agric. Food. Chem. 3:325-329.

Huff, J.E., J.K. Haseman, and D.M. DeMarini, et.al. 1989. "Multiple-Site Carcinogenicity of Benzene in Fischer 344 Rats and B6C3F1 Mice". Environ. Health. Perspect. 82:125-163. Cited in ASTDR, 1991 (Benzene).

Hulzebos, E.M., D.M.M. Adema, E.M. Dirven-van Breemen, L. Henzen, W.A. van Dis, H.A. Herbold, J.A. Hoekstra, R. Baerselman, and C.A.M van Genstel. 1993. "Phytotoxicity Studies with Lactuca sative in Soil and Nutrient Solution". Environmental Toxicology and Chemistry, 12:1079-1094.

IT Corporation. November, 1992. Baseline Risk Assessment, Weldon Springs Ordanance Works, Weldon Spring, Missouri. Prepared for the Department of Army Corps of Engineers, Kansas City District.

Ito N., H. Nagasaki, H. Aoe, et.al. 1975. "Development of Heptocellular Carcinomas in Rats Treated with Benzene Hexachloride". JNCI 54:801-805. Cited in ASTDR, 1988 (BHC).

Izushi F., and M. Ogata. 1990. "Hepatic and Muscle Injuries in Mice Treated with Heptachlor". Toxicol. Lett. 54:47-54.

Jeter, M.A., and G.K. Davis. 1954. "The Effects of Dietary Molybdenum Upon Growth, Hemoglibin, Reproduction, and Lactation in Rats." J. Nutr. 54:215-220. Cited in IRIS, August 1995

Jorgenson, T.A., E.F. Meierhenry, and C.J. Rushbrook, et.al. 1985. "Carcinogenicity of Chloroform in Drinking Water to Male Osborne-Mendel Rats and Female B6C3F$_1$ Mice". Fundam. Appl. Toxicol 5:760-769. Cited in ASTDR 1991 (Chloroform).

Kopp S.J., T. Glonek, H.M. Perry Jr. et.al., 1982. "Cardiovascular Actions of Cadmium at Environmental Exposure Levels." Science 217:837-839. Cited in ASTDR, 1991 (Cadmium).

Lamb, J.C., IV, R.E. Chapin, J. Teague, A.D. Lawton, and J.R. Reel. 1987. "Reproductive Effects of Four Phthalic Acid Esters in the Mouse". Toxicol. Appl. Pharmacol. 88:255-269.

Lane, R.W., B.L. Riddle, and J.F. Borzelleca. 1982. "Effects of 1,2-Dichloroethane and 1,1,1-Trichloroethane in Drinking Water on Reproduction and Development in Mice". Toxicol. Appl. Pharmacol. 63:409-421.

Lang, E.P., A.A. Nelson, O.G. Fitzhugh, and F.M. Kunze. 1950. "Liver Cell Alteration and DDT Storage in the Fat of the Rat Induced by Dietary Levels of 1-50 ppm DDT". J. Pharmacol. Exp. Thearp. 98:268-273. Cited in IRIS, Oct. 1994.

Laskey, J.W., G.L. Rehnberg, J.F. Hein, and S.D. Carter. 1982. "Effects of Chronic Manganese (MN_3O_4) Exposure on Selected Reproductive Parameters in Rats.: J. Toxicol. Environ. Health. 9:677-687. Cited in Opresko et.al., 1994.

REFERENCES FOR TERRESTRIAL REFERENCE VALUES

Lee, C.C. et.al., 1976. Mammalian Toxicity of Munition Compounds, Phase II. Effects of Multiple Doses. Part III: 2,6-Dinitrotoluene." U.S. Army Medical Research and Development Command, Fort Detric, MD. Cited in HEAST, March 1994

Linder, R.E., T.B. Gaines, and R.D. Kimbrough. 1974. "The Effect of Polychlorinated Biphenyls on Rat Reproduction". Food Cosmet. Toxicol. 12:63-77. Cited in ASTDR, 1991 (PCBs).

