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FINAL

REMEDIAL INVESTIGATION REPORT
OPERABLE UNIT NO. 7
(SITES 1, 28, AND 30)

MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

CONTRACT TASK ORDER 0231

JANUARY 19, 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

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

	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

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 SOIL
MCB CAMP LEJEUNE, NORTH CAROLINA
TAL INORGANICS

	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

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

	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

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

	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

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

	MIN	MAX	AVG	2Xaverage
Aluminum	17.7	9570	2104.505	4209.010
Antimony	0.33	8	2.406	4.811
Arsenic	0.065	1.8	0.386	0.772
Barium	0.65	20.8	7.096	14.192
Beryllium	0.03	0.1565	0.108	0.216
Cadmium	0.04	0.58	0.306	0.611
Calcium	4.25	10700	534.460	1068.920
Chromium	0.33	12.5	2.382	4.765
Cobalt	0.185	2.355	1.174	2.348
Copper	0.5	87.2	4.508	9.016
Iron	69.7	9640	1257.337	2514.673
Lead	0.47	142	12.059	24.117
Magnesium	2.55	610	84.698	169.397
Manganese	0.87	16	7.044	14.088
Mercury	0.01	0.08	0.039	0.078
Nickel	0.6	3.55	1.546	3.092
Potassium	1	361	79.682	159.363
Selenium	0.075	0.94	0.370	0.739
Silver	0.0435	4.3	0.480	0.960
Sodium	4.7	126	34.132	68.263
Thallium	0.06	0.565	0.403	0.806
Vanadium	0.305	13.5	3.271	6.541
Zinc	0.3	28.3	4.920	9.839

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

	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
Aluminum	672	857	3620	2970	10200	8520	4580.000
Antimony	4.7	4.85	1.4	1.25	0.355	1.6	4.200
Arsenic	0.31	0.315	0.033	0.305	0.24	0.47	1.100
Barium	2	2.05	7.6	6.5	10.9	6.6	7.500
Beryllium	0.095	0.1	0.03	0.025	0.12	0.23	0.125
Cadmium	0.285	0.295	0.57	0.17	0.6	1.2	0.370
Calcium	5.35	5.4	4410	12.1	81.3	10.6	35.600
Chromium	1.6	1.85	6	2.2	5.7	8.7	10.500
Cobalt	0.65	0.9	0.235	0.175	0.95	1.9	0.495
Copper	0.475	0.6	1.7	0.65	0.95	0.47	6.600
Iron	257	126	456	833	822	2840	4940.000
Lead	1.2	1.6	11.5	2.7	6.1	4.3	5.100
Magnesium	13.1	12.7	133	86.8	188	260	222.000
Manganese	0.475	0.395	7.5	2.6	2.4	5.2	4.100
Mercury	0.01	0.01	0.04	0.015	0.045	0.11	0.025
Nickel	1.6	1.7	0.8	0.7	2.4	4.7	0.850
Potassium	48.9	40.8	84.7	187	123	184	409.000
Selenium	0.5	0.5	0.55	0.5	0.29	0.115	0.495
Silver	0.95	1	0.195	0.175	0.355	0.7	0.600
Sodium	12.7	12.15	13.25	7.25	44.9	31.5	12.850
Thallium	0.205	0.21	0.22	0.2	0.12	0.23	0.495
Vanadium	0.75	1	3	4.7	7.4	13.4	12.200
Zinc	0.475	0.395	11.6	0.9	2.1	1.4	4.700
					0.285	0.57	

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

	1-BB-SB39-04	1-BB-SB39-06	1-GW13-04	1-GW13-08	28-BB-SB37-03	28-BB-SB38-04	28-GW09DW-01	30-BB-SB12-03
Aluminum	6180.000	5980.000	4160.000	6600.000	5170.000	2830.000	5730.000	2970
Antimony	3.250	2.950	6.900	3.200	3.550	3.550	3.750	3.9
Arsenic	0.290	0.260	0.285	0.280	0.315	0.315	1.500	0.34
Barium	11.800	8.600	7.500	8.400	9.700	5.000	11.700	0.8
Beryllium	0.095	0.085	0.095	0.095	0.105	0.105	0.110	0.12
Cadmium	0.290	0.260	0.285	0.280	0.315	0.315	0.330	0.34
Calcium	12.250	19.700	52.400	92.600	23.450	6.850	441.000	7.0
Chromium	5.500	5.300	7.100	8.300	7.300	3.400	4.700	3.9
Cobalt	0.385	0.350	0.380	0.375	0.420	0.420	0.930	0.45
Copper	0.600	0.500	2.100	1.600	0.650	0.650	0.650	0.7
Iron	1510.000	1210.000	567.000	959.000	2090.000	749.000	2780.000	908
Lead	3.800	3.100	3.300	4.000	4.100	2.300	7.400	0.7
Magnesium	189.000	217.000	131.000	262.000	153.000	66.000	157.000	24.7
Manganese	4.900	5.400	2.000	4.500	3.200	1.500	5.300	1.7
Mercury	0.025	0.020	0.050	0.025	0.025	0.025	0.025	0.03
Nickel	2.300	0.600	0.650	0.650	0.750	0.750	1.000	0.8
Potassium	191.000	268.000	98.100	308.000	122.000	91.300	136.000	13.2
Selenium	0.385	0.350	0.380	0.375	0.420	0.420	0.440	0.45
Silver	0.480	0.435	0.475	0.470	0.500	0.550	0.550	0.6
Sodium	21.600	9.200	9.600	10.900	33.800	28.600	20.300	12.5
Thallium	0.385	0.350	0.380	0.375	0.420	0.420	0.440	0.45
Vanadium	6.500	6.100	3.500	10.100	6.400	2.800	8.500	6.2
Zinc	2.900	2.400	1.000	2.700	1.900	0.970	4.200	0.35

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

	30-BB-SB13-01	30-BB-SB14-01	30-BB-SB15-01	30-BB-SB16-02	30-GW03-01	35-GWDS01-03
Aluminum	17.1	25.7	42.6	777	16.9	2910.0
Antimony	3.1	3.6	3.6	3.4	3.9	2.750
Arsenic	0.28	0.32	0.32	0.30	0.34	0.12
Barium	0.7	0.8	0.8	3.5	0.8	5.5
Beryllium	0.09	0.11	0.11	0.10	0.12	0.06
Cadmium	0.28	0.32	0.32	0.30	0.34	0.30
Calcium	6.9	4.8	6.3	116	6.6	456.0
Chromium	0.7	0.8	0.8	0.7	0.8	2.2
Cobalt	0.37	0.42	0.43	0.40	0.46	0.65
Copper	0.6	0.7	0.7	0.6	0.7	0.550
Iron	95.9	155	63.3	514	74.5	442.0
Lead	0.47	1.9	0.91	3.2	0.59	8.10
Magnesium	7.5	2.9	2.9	30.2	3.1	63.5
Manganese	4.3	6.7	1.1	3.7	1.7	5.6
Mercury	0.03	0.08	0.25	0.03	0.68	0.03
Nickel	0.7	0.8	2.2	1.7	0.8	1.050
Potassium	6.3	1.1	21.3	21.9	1.2	145.0
Selenium	0.37	0.42	0.43	0.40	0.46	0.085
Silver	0.46	0.6	0.6	0.50	0.6	0.39
Sodium	11.1	19.3	5.4	14.4	5.8	141.0
Thallium	0.37	0.42	0.43	0.40	0.46	0.06
Vanadium	0.73	1.0	0.84	1.6	0.34	3.00
Zinc	0.32	0.39	1.2	1.7	1.3	2.6

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

	MIN	MAX	AVG	2Xaverage
Aluminum	16.900	10200.000	3563.252	7126.505
Antimony	0.355	6.900	3.317	6.634
Arsenic	0.033	1.500	0.382	0.764
Barium	0.650	11.800	5.648	11.295
Beryllium	0.025	0.230	0.100	0.200
Cadmium	0.170	1.200	0.369	0.738
Calcium	4.750	4410.000	276.762	553.524
Chromium	0.650	10.500	4.186	8.371
Cobalt	0.175	1.900	0.559	1.117
Copper	0.470	6.600	1.076	2.152
Iron	63.300	4940.000	1066.271	2132.543
Lead	0.465	11.500	3.636	7.273
Magnesium	2.850	262.000	105.964	211.929
Manganese	0.395	7.500	3.537	7.073
Mercury	0.010	0.680	0.075	0.150
Nickel	0.600	4.700	1.305	2.610
Potassium	1.050	409.000	119.126	238.252
Selenium	0.085	0.550	0.396	0.792
Silver	0.175	1.000	0.523	1.045
Sodium	5.400	141.000	22.767	45.533
Thallium	0.060	0.495	0.335	0.669
Vanadium	0.340	13.400	4.765	9.530
Zinc	0.320	11.600	2.162	4.323

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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

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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

Well Number	NCWQS	FEDERAL MCL	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
			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		

Well Number	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
	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	2.6	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	1.2	2.5	34.4	1.6	5.3	7.1	6.9 J
Manganese	0.40 - 8	NA	NA	4.3 J	4.1	ND	1.8 B	3	11.5	ND	3.7 J	9.5	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	9.3	NA	NA	NA	NA	3.6	11.2	3.3	6.7	5.6 J	10 J
Copper	ND	ND	NA	NA	NA	NA	3.7	22.3	3.4	ND	6.2 J	25.4 J
Lead	4.6 J	6.2 J	NA	NA	NA	NA	4.8	110	9.5	6.1	5.5	10.7
Manganese	4.7	8.4 J	NA	NA	NA	NA	3.7	75.9	31.2	5.2	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	7.3	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.
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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	1.3	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	4.7	6.8	1.7	18.5	9.7	2.6	3
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	2.5	1.7	3.7	4.3	1.1	4.5 J	2.6 J	2.7	4.3
Manganese	41	7	4.9	18.8	3.5	6.9	4	1.2	9.7	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	1.5	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	
Units	"Clean" mg/kg	"Contaminated" mg/kg	"Clean" mg/kg	"Contaminated" mg/kg	"Clean" mg/kg	"Contaminated" 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.

Figures

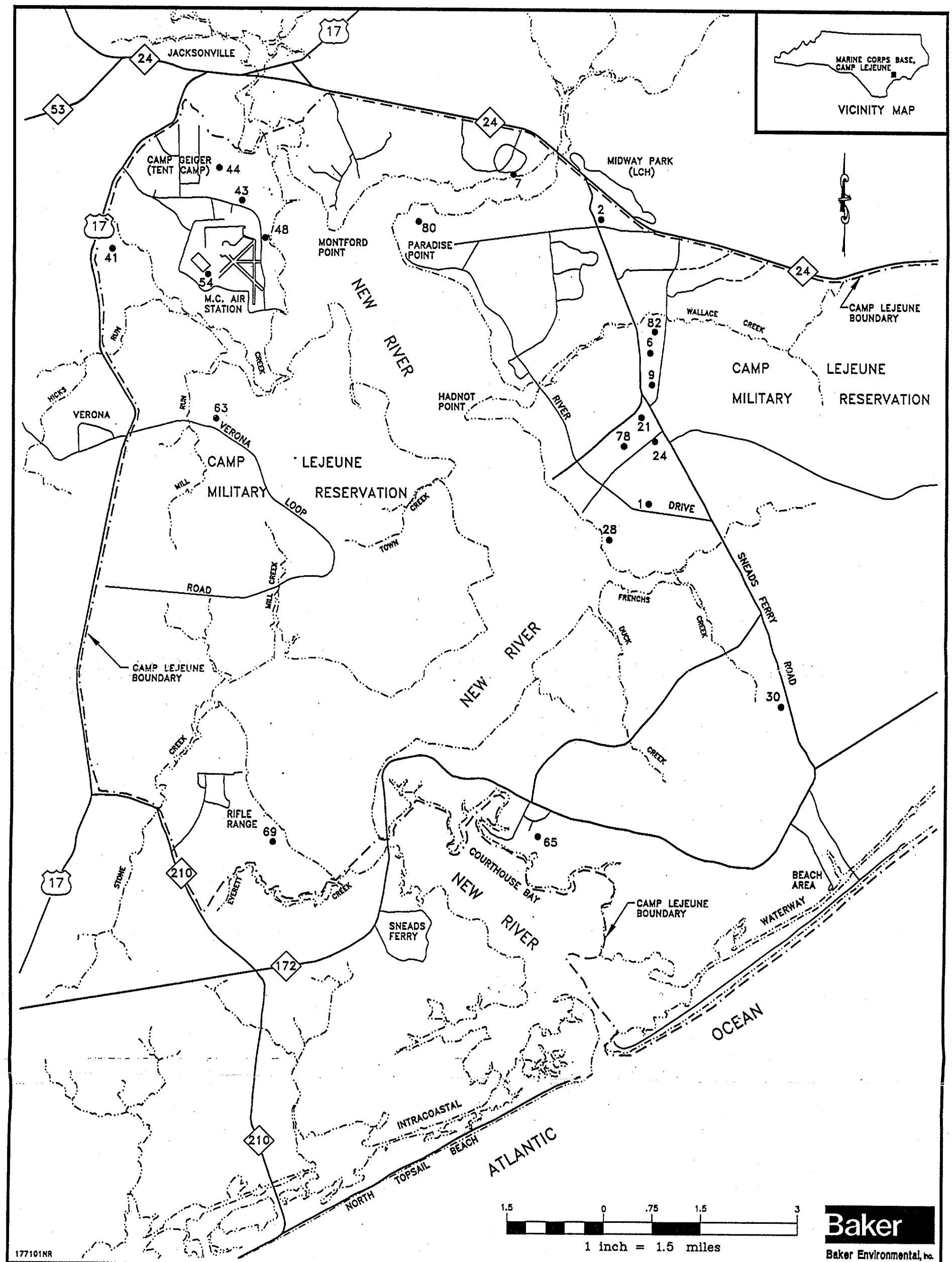
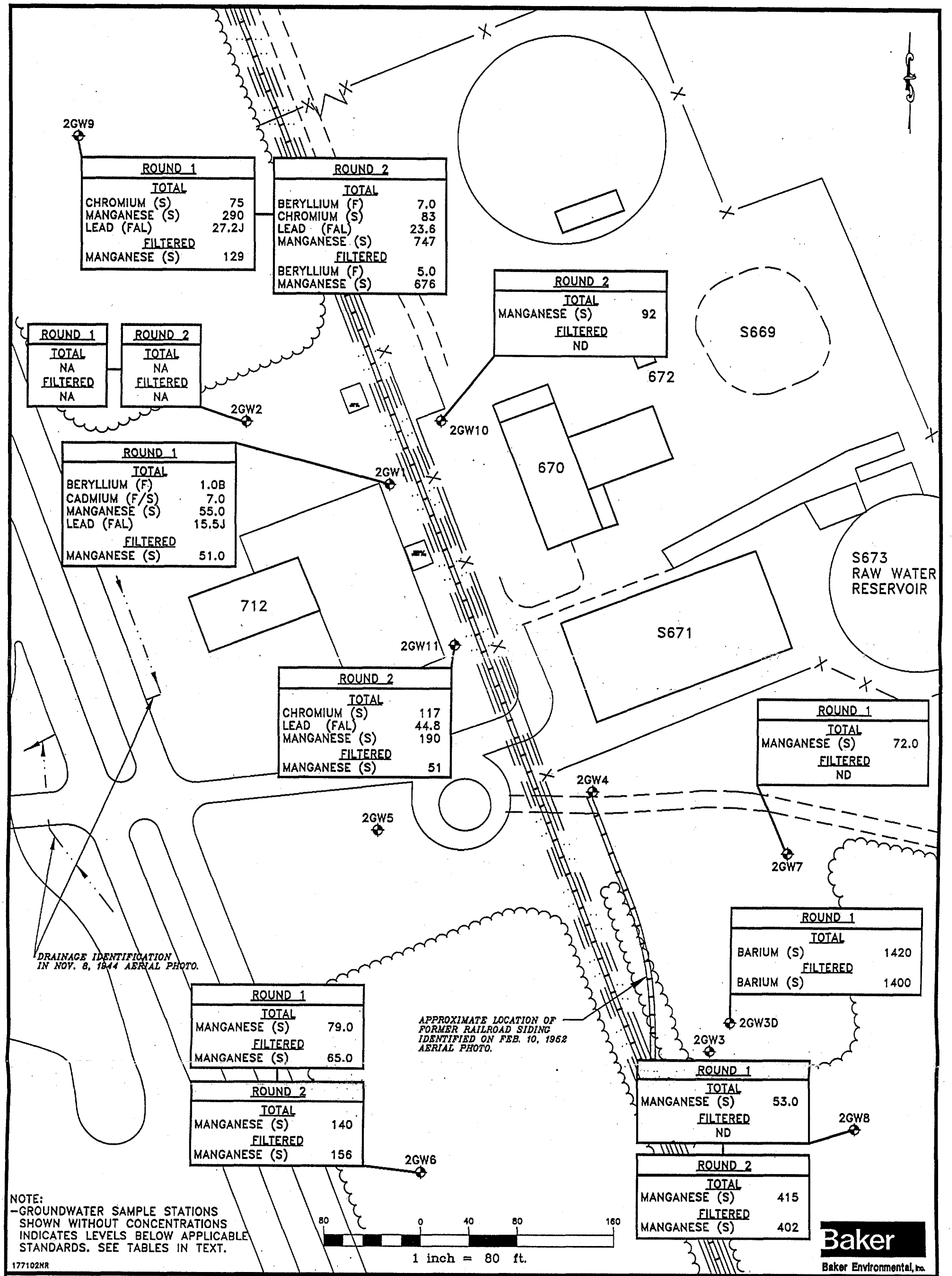


FIGURE 1
SITE LOCATION MAP
INORGANIC GROUNDWATER STUDY

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

01508TB1Z

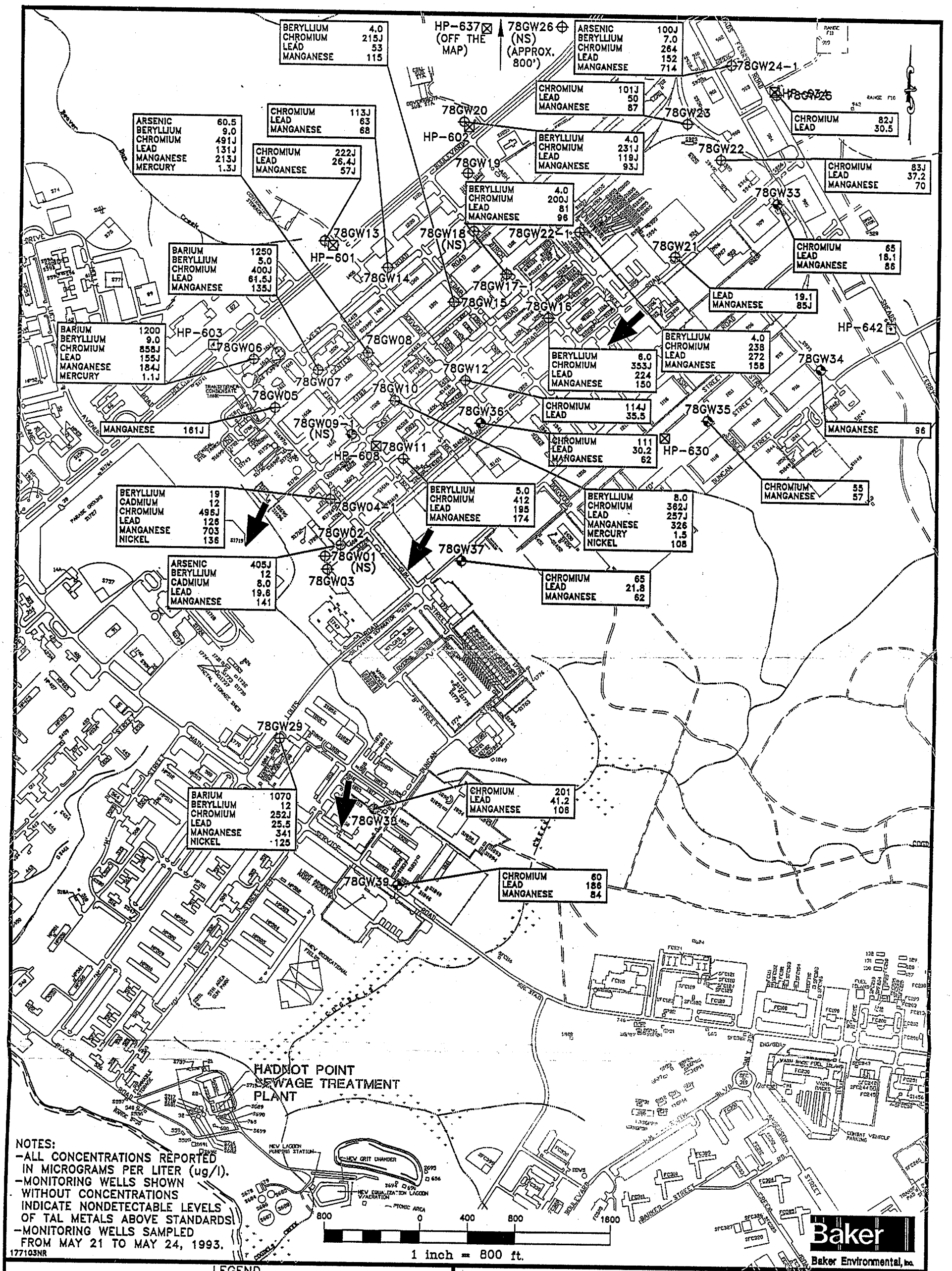


LEGEND

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.

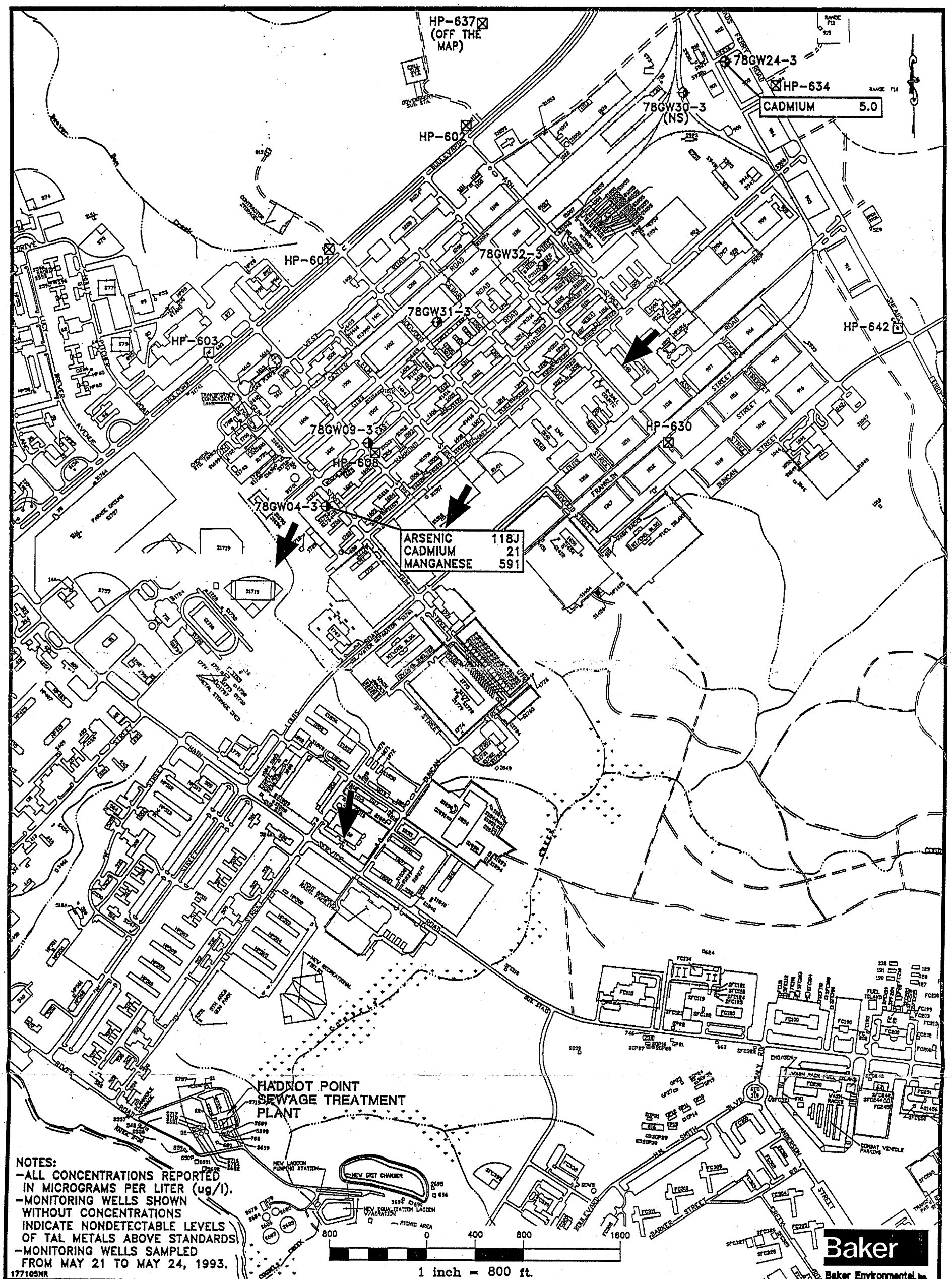
177103NR

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



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

Appendix A
Data Summary Tables for Sites 2 and 78

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-GW01-01	21-GW02-01	21-GW03-01	21-GW04-01	21-GW0A-01	21-GW0B-01
UNITS	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
ALUMINUM	4910 J	319000 J	4820 J	20100 J	16900 J	118000 J
ANTIMONY	7 UJ	7 U	7 U	7 U	7 R	7 U
ARSENIC	15	10	2 U	11.8	45.2 J	30.4
BARIUM	32 B	647	51 B	119 B	100 B	386
BERYLLIUM	1 B	5	1 B	1 B	1 B	6
CADMIUM	5 U	10 U	5 U	5 U	5 U	10 U
CALCIUM	63000 J	24100 J	6130 J	21700 J	23800	6250 J
CHROMIUM	10 UJ	348 J	10 UJ	33 J	21 J	192 J
COBALT	8 U	18 B	8 U	10 B	8 U	36 B
COPPER	4 B	79	7 B	28	24 B	38
IRON	9920 J	122000 J	13400 J	24900 J	38900 J	72900 J
LEAD	1.8 UJ	214 J	4.9 UJ	33 J	29	2000 J
MAGNESIUM	5070	15400	4550 B	5490	4850 B	11600
MANGANESE	64 J	179 J	134 J	193 J	59	276 J
MERCURY	0.2 R	2.4 J	0.2 R	0.2 R	0.2 U	0.2 R
NICKEL	20 U	86	20 U	20 U	20 U	60
POTASSIUM	2390 B	10500	2240 B	3800 B	2360 B	9520
SELENIUM	1 U	11 J	1 U	1 U	1 UJ	3.7 J
SILVER	3 U	3 U	3 U	3 U	3 UJ	3 U
SODIUM	15700	12600	7950	14400	12600	14400
THALLIUM	1 U	1 UJ	1 U	1 UJ	1 UJ	1 U
VANADIUM	30 B	281	11 B	42 B	48 B	243
ZINC	65 J	136 J	27 J	57 J	41 J	175 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.	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					

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.	24-GW07-01	24-GW08-01	24-GW09-01	24-GW10-01	78-GW02-01	78-GW03-01
UNITS	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
ALUMINUM	36000	61100	12800	23300	29200 J	23900 J
ANTIMONY	3 U	3 U	3.3 B	5.7 B	169 J	38.5 J
ARSENIC	3.7 J	8 J	4.3 J	2.5 J	405 J	5.7 J
BARIUM	85 B	112 B	164 B	59 B	109 B	36 B
BERYLLIUM	1 B	2 B	1 B	1 U	12	2 B
CADMIUM	5 U	5 U	5 U	5 U	8	5 U
CALCIUM	4960 B	27000	9530	3820 B	37000	32900
CHROMIUM	37	85	19	21	18 J	10 UJ
COBALT	8 U	8 U	11 B	8 U	8 U	8 U
COPPER	19 B	24 B	11 B	13 B	20 B	8 B
IRON	13700	27500	13100	7010	427000 J	5020 J
LEAD	11.4	23.8	5.1	7.3	19.6	3.4
MAGNESIUM	2670 B	5050	7630	1760 B	3650 B	2210 B
MANGANESE	39	47	180	29	141	27
MERCURY	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
NICKEL	20 U	20 U	20 U	20 U	20 U	20 U
POTASSIUM	3870 B	5580	4280 B	2620 B	2770 B	1320 B
SELENIUM	2.1 J	1.9 J	2.6 J	1 UJ	19.8 J	2.4 J
SILVER	3 UJ	3 UJ	3 UJ	3 UJ	15 UJ	3 UJ
SODIUM	6520	6550	6010	6650	5120	4270 B
THALLIUM	1 U	1 U	1 U	1 U	1 UJ	1 UJ
VANADIUM	64	129	26 B	34 B	1660	50
ZINC	41	47	50	20	58 J	12 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-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-GW08-01	78-GW09-2-01	78-GW09-3-01	78-GW10-01	78-GW11-01	78-GW12-01
UNITS	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
ALUMINUM	483000 J	68 J	2710 J	404000 J	332000	108000 J
ANTIMONY	7 U	7 R	7 R	7 R	7 R	7 R
ARSENIC	60.5	2 R	2 R	43 J	10 R	9.6 J
BARIUM	740	27 B	41 B	582	631	155 B
BERYLLIUM	9	1 U	1 B	8	5	2 B
CADMIUM	25 U	5 U	5 U	10 U	25 U	10 U
CALCIUM	28200 J	114000	99100	54400	9130	31200
CHROMIUM	491 J	10 UJ	10 UJ	362 J	412	114 J
COBALT	29 B	8 U	8 U	31 B	8 U	8 U
COPPER	86	4 B	4 B	91	84	30
IRON	138000 J	955 J	99 J	157000 J	120000	26400 J
LEAD	131 J	2 U	2 U	257	195	35.5
MAGNESIUM	18500	2550 B	249 B	17400	15400	7220
MANGANESE	213 J	19	2 U	326	174	47
MERCURY	1.3 J	0.2 U	0.2 U	1.5	0.75	0.2 U
NICKEL	89	20 U	20 U	108	79	20 U
POTASSIUM	14700	1220 B	7820	15800	13000	6090
SELENIUM	25.3	1 UJ	1 UJ	18 J	12 J	3.6 J
SILVER	3 U	3 UJ	5 J	3 UJ	3 U	3 UJ
SODIUM	4710 B	5820	7280	3340 B	3490 B	5420
THALLIUM	1.3 J	1 UJ	1 UJ	1 UJ	1 U	1 UJ
VANADIUM	1700	4 U	9 B	499	526	145
ZINC	200 J	11 J	181 J	217 J	120 J	64 J
CYANIDE	10 U	10 U	10 U	10 U	10 U	10 U

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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-GW19-01	78-GW20-01	78-GW21-01	78-GW22-01	78-GW22-1-01	78-GW22-2-01
UNITS	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
ALUMINUM	4110 J	149000 J	23800 J	78900 J	257000	190000 J
ANTIMONY	7 R	7 U	7 U	14 J	7 R	7 UJ
ARSENIC	3.1 J	30.3	6.3 J	10 J	59.5 J	75.6
BARIUM	101 B	430	382	107 B	411	471
BERYLLIUM	1 B	4 B	2 B	1 B	4 B	12
CADMIUM	5 U	5 U	5 U	10 U	25 U	6
CALCIUM	3700 B	5450 J	32900 J	90100	44500	118000 J
CHROMIUM	10 UJ	231 J	22 J	83 J	238	389 J
COBALT	8 U	35 B	10 B	8 U	8 U	170
COPPER	3 B	61	11 B	34	54	92
IRON	8500 J	101000 J	26400 J	27600 J	62300	140000 J
LEAD	8.3	119 J	19.1 J	37.2	272	360 J
MAGNESIUM	5740	13100	9110	5500	12000	13000
MANGANESE	26	93 J	85 J	70	158	348 J
MERCURY	0.2 U	0.37 J	0.2 R	0.3	0.45	0.2 R
NICKEL	20 U	75	20 U	21 B	99	234
POTASSIUM	2130 B	9100	4100 B	6180	12000	10200
SELENIUM	1 UJ	4.2 B	1.1 B	4.2 J	7.5 J	45
SILVER	3 UJ	3 U	3 U	3 UJ	3 U	3 U
SODIUM	24000	11900	9480	12100	9910	8230
THALLIUM	1 UJ	1.8 B	1 U	1.7 J	1 U	3 B
VANADIUM	9 B	236	86	114	269	547
ZINC	6 J	250 J	108 J	50 J	150 J	967 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-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-GW31-2-01	78-GW31-3-01	78-GW32-2-01	78-GW32-3-01	78-GW33-01	78-GW34-01
UNITS	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
ALUMINUM	110 B	1200	112000 J	539 J	78200	6870
ANTIMONY	7 R	7 R	7 R	7 R	3 U	3 U
ARSENIC	2 R	2 R	21.6 J	2 R	5.6 J	4.4 J
BARIUM	17 B	415	476	42 B	162 B	173 B
BERYLLIUM	1 B	1 B	10	1 B	1 B	1 U
CADMIUM	5 U	5 U	10	5 U	5 U	5 U
CALCIUM	77600	308000	94600	5440	64800	10400
CHROMIUM	10 U	21	215 J	10 UJ	65	10 U
COBALT	8 U	8 U	84	8 U	8 U	8 U
COPPER	3 B	5 B	87	2 U	20 B	11 B
IRON	280	72 B	98500 J	112 J	14900	7250
LEAD	2 U	2 U	146	2 U	18.1	5.5
MAGNESIUM	2200 B	151 B	13700	319 B	7290	2880 B
MANGANESE	8 B	2 B	328	2 U	86	96
MERCURY	0.3	0.2 U	0.3	0.2 U	0.2 U	0.2 U
NICKEL	20 U	20 U	166	20 U	20 B	20 U
POTASSIUM	1640 B	61600	8460	67300	6900	2620 B
SELENIUM	1 R	1.7 J	99.5 J	1 UJ	12.8 J	1 UJ
SILVER	3 U	3 U	3 UJ	3 UJ	3 UJ	3 UJ
SODIUM	10400	26100	7510	42500	7030	4070 B
THALLIUM	1 U	1 UJ	7.3 J	1.3 J	1 U	1 U
VANADIUM	4 J	10 J	462	5 B	74	15 B
ZINC	23 J	10 J	826 J	6 UJ	37	59
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

OPERABLE UNIT 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
TAL METALS AND CYANIDE

SAMPLE NO.	2-GW06-01	2-GW07-01	2-GW08-01	2-GW09-01
UNITS	UG/L	UG/L	UG/L	UG/L
ALUMINUM	13600	8550	6380	56300
ANTIMONY	10 U	10 U	3.5 UJ	10 U
ARSENIC	5.4 B	5.7 B	9.2 B	12.9
BARIUM	173 B	98 B	98 B	328
BERYLLIUM	0.5 U	0.5 U	0.5 U	3 B
CADMIUM	2.5 U	2.5 U	2.5 U	2.5 U
CALCIUM	7940	9350	5710	22100
CHROMIUM	15	15	5 U	75
COBALT	12 B	4 U	4 U	10 B
COPPER	5 B	7 B	6 B	25
IRON	11700	12500	9150	42000
LEAD	6.7 J	8.3 J	1.8 UJ	27.2 J
MAGNESIUM	4120 B	3620 B	2020 B	9980
MANGANESE	79	72	53	290
MERCURY	0.1 U	0.1 U	0.1 U	0.1 U
NICKEL	10 U	10 U	10 U	25 B
POTASSIUM	2570 B	1940 B	1550 B	6610
SELENIUM	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
SODIUM	21900	8180	11800	18300
THALLIUM	0.5 U	0.5 U	0.5 U	0.5 U
VANADIUM	15 B	18 B	12 B	86
ZINC	26	22	27	103
CYANIDE	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						

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-GW06D-01	2-GW07D-01	2-GW08D-01	2-GW09D-01
UNITS	UG/L	UG/L	UG/L	UG/L
ALUMINUM	149 B	43 B	95 B	1230
ANTIMONY	10 U	10 U	3.5 U	10 U
ARSENIC	2.9 B	1 U	7.1 B	1 U
BARIUM	126 B	49 B	62 B	149 B
BERYLLIUM	0.5 U	0.5 U	0.5 U	1 B
CADMIUM	2.5 U	2.5 U	2.5 U	2.5 U
CALCIUM	8080	9590	5800	20800
CHROMIUM	5 U	5 U	5 U	10
COBALT	10 B	8 B	4 U	14 B
COPPER	2 B	5 B	4 B	5 B
IRON	7070	4660	6180	7040
LEAD	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ
MAGNESIUM	3610 B	3060 B	1730 B	6890
MANGANESE	65	48	40	129
MERCURY	0.1 U	0.1 U	0.1 U	0.1 U
NICKEL	10 U	10 U	10 U	10 U
POTASSIUM	1970 B	1490 B	1150 B	2790
SELENIUM	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
SODIUM	22600	8720	12100	17200
THALLIUM	0.5 U	0.5 U	0.5 U	0.5 U
VANADIUM	2 U	2 U	2 U	2 U
ZINC	12 B	13 B	19 B	35
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).

APPENDIX N
WHITE OAK RIVER BASIN REFERENCE STATION

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.

<u>Fish and Shellfish</u>

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

APPENDIX N (CONT.)
BACKGROUND - UPSTREAM
SURFACE WATER - METALS
STATISTICAL SUMMARY OF ANALYTICAL RESULTS

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 LEVE (ug/L)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
Aluminum	692.00	692.00	*+ HC-SW04	333.17	858.66	265385.03	1	3	33%
Barium	9.00	49.00	*+ HM-SW01	25.67	60.76	15294.20	3	3	100%
Calcium	11600.00	27000.00	*+ HC-SW01	17566.67	31499.62	92587.15	3	3	100%
Iron	425.00	746.00	*+ HC-SW01	575.67	847.77	1123.79	3	3	100%
Magnesium	954.00	2830.00	*+ HM-SW01	1744.67	3383.48	22741.37	3	3	100%
Selenium	1.50	1.50	*+ HM-SW01	0.83	1.81	29.24	1	3	33%
Sodium	6090.00	16500.00	*+ HM-SW01	9830.00	19592.11	124185.69	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

APPENDIX N (CONT.)
BACKGROUND - UPSTREAM
SURFACE WATER - PESTICIDES/PCBs
STATISTICAL SUMMARY OF ANALYTICAL RESULTS

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 LEVE (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

APPENDIX N (CONT.)
BACKGROUND - MIDSTREAM
SURFACE WATER - METALS
STATISTICAL SUMMARY OF ANALYTICAL RESULTS

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 LEVE (ug/L)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
Aluminum	535.00	535.00	*+ HM-SW02	270.67	657.22	47743.23	1	3	33%
Barium	20.00	38.00	*+ HM-SW02	29.00	44.17	75.32	3	3	100%
Calcium	36600.00	46900.00	*+ WC-SW02	41233.33	50045.63	52734.83	3	3	100%
Chromium	36.00	36.00	*+ HM-SW02	17.67	44.49	10009.89	1	3	33%
Iron	528.00	660.00	*+ WC-SW02	582.33	698.70	731.17	3	3	100%
Magnesium	29000.00	109000.00	*+ HM-SW02	60933.33	132363.27	2716191.24	3	3	100%
Potassium	10900.00	41100.00	*+ HM-SW02	22166.67	49975.40	1126700.03	3	3	100%
Sodium	202000.00	739000.00	*+ HM-SW02	441333.33	901929.85	17057165.85	3	3	100%

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*+ = 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

APPENDIX N (CONT.)
BACKGROUND - MIDSTREAM
SURFACE WATER - PESTICIDE/PCBs
STATISTICAL SUMMARY OF ANALYTICAL RESULTS

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 LEVE (ug/L)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
Aldrin	0.04	0.04	*+ WC-SW02	0.03	0.04	0.04	1	3	33%

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*+ = 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

APPENDIX N (CONT.)
BACKGROUND - DOWNSTSREAM
SURFACE WATER - METALS
STATISTICAL SUMMARY OF ANALYTICAL RESULTS

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 LEVE (ug/L)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
Arsenic	20.00	20.00	+	HC-SW03	8.13	17.54	334.25	1	4	25%
Barium	20.00	27.00	*+	WC-SW03	24.25	27.89	29.23	4	4	100%
Calcium	40500.00	302000.00	+	HM-SW03	134025.00	269777.00	4658189.53	4	4	100%
Chromium	97.00	158.00	+	HM-SW03	127.50	156.90	176.16	4	4	100%
Iron	291.00	339.00	*+	HC-SW03	317.75	341.11	347.02	4	4	100%
Lead	58.10	58.10	+	HM-SW03	16.41	49.11	3685198.93	1	4	25%
Magnesium	44800.00	754000.00	*+	HM-SW03	511200.00	884281.78	5105380691.44	4	4	100%
Potassium	136000.00	288000.00	+	HM-SW03	207250.00	280542.42	373364.83	4	4	100%
Selenium	6.00	41.00	+	HM-SW03	12.50	35.01	330407465.54	2	4	50%
Silver	37.00	37.00	+	HM-SW03	19.13	33.16	80.27	1	4	25%
Sodium	895000.00	6750000.00	+	HM-SW03	3073750.00	6072745.87	108244495.85	4	4	100%

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*+ = 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

APPENDIX N (CONT.)
BACKGROUND - DOWNSTREAM
SURFACE WATER - PESTICIDES/PCBs
STATISTICAL SUMMARY OF ANALYTICAL RESULTS

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 LEVE (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
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RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

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%

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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
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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
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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%

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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
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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
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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
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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%

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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%

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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
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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
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RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

Statistical Summary of
Analytical Results
(Sediment)

APPENDIX N (CONT.)
BACKGROUND - UPSTREAM
SEDIMENT - METALS
STATISTICAL SUMMARY OF ANALYTICAL RESULTS

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 LEVE (mg/kg)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
Aluminum	337.00	2940.00	+	HC-SD01-06	1165.57	1864.95	3139.37	7	7	100%
Arsenic	0.26	0.46	*+	HC-SD01-06	0.37	0.50	0.91	4	7	57%
Barium	4.10	16.30	+	HC-SD01-06	6.46	11.12	35.74	4	7	57%
Beryllium	0.14	0.14	+	HC-SD01-06	0.09	0.13	3228.49	1	4	25%
Cadmium	0.03	0.11		HM-SD01-06D	0.04	0.06	0.07	6	7	86%
Calcium	282.00	3620.00	+	HC-SD01-06	1967.14	2972.71	10565.45	7	7	100%
Chromium	1.10	3.20		HC-SD01-612	1.86	2.38	2.56	7	7	100%
Copper	0.66	1.10		HC-SD01-612	0.75	0.92	0.98	4	7	57%
Iron	225.00	648.00	+	HC-SD01-06	433.71	558.82	650.45	7	7	100%
Lead	0.62	1.00	*+	HM-SD01-612	0.79	1.11	1.34	3	3	100%
Magnesium	26.70	87.70		HC-SD01-06	45.25	64.25	76.34	5	7	71%
Manganese	1.30	6.90	+	HC-SD01-06	3.63	5.31	7.80	7	7	100%
Mercury	0.09	0.18	*+	HM-SD01-612	0.14	0.22	16712.85	3	3	100%
Selenium	0.21	0.34	+	HC-SD01-612	0.19	0.27	0.36	4	7	57%
Silver	0.49	0.49		HM-SD01-06	0.25	0.33	0.33	1	7	14%
Thallium	0.13	0.16		HC-SD01-612	0.10	0.13	0.15	3	7	43%
Vanadium	0.66	2.80	+	HC-SD01-612	1.52	2.23	4.68	6	7	86%
Zinc	6.70	9.70	+	HM-SD01-06	5.11	7.40	10.62	3	7	43%

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*+ = 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

APPENDIX N (CONT.)
BACKGROUND - UPSTREAM
SEDIMENT - PESTICIDES/PCBs
STATISTICAL SUMMARY OF ANALYTICAL RESULTS

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 LEVE (ug/kg)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
beta-BHC	1.70	7.30		HM-SD01-06D	2.51	4.22	5.97	3	7	43%
delta-BHC	0.64	0.64	*+	HC-SD01-06	1.09	1.26	1.34	1	7	14%
Heptachlor	0.48	2.00		HC-SD04-612	1.18	1.51	1.79	2	7	29%
Aldrin	0.56	0.72	*+	HM-SD01-612	1.05	1.27	1.41	2	7	29%
Dieldrin	0.58	1.50	*+	HM-SD01-612	1.96	2.49	3.51	2	7	29%
4,4'-DDE	1.00	4.30		HM-SD01-612	2.42	3.15	3.70	2	7	29%
4,4'-DDD	0.87	3.10		HM-SD01-612	1.57	2.12	2.33	2	7	29%
4,4'-DDT	1.70	1.70	*+	HM-SD01-612	2.20	2.44	2.47	1	7	14%
Methoxychlor	0.94	0.94	*+	HC-SD04-06	10.21	13.34	49.17	1	7	14%
Endrin aldehyde	0.59	0.59	*+	HC-SD01-06	2.01	2.51	3.54	1	7	14%
alpha-Chlordane	1.30	1.30	+	HM-SD01-612	1.20	1.29	1.30	1	7	14%
gamma-Chlordane	3.00	3.00		HM-SD01-612	1.44	1.95	1.98	1	7	14%

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RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

APPENDIX N (CONT.)
BACKGROUND - MIDSTREAM
SEDIMENT - METALS
STATISTICAL SUMMARY OF ANALYTICAL RESULTS

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 LEVE (mg/kg)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
Aluminum	7820.00	14800.00		WC-SD02-06	10726.33	13079.42	13758.44	6	6	100%
Arsenic	1.10	1.90	*+	HC-SD02-612	3.12	5.54	12.64	2	6	33%
Barium	8.70	28.20		WC-SD02-06	15.30	21.29	25.25	6	6	100%
Beryllium	0.25	0.32	*+	HC-SD02-612	0.29	0.51	137.32	2	2	100%
Cadmium	0.04	0.26	+	WC-SD02-06	0.11	0.17	0.26	6	6	100%
Calcium	1610.00	7860.00		HM-SD02-612	3845.00	5683.04	7847.17	6	6	100%
Chromium	6.00	38.40	+	HM-SD02-06	17.55	28.53	68.22	6	6	100%
Cobalt	3.50	4.40	+	HM-SD02-06	2.18	3.35	5.20	2	6	33%
Copper	0.81	1.50	*+	HC-SD02-06	2.24	3.54	5.85	2	5	40%
Iron	3660.00	32400.00	+	HM-SD02-612	13201.67	21966.51	53108.97	6	6	100%
Lead	6.00	16.90	+	WC-SD02-06	10.50	16.35	5555.00	4	4	100%
Magnesium	618.00	4940.00	+	HM-SD02-06	2123.00	3438.32	6614.15	6	6	100%
Manganese	4.90	67.20	+	HM-SD02-06	33.38	54.41	357.04	6	6	100%
Mercury	0.27	0.40	*+	WC-SD02-06	0.34	0.40	2.78	4	4	100%
Nickel	1.80	11.20	+	HM-SD02-06	5.58	8.93	24.88	5	6	83%
Potassium	623.00	1600.00	+	HM-SD02-612	759.00	1280.80	3459.84	3	6	50%
Selenium	0.40	0.60	*+	HC-SD02-06	0.44	0.62	0.85	3	6	50%
Sodium	1630.00	2750.00	*+	HC-SD02-06	2190.00	5725.84	1.53E+83	2	2	100%
Thallium	0.28	0.42	+	HC-SD02-06	0.27	0.38	0.56	4	6	67%
Vanadium	7.00	30.00	+	HM-SD02-612	17.57	25.67	41.76	6	6	100%
Zinc	27.80	52.00	+	WC-SD02-06	27.38	43.72	355.99	4	6	67%

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*+ = 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

APPENDIX N (CONT.)
BACKGROUND - MIDSTREAM
SEDIMENT - PESTICIDE/PCBs
STATISTICAL SUMMARY OF ANALYTICAL RESULTS

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 LEVE (ug/kg)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
delta-BHC	0.79	0.79	*+	WC-SD02-612	2.03	2.67	3.61	1	6	17%
Aldrin	1.20	1.20	*+	WC-SD02-06	1.99	2.50	2.81	1	6	17%
Dieldrin	3.70	3.70	*+	WC-SD02-06	4.10	4.92	5.23	1	6	17%
4,4'-DDE	16.00	16.00		WC-SD02-06	6.15	10.20	13.96	1	6	17%
4,4'-DDD	1.50	12.00	+	WC-SD02-06	4.84	8.05	19.53	2	6	33%
4,4'-DDT	1.10	2.60	*+	WC-SD02-06	3.48	4.83	7.47	2	6	33%
Endrin aldehyde	0.77	7.10	+	HC-SD02-06	4.50	6.25	18.84	2	6	33%

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*+ = 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

APPENDIX N (CONT.)
BACKGROUND - DOWNSTREAM
SEDIMENT - METALS
STATISTICAL SUMMARY OF ANALYTICAL RESULTS

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 LEVE (mg/kg)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
Aluminum	3120.00	14600.00	** WC-SD03-612	9864.29	12793.35	86863.15	7	7	100%
Barium	10.20	19.20	+ WC-SD03-612	12.44	16.57	35.31	6	7	86%
Cadmium	0.03	0.66	+ HC-SD03-06	0.14	0.31	0.68	6	7	86%
Calcium	2000.00	3380.00	+ HC-SD03-06	2932.86	3371.27	3536.80	7	7	100%
Chromium	16.10	42.60	+ WC-SD03-612	30.87	38.48	43.57	7	7	100%
Cobalt	3.90	5.00	+ HC-SD03-612	3.20	4.30	5.76	4	7	57%
Iron	1700.00	20700.00	+ WC-SD03-612	12868.57	17941.12	46249.04	7	7	100%
Lead	3.70	9.20	+ HM-SD03-06	5.75	7.26	15.49	6	6	100%
Magnesium	4130.00	6540.00	HC-SD03-612	5081.43	5807.10	5894.11	7	7	100%
Manganese	17.10	64.70	+ HC-SD03-612	45.66	57.52	71.47	7	7	100%
Mercury	0.23	0.42	HC-SD03-612	0.30	0.35	0.36	7	7	100%
Nickel	5.50	14.20	HM-SD03-06	10.21	12.28	13.51	7	7	100%
Potassium	1250.00	1840.00	HC-SD03-612	1570.00	1729.32	1753.19	7	7	100%
Thallium	0.24	0.44	HC-SD03-612	0.25	0.32	0.34	4	7	57%
Vanadium	18.40	36.90	HC-SD03-612	26.59	31.50	32.88	7	7	100%
Zinc	20.80	40.00	HC-SD03-612	30.66	35.18	36.50	7	7	100%

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+ = THE LOG NORMAL 95% UCL IS GREATER THAN THE MAXIMUM DETECTED VALUE; THEREFORE, THE MAXIMUM VALUE IS USED TO CALCULATE CHRONIC DAILY INTAKE
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RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

APPENDIX N (CONT.)
BACKGROUND - DOWNSTREAM
SEDIMENT - PESTICIDES/PCBs
STATISTICAL SUMMARY OF ANALYTICAL RESULTS

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 LEVE (ug/kg)	No. OF TIMES DETECTED	No. OF TIMES ANALYZED	FREQUENCY OF DETECTION
4,4'-DDD	1.10	4.00	*+ HC-SD03-612	3.38	4.56	6.24	4	7	57%
4,4'-DDT	0.76	1.20	*+ HC-SD03-06D	4.12	5.76	14.23	2	7	29%

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RME = REASONABLE MAXIMUM EXPOSURE
NA = NOT APPLICABLE

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%

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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%

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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									

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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%

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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%

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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%

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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%

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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									

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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%

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RME = REASONABLE MAXIMUM EXPOSURE
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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 heteroclitus	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)	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)
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		16.833333333			
	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 - 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)
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
								5.8		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			

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			
Redbreast 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						
Heteromestus filiformis	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	4.42531	10.5317	6.18466	18.3394	7.05691	2.38048
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	0.304	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												
Ectipidrillus sp.			1									
Tubificida												
Tubificidae												
Isochaetides freyi	77	42	36							21	21	6
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												
Corophidae												
Corophium lacustre									82			
Gammaridae												
Crangonyx pseudogracilus					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 ramphe gr.	4	7	9								1	
Clinotanypus pinguis												
Cryptochironomus fulvus gr.		2	3									
Epoicladius sp.			1									1
Glyptotendipes sp.												
Nilothauma sp.		2	1									
Paratanytarsia nigrohalteralis	1	5	2									
Polypedilum illinoense	3	1										
Procladius sp. (midges)		1										
Tanytarsus sp.	2	9	2									
Tribelos lucundum	4	8	6								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												
Phylacentropus 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			61.33333			55	
Standard Deviation	23.50792	9.614633	8.961824	NA	3.535534	21.79449	4.358898	8.082904	39.67241	9.521905	7.128687	6.047432
Brillouin's Diversity		0.755			0.072			0.675			0.757	
SPECIES DENSITY (#/M^2)	850	676	497	115	45	344	191	198	1166	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	0.456	0.803	0.763

MARINE CORPS BASE CAMP LEJEUNE
BACKGROUND - HADNOT 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 pugio						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									
Mulinia 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

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.