Loser E and D. Lorke. 1977. "Semichronic Oral Toxicity of Cadmium. I. Studies on Rats". Toxicology 7:215-224. Cited in ASTDR, 1992 (Cadmium).

MacKenzie, R.D., R.U. Byerrum, C.F. Decker, C.A. Hoppert and R.F. Langham. 1958. "Chronic Toxicity Studies. II. Hexavalent and Trivalent Chromium Administered in Drinking Water to Rats". Am. Med. Assoc. Arch. Ind. Health. 18:232-234. Cited in Chromium IRIS, Accessed January 1995.

MacKenzie, K.M., and D.M. Angevine. 1981. "Infertility in Mice Exposed in Utero to Benzo(a)pyrene. Biol". Reprod. 24:183-191. Cited in ASTDR, 1989 (PAHs).

McCauley, P.T., M. Robinson, L.W. Condie, et.al. Undated. "The Effects of Subacute and Subchronic Oral Exposure To Cis-1,2-Dichloroethylene in Rats. Health Effects Research Laboratory, USEPA, Cincinnati, Ohio. Cited in HEAST, March 1994.

McLane, M.A.R., and D.L. Hughes. 1980. "Reproductive Success of Screech Owls Fed Aroclor-1248". Arch Environ. Contam. Toxicol. 9:661-665. Cited in Opresko et.al., 1994.

Massie H.R., and V.R. Aiello. 1984. "Excessive Intake of Copper: Influence on Longevity and Cadmium Accumulation in Mice". Mech. Ageing. Dev. 26:195-203. Cited in ASTDR, 1989 (Copper).

National Academy of Sciences (NAS). 1980. Mineral Tolerance of Domestic Animals. National Research Council, Commission on Natural Resources, Committee on Animan Nutrition.

National Coffee Association (NCA). 1982. "24-Month Chronic Toxicity and Oncogenecity Study of Methylene Chloride in Rats". Final report. Prepared by Hazelton Labs. America, Inc., Vienna, VA (Unpublished), Cited in IRIS, Oct. 1994.

National Research Council of Canada (NRCC). 1975. Chlordane: its Effects on Canadian Ecosystems and its Chemistry. Nat. Res. Counc. Can. Publ. NRCC 14094. Cited in Eisler, 1990 (Chlordane).

Nawrot, P.S. and R.E. Staples. 1979. "Embryofetal Toxicity and Teratogenecity of Benzene and Toluene in the Mouse". Teratology, 19:41A

NCI. 1979. Bioassay of N-Nitrosodiphenylamine for Possible Carcinogenicity. Betheseda, MD: US Dept. of Health, Education, and Welfare, Public Health Service, National Institute of Health, National Cancer Institute. Division of Cancer Cause and Prevention. DHEW Publ (NIH) 79-1720. Cited in ASTDR, 1991 (N-Nitrosodiphenylamine).

NCI. 1978a. Bioassay of Technical-Grade Endrin for Possible Carcinogenicity. Betheseda, MD: National Cancer Institute. Division of Cancer Cause and Prevention. NCI-CG-TR 12. Cited in ASTDR, 1990 (Endrin).

REFERENCES FOR TERRESTRIAL REFERENCE VALUES

NCI. 1978b. Bioassay of 1,1,2,2-Tetrachloroethane for Possible Carcinogenicity. Betheseda, MD: National Cancer Institute. Division of Cancer Cause and Prevention. NTIS PB277, 4537GA, DHEW/PUB/NIH-78-827. Cited in ASTDR, 1994 (Endrin).

NCI. 1977. Bioassay of Heptachlor of Possible Carcinogenicity. CAS No. 76-44-8. Technical Report Series 9. Betheseda, MD: U.S. Department of Health, Education, and Welfare, National Institute of Health, National Cancer Institute. DHEW Publication (NIH) 77-809. Cited in ASTDR, 1991 (Heptachlor).

Nebeker, A.V., W.L. Griffis, T.W. Stutzman, G.S. Schuytema, L.A. Carey, and S.M. Scherer. 1992. "Effects of Aqueous and Dietary Exposure of Dieldrin on Survival, Growth and Bioconcentration in Mallard Ducklings". USEPA, Corvallis Environmental Research Laboratory. Environ. Chem. and Toxicol. 11:987-699.

Newell, A.J., D.W. Johnson, and L.A. Allen. 1987. Niagara River Biota Contamination Project: Fish Flesh Criteria for Piscivorous Wildlife. Division of Fish and Wildlife, Burear of Environmental Protection, NY Department of Environmental Conservation. Technical Report 87-3.

NTP. 1989. Toxicology and Carcinogenesis Studies of Toluene in F344/N Rats and B6C3F1 Mice. Technical Report Series No. 371. Research Triangle Park, NC. Cited in IRIS Accessed Oct. 1994. (Toluene).

NTP. 1988. Developmental Toxicity Evaluation of 1,1,1-Trichloroethane (CAS No. 71-55-6) Administered to CD Rats. Final report Part 1. National Toxicology Program, Research Triangle Park, NC. Cited in ASTDR, 1988 (1,1,1-Trichloroethane).

NTP. 1986a. NTP Technical Report on the Toxicological and Carcinogenesis of Xylenes (mixed) (60.2% m-Xylene, 13.6% p-Xylene, 17.0% Ethylbenzene, and 9.1% o-Xylene) in F344/N Rats and B6C3F1 Mice (Gavage Studies). US Department of Health and Human Services, National Institutes of Health, National Toxicology Program, Research Triangle Park, NC., NTP TR 327, NIH Publ. No 86-2583. Cited in IRIS Accessed Oct. 1994.

NTP. 1986b. NTP Technical Report Series No. 289. Toxicology and Carcinogenesis Studies of Benzene in F344/N Rats and B6C3F1 Mice (Gavage Studies). US Department of Health and Human Services, National Institutes of Health, National Toxicology Program, Research Triangle Park, NC., NIH Publ. No 86-2545. Cited in ASTDR, 1991 (Benzene).

NTP. 1985a. Trichloroethylene Reproduction and Fertility Assessment in CD-1 Mice when Administered in the Feed. National Toxicology Program, Department of Health and Human Services, National Institutes of Health, Bethesada, MD. Cited in ASTDR, 1989 (Trichloroethylene).

NTP. 1985b. Twenty-Six Week Subchronic Study and Modified Mating Trial in F344 Rats. Butyl Benzyl Phthalate. Final Report. Project No. 12307-02, -03. Hazelton Laboratories America, Inc. Unpublished Study. Cited in IRIS, Oct. 1992.

REFERENCES FOR TERRESTRIAL REFERENCE VALUES

NTP. 1983a. Teratologic Evaluation of Phenol in CD Rats. Report Prepared by Research Triangle Institute, Research Triangle Park, NC. NTIS PB83-247726. Govt. Rep. Announce Index. 83(25):6247. Cited in HEAST, March 1994.

NTP. 1983b. Carcinogenic Studies of 1,1,1,2-Tetrachloroethane in F344/N Rats and B6C3F1 Mice. National Toxicology Program, Cited in HEAST, March 1994.

O'Dell, G.O., W.J. Miller, S.L. Moore, W.A. King, J.C. Ellers, and H. Jurecek. 1971. "Effect of Dietary Nickel Level on Excretion and Nickel Content of Tissues in Male Calves." Journal of Animal Science, 32:769-733. Cited in IT, 1992.

Ondreicka, R.E., E. Ginter, and J. Kortus. 1966. Chronic Toxicity of Aluminum in rats and Mice and its Effects on Phosphorus Metabolism." Brit. J. Indust. Med. 23:305-313. Cited in Opresko et.al., 1994.