SYSTEMATIC LIST OF BENTHIC MACROINVERTEBRATE SPECIES
AT BACKGROUND STATIONS
(WEBB, HADNOT, AND HOLLAND MILL CREEKS)
MCB CAMP LEJEUNE, NORTH CAROLINA

Species	USEPA[1] Metals
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
Heteromestus filiformis	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	USEPA[1] Metals
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

SYSTEMATIC LIST OF BENTHIC MACROINVERTEBRATE SPECIES
AT BACKGROUND STATIONS
(WEBB, HADNOT, AND HOLLAND MILL CREEKS)
MCB CAMP LEJEUNE, NORTH CAROLINA

Species	USEPA[1] Metals
Cryptochironomus fulvus gr	Genus Species
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

SYSTEMATIC LIST OF BENTHIC MACROINVERTEBRATE SPECIES
AT BACKGROUND STATIONS
(WEBB, HADNOT, AND HOLLAND MILL CREEKS)
MCB CAMP LEJEUNE, NORTH CAROLINA

Species	USEPA[1] Metals
Geukensia demissa	Genus Species
Veneroida	Order
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			
Heteromestus filiformis	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

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

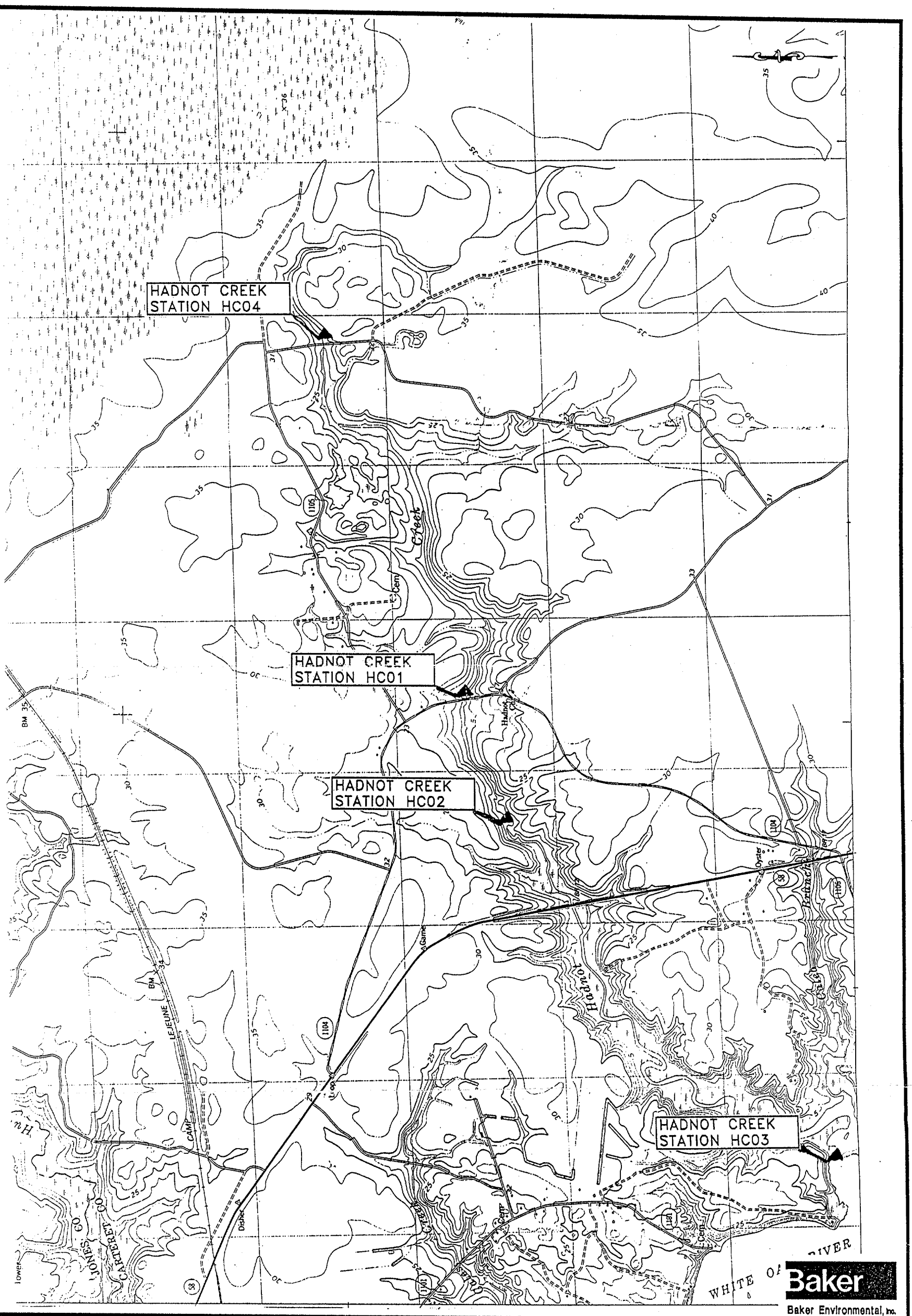
T = Tolerant to heavy metals

Organics Ranking = 0 to 5 with 0 being the least tolerant

Sampling Station
Location Maps

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.

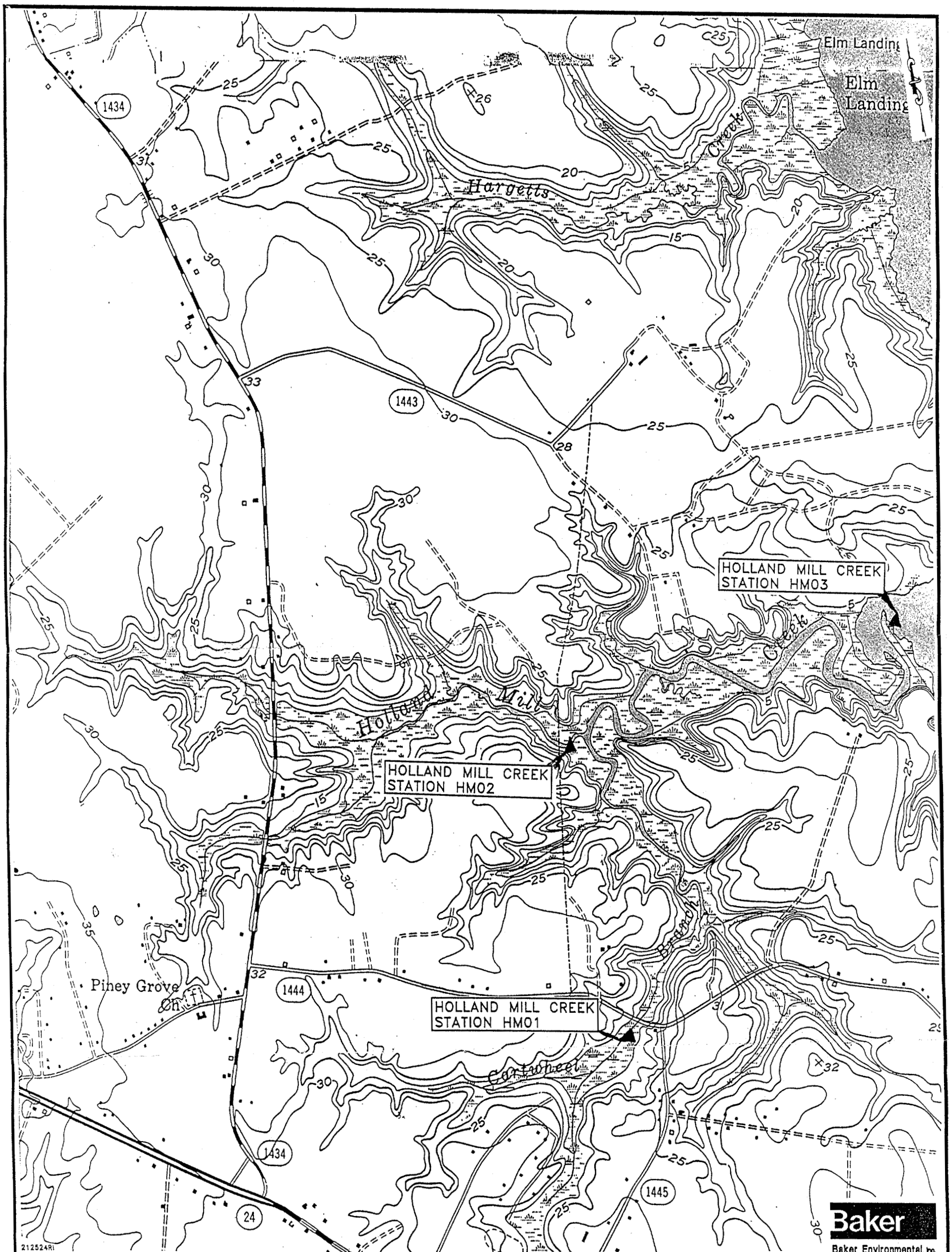


FISH AND BENTHIC MACROINVERTERBRATE
SAMPLING LOCATION IN HADNOT CREEK

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

SOURCE: N.C. DIVISION OF MARINE
FIDHERIES, REPORT AFC-9, NOV. 1975.

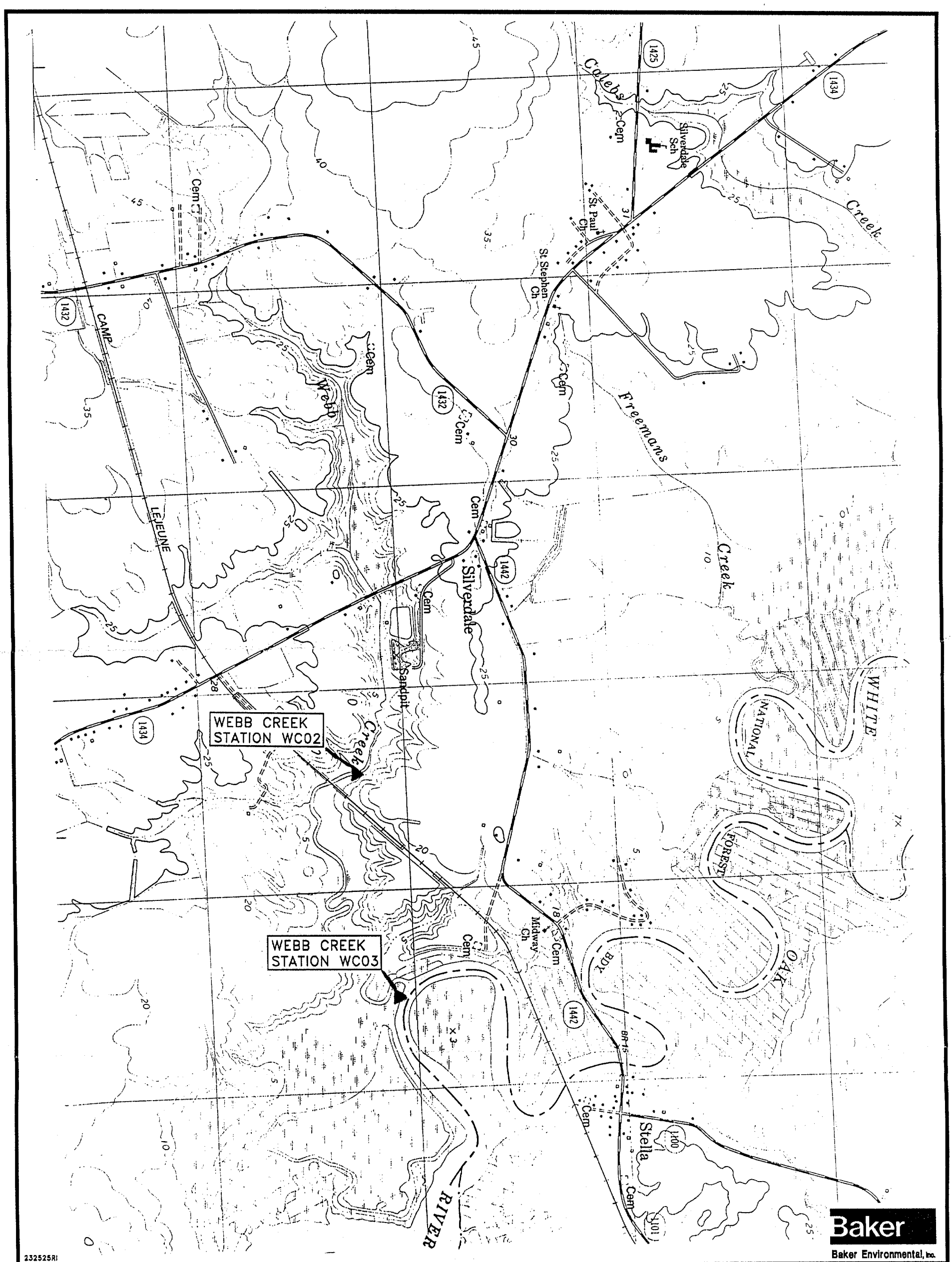
01580TB2Z



FISH AND BENTHIC MACROINVERTERBRATE
SAMPLING LOCATION IN HOLLAND MILL CREEK

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

SOURCE: N.C. DIVISION OF MARINE
FIDHERIES, REPORT AFC-9, NOV. 1975.



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.

APPENDIX O
SHOWER MODEL

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-$^{-3}$/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):

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

$$k_l(VOC) = k_l(CO_2(44/MW_{VOC})^{0.5} \quad (3)$$

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):

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

where,

K_aL = adjusted overall mass transfer coefficient (cm/hr),
T_l = calibration water temperature of K_L (K),
T_s = shower water temperature (K),
μl = water viscosity at T_l (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:

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

where,

s	=	indoor VOC generation rate ($\mu g/m^3$-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:

$$dC_a/dt=RC_a+S \qquad (7)$$

where,

C_a	=	indoor VOC air concentration ($\mu g/m^3$, 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 ($\mu g/m^2$),
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 C-1 lists the input parameters to the shower model.

Molecular weights and Henry's Law constants for the contaminants of concern are given in the respective toxicological profiles (see Appendix F).

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.

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 O (cont.)
SHOWER MODEL

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	1.5×10^{-3}

APPENDIX P
LEAD UBK MODEL

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 project site, both RME and average concentrations of lead in soil were modeled. These values are presented in Appendix D. The following 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 K-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.

RISK ASSESSMENT REPORT FOR THE CROWN INDUSTRIES
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

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 Q
SITE CONCEPTUAL MODEL

bcc: APPajak/CF; WDTrimbath/JWMentz/PRGF; RBonelli /PRJF; RWattras(ck);RSanPedro; Daily File
SO# 62470-231
Subfile: 2
Initials RPW

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

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

August 29, 1994

United States Environmental Protection Agency
Region IV
Waste Management Division
345 Courtland Street
Atlanta, GA 30365

Attn: Ms. Gena Townsend
Project Manager

Re: Contract N62470-89-D-4814
Navy CLEAN, District III
Contract Task Order (CTO) 0231
Preliminary Conceptual Evaluation Model
Operable Unit No. 7 (Sites 1, 28 and 30)
MCB, Camp Lejeune, North Carolina

Dear Ms. Townsend:

Please find enclosed a copy of the preliminary conceptual model of the human health risk assessment for Operable Unit No. 7, MCB Camp Lejeune. At your convenience, please provide a copy of the model for Mr. Kevin Koporec. The sites addressed in this model are Site 1 - French Creek Liquids Disposal Area; Site 28 - Hadnot Point Burn Dump; and Site 30 - Sneads Ferry Road Fuel Tank Sludge Area.

The model briefly describes the sites and presents the potential sources of contamination, constituents of potential concern, potential human receptors and exposure pathways at each site. In addition, a brief description of the risk assessment approach is provided.

Please review this document and provide comments as necessary. If you or Mr. Koporec have any questions and/or concerns, please feel free to call me at (412)269-2033 or Rachel San Pedro, risk assessment coordinator, at (412)269-6079.

Sincerely,

BAKER ENVIRONMENTAL, INC.

Richard E. Bonelli
Project Manager

REB/ldq
Enclosure

cc: Ms. Lee Anne Rapp, Code 183 (w/o enclosure)
Ms. Katherine Landman, Code 1823 (w/o enclosure)
Mr. Neal Paul, MCB, Camp Lejeune (with enclosure)

PRELIMINARY HUMAN HEALTH RISK ASSESSMENT CONCEPTUAL EVALUATION MODEL FOR SITES 1, 28 AND 30

MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

CONTRACT TASK ORDER 0231

AUGUST 29, 1994

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

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Current and Future Exposure Scenarios 5

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3 Flowchart of Potential Exposure Pathways and Receptors
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INTRODUCTION

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

As part of the RA/FS for CTO-0231, which includes Sites 1, 28 and 30, a conceptual evaluation model was developed for each site. The models briefly describe the sites and present potential sources of contamination, the constituents present, potentially contaminated media, the routes of migration, and potential exposure pathways at each site. Ecological receptors were not be addressed in this model. 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 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 USEPA documents: Risk Assessment Guidance for Superfund: Human Health Evaluation Manual, Part A and "Supplemental Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual."

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; "Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors"; Exposure Factors Handbook; Dermal Exposure Assessment: Principles and Applications, Interim Report; and Superfund Exposure Assessment Manual (SEAM, 1988).

Toxicity values will be obtained primarily from the Region III Risk-Based Concentration Table, which is based on IRIS, HEAST and provisional and/or recommended USEPA toxicity values, in accordance with Region IV recommendations.

Several mathematical models to estimate exposure may be used. 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 model addresses the lowest age groups because children are exceptionally sensitive to the adverse effects of lead.

TABLE 1

SUMMARY OF EXPOSURE DOSE INPUT PARAMETERS

Input Parameter	Units	Receptor			
		Child	Adult	Military Personnel	Construction Worker
Soil (mg/kg)					
Ingestion Rate, IR	mg/d	200	100	100	480
Fraction Ingested, FI	unitless	1	1	1	1
Exposure Frequency, EF	d/y	350	350	350	90
Exposure Duration, ED	y	6	24	4	1
Surface Area, SA	cm^2	2,300	5,800	5,800	4,300
Absorption Factor, AF	mg/cm^3	1	1	1	1
Averaging Time, Noncarc., ATnc	d	2,190	8,760	1,460	365
Averaging Time, Carc., ATcarc	d	25,550	25,550	25,550	25,550
Body Weight, BW	kg	15	70	70	70
Conversion Factor, CF	kg/mg	$1x10^{-6}$	$1x10^{-6}$	$1x10^{-6}$	$1x10^{-6}$
Absorbence Factor, ABS	unitless	Organics = 0.01; Inorganics = 0.001			
Groundwater (mg/L)					
Ingestion Rate, IR	L/d	1	2	NA	NA
Exposure Frequency, EF	d/y	350	350	NA	NA
Exposure Duration, ED	y	6	30	NA	NA
Exposure Time, ET	h/d	0.25	0.25	NA	NA
Surface Area, SA	cm^2	10,000	23,000	NA	NA
Averaging Time, Noncarc., ATnc	d	2,190	10,950	NA	NA
Averaging Time, Carc., ATcarc	d	25,550	25,550	NA	NA
Conversion Factor, CF	L/cm^3	0.001	0.001	NA	NA
Body Weight, BW	kg	15	70	NA	NA
Sediment (mg/kg)					
Ingestion Rate, IR	mg/d	200	100	100	NA
Fraction Ingested, FI	unitless	1	1	1	NA
Exposure Frequency, EF	d/y	350	350	350	NA
Exposure Duration, ED	y	6	30	4	NA
Surface Area, SA	cm^2	2,300	5,800	5,800	NA
Absorption Factor, AF	mg/cm^3	1	1	1	NA

TABLE 1 (CONTINUED)

SUMMARY OF EXPOSURE DOSE INPUT PARAMETERS

Input Parameter	Units	Receptor			
		Child	Adult	Military Personnel	Construction Worker
Averaging Time, Noncarc., ATnc	d	2,190	10,950	1,460	NA
Averaging Time, Carc., ATcarc	d	25,550	25,550	25,550	NA
Body Weight, BW	kg	15	70	70	NA
Conversion Factor, CF	kg/mg	$1x10^{-6}$	$1x10^{-6}$	$1x10^{-6}$	NA
Absorbence Factor, ABS	unitless	Organics = 0.01; Inorganics = 0.001			
Surface Water (mg/L)					
Ingestion Rate, IR	L/h	0.005	0.005	0.005	NA
Exposure Time, ET	h/d	2.6	2.6	2.6	NA
Exposure Frequency, EF	d/y	45	45	45	NA
Exposure Duration, ED	y	6	30	4	NA
Surface Area, SA	cm^2	2,300	5,800	5,800	NA
Averaging Time, Noncarc., ATnc	d	2,190	10,950	1,460	NA
Averaging Time, Carc., ATcarc	d	25,550	25,550	25,550	NA
Conversion Factor, CF	L/cm^3	0.001	0.001	0.001	NA
Air (mg/m^3)					
Outdoor Air					
Inhalation Rate, IR	m^3/d	10	20	20	NA
Exposure Time, ET	h/d	0.25	0.25	0.25	NA
Exposure Frequency, EF	d/y	350	350	350	NA
Exposure Duration, ED	y	6	24	4	NA
Averaging Time, Noncarc., ATnc	d	2,190	8,760	1,460	NA
Averaging Time, Carc,. ATcarc	d	25,550	25,550	25,550	NA
Body Weight, BW	kg	15	70	70	NA
Shower Air					
Inhalation Rate, IR	m^3/h	0.6	0.6	NA	NA
Exposure Time, ET	h/d	0.25	0.25	NA	NA
Exposure Frequency, EF	d/y	350	350	NA	NA
Exposure Duration, ED	y	6	30	NA	NA
Averaging Time, Noncarc., ATnc	d	2,190	10,950	NA	NA
Averaging Time, Carc., ATcarc	d	25,550	25,550	NA	NA

TABLE 1 (CONTINUED)

SUMMARY OF EXPOSURE DOSE INPUT PARAMETERS

Input Parameter	Units	Receptor			
		Child	Adult	Military Personnel	Construction Worker
Body Weight, BW	kg	15	70	NA	NA
Fish (mg/kg)					
Ingestion Rate, IR	kg/d	NA	0.54	NA	NA
Fraction Ingested, FI	unitless	NA	1	NA	NA
Exposure Frequency, EF	d/y	NA	250	NA	NA
Exposure Duration, ED	y	NA	30	NA	NA
Averaging Time, Noncarc., ATnc	d	NA	10,950	NA	NA
Averaging Time, Carc., ATcarc	d	NA	25,550	NA	NA
Body Weight, BW	kg	NA	70	NA	NA

The acceptable cancer risk range, as stipulated by the USEPA, is 10^{-4} to 10^{-6}. For these assessments, cancer risks exceeding 10^{-6} will be considered unacceptable as protective of human health. The total noncarcinogenic acceptable risk level is a hazard index less than or equal to one. This value depicts a level at or below which adverse systemic effects are not expected to occur in the exposed population.

SITE 1 - FRENCH CREEK LIQUIDS DISPOSAL AREA

Background

Historically, waste liquids including petroleum, oil, lubricants and battery acids, were directly disposed into the ground at this site. The groundwater, surface water, and sediment of this site were initially investigated in 1984, 1986 and 1993 (groundwater only). Contaminants detected included VOCs, SVOCs, and metals. Specific constituents with elevated levels were phenol, cadmium, chromium and trichloroethene (TCE). In 1986, surface water and sediment were sampled. Results indicated elevated levels of phenol and chromium. In 1991, soils were analyzed for chemical constituents. Elevated levels of toluene, benzo(a)pyrene (B[a]P), chromium, lead, nickel and zinc were detected.

The most recent sampling event included investigation of the background surface and subsurface soil, the surface and subsurface soil from the northern and southern portions of the site, and the shallow and deep groundwater, including a potable water supply well. Surface water/sediment samples also were collected from a drainage ditch, but will not be evaluated for risk. The sediment samples will be included with the surface soils.

Although samples were collected from the northern and southern portions of the site and designated as such, they will be combined for this human health risk assessment and evaluated as a single data set since both historically and presently similar operations and processes occurred at both areas.

Current and Future Exposure Scenarios

At present, the site is divided into a northern and southern portion. The northern portion is used for vehicle maintenance (Building FC-120) and also consists of an office building for the Landing Support Battalion. The southern portion of the site is primarily used for equipment, various waste and vehicle storage. There also are office buildings in this portion of the site which are associated with the Marine Corps 8th Engineers and Bridge Support Company. The majority of the site consists of a mixture of paved or coarse gravel road surfaces. Lawned and wooded areas border the site to the north, east and west. Consequently, current receptors will be on-site military personnel. The potential exposure pathways will be surface soil incidental ingestion, dermal contact and inhalation of fugitive dust from vehicular traffic.

At present, the groundwater at the site is not used for potable purposes. A water supply well, HP-638, is located on site, but was shut down in 1993 due to benzene contamination (2 ppb). Consequently, exposure to groundwater is not considered to be viable at the site. Exposure to subsurface soil is not expected for the on-site receptors. Surface water samples will not be evaluated as part of the assessment, since the surface water was collected from a drainage ditch, which is not considered to be a significant source of surface water exposure. The ditches receive surface water runoff from the nearby parking lots. Groundwater does not directly discharge into these ditches.

The sediment results from the ditches will be incorporated with the surface soil results and evaluated as part of the surface soil exposure pathway.

Trespassers are not considered to be a viable receptor population. The southern portion of this site is guarded by a sentry. The northern portion of the site is primarily surrounded by a perimeter fence and is capped with asphalt or concrete in most places. These security measures are deemed sufficient to discourage and minimize trespassing. It is important to note that there is a hot dog stand within the southern portion of the site, manned by a civilian attendant. However, it is assumed that this stand is frequented by the on-site military personnel and/or visitors. It is assumed that the time spent on-site by visitors will be minimal. Consequently, visitors will not be evaluated as part of the assessment of this site.

In the future case, it is expected that the site will remain a military restricted area. As stated previously, groundwater is currently not used for potable purposes. As a result, groundwater exposure will not be assessed for future military personnel.

It is unlikely that a future residence will be implemented at this site. However, to be conservative, groundwater exposure to a child and adult residential receptor will be assessed. It assumed that a private well could be installed on-site in the future case. The potential exposure pathways are ingestion, dermal contact and inhalation while showering. Similarly, surface soil exposure via ingestion, dermal contact and inhalation will be evaluated for the future residential child and adult receptor.

Similarly, subsurface soil exposure as a result of excavation due to construction activities that may occur at the site in the future is to be assessed. A future construction worker will be evaluated for subsurface soil ingestion and dermal contact.

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

SITE 28 - HADNOT POINT BURN DUMP

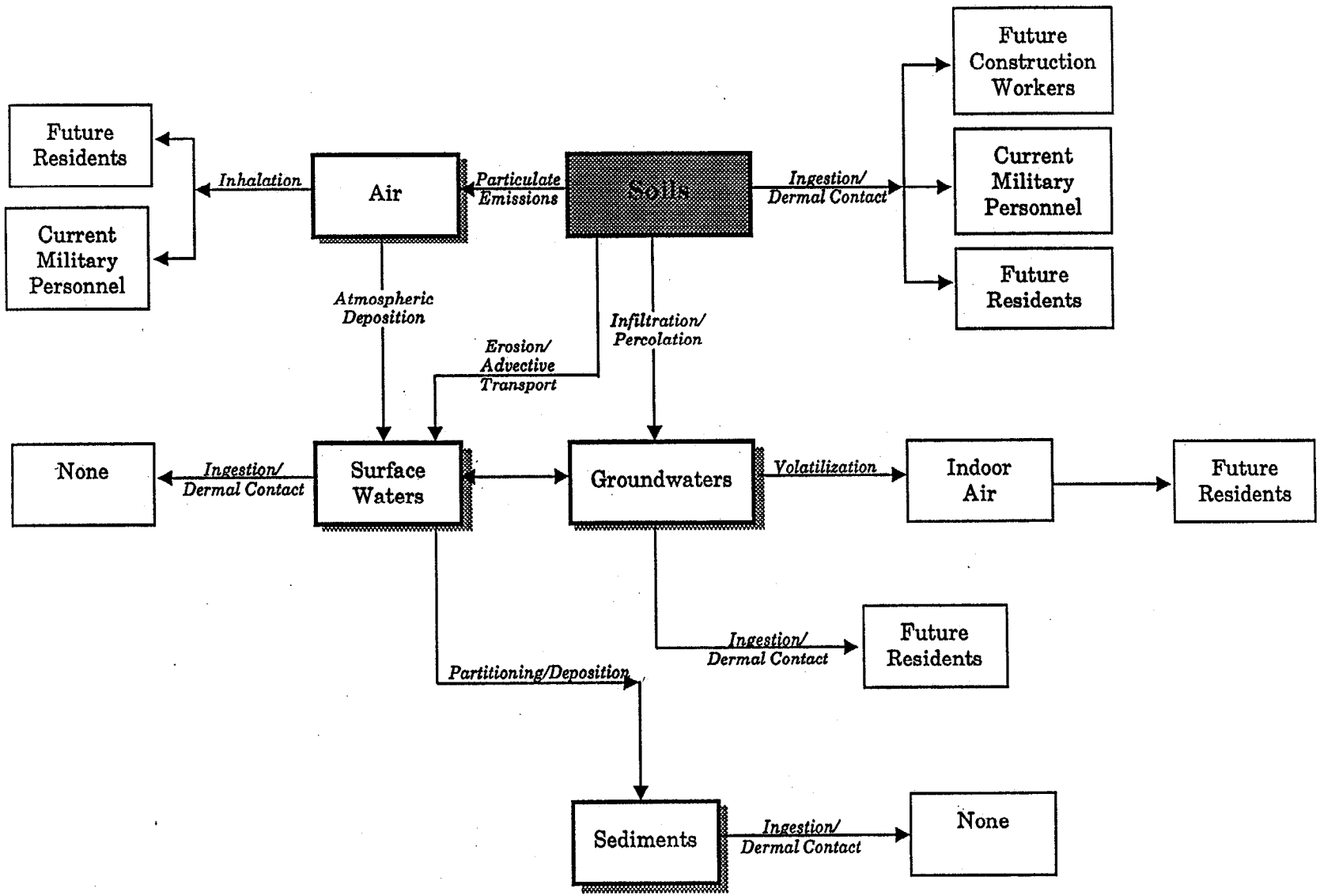
Background

In the past, this site was used for solid waste disposal. This solid waste, which consisted of industrial solid waste, refuse, garbage, oil-based paints, was burned and covered with fill. The area is now grass-covered.

The site is located adjacent to the Mainside sewage treatment plant, which is enclosed with a six-foot high chain-link fence. Codgels Creek divides the site into east and west areas. The New River borders the site in the southwest. Currently, the site is a recreational/picnic area. The area is frequented by adults and children for recreational purposes. An on-site pond, Orde Pond, is stocked with fish and used for recreational fishing. Military personnel conduct physical training, equipment assembly and other related activities at this site.

FIGURE 1

FLOWCHART OF POTENTIAL EXPOSURE PATHWAYS AND RECEPTORS
SITE 1: FRENCH CREEK LIQUIDS DISPOSAL AREA



Field investigations conducted in 1984, 1986 and 1993 revealed specific contaminants in the groundwater, surface water, sediment and fish tissue. Of the four wells sampled, the monitoring well situated beside the New River indicated the most contamination. VOCs, pesticides and metals were prevalent. These contaminants included 1,2-dichloroethene, trichloroethene, vinyl chloride, 4,4'-DDD, 4,4'-DDE, dieldrin, arsenic, lead and mercury. The other three wells indicated the presence of SVOCs, pesticides and chromium. Chromium and zinc were detected at elevated levels in the surface water samples collected from the New River.

Recent field investigations included background surface and subsurface soils, site surface and subsurface soils, and shallow and deep groundwater; surface water, sediment, fish tissue and benthic macroinvertebrates were collected from Orde Pond, the New River and Cogdels Creek. Although media samples were collected from the eastern and western portions of the site and designated accordingly, the results will evaluated as a single data set per medium. Similar historical operations occurred at both the eastern and western portions of the site, and current activities do not differ between these two areas.

Current and Future Exposure Scenarios

At Site 28, on-site military personnel and recreational adults and children frequent the area. In addition, anglers mainly fish at Orde Pond and the New River. Fishing at Cogdels Creek is less frequent. No swimming has been observed at any of the surface water bodies, although wading is possible. Signs prohibiting swimming are posted at Orde Pond. However, it is important to note that the on-site military personnel conduct training exercises at this site, including activities in Orde Pond.

In the current exposure scenario, potential receptors include on-site military personnel, recreational adults and children, and fishermen. Potential exposure pathways include surface soil ingestion, dermal contact and inhalation for the military personnel and recreational receptor population. Recreational adults and children are expected to become exposed to surface water and sediment while playing/wading in the New River and possibly Cogdels Creek. Fishermen may become exposed to these media while fishing at Orde Pond and the New River, with less frequent exposure at Cogdels Creek. It is assumed that exposure to surface water and sediment at Cogdels Creek and the New River will be minimal for the on-site military personnel during physical training exercises. However, exposure to the surface water and sediment of Orde Pond via incidental ingestion and dermal contact will be evaluated for the on-site military personnel. In addition, fish ingestion for the adult receptor (fisherman) will be evaluated.

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, surface water, sediment and biota exposure, as calculated in the current scenario for the child and adult receptor, is expected to remain the same in the future case.

Similar to Site 1, 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.

Figure 2 presents a flowchart of the potential exposure pathways and receptors at this site.

SITE 30 - SNEADS FERRY ROAD FUEL TANK SLUDGE AREA

Background

Historically, sludge collected from storage tanks containing fuels such as leaded gasoline were disposed of in this area. In addition, cleaning solvents used as part of the sludge removal process were disposed.

In 1984, 1986 and 1993, the groundwater was sampled and analyzed for contaminants. Levels of methylene chloride, chloroform, cadmium, chromium, lead and mercury were detected. In the surface water and sediment samples collected from French Creek in 1986, no VOCs or metals were detected.

The most recent sampling event investigated the following media: background surface and subsurface soil, site surface and subsurface soil, groundwater, surface water and sediment.

Current and Future Exposure Scenarios

At present, the site is not used by the on-site military personnel for training. However, the area north of the site is used for the training exercises by military personnel, and an access road is located on the northern border of the site. Access to the site by trespassers is not restricted. French Creek and Sneads Ferry Road border the site. The site is sandy with some wooded areas.

Potential receptors are the on-site military personnel. It is unlikely that trespassers, both adults and children, will be potential receptors because the area is primarily used for military training exercises. The potential exposure pathways include surface soil incidental ingestion, dermal contact and inhalation. Exposure to the surface water and sediment in French Creek via incidental ingestion and dermal contact are also viable for the current receptors.

The groundwater at the site is not potable. Hence, groundwater exposure will not be assessed. Subsurface soil exposure is not considered to be a viable pathway in the current scenario.

Similar to Sites 1 and 28, a future residential exposure scenario is not likely at Site 30. The site is a military restricted area. It is assumed that the present activities at this site will continue into the foreseeable future. However, to be conservative, groundwater exposure to a residential child and adult will be assessed. Similarly, subsurface soil exposure to a construction worker will be evaluated.

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

FIGURE 2

FLOWCHART OF POTENTIAL EXPOSURE PATHWAYS AND RECEPTORS
SITE 28: HADNOT POINT BURN DUMP

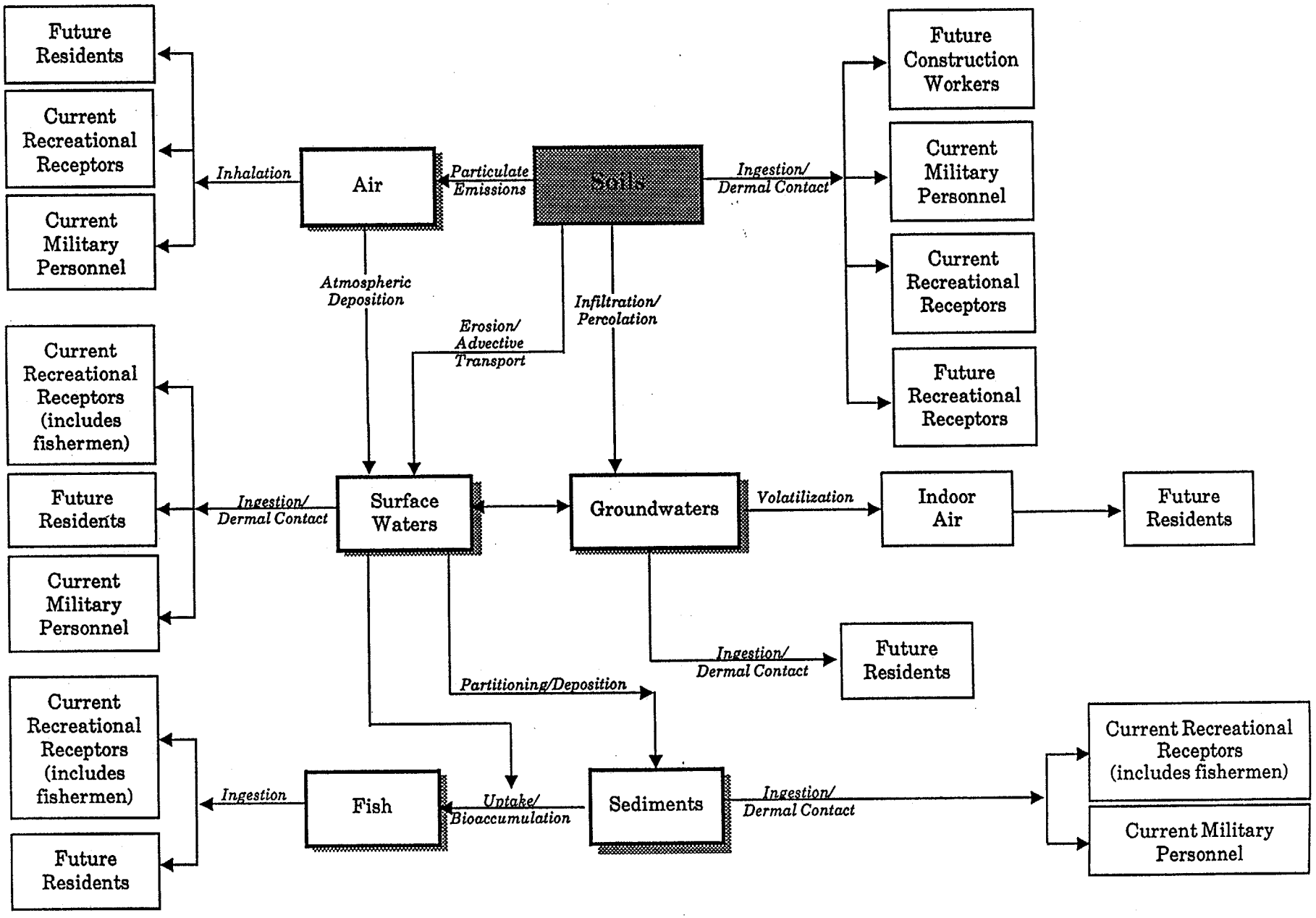
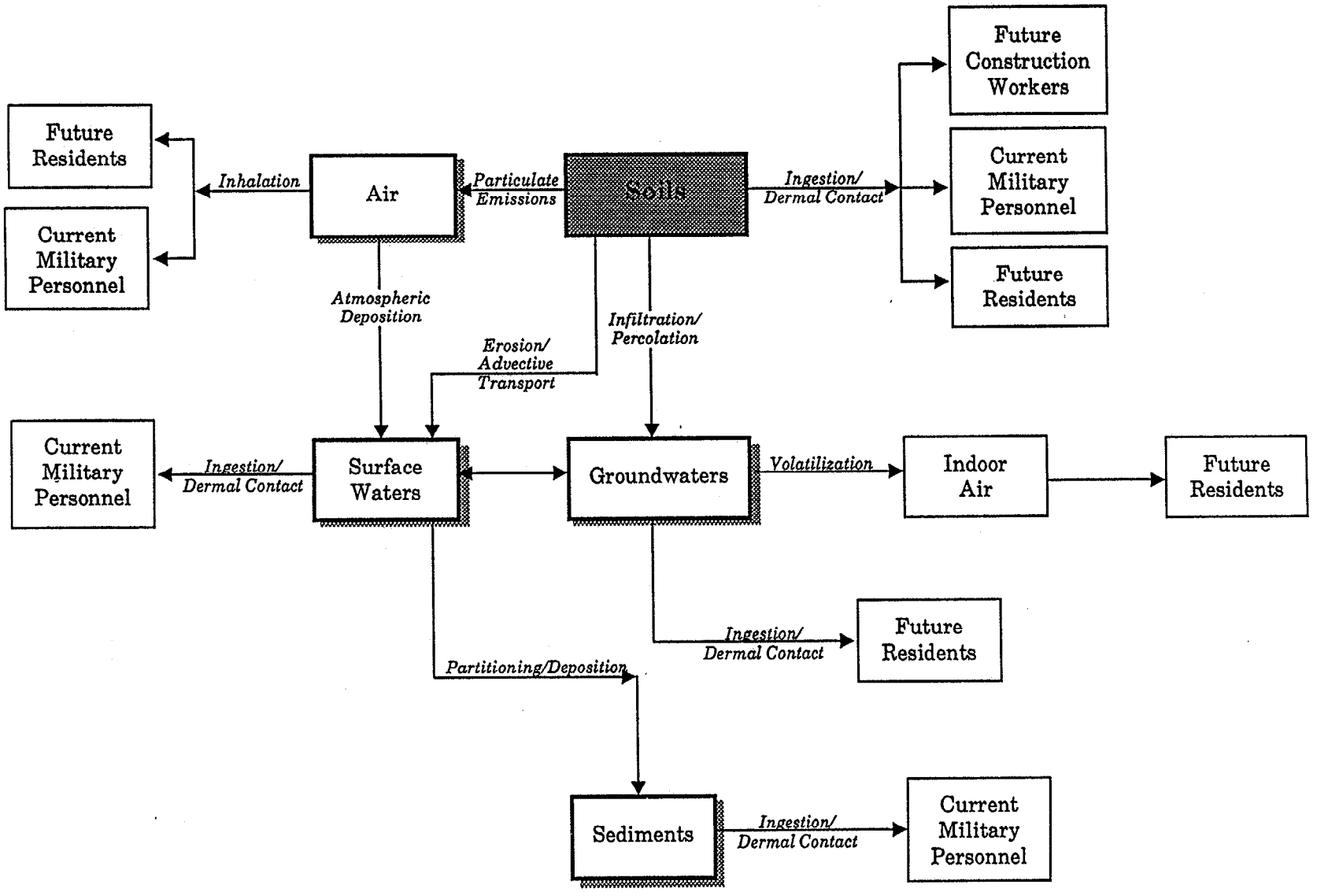


FIGURE 3

FLOWCHART OF POTENTIAL EXPOSURE PATHWAYS AND RECEPTORS
SITE 30: SNEADS FERRY ROAD FUEL TANK SLUDGE AREA



APPENDIX R
CDI CALCULATIONS

Computed by: RSP Checked by: TMB Date: 12/94

EXAMPLE SOIL* INGESTION CALCULATIONS
OPERABLE UNIT NO. 7
CONTRACT TASK ORDER 0231

Purpose: Estimate intake/risk from ingestion of soil

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

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: Arsenic

$$Intake\ (mg/kg{\cdot}day) = \frac{1.2\ mg/kg \times 100\ mg/day \times 350\ days/yr \times 30\ yrs \times 1.0E\text{-}6\ kg/mg}{70\ kg \times 25{,}550\ days}$$

= 7E-07

Risk = 5E-09 mg/kg·day x 1.75 $mg/kg{\cdot}day^{-1}$ = 1.2E-06

Example Noncarcinogen: Barium

$$Intake\ (mg/kg{\cdot}day) = \frac{9.1\ mg/kg \times 100\ mg/day \times 350\ days/yr \times 30\ yrs \times 1.0E\text{-}6\ kg/mg}{70\ kg \times 10{,}950\ days}$$

= 1.2E-05

$$Risk = \frac{1.2E\text{-}05\ mg/kg{\cdot}day}{7E\text{-}02\ mg/kg{\cdot}day} = 1.8E\text{-}04$$

* This example calculation also is applicable for sediment ingestion.
Re: Site 1 Future Residential Adult

Computed by: RSP Checked by: TMB Date: 12/94

EXAMPLE DERMAL CONTACT WITH SOIL* CALCULATIONS
OPERABLE UNIT NO. 7
CONTRACT TASK ORDER 0231

Purpose: Estimate intake/risk from dermal contact with soil

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

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

Example Carcinogen: Arsenic

$$Intake\ (mg/kg{\cdot}day) = \frac{1.2\ mg/kg \times 1.0E\text{-}06\ kg/mg \times 5{,}800\ cm^2/event \times 0.001 \times 1\ mg/cm^2 \times 350\ days/yr \times 30\ yrs}{70\ kg \times 25{,}550\ days}$$

= 4.1E-08

Risk = 4.1E-08 mg/kg·day x 8.8 $mg/kg{\cdot}day^{-1}$ = 3.6E-07

Example Noncarcinogen: Cadmium

$$Intake\ (mg/kg{\cdot}day) = \frac{0.32\ mg/kg \times 1.0E\text{-}06\ kg/mg \times 5{,}800\ cm^2/event \times 1\ mg/cm^2 \times 0.001 \times 350\ days/yr \times 30\ yrs}{70\ kg \times 10{,}950\ days}$$

= 2.5E-08

$$Risk = \frac{2.5E\text{-}08\ mg/kg{\cdot}day}{1E\text{-}04\ mg/kg{\cdot}day} = 2.5E\text{-}04$$

* This example calculation also is applicable for sediment dermal contact.
Re: Site 1 Future Residential Adult

Computed by: RSP Checked by: TMB Date: 12/94

EXAMPLE INHALATION OF PARTICULATES CALCULATIONS
OPERABLE UNIT NO. 7
CONTRACT TASK ORDER 0231

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

$$Intake\ (mg/kg{\cdot}day) = \frac{1.2\ mg/kg\ x\ 20\ m^3/day\ x\ 350\ days/yr\ x\ 30\ yrs\ x\ 1/4.6E{\cdot}09\ m^3/kg}{70\ kg\ x\ 25{,}550\ days}$$

= 3.1E-11

Risk = 3.1E-11 mg/kg·day x 15.1 $mg/kg{\cdot}day^{-1}$ = 4.6E-10

Example Noncarcinogen: Manganese

$$Intake\ (mg/kg{\cdot}day) = \frac{8.5\ mg/kg\ x\ 20\ m^3/day\ x\ 350\ days/yr\ x\ 30\ yrs\ x\ 1/4.6E{\cdot}09\ m^3/kg}{70\ kg\ x\ 10{,}950\ days}$$

= 5.1E-10

$$Risk = \frac{5.1E\text{-}10\ mg/kg{\cdot}day}{1.4E\text{-}05\ mg/kg{\cdot}day} = 3.6E\text{-}05$$

Re: Site 1 Future Residential Adult

Computed by: RSP Checked by: TMB Date: 12/94

EXAMPLE GROUNDWATER INGESTION CALCULATIONS
OPERABLE UNIT NO. 7
CONTRACT TASK ORDER 0231

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

$$Intake\ (mg/kg{\cdot}day) = \frac{2.7E\text{-}03\ mg/L \times 1\ L/day \times 350\ days/yr \times 6\ yrs}{15\ kg \times 25{,}550\ days}$$

= 1.5E-05

Risk = 1.5E-05 mg/kg·day x 1.75 $mg/kg{\cdot}day^{-1}$ = 2.6E-05

Example Noncarcinogen: 4,4'-DDT

$$Intake\ (mg/kg{\cdot}day) = \frac{1.8E\text{-}04\ mg/L \times 1\ L/day \times 350\ days/yr \times 6\ yrs}{15\ kg \times 2{,}190\ days}$$

= 1.2E-05

$$Risk = \frac{1.2E\text{-}05\ mg/kg{\cdot}day}{5E\text{-}04\ mg/kg{\cdot}day} = 2.3E\text{-}02$$

Computed by: RSP Checked by: TMB Date: 12/94

EXAMPLE DERMAL CONTACT WITH GROUNDWATER CALCULATIONS
OPERABLE UNIT NO. 7
CONTRACT TASK ORDER 0231

Purpose: Estimate intake/risk from dermal contact with groundwater

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

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)
	IR	=	Ingestion rate (L/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: Arsenic

$$Intake\ (mg/kgday) = \frac{2.7E\text{-}03\ mg/L \times 1.0E\text{-}03\ L/cm^3 \times 10{,}000\ cm^2/event \times 1.0E\text{-}03\ cm/hr \times 0.25\ hr/day \times 350\ days/yr \times 6\ yrs}{15\ kg \times 25{,}550\ days}$$

= 3.7E-08

Risk = 3.7E-08 mg/kg·day x 8.8 $mg/kg{\cdot}day^{-1}$ = 3.3E-07

Example Noncarcinogen: Mercury

$$Intake\ (mg/kg{\cdot}day) = \frac{5E\text{-}04\ mg/L \times 1.0E\text{-}03\ L/cm^3 \times 10{,}000\ cm^2/event \times 1.0E\text{-}03\ cm/hr \times 0.25\ hr/day \times 350\ days/yr \times 6\ yrs}{15\ kg \times 2{,}190\ days}$$

= 8E-08

$$Risk = \frac{8E\text{-}08\ mg/kg{\cdot}day}{6E\text{-}05\ mg/kg{\cdot}day} = 1.3E\text{-}03$$

Re: Site 28 Future Residential Child

Computed by: RSP Checked by: TMB Date: 12/94

EXAMPLE INHALATION OF GROUNDWATER VOLATILES CALCULATIONS
OPERABLE UNIT NO. 7
CONTRACT TASK ORDER 0231

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 O)
	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

$$Intake\ (mg/kg\cdot day) = \frac{4E\text{-}05\ mg/kg/shower\ x\ 350\ days/yr\ x\ 24\ yrs}{25{,}550\ days}$$

= 1.7E-05

Risk = 1.7E-05 mg/kg·day x 6E-03 $mg/kg\cdot day^{-1}$ = 9.9E-08

Example Noncarcinogen: None identified as a COPC

Re: Site 1 Future Residential Adult

Computed by: RSP Checked by: TMB Date: 12/94

EXAMPLE SURFACE WATER INGESTION CALCULATIONS
OPERABLE UNIT NO. 7
CONTRACT TASK ORDER 0231

Purpose: Estimate intake/risk from ingestion of surface water

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

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: Arsenic

$$Intake\ (mg/kgday) = \frac{4.3E\text{-}03\ mg/L \times 0.005\ L/day \times 48\ days/yr \times 30\ yrs \times 2.6\ hrs/day}{70\ kg \times 25{,}550\ days}$$

= 4.5E-08

Risk = 4.5E-08 mg/kg·day x 1.75 $mg/kg{\cdot}day^{-1}$ = 7.9E-08

Example Noncarcinogen: Cadmium

$$Intake\ (mg/kgday) = \frac{4.2E\text{-}03\ mg/L \times 0.005\ L/day \times 48\ days/yr \times 30\ yrs \times 2.6\ hrs/day}{70\ kg \times 10{,}950\ days}$$

= 1E-7

$$Risk = \frac{1E\text{-}7\ mg/kgday}{5E\text{-}04\ mg/kgday} = 2.1E\text{-}04$$

Computed by: RSP Checked by: TMB Date: 12/94

EXAMPLE SURFACE WATER DERMAL CONTACT CALCULATIONS
OPERABLE UNIT NO. 7
CONTRACT TASK ORDER 0231

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

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

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)
	IR	=	Ingestion rate (L/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: 4,4'-DDD

$$Intake\ (mg/kgday) = \frac{5E\text{-}05\ mg/L \times 5{,}800\ cm^2 \times 48\ days/yr \times 30\ yrs \times 2.6\ hrs/day\ 1.0E\text{-}3\ L/cm^3 \times 0.001\ cm/hr}{70\ kg \times 25{,}550\ days}$$

= 1.75E-07

Risk = 1.7E-7 mg/kg·day x 0.48 $mg/kg\cdot day^{-1}$ = 8.2E-08

Example Noncarcinogen: Arsenic

$$Intake\ (mg/kgday) = \frac{4.3E\text{-}03\ mg/L \times 5{,}800\ cm^2 \times 48\ days/yr \times 30\ yrs \times 2.6\ hrs/day\ 1.0E\text{-}3\ L/cm^3 \times 1E\text{-}03\ cm/hr}{70\ kg \times 10{,}950\ days}$$

= 1.2E-07

$$Risk = \frac{1.2E\text{-}07\ mg/kgday}{6E\text{-}05\ mg/kgday} = 2E\text{-}03$$