Opresko, D.M., B.E. Sample, and G.W. Suter II. 1994. Toxicological Benchmarks for Wildlife, 1994 Revisions. Prepared for the US Department of Energy, Office of Environmental Restoration and Waste Management. September, 1994. ES/ER/TM-86/R1.

Pattee, O.H., 1984. "Eggshell Thickness and Reproduction in American Kestrals Exposed to Chronic Dietary Lead". Arch. Environ. Contam. Toxicol. 13:29-34.

Peakall, D.B., 1974. "Effects of di-N-butylphthalate and di-2-ethylhexylphthalate on the Eggs of Ring Doves". Bull. Environ. Contam. Toxicol. 12:698-702.

Piekacz, H. 1971. Effect of Dioctyl and Dibutyl Phthalates on the Organism of Rats after Oral Administration in Prolonged Experiment. II. Subacute and Chronic Toxicity. Rocz Panstw Zakl HIG 22(3):295-307. Cited in HEAST, November 1994.

Quast J.F., C.G. Humiston, C.E. Wade, et.al. 1983. "A Chronic Toxicity and Oncogenecity Study in Rats and Subchronic Toxicity Study in Dogs on Ingested Vinylidene Chloride". Fundam Appl. Toxicol 3(1):55-62. Cited in ASTDR, 1989 (1,1-Dichloroethene).

Ringer, R. 1983. "Toxicology of PCBs in Mink and Ferrets". In. F. D'Itri and M Kamrin (eds.), PCBs: Human and Environmental Hazards. Butterworth Pul., Woburn, MA. pp. 227-240. Cited in Newell et. al. 1987.

Roesijadi, G., J.W. Anderson, and J.W. Blaylock. "Uptake of Hydrocarbons from Marine Sediments Contaminated with Prudhoe Bay Crude Oil: Influence of Feeding Type of Test Species and Availability of Polycyclic Aromatic Hydrocarbons." J. Fish. Res. Board. Can. 35:608-614. Cited in USEPA, 1981.

Rogers, A.E. 1979. Nutrition. In:The Laboratory Rat, Volume I: Biology and Diseases, H.J. Baker, J.R. Lindsey and S.H. Weisbroth, Ed. Academic Press, New York. Cited in Manganese IRIS, Accessed January 1995.

Rosenfeld, I., and O.A. Beath. 1964. Selenium: Geobotany, Biochemistry, Toxicity and Nutrition. Academic Press, New York. p. 198-208.

REFERENCES FOR TERRESTRIAL REFERENCE VALUES

Rungby, J., and G. Danscher. 1984. "Hypoactivity in Silver Exposed Mice." Acta. Pharmacol. et Toxicol. 55:398-401. Cited in ASTDR, 1989 (Silver).

Sanders, V.M., K.L. White Jr, G.M. Shopp Jr., and A.E. Munson. 1985. "Humoral and Cell-Mediated Immune Status of Mice Exposed to 1,1,2-Trichloroethane". Drug Chem Toxicol 8:357-372. Cited in IRIS Accessed Oct, 1988 (1,1,2-Trichloroethane).

Schlicker, S.A. and D.H. Cox. 1968. "Maternal Dietary Zinc, and Development and Zinc, Iron, and Copper Contant of the Rat Fetus". J. Nutr. 95:287-294. Cited in Opresko et.al., 1994.

Schlesinger, W.H., and G.L. Potter. 1974. "Lead, Copper, and cadmium Concentrations in Small Mammals in the Hubbard Brook Experimental Forest". OKIOS. 25:148-152. Cited in Opresko et.al., 1994.

Schmal, D. 1955. "The Testing of Naphthalene and Anthracene for Carcinogenic Effects on Rats". Z. Krebsforsch 60:697-710. Cited in ASTDR, 1989 (Naphthalene)

Schroder, H.A. M. Mitchener, and A.P. Nasur. 1976. "Zirconium, Niobium, Antimony, Vanadium, and Lead in Rats". J. Nutr. 100:59-66. Cited in IRIS, Accessed Oct. 1994 (Antimony).