Re: Site 28 (New River) Current and Future Fisherman

Computed by: RSP Checked by: TMB Date: 12/94

EXAMPLE FISH INGESTION CALCULATIONS
OPERABLE UNIT NO. 7
CONTRACT TASK ORDER 0231

Purpose: Estimate intake/risk from ingestion of soil

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

Where:			
	C	=	Contaminant concentration in fish tissue (mg/kg)
	FI	=	Fraction ingested
	EF	=	Exposure frequency (meal/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

$$Intake\ (mg/kgday) = \frac{2.3E\text{-}02\ mg/kg\ x\ 0.284\ kg/meal\ x\ 48\ days/yr\ x\ 30\ yrs\ x\ 1.0}{70\ kg\ x\ 25{,}550\ days}$$

= 5.3E-06

Risk = 5.3E-06 mg/kg·day x 2.45E-01 $mg/kg \cdot day^{-1}$ = 1.3E-06

Example Noncarcinogen: Antimony

$$Intake\ (mg/kgday) = \frac{0.24\ mg/kg\ x\ 0.284\ kg/meal\ x\ 48\ days/yr\ x\ 30\ yrs\ x\ 1.0}{70\ kg\ x\ 10{,}950\ days}$$

= 1.3E-04

$$Risk = \frac{1.3E\text{-}04\ mg/kgday}{4E\text{-}04\ mg/kgday} = 0.32$$

Re: Site 28 (New River) Current and Future Fisherman

SITE 1

GROUNDWATER INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 1 - SHALLOW AND DEEP GROUNDWATER)
REMEDIAL INVESTIGATION CTO-0231
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/Day)	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 (yr)	6
DY = days per year (day/year)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

Note: Inputs are scenario and site specific

SHALLOW AND DEEP GROUNDWATER

COPC	Concentration (mg/L)	Ingestion Rate (L/day) Child	Exposure Frequency (day/year) Child	Exposure Duration (year) Child	Body Weight (kg) Child	Average Carc Time (years)	Carc Dose (mg/kg-day) Child	Slope Factor (mg/kg-day)-1	Carcinogenic Risk Child	Percent Carcinogenic Risk Child	Average Noncarc Time (years)	Noncarc Dose (mg/kg-day) Child	Reference Dose (mg/kg-day)	Noncarcinogenic Risk Child	Percent Noncarcinogenic Risk Child
Arsenic	8.5E-03	1	350	6	15	25550	4.7E-05	1.75E+00	8.2E-05	100%	2190	5.4E-04	3.00E-04	1.8E+00	10%
Barium	4.5E-02	1	350	6	15	25550	2.5E-04	0.00E+00	0.0E+00	0%	2190	2.9E-03	7.00E-02	4.1E-02	0%
Manganese (water)	1.2E+00	1	350	6	15	25550	6.6E-03	0.00E+00	0.0E+00	0%	2190	7.7E-02	5.00E-03	1.5E+01	88%
Mercury	1.0E-03	1	350	6	15	25550	5.6E-06	0.00E+00	0.0E+00	0%	2190	6.6E-05	3.00E-04	2.2E-01	1%
1,2-Dichloroethene	2.6E-03	1	350	6	15	25550	1.4E-05	0.00E+00	0.0E+00	0%	2190	1.7E-04	9.00E-03	1.8E-02	0%
Trichloroethene	4.1E-03	1	350	6	15	25550	2.2E-05	1.10E-02	2.5E-07	0%	2190	2.6E-04	6.00E-03	4.4E-02	0%
TOTAL									8.2E-05					1.7E+01	

GROUNDWATER DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 1 - SHALLOW AND DEEP GROUNDWATER)
REMEDIAL INVESTIGATION CTO-0231
MCB CAMP LEJEUNE, NORTH CAROLINA
FUTURE RESIDENTIAL CHILD

Dermal Contact from groundwater 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)	10000
PC = contaminant specific dermal permeability (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

Note: Inputs are site and scenario specific

SHALLOW AND DEEP GROUNDWATER

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 (years)	Carc Dose (mg/kg-day) Child	Dermal Adjst. Slope Factor (mg/kg-day)-1	Carcinogenic Risk Child	Percent Carcinogenic Risk Child	Average Noncarc Time (years)	Noncarc Dose (mg/kg-day) Child	Dermal Adjst. Reference Dose (mg/kg-day)	Noncarc Risk Child	Percent Noncarcinogenic Risk Child
Arsenic	8.0E-03	10000	1.00E-03	0.25	350	6	0.001	15	25550	1.2E-07	5.79E+00	1.0E-06	99%	2190	1.4E-06	6.00E-03	2.3E-02	10%
Barium	4.6E-02	10000	1.00E-03	0.25	350	6	0.001	15	25550	6.1E-07	0.00E+00	0.0E+00	0%	2190	7.1E-06	1.40E-02	5.1E-04	0%
Manganese (water)	1.2E+00	10000	1.00E-03	0.25	350	6	0.001	15	25550	1.6E-05	0.00E+00	0.0E+00	0%	2190	1.8E-04	1.00E-03	1.9E-01	87%
Mercury	1.0E-03	10000	1.00E-03	0.25	350	6	0.001	15	25550	1.4E-08	0.00E+00	0.0E+00	0%	2190	1.6E-07	6.00E-05	2.7E-03	1%
1,2-Dichloroethane	2.6E-03	10000	1.00E-02	0.25	350	6	0.001	15	25550	3.6E-07	0.00E+00	0.0E+00	0%	2190	4.2E-05	7.20E-03	5.8E-04	0%
Trichloroethene	4.1E-03	10000	1.60E-02	0.25	350	6	0.001	15	25550	9.0E-07	1.36E-02	1.2E-08	1%	2190	1.0E-05	4.60E-03	2.2E-03	1%
TOTAL												1.0E-06					2.2E-01	

CTO-231 SITE 1 GROUNDWATER INHALATION
01-Jun-95
FILE: SHOW.WQ1

GROUNDWATER INHALATION - RME CASE

CHILD

CHEMICAL	C rme mg/kg/shw	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	1.73E-04	6	350	3285	25550	1.1E-04	1.4E-05	0.0E+00	0.0E+00	---	0.0E+00	0%	0%
Trichloroethene	2.44E-04	6	350	3285	25550	1.6E-04	2.0E-05	0.0E+00	6.0E-03	---	1.2E-07	0%	100%
									TOTAL	0.0E+00	1.2E-07		

SHOWMOD.WQ1
07-Jun-95

SHOWER EXPOSURE MODEL

CAS No.	TARGET COMPOUND LIST CONSTITUE	OVERALL MASS TRANSF COEFFICIENT (KL) (cm/hr)	HENRY'S LAW CONSTAN (H) (atm-m3/mol-K)	GAS CONSTAN (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 TRANSF. COEFFICIENT (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 MASS TRANSF. COEFF. TEMP. COMP. (KaL) (cm/hr)	WATER VISCOSITY (AT Ts) (Us) (cp)	WATER VISCOSITY (AT T1) (U1) (cp)	SHOWER WATER TEMP. (Ts) (K)	((T1)*(Us))/ ((Ts)*(U1))
VOLATILE ORGANICS:																		
	ADULT																	
540-59-0	1,2-DICHLOROETHENE (total)	1.30E+01	7.58E-03	8.20E-05	293.0	2.40E-02	1.29E+03	1.35E+01	20.0	3000.0	97.00	7.42E-02	2.45E-03	1.76E+01	0.596	1.002	318.0	5.48E-01
79-01-6	TRICHLOROETHENE (B2)	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
	CHILD																	
540-59-0	1,2-DICHLOROETHENE (total)	1.30E+01	7.58E-03	8.20E-05	293.0	2.40E-02	1.29E+03	1.35E+01	20.0	3000.0	97.00	7.42E-02	2.45E-03	1.76E+01	0.596	1.002	318.0	5.48E-01
79-01-6	TRICHLOROETHENE (B2)	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

SHOWMOD W01
07-Jun-95

CAS No	TARGET COMPOUND LIST CONSTITUENT	CONCENTRATION LEAVING SHWR DROPLET Cwd (ug/l)	SHOWER WATER CONCENTRATION Cwo (ug/l)	SHOWER DROPLET DIAMETER d (mm)	SHOWER DROPLET DROP TIME tc (sec)	KaL*tc	EQ*d	-[KaL*tc]/[EQ*d]	exp[-KaL*tc/EQ*d]	INDOOR VOC GENERATION RATE (E) (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-t))	exp(-R[t])	INHALATION EXPOSURE PER SHOWER Sh+h (mg/kg/shwr)	VENTILATION RATE Vh (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)	(Vh * B)/(Bw)(f(t))
VOLATILE ORGANICS:																											
	ADULT																										
540-59-0	1,2-DICHLOROETHENE (total)	1.16E+00	2.60E+00	1.00	2.00	2.53E+01	6.00E+01	-6.87E-01	6.0993E-01	1.92E+00	10	6	8.22E+01	0.0083	12	16	4.06E-01	8.93E-01	2.86E-05	10	70	8.93E-01	16	1.194E+02	1.175E+02	-3	3.21E-05
79-01-6	TRICHLOROETHENE (B2)	1.69E+00	4.10E+00	1.00	2.00	3.04E+01	6.00E+01	-5.07E-01	6.0221E-01	2.72E+00	10	6	1.16E+02	0.0083	12	16	4.06E-01	8.93E-01	4.02E-05	10	70	8.93E-01	16	1.194E+02	1.175E+02	-3	4.88E-05
	CHILD																										
540-59-0	1,2-DICHLOROETHENE (total)	1.16E+00	2.60E+00	1.00	2.00	2.53E+01	6.00E+01	-6.87E-01	6.0993E-01	1.92E+00	10	6	8.22E+01	0.0083	12	16	4.06E-01	8.93E-01	1.72E-04	13	16	8.93E-01	16	1.194E+02	1.175E+02	-3	2.01E-04
79-01-6	TRICHLOROETHENE (B2)	1.69E+00	4.10E+00	1.00	2.00	3.04E+01	6.00E+01	-5.07E-01	6.0221E-01	2.72E+00	10	6	1.16E+02	0.0083	12	16	4.06E-01	8.93E-01	2.44E-04	13	16	8.93E-01	16	1.194E+02	1.175E+02	-3	2.94E-04

SUBSURFACE SOIL INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 1)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site 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 (years)	Carc Dose (mg/kg/day) Child	Slope Factor (mg/kg/day)-1	Carcinogenic Risk Child	Percent Carcinogenic Risk Child	Average Noncarc Time (years)	Noncarc Dose (mg/kg/day) Child	Reference Dose (mg/kg/day)	Noncarcinogenic Risk Child	Percent Noncarcinogenic Risk Child
Aluminum	4.6E+03	350	6	1E-06	200	15	25550	5.1E-03	0.00E+00	0.0E+00	0%	2190	5.9E-02	1.00E+00	5.9E-02	44%
Arsenic	1.2E+00	350	6	1E-06	200	15	25550	1.3E-06	1.75E+00	2.3E-06	100%	2190	1.6E-05	3.00E-04	5.2E-02	38%
Barium	9.1E+00	350	6	1E-06	200	15	25550	1.0E-05	0.00E+00	0.0E+00	0%	2190	1.2E-04	7.00E-02	1.7E-03	1%
Cadmium (soil)	3.2E-01	350	6	1E-06	200	15	25550	3.5E-07	0.00E+00	0.0E+00	0%	2190	4.1E-06	1.00E-03	4.1E-03	3%
Chromium	7.0E+00	350	6	1E-06	200	15	25550	7.7E-06	0.00E+00	0.0E+00	0%	2190	9.0E-05	1.00E+00	9.0E-05	0%
Cobalt	4.7E-01	350	6	1E-06	200	15	25550	5.1E-07	0.00E+00	0.0E+00	0%	2190	5.9E-06	6.00E-02	9.9E-05	0%
Copper	1.3E+00	350	6	1E-06	200	15	25550	1.4E-06	0.00E+00	0.0E+00	0%	2190	1.7E-05	3.71E-02	4.5E-04	0%
Lead	5.5E+00	350	6	1E-06	200	15	25550	6.1E-06	0.00E+00	0.0E+00	0%	2190	7.1E-05	0.00E+00	0.0E+00	0%
Manganese (soil)	8.5E+00	350	6	1E-06	200	15	25550	9.3E-06	0.00E+00	0.0E+00	0%	2190	1.1E-04	1.40E-01	7.8E-04	1%
Nickel	1.5E+00	350	6	1E-06	200	15	25550	1.6E-06	0.00E+00	0.0E+00	0%	2190	1.9E-05	2.00E-02	9.4E-04	1%
Vanadium	8.3E+00	350	6	1E-06	200	15	25550	9.1E-06	0.00E+00	0.0E+00	0%	2190	1.1E-04	7.00E-03	1.5E-02	11%
Zinc	5.4E+00	350	6	1E-06	200	15	25550	6.0E-06	0.00E+00	0.0E+00	0%	2190	6.9E-05	3.00E-01	2.3E-04	0%
Bis(2-ethylhexyl)phthalate	4.4E-01	350	6	1E-06	200	15	25550	4.8E-07	1.40E-02	6.7E-09	0%	2190	5.6E-06	2.00E-02	2.8E-04	0%
TOTAL										2.3E-06					1.3E-01	

SUBSURFACE SOIL DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 1)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site 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 (years)	Carc Dose (mg/kg/day) Child	Dermal Adjust. Slope Factor (mg/kg-day)-1	Carcinogenic Risk Child	Percent Carcinogenic Risk Child	Average Noncarc Time (years)	Noncarc Dose (mg/kg/day) Child	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarcinogenic Risk Child	Percent Noncarcinogenic Risk Child
Aluminum	4.6E+03	1E-06	2300	1	0.001	350	6	15	25550	6.9E-05	0.0E+00	0.0E+00	0%	2190	6.8E-04	2.0E-01	3.4E-03	44%
Arsenic	1.2E+00	1E-06	2300	1	0.001	350	6	15	25550	1.5E-08	8.8E+00	1.3E-07	99%	2190	1.8E-07	6.0E-05	3.0E-03	38%
Barium	9.1E+00	1E-06	2300	1	0.001	350	6	15	25550	1.1E-07	0.0E+00	0.0E+00	0%	2190	1.3E-06	1.4E-02	9.6E-05	1%
Cadmium (soil)	3.2E-01	1E-06	2300	1	0.001	350	6	15	25550	4.0E-09	0.0E+00	0.0E+00	0%	2190	4.7E-08	2.0E-04	2.3E-04	3%
Chromium	7.0E+00	1E-06	2300	1	0.001	350	6	15	25550	8.8E-08	0.0E+00	0.0E+00	0%	2190	1.0E-06	2.0E-01	5.2E-06	0%
Cobalt	4.7E-01	1E-06	2300	1	0.001	350	6	15	25550	5.9E-09	0.0E+00	0.0E+00	0%	2190	6.8E-08	1.2E-02	5.7E-06	0%
Copper	1.3E+00	1E-06	2300	1	0.001	350	6	15	25550	1.6E-08	0.0E+00	0.0E+00	0%	2190	1.9E-07	7.4E-03	2.6E-05	0%
Lead	5.5E+00	1E-06	2300	1	0.001	350	6	15	25550	7.0E-08	0.0E+00	0.0E+00	0%	2190	8.1E-07	0.0E+00	0.0E+00	0%
Manganese (soil)	8.5E+00	1E-06	2300	1	0.001	350	6	15	25550	1.1E-07	0.0E+00	0.0E+00	0%	2190	1.2E-06	2.8E-02	4.5E-05	1%
Nickel	1.5E+00	1E-06	2300	1	0.001	350	6	15	25550	1.9E-08	0.0E+00	0.0E+00	0%	2190	2.2E-07	4.0E-03	5.4E-05	1%
Vanadium	8.3E+00	1E-06	2300	1	0.001	350	6	15	25550	1.0E-07	0.0E+00	0.0E+00	0%	2190	1.2E-06	1.4E-03	8.7E-04	11%
Zinc	5.4E+00	1E-06	2300	1	0.001	350	6	15	25550	6.8E-08	0.0E+00	0.0E+00	0%	2190	8.0E-07	6.0E-02	1.3E-05	0%
Bis(2-ethylhexyl)phthalate	4.4E-01	1E-06	2300	1	0.01	350	6	15	25550	5.5E-08	2.8E-02	1.5E-09	1%	2190	6.4E-07	1.0E-02	6.4E-05	1%
TOTAL												1.4E-07					7.8E-03	

SUBSURFACE SOIL PARTICULATE INHALATION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 1)
REMEDIAL INVESTIGATION CTO-0231
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)	10
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)	4.63E+09

Note: Inputs are scenario and site specific

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 (years)	Carc Dose (mg/kg/day)	Slope Factor (mg/kg-day)-1	Carcinogenic Risk	Percent Contribution to Risk	Average Noncarc Time (years)	Noncarc Dose (mg/kg/day)	Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
Aluminum	4.6E+03	4.6E+09	350	10	6	15	25550	5.5E-08	0.0E+00	0.0E+00	0%	2190	5.5E-08	0.0E+00	0.0E+00	0%
Arsenic	1.2E+00	4.6E+09	350	10	6	15	25550	1.4E-11	1.5E+01	2.2E-10	100%	2190	1.4E-11	0.0E+00	0.0E+00	0%
Barium	9.1E+00	4.6E+09	350	10	6	15	25550	1.1E-10	0.0E+00	0.0E+00	0%	2190	1.1E-10	1.4E-04	7.5E-07	100%
Cadmium (soil)	3.2E-01	4.6E+09	350	10	6	15	25550	3.8E-12	0.0E+00	0.0E+00	0%	2190	3.8E-12	0.0E+00	0.0E+00	0%
Chromium	7.0E+00	4.6E+09	350	10	6	15	25550	8.3E-11	0.0E+00	0.0E+00	0%	2190	8.3E-11	0.0E+00	0.0E+00	0%
Cobalt	4.7E-01	4.6E+09	350	10	6	15	25550	5.5E-12	0.0E+00	0.0E+00	0%	2190	5.5E-12	0.0E+00	0.0E+00	0%
Copper	1.3E+00	4.6E+09	350	10	6	15	25550	1.5E-11	0.0E+00	0.0E+00	0%	2190	1.5E-11	0.0E+00	0.0E+00	0%
Lead	5.5E+00	4.6E+09	350	10	6	15	25550	6.5E-11	0.0E+00	0.0E+00	0%	2190	6.5E-11	0.0E+00	0.0E+00	0%
Manganese (soil)	8.5E+00	4.6E+09	350	10	6	15	25550	1.0E-10	0.0E+00	0.0E+00	0%	2190	1.0E-10	0.0E+00	0.0E+00	0%
Nickel	1.5E+00	4.6E+09	350	10	6	15	25550	1.7E-11	0.0E+00	0.0E+00	0%	2190	1.7E-11	0.0E+00	0.0E+00	0%
Vanadium	8.3E+00	4.6E+09	350	10	6	15	25550	9.8E-11	0.0E+00	0.0E+00	0%	2190	9.8E-11	0.0E+00	0.0E+00	0%
Zinc	5.4E+00	4.6E+09	350	10	6	15	25550	6.4E-11	0.0E+00	0.0E+00	0%	2190	6.4E-11	0.0E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	4.4E-01	4.6E+09	350	10	6	15	25550	5.2E-12	0.0E+00	0.0E+00	0%	2190	5.2E-12	0.0E+00	0.0E+00	0%
TOTAL										2.2E-10					7.5E-07	

GROUNDWATER INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 1 - SHALLOW AND DEEP GROUNDWATER)
REMEDIAL INVESTIGATION CTO-0231
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/Day)	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 (yr)	30
DY = days per year (day/year)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

Note: Inputs are scenario and site 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 (years)	Carc Dose (mg/kg-day) Adult	Slope Factor (mg/kg-day)-1	Carcinogenic Risk Adult	Percent Carcinogenic Risk Adult	Average Noncarc Time (years)	Noncarc Dose (mg/kg-day) Adult	Reference Dose (mg/kg-day)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
Arsenic	8.5E-03	2	350	30	70	25550	1.0E-04	1.75E+00	1.7E-04	100%	10950	2.3E-04	3.00E-04	7.8E-01	10%
Barium	4.5E-02	2	350	30	70	25550	5.3E-04	0.00E+00	0.0E+00	0%	10950	1.2E-03	7.00E-02	1.8E-02	0%
Manganese (water)	1.2E+00	2	350	30	70	25550	1.4E-02	0.00E+00	0.0E+00	0%	10950	3.3E-02	5.00E-03	6.6E+00	88%
Mercury	1.0E-03	2	350	30	70	25550	1.2E-05	0.00E+00	0.0E+00	0%	10950	2.8E-05	3.00E-04	9.4E-02	1%
1,2-Dichloroethene	2.6E-03	2	350	30	70	25550	3.1E-05	0.00E+00	0.0E+00	0%	10950	7.1E-05	9.00E-03	7.9E-03	0%
Trichloroethene	4.1E-03	2	350	30	70	25550	4.8E-05	1.10E-02	5.3E-07	0%	10950	1.1E-04	6.00E-03	1.9E-02	0%
TOTAL									1.8E-04					7.5E+00	

GROUNDWATER DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 1 - SHALLOW AND DEEP GROUNDWATER)
REMEDIAL INVESTIGATION CTO-0201
MCB CAMP LEJEUNE, NORTH CAROLINA
FUTURE RESIDENTIAL ADULT

Dermal Contact from groundwater 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 = adult skin surface available for contact (cm2)	23000
PC = contaminant specific dermal permeability (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

Note: Inputs are site and scenario specific

SHALLOW AND DEEP GROUNDWATER

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 (years)	Carc Dose (mg/kg-day) Adult	Dermal Adjust. 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)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
Arsenic	8.9E-03	23000	1.00E-03	0.25	350	30	0.001	70	25550	2.2E-07	8.73E+00	2.9E-06	96%	10950	6.7E-07	8.00E-05	1.1E-02	10%
Barium	4.6E-02	23000	1.00E-03	0.25	350	30	0.001	70	25550	1.5E-06	0.00E+00	0.0E+00	0%	10950	3.5E-06	1.40E-02	2.6E-04	0%
Manganese (water)	1.2E+00	23000	1.00E-03	0.25	350	30	0.001	70	25550	4.1E-05	0.00E+00	0.0E+00	0%	10950	9.6E-05	1.00E-03	9.6E-02	87%
Mercury	1.0E-03	23000	1.00E-03	0.25	350	30	0.001	70	25550	3.5E-08	0.00E+00	0.0E+00	0%	10950	8.1E-08	8.00E-05	1.4E-03	1%
1,2-Dichloroethane	2.6E-03	23000	1.00E-02	0.25	350	30	0.001	70	25550	8.8E-07	0.00E+00	0.0E+00	0%	10950	2.0E-06	7.20E-03	2.8E-04	0%
richloroethene	4.1E-03	23000	1.60E-02	0.25	350	30	0.001	70	25550	2.2E-06	1.36E-02	3.0E-08	1%	10950	6.2E-06	4.60E-03	1.1E-03	1%
OTAL												2.9E-06					1.1E-01	

CTO-231 SITE 1 GROUNDWATER INHALATION
01-Jun-95
FILE: SHOW.WQ1

GROUNDWATER INHALATION - RME CASE

ADULT

CHEMICAL	C rme mg/kg/shw	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	2.8E-05	30	350	10950	25550	2.7E-05	1.2E-05	0.0E+00	0.0E+00	---	0.0E+00	0%	0%
Trichloroethene	4.0E-05	30	350	10950	25550	3.9E-05	1.7E-05	0.0E+00	6.0E-03	---	9.9E-08	0%	100%
									TOTAL	0.0E+00	9.9E-08		

SHOWMOD.WQ1
07-Jun-95

SHOWER EXPOSURE MODEL

CAS No.	TARGET COMPOUND LIST CONSTITUE	OVERALL MASS TRANSF COEFFICIENT (KL) (cm/hr)	HENRY'S LAW CONSTAN (H) (atm-m3/mol-K)	GAS CONSTAN (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 TRANSF. COEFFICIENT (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 MASS TRANSF. COEFF. TEMP. COMP. (KaL) (cm/hr)	WATER VISCOSITY (AT Ts) (Us) (cp)	WATER VISCOSITY (AT T1) (U1) (cp)	SHOWER WATER TEMP. (Ts) (K)	((T1)*(Us))/ ((Ts)*(U1))
VOLATILE ORGANICS:																		
	ADULT																	
540-59-0	1,2-DICHLOROETHENE (total)	1.30E+01	7.58E-03	8.20E-05	293.0	2.40E-02	1.29E+03	1.35E+01	20.0	3000.0	97.00	7.42E-02	2.45E-03	1.76E+01	0.596	1.002	318.0	5.48E-01
79-01-6	TRICHLOROETHENE (B2)	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
	CHILD																	
540-59-0	1,2-DICHLOROETHENE (total)	1.30E+01	7.58E-03	8.20E-05	293.0	2.40E-02	1.29E+03	1.35E+01	20.0	3000.0	97.00	7.42E-02	2.45E-03	1.76E+01	0.596	1.002	318.0	5.48E-01
79-01-6	TRICHLOROETHENE (B2)	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

SHOWVOC WQ1
07-Jun-99

CAS No.	TARGET COMPOUND LIST CONSTITUENT	CONCENTRATION LEAVING SHWR DROPLET Cwd (ug/l)	SHOWER WATER CONCENTRATION Cwp (ug/l)	SHOWER DROPLET DIAMETER d (mm)	SHOWER DROPLET DROP TIME tc (sec)	Kd,*tc	60*d	-[Kd,*tc] /[60*d]	exp [-Kd,*tc/ 60*d]	INDOOR VOC GENERATION RATE (I) (ug/m3-min)	SHOWER WATER FLOW RATE (Fw) (liter/min)	SHOWER ROOM AIR VOLUME (Sv) (m3)	INDOOR AIR VOC CONC. AT TIME t Cv(t) (ug/m3)	AIR EXCHANGE RATE S (min-1)	SHOWER DURATION Ds (min)	TOTAL TIME DURATION t (min)	exp(-S(Ds-t))	exp(-S t)	INHALATION EXPOSURE PER SHOWER Sh/n (mg/kg/shwr)	VENTILATION RATE Vr (liter/min)	BODY WEIGHT Bw (kg)	exp(-S t/Ds)	DURATION IN THE SHOWER ROOM Ds (min)	Ds + exp(-RDs)/R	exp[R(Ds+Ds)] /R	(Ds-Ds)	(Vr * S)/ (Bw)(R)(R)
VOLATILE ORGANICS:																											
	ADULT																										
540-59-0	1,2-DICHLOROETHENE (total)	1.18E+00	2.60E+00	1.00	2.00	3.06E+01	6.00E+01	-6.07E-01	5.5000E-01	1.52E+00	10	6	9.92E+01	0.0069	12	16	4.09E-01	5.93E-01	2.95E-05	10	70	5.93E-01	16	1.19E+02	1.175E+02	-3	3.21E-05
79-01-6	TRICHLOROETHENE (S2)	1.63E+00	4.10E+00	1.00	2.00	3.04E+01	6.00E+01	-6.07E-01	5.0221E-01	2.72E+00	10	6	1.16E+02	0.0083	12	16	4.09E-01	5.93E-01	4.02E-05	10	70	5.93E-01	16	1.19E+02	1.175E+02	-3	4.98E-05
	CHILD																										
540-59-0	1,2-DICHLOROETHENE (total)	1.18E+00	2.60E+00	1.00	2.00	3.06E+01	6.00E+01	-6.07E-01	5.5000E-01	1.52E+00	10	6	9.92E+01	0.0069	12	16	4.09E-01	5.93E-01	1.72E-04	13	16	5.93E-01	16	1.19E+02	1.175E+02	-3	2.01E-04
79-01-6	TRICHLOROETHENE (S2)	1.63E+00	4.10E+00	1.00	2.00	3.04E+01	6.00E+01	-6.07E-01	5.0221E-01	2.72E+00	10	6	1.16E+02	0.0083	12	16	4.09E-01	5.93E-01	2.44E-04	13	16	5.93E-01	16	1.19E+02	1.175E+02	-3	2.64E-04

SUBSURFACE SOIL INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 1)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site 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 (years)	Carc Dose (mg/kg/day) Adult	Slope Factor (mg/kg/day)-1	Carcinogenic Risk Adult	Percent Carcinogenic Risk Adult	Average Noncarc Time (years)	Noncarc Dose (mg/kg/day) Adult	Reference Dose (mg/kg/day)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
Aluminum	4.6E+03	350	30	1E-06	100	70	25550	2.7E-03	0.0E+00	0.0E+00	0%	10950	5.4E-03	1.0E+00	5.4E-03	44%
Arsenic	1.2E+00	350	30	1E-06	100	70	25550	7.1E-07	1.8E+00	1.2E-06	100%	10950	1.7E-06	3.0E-04	5.5E-03	38%
Barium	9.1E+00	350	30	1E-06	100	70	25550	5.4E-06	0.0E+00	0.0E+00	0%	10950	1.2E-05	7.0E-02	1.8E-04	1%
Cadmium (soil)	3.2E-01	350	30	1E-06	100	70	25550	1.9E-07	0.0E+00	0.0E+00	0%	10950	4.4E-07	1.0E-03	4.4E-04	3%
Chromium	7.0E+00	350	30	1E-06	100	70	25550	4.1E-06	0.0E+00	0.0E+00	0%	10950	9.6E-06	1.0E+00	9.6E-06	0%
Cobalt	4.7E-01	350	30	1E-06	100	70	25550	2.7E-07	0.0E+00	0.0E+00	0%	10950	6.4E-07	6.0E-02	1.1E-05	0%
Copper	1.3E+00	350	30	1E-06	100	70	25550	7.6E-07	0.0E+00	0.0E+00	0%	10950	1.8E-06	3.7E-02	4.8E-05	0%
Lead	5.5E+00	350	30	1E-06	100	70	25550	3.2E-06	0.0E+00	0.0E+00	0%	10950	7.6E-06	0.0E+00	0.0E+00	0%
Manganese (soil)	8.5E+00	350	30	1E-06	100	70	25550	5.0E-06	0.0E+00	0.0E+00	0%	10950	1.2E-05	1.4E-01	8.3E-05	1%
Nickel	1.5E+00	350	30	1E-06	100	70	25550	8.7E-07	0.0E+00	0.0E+00	0%	10950	2.0E-06	2.0E-02	1.0E-04	1%
Vanadium	8.3E+00	350	30	1E-06	100	70	25550	4.9E-06	0.0E+00	0.0E+00	0%	10950	1.1E-05	7.0E-03	1.6E-03	11%
Zinc	5.4E+00	350	30	1E-06	100	70	25550	3.2E-06	0.0E+00	0.0E+00	0%	10950	7.4E-06	3.0E-01	2.5E-05	0%
Bis(2-ethylhexyl)phthalate	4.4E-01	350	30	1E-06	100	70	25550	2.6E-07	1.4E-02	3.6E-09	0%	10950	6.0E-07	2.0E-02	3.0E-05	0%
TOTAL										1.2E-06					1.4E-02	

SUBSURFACE SOIL DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 1)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site 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 (years)	Carc Dose (mg/kg/day) Adult	Dermal Adjust. 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)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
Aluminum	4.6E+03	1E-06	5800	1	0.001	350	30	70	25550	1.6E-04	0.0E+00	0.0E+00	0%	10950	3.7E-04	2.0E-01	1.8E-03	44%
Arsenic	1.2E+00	1E-06	5800	1	0.001	350	30	70	25550	4.1E-08	8.8E+00	3.6E-07	99%	10950	9.6E-08	6.0E-05	1.6E-03	38%
Barium	9.1E+00	1E-06	5800	1	0.001	350	30	70	25550	3.1E-07	0.0E+00	0.0E+00	0%	10950	7.2E-07	1.4E-02	5.2E-05	1%
Cadmium (soil)	3.2E-01	1E-06	5800	1	0.001	350	30	70	25550	1.1E-08	0.0E+00	0.0E+00	0%	10950	2.5E-08	2.0E-04	1.3E-04	3%
Chromium	7.0E+00	1E-06	5800	1	0.001	350	30	70	25550	2.4E-07	0.0E+00	0.0E+00	0%	10950	5.6E-07	2.0E-01	2.8E-06	0%
Cobalt	4.7E-01	1E-06	5800	1	0.001	350	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	1.3E+00	1E-06	5800	1	0.001	350	30	70	25550	4.4E-08	0.0E+00	0.0E+00	0%	10950	1.0E-07	7.4E-03	1.4E-05	0%
Lead	5.5E+00	1E-06	5800	1	0.001	350	30	70	25550	1.9E-07	0.0E+00	0.0E+00	0%	10950	4.4E-07	0.0E+00	0.0E+00	0%
Manganese (soil)	8.5E+00	1E-06	5800	1	0.001	350	30	70	25550	2.9E-07	0.0E+00	0.0E+00	0%	10950	6.7E-07	2.8E-02	2.4E-05	1%
Nickel	1.5E+00	1E-06	5800	1	0.001	350	30	70	25550	5.0E-08	0.0E+00	0.0E+00	0%	10950	1.2E-07	4.0E-03	2.9E-05	1%
Vanadium	8.3E+00	1E-06	5800	1	0.001	350	30	70	25550	2.8E-07	0.0E+00	0.0E+00	0%	10950	6.6E-07	1.4E-03	4.7E-04	11%
Zinc	5.4E+00	1E-06	5800	1	0.001	350	30	70	25550	1.8E-07	0.0E+00	0.0E+00	0%	10950	4.3E-07	6.0E-02	7.2E-06	0%
Bis(2-ethylhexyl)phthalate	4.4E-01	1E-06	5800	1	0.01	350	30	70	25550	1.5E-07	2.8E-02	4.2E-09	1%	10950	3.5E-07	1.0E-02	3.5E-06	1%
TOTAL												3.7E-07					4.2E-03	

SUBSURFACE SOIL PARTICULATE INHALATION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 1)
REMEDIAL INVESTIGATION CTO-0231
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)	4.63E+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 (years)	Carc Dose (mg/kg/day)	Slope Factor (mg/kg-day)-1	Carcinogenic Risk	Percent Contribution to Risk	Average Noncarc Time (years)	Noncarc Dose (mg/kg/day)	Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
Aluminum	4.6E+03	4.6E+09	350	20	30	70	25550	1.2E-07	0.0E+00	0.0E+00	0%	10950	2.8E-07	0.0E+00	0.0E+00	0%
Arsenic	1.2E+00	4.6E+09	350	20	30	70	25550	3.1E-11	1.5E+01	4.6E-10	100%	10950	7.2E-11	0.0E+00	0.0E+00	0%
Barium	9.1E+00	4.6E+09	350	20	30	70	25550	2.3E-10	0.0E+00	0.0E+00	0%	10950	5.4E-10	1.4E-04	3.8E-06	100%
Cadmium (soil)	3.2E-01	4.6E+09	350	20	30	70	25550	8.1E-12	0.0E+00	0.0E+00	0%	10950	1.9E-11	0.0E+00	0.0E+00	0%
Chromium	7.0E+00	4.6E+09	350	20	30	70	25550	1.8E-10	0.0E+00	0.0E+00	0%	10950	4.2E-10	0.0E+00	0.0E+00	0%
Cobalt	4.7E-01	4.6E+09	350	20	30	70	25550	1.2E-11	0.0E+00	0.0E+00	0%	10950	2.8E-11	0.0E+00	0.0E+00	0%
Copper	1.3E+00	4.6E+09	350	20	30	70	25550	3.3E-11	0.0E+00	0.0E+00	0%	10950	7.7E-11	0.0E+00	0.0E+00	0%
Lead	5.5E+00	4.6E+09	350	20	30	70	25550	1.4E-10	0.0E+00	0.0E+00	0%	10950	3.3E-10	0.0E+00	0.0E+00	0%
Manganese (soil)	8.5E+00	4.6E+09	350	20	30	70	25550	2.2E-10	0.0E+00	0.0E+00	0%	10950	5.0E-10	0.0E+00	0.0E+00	0%
Nickel	1.5E+00	4.6E+09	350	20	30	70	25550	3.7E-11	0.0E+00	0.0E+00	0%	10950	8.7E-11	0.0E+00	0.0E+00	0%
Vanadium	8.3E+00	4.6E+09	350	20	30	70	25550	2.1E-10	0.0E+00	0.0E+00	0%	10950	4.9E-10	0.0E+00	0.0E+00	0%
Zinc	5.4E+00	4.6E+09	350	20	30	70	25550	1.4E-10	0.0E+00	0.0E+00	0%	10950	3.2E-10	0.0E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	4.4E-01	4.6E+09	350	20	30	70	25550	1.1E-11	0.0E+00	0.0E+00	0%	10950	2.6E-11	0.0E+00	0.0E+00	0%
TOTAL										4.6E-10					3.8E-06	

SURFACE SOIL INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 1)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site 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 (years)	Carc Dose (mg/kg/day) Adult	Slope Factor (mg/kg/day)-1	Carcinogenic Risk Adult	Percent Carcinogenic Risk Adult	Average Noncarc Time (years)	Noncarc Dose (mg/kg/day) Adult	Reference Dose (mg/kg/day)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
Aluminum	3.9E+03	250	4	1E-06	100	70	25550	2.1E-04	0.00E+00	0.0E+00	0%	1460	3.7E-03	1.00E+00	3.7E-03	15%
Antimony	6.2E+00	250	4	1E-06	100	70	25550	3.5E-07	0.00E+00	0.0E+00	0%	1460	6.1E-06	4.00E-04	1.5E-02	63%
Arsenic	1.1E+00	250	4	1E-06	100	70	25550	6.2E-08	1.75E+00	1.1E-07	100%	1460	1.1E-06	3.00E-04	3.6E-03	15%
Cadmium (soil)	7.1E-01	250	4	1E-06	100	70	25550	4.0E-08	0.00E+00	0.0E+00	0%	1460	6.9E-07	1.00E-03	6.9E-04	3%
Chromium	6.4E+00	250	4	1E-06	100	70	25550	3.6E-07	0.00E+00	0.0E+00	0%	1460	6.3E-06	1.00E+00	6.3E-06	0%
Manganese (soil)	1.0E+01	250	4	1E-06	100	70	25550	5.8E-07	0.00E+00	0.0E+00	0%	1460	1.0E-05	1.40E-01	7.2E-05	0%
Vanadium	6.2E+00	250	4	1E-06	100	70	25550	3.4E-07	0.00E+00	0.0E+00	0%	1460	6.0E-06	7.00E-03	8.6E-04	4%
Zinc	2.6E+01	250	4	1E-06	100	70	25550	1.5E-06	0.00E+00	0.0E+00	0%	1460	2.6E-05	3.00E-01	8.5E-05	0%
4,4'-DDE	2.6E-03	250	4	1E-06	100	70	25550	1.5E-10	3.40E-01	5.0E-11	0%	1460	2.6E-09	0.00E+00	0.0E+00	0%
4,4'-DDT	5.0E-03	250	4	1E-06	100	70	25550	2.8E-10	3.40E-01	9.4E-11	0%	1460	4.9E-09	5.00E-04	9.7E-06	0%
TOTAL										1.1E-07					2.4E-02	

SURFACE SOIL DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 1)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site 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 (years)	Carc Dose (mg/kg/day) Adult	Dermal Adjust. 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)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
Aluminum	3.9E+03	1E-06	4300	1	0.001	250	4	70	25550	9.2E-08	0.00E+00	0.0E+00	0%	1460	1.8E-04	2.00E-01	8.0E-04	15%
Antimony	6.2E+00	1E-06	4300	1	0.001	250	4	70	25550	1.5E-08	0.00E+00	0.0E+00	0%	1460	2.6E-07	8.00E-05	3.3E-03	63%
Arsenic	1.1E+00	1E-06	4300	1	0.001	250	4	70	25550	2.7E-09	8.75E+00	2.3E-08	99%	1460	4.7E-08	6.00E-05	7.8E-04	15%
Cadmium (soil)	7.1E-01	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	3%
Chromium	6.4E+00	1E-06	4300	1	0.001	250	4	70	25550	1.5E-08	0.00E+00	0.0E+00	0%	1460	2.7E-07	2.00E-01	1.3E-06	0%
Manganese (soil)	1.0E+01	1E-06	4300	1	0.001	250	4	70	25550	2.5E-08	0.00E+00	0.0E+00	0%	1460	4.4E-07	2.80E-02	1.6E-05	0%
Vanadium	6.2E+00	1E-06	4300	1	0.001	250	4	70	25550	1.5E-08	0.00E+00	0.0E+00	0%	1460	2.6E-07	1.40E-03	1.8E-04	4%
Zinc	2.6E+01	1E-06	4300	1	0.001	250	4	70	25550	6.3E-08	0.00E+00	0.0E+00	0%	1460	1.1E-06	6.00E-02	1.8E-05	0%
4,4'-DDE	2.6E-03	1E-06	4300	1	0.01	250	4	70	25550	6.3E-11	6.80E-01	4.3E-11	0%	1460	1.1E-09	0.00E+00	0.0E+00	0%
4,4'-DDT	5.0E-03	1E-06	4300	1	0.01	250	4	70	25550	1.2E-10	6.80E-01	8.1E-11	0%	1460	2.1E-09	2.50E-04	8.4E-06	0%
TOTAL												2.3E-08					5.2E-03	

SURFACE SOIL PARTICULATE INHALATION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 1)
REMEDIAL INVESTIGATION CTO-0231
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)	4.63E+09

Note: Inputs are scenario and site specific

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 (years)	Carc Dose (mg/kg/day)	Slope Factor (mg/kg-day)-1	Carcinogenic Risk	Percent Contribution to Risk	Average Noncarc Time (years)	Noncarc Dose (mg/kg/day)	Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
Aluminum	3.8E+03	4.6E+09	250	30	4	70	25550	1.4E-08	0.00E+00	0.0E+00	0%	1460	2.4E-07	0.00E+00	0.0E+00	0%
Antimony	6.2E+00	4.6E+09	250	30	4	70	25550	2.3E-11	0.00E+00	0.0E+00	0%	1460	4.0E-10	0.00E+00	0.0E+00	0%
Arsenic	1.1E+00	4.6E+09	250	30	4	70	25550	4.0E-12	1.51E+01	6.1E-11	100%	1460	7.0E-11	0.00E+00	0.0E+00	0%
Cadmium (soil)	7.1E-01	4.6E+09	250	30	4	70	25550	2.6E-12	0.00E+00	0.0E+00	0%	1460	4.5E-11	0.00E+00	0.0E+00	0%
Chromium	6.4E+00	4.6E+09	250	30	4	70	25550	2.3E-11	0.00E+00	0.0E+00	0%	1460	4.1E-10	0.00E+00	0.0E+00	0%
Manganese (soil)	1.0E+01	4.6E+09	250	30	4	70	25550	3.7E-11	0.00E+00	0.0E+00	0%	1460	6.6E-10	0.00E+00	0.0E+00	0%
Vanadium	6.2E+00	4.6E+09	250	30	4	70	25550	2.2E-11	0.00E+00	0.0E+00	0%	1460	3.9E-10	0.00E+00	0.0E+00	0%
Zinc	2.6E+01	4.6E+09	250	30	4	70	25550	9.5E-11	0.00E+00	0.0E+00	0%	1460	1.7E-09	0.00E+00	0.0E+00	0%
4,4'-DDE	2.6E-03	4.6E+09	250	30	4	70	25550	9.6E-15	0.00E+00	0.0E+00	0%	1460	1.7E-13	0.00E+00	0.0E+00	0%
4,4'-DDT	5.0E-03	4.6E+09	250	30	4	70	25550	1.8E-14	3.40E-01	6.1E-15	0%	1460	3.2E-13	0.00E+00	0.0E+00	0%
TOTAL										6.1E-11					0.0E+00	

SUBSURFACE SOIL INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 1)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site 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 (years)	Carc Dose (mg/kg/day) Adult	Slope Factor (mg/kg/day)-1	Carcinogenic Risk Adult	Percent Carcinogenic Risk Adult	Average Noncarc Time (years)	Noncarc Dose (mg/kg/day) Adult	Reference Dose (mg/kg/day)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
Aluminum	4.6E+03	90	1	1E-06	480	70	25550	1.1E-04	0.00E+00	0.0E+00	0%	365	1.1E-04	1.00E+00	1.1E-04	44%
Arsenic	1.2E+00	90	1	1E-06	480	70	25550	2.9E-08	1.75E+00	5.1E-08	100%	365	2.9E-08	3.00E-04	9.8E-05	38%
Barium	9.1E+00	90	1	1E-06	480	70	25550	2.2E-07	0.00E+00	0.0E+00	0%	365	2.2E-07	7.00E-02	3.1E-06	1%
Cadmium (soil)	3.2E-01	90	1	1E-06	480	70	25550	7.7E-09	0.00E+00	0.0E+00	0%	365	7.7E-09	1.00E-03	7.7E-06	3%
Chromium	7.0E+00	90	1	1E-06	480	70	25550	1.7E-07	0.00E+00	0.0E+00	0%	365	1.7E-07	1.00E+00	1.7E-07	0%
Cobalt	4.7E-01	90	1	1E-06	480	70	25550	1.1E-08	0.00E+00	0.0E+00	0%	365	1.1E-08	6.00E-02	1.9E-07	0%
Copper	1.3E+00	90	1	1E-06	480	70	25550	3.1E-08	0.00E+00	0.0E+00	0%	365	3.1E-08	3.71E-02	8.5E-07	0%
Lead	5.5E+00	90	1	1E-06	480	70	25550	1.3E-07	0.00E+00	0.0E+00	0%	365	1.3E-07	0.00E+00	0.0E+00	0%
Manganese (soil)	8.5E+00	90	1	1E-06	480	70	25550	2.1E-07	0.00E+00	0.0E+00	0%	365	2.1E-07	1.40E-01	1.5E-06	1%
Nickel	1.5E+00	90	1	1E-06	480	70	25550	3.6E-08	0.00E+00	0.0E+00	0%	365	3.6E-08	2.00E-02	1.8E-06	1%
Vanadium	8.3E+00	90	1	1E-06	480	70	25550	2.0E-07	0.00E+00	0.0E+00	0%	365	2.0E-07	7.00E-03	2.9E-05	11%
Zinc	5.4E+00	90	1	1E-06	480	70	25550	1.3E-07	0.00E+00	0.0E+00	0%	365	1.3E-07	3.00E-01	4.4E-07	0%
Bis(2-ethylhexyl)phthalate	4.4E-01	90	1	1E-06	480	70	25550	1.1E-08	1.40E-02	1.5E-10	0%	365	1.1E-08	2.00E-02	5.3E-07	0%
TOTAL										5.1E-08					2.5E-04	

SUBSURFACE SOIL DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 1)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site 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 (years)	Carc Dose (mg/kg/day) Adult	Dermal Adjust. 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)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
Aluminum	4.6E+03	1E-06	4300	1	0.001	90	1	70	25550	1.0E-08	0.00E+00	0.0E+00	0%	365	7.0E-05	2.00E-01	3.5E-04	44%
Arsenic	1.2E+00	1E-06	4300	1	0.001	90	1	70	25550	2.6E-10	8.75E+00	2.3E-09	99%	365	1.8E-08	6.00E-05	3.1E-04	38%
Barium	9.1E+00	1E-06	4300	1	0.001	90	1	70	25550	2.0E-09	0.00E+00	0.0E+00	0%	365	1.4E-07	1.40E-02	9.9E-06	1%
Cadmium (soil)	3.2E-01	1E-06	4300	1	0.001	90	1	70	25550	6.9E-11	0.00E+00	0.0E+00	0%	365	4.8E-09	2.00E-04	2.4E-05	3%
Chromium	7.0E+00	1E-06	4300	1	0.001	90	1	70	25550	1.5E-09	0.00E+00	0.0E+00	0%	365	1.1E-07	2.00E-01	5.3E-07	0%
Cobalt	4.7E-01	1E-06	4300	1	0.001	90	1	70	25550	1.0E-10	0.00E+00	0.0E+00	0%	365	7.0E-09	1.20E-02	5.9E-07	0%
Copper	1.3E+00	1E-06	4300	1	0.001	90	1	70	25550	2.8E-10	0.00E+00	0.0E+00	0%	365	2.0E-08	7.42E-03	2.7E-06	0%
Lead	5.5E+00	1E-06	4300	1	0.001	90	1	70	25550	1.2E-09	0.00E+00	0.0E+00	0%	365	8.4E-08	0.00E+00	0.0E+00	0%
Manganese (soil)	8.5E+00	1E-06	4300	1	0.001	90	1	70	25550	1.8E-09	0.00E+00	0.0E+00	0%	365	1.3E-07	2.80E-02	4.6E-06	1%
Nickel	1.5E+00	1E-06	4300	1	0.001	90	1	70	25550	3.2E-10	0.00E+00	0.0E+00	0%	365	2.2E-08	4.00E-03	5.6E-06	1%
Vanadium	8.3E+00	1E-06	4300	1	0.001	90	1	70	25550	1.8E-09	0.00E+00	0.0E+00	0%	365	1.3E-07	1.40E-03	9.0E-05	11%
Zinc	5.4E+00	1E-06	4300	1	0.001	90	1	70	25550	1.2E-09	0.00E+00	0.0E+00	0%	365	8.2E-08	6.00E-02	1.4E-06	0%
Bis(2-ethylhexyl)phthalate	4.4E-01	1E-06	4300	1	0.01	90	1	70	25550	9.4E-10	2.80E-02	2.6E-11	1%	365	6.6E-08	1.00E-02	6.6E-06	1%
TOTAL												2.3E-09					8.0E-04	

SUBSURFACE SOIL PARTICULATE INHALATION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 1)
REMEDIAL INVESTIGATION CTO-0231
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)	Calculated
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)	4.63E+09

Note: Inputs are scenario and site specific

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 (years)	Carc Dose (mg/kg/day)	Slope Factor (mg/kg-day)-1	Carcinogenic Risk	Percent Contribution to Risk	Average Noncarc Time (years)	Noncarc Dose (mg/kg/day)	Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
Aluminum	4.6E+03	4.6E+09	90	20	1	70	25550	1.0E-09	0.0E+00	0.0E+00	0%	365	7.1E-08	0.0E+00	0.0E+00	0%
Arsenic	1.2E+00	4.6E+09	90	20	1	70	25550	2.6E-13	1.5E+01	4.0E-12	100%	365	1.8E-11	0.0E+00	0.0E+00	0%
Barium	9.1E+00	4.6E+09	90	20	1	70	25550	2.0E-12	0.0E+00	0.0E+00	0%	365	1.4E-10	1.4E-04	9.7E-07	100%
Cadmium (soil)	3.2E-01	4.6E+09	90	20	1	70	25550	6.9E-14	0.0E+00	0.0E+00	0%	365	4.9E-12	0.0E+00	0.0E+00	0%
Chromium	7.0E+00	4.6E+09	90	20	1	70	25550	1.5E-12	0.0E+00	0.0E+00	0%	365	1.1E-10	0.0E+00	0.0E+00	0%
Cobalt	4.7E-01	4.6E+09	90	20	1	70	25550	1.0E-13	0.0E+00	0.0E+00	0%	365	7.1E-12	0.0E+00	0.0E+00	0%
Copper	1.3E+00	4.6E+09	90	20	1	70	25550	2.8E-13	0.0E+00	0.0E+00	0%	365	2.0E-11	0.0E+00	0.0E+00	0%
Lead	5.5E+00	4.6E+09	90	20	1	70	25550	1.2E-12	0.0E+00	0.0E+00	0%	365	8.4E-11	0.0E+00	0.0E+00	0%
Manganese (soil)	8.5E+00	4.6E+09	90	20	1	70	25550	1.8E-12	0.0E+00	0.0E+00	0%	365	1.3E-10	0.0E+00	0.0E+00	0%
Nickel	1.5E+00	4.6E+09	90	20	1	70	25550	3.2E-13	0.0E+00	0.0E+00	0%	365	2.2E-11	0.0E+00	0.0E+00	0%
Vanadium	8.3E+00	4.6E+09	90	20	1	70	25550	1.8E-12	0.0E+00	0.0E+00	0%	365	1.3E-10	0.0E+00	0.0E+00	0%
Zinc	5.4E+00	4.6E+09	90	20	1	70	25550	1.2E-12	0.0E+00	0.0E+00	0%	365	8.3E-11	0.0E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	4.4E-01	4.6E+09	90	20	1	70	25550	9.5E-14	0.0E+00	0.0E+00	0%	365	6.6E-12	0.0E+00	0.0E+00	0%
TOTAL										4.0E-12					9.7E-07	

SITE 28

GROUNDWATER INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 28)
REMEDIAL INVESTIGATION CTO-0231
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/Day)	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 (yr)	6
DY = days per year (day/year)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

Note: Inputs are scenario and site 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
Arsenic	2.7E-03	1	350	6	15	25550	1.5E-05	1.8E+00	2.8E-05	63%	2190	1.7E-04	3.0E-04	5.8E-01	3%
Barium	7.6E-01	1	350	6	15	25550	4.2E-03	0.0E+00	0.0E+00	0%	2190	4.9E-02	7.0E-02	6.9E-01	3%
Lead	3.7E-02	1	350	6	15	25550	2.0E-04	0.0E+00	0.0E+00	0%	2190	2.4E-03	0.0E+00	0.0E+00	0%
Manganese (water)	1.5E+00	1	350	6	15	25550	7.9E-03	0.0E+00	0.0E+00	0%	2190	9.3E-02	5.0E-03	1.9E+01	92%
Mercury	5.0E-04	1	350	6	15	25550	2.7E-06	0.0E+00	0.0E+00	0%	2190	3.2E-05	3.0E-04	1.1E-01	1%
2,4-Dimethylphenol	4.3E-03	1	350	6	15	25550	2.4E-05	0.0E+00	0.0E+00	0%	2190	2.7E-04	2.0E-02	1.4E-02	0%
Acenaphthene	1.0E-02	1	350	6	15	25550	5.5E-05	0.0E+00	0.0E+00	0%	2190	6.4E-04	6.0E-02	1.1E-02	0%
4,4'-DDE	1.6E-03	1	350	6	15	25550	8.8E-06	3.4E-01	3.0E-06	7%	2190	1.0E-04	0.0E+00	0.0E+00	0%
4,4'-DDD	9.0E-03	1	350	6	15	25550	4.9E-05	2.4E-01	1.2E-05	29%	2190	5.6E-04	0.0E+00	0.0E+00	0%
4,4'-DDT	1.8E-04	1	350	6	15	25550	9.9E-07	3.4E-01	3.4E-07	1%	2190	1.2E-05	5.0E-04	2.3E-02	0%
Chloroform	1.2E-03	1	350	6	15	25550	6.6E-06	6.1E-03	4.0E-08	0%	2190	7.7E-05	1.0E-02	7.7E-03	0%
2-Methylnaphthalene	9.3E-03	1	350	6	15	25550	5.1E-05	0.0E+00	0.0E+00	0%	2190	5.9E-04	4.0E-02	1.5E-02	0%
Phenanthrene	6.6E-03	1	350	6	15	25550	3.6E-05	0.0E+00	0.0E+00	0%	2190	4.2E-04	3.0E-02	1.4E-02	0%
4-Methylphenol	9.3E-03	1	350	6	15	25550	5.1E-05	0.0E+00	0.0E+00	0%	2190	5.9E-04	5.0E-03	1.2E-01	1%
TOTAL									4.1E-05					2.0E+01	

GROUNDWATER DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 28)
REMEDIAL INVESTIGATION CTO-0231
MCB CAMP LEJEUNE, NORTH CAROLINA
FUTURE RESIDENTIAL CHILD

Dermal Contact from groundwater 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)	10000
PC = contaminant specific dermal permeability (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

Note: Inputs are site and scenario specific

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
Arsenic	2.7E-03	10000	1.00E-03	0.25	350	6	0.001	15	25550	3.7E-08	8.6E+00	3.3E-07	2%	2190	4.3E-07	8.0E-05	7.2E-03	2%
Barium	7.6E-01	10000	1.00E-03	0.25	350	6	0.001	15	25550	1.0E-05	0.0E+00	0.0E+00	0%	2190	1.2E-04	1.4E-02	8.7E-03	2%
Lead	3.7E-02	10000	4.00E-06	0.25	350	6	0.001	15	25550	2.0E-09	0.0E+00	0.0E+00	0%	2190	2.4E-08	0.0E+00	0.0E+00	0%
Manganese (water)	1.6E+00	10000	1.00E-03	0.25	350	6	0.001	15	25550	2.0E-05	0.0E+00	0.0E+00	0%	2190	2.3E-04	1.0E-03	2.3E-01	67%
Mercury	5.0E-04	10000	1.00E-03	0.25	350	6	0.001	15	25550	6.9E-09	0.0E+00	0.0E+00	0%	2190	8.0E-08	6.0E-05	1.3E-03	0%
2,4-Dimethylphenol	4.3E-03	10000	1.60E-02	0.25	350	6	0.001	15	25550	8.9E-07	0.0E+00	0.0E+00	0%	2190	1.0E-05	1.0E-02	1.0E-03	0%
Acenaphthene	1.0E-02	10000	1.52E-01	0.25	350	6	0.001	15	25550	2.1E-06	0.0E+00	0.0E+00	0%	2190	2.4E-04	3.0E-02	8.1E-03	2%
4,4'-DDE	1.6E-03	10000	2.40E-01	0.25	350	6	0.001	15	25550	5.3E-06	6.8E-01	3.6E-06	17%	2190	6.1E-05	0.0E+00	0.0E+00	0%
4,4'-DDD	9.0E-03	10000	2.80E-01	0.25	350	6	0.001	15	25550	3.9E-05	4.6E-01	1.7E-05	78%	2190	4.0E-04	0.0E+00	0.0E+00	0%
4,4'-DDT	1.8E-04	10000	4.30E-01	0.25	350	6	0.001	15	25550	1.1E-08	6.8E-01	7.2E-07	3%	2190	1.2E-06	2.5E-04	4.9E-02	14%
Chloroform	1.2E-03	10000	8.90E-03	0.25	350	6	0.001	15	25550	1.5E-07	7.6E-03	1.1E-09	0%	2190	1.7E-08	8.0E-03	2.1E-04	0%
2-Methylnaphthalene	9.3E-03	10000	1.42E-01	0.25	350	6	0.001	15	25550	1.8E-05	0.0E+00	0.0E+00	0%	2190	2.1E-04	2.0E-02	1.1E-02	3%
Phenanthrene	6.6E-03	10000	2.70E-01	0.25	350	6	0.001	15	25550	2.4E-05	0.0E+00	0.0E+00	0%	2190	2.8E-04	1.5E-02	1.9E-02	5%
4-Methylphenol	9.3E-03	10000	1.80E-02	0.25	350	6	0.001	15	25550	2.3E-06	0.0E+00	0.0E+00	0%	2190	2.7E-05	2.5E-03	1.1E-02	3%
TOTAL												2.1E-05					3.5E-01	

CTO-231 SITE 28 GROUNDWATER INHALATION
13-Jun-95
FILE: SHOW.WQ1

GROUNDWATER INHALATION - RME CASE

CHILD

CHEMICAL	C rme mg/kg/shw	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
Chloroform	7.09E-05	9	350	3285	25550	6.8E-05	8.7E-06	0.0E+00	8.1E-02	---	7.0E-07	0%	88%
Phenanthrene	1.57E-04	9	350	3285	25550	1.5E-04	1.9E-05	0.0E+00	0.0E+00	---	0.0E+00	0%	0%
2, 4-Dimethylphenol	8.71E-07	9	350	3285	25550	8.4E-07	1.1E-07	0.0E+00	0.0E+00	---	0.0E+00	0%	0%
Acenaphthene	1.81E-04	9	350	3285	25550	1.7E-04	2.2E-05	0.0E+00	0.0E+00	---	0.0E+00	0%	0%
4, 4'-DDE	2.06E-05	9	350	3285	25550	2.0E-05	2.5E-06	0.0E+00	0.0E+00	---	0.0E+00	0%	0%
4, 4'-DDT	2.20E-06	9	350	3285	25550	2.1E-06	2.7E-07	0.0E+00	3.4E-01	---	9.2E-08	0%	12%
4-Methylphenol	3.05E-06	9	350	3285	25550	2.9E-06	3.8E-07	0.0E+00	0.0E+00	---	0.0E+00	0%	0%
									TOTAL	0.0E+00	8.0E-07		

site 28 groundwater
13-Jun-95 file: showmod.wq1

CAS No.	TARGET COMPOUND LIST CONSTITUE	OVERALL MASS TRANSF COEFFICIENT (KL) (cm/hr)	HENRY'S LAW CONSTAN (H) (atm-m3/mol-K)	GAS CONSTAN (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 TRANSF. COEFFICIENT (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 MASS TRANSF. COEFF. TEMP. COMP. (KaL) (cm/hr)	WATER VISCOSITY (AT Ts) (Us) (cp)	WATER VISCOSITY (AT T1) (U1) (cp)	SHOWER WATER TEMP. (Ts) (K)	((T1)*(Us))/ ((Ts)*(U1))
site 28 RME adult																		
	Chloroform	1.12E+01	2.87E-03	8.20E-05	293.0	2.40E-02	1.16E+03	1.21E+01	20.0	3000.0	119.40	8.24E-02	7.19E-03	1.51E+01	0.596	1.002	318.0	5.48E-01
	Phenanthrene	3.86E+00	1.59E-04	8.20E-05	293.0	2.40E-02	9.53E+02	9.94E+00	20.0	3000.0	178.22	1.01E-01	1.58E-01	5.21E+00	0.596	1.002	318.0	5.48E-01
	2,4-dimethylphenol	3.01E-02	6.30E-07	8.20E-05	293.0	2.40E-02	1.15E+03	1.20E+01	20.0	3000.0	122.16	8.33E-02	3.31E+01	4.07E-02	0.596	1.002	318.0	5.48E-01
	acenaphthene	2.87E+00	9.20E-05	8.20E-05	293.0	2.40E-02	1.03E+03	1.07E+01	20.0	3000.0	154.00	9.35E-02	2.55E-01	3.88E+00	0.596	1.002	318.0	5.48E-01
	4,4'-DDE	2.00E+00	9.20E-05	8.20E-05	293.0	2.40E-02	7.14E+02	7.44E+00	20.0	3000.0	318.00	1.34E-01	3.66E-01	2.70E+00	0.596	1.002	318.0	5.48E-01
	4,4'-DDT	1.89E+00	9.20E-05	8.20E-05	293.0	2.40E-02	6.76E+02	7.05E+00	20.0	3000.0	354.50	1.42E-01	3.86E-01	2.56E+00	0.596	1.002	318.0	5.48E-01
	4-Methyphenol	4.87E-02	9.60E-07	8.20E-05	293.0	2.40E-02	1.22E+03	1.28E+01	20.0	3000.0	108.13	7.84E-02	2.04E+01	6.58E-02	0.596	1.002	318.0	5.48E-01
child	Chloroform	1.12E+01	2.87E-03	8.20E-05	293.0	2.40E-02	1.16E+03	1.21E+01	20.0	3000.0	119.40	8.24E-02	7.19E-03	1.51E+01	0.596	1.002	318.0	5.48E-01
	Phenanthrene	3.86E+00	1.59E-04	8.20E-05	293.0	2.40E-02	9.53E+02	9.94E+00	20.0	3000.0	178.22	1.01E-01	1.58E-01	5.21E+00	0.596	1.002	318.0	5.48E-01
	2,4-dimethylphenol	3.01E-02	6.30E-07	8.20E-05	293.0	2.40E-02	1.15E+03	1.20E+01	20.0	3000.0	122.16	8.33E-02	3.31E+01	4.07E-02	0.596	1.002	318.0	5.48E-01
	acenaphthene	2.87E+00	9.20E-05	8.20E-05	293.0	2.40E-02	1.03E+03	1.07E+01	20.0	3000.0	154.00	9.35E-02	2.55E-01	3.88E+00	0.596	1.002	318.0	5.48E-01
	4,4'-DDE	2.00E+00	9.20E-05	8.20E-05	293.0	2.40E-02	7.14E+02	7.44E+00	20.0	3000.0	318.00	1.34E-01	3.66E-01	2.70E+00	0.596	1.002	318.0	5.48E-01
	4,4'-DDT	1.89E+00	9.20E-05	8.20E-05	293.0	2.40E-02	6.76E+02	7.05E+00	20.0	3000.0	354.50	1.42E-01	3.86E-01	2.56E+00	0.596	1.002	318.0	5.48E-01
	4-Methyphenol	4.87E-02	9.60E-07	8.20E-05	293.0	2.40E-02	1.22E+03	1.28E+01	20.0	3000.0	108.13	7.84E-02	2.04E+01	6.58E-02	0.596	1.002	318.0	5.48E-01

site 28 groundwater
13-Jun-95 file: shower(tox).wq1

CAS No.	TARGET COMPOUND LIST CONSTITUENT	CONCENTRATION LEAVING SHWR DROPLET Cwd (ug/l)	SHOWER WATER CONCENTRATION Cwo (ug/l)	SHOWER DROPLET DIAMETER d (mm)	SHOWER DROPLET DROP TIME tr (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 (F/V) (liter/min)	SHOWER ROOM AIR VOLUME (V/F) (m3)	INDOOR AIR VOC CONC. AT TIME t Cair(t) (ug/m3)	AIR EXCHANGE RATE A (min-1)	SHOWER DURATION Ds (min)	TOTAL TIME DURATION t (min)	exp(A(Ds)-1)	exp(-A(t))	INHALATION EXPOSURE PER SHOWER Einh (mg/kg/shwr)	VENTILATION RATE Vr (liter/min)	BODY WEIGHT Bw (kg)	exp(-A(Dt))	DURATION IN THE SHOWER ROOM Dr (min)	Ds + exp(-A(Ds))/A	exp(A(Ds+Dr))/A	(Ds+Dr)	(Vr * B)/(BW)(t)(Q)
site 28 RME aux																											
	Chloroform	4.74E-01	1.2	1.00	2.00	3.02E+01	6.00E+01	-5.03E-01	6.0464E-01	7.90E-01	10	6	3.42E+01	0.0083	12	15	4.06E-01	8.83E-01	1.17E-05	10	70	8.83E-01	15	1.184E+02	1.175E+02	-3	1.38E-05
	Phenanthrene	1.05E+00	6.6	1.00	2.00	1.04E+01	6.00E+01	-1.74E-01	8.4049E-01	1.75E+00	10	6	7.58E+01	0.0083	12	15	4.06E-01	8.83E-01	2.59E-05	10	70	8.83E-01	15	1.184E+02	1.175E+02	-3	3.02E-05
	2,4-dimethylphenol	5.83E-03	4.3	1.00	2.00	8.14E-02	6.00E+01	-1.36E-03	9.9864E-01	9.71E-03	10	6	4.20E-01	0.0083	12	15	4.06E-01	8.83E-01	1.44E-07	10	70	8.83E-01	15	1.184E+02	1.175E+02	-3	1.67E-07
	acenaphthene	1.21E+00	10.0	1.00	2.00	7.78E+00	6.00E+01	-1.29E-01	8.7809E-01	2.02E+00	10	6	8.74E+01	0.0083	12	15	4.06E-01	8.83E-01	2.99E-05	10	70	8.83E-01	15	1.184E+02	1.175E+02	-3	3.48E-05
	4,4'-DDE	1.38E-01	1.6	1.00	2.00	6.40E+00	6.00E+01	-8.00E-02	9.1353E-01	2.30E-01	10	6	9.92E+00	0.0083	12	15	4.06E-01	8.83E-01	3.38E-06	10	70	8.83E-01	15	1.184E+02	1.175E+02	-3	3.95E-06
	4,4'-DDT	1.47E-02	0.2	1.00	2.00	8.11E+00	6.00E+01	-8.62E-02	9.1825E-01	2.46E-02	10	6	1.05E+00	0.0083	12	15	4.06E-01	8.83E-01	3.62E-07	10	70	8.83E-01	15	1.184E+02	1.175E+02	-3	4.22E-07
	4-methylphenol	2.04E-02	0.3	1.00	2.00	1.32E-01	6.00E+01	-2.19E-03	9.9781E-01	3.40E-02	10	6	1.47E+00	0.0083	12	15	4.06E-01	8.83E-01	5.02E-07	10	70	8.83E-01	15	1.184E+02	1.175E+02	-3	5.85E-07
site 28	Chloroform	4.74E-01	1.2	1.00	2.00	3.02E+01	6.00E+01	-5.03E-01	6.0464E-01	7.90E-01	10	6	3.42E+01	0.0083	12	15	4.06E-01	8.83E-01	7.08E-05	13	15	8.83E-01	15	1.184E+02	1.175E+02	-3	8.25E-06
	Phenanthrene	1.05E+00	6.6	1.00	2.00	1.04E+01	6.00E+01	-1.74E-01	8.4049E-01	1.75E+00	10	6	7.58E+01	0.0083	12	15	4.06E-01	8.83E-01	1.57E-04	13	15	8.83E-01	15	1.184E+02	1.175E+02	-3	1.83E-04
	2,4-dimethylphenol	5.83E-03	4.3	1.00	2.00	8.14E-02	6.00E+01	-1.36E-03	9.9864E-01	9.71E-03	10	6	4.20E-01	0.0083	12	15	4.06E-01	8.83E-01	8.71E-07	13	15	8.83E-01	15	1.184E+02	1.175E+02	-3	1.01E-06
	acenaphthene	1.21E+00	10.0	1.00	2.00	7.78E+00	6.00E+01	-1.29E-01	8.7809E-01	2.02E+00	10	6	8.74E+01	0.0083	12	15	4.06E-01	8.83E-01	1.81E-04	13	15	8.83E-01	15	1.184E+02	1.175E+02	-3	2.11E-04
	4,4'-DDE	1.38E-01	1.6	1.00	2.00	6.40E+00	6.00E+01	-8.00E-02	9.1353E-01	2.30E-01	10	6	9.92E+00	0.0083	12	15	4.06E-01	8.83E-01	2.06E-05	13	15	8.83E-01	15	1.184E+02	1.175E+02	-3	2.40E-05
	4,4'-DDT	1.47E-02	0.2	1.00	2.00	8.11E+00	6.00E+01	-8.62E-02	9.1825E-01	2.46E-02	10	6	1.05E+00	0.0083	12	15	4.06E-01	8.83E-01	2.20E-06	13	15	8.83E-01	15	1.184E+02	1.175E+02	-3	2.56E-06

SURFACE SOIL INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 28)
REMEDIAL INVESTIGATION CTO-0231
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

[1] Note: Inputs are scenario and site 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
Aluminum	3.4E+03	350	6	1E-06	200	15	25550	3.7E-03	0.00E+00	0.0E+00	0%	2190	4.4E-02	1.00E+00	4.4E-02	7%
Antimony	5.7E+00	350	6	1E-06	200	15	25550	6.2E-06	0.00E+00	0.0E+00	0%	2190	7.2E-05	4.00E-04	1.8E-01	31%
Arsenic	1.7E+00	350	6	1E-06	200	15	25550	1.9E-06	1.75E+00	3.3E-06	51%	2190	2.2E-05	3.00E-04	7.4E-02	13%
Barium	3.5E+01	350	6	1E-06	200	15	25550	3.8E-05	0.00E+00	0.0E+00	0%	2190	4.4E-04	7.00E-02	6.3E-03	1%
Cadmium (soil)	1.6E+00	350	6	1E-06	200	15	25550	1.7E-06	0.00E+00	0.0E+00	0%	2190	2.0E-05	1.00E-03	2.0E-02	3%
Chromium	1.0E+01	350	6	1E-06	200	15	25550	1.1E-05	0.00E+00	0.0E+00	0%	2190	1.3E-04	1.00E+00	1.3E-04	0%
Cobalt	9.1E-01	350	6	1E-06	200	15	25550	1.0E-06	0.00E+00	0.0E+00	0%	2190	1.2E-05	6.00E-02	1.9E-04	0%
Copper	1.3E+02	350	6	1E-06	200	15	25550	1.4E-04	0.00E+00	0.0E+00	0%	2190	1.7E-03	3.71E-02	4.5E-02	8%
Lead	1.7E+02	350	6	1E-06	200	15	25550	1.9E-04	0.00E+00	0.0E+00	0%	2190	2.2E-03	0.00E+00	0.0E+00	0%
Manganese (soil)	3.3E+02	350	6	1E-06	200	15	25550	3.6E-04	0.00E+00	0.0E+00	0%	2190	4.2E-03	1.40E-01	3.0E-02	5%
Mercury	2.8E-01	350	6	1E-06	200	15	25550	3.1E-07	0.00E+00	0.0E+00	0%	2190	3.6E-06	3.00E-04	1.2E-02	2%
Nickel	5.6E+00	350	6	1E-06	200	15	25550	6.1E-06	0.00E+00	0.0E+00	0%	2190	7.1E-05	2.00E-02	3.6E-03	1%
Silver	1.1E+00	350	6	1E-06	200	15	25550	1.2E-06	0.00E+00	0.0E+00	0%	2190	1.4E-05	5.00E-03	2.9E-03	0%
Thallium	5.1E-01	350	6	1E-06	200	15	25550	5.6E-07	0.00E+00	0.0E+00	0%	2190	6.6E-06	8.00E-05	8.2E-02	14%
Vanadium	7.9E+00	350	6	1E-06	200	15	25550	8.7E-06	0.00E+00	0.0E+00	0%	2190	1.0E-04	7.00E-03	1.5E-02	2%
Zinc	1.1E+03	350	6	1E-06	200	15	25550	1.2E-03	0.00E+00	0.0E+00	0%	2190	1.4E-02	3.00E-01	4.5E-02	8%
4,4'-DDD	6.4E-02	350	6	1E-06	200	15	25550	7.0E-08	2.40E-01	1.7E-08	0%	2190	8.2E-07	0.00E+00	0.0E+00	0%
4,4'-DDE	3.5E-01	350	6	1E-06	200	15	25550	3.8E-07	3.40E-01	1.3E-07	2%	2190	4.4E-06	0.00E+00	0.0E+00	0%
4,4'-DDT	1.5E-01	350	6	1E-06	200	15	25550	1.6E-07	3.40E-01	5.5E-08	1%	2190	1.9E-06	5.00E-04	3.8E-03	1%
Anthracene	2.1E-01	350	6	1E-06	200	15	25550	2.2E-07	0.00E+00	0.0E+00	0%	2190	2.6E-06	3.00E-01	8.7E-06	0%
Benzo(a)anthracene	2.8E-01	350	6	1E-06	200	15	25550	3.0E-07	7.30E-01	2.2E-07	3%	2190	3.6E-06	0.00E+00	0.0E+00	0%
Benzo(a)pyrene	2.7E-01	350	6	1E-06	200	15	25550	2.9E-07	7.30E+00	2.1E-06	33%	2190	3.4E-06	0.00E+00	0.0E+00	0%
Benzo(b)fluoranthene	2.9E-01	350	6	1E-06	200	15	25550	3.2E-07	7.30E-01	2.4E-07	4%	2190	3.8E-06	0.00E+00	0.0E+00	0%
Benzo(g,h,i)perylene	2.5E-01	350	6	1E-06	200	15	25550	2.8E-07	0.00E+00	0.0E+00	0%	2190	3.2E-06	3.00E-02	1.1E-04	0%
Carbazole	1.7E-01	350	6	1E-06	200	15	25550	1.9E-07	2.00E-02	3.7E-09	0%	2190	2.2E-06	0.00E+00	0.0E+00	0%
Chrysene	2.8E-01	350	6	1E-06	200	15	25550	3.1E-07	7.30E-03	2.2E-09	0%	2190	3.6E-06	0.00E+00	0.0E+00	0%
Heptachlor epoxide	6.9E-03	350	6	1E-06	200	15	25550	7.6E-09	9.10E+00	6.9E-08	1%	2190	8.8E-08	1.30E-05	6.8E-03	1%
Indeno(1,2,3-cd)pyrene	2.5E-01	350	6	1E-06	200	15	25550	2.8E-07	7.30E-01	2.0E-07	3%	2190	3.2E-06	0.00E+00	0.0E+00	0%
Phenanthrene	2.8E-01	350	6	1E-06	200	15	25550	3.1E-07	0.00E+00	0.0E+00	0%	2190	3.6E-06	3.00E-02	1.2E-04	0%
alpha-Chlordane	3.8E-02	350	6	1E-06	200	15	25550	4.2E-08	1.30E+00	5.4E-08	1%	2190	4.9E-07	6.00E-05	8.1E-03	1%
gamma-Chlordane	1.3E-02	350	6	1E-06	200	15	25550	1.4E-08	1.30E+00	1.8E-08	0%	2190	1.7E-07	6.00E-05	2.9E-03	0%
TOTAL										6.5E-06					5.9E-01	

SURFACE SOIL DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 28)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site 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 Time (days)	Noncarc Dose (mg/kg/day) Child	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarcinogenic Risk Child	Percent Noncarcinogenic Risk Child
Aluminum	3.4E+03	1E-06	2300	1	0.001	350	6	15	25550	4.3E-08	0.0E+00	0.0E+00	0%	2190	5.0E-04	2.0E-01	2.6E-03	7%
Antimony	5.7E+00	1E-06	2300	1	0.001	350	6	15	25550	7.1E-08	0.0E+00	0.0E+00	0%	2190	8.3E-07	8.0E-05	1.0E-02	28%
Arsenic	1.7E+00	1E-06	2300	1	0.001	350	6	15	25550	2.2E-08	8.8E+00	1.9E-07	21%	2190	2.6E-07	6.0E-05	4.3E-03	11%
Barium	3.5E+01	1E-06	2300	1	0.001	350	6	15	25550	4.4E-07	0.0E+00	0.0E+00	0%	2190	5.1E-06	1.4E-02	3.7E-04	1%
Cadmium (soil)	1.6E+00	1E-06	2300	1	0.001	350	6	15	25550	2.0E-08	0.0E+00	0.0E+00	0%	2190	2.3E-07	2.0E-04	1.1E-03	3%
Chromium	1.0E+01	1E-06	2300	1	0.001	350	6	15	25550	1.3E-07	0.0E+00	0.0E+00	0%	2190	1.5E-06	2.0E-01	7.6E-06	0%
Cobalt	9.1E-01	1E-06	2300	1	0.001	350	6	15	25550	1.1E-08	0.0E+00	0.0E+00	0%	2190	1.3E-07	1.2E-02	1.1E-05	0%
Copper	1.3E+02	1E-06	2300	1	0.001	350	6	15	25550	1.6E-08	0.0E+00	0.0E+00	0%	2190	1.9E-05	7.4E-03	2.6E-03	7%
Lead	1.7E+02	1E-06	2300	1	0.001	350	6	15	25550	2.1E-08	0.0E+00	0.0E+00	0%	2190	2.5E-05	0.0E+00	0.0E+00	0%
Manganese (soil)	3.3E+02	1E-06	2300	1	0.001	350	6	15	25550	4.1E-08	0.0E+00	0.0E+00	0%	2190	4.8E-05	2.8E-02	1.7E-03	5%
Mercury	2.8E-01	1E-06	2300	1	0.001	350	6	15	25550	3.6E-09	0.0E+00	0.0E+00	0%	2190	4.2E-08	6.0E-05	7.0E-04	2%
Nickel	5.6E+00	1E-06	2300	1	0.001	350	6	15	25550	7.0E-08	0.0E+00	0.0E+00	0%	2190	8.2E-07	4.0E-03	2.0E-04	1%
Silver	1.1E+00	1E-06	2300	1	0.001	350	6	15	25550	1.4E-08	0.0E+00	0.0E+00	0%	2190	1.7E-07	1.0E-03	1.7E-04	0%
Thallium	5.1E-01	1E-06	2300	1	0.001	350	6	15	25550	6.5E-09	0.0E+00	0.0E+00	0%	2190	7.6E-08	1.6E-05	4.7E-03	13%
Vanadium	7.9E+00	1E-06	2300	1	0.001	350	6	15	25550	1.0E-07	0.0E+00	0.0E+00	0%	2190	1.2E-06	1.4E-03	8.3E-04	2%
Zinc	1.1E+03	1E-06	2300	1	0.001	350	6	15	25550	1.3E-05	0.0E+00	0.0E+00	0%	2190	1.6E-04	6.0E-02	2.6E-03	7%
4,4'-DDD	6.4E-02	1E-06	2300	1	0.01	350	6	15	25550	8.1E-09	4.8E-01	3.9E-09	0%	2190	9.4E-08	0.0E+00	0.0E+00	0%
4,4'-DDE	3.5E-01	1E-06	2300	1	0.01	350	6	15	25550	4.4E-08	6.8E-01	3.0E-08	3%	2190	5.1E-07	0.0E+00	0.0E+00	0%
4,4'-DDT	1.5E-01	1E-06	2300	1	0.01	350	6	15	25550	1.9E-08	6.8E-01	1.3E-08	1%	2190	2.2E-07	2.5E-04	8.7E-04	2%
Anthracene	2.1E-01	1E-06	2300	1	0.01	350	6	15	25550	2.6E-08	0.0E+00	0.0E+00	0%	2190	3.0E-07	1.5E-01	2.0E-06	0%
Benzo(a)anthracene	2.8E-01	1E-06	2300	1	0.01	350	6	15	25550	3.5E-08	1.5E+00	5.1E-08	6%	2190	4.1E-07	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	2.7E-01	1E-06	2300	1	0.01	350	6	15	25550	3.4E-08	1.5E+01	4.9E-07	54%	2190	3.9E-07	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	2.9E-01	1E-06	2300	1	0.01	350	6	15	25550	3.7E-08	1.5E+00	5.4E-08	6%	2190	4.3E-07	0.0E+00	0.0E+00	0%
Benzo(g,h,i)perylene	2.5E-01	1E-06	2300	1	0.01	350	6	15	25550	3.2E-08	0.0E+00	0.0E+00	0%	2190	3.7E-07	1.5E-02	2.5E-05	0%
Carbazole	1.7E-01	1E-06	2300	1	0.01	350	6	15	25550	2.1E-08	4.0E-02	8.6E-10	0%	2190	2.5E-07	0.0E+00	0.0E+00	0%
Chrysene	2.8E-01	1E-06	2300	1	0.01	350	6	15	25550	3.5E-08	1.5E-02	5.1E-10	0%	2190	4.1E-07	0.0E+00	0.0E+00	0%
Heptachlor epoxide	6.9E-03	1E-06	2300	1	0.01	350	6	15	25550	8.7E-10	1.8E+01	1.6E-08	2%	2190	1.0E-08	6.5E-06	1.6E-03	4%
Indeno(1,2,3-cd)pyrene	2.5E-01	1E-06	2300	1	0.01	350	6	15	25550	3.2E-08	1.5E+00	4.7E-08	5%	2190	3.7E-07	0.0E+00	0.0E+00	0%
Phenanthrene	2.8E-01	1E-06	2300	1	0.01	350	6	15	25550	3.6E-08	0.0E+00	0.0E+00	0%	2190	4.2E-07	1.5E-02	2.8E-05	0%
alpha-Chlordane	3.8E-02	1E-06	2300	1	0.01	350	6	15	25550	4.8E-09	2.6E+00	1.3E-08	1%	2190	5.6E-08	3.0E-05	1.9E-03	5%
gamma-Chlordane	1.3E-02	1E-06	2300	1	0.01	350	6	15	25550	1.6E-09	2.6E+00	4.2E-09	0%	2190	1.9E-08	3.0E-05	6.3E-04	2%
TOTAL												9.2E-07					3.7E-02	

SURFACE SOIL PARTICULATE INHALATION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 28)
REMEDIAL INVESTIGATION CTO-0231
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)	10
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)	4.63E+09

Note: Inputs are scenario and site specific

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 Contribution to Risk	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day)	Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
Aluminum	3.4E+03	4.6E+09	350	10	6	15	25550	4.0E-08	0.0E+00	0.0E+00	0%	2190	4.7E-07	0.0E+00	0.0E+00	0%
Antimony	5.7E+00	4.6E+09	350	10	6	15	25550	6.7E-11	0.0E+00	0.0E+00	0%	2190	7.8E-10	0.0E+00	0.0E+00	0%
Arsenic	1.7E+00	4.6E+09	350	10	6	15	25550	2.1E-11	1.5E+01	3.1E-10	92%	2190	2.4E-10	0.0E+00	0.0E+00	0%
Barium	3.5E+01	4.6E+09	350	10	6	15	25550	4.1E-10	0.0E+00	0.0E+00	0%	2190	4.8E-09	1.4E-04	3.4E-05	99%
Cadmium (soil)	1.6E+00	4.6E+09	350	10	6	15	25550	1.8E-11	0.0E+00	0.0E+00	0%	2190	2.1E-10	0.0E+00	0.0E+00	0%
Chromium	1.0E+01	4.6E+09	350	10	6	15	25550	1.2E-10	0.0E+00	0.0E+00	0%	2190	1.4E-09	0.0E+00	0.0E+00	0%
Cobalt	9.1E-01	4.6E+09	350	10	6	15	25550	1.1E-11	0.0E+00	0.0E+00	0%	2190	1.3E-10	0.0E+00	0.0E+00	0%
Copper	1.3E+02	4.6E+09	350	10	6	15	25550	1.5E-09	0.0E+00	0.0E+00	0%	2190	1.8E-08	0.0E+00	0.0E+00	0%
Lead	1.7E+02	4.6E+09	350	10	6	15	25550	2.0E-09	0.0E+00	0.0E+00	0%	2190	2.3E-08	0.0E+00	0.0E+00	0%
Manganese (soil)	3.3E+02	4.6E+09	350	10	6	15	25550	3.9E-09	0.0E+00	0.0E+00	0%	2190	4.5E-08	0.0E+00	0.0E+00	0%
Mercury	2.8E-01	4.6E+09	350	10	6	15	25550	3.4E-12	0.0E+00	0.0E+00	0%	2190	3.9E-11	8.6E-05	4.6E-07	1%
Nickel	5.6E+00	4.6E+09	350	10	6	15	25550	6.6E-11	0.0E+00	0.0E+00	0%	2190	7.7E-10	0.0E+00	0.0E+00	0%
Silver	1.1E+00	4.6E+09	350	10	6	15	25550	1.3E-11	0.0E+00	0.0E+00	0%	2190	1.6E-10	0.0E+00	0.0E+00	0%
Thallium	5.1E-01	4.6E+09	350	10	6	15	25550	6.1E-12	0.0E+00	0.0E+00	0%	2190	7.1E-11	0.0E+00	0.0E+00	0%
Vanadium	7.9E+00	4.6E+09	350	10	6	15	25550	9.4E-11	0.0E+00	0.0E+00	0%	2190	1.1E-09	0.0E+00	0.0E+00	0%
Zinc	1.1E+03	4.6E+09	350	10	6	15	25550	1.3E-08	0.0E+00	0.0E+00	0%	2190	1.5E-07	0.0E+00	0.0E+00	0%
4,4'-DDD	6.4E-02	4.6E+09	350	10	6	15	25550	7.6E-13	0.0E+00	0.0E+00	0%	2190	8.8E-12	0.0E+00	0.0E+00	0%
4,4'-DDE	3.5E-01	4.6E+09	350	10	6	15	25550	4.1E-12	0.0E+00	0.0E+00	0%	2190	4.9E-11	0.0E+00	0.0E+00	0%
4,4'-DDT	1.5E-01	4.6E+09	350	10	6	15	25550	1.8E-12	3.4E-01	6.0E-13	0%	2190	2.1E-11	0.0E+00	0.0E+00	0%
Anthracene	2.1E-01	4.6E+09	350	10	6	15	25550	2.4E-12	0.0E+00	0.0E+00	0%	2190	2.8E-11	0.0E+00	0.0E+00	0%
Benzo(a)anthracene	2.8E-01	4.6E+09	350	10	6	15	25550	3.3E-12	6.1E-01	2.0E-12	1%	2190	3.8E-11	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	2.7E-01	4.6E+09	350	10	6	15	25550	3.2E-12	6.1E+00	1.9E-11	6%	2190	3.7E-11	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	2.9E-01	4.6E+09	350	10	6	15	25550	3.5E-12	6.1E-01	2.1E-12	1%	2190	4.1E-11	0.0E+00	0.0E+00	0%
Benzo(g,h,i)perylene	2.5E-01	4.6E+09	350	10	6	15	25550	3.0E-12	0.0E+00	0.0E+00	0%	2190	3.5E-11	0.0E+00	0.0E+00	0%
Carbazole	1.7E-01	4.6E+09	350	10	6	15	25550	2.0E-12	0.0E+00	0.0E+00	0%	2190	2.3E-11	0.0E+00	0.0E+00	0%
Chrysene	2.8E-01	4.6E+09	350	10	6	15	25550	3.3E-12	6.1E-03	2.0E-14	0%	2190	3.9E-11	0.0E+00	0.0E+00	0%
Heptachlor epoxide	6.9E-03	4.6E+09	350	10	6	15	25550	8.2E-14	9.1E+00	7.4E-13	0%	2190	9.5E-13	0.0E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	2.5E-01	4.6E+09	350	10	6	15	25550	3.0E-12	6.1E-01	1.8E-12	1%	2190	3.5E-11	0.0E+00	0.0E+00	0%
Phenanthrene	2.8E-01	4.6E+09	350	10	6	15	25550	3.4E-12	0.0E+00	0.0E+00	0%	2190	3.9E-11	0.0E+00	0.0E+00	0%
alpha-Chlordane	3.8E-02	4.6E+09	350	10	6	15	25550	4.5E-13	1.3E+00	5.8E-13	0%	2190	5.3E-12	0.0E+00	0.0E+00	0%
gamma-Chlordane	1.3E-02	4.6E+09	350	10	6	15	25550	1.5E-13	1.3E+00	2.0E-13	0%	2190	1.8E-12	0.0E+00	0.0E+00	0%
TOTAL										3.4E-10					3.4E-05	

SUBSURFACE SOIL INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 28)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site 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
Aluminum	7.8E+03	350	6	1E-06	200	15	25550	8.5E-03	0.00E+00	0.0E+00	0%	2190	1.0E-01	1.00E+00	1.0E-01	6%
Antimony	1.2E+01	350	6	1E-06	200	15	25550	1.3E-05	0.00E+00	0.0E+00	0%	2190	1.5E-04	4.00E-04	3.8E-01	24%
Arsenic	7.9E+00	350	6	1E-06	200	15	25550	8.7E-06	1.75E+00	1.5E-05	61%	2190	1.0E-04	3.00E-04	3.4E-01	22%
Barium	7.8E+01	350	6	1E-06	200	15	25550	8.6E-05	0.00E+00	0.0E+00	0%	2190	1.0E-03	7.00E-02	1.4E-02	1%
Beryllium	1.4E-01	350	6	1E-06	200	15	25550	1.6E-07	4.30E+00	6.8E-07	3%	2190	1.8E-06	5.00E-03	3.7E-04	0%
Cadmium (soil)	3.2E+00	350	6	1E-06	200	15	25550	3.5E-06	0.00E+00	0.0E+00	0%	2190	4.1E-05	1.00E-03	4.1E-02	3%
Chromium	3.4E+01	350	6	1E-06	200	15	25550	3.7E-05	0.00E+00	0.0E+00	0%	2190	4.4E-04	1.00E+00	4.4E-04	0%
Cobalt	2.7E+00	350	6	1E-06	200	15	25550	2.9E-06	0.00E+00	0.0E+00	0%	2190	3.4E-05	6.00E-02	5.7E-04	0%
Copper	8.9E+02	350	6	1E-06	200	15	25550	9.7E-04	0.00E+00	0.0E+00	0%	2190	1.1E-02	3.71E-02	3.1E-01	20%
Lead	1.7E+03	350	6	1E-06	200	15	25550	1.9E-03	0.00E+00	0.0E+00	0%	2190	2.2E-02	0.00E+00	0.0E+00	0%
Manganese (soil)	1.2E+03	350	6	1E-06	200	15	25550	1.3E-03	0.00E+00	0.0E+00	0%	2190	1.5E-02	1.40E-01	1.1E-01	7%
Mercury	2.3E-01	350	6	1E-06	200	15	25550	2.5E-07	0.00E+00	0.0E+00	0%	2190	2.9E-06	3.00E-04	9.7E-03	1%
Nickel	2.3E+01	350	6	1E-06	200	15	25550	2.5E-05	0.00E+00	0.0E+00	0%	2190	3.0E-04	2.00E-02	1.5E-02	1%
Silver	2.5E+00	350	6	1E-06	200	15	25550	2.7E-06	0.00E+00	0.0E+00	0%	2190	3.2E-05	5.00E-03	6.4E-03	0%
Vanadium	2.4E+01	350	6	1E-06	200	15	25550	2.7E-05	0.00E+00	0.0E+00	0%	2190	3.1E-04	7.00E-03	4.5E-02	3%
Zinc	4.3E+03	350	6	1E-06	200	15	25550	4.7E-03	0.00E+00	0.0E+00	0%	2190	5.5E-02	3.00E-01	1.8E-01	12%
2-Methylnaphthalene	8.9E-02	350	6	1E-06	200	15	25550	9.8E-08	0.00E+00	0.0E+00	0%	2190	1.1E-08	4.00E-02	2.8E-05	0%
4,4'-DDD	8.9E-01	350	6	1E-06	200	15	25550	9.8E-07	2.40E-01	2.3E-07	1%	2190	1.1E-06	0.00E+00	0.0E+00	0%
4,4'-DDE	1.6E+00	350	6	1E-06	200	15	25550	1.8E-06	3.40E-01	6.0E-07	2%	2190	2.0E-05	0.00E+00	0.0E+00	0%
4,4'-DDT	1.2E-01	350	6	1E-06	200	15	25550	1.3E-07	3.40E-01	4.4E-08	0%	2190	1.5E-06	5.00E-04	3.0E-03	0%
Benzo(a)anthracene	5.9E-01	350	6	1E-06	200	15	25550	6.4E-07	7.30E-01	4.6E-07	2%	2190	7.4E-08	0.00E+00	0.0E+00	0%
Benzo(a)pyrene	5.6E-01	350	6	1E-06	200	15	25550	6.2E-07	7.30E+00	4.5E-06	18%	2190	7.2E-08	0.00E+00	0.0E+00	0%
Benzo(b)fluoranthene	6.2E-01	350	6	1E-06	200	15	25550	6.7E-07	7.30E-01	4.9E-07	2%	2190	7.9E-08	0.00E+00	0.0E+00	0%
Benzo(g,h,i)perylene	4.4E-01	350	6	1E-06	200	15	25550	4.9E-07	0.00E+00	0.0E+00	0%	2190	5.7E-08	3.00E-02	1.9E-04	0%
Benzo(k)fluoranthene	5.4E-01	350	6	1E-06	200	15	25550	5.9E-07	7.30E-02	4.3E-08	0%	2190	6.8E-08	0.00E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	4.8E-01	350	6	1E-06	200	15	25550	5.2E-07	1.40E-02	7.3E-09	0%	2190	6.1E-08	2.00E-02	3.1E-04	0%
Chrysene	5.7E-01	350	6	1E-06	200	15	25550	6.3E-07	7.30E-03	4.6E-09	0%	2190	7.3E-08	0.00E+00	0.0E+00	0%
Dibenz(a,h)anthracene	2.8E-01	350	6	1E-06	200	15	25550	3.1E-07	7.30E+00	2.3E-06	9%	2190	3.6E-08	0.00E+00	0.0E+00	0%
Fluorene	2.8E-01	350	6	1E-06	200	15	25550	3.1E-07	0.00E+00	0.0E+00	0%	2190	3.6E-08	4.00E-02	8.9E-05	0%
Indeno(1,2,3-cd)pyrene	4.3E-01	350	6	1E-06	200	15	25550	4.8E-07	7.30E-01	3.5E-07	1%	2190	5.6E-08	0.00E+00	0.0E+00	0%
Naphthalene	3.4E-01	350	6	1E-06	200	15	25550	3.8E-07	0.00E+00	0.0E+00	0%	2190	4.4E-08	4.00E-02	1.1E-04	0%
Phenanthrene	6.4E-01	350	6	1E-06	200	15	25550	7.0E-07	0.00E+00	0.0E+00	0%	2190	8.2E-08	3.00E-02	2.7E-04	0%
alpha-Chlordane	1.2E-02	350	6	1E-06	200	15	25550	1.3E-08	1.30E+00	1.6E-08	0%	2190	1.5E-07	6.00E-05	2.5E-03	0%
gamma-Chlordane	8.7E-03	350	6	1E-06	200	15	25550	7.3E-09	1.30E+00	9.5E-09	0%	2190	8.5E-08	6.00E-05	1.4E-03	0%
TOTAL										2.5E-05					1.6E+00	

SUBSURFACE SOIL DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 28)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site specific

COPC	Concentration Carcinogen (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 Time (days)	Noncarc Dose (mg/kg/day) Child	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarcinogenic Risk Child	Percent Noncarcinogenic Risk Child
Aluminum	7.8E+03	1E-06	2300	1	0.001	350	6	15	25550	9.9E-05	0.0E+00	0.0E+00	0%	2190	1.1E-03	2.0E-01	5.7E-03	6%
Antimony	1.2E+01	1E-06	2300	1	0.001	350	6	15	25550	1.6E-07	0.0E+00	0.0E+00	0%	2190	1.7E-06	8.0E-05	2.2E-02	24%
Arsenic	7.6E+00	1E-06	2300	1	0.001	350	6	15	25550	1.0E-07	8.8E+00	8.7E-07	29%	2190	1.2E-06	6.0E-05	1.9E-02	21%
Barium	7.8E+01	1E-06	2300	1	0.001	350	6	15	25550	9.9E-07	0.0E+00	0.0E+00	0%	2190	1.2E-05	1.4E-02	8.2E-04	1%
Beryllium	1.4E-01	1E-06	2300	1	0.001	350	6	15	25550	1.8E-09	2.1E+01	3.9E-08	1%	2190	2.1E-08	1.0E-03	2.1E-05	0%
Cadmium (soil)	3.2E+00	1E-06	2300	1	0.001	350	6	15	25550	4.0E-08	0.0E+00	0.0E+00	0%	2190	4.7E-07	2.0E-04	2.4E-03	3%
Chromium	3.4E+01	1E-06	2300	1	0.001	350	6	15	25550	4.3E-07	0.0E+00	0.0E+00	0%	2190	5.0E-06	2.0E-01	2.6E-05	0%
Cobalt	2.7E+00	1E-06	2300	1	0.001	350	6	15	25550	3.4E-08	0.0E+00	0.0E+00	0%	2190	4.0E-07	1.2E-02	3.3E-05	0%
Copper	8.9E+02	1E-06	2300	1	0.001	350	6	15	25550	1.1E-05	0.0E+00	0.0E+00	0%	2190	1.3E-04	7.4E-03	1.8E-02	19%
Lead	1.7E+03	1E-06	2300	1	0.001	350	6	15	25550	2.2E-05	0.0E+00	0.0E+00	0%	2190	2.5E-04	0.0E+00	0.0E+00	0%
Manganese (soil)	1.2E+03	1E-06	2300	1	0.001	350	6	15	25550	1.6E-05	0.0E+00	0.0E+00	0%	2190	1.7E-04	2.8E-02	6.2E-03	7%
Mercury	2.3E-01	1E-06	2300	1	0.001	350	6	15	25550	2.9E-09	0.0E+00	0.0E+00	0%	2190	3.4E-08	6.0E-05	5.6E-04	1%
Nickel	2.3E+01	1E-06	2300	1	0.001	350	6	15	25550	2.9E-07	0.0E+00	0.0E+00	0%	2190	3.4E-06	4.0E-03	8.5E-04	1%
Silver	2.6E+00	1E-06	2300	1	0.001	350	6	15	25550	3.2E-08	0.0E+00	0.0E+00	0%	2190	3.7E-07	1.0E-03	3.7E-04	0%
Vanadium	2.4E+01	1E-06	2300	1	0.001	350	6	15	25550	3.1E-07	0.0E+00	0.0E+00	0%	2190	3.6E-06	1.4E-03	2.6E-03	3%
Zinc	4.3E+03	1E-06	2300	1	0.001	350	6	15	25550	5.6E-05	0.0E+00	0.0E+00	0%	2190	6.4E-04	6.0E-02	1.1E-02	12%
2-Methylnaphthalene	8.9E-02	1E-06	2300	1	0.01	350	6	15	25550	1.1E-06	0.0E+00	0.0E+00	0%	2190	1.3E-07	2.0E-02	6.5E-06	0%
4,4'-DDD	8.8E-01	1E-06	2300	1	0.01	350	6	15	25550	1.1E-07	4.8E-01	5.3E-08	2%	2190	1.3E-08	0.0E+00	0.0E+00	0%
4,4'-DDE	1.6E+00	1E-06	2300	1	0.01	350	6	15	25550	2.0E-07	6.8E-01	1.4E-07	8%	2190	2.4E-08	0.0E+00	0.0E+00	0%
4,4'-DDT	1.2E-01	1E-06	2300	1	0.01	350	6	15	25550	1.5E-08	6.8E-01	1.0E-08	0%	2190	1.7E-07	2.6E-04	6.6E-04	1%
Benzo(a)anthracene	5.6E-01	1E-06	2300	1	0.01	350	6	15	25550	7.3E-08	1.6E+00	1.1E-07	4%	2190	8.6E-07	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	5.6E-01	1E-06	2300	1	0.01	350	6	15	25550	7.1E-08	1.8E+01	1.0E-06	35%	2190	8.3E-07	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	6.2E-01	1E-06	2300	1	0.01	350	6	15	25550	7.8E-08	1.6E+00	1.1E-07	4%	2190	9.1E-07	0.0E+00	0.0E+00	0%
Benzo(g,h,i)perylene	4.4E-01	1E-06	2300	1	0.01	350	6	15	25550	5.6E-08	0.0E+00	0.0E+00	0%	2190	6.6E-07	1.8E-02	4.4E-05	0%
Benzo(k)fluoranthene	5.4E-01	1E-06	2300	1	0.01	350	6	15	25550	6.7E-08	1.6E-01	9.9E-09	0%	2190	7.9E-07	0.0E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	4.8E-01	1E-06	2300	1	0.01	350	6	15	25550	6.0E-08	2.8E-02	1.7E-09	0%	2190	7.0E-07	1.0E-02	7.0E-05	0%
Chrysene	5.7E-01	1E-06	2300	1	0.01	350	6	15	25550	7.2E-08	1.6E-02	1.1E-09	0%	2190	8.4E-07	0.0E+00	0.0E+00	0%
Dibenz(a,h)anthracene	2.8E-01	1E-06	2300	1	0.01	350	6	15	25550	3.6E-08	1.8E+01	6.2E-07	17%	2190	4.2E-07	0.0E+00	0.0E+00	0%
Fluoranthene	2.8E-01	1E-06	2300	1	0.01	350	6	15	25550	3.5E-08	0.0E+00	0.0E+00	0%	2190	4.1E-07	2.0E-02	2.1E-05	0%
Indeno(1,2,3-cd)pyrene	4.3E-01	1E-06	2300	1	0.01	350	6	15	25550	5.5E-08	1.6E+00	8.0E-08	3%	2190	6.4E-07	0.0E+00	0.0E+00	0%
Naphthalene	3.4E-01	1E-06	2300	1	0.01	350	6	15	25550	4.3E-08	0.0E+00	0.0E+00	0%	2190	5.0E-07	2.0E-02	2.5E-05	0%
Phenanthrene	6.4E-01	1E-06	2300	1	0.01	350	6	15	25550	8.1E-08	0.0E+00	0.0E+00	0%	2190	9.4E-07	1.8E-02	5.3E-05	0%
alpha-Chlordane	1.2E-02	1E-06	2300	1	0.01	350	6	15	25550	1.5E-09	2.6E+00	3.8E-09	0%	2190	1.7E-08	3.0E-05	5.7E-04	1%
gamma-Chlordane	6.7E-03	1E-06	2300	1	0.01	350	6	15	25550	8.4E-10	2.6E+00	2.2E-09	0%	2190	9.8E-09	3.0E-05	3.3E-04	0%
TOTAL												3.0E-06					8.1E-02	

SUBSURFACE SOIL PAR. ATE INHALATION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 28)
REMEDIAL INVESTIGATION CTO-0231
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)	10
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)	4.63E+09