Schroder, H.A. and M. Mitchener. 1975a. "Life-term Effects of Mercury, Methyl Mercury and Nine Other Trace Metals on Mice." J. Nutr. 105:452-458. Cited in IRIS, Accessed January 1995 (Barium).

Schroder, H.A. and M. Mitchener. 1975b. "Life-term Studies in Rats: Effects of Aluminum, Barium, Beryllium and Tungsten." J. Nutr. 105:421-427. Cited in IRIS, Accessed January 1995 (Barium).

Schroder, H.A. and M. Mitchener. 1971. "Toxic Effects of Trace Elements on the Reproduction of Mice and Rats". Arch. Environ. Health 23:102-106. Cited in ASTDR, 1991 (Arsenic).

Schroder, H.A., M. Mitchener, and A.P. Nason. 1970. "Zirconium, Niobium, Antimony, and Lead in Rats: Life-Term Studies." J. Nutr. 100:59-69. Cited in HEAST, March 1994.

Smith, C.C. 1953. "Toxicity of Butyl Sterate, Bibutyl Sebacate, Dubutyl Phthalate, and Methoxyethyl Oleate". Arch. Hyg. Occup. Med. 7:310-318.

Smyth, H. Jr, C.P. Carpenter, C.S. Weil, et.al. 1962. "Range Finding Toxicity Data: List VI". Am. Indust. Hyg. Assoc. J. 23:95-107. Cited in ASTDR, 1989 (Ethylbenzene).

Spann, J.W., G.H. Heinz, and C.S. Hulse. 1986. "Reproduction and Health in Mallards Fed Endrin". Environ. Toxicol. Chem. 5:755-759.

Stickel, L.F., W.H. Stickel, R.A. Dryland, and D.L. Hughes. 1983. "Oxychlordane, HCS-3260, and Nonachlor in Birds: Lethal Residues and Loss Rates". J. Toxicol. Environ. Health. 12:611-622.

Storm, G.L., R.D. Andrews, R.L. Phillips, R.A. Bishop, D.B. Siniff, and J.R. Tester. 1976. "Morphology, Reproduction, Dispersal, and Mortality of Midwestern Red Fox Populations". Wildl. Monogr. Cited in Opresko et.al., 1994.

REFERENCES FOR TERRESTRIAL REFERENCE VALUES

Street J.C., and R.P. Sharma. 1975. "Alteration of Induced Cellular and Humoral Immune responses by Pesticides and Chemicals of Environmental Concern: Quantitative Studies of Immunosuppression by DDT, Aroclor 1254, Carbaryl, Carbofuran, and Methylparathion". Toxicol. Appl. Pharmacol. 32:587-602. Cited in ASTDR, 1991 (PCBs).

Tewe, O.O., and E. Pessu. 1982. "Performance and Nutrient Utilization in Growing Pigs Fed Cassava Peel Rations." Cited in Eisler,

Tewe, O.O., and J.H. Maner. 1981. "Long-Term and Carry-Over Effect of Dietary Inorganic Cyanide (KCN) in the Life Cycle Performance and Metabolism of Rats". Toxicol. Appl. Pharmacol. 58:1-7.

Thomas, P.T., and R.D. Hinsdill. 1980. Perinatal PCB Exposure and ite Effects on the Immune System of Young Rabbits". Drug Chem. Toxicol. 3:173-184. Cited in ASTDR, 1991 (PCBs).

Til, H.P., H.R. Immel, and V.J. Feron. 1983. Lifespan Oral Carcinogenicity Study of Vinyl Chloride in Rats. Final Report. Civo Institutes, TNO, Report No. V-93.285/291099. Cited in ASTDR, 1991 (Vinyl Chloride)

Tinsley, I.J, J.R. Harr, J.F. Bone et.al. 1967. "Selenium Toxicity in Rats. I. Growth and Longetivity". In: Muth OH, Oldfield J.E., P.H., Weswig, ed. Selenium Biomed Proc 1st Int. Symp. Oregon State Univ. 1966. Vol, II, Westport, Conn: AVI Publishing Co. 141-152. Cited in ASTDR, 1994 (Selenium).