Note: Inputs are scenario and site specific

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
Aluminum	7.8E+03	4.6E+09	350	10	6	15	25550	9.2E-08	0.0E+00	0.0E+00	0%	2190	1.1E-06	0.0E+00	0.0E+00	0%
Antimony	1.2E+01	4.6E+09	350	10	6	15	25550	1.4E-10	0.0E+00	0.0E+00	0%	2190	1.6E-09	0.0E+00	0.0E+00	0%
Arsenic	7.9E+00	4.6E+09	350	10	6	15	25550	9.4E-11	1.5E+01	1.4E-09	94%	2190	1.1E-09	0.0E+00	0.0E+00	0%
Barium	7.8E+01	4.6E+09	350	10	6	15	25550	9.3E-10	0.0E+00	0.0E+00	0%	2190	1.1E-08	1.4E-04	7.6E-05	100%
Beryllium	1.4E-01	4.6E+09	350	10	6	15	25550	1.7E-12	8.4E+00	1.4E-11	1%	2190	2.0E-11	0.0E+00	0.0E+00	0%
Cadmium (soil)	3.2E+00	4.6E+09	350	10	6	15	25550	3.8E-11	0.0E+00	0.0E+00	0%	2190	4.4E-10	0.0E+00	0.0E+00	0%
Chromium	3.4E+01	4.6E+09	350	10	6	15	25550	4.0E-10	0.0E+00	0.0E+00	0%	2190	4.7E-09	0.0E+00	0.0E+00	0%
Cobalt	2.7E+00	4.6E+09	350	10	6	15	25550	3.2E-11	0.0E+00	0.0E+00	0%	2190	3.7E-10	0.0E+00	0.0E+00	0%
Copper	8.9E+02	4.6E+09	350	10	6	15	25550	1.0E-08	0.0E+00	0.0E+00	0%	2190	1.2E-07	0.0E+00	0.0E+00	0%
Lead	1.7E+03	4.6E+09	350	10	6	15	25550	2.0E-08	0.0E+00	0.0E+00	0%	2190	2.4E-07	0.0E+00	0.0E+00	0%
Manganese (soil)	1.2E+03	4.6E+09	350	10	6	15	25550	1.4E-08	0.0E+00	0.0E+00	0%	2190	1.6E-07	0.0E+00	0.0E+00	0%
Mercury	2.3E-01	4.6E+09	350	10	6	15	25550	2.7E-12	0.0E+00	0.0E+00	0%	2190	3.1E-11	8.6E-05	3.7E-07	0%
Nickel	2.3E+01	4.6E+09	350	10	6	15	25550	2.7E-10	0.0E+00	0.0E+00	0%	2190	3.2E-09	0.0E+00	0.0E+00	0%
Silver	2.5E+00	4.6E+09	350	10	6	15	25550	3.0E-11	0.0E+00	0.0E+00	0%	2190	3.5E-10	0.0E+00	0.0E+00	0%
Vanadium	2.4E+01	4.6E+09	350	10	6	15	25550	2.9E-10	0.0E+00	0.0E+00	0%	2190	3.4E-09	0.0E+00	0.0E+00	0%
Zinc	4.3E+03	4.6E+09	350	10	6	15	25550	5.1E-08	0.0E+00	0.0E+00	0%	2190	6.0E-07	0.0E+00	0.0E+00	0%
2-Methylnaphthalene	8.9E-02	4.6E+09	350	10	6	15	25550	1.1E-12	0.0E+00	0.0E+00	0%	2190	1.2E-11	0.0E+00	0.0E+00	0%
4,4'-DDD	8.8E-01	4.6E+09	350	10	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'-DDE	1.6E+00	4.6E+09	350	10	6	15	25550	1.9E-11	0.0E+00	0.0E+00	0%	2190	2.2E-10	0.0E+00	0.0E+00	0%
4,4'-DDT	1.2E-01	4.6E+09	350	10	6	15	25550	1.4E-12	3.4E-01	4.7E-13	0%	2190	1.6E-11	0.0E+00	0.0E+00	0%
Benzo(a)anthracene	5.8E-01	4.6E+09	350	10	6	15	25550	6.9E-12	6.1E-01	4.2E-12	0%	2190	8.0E-11	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	5.6E-01	4.6E+09	350	10	6	15	25550	6.7E-12	6.1E+00	4.1E-11	3%	2190	7.8E-11	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	6.2E-01	4.6E+09	350	10	6	15	25550	7.3E-12	6.1E-01	4.4E-12	0%	2190	8.5E-11	0.0E+00	0.0E+00	0%
Benzo(g,h,i)perylene	4.4E-01	4.6E+09	350	10	6	15	25550	5.3E-12	0.0E+00	0.0E+00	0%	2190	6.1E-11	0.0E+00	0.0E+00	0%
Benzo(k)fluoranthene	5.4E-01	4.6E+09	350	10	6	15	25550	6.3E-12	6.1E-02	3.9E-13	0%	2190	7.4E-11	0.0E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	4.8E-01	4.6E+09	350	10	6	15	25550	5.7E-12	0.0E+00	0.0E+00	0%	2190	6.6E-11	0.0E+00	0.0E+00	0%
Chrysene	5.7E-01	4.6E+09	350	10	6	15	25550	6.8E-12	6.1E-03	4.1E-14	0%	2190	7.9E-11	0.0E+00	0.0E+00	0%
Dibenz(a,h)anthracene	2.8E-01	4.6E+09	350	10	6	15	25550	3.3E-12	6.1E+00	2.0E-11	1%	2190	3.9E-11	0.0E+00	0.0E+00	0%
Fluorene	2.8E-01	4.6E+09	350	10	6	15	25550	3.3E-12	0.0E+00	0.0E+00	0%	2190	3.9E-11	0.0E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	4.3E-01	4.6E+09	350	10	6	15	25550	5.1E-12	6.1E-01	3.1E-12	0%	2190	6.0E-11	0.0E+00	0.0E+00	0%
Naphthalene	3.4E-01	4.6E+09	350	10	6	15	25550	4.1E-12	0.0E+00	0.0E+00	0%	2190	4.7E-11	0.0E+00	0.0E+00	0%
Phenanthrene	6.4E-01	4.6E+09	350	10	6	15	25550	7.6E-12	0.0E+00	0.0E+00	0%	2190	8.8E-11	0.0E+00	0.0E+00	0%
alpha-Chlordane	1.2E-02	4.6E+09	350	10	6	15	25550	1.4E-13	1.3E+00	1.8E-13	0%	2190	1.6E-12	0.0E+00	0.0E+00	0%
gamma-Chlordane	6.7E-03	4.6E+09	350	10	6	15	25550	7.9E-14	1.3E+00	1.0E-13	0%	2190	9.2E-13	0.0E+00	0.0E+00	0%
TOTAL										1.5E-09					7.6E-05	

SEDIMENT INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 26 - NEW RIVER AND COGDELS CREEK)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site specific

NEW RIVER

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 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
Antimony	2.6E+02	45	6	200	1E-06	15	25550	3.7E-05	0.0E+00	0.0E+00	0%	2190	4.3E-04	4.0E-04	1.1E+00	91%
Arsenic	9.0E+00	45	6	200	1E-06	15	25550	1.3E-06	1.8E+00	2.2E-06	72%	2190	1.5E-05	3.0E-04	4.9E-02	4%
Barium	1.6E+01	45	6	200	1E-06	15	25550	2.2E-06	0.0E+00	0.0E+00	0%	2190	2.5E-05	7.0E-02	3.6E-04	0%
Copper	1.3E+03	45	6	200	1E-06	15	25550	1.9E-04	0.0E+00	0.0E+00	0%	2190	2.2E-03	3.7E-02	5.9E-02	5%
Lead	3.9E+04	45	6	200	1E-06	15	25550	5.5E-03	0.0E+00	0.0E+00	0%	2190	6.4E-02	0.0E+00	0.0E+00	0%
Silver	2.1E+00	45	6	200	1E-06	15	25550	3.0E-07	0.0E+00	0.0E+00	0%	2190	3.5E-06	5.0E-03	7.0E-04	0%
Zinc	9.0E+01	45	6	200	1E-06	15	25550	1.3E-05	0.0E+00	0.0E+00	0%	2190	1.5E-04	3.0E-01	4.9E-04	0%
4,4'-DDD	1.8E-02	45	6	200	1E-06	15	25550	2.1E-09	2.4E-01	5.1E-10	0%	2190	2.5E-08	0.0E+00	0.0E+00	0%
4,4'-DDE	8.6E-03	45	6	200	1E-06	15	25550	1.2E-09	3.4E-01	4.1E-10	0%	2190	1.4E-08	0.0E+00	0.0E+00	0%
4,4'-DDT	3.0E-01	45	6	200	1E-06	15	25550	4.2E-08	3.4E-01	1.4E-08	0%	2190	4.9E-07	5.0E-04	9.9E-04	0%
Anthracene	2.6E-01	45	6	200	1E-06	15	25550	3.6E-08	0.0E+00	0.0E+00	0%	2190	4.5E-07	3.0E-01	1.5E-06	0%
Benzo(a)anthracene	1.2E+00	45	6	200	1E-06	15	25550	1.7E-07	7.3E-01	1.2E-07	4%	2190	1.9E-06	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	5.6E-01	45	6	200	1E-06	15	25550	7.9E-08	7.3E+00	5.8E-07	19%	2190	9.3E-07	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	1.1E+00	45	6	200	1E-06	15	25550	1.5E-07	7.3E-01	1.1E-07	4%	2190	1.8E-06	0.0E+00	0.0E+00	0%
Benzo(g,h,i)perylene	3.0E-01	45	6	200	1E-06	15	25550	4.2E-08	0.0E+00	0.0E+00	0%	2190	4.9E-07	3.0E-02	1.6E-05	0%
Benzo(k)fluoranthene	4.9E-01	45	6	200	1E-06	15	25550	6.8E-08	7.3E-02	5.0E-09	0%	2190	8.0E-07	0.0E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	1.3E+00	45	6	200	1E-06	15	25550	1.8E-07	1.4E-02	2.5E-09	0%	2190	2.1E-06	2.0E-02	1.0E-04	0%
Carbazole	1.6E-01	45	6	200	1E-06	15	25550	2.2E-08	2.0E-02	4.5E-10	0%	2190	2.6E-07	0.0E+00	0.0E+00	0%
Chrysene	1.6E+00	45	6	200	1E-06	15	25550	2.2E-07	7.3E-03	1.6E-08	0%	2190	2.6E-06	0.0E+00	0.0E+00	0%
Dibenzofuran	6.0E-02	45	6	200	1E-06	15	25550	8.5E-09	0.0E+00	0.0E+00	0%	2190	9.9E-08	0.0E+00	0.0E+00	0%
Fluoranthene	1.3E+00	45	6	200	1E-06	15	25550	1.8E-07	0.0E+00	0.0E+00	0%	2190	2.1E-06	4.0E-02	5.1E-05	0%
Indeno(1,2,3-cd)pyrene	3.0E-01	45	6	200	1E-06	15	25550	4.2E-08	7.3E-01	3.1E-08	1%	2190	4.9E-07	0.0E+00	0.0E+00	0%
Phenanthrene	7.7E-01	45	6	200	1E-06	15	25550	1.1E-07	0.0E+00	0.0E+00	0%	2190	1.3E-06	3.0E-02	4.2E-05	0%
Pyrene	1.1E+00	45	6	200	1E-06	15	25550	1.5E-07	0.0E+00	0.0E+00	0%	2190	1.8E-06	3.0E-02	6.0E-05	0%
alpha-Chlordane	6.6E-03	45	6	200	1E-06	15	25550	9.3E-10	1.3E+00	1.2E-09	0%	2190	1.1E-08	6.0E-05	1.8E-04	0%
gamma-Chlordane	4.6E-03	45	6	200	1E-06	15	25550	6.5E-10	1.3E+00	8.4E-10	0%	2190	7.6E-09	6.0E-05	1.3E-04	0%
TOTAL										3.1E-06					1.2E+00	

SEDIMENT DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO.7 (SITE 28 - NEW RIVER AND COGDELS CREEK)
REMEDIAL INVESTIGATION CTO-0231
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 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

Note: Inputs are scenario and site specific

NEW RIVER

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 Time (days)	Noncarc Dose (mg/kg/day) Child	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarcinogenic Risk Child	Percent Noncarcinogenic Risk Child
Antimony	2.0E+02	1E-06	2300	1	0.001	45	6	15	25550	4.3E-07	0.0E+00	0.0E+00	0%	2190	6.0E-06	6.0E-05	9.2E-02	90%
Arsenic	8.0E+00	1E-06	2300	1	0.001	45	6	15	25550	1.6E-08	8.8E+00	1.3E-07	44%	2190	1.7E-07	8.0E-05	2.8E-03	4%
Barium	1.6E+01	1E-06	2300	1	0.001	45	6	15	25550	2.8E-08	0.0E+00	0.0E+00	0%	2190	2.9E-07	1.4E-02	2.1E-05	0%
Copper	1.3E+03	1E-06	2300	1	0.001	45	6	15	25550	2.2E-06	0.0E+00	0.0E+00	0%	2190	2.5E-05	7.4E-03	3.4E-03	5%
Lead	3.9E+04	1E-06	2300	1	0.001	45	6	15	25550	6.3E-05	0.0E+00	0.0E+00	0%	2190	7.3E-04	0.0E+00	0.0E+00	0%
Silver	2.1E+00	1E-06	2300	1	0.001	45	6	15	25550	3.6E-08	0.0E+00	0.0E+00	0%	2190	4.0E-08	1.0E-03	4.0E-05	0%
Zinc	9.0E+01	1E-06	2300	1	0.001	45	6	15	25550	1.5E-07	0.0E+00	0.0E+00	0%	2190	1.7E-06	6.0E-02	2.8E-05	0%
4,4'-DDD	1.8E-02	1E-06	2300	1	0.01	45	6	15	25550	2.4E-10	4.8E-01	1.2E-10	0%	2190	2.8E-09	0.0E+00	0.0E+00	0%
4,4'-DDE	8.5E-03	1E-06	2300	1	0.01	45	6	15	25550	1.4E-10	6.8E-01	9.4E-11	0%	2190	1.6E-09	0.0E+00	0.0E+00	0%
4,4'-DDT	3.0E-01	1E-06	2300	1	0.01	45	6	15	25550	4.9E-09	6.8E-01	3.3E-09	1%	2190	5.7E-08	2.5E-04	2.3E-04	0%
Anthracene	2.8E-01	1E-06	2300	1	0.01	45	6	15	25550	4.5E-09	0.0E+00	0.0E+00	0%	2190	5.2E-08	1.8E-01	3.6E-07	0%
Benzo(a)anthracene	1.2E+00	1E-06	2300	1	0.01	45	6	15	25550	1.9E-08	1.6E+00	2.8E-08	10%	2190	2.2E-07	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	5.6E-01	1E-06	2300	1	0.01	45	6	15	25550	9.1E-09	1.6E+01	1.3E-07	46%	2190	1.1E-07	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	1.1E+00	1E-06	2300	1	0.01	45	6	15	25550	1.8E-08	1.6E+00	2.6E-08	9%	2190	2.1E-07	0.0E+00	0.0E+00	0%
Benzo(g,h,i)perylene	3.0E-01	1E-06	2300	1	0.01	45	6	15	25550	4.9E-09	0.0E+00	0.0E+00	0%	2190	5.7E-08	1.6E-02	3.6E-06	0%
Benzo(k)fluoranthene	4.9E-01	1E-06	2300	1	0.01	45	6	15	25550	7.9E-09	1.6E-01	1.1E-09	0%	2190	9.2E-08	0.0E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	1.3E+00	1E-06	2300	1	0.01	45	6	15	25550	2.1E-08	2.8E-02	5.8E-10	0%	2190	2.4E-07	1.0E-02	2.4E-05	0%
Carbazole	1.6E-01	1E-06	2300	1	0.01	45	6	15	25550	2.6E-09	4.0E-02	1.0E-10	0%	2190	3.0E-08	0.0E+00	0.0E+00	0%
Chrysene	1.6E+00	1E-06	2300	1	0.01	45	6	15	25550	2.5E-08	1.6E-02	3.7E-10	0%	2190	2.9E-07	0.0E+00	0.0E+00	0%
Dibenzofuran	6.0E-02	1E-06	2300	1	0.01	45	6	15	25550	9.7E-10	0.0E+00	0.0E+00	0%	2190	1.1E-08	0.0E+00	0.0E+00	0%
Fluoranthene	1.3E+00	1E-06	2300	1	0.01	45	6	15	25550	2.0E-08	0.0E+00	0.0E+00	0%	2190	2.4E-07	2.0E-02	1.2E-05	0%
Indeno(1,2,3-cd)pyrene	3.0E-01	1E-06	2300	1	0.01	45	6	15	25550	4.9E-09	1.6E+00	7.1E-09	2%	2190	5.7E-08	0.0E+00	0.0E+00	0%
Phenanthrene	7.7E-01	1E-06	2300	1	0.01	45	6	15	25550	1.2E-08	0.0E+00	0.0E+00	0%	2190	1.5E-07	1.5E-02	9.7E-06	0%
Pyrene	1.1E+00	1E-06	2300	1	0.01	45	6	15	25550	1.8E-08	0.0E+00	0.0E+00	0%	2190	2.1E-07	1.5E-02	1.4E-05	0%
alpha-Chlordane	6.6E-03	1E-06	2300	1	0.01	45	6	15	25550	1.1E-10	2.6E+00	2.8E-10	0%	2190	1.2E-09	3.0E-05	4.2E-05	0%
gamma-Chlordane	4.6E-03	1E-06	2300	1	0.01	45	6	15	25550	7.5E-11	2.6E+00	1.9E-10	0%	2190	8.7E-10	3.0E-05	2.9E-05	0%
TOTAL												2.0E-07					0.9E-02	

SEDIMENT INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 28 - NEW RIVER AND COGDELS CREEK)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site specific

COGDELS CREEK

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 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
Aluminum	2.5E+04	45	6	200	1E-06	15	25550	3.5E-03	0.0E+00	0.0E+00	0%	2190	4.1E-02	1.0E+00	4.1E-02	25%
Arsenic	7.4E+00	45	6	200	1E-06	15	25550	1.0E-06	1.8E+00	1.8E-06	61%	2190	1.2E-05	3.0E-04	4.1E-02	25%
Barium	5.9E+01	45	6	200	1E-06	15	25550	8.4E-06	0.0E+00	0.0E+00	0%	2190	9.8E-05	7.0E-02	1.4E-03	1%
Chromium	2.8E+01	45	6	200	1E-06	15	25550	3.9E-06	0.0E+00	0.0E+00	0%	2190	4.5E-05	1.0E+00	4.5E-05	0%
Copper	5.1E+01	45	6	200	1E-06	15	25550	7.2E-06	0.0E+00	0.0E+00	0%	2190	8.4E-05	3.7E-02	2.3E-03	1%
Lead	1.6E+02	45	6	200	1E-06	15	25550	2.3E-05	0.0E+00	0.0E+00	0%	2190	2.6E-04	0.0E+00	0.0E+00	0%
Manganese (soil)	2.3E+02	45	6	200	1E-06	15	25550	3.2E-05	0.0E+00	0.0E+00	0%	2190	3.7E-04	1.4E-01	2.7E-03	2%
Mercury	3.8E-01	45	6	200	1E-06	15	25550	5.3E-08	0.0E+00	0.0E+00	0%	2190	6.2E-07	3.0E-04	2.1E-03	1%
Thallium	2.9E+00	45	6	200	1E-06	15	25550	4.0E-07	0.0E+00	0.0E+00	0%	2190	4.7E-06	8.0E-05	5.9E-02	37%
Vanadium	3.6E+01	45	6	200	1E-06	15	25550	5.1E-06	0.0E+00	0.0E+00	0%	2190	5.9E-05	7.0E-03	8.4E-03	5%
Zinc	1.7E+02	45	6	200	1E-06	15	25550	2.6E-05	0.0E+00	0.0E+00	0%	2190	2.9E-04	3.0E-01	9.6E-04	1%
3,3-Dichlorobenzidine	4.1E-01	45	6	200	1E-06	15	25550	5.8E-08	4.5E-01	2.6E-08	1%	2190	6.7E-07	0.0E+00	0.0E+00	0%
4,4'-DDD	4.6E-01	45	6	200	1E-06	15	25550	6.3E-08	2.4E-01	1.5E-08	1%	2190	7.4E-07	0.0E+00	0.0E+00	0%
4,4'-DDE	1.6E-01	45	6	200	1E-06	15	25550	2.2E-08	3.4E-01	7.6E-09	0%	2190	2.6E-07	0.0E+00	0.0E+00	0%
Benzo(a)anthracene	1.4E-01	45	6	200	1E-06	15	25550	2.0E-08	7.3E-01	1.4E-08	0%	2190	2.3E-07	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	1.1E+00	45	6	200	1E-06	15	25550	1.6E-07	7.3E+00	1.1E-06	37%	2190	1.8E-06	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	8.3E-02	45	6	200	1E-06	15	25550	8.6E-09	7.3E-01	6.6E-09	0%	2190	1.0E-07	0.0E+00	0.0E+00	0%
Benzo(k)fluoranthene	4.2E-02	45	6	200	1E-06	15	25550	6.6E-09	7.3E-02	4.3E-10	0%	2190	6.9E-08	0.0E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	7.0E-01	45	6	200	1E-06	15	25550	9.9E-08	1.4E-02	1.4E-09	0%	2190	1.2E-05	2.0E-02	6.6E-05	0%
Carbon Disulfide	1.3E-02	45	6	200	1E-06	15	25550	1.8E-09	0.0E+00	0.0E+00	0%	2190	2.1E-08	1.0E-01	2.1E-07	0%
Chrysene	1.6E-01	45	6	200	1E-06	15	25550	2.3E-08	7.3E-03	1.6E-10	0%	2190	2.6E-07	0.0E+00	0.0E+00	0%
Fluoranthene	3.4E-01	45	6	200	1E-06	15	25550	4.8E-08	0.0E+00	0.0E+00	0%	2190	5.6E-07	4.0E-02	1.4E-05	0%
Phenanthrene	2.6E-01	45	6	200	1E-06	15	25550	3.7E-08	0.0E+00	0.0E+00	0%	2190	4.3E-07	3.0E-02	1.4E-05	0%
Pyrene	2.5E-01	45	6	200	1E-06	15	25550	3.5E-08	0.0E+00	0.0E+00	0%	2190	4.1E-07	3.0E-02	1.4E-05	0%
alpha-Chlordane	5.9E-03	45	6	200	1E-06	15	25550	8.3E-10	1.3E+00	1.1E-09	0%	2190	9.7E-09	6.0E-05	1.6E-04	0%
gamma-Chlordane	8.4E-03	45	6	200	1E-06	15	25550	1.2E-09	1.3E+00	1.6E-09	0%	2190	1.4E-08	6.0E-05	2.3E-04	0%
TOTAL										3.0E-06					1.6E-01	

SEDIMENT DERMAL CONTACT [illegible] E ASSESSMENT
OPERABLE UNIT NO.7 (SITE 28 - N[illegible] [illegible]VER AND COGDELS CREEK)
REMEDIAL INVESTIGATION CTO-0231
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 adherance factor (mg/cm2)	1
Abs = fraction absorbed (unitless) (contaminant specific)	Specific
EF = child exposure frequency (events/yr)	45
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

Note: Inputs are scenario and site specific

COGDELS CREEK

COPC	Concentration Carcinogen (mg/kg)	Conversion Factor (kg/mg)	Surface Area (cm2) Child	Adherance 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
Aluminum	2.0E+04	1E-06	2300	1	0.001	45	6	15	25550	4.1E-06	0.0E+00	0.0E+00	0%	2190	4.7E-04	2.0E-01	2.4E-03	25%
Arsenic	7.4E+00	1E-06	2300	1	0.001	45	6	15	25550	1.2E-06	6.6E+00	1.0E-07	28%	2190	1.4E-07	6.0E-05	2.3E-03	25%
Barium	5.9E+01	1E-06	2300	1	0.001	45	6	15	25550	9.6E-06	0.0E+00	0.0E+00	0%	2190	1.1E-06	1.4E-02	8.0E-05	1%
Chromium	2.6E+01	1E-06	2300	1	0.001	45	6	15	25550	4.6E-06	0.0E+00	0.0E+00	0%	2190	5.2E-07	2.0E-01	2.6E-06	0%
Copper	5.1E+01	1E-06	2300	1	0.001	45	6	15	25550	8.3E-06	0.0E+00	0.0E+00	0%	2190	9.6E-07	7.4E-03	1.3E-04	1%
Lead	1.6E+02	1E-06	2300	1	0.001	45	6	15	25550	2.6E-07	0.0E+00	0.0E+00	0%	2190	3.0E-06	0.0E+00	0.0E+00	0%
Manganese (soil)	2.3E+02	1E-06	2300	1	0.001	45	6	15	25550	3.7E-07	0.0E+00	0.0E+00	0%	2190	4.3E-06	2.6E-02	1.5E-04	2%
Mercury	3.6E-01	1E-06	2300	1	0.001	45	6	15	25550	6.1E-10	0.0E+00	0.0E+00	0%	2190	7.1E-09	6.0E-05	1.2E-04	1%
Thallium	2.9E+00	1E-06	2300	1	0.001	45	6	15	25550	4.6E-09	0.0E+00	0.0E+00	0%	2190	5.4E-08	1.6E-05	3.4E-03	37%
Vanadium	3.6E+01	1E-06	2300	1	0.001	45	6	15	25550	5.6E-06	0.0E+00	0.0E+00	0%	2190	6.6E-07	1.4E-06	4.9E-04	5%
Zinc	1.7E+02	1E-06	2300	1	0.001	45	6	15	25550	2.6E-07	0.0E+00	0.0E+00	0%	2190	3.3E-06	6.0E-02	5.5E-05	1%
3,3-Dichlorobenzidine	4.1E-01	1E-06	2300	1	0.01	45	6	15	25550	6.6E-09	9.0E-01	6.0E-09	2%	2190	7.8E-08	0.0E+00	0.0E+00	0%
4,4'-DDD	4.6E-01	1E-06	2300	1	0.01	45	6	15	25550	7.3E-09	4.6E-01	3.6E-09	1%	2190	8.6E-08	0.0E+00	0.0E+00	0%
4,4'-DDE	1.6E-01	1E-06	2300	1	0.01	45	6	15	25550	2.6E-09	6.8E-01	1.8E-09	0%	2190	3.0E-08	0.0E+00	0.0E+00	0%
Benzo(a)anthracene	1.4E-01	1E-06	2300	1	0.01	45	6	15	25550	2.3E-09	1.6E+00	3.3E-09	1%	2190	2.6E-08	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	1.1E+00	1E-06	2300	1	0.01	45	6	15	25550	1.7E-08	1.6E+01	2.6E-07	68%	2190	2.0E-07	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	8.3E-02	1E-06	2300	1	0.01	45	6	15	25550	1.0E-09	1.6E+00	1.6E-09	0%	2190	1.2E-08	0.0E+00	0.0E+00	0%
Benzo(k)fluoranthene	4.2E-02	1E-06	2300	1	0.01	45	6	15	25550	6.6E-10	1.6E-01	9.9E-11	0%	2190	7.9E-09	0.0E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	7.0E-01	1E-06	2300	1	0.01	45	6	15	25550	1.1E-08	2.8E-02	3.2E-10	0%	2190	1.3E-07	1.0E-02	1.3E-05	0%
Carbon Disulfide	1.3E-02	1E-06	2300	1	0.01	45	6	15	25550	2.1E-10	0.0E+00	0.0E+00	0%	2190	2.5E-09	8.0E-02	3.1E-08	0%
Chrysene	1.6E-01	1E-06	2300	1	0.01	45	6	15	25550	2.6E-09	1.6E-02	3.8E-11	0%	2190	3.0E-08	0.0E+00	0.0E+00	0%
Fluoranthene	3.4E-01	1E-06	2300	1	0.01	45	6	15	25550	5.5E-09	0.0E+00	0.0E+00	0%	2190	6.4E-08	2.0E-02	3.2E-06	0%
Phenanthrene	2.6E-01	1E-06	2300	1	0.01	45	6	15	25550	4.2E-09	0.0E+00	0.0E+00	0%	2190	4.9E-08	1.5E-02	3.3E-06	0%
Pyrene	2.5E-01	1E-06	2300	1	0.01	45	6	15	25550	4.1E-09	0.0E+00	0.0E+00	0%	2190	4.7E-08	1.6E-02	3.0E-06	0%
Alpha-Chlordane	5.9E-03	1E-06	2300	1	0.01	45	6	15	25550	9.6E-11	2.6E+00	2.6E-10	0%	2190	1.1E-09	3.0E-05	3.7E-05	0%
Gamma-Chlordane	8.4E-03	1E-06	2300	1	0.01	45	6	15	25550	1.4E-10	2.6E+00	3.6E-10	0%	2190	1.6E-09	3.0E-05	5.3E-05	1%
TOTAL												3.8E-07					9.2E-03	

SURFACE WATER INGESTION EX... ASSESSMENT
OPERABLE UNIT NO.7 (SITE 28 - NEW RIVER AND COGDELS CREEK)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site specific

NEW RIVER

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
Aluminum	1.7E+00	0.005	2.6	45	6	15	25550	1.5E-05	0.0E+00	0.0E+00	0%	2190	1.3E-04	1.0E+00	1.6E-04	4%
Arsenic	4.3E-03	0.005	2.6	45	6	15	25550	3.9E-08	1.8E+00	6.9E-08	100%	2190	4.6E-07	3.0E-04	1.5E-03	39%
Cadmium (water)	4.2E-03	0.005	2.6	45	6	15	25550	3.8E-08	0.0E+00	0.0E+00	0%	2190	4.6E-07	5.0E-04	9.0E-04	23%
Copper	1.8E-02	0.005	2.6	45	6	15	25550	1.7E-07	0.0E+00	0.0E+00	0%	2190	1.9E-06	3.7E-02	5.2E-05	1%
Lead	2.3E-02	0.005	2.6	45	6	15	25550	2.1E-07	0.0E+00	0.0E+00	0%	2190	2.5E-06	0.0E+00	0.0E+00	0%
Manganese (water)	5.0E-02	0.005	2.6	45	6	15	25550	4.6E-07	0.0E+00	0.0E+00	0%	2190	5.3E-06	5.0E-03	1.1E-03	27%
Vanadium	6.1E-03	0.005	2.6	45	6	15	25550	5.6E-08	0.0E+00	0.0E+00	0%	2190	6.6E-07	7.0E-03	9.5E-05	2%
Zinc	3.6E-01	0.005	2.6	45	6	15	25550	3.3E-06	0.0E+00	0.0E+00	0%	2190	3.9E-05	3.0E-01	1.3E-04	3%
4,4'-DDE	4.0E-05	0.005	2.6	45	6	15	25550	3.7E-10	3.4E-01	1.2E-10	0%	2190	4.3E-09	0.0E+00	0.0E+00	0%
4,4'-DDD	8.0E-05	0.005	2.6	45	6	15	25550	4.6E-10	2.4E-01	1.1E-10	0%	2190	5.3E-09	0.0E+00	0.0E+00	0%
TOTAL										8.9E-08					3.9E-03	

COGDELS CREEK

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	Average 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
Aluminum	9.4E-01	0.005	2.6	45	6	15	25550	8.6E-06	0.0E+00	0.0E+00	0%	2190	1.0E-04	1.0E+00	1.0E-04	5%
Arsenic	2.6E-03	0.005	2.6	45	6	15	25550	2.4E-08	1.8E+00	4.1E-08	100%	2190	2.7E-07	3.0E-04	9.2E-04	44%
Lead	3.7E-03	0.005	2.6	45	6	15	25550	3.4E-08	0.0E+00	0.0E+00	0%	2190	3.9E-07	0.0E+00	0.0E+00	0%
Manganese (water)	4.9E-02	0.005	2.6	45	6	15	25550	4.6E-07	0.0E+00	0.0E+00	0%	2190	5.2E-06	5.0E-03	1.0E-03	50%
Vanadium	2.4E-03	0.005	2.6	45	6	15	25550	2.2E-08	0.0E+00	0.0E+00	0%	2190	2.6E-07	7.0E-03	3.7E-05	2%
Zinc	1.2E-02	0.005	2.6	45	6	15	25550	1.1E-07	0.0E+00	0.0E+00	0%	2190	1.3E-06	3.0E-01	4.2E-06	0%
TOTAL										4.1E-08					2.1E-03	

SURFACE WATER DERMAL CC. EXPOSURE ASSESSMENT
OPERABLE UNIT NO.7 (SITE 28 - New RIVER AND COGDELS CREEK)
REMEDIAL INVESTIGATION - CTO-0231
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 permeability (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

Note: Inputs are site and scenario specific

NEW RIVER

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
Aluminum	1.7E+00	2300	1.0E-03	2.6	45	6	0.001	15	25550	7.0E-06	0.0E+00	0.0E+00	0%	2190	6.2E-05	2.0E-01	4.1E-04	5%
Arsenic	4.3E-03	2300	1.0E-03	2.6	45	6	0.001	15	25550	1.8E-08	6.8E+00	1.6E-07	74%	2190	2.1E-07	8.0E-05	3.5E-03	39%
Cadmium (water)	4.2E-03	2300	1.0E-03	2.6	45	6	0.001	15	25550	1.8E-08	0.0E+00	0.0E+00	0%	2190	2.1E-07	1.0E-04	2.1E-03	23%
Copper	1.8E-02	2300	1.0E-03	2.6	45	6	0.001	15	25550	7.6E-08	0.0E+00	0.0E+00	0%	2190	8.9E-07	7.4E-03	1.2E-04	1%
Lead	2.3E-02	2300	4.0E-06	2.6	45	6	0.001	15	25550	3.9E-10	0.0E+00	0.0E+00	0%	2190	4.6E-09	0.0E+00	0.0E+00	0%
Manganese (water)	6.0E-02	2300	1.0E-03	2.6	45	6	0.001	15	25550	2.1E-07	0.0E+00	0.0E+00	0%	2190	2.4E-06	1.0E-03	2.4E-03	27%
Vanadium	6.1E-03	2300	1.0E-03	2.6	45	6	0.001	15	25550	2.6E-08	0.0E+00	0.0E+00	0%	2190	3.0E-07	1.4E-03	2.1E-04	2%
Zinc	3.6E-01	2300	6.0E-04	2.6	45	6	0.001	15	25550	9.2E-07	0.0E+00	0.0E+00	0%	2190	1.1E-05	6.0E-02	1.8E-04	2%
4,4'-DDE	4.0E-06	2300	2.4E-01	2.6	45	6	0.001	15	25550	4.0E-08	6.8E-01	2.8E-08	13%	2190	4.7E-07	0.0E+00	0.0E+00	0%
4,4'-DDD	5.0E-06	2300	2.8E-01	2.6	45	6	0.001	15	25550	5.9E-08	4.8E-01	2.8E-08	13%	2190	5.9E-07	0.0E+00	0.0E+00	0%
TOTAL												2.1E-07					9.0E-03	

SURFACE WATER DERMAL CL[illegible]POSURE ASSESSMENT
OPERABLE UNIT NO.7 (SITE 28 - [illegible]VER AND COGDELS CREEK)
REMEDIAL INVESTIGATION - CTO-0231
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 permeability (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 (1 l/hr/1 000 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

Note: Inputs are site and scenario specific

COGDELS CREEK

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
luminum	9.4E-01	2300	1.0E-03	2.6	45	6	0.001	15	25550	3.0E-08	0.0E+00	0.0E+00	0%	2190	4.6E-05	2.0E-01	2.3E-04	5%
/rsenic	2.6E-03	2300	1.0E-03	2.6	45	6	0.001	15	25550	1.1E-08	8.6E+00	9.8E-08	100%	2190	1.3E-07	6.0E-05	2.1E-03	44%
,ead	3.7E-03	2300	4.0E-06	2.6	45	6	0.001	15	25550	6.2E-11	0.0E+00	0.0E+00	0%	2190	7.3E-10	0.0E+00	0.0E+00	0%
/langanese (water)	4.9E-02	2300	1.0E-03	2.6	45	6	0.001	15	25550	2.0E-07	0.0E+00	0.0E+00	0%	2190	2.4E-06	1.0E-03	2.4E-03	50%
/anadium	2.4E-03	2300	1.0E-03	2.6	45	6	0.001	15	25550	1.0E-08	0.0E+00	0.0E+00	0%	2190	1.2E-07	1.4E-03	8.6E-05	2%
Zinc	1.2E-02	2300	6.0E-04	2.6	45	6	0.001	15	25550	3.0E-08	0.0E+00	0.0E+00	0%	2190	3.6E-07	6.0E-02	5.9E-06	0%
OTAL												9.8E-08					4.8E-03	

GROUNDWATER INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 28)
REMEDIAL INVESTIGATION CTO-0231
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/Day)	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 (yr)	30
DY = days per year (day/year)	365
CSF = cancer slope factor (mg/kg-day)-1	specific
RfD = reference dose (mg/kg-day)	specific

Note: Inputs are scenario and site 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
Arsenic	2.7E-03	2	350	30	70	25550	3.2E-05	1.8E+00	5.6E-05	63%	10950	7.4E-05	3.0E-04	2.5E-01	3%
Barium	7.6E-01	2	350	30	70	25550	8.9E-03	0.0E+00	0.0E+00	0%	10950	2.1E-02	7.0E-02	3.0E-01	3%
Lead	3.7E-02	2	350	30	70	25550	4.4E-04	0.0E+00	0.0E+00	0%	10950	1.0E-03	0.0E+00	0.0E+00	0%
Manganese (water)	1.5E+00	2	350	30	70	25550	1.7E-02	0.0E+00	0.0E+00	0%	10950	4.0E-02	5.0E-03	7.9E+00	92%
Mercury	5.0E-04	2	350	30	70	25550	5.9E-06	0.0E+00	0.0E+00	0%	10950	1.4E-05	3.0E-04	4.6E-02	1%
2,4-Dimethylphenol	4.3E-03	2	350	30	70	25550	5.0E-05	0.0E+00	0.0E+00	0%	10950	1.2E-04	2.0E-02	5.9E-03	0%
Acenaphthene	1.0E-02	2	350	30	70	25550	1.2E-04	0.0E+00	0.0E+00	0%	10950	2.7E-04	6.0E-02	4.6E-03	0%
4,4'-DDE	1.6E-03	2	350	30	70	25550	1.9E-05	3.4E-01	6.4E-06	7%	10950	4.4E-05	0.0E+00	0.0E+00	0%
4,4'-DDD	9.0E-03	2	350	30	70	25550	1.1E-04	2.4E-01	2.5E-05	29%	10950	2.5E-04	0.0E+00	0.0E+00	0%
4,4'-DDT	1.8E-04	2	350	30	70	25550	2.1E-06	3.4E-01	7.2E-07	1%	10950	4.9E-06	5.0E-04	9.9E-03	0%
Chloroform	1.2E-03	2	350	30	70	25550	1.4E-05	6.1E-03	8.6E-08	0%	10950	3.3E-05	1.0E-02	3.3E-03	0%
2-Methylnaphthalene	9.3E-03	2	350	30	70	25550	1.1E-04	0.0E+00	0.0E+00	0%	10950	2.5E-04	4.0E-02	6.4E-03	0%
Phenanthrene	6.6E-03	2	350	30	70	25550	7.7E-05	0.0E+00	0.0E+00	0%	10950	1.8E-04	3.0E-02	6.0E-03	0%
4-Methylphenol	9.3E-03	2	350	30	70	25550	1.1E-04	0.0E+00	0.0E+00	0%	10950	2.5E-04	5.0E-03	5.1E-02	1%
TOTAL									8.8E-05					8.6E+00	

GROUNDWATER DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 28)
REMEDIAL INVESTIGATION CTO-0231
MCB CAMP LEJEUNE, NORTH CAROLINA
FUTURE RESIDENTIAL ADULT

Dermal Contact from groundwater 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 = adult skin surface available for contact (cm2)	23000
PC = contaminant specific dermal permeability (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 (1 liter/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

Note: Inputs are site and scenario specific

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	Dermal 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
Arsenic	2.7E-03	23000	1.00E-03	0.25	350	30	0.001	70	25550	9.2E-08	8.8E+00	8.0E-07	2%	10950	2.1E-07	6.0E-05	3.6E-03	2%
Barium	7.6E-01	23000	1.00E-03	0.25	350	30	0.001	70	25550	2.6E-05	0.0E+00	0.0E+00	0%	10950	6.0E-05	1.4E-02	4.3E-03	2%
Lead	3.7E-02	23000	4.00E-06	0.25	350	30	0.001	70	25550	5.0E-09	0.0E+00	0.0E+00	0%	10950	1.2E-08	0.0E+00	0.0E+00	0%
Manganese (water)	1.6E+00	23000	1.00E-03	0.25	350	30	0.001	70	25550	4.9E-05	0.0E+00	0.0E+00	0%	10950	1.1E-04	1.0E-03	1.1E-01	67%
Mercury	6.0E-04	23000	1.00E-03	0.25	350	30	0.001	70	25550	1.7E-08	0.0E+00	0.0E+00	0%	10950	3.9E-08	6.0E-05	6.6E-04	0%
2,4-Dimethylphenol	4.3E-03	23000	1.60E-02	0.25	350	30	0.001	70	25550	2.2E-06	0.0E+00	0.0E+00	0%	10950	5.1E-06	1.0E-02	5.1E-04	0%
Acenaphthene	1.0E-02	23000	1.52E-01	0.25	350	30	0.001	70	25550	5.1E-05	0.0E+00	0.0E+00	0%	10950	1.2E-04	3.0E-02	4.0E-03	2%
4,4'-DDE	1.6E-03	23000	2.40E-01	0.25	350	30	0.001	70	25550	1.3E-05	8.8E-01	8.8E-06	17%	10950	3.0E-05	0.0E+00	0.0E+00	0%
4,4'-DDD	9.0E-03	23000	2.80E-01	0.25	350	30	0.001	70	25550	8.5E-05	4.8E-01	4.1E-05	78%	10950	2.0E-04	0.0E+00	0.0E+00	0%
4,4'-DDT	1.8E-04	23000	4.30E-01	0.25	350	30	0.001	70	25550	2.6E-06	8.8E-01	1.8E-06	3%	10950	6.1E-06	2.5E-04	2.4E-02	14%
Chloroform	1.2E-03	23000	8.90E-03	0.25	350	30	0.001	70	25550	3.6E-07	7.6E-03	2.7E-09	0%	10950	8.4E-07	8.0E-03	1.1E-04	0%
2-Methylnaphthalene	9.3E-03	23000	1.42E-01	0.25	350	30	0.001	70	25550	4.5E-05	0.0E+00	0.0E+00	0%	10950	1.0E-04	2.0E-02	5.2E-03	3%
Phenanthrene	6.6E-03	23000	2.70E-01	0.25	350	30	0.001	70	25550	6.0E-05	0.0E+00	0.0E+00	0%	10950	1.4E-04	1.5E-02	9.4E-03	5%
4-Methylphenol	9.3E-03	23000	1.80E-02	0.25	350	30	0.001	70	25550	5.7E-06	0.0E+00	0.0E+00	0%	10950	1.3E-05	2.5E-03	5.3E-03	3%
TOTAL												6.2E-06					1.7E-01	

CTO-231 SITE 28 GROUNDWATER INHALATION
13-Jun-95
FILE: SHOW.WQ1

GROUNDWATER INHALATION - RME CASE

ADULT

CHEMICAL	C rme mg/kg/shw	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
Chloroform	1.2E-05	30	350	10950	25550	1.1E-05	4.8E-06	0.0E+00	8.1E-02	---	3.9E-07	0%	88%
Phenanthrene	2.6E-05	30	350	10950	25550	2.5E-05	1.1E-05	0.0E+00	0.0E+00	---	0.0E+00	0%	0%
2, 4-Dimethylphenol	1.4E-07	30	350	10950	25550	1.4E-07	5.9E-08	0.0E+00	0.0E+00	---	0.0E+00	0%	0%
Acenaphthene	3.0E-05	30	350	10950	25550	2.9E-05	1.2E-05	0.0E+00	0.0E+00	---	0.0E+00	0%	0%
4, 4'-DDE	3.4E-06	30	350	10950	25550	3.3E-06	1.4E-06	0.0E+00	0.0E+00	---	0.0E+00	0%	0%
4, 4'-DDT	3.6E-07	30	350	10950	25550	3.5E-07	1.5E-07	0.0E+00	3.4E-01	---	5.1E-08	0%	12%
4-Methylphenol	5.0E-07	30	350	10950	25550	4.8E-07	2.1E-07	0.0E+00	0.0E+00	---	0.0E+00	0%	0%
									TOTAL	0.0E+00	4.4E-07		

site 28 groundwater
13-Jun-95 file: showmod.wq1

CAS No.	TARGET COMPOUND LIST CONSTITUE	OVERALL MASS TRANSF COEFFICIENT (KL) (cm/hr)	HENRY'S LAW CONSTAN (H) (atm-m3/mol-K)	GAS CONSTAN (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 TRANSF. COEFFICIENT (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 MASS TRANSF. COEFF. TEMP. COMP. (KaL) (cm/hr)	WATER VISCOSITY (AT Ts) (Us) (cp)	WATER VISCOSITY (AT T1) (U1) (cp)	SHOWER WATER TEMP. (Ts) (K)	((T1)*(Us))/ ((Ts)*(U1))
site 28 RME adult																		
	Chloroform	1.12E+01	2.87E-03	8.20E-05	293.0	2.40E-02	1.16E+03	1.21E+01	20.0	3000.0	119.40	8.24E-02	7.19E-03	1.51E+01	0.596	1.002	318.0	5.48E-01
	Phenanthrene	3.86E+00	1.59E-04	8.20E-05	293.0	2.40E-02	9.53E+02	9.94E+00	20.0	3000.0	178.22	1.01E-01	1.58E-01	5.21E+00	0.596	1.002	318.0	5.48E-01
	2,4-dimethylphenol	3.01E-02	6.30E-07	8.20E-05	293.0	2.40E-02	1.15E+03	1.20E+01	20.0	3000.0	122.16	8.33E-02	3.31E+01	4.07E-02	0.596	1.002	318.0	5.48E-01
	acenaphthene	2.87E+00	9.20E-05	8.20E-05	293.0	2.40E-02	1.03E+03	1.07E+01	20.0	3000.0	154.00	9.35E-02	2.55E-01	3.88E+00	0.596	1.002	318.0	5.48E-01
	4,4'-DDE	2.00E+00	9.20E-05	8.20E-05	293.0	2.40E-02	7.14E+02	7.44E+00	20.0	3000.0	318.00	1.34E-01	3.66E-01	2.70E+00	0.596	1.002	318.0	5.48E-01
	4,4'-DDT	1.89E+00	9.20E-05	8.20E-05	293.0	2.40E-02	6.76E+02	7.05E+00	20.0	3000.0	354.50	1.42E-01	3.86E-01	2.56E+00	0.596	1.002	318.0	5.48E-01
	4-Methyphenol	4.87E-02	9.60E-07	8.20E-05	293.0	2.40E-02	1.22E+03	1.28E+01	20.0	3000.0	108.13	7.84E-02	2.04E+01	6.58E-02	0.596	1.002	318.0	5.48E-01
child	Chloroform	1.12E+01	2.87E-03	8.20E-05	293.0	2.40E-02	1.16E+03	1.21E+01	20.0	3000.0	119.40	8.24E-02	7.19E-03	1.51E+01	0.596	1.002	318.0	5.48E-01
	Phenanthrene	3.86E+00	1.59E-04	8.20E-05	293.0	2.40E-02	9.53E+02	9.94E+00	20.0	3000.0	178.22	1.01E-01	1.58E-01	5.21E+00	0.596	1.002	318.0	5.48E-01
	2,4-dimethylphenol	3.01E-02	6.30E-07	8.20E-05	293.0	2.40E-02	1.15E+03	1.20E+01	20.0	3000.0	122.16	8.33E-02	3.31E+01	4.07E-02	0.596	1.002	318.0	5.48E-01
	acenaphthene	2.87E+00	9.20E-05	8.20E-05	293.0	2.40E-02	1.03E+03	1.07E+01	20.0	3000.0	154.00	9.35E-02	2.55E-01	3.88E+00	0.596	1.002	318.0	5.48E-01
	4,4'-DDE	2.00E+00	9.20E-05	8.20E-05	293.0	2.40E-02	7.14E+02	7.44E+00	20.0	3000.0	318.00	1.34E-01	3.66E-01	2.70E+00	0.596	1.002	318.0	5.48E-01
	4,4'-DDT	1.89E+00	9.20E-05	8.20E-05	293.0	2.40E-02	6.76E+02	7.05E+00	20.0	3000.0	354.50	1.42E-01	3.86E-01	2.56E+00	0.596	1.002	318.0	5.48E-01
	4-Methyphenol	4.87E-02	9.60E-07	8.20E-05	293.0	2.40E-02	1.22E+03	1.28E+01	20.0	3000.0	108.13	7.84E-02	2.04E+01	6.58E-02	0.596	1.002	318.0	5.48E-01

site 28 groundwater
13-Jun-95 file: showmod.wq1

CAS No.	TARGET COMPOUND LIST CONSTITUENT	CONCENTRATION LEAVING SHWR DROPLET Cwd (ug/l)	SHOWER WATER CONCENTRATION Cws (ug/l)	SHOWER DROPLET DIAMETER d (mm)	SHOWER DROPLET DROP TIME ts (sec)	KaL*ts	d/6*d	-[KaL*ts]/[d/6*d]	exp [-KaL*ts/ d/6*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)-1)	exp(-R.t))	INHALATION EXPOSURE PER SHOWER EIrh (mg/kg/shwr)	VENTILATION RATE VR (liter/min)	BODY WEIGHT BW (kg)	exp(-R.(Ds))	DURATION IN THE SHOWER ROOM Ds (min)	Ds + exp(-R.Ds)/R	exp(R(Ds-Ds))/R	(Ds-Ds)	(VR * S)/ (SW)(R)(K)
site 28 RME																											
adult																											
	Chloroform	4.74E-01	1.2	1.00	2.00	3.02E+01	6.00E+01	-5.03E-01	6.0464E-01	7.90E-01	10	6	3.42E+01	0.0083	12	15	4.05E-01	8.63E-01	1.17E-05	10	70	8.63E-01	15	1.184E+02	1.175E+02	-3	1.36E-05
	Phenanthrene	1.05E+00	6.6	1.00	2.00	1.04E+01	6.00E+01	-1.74E-01	8.4046E-01	1.76E+00	10	6	7.62E+01	0.0083	12	15	4.05E-01	8.63E-01	2.60E-05	10	70	8.63E-01	15	1.184E+02	1.175E+02	-3	3.02E-05
	2,4-dimethylphenol	5.83E-03	4.3	1.00	2.00	8.14E-02	6.00E+01	-1.36E-03	9.9864E-01	9.71E-03	10	6	4.20E-01	0.0083	12	15	4.05E-01	8.63E-01	1.44E-07	10	70	8.63E-01	15	1.184E+02	1.175E+02	-3	1.67E-07
	acenaphthene	1.21E+00	10.0	1.00	2.00	7.78E+00	6.00E+01	-1.29E-01	8.7869E-01	2.02E+00	10	6	8.74E+01	0.0083	12	15	4.05E-01	8.63E-01	2.98E-05	10	70	8.63E-01	15	1.184E+02	1.175E+02	-3	3.46E-05
	4,4'-DDE	1.38E-01	1.6	1.00	2.00	8.40E+00	6.00E+01	-8.00E-02	9.1393E-01	2.30E-01	10	6	9.92E+00	0.0083	12	15	4.05E-01	8.63E-01	3.39E-06	10	70	8.63E-01	15	1.184E+02	1.175E+02	-3	3.95E-06
	4,4'-DDT	1.47E-02	0.2	1.00	2.00	6.11E+00	6.00E+01	-8.62E-02	9.1629E-01	2.46E-02	10	6	1.06E+00	0.0083	12	15	4.05E-01	8.63E-01	3.62E-07	10	70	8.63E-01	15	1.184E+02	1.175E+02	-3	4.22E-07
	4-Methylphenol	2.04E-02	9.3	1.00	2.00	1.32E-01	6.00E+01	-2.18E-03	9.9781E-01	3.40E-02	10	6	1.47E+00	0.0083	12	15	4.05E-01	8.63E-01	5.02E-07	10	70	8.63E-01	15	1.184E+02	1.175E+02	-3	5.85E-07
child	Chloroform	4.74E-01	1.2	1.00	2.00	3.02E+01	6.00E+01	-5.03E-01	6.0464E-01	7.90E-01	10	6	3.42E+01	0.0083	12	15	4.05E-01	8.63E-01	7.00E-05	13	15	8.63E-01	15	1.184E+02	1.175E+02	-3	9.25E-05
	Phenanthrene	1.05E+00	6.6	1.00	2.00	1.04E+01	6.00E+01	-1.74E-01	8.4046E-01	1.76E+00	10	6	7.62E+01	0.0083	12	15	4.05E-01	8.63E-01	1.87E-04	13	15	8.63E-01	15	1.184E+02	1.175E+02	-3	1.83E-04
	2,4-dimethylphenol	5.83E-03	4.3	1.00	2.00	8.14E-02	6.00E+01	-1.36E-03	9.9864E-01	9.71E-03	10	6	4.20E-01	0.0083	12	15	4.05E-01	8.63E-01	8.71E-07	13	15	8.63E-01	15	1.184E+02	1.175E+02	-3	1.01E-06
	acenaphthene	1.21E+00	10.0	1.00	2.00	7.78E+00	6.00E+01	-1.29E-01	8.7869E-01	2.02E+00	10	6	8.74E+01	0.0083	12	15	4.05E-01	8.63E-01	1.81E-04	13	15	8.63E-01	15	1.184E+02	1.175E+02	-3	2.11E-04
	4,4'-DDE	1.38E-01	1.6	1.00	2.00	8.40E+00	6.00E+01	-8.00E-02	9.1393E-01	2.30E-01	10	6	9.92E+00	0.0083	12	15	4.05E-01	8.63E-01	2.06E-05	13	15	8.63E-01	15	1.184E+02	1.175E+02	-3	2.40E-05
	4,4'-DDT	1.47E-02	0.2	1.00	2.00	6.11E+00	6.00E+01	-8.62E-02	9.1629E-01	2.46E-02	10	6	1.06E+00	0.0083	12	15	4.05E-01	8.63E-01	2.20E-06	13	15	8.63E-01	15	1.184E+02	1.175E+02	-3	2.56E-06

SURFACE SOIL INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 26)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site 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
Aluminum	3.4E+03	350	30	1E-06	100	70	25550	2.0E-03	0.0E+00	0.0E+00	0%	10950	4.7E-03	1.0E+00	4.7E-03	7%
Antimony	5.7E+00	350	30	1E-06	100	70	25550	3.3E-06	0.0E+00	0.0E+00	0%	10950	7.8E-06	4.0E-04	1.9E-02	31%
Arsenic	1.7E+00	350	30	1E-06	100	70	25550	1.0E-06	1.8E+00	1.8E-06	51%	10950	2.4E-06	3.0E-04	8.0E-03	13%
Barium	3.5E+01	350	30	1E-06	100	70	25550	2.0E-05	0.0E+00	0.0E+00	0%	10950	4.8E-05	7.0E-02	6.8E-04	1%
Cadmium (soil)	1.6E+00	350	30	1E-06	100	70	25550	9.1E-07	0.0E+00	0.0E+00	0%	10950	2.1E-06	1.0E-03	2.1E-03	3%
Chromium	1.0E+01	350	30	1E-06	100	70	25550	6.1E-06	0.0E+00	0.0E+00	0%	10950	1.4E-05	1.0E+00	1.4E-05	0%
Cobalt	9.1E-01	350	30	1E-06	100	70	25550	5.3E-07	0.0E+00	0.0E+00	0%	10950	1.2E-06	6.0E-02	2.1E-05	0%
Copper	1.3E+02	350	30	1E-06	100	70	25550	7.6E-05	0.0E+00	0.0E+00	0%	10950	1.8E-04	3.7E-02	4.8E-03	8%
Lead	1.7E+02	350	30	1E-06	100	70	25550	1.0E-04	0.0E+00	0.0E+00	0%	10950	2.3E-04	0.0E+00	0.0E+00	0%
Manganese (soil)	3.3E+02	350	30	1E-06	100	70	25550	1.9E-04	0.0E+00	0.0E+00	0%	10950	4.5E-04	1.4E-01	3.2E-03	5%
Mercury	2.8E-01	350	30	1E-06	100	70	25550	1.7E-07	0.0E+00	0.0E+00	0%	10950	3.9E-07	3.0E-04	1.3E-03	2%
Nickel	5.6E+00	350	30	1E-06	100	70	25550	3.3E-06	0.0E+00	0.0E+00	0%	10950	7.6E-06	2.0E-02	3.8E-04	1%
Silver	1.1E+00	350	30	1E-06	100	70	25550	6.6E-07	0.0E+00	0.0E+00	0%	10950	1.5E-06	5.0E-03	3.1E-04	0%
Thallium	5.1E-01	350	30	1E-06	100	70	25550	3.0E-07	0.0E+00	0.0E+00	0%	10950	7.0E-07	8.0E-05	8.8E-03	14%
Vanadium	7.9E+00	350	30	1E-06	100	70	25550	4.7E-06	0.0E+00	0.0E+00	0%	10950	1.1E-05	7.0E-03	1.6E-03	2%
Zinc	1.1E+03	350	30	1E-06	100	70	25550	6.3E-04	0.0E+00	0.0E+00	0%	10950	1.5E-03	3.0E-01	4.9E-03	8%
4,4'-DDD	6.4E-02	350	30	1E-06	100	70	25550	3.8E-08	2.4E-01	9.0E-09	0%	10950	8.8E-08	0.0E+00	0.0E+00	0%
4,4'-DDE	3.5E-01	350	30	1E-06	100	70	25550	2.0E-07	3.4E-01	6.9E-08	2%	10950	4.8E-07	0.0E+00	0.0E+00	0%
4,4'-DDT	1.6E-01	350	30	1E-06	100	70	25550	8.7E-08	3.4E-01	3.0E-08	1%	10950	2.0E-07	5.0E-04	4.1E-04	1%
Anthracene	2.1E-01	350	30	1E-06	100	70	25550	1.2E-07	0.0E+00	0.0E+00	0%	10950	2.8E-07	3.0E-01	9.4E-07	0%
Benzo(a)anthracene	2.8E-01	350	30	1E-06	100	70	25550	1.6E-07	7.3E-01	1.2E-07	3%	10950	3.8E-07	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	2.7E-01	350	30	1E-06	100	70	25550	1.6E-07	7.3E+00	1.1E-06	33%	10950	3.7E-07	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	2.9E-01	350	30	1E-06	100	70	25550	1.7E-07	7.3E-01	1.3E-07	4%	10950	4.0E-07	0.0E+00	0.0E+00	0%
Benzo(g,h,i)perylene	2.5E-01	350	30	1E-06	100	70	25550	1.5E-07	0.0E+00	0.0E+00	0%	10950	3.5E-07	3.0E-02	1.2E-05	0%
Carbazole	1.7E-01	350	30	1E-06	100	70	25550	1.0E-07	2.0E-02	2.0E-09	0%	10950	2.3E-07	0.0E+00	0.0E+00	0%
Chrysene	2.8E-01	350	30	1E-06	100	70	25550	1.6E-07	7.3E-03	1.2E-09	0%	10950	3.8E-07	0.0E+00	0.0E+00	0%
Heptachlor epoxide	6.9E-03	350	30	1E-06	100	70	25550	4.1E-09	9.1E+00	3.7E-08	1%	10950	9.5E-09	1.3E-05	7.3E-04	1%
Indeno(1,2,3-cd)pyrene	2.5E-01	350	30	1E-06	100	70	25550	1.5E-07	7.3E-01	1.1E-07	3%	10950	3.5E-07	0.0E+00	0.0E+00	0%
Phenanthrene	2.8E-01	350	30	1E-06	100	70	25550	1.7E-07	0.0E+00	0.0E+00	0%	10950	3.9E-07	3.0E-02	1.3E-05	0%
alpha-Chlordane	3.8E-02	350	30	1E-06	100	70	25550	2.2E-08	1.3E+00	2.9E-08	1%	10950	5.2E-08	6.0E-05	8.7E-04	1%
gamma-Chlordane	1.3E-02	350	30	1E-06	100	70	25550	7.6E-09	1.3E+00	9.9E-09	0%	10950	1.8E-08	6.0E-05	3.0E-04	0%
TOTAL										3.5E-06					6.2E-02	

SURFACE SOIL DERMAL C... ...CT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 28)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site 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
Aluminum	3.4E+03	1E-06	5800	1	0.001	350	30	70	25550	1.2E-04	0.0E+00	0.0E+00	0%	10950	2.7E-04	2.0E-01	1.4E-03	7%
Antimony	5.7E+00	1E-06	5800	1	0.001	350	30	70	25550	1.9E-07	0.0E+00	0.0E+00	0%	10950	4.5E-07	8.0E-05	5.6E-03	28%
Arsenic	1.7E+00	1E-06	5800	1	0.001	350	30	70	25550	5.9E-08	8.8E+00	5.2E-07	21%	10950	1.4E-07	6.0E-05	2.3E-03	11%
Barium	3.5E+01	1E-06	5800	1	0.001	350	30	70	25550	1.2E-06	0.0E+00	0.0E+00	0%	10950	2.8E-06	1.4E-02	2.0E-04	1%
Cadmium (soil)	1.6E+00	1E-06	5800	1	0.001	350	30	70	25550	5.3E-08	0.0E+00	0.0E+00	0%	10950	1.2E-07	2.0E-04	6.2E-04	3%
Chromium	1.0E+01	1E-06	5800	1	0.001	350	30	70	25550	3.5E-07	0.0E+00	0.0E+00	0%	10950	8.2E-07	2.0E-01	4.1E-06	0%
Cobalt	9.1E-01	1E-06	5800	1	0.001	350	30	70	25550	3.1E-08	0.0E+00	0.0E+00	0%	10950	7.2E-08	1.2E-02	6.0E-06	0%
Copper	1.3E+02	1E-06	5800	1	0.001	350	30	70	25550	4.4E-06	0.0E+00	0.0E+00	0%	10950	1.0E-05	7.4E-03	1.4E-03	7%
Lead	1.7E+02	1E-06	5800	1	0.001	350	30	70	25550	5.8E-06	0.0E+00	0.0E+00	0%	10950	1.3E-05	0.0E+00	0.0E+00	0%
Manganese (soil)	3.3E+02	1E-06	5800	1	0.001	350	30	70	25550	1.1E-05	0.0E+00	0.0E+00	0%	10950	2.6E-05	2.8E-02	9.3E-04	5%
Mercury	2.8E-01	1E-06	5800	1	0.001	350	30	70	25550	9.7E-09	0.0E+00	0.0E+00	0%	10950	2.3E-08	6.0E-05	3.8E-04	2%
Nickel	5.6E+00	1E-06	5800	1	0.001	350	30	70	25550	1.9E-07	0.0E+00	0.0E+00	0%	10950	4.4E-07	4.0E-03	1.1E-04	1%
Silver	1.1E+00	1E-06	5800	1	0.001	350	30	70	25550	3.8E-08	0.0E+00	0.0E+00	0%	10950	9.0E-08	1.0E-03	9.0E-05	0%
Thallium	5.1E-01	1E-06	5800	1	0.001	350	30	70	25550	1.7E-08	0.0E+00	0.0E+00	0%	10950	4.1E-08	1.6E-05	2.6E-03	13%
Vanadium	7.9E+00	1E-06	5800	1	0.001	350	30	70	25550	2.7E-07	0.0E+00	0.0E+00	0%	10950	6.3E-07	1.4E-03	4.5E-04	2%
Zinc	1.1E+03	1E-06	5800	1	0.001	350	30	70	25550	3.6E-05	0.0E+00	0.0E+00	0%	10950	8.5E-05	6.0E-02	1.4E-03	7%
4,4'-DDD	6.4E-02	1E-06	5800	1	0.01	350	30	70	25550	2.2E-08	4.8E-01	1.0E-08	0%	10950	5.1E-08	0.0E+00	0.0E+00	0%
4,4'-DDE	3.5E-01	1E-06	5800	1	0.01	350	30	70	25550	1.2E-07	6.8E-01	8.1E-08	3%	10950	2.8E-07	0.0E+00	0.0E+00	0%
4,4'-DDT	1.5E-01	1E-06	5800	1	0.01	350	30	70	25550	5.1E-08	6.8E-01	3.4E-08	1%	10950	1.2E-07	2.5E-04	4.7E-04	2%
Anthracene	2.1E-01	1E-06	5800	1	0.01	350	30	70	25550	7.0E-08	0.0E+00	0.0E+00	0%	10950	1.6E-07	1.5E-01	1.1E-06	0%
Benzo(a)anthracene	2.8E-01	1E-06	5800	1	0.01	350	30	70	25550	9.5E-08	1.5E+00	1.4E-07	6%	10950	2.2E-07	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	2.7E-01	1E-06	5800	1	0.01	350	30	70	25550	9.1E-08	1.5E+01	1.3E-06	54%	10950	2.1E-07	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	2.9E-01	1E-06	5800	1	0.01	350	30	70	25550	1.0E-07	1.5E+00	1.5E-07	6%	10950	2.3E-07	0.0E+00	0.0E+00	0%
Benzo(g,h,i)perylene	2.5E-01	1E-06	5800	1	0.01	350	30	70	25550	8.6E-08	0.0E+00	0.0E+00	0%	10950	2.0E-07	1.5E-02	1.3E-05	0%
Carbazole	1.7E-01	1E-06	5800	1	0.01	350	30	70	25550	5.8E-08	4.0E-02	2.3E-09	0%	10950	1.4E-07	0.0E+00	0.0E+00	0%
Chrysene	2.8E-01	1E-06	5800	1	0.01	350	30	70	25550	9.5E-08	1.5E-02	1.4E-09	0%	10950	2.2E-07	0.0E+00	0.0E+00	0%
Heptachlor epoxide	6.9E-03	1E-06	5800	1	0.01	350	30	70	25550	2.4E-09	1.8E+01	4.3E-08	2%	10950	5.5E-09	6.5E-06	8.4E-04	4%
Indeno(1,2,3-cd)pyrene	2.5E-01	1E-06	5800	1	0.01	350	30	70	25550	8.6E-08	1.5E+00	1.3E-07	5%	10950	2.0E-07	0.0E+00	0.0E+00	0%
Phenanthrene	2.8E-01	1E-06	5800	1	0.01	350	30	70	25550	9.7E-08	0.0E+00	0.0E+00	0%	10950	2.3E-07	1.5E-02	1.5E-05	0%
alpha-Chlordane	3.8E-02	1E-06	5800	1	0.01	350	30	70	25550	1.3E-08	2.6E+00	3.4E-08	1%	10950	3.0E-08	3.0E-05	1.0E-03	5%
gamma-Chlordane	1.3E-02	1E-06	5800	1	0.01	350	30	70	25550	4.4E-09	2.6E+00	1.1E-08	0%	10950	1.0E-08	3.0E-05	3.4E-04	2%
TOTAL												2.5E-06					2.0E-02	

SURFACE SOIL PARTICULATE INHALATION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 26)
REMEDIAL INVESTIGATION CTO-0231
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 1/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)	4.63E+09

Note: Inputs are scenario and site specific

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 Contribution to Risk	Average Noncarc Time (days)	Noncarc Dose (mg/kg/day)	Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
Aluminum	3.4E+03	4.6E+09	350	20	30	70	25550	8.7E-08	0.0E+00	0.0E+00	0%	10950	2.0E-07	0.0E+00	0.0E+00	0%
Antimony	5.7E+00	4.6E+09	350	20	30	70	25550	1.4E-10	0.0E+00	0.0E+00	0%	10950	3.4E-10	0.0E+00	0.0E+00	0%
Arsenic	1.7E+00	4.6E+09	350	20	30	70	25550	4.4E-11	1.5E+01	6.7E-10	92%	10950	1.0E-10	0.0E+00	0.0E+00	0%
Barium	3.5E+01	4.6E+09	350	20	30	70	25550	8.8E-10	0.0E+00	0.0E+00	0%	10950	2.1E-09	1.4E-04	1.4E-05	99%
Cadmium (soil)	1.6E+00	4.6E+09	350	20	30	70	25550	3.9E-11	0.0E+00	0.0E+00	0%	10950	9.2E-11	0.0E+00	0.0E+00	0%
Chromium	1.0E+01	4.6E+09	350	20	30	70	25550	2.6E-10	0.0E+00	0.0E+00	0%	10950	6.1E-10	0.0E+00	0.0E+00	0%
Cobalt	9.1E-01	4.6E+09	350	20	30	70	25550	2.3E-11	0.0E+00	0.0E+00	0%	10950	5.4E-11	0.0E+00	0.0E+00	0%
Copper	1.3E+02	4.6E+09	350	20	30	70	25550	3.3E-09	0.0E+00	0.0E+00	0%	10950	7.7E-09	0.0E+00	0.0E+00	0%
Lead	1.7E+02	4.6E+09	350	20	30	70	25550	4.3E-09	0.0E+00	0.0E+00	0%	10950	1.0E-08	0.0E+00	0.0E+00	0%
Manganese (soil)	3.3E+02	4.6E+09	350	20	30	70	25550	8.3E-09	0.0E+00	0.0E+00	0%	10950	1.9E-08	0.0E+00	0.0E+00	0%
Mercury	2.8E-01	4.6E+09	350	20	30	70	25550	7.2E-12	0.0E+00	0.0E+00	0%	10950	1.7E-11	8.6E-05	2.0E-07	1%
Nickel	5.6E+00	4.6E+09	350	20	30	70	25550	1.4E-10	0.0E+00	0.0E+00	0%	10950	3.3E-10	0.0E+00	0.0E+00	0%
Silver	1.1E+00	4.6E+09	350	20	30	70	25550	2.9E-11	0.0E+00	0.0E+00	0%	10950	6.7E-11	0.0E+00	0.0E+00	0%
Thallium	5.1E-01	4.6E+09	350	20	30	70	25550	1.3E-11	0.0E+00	0.0E+00	0%	10950	3.0E-11	0.0E+00	0.0E+00	0%
Vanadium	7.9E+00	4.6E+09	350	20	30	70	25550	2.0E-10	0.0E+00	0.0E+00	0%	10950	4.7E-10	0.0E+00	0.0E+00	0%
Zinc	1.1E+03	4.6E+09	350	20	30	70	25550	2.7E-08	0.0E+00	0.0E+00	0%	10950	6.3E-08	0.0E+00	0.0E+00	0%
4,4'-DDD	6.4E-02	4.6E+09	350	20	30	70	25550	1.6E-12	0.0E+00	0.0E+00	0%	10950	3.8E-12	0.0E+00	0.0E+00	0%
4,4'-DDE	3.6E-01	4.6E+09	350	20	30	70	25550	8.8E-12	0.0E+00	0.0E+00	0%	10950	2.1E-11	0.0E+00	0.0E+00	0%
4,4'-DDT	1.5E-01	4.6E+09	350	20	30	70	25550	3.8E-12	3.4E-01	1.3E-12	0%	10950	8.8E-12	0.0E+00	0.0E+00	0%
Anthracene	2.1E-01	4.6E+09	350	20	30	70	25550	5.2E-12	0.0E+00	0.0E+00	0%	10950	1.2E-11	0.0E+00	0.0E+00	0%
Benzo(a)anthracene	2.8E-01	4.6E+09	350	20	30	70	25550	7.1E-12	6.1E-01	4.3E-12	1%	10950	1.6E-11	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	2.7E-01	4.6E+09	350	20	30	70	25550	6.8E-12	6.1E+00	4.1E-11	6%	10950	1.6E-11	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	2.9E-01	4.6E+09	350	20	30	70	25550	7.5E-12	6.1E-01	4.6E-12	1%	10950	1.7E-11	0.0E+00	0.0E+00	0%
Benzo(g,h,i)perylene	2.5E-01	4.6E+09	350	20	30	70	25550	6.4E-12	0.0E+00	0.0E+00	0%	10950	1.5E-11	0.0E+00	0.0E+00	0%
Carbazole	1.7E-01	4.6E+09	350	20	30	70	25550	4.3E-12	0.0E+00	0.0E+00	0%	10950	1.0E-11	0.0E+00	0.0E+00	0%
Chrysene	2.8E-01	4.6E+09	350	20	30	70	25550	7.1E-12	6.1E-03	4.3E-14	0%	10950	1.7E-11	0.0E+00	0.0E+00	0%
Heptachlor epoxide	6.9E-03	4.6E+09	350	20	30	70	25550	1.8E-13	9.1E+00	1.6E-12	0%	10950	4.1E-13	0.0E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	2.5E-01	4.6E+09	350	20	30	70	25550	6.4E-12	6.1E-01	3.9E-12	1%	10950	1.5E-11	0.0E+00	0.0E+00	0%
Phenanthrene	2.8E-01	4.6E+09	350	20	30	70	25550	7.2E-12	0.0E+00	0.0E+00	0%	10950	1.7E-11	0.0E+00	0.0E+00	0%
alpha-Chlordane	3.8E-02	4.6E+09	350	20	30	70	25550	9.7E-13	1.3E+00	1.2E-12	0%	10950	2.3E-12	0.0E+00	0.0E+00	0%
gamma-Chlordane	1.3E-02	4.6E+09	350	20	30	70	25550	3.3E-13	1.3E+00	4.2E-13	0%	10950	7.7E-13	0.0E+00	0.0E+00	0%
TOTAL										7.3E-10					1.5E-05	

SUBSURFACE SOIL INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 28)
REMEDIAL INVESTIGATION CTO-0231
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)	SPECIFIC
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

Note: Inputs are scenario and site 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
Aluminum	7.8E+03	350	30	1E-06	100	70	25550	4.6E-03	0.0E+00	0.0E+00	0%	10950	1.1E-02	1.0E+00	1.1E-02	6%
Antimony	1.2E+01	350	30	1E-06	100	70	25550	6.9E-06	0.0E+00	0.0E+00	0%	10950	1.6E-05	4.0E-04	4.0E-02	24%
Arsenic	7.9E+00	350	30	1E-06	100	70	25550	4.6E-06	1.8E+00	8.1E-06	61%	10950	1.1E-05	3.0E-04	3.6E-02	22%
Barium	7.8E+01	350	30	1E-06	100	70	25550	4.6E-05	0.0E+00	0.0E+00	0%	10950	1.1E-04	7.0E-02	1.5E-03	1%
Beryllium	1.4E-01	350	30	1E-06	100	70	25550	8.4E-08	4.3E+00	3.6E-07	3%	10950	2.0E-07	5.0E-03	3.9E-05	0%
Cadmium (soil)	3.2E+00	350	30	1E-06	100	70	25550	1.9E-06	0.0E+00	0.0E+00	0%	10950	4.4E-06	1.0E-03	4.4E-03	3%
Chromium	3.4E+01	350	30	1E-06	100	70	25550	2.0E-05	0.0E+00	0.0E+00	0%	10950	4.7E-05	1.0E+00	4.7E-05	0%
Cobalt	2.7E+00	350	30	1E-06	100	70	25550	1.6E-06	0.0E+00	0.0E+00	0%	10950	3.7E-06	6.0E-02	6.1E-05	0%
Copper	6.9E+02	350	30	1E-06	100	70	25550	5.2E-04	0.0E+00	0.0E+00	0%	10950	1.2E-03	3.7E-02	3.3E-02	20%
Lead	1.7E+03	350	30	1E-06	100	70	25550	1.0E-03	0.0E+00	0.0E+00	0%	10950	2.4E-03	0.0E+00	0.0E+00	0%
Manganese (soil)	1.2E+03	350	30	1E-06	100	70	25550	7.0E-04	0.0E+00	0.0E+00	0%	10950	1.6E-03	1.4E-01	1.2E-02	7%
Mercury	2.3E-01	350	30	1E-06	100	70	25550	1.3E-07	0.0E+00	0.0E+00	0%	10950	3.1E-07	3.0E-04	1.0E-03	1%
Nickel	2.3E+01	350	30	1E-06	100	70	25550	1.4E-05	0.0E+00	0.0E+00	0%	10950	3.2E-05	2.0E-02	1.6E-03	1%
Silver	2.5E+00	350	30	1E-06	100	70	25550	1.5E-06	0.0E+00	0.0E+00	0%	10950	3.4E-06	5.0E-03	6.9E-04	0%
Vanadium	2.4E+01	350	30	1E-06	100	70	25550	1.4E-05	0.0E+00	0.0E+00	0%	10950	3.4E-05	7.0E-03	4.8E-03	3%
Zinc	4.3E+03	350	30	1E-06	100	70	25550	2.5E-03	0.0E+00	0.0E+00	0%	10950	5.9E-03	3.0E-01	2.0E-02	12%
2-Methylnaphthalene	8.9E-02	350	30	1E-06	100	70	25550	5.2E-08	0.0E+00	0.0E+00	0%	10950	1.2E-07	4.0E-02	3.0E-06	0%
4,4'-DDD	8.8E-01	350	30	1E-06	100	70	25550	5.2E-07	2.4E-01	1.2E-07	1%	10950	1.2E-06	0.0E+00	0.0E+00	0%
4,4'-DDE	1.6E+00	350	30	1E-06	100	70	25550	9.4E-07	3.4E-01	3.2E-07	2%	10950	2.2E-06	0.0E+00	0.0E+00	0%
4,4'-DDT	1.2E-01	350	30	1E-06	100	70	25550	6.9E-08	3.4E-01	2.3E-08	0%	10950	1.6E-07	5.0E-04	3.2E-04	0%
Benzo(a)anthracene	5.8E-01	350	30	1E-06	100	70	25550	3.4E-07	7.3E-01	2.5E-07	2%	10950	8.0E-07	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	5.6E-01	350	30	1E-06	100	70	25550	3.3E-07	7.3E+00	2.4E-06	16%	10950	7.7E-07	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	6.2E-01	350	30	1E-06	100	70	25550	3.6E-07	7.3E-01	2.6E-07	2%	10950	8.4E-07	0.0E+00	0.0E+00	0%
Benzo(g,h,i)perylene	4.4E-01	350	30	1E-06	100	70	25550	2.6E-07	0.0E+00	0.0E+00	0%	10950	6.1E-07	3.0E-02	2.0E-05	0%
Benzo(k)fluoranthene	5.4E-01	350	30	1E-06	100	70	25550	3.1E-07	7.3E-02	2.3E-08	0%	10950	7.3E-07	0.0E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	4.8E-01	350	30	1E-06	100	70	25550	2.8E-07	1.4E-02	3.9E-09	0%	10950	6.5E-07	2.0E-02	3.3E-05	0%
Chrysene	5.7E-01	350	30	1E-06	100	70	25550	3.4E-07	7.3E-03	2.5E-09	0%	10950	7.9E-07	0.0E+00	0.0E+00	0%
Dibenz(a,h)anthracene	2.8E-01	350	30	1E-06	100	70	25550	1.7E-07	7.3E+00	1.2E-06	9%	10950	3.9E-07	0.0E+00	0.0E+00	0%
Fluorene	2.8E-01	350	30	1E-06	100	70	25550	1.6E-07	0.0E+00	0.0E+00	0%	10950	3.8E-07	4.0E-02	9.6E-06	0%
Indeno(1,2,3-cd)pyrene	4.3E-01	350	30	1E-06	100	70	25550	2.6E-07	7.3E-01	1.9E-07	1%	10950	6.0E-07	0.0E+00	0.0E+00	0%
Naphthalene	3.4E-01	350	30	1E-06	100	70	25550	2.0E-07	0.0E+00	0.0E+00	0%	10950	4.7E-07	4.0E-02	1.2E-05	0%
Phenanthrene	6.4E-01	350	30	1E-06	100	70	25550	3.8E-07	0.0E+00	0.0E+00	0%	10950	8.8E-07	3.0E-02	2.9E-05	0%
alpha-Chlordane	1.2E-02	350	30	1E-06	100	70	25550	6.8E-09	1.3E+00	8.8E-09	0%	10950	1.6E-06	6.0E-05	2.6E-04	0%
gamma-Chlordane	6.7E-03	350	30	1E-06	100	70	25550	3.9E-09	1.3E+00	5.1E-09	0%	10950	9.2E-09	6.0E-05	1.5E-04	0%
TOTAL										1.3E-05					1.7E-01	

SUBSURFACE SOIL DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 28)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site 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
Aluminum	7.8E+03	1E-06	5800	1	0.001	350	30	70	25550	2.7E-04	0.0E+00	0.0E+00	0%	10950	6.2E-04	2.0E-01	3.1E-03	6%
Antimony	1.2E+01	1E-06	5800	1	0.001	350	30	70	25550	4.0E-07	0.0E+00	0.0E+00	0%	10950	9.3E-07	8.0E-05	1.2E-02	24%
Arsenic	7.9E+00	1E-06	5800	1	0.001	350	30	70	25550	2.7E-07	8.8E+00	2.4E-06	29%	10950	6.3E-07	6.0E-05	1.0E-02	21%
Barium	7.8E+01	1E-06	5800	1	0.001	350	30	70	25550	2.7E-06	0.0E+00	0.0E+00	0%	10950	6.2E-06	1.4E-02	4.4E-04	1%
Beryllium	1.4E-01	1E-06	5800	1	0.001	350	30	70	25550	4.9E-09	2.1E+01	1.1E-07	1%	10950	1.1E-06	1.0E-03	1.1E-05	0%
Cadmium (soil)	3.2E+00	1E-06	5800	1	0.001	350	30	70	25550	1.1E-07	0.0E+00	0.0E+00	0%	10950	2.5E-07	2.0E-04	1.3E-03	3%
Chromium	3.4E+01	1E-06	5800	1	0.001	350	30	70	25550	1.2E-06	0.0E+00	0.0E+00	0%	10950	2.7E-06	2.0E-01	1.4E-05	0%
Cobalt	2.7E+00	1E-06	5800	1	0.001	350	30	70	25550	9.2E-08	0.0E+00	0.0E+00	0%	10950	2.1E-07	1.2E-02	1.8E-05	0%
Copper	8.9E+02	1E-06	5800	1	0.001	350	30	70	25550	3.0E-05	0.0E+00	0.0E+00	0%	10950	7.0E-05	7.4E-03	9.5E-03	19%
Lead	1.7E+03	1E-06	5800	1	0.001	350	30	70	25550	5.9E-05	0.0E+00	0.0E+00	0%	10950	1.4E-04	0.0E+00	0.0E+00	0%
Manganese (soil)	1.2E+03	1E-06	5800	1	0.001	350	30	70	25550	4.0E-05	0.0E+00	0.0E+00	0%	10950	9.4E-05	2.8E-02	3.4E-03	7%
Mercury	2.3E-01	1E-06	5800	1	0.001	350	30	70	25550	7.8E-09	0.0E+00	0.0E+00	0%	10950	1.8E-06	6.0E-05	3.0E-04	1%
Nickel	2.3E+01	1E-06	5800	1	0.001	350	30	70	25550	7.9E-07	0.0E+00	0.0E+00	0%	10950	1.8E-06	4.0E-03	4.6E-04	1%
Silver	2.6E+00	1E-06	5800	1	0.001	350	30	70	25550	8.8E-08	0.0E+00	0.0E+00	0%	10950	2.0E-07	1.0E-03	2.0E-04	0%
Vanadium	2.4E+01	1E-06	5800	1	0.001	350	30	70	25550	8.3E-07	0.0E+00	0.0E+00	0%	10950	1.9E-06	1.4E-03	1.4E-03	3%
Zinc	4.3E+03	1E-06	5800	1	0.001	350	30	70	25550	1.5E-04	0.0E+00	0.0E+00	0%	10950	3.4E-04	6.0E-02	5.7E-03	12%
2-Methylnaphthalene	8.9E-02	1E-06	5800	1	0.01	350	30	70	25550	3.0E-08	0.0E+00	0.0E+00	0%	10950	7.1E-08	2.0E-02	3.5E-06	0%
4,4'-DDD	8.8E-01	1E-06	5800	1	0.01	350	30	70	25550	3.0E-07	4.8E-01	1.4E-07	2%	10950	7.0E-07	0.0E+00	0.0E+00	0%
4,4'-DDE	1.6E+00	1E-06	5800	1	0.01	350	30	70	25550	5.4E-07	6.8E-01	3.7E-07	5%	10950	1.3E-06	0.0E+00	0.0E+00	0%
4,4'-DDT	1.2E-01	1E-06	5800	1	0.01	350	30	70	25550	4.0E-08	6.8E-01	2.7E-08	0%	10950	9.3E-08	2.5E-04	3.7E-04	1%
Benzo(a)anthracene	5.8E-01	1E-06	5800	1	0.01	350	30	70	25550	2.0E-07	1.5E+00	2.9E-07	4%	10950	4.6E-07	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	5.6E-01	1E-06	5800	1	0.01	350	30	70	25550	1.9E-07	1.5E+01	2.8E-06	35%	10950	4.5E-07	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	6.2E-01	1E-06	5800	1	0.01	350	30	70	25550	2.1E-07	1.5E+00	3.1E-07	4%	10950	4.9E-07	0.0E+00	0.0E+00	0%
Benzo(g,h,i)perylene	4.4E-01	1E-06	5800	1	0.01	350	30	70	25550	1.5E-07	0.0E+00	0.0E+00	0%	10950	3.5E-07	1.5E-02	2.4E-05	0%
Benzo(k)fluoranthene	5.4E-01	1E-06	5800	1	0.01	350	30	70	25550	1.8E-07	1.5E-01	2.7E-08	0%	10950	4.3E-07	0.0E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	4.8E-01	1E-06	5800	1	0.01	350	30	70	25550	1.6E-07	2.8E-02	4.6E-09	0%	10950	3.8E-07	1.0E-02	3.8E-05	0%
Chrysene	5.7E-01	1E-06	5800	1	0.01	350	30	70	25550	2.0E-07	1.5E-02	2.9E-09	0%	10950	4.6E-07	0.0E+00	0.0E+00	0%
Dibenz(a,h)anthracene	2.8E-01	1E-06	5800	1	0.01	350	30	70	25550	9.6E-08	1.5E+01	1.4E-06	17%	10950	2.2E-07	0.0E+00	0.0E+00	0%
Fluorene	2.8E-01	1E-06	5800	1	0.01	350	30	70	25550	9.5E-08	0.0E+00	0.0E+00	0%	10950	2.2E-07	2.0E-02	1.1E-05	0%
Indeno(1,2,3-cd)pyrene	4.3E-01	1E-06	5800	1	0.01	350	30	70	25550	1.5E-07	1.5E+00	2.2E-07	3%	10950	3.5E-07	0.0E+00	0.0E+00	0%
Naphthalene	3.4E-01	1E-06	5800	1	0.01	350	30	70	25550	1.2E-07	0.0E+00	0.0E+00	0%	10950	2.7E-07	2.0E-02	1.4E-05	0%
Phenanthrene	6.4E-01	1E-06	5800	1	0.01	350	30	70	25550	2.2E-07	0.0E+00	0.0E+00	0%	10950	5.1E-07	1.5E-02	3.4E-05	0%
Alpha-Chlordane	1.2E-02	1E-06	5800	1	0.01	350	30	70	25550	3.9E-09	2.6E+00	1.0E-08	0%	10950	9.2E-09	3.0E-05	3.1E-04	1%
Gamma-Chlordane	6.7E-03	1E-06	5800	1	0.01	350	30	70	25550	2.3E-09	2.6E+00	5.9E-09	0%	10950	5.3E-09	3.0E-05	1.8E-04	0%
TOTAL												8.1E-06					4.9E-02	

SUBSURFACE SOIL PARTIC... INHALATION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 28)
REMEDIAL INVESTIGATION CTO-0231
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)	Specific
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)	4.63E+09

Note: Inputs are scenario and site specific

COPC	Concentration Carcinogen (mg/kg)	Paruculate 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
Aluminum	7.8E+03	4.6E+09	350	20	30	70	25550	2.0E-07	0.0E+00	0.0E+00	0%	10950	4.6E-07	0.0E+00	0.0E+00	0%
Antimony	1.2E+01	4.6E+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	7.9E+00	4.6E+09	350	20	30	70	25550	2.0E-10	1.5E+01	3.0E-09	94%	10950	4.7E-10	0.0E+00	0.0E+00	0%
Barium	7.8E+01	4.6E+09	350	20	30	70	25550	2.0E-09	0.0E+00	0.0E+00	0%	10950	4.6E-09	1.4E-04	3.2E-05	100%
Beryllium	1.4E-01	4.6E+09	350	20	30	70	25550	3.6E-12	8.4E+00	3.1E-11	1%	10950	8.5E-12	0.0E+00	0.0E+00	0%
Cadmium (soil)	3.2E+00	4.6E+09	350	20	30	70	25550	8.1E-11	0.0E+00	0.0E+00	0%	10950	1.9E-10	0.0E+00	0.0E+00	0%
Chromium	3.4E+01	4.6E+09	350	20	30	70	25550	8.7E-10	0.0E+00	0.0E+00	0%	10950	2.0E-09	0.0E+00	0.0E+00	0%
Cobalt	2.7E+00	4.6E+09	350	20	30	70	25550	6.8E-11	0.0E+00	0.0E+00	0%	10950	1.6E-10	0.0E+00	0.0E+00	0%
Copper	8.9E+02	4.6E+09	350	20	30	70	25550	2.2E-08	0.0E+00	0.0E+00	0%	10950	5.2E-08	0.0E+00	0.0E+00	0%
Lead	1.7E+03	4.6E+09	350	20	30	70	25550	4.4E-08	0.0E+00	0.0E+00	0%	10950	1.0E-07	0.0E+00	0.0E+00	0%
Manganese (soil)	1.2E+03	4.6E+09	350	20	30	70	25550	3.0E-08	0.0E+00	0.0E+00	0%	10950	7.0E-08	0.0E+00	0.0E+00	0%
Mercury	2.3E-01	4.6E+09	350	20	30	70	25550	5.9E-12	0.0E+00	0.0E+00	0%	10950	1.3E-11	8.6E-05	1.6E-07	0%
Nickel	2.3E+01	4.6E+09	350	20	30	70	25550	5.9E-10	0.0E+00	0.0E+00	0%	10950	1.4E-09	0.0E+00	0.0E+00	0%
Silver	2.5E+00	4.6E+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%
Vanadium	2.4E+01	4.6E+09	350	20	30	70	25550	6.2E-10	0.0E+00	0.0E+00	0%	10950	1.4E-09	0.0E+00	0.0E+00	0%
Zinc	4.3E+03	4.6E+09	350	20	30	70	25550	1.1E-07	0.0E+00	0.0E+00	0%	10950	2.6E-07	0.0E+00	0.0E+00	0%
2-Methylnaphthalene	8.9E-02	4.6E+09	350	20	30	70	25550	2.3E-12	0.0E+00	0.0E+00	0%	10950	5.3E-12	0.0E+00	0.0E+00	0%
4,4'-DDD	8.6E-01	4.6E+09	350	20	30	70	25550	2.2E-11	0.0E+00	0.0E+00	0%	10950	5.2E-11	0.0E+00	0.0E+00	0%
4,4'-DDE	1.6E+00	4.6E+09	350	20	30	70	25550	4.1E-11	0.0E+00	0.0E+00	0%	10950	9.5E-11	0.0E+00	0.0E+00	0%
4,4'-DDT	1.2E-01	4.6E+09	350	20	30	70	25550	3.0E-12	3.4E-01	1.0E-12	0%	10950	6.9E-12	0.0E+00	0.0E+00	0%
Benzo(a)anthracene	5.8E-01	4.6E+09	350	20	30	70	25550	1.5E-11	6.1E-01	9.0E-12	0%	10950	3.4E-11	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	5.6E-01	4.6E+09	350	20	30	70	25550	1.4E-11	6.1E+00	8.7E-11	3%	10950	3.3E-11	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	6.2E-01	4.6E+09	350	20	30	70	25550	1.6E-11	6.1E-01	9.5E-12	0%	10950	3.6E-11	0.0E+00	0.0E+00	0%
Benzo(g,h,i)perylene	4.4E-01	4.6E+09	350	20	30	70	25550	1.1E-11	0.0E+00	0.0E+00	0%	10950	2.6E-11	0.0E+00	0.0E+00	0%
Benzo(k)fluoranthene	5.4E-01	4.6E+09	350	20	30	70	25550	1.4E-11	6.1E-02	8.3E-13	0%	10950	3.2E-11	0.0E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	4.8E-01	4.6E+09	350	20	30	70	25550	1.2E-11	0.0E+00	0.0E+00	0%	10950	2.8E-11	0.0E+00	0.0E+00	0%
Chrysene	5.7E-01	4.6E+09	350	20	30	70	25550	1.5E-11	6.1E-03	8.9E-14	0%	10950	3.4E-11	0.0E+00	0.0E+00	0%
Dibenz(a,h)anthracene	2.8E-01	4.6E+09	350	20	30	70	25550	7.2E-12	6.1E+00	4.4E-11	1%	10950	1.7E-11	0.0E+00	0.0E+00	0%
Fluorene	2.8E-01	4.6E+09	350	20	30	70	25550	7.1E-12	0.0E+00	0.0E+00	0%	10950	1.7E-11	0.0E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	4.3E-01	4.6E+09	350	20	30	70	25550	1.1E-11	6.1E-01	6.7E-12	0%	10950	2.6E-11	0.0E+00	0.0E+00	0%
Naphthalene	3.4E-01	4.6E+09	350	20	30	70	25550	8.7E-12	0.0E+00	0.0E+00	0%	10950	2.0E-11	0.0E+00	0.0E+00	0%
Phenanthrene	6.4E-01	4.6E+09	350	20	30	70	25550	1.6E-11	0.0E+00	0.0E+00	0%	10950	3.8E-11	0.0E+00	0.0E+00	0%
alpha-Chlordane	1.2E-02	4.6E+09	350	20	30	70	25550	2.9E-13	1.3E+00	3.8E-13	0%	10950	6.8E-13	0.0E+00	0.0E+00	0%
gamma-Chlordane	6.7E-03	4.6E+09	350	20	30	70	25550	1.7E-13	1.3E+00	2.2E-13	0%	10950	4.0E-13	0.0E+00	0.0E+00	0%
TOTAL										3.2E-09					3.3E-05	

SEDIMENT INGESTION EXPOSU[illegible]SMENT
OPERABLE UNIT NO. 7 (SITE 26 - NEW RIVER AND COGDELS CREEK)
REMEDIAL INVESTIGATION CTO-0231
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

CHANGE

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

Note: Inputs are scenario and site specific

NEW RIVER

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
Antimony	2.8E+02	45	30	100	1E-06	70	25550	2.0E-05	0.0E+00	0.0E+00	0%	10950	4.6E-05	4.0E-04	1.2E-01	91%
Arsenic	9.0E+00	45	30	100	1E-06	70	25550	6.6E-07	1.8E+00	1.2E-06	72%	10950	1.6E-06	3.0E-04	5.3E-03	4%
Barium	1.6E+01	45	30	100	1E-06	70	25550	1.2E-06	0.0E+00	0.0E+00	0%	10950	2.7E-06	7.0E-02	3.9E-05	0%
Copper	1.3E+03	45	30	100	1E-06	70	25550	1.0E-04	0.0E+00	0.0E+00	0%	10950	2.4E-04	3.7E-02	6.4E-03	5%
Lead	3.9E+04	45	30	100	1E-06	70	25550	2.9E-03	0.0E+00	0.0E+00	0%	10950	6.8E-03	0.0E+00	0.0E+00	0%
Silver	2.1E+00	45	30	100	1E-06	70	25550	1.6E-07	0.0E+00	0.0E+00	0%	10950	3.8E-07	5.0E-03	7.5E-05	0%
Zinc	9.0E+01	45	30	100	1E-06	70	25550	6.8E-06	0.0E+00	0.0E+00	0%	10950	1.6E-05	3.0E-01	5.3E-05	0%
4,4'-DDD	1.6E-02	45	30	100	1E-06	70	25550	1.1E-09	2.4E-01	2.7E-10	0%	10950	2.6E-09	0.0E+00	0.0E+00	0%
4,4'-DDE	8.5E-03	45	30	100	1E-06	70	25550	6.4E-10	3.4E-01	2.2E-10	0%	10950	1.5E-09	0.0E+00	0.0E+00	0%
4,4'-DDT	3.0E-01	45	30	100	1E-06	70	25550	2.3E-08	3.4E-01	7.7E-09	0%	10950	5.3E-08	5.0E-04	1.1E-04	0%
Anthracene	2.8E-01	45	30	100	1E-06	70	25550	2.1E-08	0.0E+00	0.0E+00	0%	10950	4.9E-08	3.0E-01	1.6E-07	0%
Benzo(a)anthracene	1.3E+00	45	30	100	1E-06	70	25550	8.0E-08	7.3E-01	6.6E-08	4%	10950	2.1E-07	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	5.6E-01	45	30	100	1E-06	70	25550	4.2E-08	7.3E+00	3.1E-07	19%	10950	8.9E-08	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	1.1E+00	45	30	100	1E-06	70	25550	8.3E-08	7.3E-01	6.1E-08	4%	10950	1.6E-07	0.0E+00	0.0E+00	0%
Benzo(g,h,i)perylene	3.0E-01	45	30	100	1E-06	70	25550	2.3E-08	0.0E+00	0.0E+00	0%	10950	5.3E-08	3.0E-02	1.8E-06	0%
Benzo(k)fluoranthene	4.9E-01	45	30	100	1E-06	70	25550	3.7E-08	7.3E-02	2.7E-09	0%	10950	8.6E-08	0.0E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	1.3E+00	45	30	100	1E-06	70	25550	9.6E-08	1.4E-02	1.3E-09	0%	10950	2.2E-07	2.0E-02	1.1E-05	0%
Carbazole	1.6E-01	45	30	100	1E-06	70	25550	1.2E-08	2.0E-02	2.4E-10	0%	10950	2.8E-08	0.0E+00	0.0E+00	0%
Chrysene	1.6E+00	45	30	100	1E-06	70	25550	1.2E-07	7.3E-03	8.6E-10	0%	10950	2.7E-07	0.0E+00	0.0E+00	0%
Dibenzofuran	6.0E-02	45	30	100	1E-06	70	25550	4.6E-09	0.0E+00	0.0E+00	0%	10950	1.1E-08	0.0E+00	0.0E+00	0%
Fluoranthene	1.3E+00	45	30	100	1E-06	70	25550	9.4E-08	0.0E+00	0.0E+00	0%	10950	2.2E-07	4.0E-02	5.6E-06	0%
Indeno(1,2,3-cd)pyrene	3.0E-01	45	30	100	1E-06	70	25550	2.3E-08	7.3E-01	1.7E-08	1%	10950	5.3E-08	0.0E+00	0.0E+00	0%
Phenanthrene	7.7E-01	45	30	100	1E-06	70	25550	5.8E-08	0.0E+00	0.0E+00	0%	10950	1.4E-07	3.0E-02	4.5E-06	0%
Pyrene	1.1E+00	45	30	100	1E-06	70	25550	8.2E-08	0.0E+00	0.0E+00	0%	10950	1.9E-07	3.0E-02	6.4E-06	0%
alpha-Chlordane	6.6E-03	45	30	100	1E-06	70	25550	5.0E-10	1.3E+00	6.6E-10	0%	10950	1.2E-09	6.0E-05	1.9E-05	0%
gamma-Chlordane	4.6E-03	45	30	100	1E-06	70	25550	3.5E-10	1.3E+00	4.6E-10	0%	10950	8.1E-10	6.0E-05	1.4E-05	0%
TOTAL										1.7E-06					1.3E-01	

SEDIMENT DERMAL CONTACT EX. ASSESSMENT
OPERABLE UNIT NO.7 (SITE 29 - NEW RIVER AND COGDELS CREEK)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site specific

NEW RIVER

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
Antimony	2.0E+02	1E-06	5800	1	0.001	45	30	70	25550	1.2E-08	0.0E+00	0.0E+00	0%	10950	2.7E-06	6.0E-05	3.4E-02	90%
Arsenic	9.0E+00	1E-06	5800	1	0.001	45	30	70	25550	3.9E-08	6.8E+00	3.4E-07	39%	10950	9.2E-08	6.0E-05	1.5E-03	4%
Barium	1.6E+01	1E-06	5800	1	0.001	45	30	70	25550	6.9E-09	0.0E+00	0.0E+00	0%	10950	1.6E-07	1.4E-02	1.1E-05	0%
Copper	1.3E+03	1E-06	5800	1	0.001	45	30	70	25550	5.9E-08	0.0E+00	0.0E+00	0%	10950	1.4E-05	7.4E-03	1.8E-03	5%
Lead	3.9E+04	1E-06	5800	1	0.001	45	30	70	25550	1.7E-04	0.0E+00	0.0E+00	0%	10950	4.0E-04	0.0E+00	0.0E+00	0%
Silver	2.1E+00	1E-06	5800	1	0.001	45	30	70	25550	9.4E-09	0.0E+00	0.0E+00	0%	10950	2.2E-08	1.0E-03	2.2E-05	0%
Zinc	9.0E+01	1E-06	5800	1	0.001	45	30	70	25550	3.9E-07	0.0E+00	0.0E+00	0%	10950	9.2E-07	6.0E-02	1.5E-05	0%
4,4'-DDD	1.8E-02	1E-06	5800	1	0.01	45	30	70	25550	6.6E-10	4.6E-01	3.2E-10	0%	10950	1.5E-09	0.0E+00	0.0E+00	0%
4,4'-DDE	8.5E-03	1E-06	5800	1	0.01	45	30	70	25550	3.7E-10	6.8E-01	2.5E-10	0%	10950	8.7E-10	0.0E+00	0.0E+00	0%
4,4'-DDT	3.0E-01	1E-06	5800	1	0.01	45	30	70	25550	1.3E-08	6.8E-01	8.9E-09	1%	10950	3.1E-08	2.5E-04	1.2E-04	0%
Anthracene	2.5E-01	1E-06	5800	1	0.01	45	30	70	25550	1.2E-08	0.0E+00	0.0E+00	0%	10950	2.8E-08	1.5E-01	1.9E-07	0%
Benzo(a)anthracene	1.2E+00	1E-06	5800	1	0.01	45	30	70	25550	5.1E-08	1.5E+00	7.5E-08	8%	10950	1.2E-07	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	5.6E-01	1E-06	5800	1	0.01	45	30	70	25550	2.5E-08	1.5E+01	3.6E-07	41%	10950	5.8E-08	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	1.1E+00	1E-06	5800	1	0.01	45	30	70	25550	4.8E-08	1.5E+00	7.0E-08	8%	10950	1.1E-07	0.0E+00	0.0E+00	0%
Benzo(g,h,i)perylene	3.0E-01	1E-06	5800	1	0.01	45	30	70	25550	1.3E-08	0.0E+00	0.0E+00	0%	10950	3.1E-08	1.5E-02	2.0E-06	0%
Benzo(k)fluoranthene	4.9E-01	1E-06	5800	1	0.01	45	30	70	25550	2.1E-08	1.5E-01	3.1E-09	0%	10950	5.0E-08	0.0E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	1.3E+00	1E-06	5800	1	0.01	45	30	70	25550	5.6E-08	2.8E-02	1.5E-09	0%	10950	1.3E-07	1.0E-02	1.3E-05	0%
Carbazole	1.6E-01	1E-06	5800	1	0.01	45	30	70	25550	7.0E-09	4.0E-02	2.8E-10	0%	10950	1.6E-08	0.0E+00	0.0E+00	0%
Chrysene	1.6E+00	1E-06	5800	1	0.01	45	30	70	25550	6.8E-08	1.5E-02	9.9E-10	0%	10950	1.6E-07	0.0E+00	0.0E+00	0%
Dibenzofuran	6.0E-02	1E-06	5800	1	0.01	45	30	70	25550	2.6E-09	0.0E+00	0.0E+00	0%	10950	6.1E-09	0.0E+00	0.0E+00	0%
Fluoranthene	1.3E+00	1E-06	5800	1	0.01	45	30	70	25550	5.6E-08	0.0E+00	0.0E+00	0%	10950	1.3E-07	2.0E-02	6.4E-06	0%
Indeno(1,2,3-cd)pyrene	3.0E-01	1E-06	5800	1	0.01	45	30	70	25550	1.3E-08	1.5E+00	1.9E-08	2%	10950	3.1E-08	0.0E+00	0.0E+00	0%
Phenanthrene	7.7E-01	1E-06	5800	1	0.01	45	30	70	25550	3.4E-08	0.0E+00	0.0E+00	0%	10950	7.9E-08	1.5E-02	5.3E-06	0%
Pyrene	1.1E+00	1E-06	5800	1	0.01	45	30	70	25550	4.8E-08	0.0E+00	0.0E+00	0%	10950	1.1E-07	1.5E-02	7.4E-06	0%
alpha-Chlordane	8.6E-03	1E-06	5800	1	0.01	45	30	70	25550	2.9E-10	2.6E+00	7.5E-10	0%	10950	8.7E-10	3.0E-05	2.2E-05	0%
gamma-Chlordane	4.6E-03	1E-06	5800	1	0.01	45	30	70	25550	2.0E-10	2.6E+00	5.2E-10	0%	10950	4.7E-10	3.0E-05	1.6E-05	0%
TOTAL												8.9E-07					3.7E-02	

SEDIMENT INGESTION EXPOSU... ...SSMENT
OPERABLE UNIT NO. 7 (SITE 28 - NEW RIVER AND COGDELS CREEK)
REMEDIAL INVESTIGATION CTO-0251
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

CHANGE

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

Note: Inputs are scenario and site specific

COGDELS CREEK

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
Aluminum	2.5E+04	45	30	100	1E-06	70	25550	1.9E-03	0.0E+00	0.0E+00	0%	10950	4.4E-03	1.0E+00	4.4E-03	26%
Arsenic	7.4E+00	45	30	100	1E-06	70	25550	5.6E-07	1.6E+00	9.6E-07	61%	10950	1.3E-06	3.0E-04	4.3E-03	26%
Barium	5.9E+01	45	30	100	1E-06	70	25550	4.6E-06	0.0E+00	0.0E+00	0%	10950	1.0E-05	7.0E-02	1.5E-04	1%
Chromium	2.6E+01	45	30	100	1E-06	70	25550	2.1E-06	0.0E+00	0.0E+00	0%	10950	4.9E-06	1.0E+00	4.9E-06	0%
Copper	5.1E+01	45	30	100	1E-06	70	25550	3.9E-06	0.0E+00	0.0E+00	0%	10950	9.0E-06	3.7E-02	2.4E-04	1%
Lead	1.6E+02	45	30	100	1E-06	70	25550	1.2E-05	0.0E+00	0.0E+00	0%	10950	2.8E-05	0.0E+00	0.0E+00	0%
Manganese (soil)	2.3E+02	45	30	100	1E-06	70	25550	1.7E-05	0.0E+00	0.0E+00	0%	10950	4.0E-05	1.4E-01	2.8E-04	2%
Mercury	3.8E-01	45	30	100	1E-06	70	25550	2.9E-08	0.0E+00	0.0E+00	0%	10950	6.7E-08	3.0E-04	2.2E-04	1%
Thallium	2.9E+00	45	30	100	1E-06	70	25550	2.2E-07	0.0E+00	0.0E+00	0%	10950	5.0E-07	8.0E-05	6.3E-03	37%
Vanadium	3.6E+01	45	30	100	1E-06	70	25550	2.7E-06	0.0E+00	0.0E+00	0%	10950	6.3E-06	7.0E-03	9.0E-04	5%
Zinc	1.7E+02	45	30	100	1E-06	70	25550	1.3E-05	0.0E+00	0.0E+00	0%	10950	3.1E-05	3.0E-01	1.0E-04	1%
3,3-Dichlorobenzidine	4.1E-01	45	30	100	1E-06	70	25550	3.1E-08	4.5E-01	1.4E-08	1%	10950	7.2E-08	0.0E+00	0.0E+00	0%
4,4'-DDD	4.6E-01	45	30	100	1E-06	70	25550	3.4E-08	2.4E-01	8.2E-09	1%	10950	7.9E-08	0.0E+00	0.0E+00	0%
4,4'-DDE	1.6E-01	45	30	100	1E-06	70	25550	1.2E-08	3.4E-01	4.1E-09	0%	10950	2.8E-08	0.0E+00	0.0E+00	0%
Benzo(a)anthracene	1.4E-01	45	30	100	1E-06	70	25550	1.1E-08	7.3E-01	7.7E-09	0%	10950	2.5E-08	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	1.1E+00	45	30	100	1E-06	70	25550	8.1E-08	7.3E+00	5.9E-07	37%	10950	1.9E-07	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	6.3E-02	45	30	100	1E-06	70	25550	4.6E-09	7.3E-01	3.5E-09	0%	10950	1.1E-08	0.0E+00	0.0E+00	0%
Benzo(k)fluoranthene	4.2E-02	45	30	100	1E-06	70	25550	3.2E-09	7.3E-02	2.3E-10	0%	10950	7.4E-09	0.0E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	7.0E-01	45	30	100	1E-06	70	25550	5.3E-08	1.4E-02	7.4E-10	0%	10950	1.2E-07	2.0E-02	6.2E-06	0%
Carbon Disulfide	1.3E-02	45	30	100	1E-06	70	25550	9.6E-10	0.0E+00	0.0E+00	0%	10950	2.3E-09	1.0E-01	2.3E-08	0%
Chrysene	1.6E-01	45	30	100	1E-06	70	25550	1.2E-08	7.3E-03	8.6E-11	0%	10950	2.8E-08	0.0E+00	0.0E+00	0%
Fluoranthene	3.4E-01	45	30	100	1E-06	70	25550	2.6E-08	0.0E+00	0.0E+00	0%	10950	6.0E-08	4.0E-02	1.5E-06	0%
Phenanthrene	2.6E-01	45	30	100	1E-06	70	25550	2.0E-08	0.0E+00	0.0E+00	0%	10950	4.6E-08	3.0E-02	1.5E-06	0%
Pyrene	2.5E-01	45	30	100	1E-06	70	25550	1.9E-08	0.0E+00	0.0E+00	0%	10950	4.4E-08	3.0E-02	1.5E-06	0%
alpha-Chlordane	5.9E-03	45	30	100	1E-06	70	25550	4.6E-10	1.3E+00	5.9E-10	0%	10950	1.0E-09	6.0E-05	1.7E-05	0%
gamma-Chlordane	6.4E-03	45	30	100	1E-06	70	25550	5.0E-10	1.3E+00	6.2E-10	0%	10950	1.5E-09	6.0E-05	2.6E-05	0%
TOTAL										1.6E-06					1.7E-02	