Treon, J.F., F.P. Cleveland, and L. Cappel. 1955. "Toxicity of Endrin for Laboratory Animals." Agricultural and Food Chemistry 3:842-848. Cited in ASTDR, 1989 (Endrin)

USDOD. 1985. AD-A171-601. Department of Defense. Available form Defense Technical Center. Write to Documents, Cameron Station, Alexandria, VA, 22314. Cited in IRIS, March, 1995. (HMX)

USDOD. 1983a. AD-A168-637. Department of Defense. Available form Defense Technical Center. Write to Documents, Cameron Station, Alexandria, VA, 22314. Cited in IRIS, March, 1995. (TNT)

USDOD. 1983a. AD-A160-774. Department of Defense. Available form Defense Technical Center. Write to Documents, Cameron Station, Alexandria, VA, 22314. Cited in IRIS, March, 1995. (RDX)

USDOD. 1983b. AD-A157-002. Department of Defense. Available form Defense Technical Center. Write to Documents, Cameron Station, Alexandria, VA, 22314. Cited in IRIS, March, 1995. (TNT)

USEPA, 1993a. Great Lakes Water Quality Initiatives Criteria Documents for the Protection of Wildlife (Proposed). DDT, Mercury, 2,3,7,8-TCDD, PCBs. EPA/822/R-93-007. Office of Science and Technology, Washington, D.C. Cited in Opresko, et.al., 1994.

USEPA, U.S. Environmental Protection Agency. December 1993b. Wildlife Exposure Factors Handbook. Office of Research and Development. Washington, D.C. EPA/600/R-93/187a.

USEPA, 1989a. Mouse Oral Subchronic Study. Conducted by Toxicity Research Labs, LTD. Muskegon, MI. for the Office of Solid Waste. Cited in IRIS, After Jan. 1992.

REFERENCES FOR TERRESTRIAL REFERENCE VALUES

USEPA, 1989b. Mouse Oral Subchronic Study with Acenaphthene. Conducted by Hazelton Laboratory Inc., for the Office of Solid Waste. Cited in IRIS, Sept. 1993.

USEPA, 1989c. Ninty-Day Gavage Study in Albino Mice Using 2,4-Dimethylphenol. Study No. 410-2831. Prepared by Dynamac Corporation, Rockville, MD, for the Office of Solid Waste and Emergency responce, Washington, DC.

USEPA, 1988a. 13-Week Mouse Oral Subchronic Study. Prepared by Toxicity Research Labs, LTD. Muskegon, MI. for the Office of Solid Waste. Cited in IRIS, Jan. 1995.

USEPA, 1988b. Recommendations for and Documentation of Biological Values for Use in Risk Assessment. Environmental Criteria and Assessment Office, Cincinnati, OH. EPA/600/6-87/008. Cited in Opresko, et.al., 1994.

USEPA, 1987. Health and Environmental Effects Document for Chlorinated Cyclopentadienes. Prepared for the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH, for the Office of Solid Waste. Cited in HEAST, March 1994.

USEPA, 1986a. Ninty-day Gavage Study with Albino Rats using Acetone. Office of Solid Waste. Cited in HEAST, March 1994.

USEPA, 1986b. Subchronic (90 day) Toxicity of Thallium(I) Sulfate in Spragu-Dawley Rats. Final Report. Environmental Criteria and Assessment Office, Cincinnati, OH, for the Office of Solid Waste. Cited in HEAST, March 1994.

USEPA, 1981. An Exposure and Risk Assessment for Benzo(a)pyrene and Other Polycyclic Aromatic Hydrocarbons, Volume IV.

USEPA, 1980. Ambient Water Quality Criteria for Cyanides. USEPA. 440/5-80-037. Cited in Eisler, 1991.

U.S. Fish and Wildlife Service. 1964. Pesticide-Wildlife Studies, 1963: A Review of Fish and Wildlife Service Investigations During the Calander Year. FWS Circular 199.

Velsicol Chemical Company. 1969. MRID No. 00030198. Available from USEPA. Write to FOI, USEPA, Washington, DC, 20460. Cited in IRIS, Oct. 1992 (Endrin).

Velsicol Chemical Company. 1955. MRID No. 00062599. Available from USEPA. Write to FOI, USEPA, Washington, DC, 20460. Cited in IRIS, Oct. 1992 (Heptachlor).

Velsicol Chemical Company. 1983. MRID No. 00138591, 00144313. Available from USEPA. Write to FOI, USEPA, Washington, DC, 20460. Cited in IRIS, Oct. 1994 (Chlordane).

Villeneuve D.C., D.L. grant, and W.E.J. Phillips. 1972. "Modification of Pentobarbital Sleeping Times in Rats Following Chronic PCB Ingestion". Bull. Environ. Contam. Toxicol. 7:264-269. Cited in ASTDR, 1991 (PCBs).

REFERENCES FOR TERRESTRIAL REFERENCE VALUES

Vreman, K., N.G. van der Veen, E.J. van der Molen, and W.G. de Ruig. 1986. "Transfer of Cadmium, Lead, Mercury and Arsenic form Feed into Milk and Various Tissues of Dairy Cows: Chemical and Pathological Data". Neth. J. Agricu. Sci. 34:129-144. Cited in Eisler, 1991 (Arsenic).

Walker, A.I.T., D.E. Stevenson, J. Robinson, R. Thorpe, and M. Roberts. 1969. "The Toxicology and Pharmacodynamics of Dieldrin (HEOD): Two-Year Oral Exposure to Rabbits and Dogs". Toxicol. Appl. Pharmacol. 15:345-373.

Wasserman, D. M., M. Cucos, et.al. 1973. "Function of Adrenal Gland-Zona Fasciculata in rats Receiving Polychlorinated Biphenyls". Environ Res. 6:334-338. Cited in ASTDR, 1991 (PCBs).

Wentink, G.H., T.J. Spierenburg, G.J. de Graaf, and A.C.A. van Exsel. 1985. A Case of Chronic Zinc Poisoning in Calves Fed with Zinc-Contaminated Rouphage. Veterinary Quarterly 7:153-157. Cited in Eisler, Ronald. 1990. Zinc Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. U.S. Department of the Interior, Fish and Wildlife Service. Biological Report 85(1.23), July 1991.

Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process. Environmental Sciences Division, Oak Ridge National Laboratory. ES/ER/TM-126.

Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants. Environmental Sciences Division, Oak Ridge National Laboratory. ES/ER/TM-85/RI.

White, D.H., and M.P. Dieter. 1978. "Effects of Dietary Vanadium in Mallard Ducks". J. Toxicol. Environ. Health 4:43-50. Cited in Opresko et.al., 1994.

White K.L. Jr, and V.M. Sanders, D.W. Barnes, et.al. 1985. "Toxicology of 1,1,2-Trichloroethane in the Mouse". Drug Chem Toxicol 8:333-356. Cited in ASTDR, 1988 (1,1,2-Trichloroethane).

White, D.H., and M.T. Finley. 1978. "Uptake and Retention of Dietary Cadmium in Mallard Ducks". Environ. Res. 17:53-59

Wolf, M.A., V.K. Rowe, D.D. McCollister, et.al., 1956. "Toxicological Studies of Certain Alkylated Benzenes and Benzene." AMA Arch. Ind. Health. Cited in IRIS, Accessed Oct. 1992.

World Health Orginization (WHO). 1984. Chlordane. Environmental Health Criteria 34. World Health Orginization, Geneva, Switzerland. Cited in Eisler, Ronald. 1990.

NOTE: Some of the references in this list are not specifically referenced in the proceeding table. This reference list also includes other toxicity values not used in the development of the terrestrial reference values.