SEDIMENT DERMAL CONTACT [illegible]E ASSESSMENT
OPERABLE UNIT NO.7 (SITE 26 - NEW RIVER AND COGDELS CREEK)
REMEDIAL INVESTIGATION CTO-0231
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT AND FUTURE RESIDENTIAL ADULT

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)	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

Note: Inputs are scenario and site specific

COGDELS CREEK

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
Aluminum	2.9E+04	1E-06	5800	1	0.001	45	30	70	25550	1.1E-04	0.0E+00	0.0E+00	0%	10950	2.0E-04	2.0E-01	1.3E-03	20%
Arsenic	7.4E+00	1E-06	5800	1	0.001	45	30	70	25550	3.2E-08	8.8E+00	2.8E-07	28%	10950	7.0E-08	8.0E-05	1.3E-03	25%
Barium	5.9E+01	1E-06	5800	1	0.001	45	30	70	25550	2.6E-07	0.0E+00	0.0E+00	0%	10950	5.1E-07	1.4E-02	4.3E-05	1%
Chromium	2.8E+01	1E-06	5800	1	0.001	45	30	70	25550	1.2E-07	0.0E+00	0.0E+00	0%	10950	2.8E-07	2.0E-01	1.4E-06	0%
Copper	5.1E+01	1E-06	5800	1	0.001	45	30	70	25550	2.2E-07	0.0E+00	0.0E+00	0%	10950	5.2E-07	7.4E-03	7.0E-05	1%
Lead	1.6E+02	1E-06	5800	1	0.001	45	30	70	25550	7.0E-07	0.0E+00	0.0E+00	0%	10950	1.6E-06	0.0E+00	0.0E+00	0%
Manganese (soil)	2.5E+02	1E-06	5800	1	0.001	45	30	70	25550	9.9E-07	0.0E+00	0.0E+00	0%	10950	2.3E-06	2.8E-02	8.2E-05	2%
Mercury	3.8E-01	1E-06	5800	1	0.001	45	30	70	25550	1.7E-09	0.0E+00	0.0E+00	0%	10950	3.9E-09	6.0E-05	6.4E-05	1%
Thallium	2.9E+00	1E-06	5800	1	0.001	45	30	70	25550	1.2E-08	0.0E+00	0.0E+00	0%	10950	2.9E-08	1.6E-05	1.8E-03	37%
Vanadium	3.6E+01	1E-06	5800	1	0.001	45	30	70	25550	1.6E-07	0.0E+00	0.0E+00	0%	10950	3.7E-07	1.4E-03	2.6E-04	5%
Zinc	1.7E+02	1E-06	5800	1	0.001	45	30	70	25550	7.0E-07	0.0E+00	0.0E+00	0%	10950	1.6E-06	6.0E-02	3.0E-05	1%
3,3-Dichlorobenzidine	4.1E-01	1E-06	5800	1	0.01	45	30	70	25550	1.8E-08	9.0E-01	1.6E-08	2%	10950	4.2E-08	0.0E+00	0.0E+00	0%
4,4'-DDD	4.5E-01	1E-06	5800	1	0.01	45	30	70	25550	2.0E-08	4.5E-01	9.0E-09	1%	10950	4.6E-08	0.0E+00	0.0E+00	0%
4,4'-DDE	1.6E-01	1E-06	5800	1	0.01	45	30	70	25550	7.0E-09	6.6E-01	4.6E-09	0%	10950	1.6E-08	0.0E+00	0.0E+00	0%
Benzo(a)anthracene	1.4E-01	1E-06	5800	1	0.01	45	30	70	25550	6.1E-09	1.5E+00	8.9E-09	1%	10950	1.4E-08	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	1.1E+00	1E-06	5800	1	0.01	45	30	70	25550	4.7E-08	1.5E+01	6.9E-07	68%	10950	1.1E-07	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	6.3E-02	1E-06	5800	1	0.01	45	30	70	25550	2.6E-09	1.5E+00	4.0E-09	0%	10950	6.4E-09	0.0E+00	0.0E+00	0%
Benzo(k)fluoranthene	4.2E-02	1E-06	5800	1	0.01	45	30	70	25550	1.8E-09	1.6E-01	2.7E-10	0%	10950	4.3E-09	0.0E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	7.0E-01	1E-06	5800	1	0.01	45	30	70	25550	3.1E-08	2.0E-02	6.6E-10	0%	10950	7.2E-08	1.0E-02	7.2E-06	0%
Carbon Disulfide	1.3E-02	1E-06	5800	1	0.01	45	30	70	25550	5.7E-10	0.0E+00	0.0E+00	0%	10950	1.3E-09	8.0E-02	1.7E-08	0%
Chrysene	1.6E-01	1E-06	5800	1	0.01	45	30	70	25550	7.0E-09	1.6E-02	1.0E-10	0%	10950	1.6E-08	0.0E+00	0.0E+00	0%
Fluoranthene	3.4E-01	1E-06	5800	1	0.01	45	30	70	25550	1.5E-08	0.0E+00	0.0E+00	0%	10950	3.6E-08	2.0E-02	1.7E-06	0%
Phenanthrene	2.6E-01	1E-06	5800	1	0.01	45	30	70	25550	1.1E-08	0.0E+00	0.0E+00	0%	10950	2.7E-08	1.6E-02	1.6E-06	0%
Pyrene	2.6E-01	1E-06	5800	1	0.01	45	30	70	25550	1.1E-08	0.0E+00	0.0E+00	0%	10950	2.6E-08	1.6E-02	1.7E-06	0%
alpha-Chlordane	5.9E-03	1E-06	5800	1	0.01	45	30	70	25550	2.6E-10	2.6E+00	6.7E-10	0%	10950	6.0E-10	3.0E-05	2.0E-05	0%
gamma-Chlordane	8.4E-03	1E-06	5800	1	0.01	45	30	70	25550	3.7E-10	2.6E+00	9.6E-10	0%	10950	8.6E-10	3.0E-05	2.9E-05	1%
TOTAL												1.0E-06					0.0E+00	

SURFACE WATER INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO.7 (SITE 28 - NEW RIVER AND COGDELS CREEK)
REMEDIAL INVESTIGATION CTO-0231
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

CHANGE!!

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	

Note: Inputs are scenario and site specific

NEW RIVER

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
Aluminum	1.7E+00	0.005	2.6	45	30	70	25550	1.6E-05	0.0E+00	0.0E+00	0%	10950	3.9E-05	1.0E+00	3.9E-05	4%
Arsenic	4.3E-03	0.005	2.6	45	30	70	25550	4.2E-08	1.8E+00	7.4E-08	100%	10950	9.8E-08	3.0E-04	3.3E-04	39%
Cadmium (water)	4.2E-03	0.005	2.6	45	30	70	25550	4.1E-08	0.0E+00	0.0E+00	0%	10950	9.6E-08	5.0E-04	1.9E-04	23%
Copper	1.8E-02	0.005	2.6	45	30	70	25550	1.8E-07	0.0E+00	0.0E+00	0%	10950	4.1E-07	3.7E-02	1.1E-05	1%
Lead	2.3E-02	0.005	2.6	45	30	70	25550	2.3E-07	0.0E+00	0.0E+00	0%	10950	5.4E-07	0.0E+00	0.0E+00	0%
Manganese (water)	6.0E-02	0.005	2.6	45	30	70	25550	4.9E-07	0.0E+00	0.0E+00	0%	10950	1.1E-06	6.0E-03	2.3E-04	27%
Vanadium	6.1E-03	0.005	2.6	45	30	70	25550	6.0E-08	0.0E+00	0.0E+00	0%	10950	1.4E-07	7.0E-03	2.0E-05	2%
Zinc	3.6E-01	0.005	2.6	45	30	70	25550	3.6E-06	0.0E+00	0.0E+00	0%	10950	8.3E-06	3.0E-01	2.8E-05	3%
4,4'-DDE	4.0E-05	0.005	2.6	45	30	70	25550	3.9E-10	3.4E-01	1.3E-10	0%	10950	9.2E-10	0.0E+00	0.0E+00	0%
4,4'-DDD	5.0E-05	0.005	2.6	45	30	70	25550	4.9E-10	2.4E-01	1.2E-10	0%	10950	1.1E-09	0.0E+00	0.0E+00	0%
TOTAL										7.4E-08					8.5E-04	

COGDELS CREEK

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
Aluminum	9.4E-01	0.005	2.6	45	30	70	25550	9.2E-06	0.0E+00	0.0E+00	0%	10950	2.1E-05	1.0E+00	2.1E-05	5%
Arsenic	2.6E-03	0.005	2.6	45	30	70	25550	2.5E-08	1.8E+00	4.4E-08	100%	10950	5.9E-08	3.0E-04	2.0E-04	44%
Lead	3.7E-03	0.005	2.6	45	30	70	25550	3.6E-08	0.0E+00	0.0E+00	0%	10950	8.6E-08	0.0E+00	0.0E+00	0%
Manganese (water)	4.9E-02	0.005	2.6	45	30	70	25550	4.8E-07	0.0E+00	0.0E+00	0%	10950	1.1E-06	6.0E-03	2.2E-04	50%
Vanadium	2.4E-03	0.005	2.6	45	30	70	25550	2.4E-08	0.0E+00	0.0E+00	0%	10950	5.6E-08	7.0E-03	8.0E-06	2%
Zinc	1.2E-02	0.005	2.6	45	30	70	25550	1.2E-07	0.0E+00	0.0E+00	0%	10950	2.7E-07	3.0E-01	9.1E-07	0%
TOTAL										4.4E-08					4.5E-04	

SURFACE WATER DERMAL C[illegible]POSURE ASSESSMENT
OPERABLE UNIT NO.7 (SITE 29 - [illegible]VER AND COGDELS CREEK)
REMEDIAL INVESTIGATION - CTO-0231
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

CHANGE!

Where:	INPUTS
CW = contaminant concentration in water (mg/l)	
SA = skin surface available for contact (cm2)	5800
PC = contaminant specific dermal permeability (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

Note: Inputs are site and scenario specific

NEW RIVER

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
Aluminum	1.7E+00	5800	1.0E-03	2.6	45	30	0.001	70	25550	1.9E-05	0.0E+00	0.0E+00	0%	10950	4.4E-05	2.0E-01	2.2E-04	5%
Arsenic	4.3E-03	5800	1.0E-03	2.6	45	30	0.001	70	25550	4.9E-08	8.8E+00	4.3E-07	22%	10950	1.1E-07	8.0E-05	1.9E-03	39%
Cadmium (water)	4.2E-03	5800	1.0E-03	2.6	45	30	0.001	70	25550	4.8E-08	0.0E+00	0.0E+00	0%	10950	1.1E-07	1.0E-04	1.1E-03	23%
Copper	1.8E-02	5800	1.0E-03	2.6	45	30	0.001	70	25550	2.1E-07	0.0E+00	0.0E+00	0%	10950	4.8E-07	7.4E-03	6.6E-05	1%
Lead	2.3E-02	5800	4.0E-06	2.6	45	30	0.001	70	25550	1.1E-09	0.0E+00	0.0E+00	0%	10950	2.6E-09	0.0E+00	0.0E+00	0%
Manganese (water)	5.0E-02	5800	1.0E-03	2.6	45	30	0.001	70	25550	5.7E-07	0.0E+00	0.0E+00	0%	10950	1.3E-06	1.0E-03	1.3E-03	27%
Vanadium	8.1E-03	5800	1.0E-03	2.6	45	30	0.001	70	25550	6.9E-08	0.0E+00	0.0E+00	0%	10950	1.6E-07	1.4E-03	1.2E-04	2%
Zinc	3.6E-01	5800	6.0E-04	2.6	45	30	0.001	70	25550	2.5E-06	0.0E+00	0.0E+00	0%	10950	5.6E-06	6.0E-02	9.6E-05	2%
4,4'-DDE	4.0E-05	5800	2.4E-01	2.6	45	30	0.01	70	25550	1.1E-08	6.8E-01	7.4E-07	38%	10950	2.6E-06	0.0E+00	0.0E+00	0%
4,4'-DDD	6.0E-05	5800	2.6E-01	2.6	45	30	0.01	70	25550	1.6E-08	4.6E-01	7.6E-07	40%	10950	3.7E-06	0.0E+00	0.0E+00	0%
TOTAL												1.9E-06					4.8E-03	

SURFACE WATER DERMAL CO[illegible]OSURE ASSESSMENT
OPERABLE UNIT NO.7 (SITE 28 - Pe[illegible]VER AND COGDELS CREEK)
REMEDIAL INVESTIGATION - CTO-0231
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

CHANGE!

Where:	INPUTS
CW = contaminant concentration in water (mg/l)	
SA = skin surface available for contact (cm2)	5800
PC = contaminant specific dermal permeability (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 (1 liter/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

Note: Inputs are site and scenario specific

COGDELS CREEK

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)	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)	Noncarc Risk	Percent Noncarcinogenic Risk
Cadmium	8.4E-01	5800	1.0E-03	2.6	45	30	0.001	70	25550	1.1E-08	0.0E+00	0.0E+00	0%	10950	2.3E-05	2.0E-01	1.2E-04	5%
Arsenic	2.6E-03	5800	1.0E-03	2.6	45	30	0.001	70	25550	2.9E-08	8.8E+00	2.6E-07	100%	10950	8.8E-08	8.0E-05	1.1E-03	44%
Lead	3.7E-03	5800	4.0E-06	2.6	45	30	0.001	70	25550	1.7E-10	0.0E+00	0.0E+00	0%	10950	3.9E-10	0.0E+00	0.0E+00	0%
Manganese (water)	4.9E-02	5800	1.0E-03	2.6	45	30	0.001	70	25550	5.6E-07	0.0E+00	0.0E+00	0%	10950	1.3E-06	1.0E-03	1.3E-03	50%
Vanadium	2.4E-03	5800	1.0E-03	2.6	45	30	0.001	70	25550	2.8E-08	0.0E+00	0.0E+00	0%	10950	6.6E-08	1.4E-03	4.6E-05	2%
Zinc	1.2E-02	5800	6.0E-04	2.6	45	30	0.001	70	25550	8.1E-08	0.0E+00	0.0E+00	0%	10950	1.9E-07	6.0E-02	3.2E-06	0%
TOTAL												2.6E-07					2.6E-03	

SEDIMENT INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 28 - ORDE POND AND NEW RIVER)
REMEDIAL INVESTIGATION CTO-0220
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

Note: Inputs are scenario and site specific

ORDE POND

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
Aluminum	4.9E+03	48	30	100	1E-06	70	25550	3.9E-04	0.00E+00	0.0E+00	0%	10950	9.2E-04	1.00E+00	9.2E-04	17%
Arsenic	6.4E+00	48	30	100	1E-06	70	25550	5.2E-07	1.75E+00	9.0E-07	89%	10950	1.9E-06	3.00E-04	4.0E-03	76%
Beryllium	3.2E-01	48	30	100	1E-06	70	25550	2.6E-08	4.30E+00	1.1E-07	11%	10950	6.0E-08	5.00E-03	1.2E-05	0%
Chromium	1.2E+01	48	30	100	1E-06	70	25550	9.6E-07	0.00E+00	0.0E+00	0%	10950	2.2E-06	1.00E+00	2.2E-06	0%
Cobalt	1.7E+00	48	30	100	1E-06	70	25550	1.4E-07	0.00E+00	0.0E+00	0%	10950	3.2E-07	6.00E-02	5.3E-06	0%
Copper	1.7E+00	48	30	100	1E-06	70	25550	1.4E-07	0.00E+00	0.0E+00	0%	10950	3.2E-07	3.71E-02	8.6E-06	0%
Lead	8.3E+00	48	30	100	1E-06	70	25550	6.7E-07	0.00E+00	0.0E+00	0%	10950	1.6E-06	0.00E+00	0.0E+00	0%
Manganese (soil)	9.8E+00	48	30	100	1E-06	70	25550	7.9E-07	0.00E+00	0.0E+00	0%	10950	1.8E-06	1.40E-01	1.3E-05	0%
Nickel	2.2E+00	48	30	100	1E-06	70	25550	1.8E-07	0.00E+00	0.0E+00	0%	10950	4.1E-07	2.00E-02	2.1E-05	0%
Vanadium	1.2E+01	48	30	100	1E-06	70	25550	9.3E-07	0.00E+00	0.0E+00	0%	10950	2.2E-06	7.00E-03	3.1E-04	6%
4'-DDD	8.3E-03	48	30	100	1E-06	70	25550	6.7E-10	2.40E-01	1.6E-10	0%	10950	1.6E-09	0.00E+00	0.0E+00	0%
TOTAL										1.0E-06					5.3E-03	

SEDIMENT DERMAL CONTACT L ASSESSMENT
OPERABLE UNIT NO.7 (SITE 28 - Ch-uc POND AND NEW RIVER)
REMEDIAL INVESTIGATION CTO-0231
MCB CAMP LEJEUNE, NORTH CAROLINA
FISHERMAN

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)	48
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

Note: Inputs are scenario and site specific

ORDE POND

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
Aluminum	4.9E+03	1E-06	5800	1	0.001	48	30	70	25550	2.2E-03	0.00E+00	0.0E+00	0%	10950	3.3E-03	2.00E-01	2.7E-04	17%
Arsenic	6.4E+00	1E-06	5800	1	0.001	48	30	70	25550	3.0E-06	8.75E+00	2.6E-07	89%	10950	7.0E-06	6.00E-05	1.2E-03	75%
Beryllium	3.2E-01	1E-06	5800	1	0.001	48	30	70	25550	1.6E-09	2.15E+01	3.2E-08	11%	10950	3.6E-09	1.00E-03	3.6E-06	0%
Chromium	1.2E+01	1E-06	5800	1	0.001	48	30	70	25550	5.6E-09	0.00E+00	0.0E+00	0%	10950	1.3E-07	2.00E-01	6.4E-07	0%
Cobalt	1.7E+00	1E-06	5800	1	0.001	48	30	70	25550	7.9E-09	0.00E+00	0.0E+00	0%	10950	1.9E-08	1.20E-02	1.6E-06	0%
Copper	1.7E+00	1E-06	5800	1	0.001	48	30	70	25550	7.9E-09	0.00E+00	0.0E+00	0%	10950	1.9E-08	7.42E-03	2.6E-06	0%
Lead	8.3E+00	1E-06	5800	1	0.001	48	30	70	25550	3.9E-08	0.00E+00	0.0E+00	0%	10950	9.0E-08	0.00E+00	0.0E+00	0%
Manganese (soil)	9.6E+00	1E-06	5800	1	0.001	48	30	70	25550	4.6E-08	0.00E+00	0.0E+00	0%	10950	1.1E-07	2.80E-02	3.8E-06	0%
Nickel	2.2E+00	1E-06	5800	1	0.001	48	30	70	25550	1.0E-08	0.00E+00	0.0E+00	0%	10950	2.4E-08	4.00E-03	6.0E-06	0%
Vanadium	1.2E+01	1E-06	5800	1	0.001	48	30	70	25550	5.4E-08	0.00E+00	0.0E+00	0%	10950	1.3E-07	1.40E-03	9.0E-05	6%
4,4'-DDD	8.3E-03	1E-06	5800	1	0.01	48	30	70	25550	3.9E-10	4.80E-01	1.9E-10	0%	10950	9.0E-10	0.00E+00	0.0E+00	0%
TOTAL												2.0E-07					1.5E-03	

SEDIMENT INGESTION EXPOSURE . . .SSMENT
OPERABLE UNIT NO. 7 (SITE 28 - ORDE POND AND NEW RIVER)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site specific

NEW RIVER

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
Antimony	2.6E+02	48	30	100	1E-06	70	25550	2.1E-05	0.00E+00	0.0E+00	0%	10950	4.9E-05	4.0E-04	1.2E-01	91%
Arsenic	9.0E+00	48	30	100	1E-06	70	25550	7.2E-07	1.75E+00	1.3E-06	72%	10950	1.7E-06	3.0E-04	5.6E-03	4%
Barium	1.6E+01	48	30	100	1E-06	70	25550	1.2E-06	0.00E+00	0.0E+00	0%	10950	2.9E-06	7.0E-02	4.2E-05	0%
Copper	1.3E+03	48	30	100	1E-06	70	25550	1.1E-04	0.00E+00	0.0E+00	0%	10950	2.6E-04	3.71E-02	6.8E-03	5%
Lead	3.9E+04	48	30	100	1E-06	70	25550	3.1E-03	0.00E+00	0.0E+00	0%	10950	7.3E-03	0.00E+00	0.0E+00	0%
Silver	2.1E+00	48	30	100	1E-06	70	25550	1.7E-07	0.00E+00	0.0E+00	0%	10950	4.0E-07	5.00E-03	8.0E-05	0%
Zinc	9.0E+01	48	30	100	1E-06	70	25550	7.2E-06	0.00E+00	0.0E+00	0%	10950	1.7E-05	3.00E-01	5.6E-05	0%
4,4'-DDD	1.8E-02	48	30	100	1E-06	70	25550	1.2E-09	2.40E-01	2.9E-10	0%	10950	2.8E-09	0.00E+00	0.0E+00	0%
4,4'-DDE	8.6E-03	48	30	100	1E-06	70	25550	6.8E-10	3.40E-01	2.3E-10	0%	10950	1.6E-09	0.00E+00	0.0E+00	0%
4,4'-DDT	3.0E-01	48	30	100	1E-06	70	25550	2.4E-08	3.40E-01	8.2E-09	0%	10950	5.6E-08	5.00E-04	1.1E-04	0%
Anthracene	2.8E-01	48	30	100	1E-06	70	25550	2.2E-08	0.00E+00	0.0E+00	0%	10950	5.2E-08	3.00E-01	1.7E-07	0%
Benzo(a)anthracene	1.2E+00	48	30	100	1E-06	70	25550	9.4E-08	7.30E-01	6.9E-08	4%	10950	2.2E-07	0.00E+00	0.0E+00	0%
Benzo(a)pyrene	5.6E-01	48	30	100	1E-06	70	25550	4.5E-08	7.30E+00	3.3E-07	19%	10950	1.1E-07	0.00E+00	0.0E+00	0%
Benzo(b)fluoranthene	1.1E+00	48	30	100	1E-06	70	25550	8.9E-08	7.30E-01	6.5E-08	4%	10950	2.1E-07	0.00E+00	0.0E+00	0%
Benzo(g,h,i)perylene	3.0E-01	48	30	100	1E-06	70	25550	2.4E-08	0.00E+00	0.0E+00	0%	10950	5.6E-08	3.00E-02	1.9E-06	0%
Benzo(k)fluoranthene	4.9E-01	48	30	100	1E-06	70	25550	3.9E-08	7.30E-02	2.9E-09	0%	10950	9.1E-08	0.00E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	1.3E+00	48	30	100	1E-06	70	25550	1.0E-07	1.40E-02	1.4E-09	0%	10950	2.4E-07	2.00E-02	1.2E-05	0%
Carbazole	1.6E-01	48	30	100	1E-06	70	25550	1.3E-08	2.00E-02	2.6E-10	0%	10950	3.0E-08	0.00E+00	0.0E+00	0%
Chrysene	1.6E+00	48	30	100	1E-06	70	25550	1.3E-07	7.30E-03	9.1E-10	0%	10950	2.9E-07	0.00E+00	0.0E+00	0%
Dibenzofuran	6.0E-02	48	30	100	1E-06	70	25550	4.8E-09	0.00E+00	0.0E+00	0%	10950	1.1E-08	0.00E+00	0.0E+00	0%
Fluoranthene	1.3E+00	48	30	100	1E-06	70	25550	1.0E-07	0.00E+00	0.0E+00	0%	10950	2.4E-07	4.00E-02	6.0E-06	0%
Indeno(1,2,3-cd)pyrene	3.0E-01	48	30	100	1E-06	70	25550	2.4E-08	7.30E-01	1.8E-08	1%	10950	5.6E-08	0.00E+00	0.0E+00	0%
Phenanthrene	7.7E-01	48	30	100	1E-06	70	25550	6.2E-08	0.00E+00	0.0E+00	0%	10950	1.4E-07	3.00E-02	4.8E-06	0%
Pyrene	1.1E+00	48	30	100	1E-06	70	25550	8.8E-08	0.00E+00	0.0E+00	0%	10950	2.0E-07	3.00E-02	6.8E-06	0%
alpha-Chlordane	6.6E-03	48	30	100	1E-06	70	25550	5.3E-10	1.30E+00	6.9E-10	0%	10950	1.2E-09	6.00E-05	2.1E-05	0%
gamma-Chlordane	4.6E-03	48	30	100	1E-06	70	25550	3.7E-10	1.30E+00	4.8E-10	0%	10950	8.6E-10	6.00E-05	1.4E-05	0%
TOTAL										1.8E-06					1.4E-01	

SEDIMENT DERMAL CONTAC[illegible]E ASSESSMENT
OPERABLE UNIT NO.7 (SITE 29 [illegible] POND AND NEW RIVER)
REMEDIAL INVESTIGATION CTO-0231
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 adherance factor (mg/cm2)	1
Abs = fraction absorbed (unitless) (contaminant specific)	Specific
EF = exposure frequency (events/yr)	48
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

Note: Inputs are scenario and site specific

NEW RIVER

COPC	Contamination Carcinogen (mg/kg)	Conversion Factor (kg/mg)	Surface Area (cm2)	Adherance 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
Antimony	2.0E+02	1E-06	5800	1	0.001	48	30	70	25550	1.2E-06	0.00E+00	0.0E+00	0%	10950	2.9E-06	8.0E-05	3.6E-02	90%
Arsenic	9.0E+00	1E-06	5800	1	0.001	48	30	70	25550	4.2E-08	8.78E+00	3.7E-07	39%	10950	9.9E-08	8.00E-05	1.6E-03	4%
Barium	1.6E+01	1E-06	5800	1	0.001	48	30	70	25550	7.2E-08	0.00E+00	0.0E+00	0%	10950	1.7E-07	1.40E-02	1.2E-05	0%
Copper	1.3E+03	1E-06	5800	1	0.001	48	30	70	25550	6.3E-06	0.00E+00	0.0E+00	0%	10950	1.5E-05	7.42E-03	2.0E-03	5%
Lead	3.9E+04	1E-06	5800	1	0.001	48	30	70	25550	1.8E-04	0.00E+00	0.0E+00	0%	10950	4.2E-04	0.00E+00	0.0E+00	0%
Silver	2.1E+00	1E-06	5800	1	0.001	48	30	70	25550	1.0E-08	0.00E+00	0.0E+00	0%	10950	2.2E-08	1.00E-03	2.3E-05	0%
Zinc	9.0E+01	1E-06	5800	1	0.001	48	30	70	25550	4.2E-07	0.00E+00	0.0E+00	0%	10950	9.8E-07	6.00E-02	1.6E-05	0%
4,4'-DDD	1.6E-02	1E-06	5800	1	0.01	48	30	70	25550	7.0E-10	4.80E-01	3.4E-10	0%	10950	1.6E-09	0.00E+00	0.0E+00	0%
4,4'-DDE	8.0E-03	1E-06	5800	1	0.01	48	30	70	25550	4.0E-10	6.80E-01	2.7E-10	0%	10950	9.3E-10	0.00E+00	0.0E+00	0%
4,4'-DDT	3.0E-01	1E-06	5800	1	0.01	48	30	70	25550	1.4E-08	6.90E-01	9.6E-09	1%	10950	3.3E-08	2.50E-04	1.3E-04	0%
Anthracene	2.8E-01	1E-06	5800	1	0.01	48	30	70	25550	1.3E-08	0.00E+00	0.0E+00	0%	10950	3.0E-08	1.50E-01	2.0E-07	0%
Benzo(a)anthracene	1.2E+00	1E-06	5800	1	0.01	48	30	70	25550	5.6E-08	1.46E+00	8.0E-08	8%	10950	1.3E-07	0.00E+00	0.0E+00	0%
Benzo(a)pyrene	5.6E-01	1E-06	5800	1	0.01	48	30	70	25550	2.6E-08	1.46E+01	3.8E-07	41%	10950	6.1E-08	0.00E+00	0.0E+00	0%
Benzo(b)fluoranthene	1.1E+00	1E-06	5800	1	0.01	48	30	70	25550	5.1E-08	1.46E+00	7.6E-08	8%	10950	1.2E-07	0.00E+00	0.0E+00	0%
Benzo(g,h,i)perylene	3.0E-01	1E-06	5800	1	0.01	48	30	70	25550	1.4E-08	0.00E+00	0.0E+00	0%	10950	3.3E-08	1.50E-02	2.2E-06	0%
Benzo(k)fluoranthene	4.9E-01	1E-06	5800	1	0.01	48	30	70	25550	2.3E-08	1.46E-01	3.3E-09	0%	10950	5.3E-08	0.00E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	1.3E+00	1E-06	5800	1	0.01	48	30	70	25550	6.0E-08	2.80E-02	1.7E-09	0%	10950	1.4E-07	1.00E-02	1.4E-06	0%
Carbazole	1.6E-01	1E-06	5800	1	0.01	48	30	70	25550	7.6E-09	4.00E-02	3.0E-10	0%	10950	1.7E-08	0.00E+00	0.0E+00	0%
Chrysene	1.6E+00	1E-06	5800	1	0.01	48	30	70	25550	7.3E-08	1.46E-02	1.1E-09	0%	10950	1.7E-07	0.00E+00	0.0E+00	0%
Dibenzofuran	6.0E-02	1E-06	5800	1	0.01	48	30	70	25550	2.8E-09	0.00E+00	0.0E+00	0%	10950	6.6E-09	0.00E+00	0.0E+00	0%
Fluoranthene	1.3E+00	1E-06	5800	1	0.01	48	30	70	25550	6.6E-08	0.00E+00	0.0E+00	0%	10950	1.4E-07	2.00E-02	6.6E-06	0%
Indeno(1,2,3-cd)pyrene	3.0E-01	1E-06	5800	1	0.01	48	30	70	25550	1.4E-08	1.46E+00	2.0E-08	2%	10950	3.3E-08	0.00E+00	0.0E+00	0%
Phenanthrene	7.7E-01	1E-06	5800	1	0.01	48	30	70	25550	3.6E-08	0.00E+00	0.0E+00	0%	10950	8.4E-08	1.60E-02	5.6E-06	0%
Pyrene	1.1E+00	1E-06	5800	1	0.01	48	30	70	25550	5.1E-08	0.00E+00	0.0E+00	0%	10950	1.2E-07	1.80E-02	7.9E-06	0%
alpha-Chlordane	6.6E-03	1E-06	5800	1	0.01	48	30	70	25550	3.1E-10	2.60E+00	8.0E-10	0%	10950	7.2E-10	3.00E-05	2.4E-05	0%
gamma-Chlordane	4.6E-03	1E-06	5800	1	0.01	48	30	70	25550	2.1E-10	2.60E+00	5.6E-10	0%	10950	5.0E-10	3.00E-05	1.7E-05	0%
TOTAL												8.9E-07					4.0E-02	

SURFACE WATER INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO.7 (SITE 28 : ORDE POND AND NEW RIVER)
REMEDIAL INVESTIGATION CTO-0231
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

CHANGEIIII

Where:

		INPUT
Cw = contaminant concentration in surface water (mg/l)		
CR = contact 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	

ORDE POND

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
Aluminum	1.2E-03	0.005	2.6	48	30	70	25550	1.2E-04	0.00E+00	0.0E+00	0%	10950	2.0E-08	1.00E+00	2.0E-08	0%
Nickel	9.3E-03	0.005	2.6	48	30	70	25550	9.7E-08	0.00E+00	0.0E+00	0%	10950	2.3E-07	2.00E-02	1.1E-05	1%
Thallium	6.6E-03	0.005	2.6	48	30	70	25550	6.9E-08	0.00E+00	0.0E+00	0%	10950	1.6E-07	8.00E-05	2.0E-03	99%
TOTAL										0.0E+00					2.0E-03	

NEW RIVER

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. (years)	Noncarc Dose (mg/kg-day)	Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
Aluminum	1.7E+00	0.005	2.6	48	30	70	25550	1.7E-05	0.00E+00	0.0E+00	0%	10950	4.1E-05	1.00E+00	4.1E-05	4%
Arsenic	4.3E-03	0.005	2.6	48	30	70	25550	4.6E-08	1.75E+00	7.9E-08	100%	10950	1.1E-07	3.00E-04	3.6E-04	39%
Cadmium (water)	4.2E-03	0.005	2.6	48	30	70	25550	4.4E-08	0.00E+00	0.0E+00	0%	10950	1.0E-07	5.00E-04	2.1E-04	23%
Copper	1.8E-02	0.005	2.6	48	30	70	25550	1.9E-07	0.00E+00	0.0E+00	0%	10950	4.4E-07	3.71E-02	1.2E-05	1%
Lead	2.3E-02	0.005	2.6	48	30	70	25550	2.4E-07	0.00E+00	0.0E+00	0%	10950	5.7E-07	0.00E+00	0.0E+00	0%
Manganese (water)	5.0E-02	0.005	2.6	48	30	70	25550	5.2E-07	0.00E+00	0.0E+00	0%	10950	1.2E-06	5.00E-03	2.4E-04	27%
Vanadium	6.1E-03	0.005	2.6	48	30	70	25550	6.4E-08	0.00E+00	0.0E+00	0%	10950	1.5E-07	7.00E-03	2.1E-05	2%
Zinc	3.6E-01	0.005	2.6	48	30	70	25550	3.6E-06	0.00E+00	0.0E+00	0%	10950	8.6E-06	3.00E-01	3.0E-05	3%
4,4'-DDE	4.0E-05	0.005	2.6	48	30	70	25550	4.2E-10	3.40E-01	1.4E-10	0%	10950	9.8E-10	0.00E+00	0.0E+00	0%
4,4'-DDD	6.0E-05	0.005	2.6	48	30	70	25550	6.2E-10	2.40E-01	1.3E-10	0%	10950	1.2E-09	0.00E+00	0.0E+00	0%
TOTAL										7.9E-08					1.0E-04	

SURFACE WATER DERMAL C. EXPOSURE ASSESSMENT
OPERABLE UNIT NO.7 (SITE 28 - ONÉ POND AND NEW RIVER)
REMEDIAL INVESTIGATION - CTO-0231
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

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Where:	INPUTS
CW = contaminant concentration in water (mg/l)	
SA = skin surface available for contact (cm2)	6800
PC = contaminant specific dermal permeability (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 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

Note: Inputs are site and scenario specific

ONE POND

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
Aluminum	1.7E-01	6800	1.0E-03	2.6	48	30	0.001	70	25550	2.1E-06	0.00E+00	0.0E+00	0%	10950	4.9E-06	2.0E-01	2.4E-05	0%
Nickel	1.3E-02	6800	1.0E-04	2.6	48	30	0.001	70	25550	1.6E-08	0.00E+00	0.0E+00	0%	10950	3.6E-08	4.0E-03	9.1E-06	0%
Thallium	4.7E-03	6800	1.0E-03	2.6	48	30	0.001	70	25550	5.7E-08	0.00E+00	0.0E+00	0%	10950	1.3E-07	1.6E-05	8.3E-03	100%
TOTAL												0.0E+00					8.4E-03	

NEW RIVER

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
Aluminum	1.7E+00	6800	1.0E-03	2.6	48	30	0.001	70	25550	2.0E-05	0.00E+00	0.0E+00	0%	10950	4.7E-05	2.0E-01	2.4E-04	5%
Arsenic	4.3E-03	6800	1.0E-03	2.6	48	30	0.001	70	25550	5.2E-08	6.75E+00	4.6E-07	74%	10950	1.2E-07	8.0E-06	2.0E-03	39%
Cadmium (water)	4.2E-03	6800	1.0E-03	2.6	48	30	0.001	70	25550	5.1E-08	0.00E+00	0.0E+00	0%	10950	1.2E-07	1.0E-04	1.2E-03	23%
Copper	1.8E-02	6800	1.0E-03	2.6	48	30	0.001	70	25550	2.2E-07	0.00E+00	0.0E+00	0%	10950	5.1E-07	7.4E-03	6.9E-05	1%
Lead	2.3E-02	6800	4.0E-06	2.6	48	30	0.001	70	25550	1.1E-06	0.00E+00	0.0E+00	0%	10950	2.7E-06	0.00E+00	0.0E+00	0%
Manganese (water)	6.0E-02	6800	1.0E-03	2.6	48	30	0.001	70	25550	6.0E-07	0.00E+00	0.0E+00	0%	10950	1.4E-06	1.0E-03	1.4E-03	27%
Vanadium	6.1E-03	6800	1.0E-03	2.6	48	30	0.001	70	25550	7.4E-08	0.00E+00	0.0E+00	0%	10950	1.7E-07	1.4E-03	1.2E-04	2%
Zinc	3.6E-01	6800	6.0E-04	2.6	48	30	0.001	70	25550	2.6E-06	0.00E+00	0.0E+00	0%	10950	6.2E-06	6.0E-02	1.0E-04	2%
4,4'-DDE	4.0E-06	6800	2.4E-01	2.6	48	30	0.001	70	25550	1.2E-07	6.80E-01	7.9E-08	13%	10950	2.7E-07	0.00E+00	0.0E+00	0%
4,4'-DDD	6.0E-06	6800	2.6E-01	2.6	48	30	0.001	70	25550	1.7E-07	4.80E-01	8.2E-08	13%	10950	4.0E-07	0.00E+00	0.0E+00	0%
TOTAL												6.2E-07					5.2E-03	

FISH INGESTION EXPOSURE ASSESSMENT
SITE 29 - ORDE POND
REMEDIAL INVESTIGATION CTO-0231
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)	100
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

Note: Inputs are scenario and site specific

ORDE POND

POPC	Concentration (mg/kg)	Ingestion Rate (kg/meal) Adult	Fraction Ingestion (%)	Exposure Frequency (meals/yr) Adult	Exposure Duration (years) 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
Barium	6.0E-01	0.284	1	48	30	70	25550	1.4E-04	0.0E+00	0.0E+00	0%	10950	3.2E-04	7.0E-02	4.6E-03	5%
Manganese (soil)	2.2E+02	0.284	1	48	30	70	25550	5.0E-04	0.0E+00	0.0E+00	0%	10950	1.2E-03	1.4E-01	8.4E-03	10%
Selenium	3.3E-01	0.284	1	48	30	70	25550	7.5E-05	0.0E+00	0.0E+00	0%	10950	1.7E-04	5.0E-03	3.4E-02	39%
Zinc	2.3E+01	0.284	1	48	30	70	25550	5.2E-03	0.0E+00	0.0E+00	0%	10950	1.2E-02	3.0E-01	4.1E-02	46%
TOTAL										0.0E+00	0				8.9E-02	

FISH INGESTION EXPOSURE ASSESSMENT
SITE 28 NEW RIVER
REMEDIAL INVESTIGATION CTO-0231
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)	100
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

Note: Inputs are scenario and site specific

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 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
Antimony	2.4E-01	0.284	1	48	30	70	25550	5.5E-06	0.0E+00	0.0E+00	0%	10950	1.3E-04	4.0E-04	3.2E-01	78%
Barium	8.8E-01	0.284	1	48	30	70	25550	2.2E-04	0.0E+00	0.0E+00	0%	10950	5.2E-04	7.0E-02	7.5E-03	2%
Cobalt	3.0E-02	0.284	1	48	30	70	25550	6.9E-06	0.0E+00	0.0E+00	0%	10950	1.6E-05	6.0E-02	2.7E-04	0%
Copper	6.1E-01	0.284	1	48	30	70	25550	1.4E-04	0.0E+00	0.0E+00	0%	10950	3.3E-04	3.7E-02	8.9E-03	2%
Selenium	3.9E-01	0.284	1	48	30	70	25550	8.9E-06	0.0E+00	0.0E+00	0%	10950	2.1E-04	5.0E-03	4.2E-02	10%
4,4'-DDE	4.2E-02	0.284	1	48	30	70	25550	9.6E-06	3.4E-01	3.3E-06	58%	10950	2.2E-05	0.0E+00	0.0E+00	0%
4,4'-DDD	2.3E-02	0.284	1	48	30	70	25550	5.3E-06	2.4E-01	1.3E-06	23%	10950	1.2E-05	0.0E+00	0.0E+00	0%
Alpha-Chlordane	3.6E-03	0.284	1	48	30	70	25550	8.2E-07	1.3E+00	1.1E-06	19%	10950	1.9E-06	6.0E-05	3.2E-02	8%
TOTAL										5.6E-06					4.1E-01	

SURFACE SOIL INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 26)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site 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
Aluminum	3.4E+03	250	4	1E-06	100	70	25550	1.9E-04	0.0E+00	0.0E+00	0%	1460	3.3E-03	1.0E+00	3.3E-03	7%
Antimony	5.7E+00	250	4	1E-06	100	70	25550	3.2E-07	0.0E+00	0.0E+00	0%	1460	5.5E-06	4.0E-04	1.4E-02	31%
Arsenic	1.7E+00	250	4	1E-06	100	70	25550	9.7E-08	1.8E+00	1.7E-07	51%	1460	1.7E-06	3.0E-04	5.7E-03	13%
Barium	3.5E+01	250	4	1E-06	100	70	25550	1.9E-06	0.0E+00	0.0E+00	0%	1460	3.4E-05	7.0E-02	4.9E-04	1%
Cadmium (soil)	1.6E+00	250	4	1E-06	100	70	25550	8.7E-08	0.0E+00	0.0E+00	0%	1460	1.5E-06	1.0E-03	1.5E-03	3%
Chromium	1.0E+01	250	4	1E-06	100	70	25550	5.6E-07	0.0E+00	0.0E+00	0%	1460	1.0E-05	1.0E+00	1.0E-05	0%
Cobalt	9.1E-01	250	4	1E-06	100	70	25550	5.1E-08	0.0E+00	0.0E+00	0%	1460	8.9E-07	6.0E-02	1.5E-05	0%
Copper	1.3E+02	250	4	1E-06	100	70	25550	7.3E-06	0.0E+00	0.0E+00	0%	1460	1.3E-04	3.7E-02	3.4E-03	8%
Lead	1.7E+02	250	4	1E-06	100	70	25550	9.5E-06	0.0E+00	0.0E+00	0%	1460	1.7E-04	0.0E+00	0.0E+00	0%
Manganese (soil)	3.3E+02	250	4	1E-06	100	70	25550	1.8E-05	0.0E+00	0.0E+00	0%	1460	3.2E-04	1.4E-01	2.3E-03	5%
Mercury	2.8E-01	250	4	1E-06	100	70	25550	1.6E-08	0.0E+00	0.0E+00	0%	1460	2.8E-07	3.0E-04	9.3E-04	2%
Nickel	5.6E+00	250	4	1E-06	100	70	25550	3.1E-07	0.0E+00	0.0E+00	0%	1460	5.4E-06	2.0E-02	2.7E-04	1%
Silver	1.1E+00	250	4	1E-06	100	70	25550	6.3E-08	0.0E+00	0.0E+00	0%	1460	1.1E-06	5.0E-03	2.2E-04	0%
Thallium	5.1E-01	250	4	1E-06	100	70	25550	2.9E-08	0.0E+00	0.0E+00	0%	1460	5.0E-07	8.0E-05	6.3E-03	14%
Vanadium	7.9E+00	250	4	1E-06	100	70	25550	4.4E-07	0.0E+00	0.0E+00	0%	1460	7.8E-06	7.0E-03	1.1E-03	2%
Zinc	1.1E+03	250	4	1E-06	100	70	25550	6.0E-05	0.0E+00	0.0E+00	0%	1460	1.0E-03	3.0E-01	3.5E-03	8%
4,4'-DDD	6.4E-02	250	4	1E-06	100	70	25550	3.6E-09	2.4E-01	8.6E-10	0%	1460	6.3E-08	0.0E+00	0.0E+00	0%
4,4'-DDE	3.5E-01	250	4	1E-06	100	70	25550	1.9E-08	3.4E-01	6.6E-09	2%	1460	3.4E-07	0.0E+00	0.0E+00	0%
4,4'-DDT	1.5E-01	250	4	1E-06	100	70	25550	8.3E-09	3.4E-01	2.8E-09	1%	1460	1.5E-07	5.0E-04	2.9E-04	1%
Anthracene	2.1E-01	250	4	1E-06	100	70	25550	1.1E-08	0.0E+00	0.0E+00	0%	1460	2.0E-07	3.0E-01	6.7E-07	0%
Benzo(a)anthracene	2.8E-01	250	4	1E-06	100	70	25550	1.6E-08	7.3E-01	1.1E-08	3%	1460	2.7E-07	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	2.7E-01	250	4	1E-06	100	70	25550	1.5E-08	7.3E+00	1.1E-07	33%	1460	2.6E-07	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	2.9E-01	250	4	1E-06	100	70	25550	1.6E-08	7.3E-01	1.2E-08	4%	1460	2.9E-07	0.0E+00	0.0E+00	0%
Benzo(g,h,i)perylene	2.5E-01	250	4	1E-06	100	70	25550	1.4E-08	0.0E+00	0.0E+00	0%	1460	2.5E-07	3.0E-02	8.3E-06	0%
Carbazole	1.7E-01	250	4	1E-06	100	70	25550	9.5E-09	2.0E-02	1.9E-10	0%	1460	1.7E-07	0.0E+00	0.0E+00	0%
Chrysene	2.8E-01	250	4	1E-06	100	70	25550	1.6E-08	7.3E-03	1.1E-10	0%	1460	2.7E-07	0.0E+00	0.0E+00	0%
Heptachlor epoxide	6.9E-03	250	4	1E-06	100	70	25550	3.9E-10	9.1E+00	3.5E-09	1%	1460	6.8E-09	1.3E-05	5.2E-04	1%
Indeno(1,2,3-cd)pyrene	2.5E-01	250	4	1E-06	100	70	25550	1.4E-08	7.3E-01	1.0E-08	3%	1460	2.5E-07	0.0E+00	0.0E+00	0%
Phenanthrene	2.8E-01	250	4	1E-06	100	70	25550	1.6E-08	0.0E+00	0.0E+00	0%	1460	2.8E-07	3.0E-02	9.3E-06	0%
alpha-Chlordane	3.8E-02	250	4	1E-06	100	70	25550	2.1E-09	1.3E+00	2.8E-09	1%	1460	3.7E-08	6.0E-05	6.2E-04	1%
gamma-Chlordane	1.3E-02	250	4	1E-06	100	70	25550	7.2E-10	1.3E+00	9.4E-10	0%	1460	1.3E-08	6.0E-05	2.1E-04	0%
TOTAL										3.3E-07					4.5E-02	

SURFACE SOIL DERMAL CONTAC... ...OSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 26)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site 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	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
Aluminum	3.4E+03	1E-06	4300	1	0.001	250	4	70	25550	8.2E-08	0.00E+00	0.0E+00	0%	1460	1.4E-04	2.00E-01	7.2E-04	7%
Antimony	5.7E+00	1E-06	4300	1	0.001	250	4	70	25550	1.4E-08	0.00E+00	0.0E+00	0%	1460	2.4E-07	8.00E-05	3.0E-03	28%
Arsenic	1.7E+00	1E-06	4300	1	0.001	250	4	70	25550	4.2E-09	8.75E+00	3.7E-08	21%	1460	7.3E-08	8.00E-05	1.2E-03	11%
Barium	3.6E+01	1E-06	4300	1	0.001	250	4	70	25550	8.4E-08	0.00E+00	0.0E+00	0%	1460	1.5E-06	1.40E-02	1.0E-04	1%
Cadmium (soil)	1.6E+00	1E-06	4300	1	0.001	250	4	70	25550	3.7E-09	0.00E+00	0.0E+00	0%	1460	6.6E-08	2.00E-04	3.3E-04	3%
Chromium	1.0E+01	1E-06	4300	1	0.001	250	4	70	25550	2.5E-08	0.00E+00	0.0E+00	0%	1460	4.4E-07	2.00E-01	2.2E-06	0%
Cobalt	9.1E-01	1E-06	4300	1	0.001	250	4	70	25550	2.2E-09	0.00E+00	0.0E+00	0%	1460	3.8E-08	1.20E-02	3.2E-06	0%
Copper	1.3E+02	1E-06	4300	1	0.001	250	4	70	25550	3.1E-07	0.00E+00	0.0E+00	0%	1460	6.6E-06	7.42E-03	7.4E-04	7%
Lead	1.7E+02	1E-06	4300	1	0.001	250	4	70	25550	4.1E-07	0.00E+00	0.0E+00	0%	1460	7.1E-06	0.00E+00	0.0E+00	0%
Manganese (soil)	3.3E+02	1E-06	4300	1	0.001	250	4	70	25550	7.9E-07	0.00E+00	0.0E+00	0%	1460	1.4E-05	2.80E-02	4.9E-04	5%
Mercury	2.8E-01	1E-06	4300	1	0.001	250	4	70	25550	6.8E-10	0.00E+00	0.0E+00	0%	1460	1.2E-08	6.00E-05	2.0E-04	2%
Nickel	5.6E+00	1E-06	4300	1	0.001	250	4	70	25550	1.3E-08	0.00E+00	0.0E+00	0%	1460	2.3E-07	4.00E-03	5.9E-05	1%
Silver	1.1E+00	1E-06	4300	1	0.001	250	4	70	25550	2.7E-09	0.00E+00	0.0E+00	0%	1460	4.8E-08	1.00E-03	4.8E-05	0%
Thallium	5.1E-01	1E-06	4300	1	0.001	250	4	70	25550	1.2E-09	0.00E+00	0.0E+00	0%	1460	2.2E-08	1.60E-05	1.4E-03	13%
Vanadium	7.9E+00	1E-06	4300	1	0.001	250	4	70	25550	1.9E-08	0.00E+00	0.0E+00	0%	1460	3.3E-07	1.40E-03	2.4E-04	2%
Zinc	1.1E+03	1E-06	4300	1	0.001	250	4	70	25550	2.6E-06	0.00E+00	0.0E+00	0%	1460	4.6E-05	6.00E-02	7.6E-04	7%
4,4'-DDD	6.4E-02	1E-06	4300	1	0.01	250	4	70	25550	1.5E-09	4.60E-01	7.4E-10	0%	1460	2.7E-08	0.00E+00	0.0E+00	0%
4,4'-DDE	3.6E-01	1E-06	4300	1	0.01	250	4	70	25550	8.4E-09	6.80E-01	5.7E-09	3%	1460	1.5E-07	0.00E+00	0.0E+00	0%
4,4'-DDT	1.9E-01	1E-06	4300	1	0.01	250	4	70	25550	3.0E-09	6.80E-01	2.4E-09	1%	1460	6.3E-08	2.50E-04	2.5E-04	2%
Anthracene	2.1E-01	1E-06	4300	1	0.01	250	4	70	25550	4.9E-09	0.00E+00	0.0E+00	0%	1460	8.6E-08	1.50E-01	5.8E-07	0%
Benzo(a)anthracene	2.8E-01	1E-06	4300	1	0.01	250	4	70	25550	6.7E-09	1.46E+00	9.8E-09	8%	1460	1.2E-07	0.00E+00	0.0E+00	0%
Benzo(a)pyrene	2.7E-01	1E-06	4300	1	0.01	250	4	70	25550	6.4E-09	1.46E+01	9.4E-08	54%	1460	1.1E-07	0.00E+00	0.0E+00	0%
Benzo(b)fluoranthene	2.9E-01	1E-06	4300	1	0.01	250	4	70	25550	7.1E-09	1.46E+00	1.0E-08	6%	1460	1.2E-07	0.00E+00	0.0E+00	0%
Benzo(g,h,i)perylene	2.5E-01	1E-06	4300	1	0.01	250	4	70	25550	6.1E-09	0.00E+00	0.0E+00	0%	1460	1.1E-07	1.80E-02	7.1E-06	0%
Carbazole	1.7E-01	1E-06	4300	1	0.01	250	4	70	25550	4.1E-09	4.00E-02	1.6E-10	0%	1460	7.2E-08	0.00E+00	0.0E+00	0%
Chrysene	2.8E-01	1E-06	4300	1	0.01	250	4	70	25550	6.7E-09	1.46E-02	9.8E-11	0%	1460	1.2E-07	0.00E+00	0.0E+00	0%
Heptachlor epoxide	6.9E-03	1E-06	4300	1	0.01	250	4	70	25550	1.7E-10	1.82E+01	3.0E-09	2%	1460	2.9E-09	6.50E-05	4.5E-04	4%
Indeno(1,2,3-cd)pyrene	2.8E-01	1E-06	4300	1	0.01	250	4	70	25550	6.1E-09	1.46E+00	8.9E-09	6%	1460	1.1E-07	0.00E+00	0.0E+00	0%
Phenanthrene	2.6E-01	1E-06	4300	1	0.01	250	4	70	25550	6.6E-09	0.00E+00	0.0E+00	0%	1460	1.2E-07	1.60E-02	8.0E-06	0%
alpha-Chlordane	3.6E-02	1E-06	4300	1	0.01	250	4	70	25550	9.2E-10	2.60E+00	2.4E-09	1%	1460	1.6E-08	3.00E-05	5.4E-04	5%
gamma-Chlordane	1.3E-02	1E-06	4300	1	0.01	250	4	70	25550	3.1E-10	2.60E+00	8.1E-10	0%	1460	5.4E-09	3.00E-05	1.8E-04	2%
TOTAL												1.7E-07					1.1E-02	

SURFACE SOIL PARTICULATE INHALATION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 28)
REMEDIAL INVESTIGATION CTO-0231
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)	4.63E+09

Note: Inputs are scenario and site specific

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
Aluminum	3.4E+03	4.6E+09	250	30	4	70	25550	1.2E-08	0.00E+00	0.0E+00	0%	1460	2.2E-07	0.00E+00	0.0E+00	0%
Antimony	5.7E+00	4.6E+09	250	30	4	70	25550	2.1E-11	0.00E+00	0.0E+00	0%	1460	3.6E-10	0.00E+00	0.0E+00	0%
Arsenic	1.7E+00	4.6E+09	250	30	4	70	25550	6.3E-12	1.51E+01	9.5E-11	92%	1460	1.1E-10	0.00E+00	0.0E+00	0%
Barium	3.6E+01	4.6E+09	250	30	4	70	25550	1.3E-10	0.00E+00	0.0E+00	0%	1460	2.2E-09	1.43E-04	1.5E-05	99%
Cadmium (soil)	1.6E+00	4.6E+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%
Chromium	1.0E+01	4.6E+09	250	30	4	70	25550	3.8E-11	0.00E+00	0.0E+00	0%	1460	6.6E-10	0.00E+00	0.0E+00	0%
Cobalt	9.1E-01	4.6E+09	250	30	4	70	25550	3.3E-12	0.00E+00	0.0E+00	0%	1460	5.8E-11	0.00E+00	0.0E+00	0%
Copper	1.3E+02	4.6E+09	250	30	4	70	25550	4.7E-10	0.00E+00	0.0E+00	0%	1460	8.2E-09	0.00E+00	0.0E+00	0%
Lead	1.7E+02	4.6E+09	250	30	4	70	25550	6.1E-10	0.00E+00	0.0E+00	0%	1460	1.1E-08	0.00E+00	0.0E+00	0%
Manganese (soil)	3.3E+02	4.6E+09	250	30	4	70	25550	1.2E-09	0.00E+00	0.0E+00	0%	1460	2.1E-08	0.00E+00	0.0E+00	0%
Mercury	2.8E-01	4.6E+09	250	30	4	70	25550	1.0E-12	0.00E+00	0.0E+00	0%	1460	1.8E-11	8.57E-05	2.1E-07	1%
Nickel	5.6E+00	4.6E+09	250	30	4	70	25550	2.0E-11	0.00E+00	0.0E+00	0%	1460	3.5E-10	0.00E+00	0.0E+00	0%
Silver	1.1E+00	4.6E+09	250	30	4	70	25550	4.1E-12	0.00E+00	0.0E+00	0%	1460	7.2E-11	0.00E+00	0.0E+00	0%
Thallium	5.1E-01	4.6E+09	250	30	4	70	25550	1.9E-12	0.00E+00	0.0E+00	0%	1460	3.3E-11	0.00E+00	0.0E+00	0%
Vanadium	7.9E+00	4.6E+09	250	30	4	70	25550	2.9E-11	0.00E+00	0.0E+00	0%	1460	5.0E-10	0.00E+00	0.0E+00	0%
Zinc	1.1E+03	4.6E+09	250	30	4	70	25550	3.9E-09	0.00E+00	0.0E+00	0%	1460	6.8E-08	0.00E+00	0.0E+00	0%
4,4'-DDD	6.4E-02	4.6E+09	250	30	4	70	25550	2.3E-13	0.00E+00	0.0E+00	0%	1460	4.1E-12	0.00E+00	0.0E+00	0%
4,4'-DDE	3.6E-01	4.6E+09	250	30	4	70	25550	1.3E-12	0.00E+00	0.0E+00	0%	1460	2.2E-11	0.00E+00	0.0E+00	0%
4,4'-DDT	1.5E-01	4.6E+09	250	30	4	70	25550	5.4E-13	3.40E-01	1.8E-13	0%	1460	9.4E-12	0.00E+00	0.0E+00	0%
Anthracene	2.1E-01	4.6E+09	250	30	4	70	25550	7.4E-13	0.00E+00	0.0E+00	0%	1460	1.3E-11	0.00E+00	0.0E+00	0%
Benzo(a)anthracene	2.8E-01	4.6E+09	250	30	4	70	25550	1.0E-12	6.10E-01	6.1E-13	1%	1460	1.8E-11	0.00E+00	0.0E+00	0%
Benzo(a)pyrene	2.7E-01	4.6E+09	250	30	4	70	25550	9.7E-13	6.10E+00	5.9E-12	6%	1460	1.7E-11	0.00E+00	0.0E+00	0%
Benzo(b)fluoranthene	2.9E-01	4.6E+09	250	30	4	70	25550	1.1E-12	6.10E-01	6.5E-13	1%	1460	1.9E-11	0.00E+00	0.0E+00	0%
Benzo(g,h,i)perylene	2.5E-01	4.6E+09	250	30	4	70	25550	9.2E-13	0.00E+00	0.0E+00	0%	1460	1.6E-11	0.00E+00	0.0E+00	0%
Carbazole	1.7E-01	4.6E+09	250	30	4	70	25550	6.2E-13	0.00E+00	0.0E+00	0%	1460	1.1E-11	0.00E+00	0.0E+00	0%
Chrysene	2.8E-01	4.6E+09	250	30	4	70	25550	1.0E-12	6.10E-03	6.2E-15	0%	1460	1.8E-11	0.00E+00	0.0E+00	0%
Heptachlor epoxide	6.9E-03	4.6E+09	250	30	4	70	25550	2.5E-14	9.10E+00	2.3E-13	0%	1460	4.4E-13	0.00E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	2.5E-01	4.6E+09	250	30	4	70	25550	9.2E-13	6.10E-01	5.6E-13	1%	1460	1.6E-11	0.00E+00	0.0E+00	0%
Phenanthrene	2.8E-01	4.6E+09	250	30	4	70	25550	1.0E-12	0.00E+00	0.0E+00	0%	1460	1.8E-11	0.00E+00	0.0E+00	0%
alpha-Chlordane	3.8E-02	4.6E+09	250	30	4	70	25550	1.4E-13	1.29E+00	1.8E-13	0%	1460	2.4E-12	0.00E+00	0.0E+00	0%
gamma-Chlordane	1.3E-02	4.6E+09	250	30	4	70	25550	4.7E-14	1.29E+00	6.0E-14	0%	1460	8.2E-13	0.00E+00	0.0E+00	0%
TOTAL										1.0E-10					1.6E-05	

SEDIMENT INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 28 - ORDE POND)
REMEDIAL INVESTIGATION CTO-0231
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT MILITARY PERSONNEL

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)	250
ED = exposure duration (yr)	4
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)	4
DY = days per year (days/year)	365
CSF = cancer slope factor (mg/kg-day)-1	Specific
RfD = reference dose (mg/kg-day)	Specific

Note: Inputs are scenario and site specific

ORDE POND

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
Aluminum	4.9E+00	250	4	100	1E-06	70	25550	2.7E-04	0.00E+00	0.0E+00	0%	1460	4.9E-03	1.00E+00	4.9E-03	17%
Arsenic	8.4E+00	250	4	100	1E-06	70	25550	3.6E-07	1.75E+00	6.3E-07	89%	1460	6.3E-06	3.00E-04	2.1E-02	76%
Beryllium	3.2E-01	250	4	100	1E-06	70	25550	1.8E-08	4.30E+00	7.7E-08	11%	1460	3.1E-07	5.00E-03	6.3E-05	0%
Chromium	1.2E+01	250	4	100	1E-06	70	25550	6.6E-07	0.00E+00	0.0E+00	0%	1460	1.2E-05	1.00E+00	1.2E-05	0%
Cobalt	1.7E+00	250	4	100	1E-06	70	25550	9.6E-08	0.00E+00	0.0E+00	0%	1460	1.7E-06	6.00E-02	2.8E-05	0%
Copper	1.7E+00	250	4	100	1E-06	70	25550	9.0E-08	0.00E+00	0.0E+00	0%	1460	1.7E-06	3.71E-02	4.5E-05	0%
Lead	8.3E+00	250	4	100	1E-06	70	25550	4.8E-07	0.00E+00	0.0E+00	0%	1460	8.1E-06	0.00E+00	0.0E+00	0%
Manganese (soil)	9.8E+00	250	4	100	1E-06	70	25550	5.6E-07	0.00E+00	0.0E+00	0%	1460	9.6E-06	1.40E-01	6.8E-05	0%
Nickel	2.2E+00	250	4	100	1E-06	70	25550	1.2E-07	0.00E+00	0.0E+00	0%	1460	2.2E-06	2.00E-02	1.1E-04	0%
Vanadium	1.2E+01	250	4	100	1E-06	70	25550	6.4E-07	0.00E+00	0.0E+00	0%	1460	1.1E-05	7.00E-03	1.6E-03	6%
4,4'-DDD	8.3E-03	250	4	100	1E-06	70	25550	4.6E-10	2.40E-01	1.1E-10	0%	1460	8.1E-09	0.00E+00	0.0E+00	0%
TOTAL										7.0E-07					2.9E-02	

SEDIMENT DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO.7 (SITE 28 - ORDE POND)
REMEDIAL INVESTIGATION CTO-0031
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT MILITARY PERSONNEL

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)	4300
AF = sediment to skin adherence factor (mg/cm2)	1
Abs = fraction absorbed (unitless) (contaminant specific)	Specific
EF = exposure frequency (events/yr)	250
ED = exposure duration (years)	4
BW = 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

Note: Inputs are scenario and site specific

ORDE POND

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)	Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
Aluminum	4.9E+03	1E-06	4300	1	0.001	250	4	70	25550	1.2E-06	0.00E+00	0.0E+00	0%	1460	2.1E-04	2.00E-01	1.0E-03	17%
Arsenic	6.4E+00	1E-06	4300	1	0.001	250	4	70	25550	1.6E-08	8.76E+00	1.3E-07	89%	1460	2.7E-07	6.00E-05	4.6E-03	78%
Beryllium	3.2E-01	1E-06	4300	1	0.001	250	4	70	25550	7.7E-10	2.18E+01	1.7E-08	11%	1460	1.3E-08	1.00E-03	1.3E-05	0%
Chromium	1.2E+01	1E-06	4300	1	0.001	250	4	70	25550	2.8E-08	0.00E+00	0.0E+00	0%	1460	6.0E-07	2.00E-01	2.8E-06	0%
Cobalt	1.7E+00	1E-06	4300	1	0.001	250	4	70	25550	4.1E-09	0.00E+00	0.0E+00	0%	1460	7.2E-08	1.20E-02	6.0E-06	0%
Copper	1.7E+00	1E-06	4300	1	0.001	250	4	70	25550	4.1E-09	0.00E+00	0.0E+00	0%	1460	7.2E-08	7.42E-03	9.6E-06	0%
Lead	8.3E+00	1E-06	4300	1	0.001	250	4	70	25550	2.0E-08	0.00E+00	0.0E+00	0%	1460	3.6E-07	0.00E+00	0.0E+00	0%
Manganese (soil)	9.6E+00	1E-06	4300	1	0.001	250	4	70	25550	2.4E-08	0.00E+00	0.0E+00	0%	1460	4.1E-07	2.80E-02	1.5E-05	0%
Nickel	2.2E+00	1E-06	4300	1	0.001	250	4	70	25550	5.3E-09	0.00E+00	0.0E+00	0%	1460	9.3E-08	4.00E-03	2.3E-05	0%
Vanadium	1.2E+01	1E-06	4300	1	0.001	250	4	70	25550	2.8E-08	0.00E+00	0.0E+00	0%	1460	4.8E-07	1.40E-03	3.6E-04	6%
4,4'-DDD	8.3E-03	1E-06	4300	1	0.01	250	4	70	25550	2.0E-10	4.60E-01	9.6E-11	0%	1460	3.6E-09	0.00E+00	0.0E+00	0%
TOTAL												1.5E-07					5.9E-03	

SURFACE WATER INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO.7 (SITE 26 - ORDE POND)
REMEDIAL INVESTIGATION CTO-0231
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT MILITARY PERSONNEL

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

CHANGE!!!!

Where:

		INPUT
Cw = contaminant concentration in surface water (mg/l)		
CR = contact rate (L/hr/hour)		0.005
ET = exposure time (hours/event)		2.6
EF = exposure frequency (events/yr)		45
ED = exposure duration (yrs)		4
BW = body weight (kg)		70
ATc = averaging time for carcinogen (yr)		70
ATnc = averaging time for noncarcinogen (yr)		4
DY = days per year (days)		365
CSF = cancer slope factor (mg/kg-day)-1	specific	
RfD = reference dose (mg/kg-day)	specific	

Note: Inputs are scenario and site specific

COPC	Concentration (mg/l)	Contact Rate (l/hour)	Exposure Time (hrs/event)	Exposure Frequency (events/yr)	Exposure Duration (years)	Body Weight (kg)	Averaging 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
Aluminum	1.7E-01	0.005	2.6	45	4	70	25550	2.2E-07	0.00E+00	0.0E+00	0%	1460	3.9E-06	1.00E+00	3.9E-06	0%
Nickel	1.3E-02	0.005	2.6	45	4	70	25550	1.7E-08	0.00E+00	0.0E+00	0%	1460	2.9E-07	2.00E-02	1.6E-05	1%
Thallium	4.7E-03	0.005	2.6	45	4	70	25550	6.1E-09	0.00E+00	0.0E+00	0%	1460	1.1E-07	8.00E-05	1.3E-03	99%
TOTAL										0.0E+00					1.4E-03	

SURFACE WATER DERMAL CONTA... OSURE ASSESSMENT
OPERABLE UNIT NO.7 (SITE 28 - ORDE POND)
REMEDIAL INVESTIGATION - CTO-0231
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT MILITARY PERSONNEL

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)	4300
PC = contaminant specific dermal permeability (cm/hr)	Specific
ET = exposure time (hours/day)	2.6
EF = exposure frequency (days/yr)	45
ED = exposure duration (years)	4
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)	4
DY = days per year (days)	365
CSF = cancer slope factor (mg/kg-day)-1	Specific
RfD = reference dose (mg/kg-day)	Specific

Note: Inputs are site and scenario 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
Aluminum	0.17	4300	1.0E-03	2.6	45	4	0.001	70	25550	1.3E-07	0.00E+00	0.0E+00	0%	1460	3.3E-06	2.00E-01	1.7E-05	0%
Nickel	0.0129	4300	1.0E-04	2.6	45	4	0.001	70	25550	1.4E-09	0.00E+00	0.0E+00	0%	1460	3.6E-08	4.00E-03	8.9E-06	0%
Thallium	0.0047	4300	1.0E-03	2.6	45	4	0.001	70	25550	5.3E-09	0.00E+00	0.0E+00	0%	1460	9.3E-08	1.00E-05	5.6E-03	100%
TOTAL												0.0E+00					5.6E-03	

SUBSURFACE SOIL INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 28)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site 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
Aluminum	7.8E+03	90	1	1E-06	480	70	25550	1.9E-04	0.0E+00	0.0E+00	0%	365	1.3E-02	1.0E+00	1.3E-02	6%
Antimony	1.2E+01	90	1	1E-06	480	70	25550	2.8E-07	0.0E+00	0.0E+00	0%	365	2.0E-05	4.0E-04	5.0E-02	24%
Arsenic	7.9E+00	90	1	1E-06	480	70	25550	1.9E-07	1.8E+00	3.3E-07	61%	365	1.3E-05	3.0E-04	4.5E-02	22%
Barium	7.6E+01	90	1	1E-06	480	70	25550	1.9E-06	0.0E+00	0.0E+00	0%	365	1.3E-04	7.0E-02	1.9E-03	1%
Beryllium	1.4E-01	90	1	1E-06	480	70	25550	3.5E-09	4.3E+00	1.5E-08	3%	365	2.4E-07	5.0E-03	4.9E-05	0%
Cadmium (soil)	3.2E+00	90	1	1E-06	480	70	25550	7.7E-08	0.0E+00	0.0E+00	0%	365	5.4E-06	1.0E-03	5.4E-03	3%
Chromium	3.4E+01	90	1	1E-06	480	70	25550	8.2E-07	0.0E+00	0.0E+00	0%	365	5.8E-05	1.0E+00	5.8E-05	0%
Cobalt	2.7E+00	90	1	1E-06	480	70	25550	6.5E-08	0.0E+00	0.0E+00	0%	365	4.5E-06	6.0E-02	7.6E-05	0%
Copper	8.9E+02	90	1	1E-06	480	70	25550	2.1E-05	0.0E+00	0.0E+00	0%	365	1.5E-03	3.7E-02	4.0E-02	20%
Lead	1.7E+03	90	1	1E-06	480	70	25550	4.2E-05	0.0E+00	0.0E+00	0%	365	2.9E-03	0.0E+00	0.0E+00	0%
Manganese (soil)	1.2E+03	90	1	1E-06	480	70	25550	2.9E-05	0.0E+00	0.0E+00	0%	365	2.0E-03	1.4E-01	1.4E-02	7%
Mercury	2.3E-01	90	1	1E-06	480	70	25550	5.5E-09	0.0E+00	0.0E+00	0%	365	3.9E-07	3.0E-04	1.3E-03	1%
Nickel	2.3E+01	90	1	1E-06	480	70	25550	5.6E-07	0.0E+00	0.0E+00	0%	365	3.9E-05	2.0E-02	2.0E-03	1%
Silver	2.5E+00	90	1	1E-06	480	70	25550	6.0E-08	0.0E+00	0.0E+00	0%	365	4.2E-06	5.0E-03	8.5E-04	0%
Vanadium	2.4E+01	90	1	1E-06	480	70	25550	5.9E-07	0.0E+00	0.0E+00	0%	365	4.1E-05	7.0E-03	5.9E-03	3%
Zinc	4.3E+03	90	1	1E-06	480	70	25550	1.0E-04	0.0E+00	0.0E+00	0%	365	7.3E-03	3.0E-01	2.4E-02	12%
2-Methylnaphthalene	8.9E-02	90	1	1E-06	480	70	25550	2.1E-09	0.0E+00	0.0E+00	0%	365	1.5E-07	4.0E-02	3.8E-06	0%
4,4'-DDD	8.8E-01	90	1	1E-06	480	70	25550	2.1E-08	2.4E-01	5.1E-09	1%	365	1.5E-06	0.0E+00	0.0E+00	0%
4,4'-DDE	1.6E+00	90	1	1E-06	480	70	25550	3.9E-08	3.4E-01	1.3E-08	2%	365	2.7E-06	0.0E+00	0.0E+00	0%
4,4'-DDT	1.2E-01	90	1	1E-06	480	70	25550	2.8E-09	3.4E-01	9.6E-10	0%	365	2.0E-07	5.0E-04	4.0E-04	0%
Benzo(a)anthracene	5.8E-01	90	1	1E-06	480	70	25550	1.4E-08	7.3E-01	1.0E-08	2%	365	9.8E-07	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	5.6E-01	90	1	1E-06	480	70	25550	1.4E-08	7.3E+00	9.9E-08	18%	365	9.5E-07	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	6.2E-01	90	1	1E-06	480	70	25550	1.5E-08	7.3E-01	1.1E-08	2%	365	1.0E-06	0.0E+00	0.0E+00	0%
Benzo(g,h,i)perylene	4.4E-01	90	1	1E-06	480	70	25550	1.1E-08	0.0E+00	0.0E+00	0%	365	7.5E-07	3.0E-02	2.5E-05	0%
Benzo(k)fluoranthene	5.4E-01	90	1	1E-06	480	70	25550	1.3E-08	7.3E-02	9.4E-10	0%	365	9.1E-07	0.0E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	4.8E-01	90	1	1E-06	480	70	25550	1.2E-08	1.4E-02	1.6E-10	0%	365	8.1E-07	2.0E-02	4.0E-05	0%
Chrysene	5.7E-01	90	1	1E-06	480	70	25550	1.4E-08	7.3E-03	1.0E-10	0%	365	9.7E-07	0.0E+00	0.0E+00	0%
Dibenz(a,h)anthracene	2.8E-01	90	1	1E-06	480	70	25550	6.8E-09	7.3E+00	5.0E-08	9%	365	4.8E-07	0.0E+00	0.0E+00	0%
Fluorene	2.8E-01	90	1	1E-06	480	70	25550	6.8E-09	0.0E+00	0.0E+00	0%	365	4.7E-07	4.0E-02	1.2E-05	0%
Indeno(1,2,3-cd)pyrene	4.3E-01	90	1	1E-06	480	70	25550	1.1E-08	7.3E-01	7.7E-09	1%	365	7.4E-07	0.0E+00	0.0E+00	0%
Naphthalene	3.4E-01	90	1	1E-06	480	70	25550	8.3E-09	0.0E+00	0.0E+00	0%	365	5.8E-07	4.0E-02	1.4E-05	0%
Phenanthrene	6.4E-01	90	1	1E-06	480	70	25550	1.5E-08	0.0E+00	0.0E+00	0%	365	1.1E-06	3.0E-02	3.6E-05	0%
alpha-Chlordane	1.2E-02	90	1	1E-06	480	70	25550	2.8E-10	1.3E+00	3.6E-10	0%	365	2.0E-08	6.0E-05	3.3E-04	0%
gamma-Chlordane	6.7E-03	90	1	1E-06	480	70	25550	1.6E-10	1.3E+00	2.1E-10	0%	365	1.1E-08	6.0E-05	1.9E-04	0%
TOTAL										5.5E-07					2.1E-01	

SUBSURFACE SOIL DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 28)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site 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	Reference Dose (mg/kg-day)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
Aluminum	7.8E+03	1E-06	4300	1	0.001	90	1	70	25550	1.7E-08	0.0E+00	0.0E+00	0%	365	1.2E-04	2.0E-01	5.9E-04	6%
Antimony	1.2E+01	1E-06	4300	1	0.001	90	1	70	25550	2.5E-09	0.0E+00	0.0E+00	0%	365	1.8E-07	8.0E-05	2.2E-03	24%
Arsenic	7.9E+00	1E-06	4300	1	0.001	90	1	70	25550	1.7E-09	8.8E+00	1.5E-08	29%	365	1.2E-07	8.0E-05	2.0E-03	21%
Barium	7.8E+01	1E-06	4300	1	0.001	90	1	70	25550	1.7E-08	0.0E+00	0.0E+00	0%	365	1.2E-06	1.4E-02	8.5E-05	1%
Beryllium	1.4E-01	1E-06	4300	1	0.001	90	1	70	25550	3.1E-11	2.1E+01	6.7E-10	1%	365	2.2E-09	1.0E-03	2.2E-06	0%
Cadmium (soil)	3.2E+00	1E-06	4300	1	0.001	90	1	70	25550	6.9E-10	0.0E+00	0.0E+00	0%	365	4.9E-08	2.0E-04	2.4E-04	3%
Chromium	3.4E+01	1E-06	4300	1	0.001	90	1	70	25550	7.4E-09	0.0E+00	0.0E+00	0%	365	5.2E-07	2.0E-01	2.6E-06	0%
Cobalt	2.7E+00	1E-06	4300	1	0.001	90	1	70	25550	5.8E-10	0.0E+00	0.0E+00	0%	365	4.1E-08	1.2E-02	3.4E-06	0%
Copper	8.9E+02	1E-06	4300	1	0.001	90	1	70	25550	1.9E-07	0.0E+00	0.0E+00	0%	365	1.3E-05	7.4E-03	1.8E-03	19%
Lead	1.7E+03	1E-06	4300	1	0.001	90	1	70	25550	3.7E-07	0.0E+00	0.0E+00	0%	365	2.6E-05	0.0E+00	0.0E+00	0%
Manganese (soil)	1.2E+03	1E-06	4300	1	0.001	90	1	70	25550	2.6E-07	0.0E+00	0.0E+00	0%	365	1.8E-05	2.8E-02	6.4E-04	7%
Mercury	2.3E-01	1E-06	4300	1	0.001	90	1	70	25550	4.9E-11	0.0E+00	0.0E+00	0%	365	3.5E-09	8.0E-05	5.8E-05	1%
Nickel	2.3E+01	1E-06	4300	1	0.001	90	1	70	25550	5.0E-09	0.0E+00	0.0E+00	0%	365	3.5E-07	4.0E-03	8.8E-05	1%
Silver	2.5E+00	1E-06	4300	1	0.001	90	1	70	25550	5.4E-10	0.0E+00	0.0E+00	0%	365	3.8E-08	1.0E-03	3.8E-05	0%
Vanadium	2.4E+01	1E-06	4300	1	0.001	90	1	70	25550	5.3E-09	0.0E+00	0.0E+00	0%	365	3.7E-07	1.4E-03	2.6E-04	3%
Zinc	4.3E+03	1E-06	4300	1	0.001	90	1	70	25550	9.4E-07	0.0E+00	0.0E+00	0%	365	6.6E-05	6.0E-02	1.1E-03	12%
2-Methylnaphthalene	8.9E-02	1E-06	4300	1	0.01	90	1	70	25550	1.9E-10	0.0E+00	0.0E+00	0%	365	1.3E-08	2.0E-02	6.7E-07	0%
4,4'-DDD	8.8E-01	1E-06	4300	1	0.01	90	1	70	25550	1.9E-09	4.8E-01	9.1E-10	2%	365	1.3E-07	0.0E+00	0.0E+00	0%
4,4'-DDE	1.6E+00	1E-06	4300	1	0.01	90	1	70	25550	3.5E-09	6.8E-01	2.4E-09	5%	365	2.4E-07	0.0E+00	0.0E+00	0%
4,4'-DDT	1.2E-01	1E-06	4300	1	0.01	90	1	70	25550	2.5E-10	6.8E-01	1.7E-10	0%	365	1.8E-08	2.5E-04	7.1E-05	1%
Benzo(a)anthracene	5.9E-01	1E-06	4300	1	0.01	90	1	70	25550	1.3E-09	1.5E+00	1.8E-09	4%	365	8.8E-08	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	5.6E-01	1E-06	4300	1	0.01	90	1	70	25550	1.2E-09	1.5E+01	1.8E-08	35%	365	8.5E-08	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	6.2E-01	1E-06	4300	1	0.01	90	1	70	25550	1.3E-09	1.5E+00	1.9E-09	4%	365	9.3E-08	0.0E+00	0.0E+00	0%
Benzo(g,h,i)perylene	4.4E-01	1E-06	4300	1	0.01	90	1	70	25550	9.6E-10	0.0E+00	0.0E+00	0%	365	6.7E-08	1.5E-02	4.5E-06	0%
Benzo(k)fluoranthene	5.4E-01	1E-06	4300	1	0.01	90	1	70	25550	1.2E-09	1.5E-01	1.7E-10	0%	365	8.1E-08	0.0E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	4.8E-01	1E-06	4300	1	0.01	90	1	70	25550	1.0E-09	2.8E-02	2.9E-11	0%	365	7.2E-08	1.0E-02	7.2E-06	0%
Chrysene	5.7E-01	1E-06	4300	1	0.01	90	1	70	25550	1.2E-09	1.5E-02	1.8E-11	0%	365	8.7E-08	0.0E+00	0.0E+00	0%
Dibenz(a,h)anthracene	2.8E-01	1E-06	4300	1	0.01	90	1	70	25550	6.1E-10	1.5E+01	8.9E-09	17%	365	4.3E-08	0.0E+00	0.0E+00	0%
Fluorene	2.8E-01	1E-06	4300	1	0.01	90	1	70	25550	6.1E-10	0.0E+00	0.0E+00	0%	365	4.2E-08	2.0E-02	2.1E-06	0%
Indeno(1,2,3-cd)pyrene	4.3E-01	1E-06	4300	1	0.01	90	1	70	25550	9.4E-10	1.5E+00	1.4E-09	3%	365	6.6E-08	0.0E+00	0.0E+00	0%
Naphthalene	3.4E-01	1E-06	4300	1	0.01	90	1	70	25550	7.4E-10	0.0E+00	0.0E+00	0%	365	5.2E-08	2.0E-02	2.6E-06	0%
Phenanthrene	6.4E-01	1E-06	4300	1	0.01	90	1	70	25550	1.4E-09	0.0E+00	0.0E+00	0%	365	9.7E-08	1.5E-02	6.5E-06	0%
alpha-Chlordane	1.2E-02	1E-06	4300	1	0.01	90	1	70	25550	2.5E-11	2.6E+00	6.5E-11	0%	365	1.7E-09	3.0E-05	5.8E-05	1%
gamma-Chlordane	6.7E-03	1E-06	4300	1	0.01	90	1	70	25550	1.4E-11	2.6E+00	3.8E-11	0%	365	1.0E-09	3.0E-05	3.4E-05	0%
TOTAL												5.1E-08					9.3E-03	

SUBSURFACE SOIL PARTICULATE INHALATION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 28)
REMEDIAL INVESTIGATION CTO-0231
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)	4.63E+09

Note: Inputs are scenario and site specific

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
Aluminum	7.8E+03	4.6E+09	90	20	1	70	25550	1.7E-09	0.0E+00	0.0E+00	0%	365	1.2E-07	0.0E+00	0.0E+00	0%
Antimony	1.2E+01	4.6E+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	7.9E+00	4.6E+09	90	20	1	70	25550	1.7E-12	1.5E+01	2.6E-11	94%	365	1.2E-10	0.0E+00	0.0E+00	0%
Barium	7.8E+01	4.6E+09	90	20	1	70	25550	1.7E-11	0.0E+00	0.0E+00	0%	365	1.2E-09	1.4E-04	8.3E-06	100%
Beryllium	1.4E-01	4.6E+09	90	20	1	70	25550	3.1E-14	8.4E+00	2.6E-13	1%	365	2.2E-12	0.0E+00	0.0E+00	0%
Cadmium (soil)	3.2E+00	4.6E+09	90	20	1	70	25550	7.0E-13	0.0E+00	0.0E+00	0%	365	4.9E-11	0.0E+00	0.0E+00	0%
Chromium	3.4E+01	4.6E+09	90	20	1	70	25550	7.4E-12	0.0E+00	0.0E+00	0%	365	5.2E-10	0.0E+00	0.0E+00	0%
Cobalt	2.7E+00	4.6E+09	90	20	1	70	25550	5.8E-13	0.0E+00	0.0E+00	0%	365	4.1E-11	0.0E+00	0.0E+00	0%
Copper	8.9E+02	4.6E+09	90	20	1	70	25550	1.9E-10	0.0E+00	0.0E+00	0%	365	1.3E-08	0.0E+00	0.0E+00	0%
Lead	1.7E+03	4.6E+09	90	20	1	70	25550	3.7E-10	0.0E+00	0.0E+00	0%	365	2.6E-08	0.0E+00	0.0E+00	0%
Manganese (soil)	1.2E+03	4.6E+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%
Mercury	2.3E-01	4.6E+09	90	20	1	70	25550	5.0E-14	0.0E+00	0.0E+00	0%	365	3.5E-12	8.6E-05	4.0E-08	0%
Nickel	2.3E+01	4.6E+09	90	20	1	70	25550	5.0E-12	0.0E+00	0.0E+00	0%	365	3.5E-10	0.0E+00	0.0E+00	0%
Silver	2.5E+00	4.6E+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%
Vanadium	2.4E+01	4.6E+09	90	20	1	70	25550	5.3E-12	0.0E+00	0.0E+00	0%	365	3.7E-10	0.0E+00	0.0E+00	0%
Zinc	4.3E+03	4.6E+09	90	20	1	70	25550	9.4E-10	0.0E+00	0.0E+00	0%	365	6.6E-08	0.0E+00	0.0E+00	0%
2-Methylnaphthalene	8.9E-02	4.6E+09	90	20	1	70	25550	1.9E-14	0.0E+00	0.0E+00	0%	365	1.4E-12	0.0E+00	0.0E+00	0%
4,4'-DDD	8.8E-01	4.6E+09	90	20	1	70	25550	1.9E-13	0.0E+00	0.0E+00	0%	365	1.3E-11	0.0E+00	0.0E+00	0%
4,4'-DDE	1.6E+00	4.6E+09	90	20	1	70	25550	3.5E-13	0.0E+00	0.0E+00	0%	365	2.4E-11	0.0E+00	0.0E+00	0%
4,4'-DDT	1.2E-01	4.6E+09	90	20	1	70	25550	2.5E-14	3.4E-01	8.6E-15	0%	365	1.6E-12	0.0E+00	0.0E+00	0%
Benzo(a)anthracene	5.8E-01	4.6E+09	90	20	1	70	25550	1.3E-13	6.1E-01	7.7E-14	0%	365	8.8E-12	0.0E+00	0.0E+00	0%
Benzo(a)pyrene	5.6E-01	4.6E+09	90	20	1	70	25550	1.2E-13	6.1E+00	7.5E-13	3%	365	8.6E-12	0.0E+00	0.0E+00	0%
Benzo(b)fluoranthene	6.2E-01	4.6E+09	90	20	1	70	25550	1.3E-13	6.1E-01	8.2E-14	0%	365	9.4E-12	0.0E+00	0.0E+00	0%
Benzo(g,h,i)perylene	4.4E-01	4.6E+09	90	20	1	70	25550	9.7E-14	0.0E+00	0.0E+00	0%	365	6.8E-12	0.0E+00	0.0E+00	0%
Benzo(k)fluoranthene	5.4E-01	4.6E+09	90	20	1	70	25550	1.2E-13	6.1E-02	7.1E-15	0%	365	8.1E-12	0.0E+00	0.0E+00	0%
Bis(2-ethylhexyl)phthalate	4.8E-01	4.6E+09	90	20	1	70	25550	1.0E-13	0.0E+00	0.0E+00	0%	365	7.3E-12	0.0E+00	0.0E+00	0%
Chrysene	5.7E-01	4.6E+09	90	20	1	70	25550	1.2E-13	6.1E-03	7.6E-16	0%	365	8.7E-12	0.0E+00	0.0E+00	0%
Dibenz(a,h)anthracene	2.8E-01	4.6E+09	90	20	1	70	25550	6.1E-14	6.1E+00	3.7E-13	1%	365	4.3E-12	0.0E+00	0.0E+00	0%
Fluorene	2.8E-01	4.6E+09	90	20	1	70	25550	6.1E-14	0.0E+00	0.0E+00	0%	365	4.3E-12	0.0E+00	0.0E+00	0%
Indeno(1,2,3-cd)pyrene	4.3E-01	4.6E+09	90	20	1	70	25550	9.5E-14	6.1E-01	5.8E-14	0%	365	6.6E-12	0.0E+00	0.0E+00	0%
Naphthalene	3.4E-01	4.6E+09	90	20	1	70	25550	7.5E-14	0.0E+00	0.0E+00	0%	365	5.2E-12	0.0E+00	0.0E+00	0%
Phenanthrene	6.4E-01	4.6E+09	90	20	1	70	25550	1.4E-13	0.0E+00	0.0E+00	0%	365	9.7E-12	0.0E+00	0.0E+00	0%
alpha-Chlordane	1.2E-02	4.6E+09	90	20	1	70	25550	2.5E-15	1.3E+00	3.2E-15	0%	365	1.8E-13	0.0E+00	0.0E+00	0%
gamma-Chlordane	6.7E-03	4.6E+09	90	20	1	70	25550	1.5E-15	1.3E+00	1.9E-15	0%	365	1.0E-13	0.0E+00	0.0E+00	0%
TOTAL										2.8E-11					8.4E-05	

SITE 30

SUBSURFACE SOIL INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 30)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site specific

COPC	Concentration Carcinogen (mg/kg)	Exposure Frequency (days/yr) Child	Exposure Duration (yr) Child	Conversion Factor (kg/mg)	Ingestion Rate (mg/day) Child	Body Weight (kg) Child	Averaging Carc Time (days)	Carc Dose (mg/kg/day) Child	Slope Factor (mg/kg/day)-1	Carcinogenic Risk Child	Percent Carcinogenic Risk Child	Averaging Noncarc Time (days)	Noncarc Dose (mg/kg/day) Child	Reference Dose (mg/kg/day)	Noncarcinogenic Risk Child	Percent Noncarcinogenic Risk Child
Aluminum	9567.1	350	6	1E-06	200	15	25550	1.0E-02	0.0E+00	0.0E+00	0%	2190	1.2E-01	1.0E+00	1.2E-01	66%
Arsenic	0.9	350	6	1E-06	200	15	25550	9.7E-07	1.8E+00	1.7E-06	100%	2190	1.1E-05	3.0E-04	3.8E-02	21%
Chromium	10.1	350	6	1E-06	200	15	25550	1.1E-06	0.0E+00	0.0E+00	0%	2190	1.3E-04	1.0E+00	1.3E-04	0%
Cobalt	0.5	350	6	1E-06	200	15	25550	5.9E-07	0.0E+00	0.0E+00	0%	2190	6.9E-06	6.0E-02	1.1E-04	0%
Copper	3.5	350	6	1E-06	200	15	25550	3.9E-06	0.0E+00	0.0E+00	0%	2190	4.5E-05	3.7E-02	1.2E-03	1%
Manganese (soil)	6.8	350	6	1E-06	200	15	25550	7.4E-06	0.0E+00	0.0E+00	0%	2190	8.7E-05	1.4E-01	6.2E-04	0%
Mercury	0.1	350	6	1E-06	200	15	25550	1.4E-07	0.0E+00	0.0E+00	0%	2190	1.7E-06	3.0E-04	5.5E-03	3%
Nickel	2.2	350	6	1E-06	200	15	25550	2.4E-06	0.0E+00	0.0E+00	0%	2190	2.8E-05	2.0E-02	1.4E-03	1%
Vanadium	8.1	350	6	1E-06	200	15	25550	8.9E-06	0.0E+00	0.0E+00	0%	2190	1.0E-04	7.0E-03	1.5E-02	8%
TOTAL										1.7E-06					1.8E-01	

SUBSURFACE SOIL DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 30)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site specific

COPC	Concentration Carcinogen (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	Averaging Noncarc Time (days)	Noncarc Dose (mg/kg/day) Child	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarcinogenic Risk Child	Percent Noncarcinogenic Risk Child
Aluminum	9.6E+03	1E-06	2300	1	0.001	350	6	15	25550	1.2E-04	0.0E+00	0.0E+00	0%	2190	1.4E-03	2.0E-01	7.0E-03	66%
Arsenic	8.9E-01	1E-06	2300	1	0.001	350	6	15	25550	1.1E-08	8.8E+00	9.8E-08	100%	2190	1.3E-07	6.0E-05	2.2E-03	21%
Chromium	1.0E+01	1E-06	2300	1	0.001	350	6	15	25550	1.3E-07	0.0E+00	0.0E+00	0%	2190	1.5E-06	2.0E-01	7.4E-06	0%
Cobalt	5.4E-01	1E-06	2300	1	0.001	350	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	3.5E+00	1E-06	2300	1	0.001	350	6	15	25550	4.4E-08	0.0E+00	0.0E+00	0%	2190	5.2E-07	7.4E-03	7.0E-05	1%
Manganese (soil)	6.6E+00	1E-06	2300	1	0.001	350	6	15	25550	8.6E-08	0.0E+00	0.0E+00	0%	2190	1.0E-06	2.8E-02	3.6E-05	0%
Mercury	1.3E-01	1E-06	2300	1	0.001	350	6	15	25550	1.6E-09	0.0E+00	0.0E+00	0%	2190	1.9E-08	6.0E-05	3.2E-04	3%
Nickel	2.2E+00	1E-06	2300	1	0.001	350	6	15	25550	2.7E-08	0.0E+00	0.0E+00	0%	2190	3.2E-07	4.0E-03	8.0E-05	1%
Vanadium	8.1E+00	1E-06	2300	1	0.001	350	6	15	25550	1.0E-07	0.0E+00	0.0E+00	0%	2190	1.2E-06	1.4E-03	8.5E-04	8%
TOTAL												9.8E-08					1.1E-02	

SUBSURFACE SOIL PARTICULATE INHALATION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 30)
REMEDIAL INVESTIGATION CTO-0231
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)	10
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)	4.63E+09

Note: Inputs are scenario and site specific

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
Aluminum	9.6E+03	4.6E+09	350	10	6	15	25550	1.1E-07	0.0E+00	0.0E+00	0%	2190	1.3E-06	0.0E+00	0.0E+00	0%
Arsenic	8.9E-01	4.6E+09	350	10	6	15	25550	1.0E-11	1.5E+01	1.6E-10	100%	2190	1.2E-10	0.0E+00	0.0E+00	0%
Chromium	1.0E+01	4.6E+09	350	10	6	15	25550	1.2E-10	0.0E+00	0.0E+00	0%	2190	1.4E-09	0.0E+00	0.0E+00	0%
Cobalt	5.4E-01	4.6E+09	350	10	6	15	25550	6.3E-12	0.0E+00	0.0E+00	0%	2190	7.4E-11	0.0E+00	0.0E+00	0%
Copper	3.5E+00	4.6E+09	350	10	6	15	25550	4.2E-11	0.0E+00	0.0E+00	0%	2190	4.9E-10	0.0E+00	0.0E+00	0%
Manganese (soil)	6.8E+00	4.6E+09	350	10	6	15	25550	8.0E-11	0.0E+00	0.0E+00	0%	2190	9.4E-10	0.0E+00	0.0E+00	0%
Mercury	1.3E-01	4.6E+09	350	10	6	15	25550	1.5E-12	0.0E+00	0.0E+00	0%	2190	1.8E-11	8.6E-05	2.1E-07	100%
Nickel	2.2E+00	4.6E+09	350	10	6	15	25550	2.6E-11	0.0E+00	0.0E+00	0%	2190	3.0E-10	0.0E+00	0.0E+00	0%
Vanadium	8.1E+00	4.6E+09	350	10	6	15	25550	9.6E-11	0.0E+00	0.0E+00	0%	2190	1.1E-09	0.0E+00	0.0E+00	0%
TOTAL										1.6E-10					2.1E-07	

SURFACE WATER INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO.7 (SITE 30 - FRENCHS CREEK)
REMEDIAL INVESTIGATION CTO-0231
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	

Note: Inputs are scenario and site specific

FRENCHS CREEK

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
Aluminum	1.48	0.005	2.6	45	6	15	25550	1.4E-05	0.0E+00	0.0E+00	0%	2190	1.8E-04	1.0E+00	1.8E-04	35%
Lead	0.0023	0.005	2.6	45	6	15	25550	2.1E-08	0.0E+00	0.0E+00	0%	2190	2.6E-07	0.0E+00	0.0E+00	0%
Manganese (water)	0.0111	0.005	2.6	45	6	15	25550	1.0E-07	0.0E+00	0.0E+00	0%	2190	1.2E-06	5.0E-03	2.4E-04	53%
Mercury	0.00015	0.005	2.6	45	6	15	25550	1.4E-09	0.0E+00	0.0E+00	0%	2190	1.6E-08	3.0E-04	5.3E-05	12%
TOTAL										0.0E+00					4.5E-04	

SURFACE WATER DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO.7 (SITE 30 - FRENCHS CREEK)
REMEDIAL INVESTIGATION - CTO-0231
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 permeability (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

Note: Inputs are site and scenario specific

FRENCHS CREEK

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
Aluminum	1.5E+00	2300	1.0E-03	2.6	45	6	0.001	15	25550	6.2E-08	0.0E+00	0.0E+00	0%	2190	7.3E-05	2.0E-01	3.6E-04	35%
Lead	2.3E-03	2300	4.0E-06	2.6	45	6	0.001	15	25550	3.9E-11	0.0E+00	0.0E+00	0%	2190	4.6E-10	0.0E+00	0.0E+00	0%
Manganese (water)	1.1E-02	2300	1.0E-03	2.6	45	6	0.001	15	25550	4.7E-08	0.0E+00	0.0E+00	0%	2190	5.6E-07	1.0E-03	5.6E-04	53%
Mercury	1.6E-04	2300	1.0E-03	2.6	45	6	0.001	15	25550	6.3E-10	0.0E+00	0.0E+00	0%	2190	7.4E-09	6.0E-05	1.2E-04	12%
TOTAL												0.0E+00					1.0E-03	

SEDIMENT INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 30 - FRENCHS CREEK)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site specific

FRENCHS CREEK

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 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
Aluminum	3.4E+03	45	6	200	1E-06	15	25550	4.8E-04	0.0E+00	0.0E+00	0%	2190	5.6E-03	1.0E+00	5.6E-03	88%
Chromium	7.9E+00	45	6	200	1E-06	15	25550	1.1E-06	0.0E+00	0.0E+00	0%	2190	1.3E-05	1.0E+00	1.3E-05	0%
Copper	9.6E+00	45	6	200	1E-06	15	25550	1.3E-06	0.0E+00	0.0E+00	0%	2190	1.6E-05	3.7E-02	4.3E-04	5%
Lead	1.6E+01	45	6	200	1E-06	15	25550	2.2E-06	0.0E+00	0.0E+00	0%	2190	2.6E-05	0.0E+00	0.0E+00	0%
Manganese (soil)	1.6E+01	45	6	200	1E-06	15	25550	2.7E-06	0.0E+00	0.0E+00	0%	2190	3.1E-05	1.4E-01	2.2E-04	3%
Nickel	5.8E+00	45	6	200	1E-06	15	25550	8.2E-07	0.0E+00	0.0E+00	0%	2190	9.6E-06	2.0E-02	4.8E-04	6%
Vanadium	6.0E+00	45	6	200	1E-06	15	25550	8.5E-07	0.0E+00	0.0E+00	0%	2190	9.9E-06	7.0E-03	1.4E-03	17%
Zinc	1.1E+01	45	6	200	1E-06	15	25550	1.6E-06	0.0E+00	0.0E+00	0%	2190	1.9E-05	3.0E-01	6.2E-05	1%
TOTAL										0.0E+00					8.2E-03	

SEDIMENT DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO.7 (SITE 30 - FRENCHS CREEK)
REMEDIAL INVESTIGATION CTO-0231
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 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

Note: Inputs are scenario and site specific

FRENCHS CREEK

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 Time (days)	Noncarc Dose (mg/kg/day) Child	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarcinogenic Risk Child	Percent Noncarcinogenic Risk Child
Aluminum	3.4E+03	1E-06	2300	1	0.001	45	6	15	25550	3.3E-08	0.0E+00	0.0E+00	0%	2190	6.4E-06	2.0E-01	3.2E-04	66%
Chromium	7.9E+00	1E-06	2300	1	0.001	45	6	15	25550	1.5E-08	0.0E+00	0.0E+00	0%	2190	1.6E-07	2.0E-01	7.6E-07	0%
Copper	9.6E+00	1E-06	2300	1	0.001	45	6	15	25550	1.6E-08	0.0E+00	0.0E+00	0%	2190	1.8E-07	7.4E-03	2.4E-05	5%
Lead	1.6E+01	1E-06	2300	1	0.001	45	6	15	25550	2.6E-08	0.0E+00	0.0E+00	0%	2190	2.9E-07	0.0E+00	0.0E+00	0%
Manganese (soil)	1.9E+01	1E-06	2300	1	0.001	45	6	15	25550	3.1E-08	0.0E+00	0.0E+00	0%	2190	3.6E-07	2.8E-02	1.3E-05	3%
Nickel	5.8E+00	1E-06	2300	1	0.001	45	6	15	25550	9.4E-09	0.0E+00	0.0E+00	0%	2190	1.1E-07	4.0E-03	2.7E-05	6%
Vanadium	6.0E+00	1E-06	2300	1	0.001	45	6	15	25550	9.7E-09	0.0E+00	0.0E+00	0%	2190	1.1E-07	1.4E-03	8.1E-05	17%
Zinc	1.1E+01	1E-06	2300	1	0.001	45	6	15	25550	1.8E-08	0.0E+00	0.0E+00	0%	2190	2.1E-07	6.0E-02	3.6E-06	1%
TOTAL												0.0E+00					4.7E-04	

SUBSURFACE SOIL INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 30)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site 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	Averaging Carc Time (years)	Carc Dose (mg/kg/day) Adult	Slope Factor (mg/kg/day)-1	Carcinogenic Risk Adult	Percent Carcinogenic Risk Adult	Averaging Noncarc Time (days)	Noncarc Dose (mg/kg/day) Adult	Reference Dose (mg/kg/day)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
Aluminum	9567.1	350	30	1E-06	100	70	25550	5.6E-03	0.0E+00	0.0E+00	0%	10950	1.3E-02	1.0E+00	1.3E-02	65%
Arsenic	0.9	350	30	1E-06	100	70	25550	5.2E-07	1.8E+00	9.1E-07	100%	10950	1.2E-06	3.0E-04	4.0E-03	21%
Chromium	10.1	350	30	1E-06	100	70	25550	5.9E-06	0.0E+00	0.0E+00	0%	10950	1.4E-05	1.0E+00	1.4E-05	0%
Cobalt	0.5	350	30	1E-06	100	70	25550	3.1E-07	0.0E+00	0.0E+00	0%	10950	7.3E-07	6.0E-02	1.2E-05	0%
Copper	3.5	350	30	1E-06	100	70	25550	2.1E-06	0.0E+00	0.0E+00	0%	10950	4.8E-06	3.7E-02	1.3E-04	1%
Manganese (soil)	6.6	350	30	1E-06	100	70	25550	4.0E-06	0.0E+00	0.0E+00	0%	10950	9.3E-06	1.4E-01	6.7E-05	0%
Mercury	0.1	350	30	1E-06	100	70	25550	7.6E-08	0.0E+00	0.0E+00	0%	10950	1.8E-07	3.0E-04	5.9E-04	3%
Nickel	2.2	350	30	1E-06	100	70	25550	1.3E-06	0.0E+00	0.0E+00	0%	10950	3.0E-06	2.0E-02	1.5E-04	1%
Vanadium	8.1	350	30	1E-06	100	70	25550	4.8E-06	0.0E+00	0.0E+00	0%	10950	1.1E-05	7.0E-03	1.6E-03	8%
TOTAL										9.1E-07					2.0E-02	

SUBSURFACE SOIL DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 30)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site 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	Averaging Carc Time (days)	Carc Dose (mg/kg/day) Adult	Dermal Adjust. Slope Factor (mg/kg-day)-1	Carcinogenic Risk Adult	Percent Carcinogenic Risk Adult	Averaging Noncarc Time (days)	Noncarc Dose (mg/kg/day) Adult	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
Aluminum	9557.1	1E-06	5800	1	0.001	350	30	70	25550	3.3E-04	0.0E+00	0.0E+00	0%	10950	7.6E-04	2.0E-01	3.8E-03	65%
Arsenic	0.9	1E-06	5800	1	0.001	350	30	70	25550	3.0E-08	8.8E+00	2.6E-07	100%	10950	7.0E-08	6.0E-05	1.2E-03	21%
Chromium	10.1	1E-06	5800	1	0.001	350	30	70	25550	3.4E-07	0.0E+00	0.0E+00	0%	10950	8.0E-07	2.0E-01	4.0E-06	0%
Cobalt	0.5	1E-06	5800	1	0.001	350	30	70	25550	1.8E-08	0.0E+00	0.0E+00	0%	10950	4.3E-08	1.2E-02	3.5E-06	0%
Copper	3.5	1E-06	5800	1	0.001	350	30	70	25550	1.2E-07	0.0E+00	0.0E+00	0%	10950	2.8E-07	7.4E-03	3.8E-05	1%
Manganese (soil)	6.8	1E-06	5800	1	0.001	350	30	70	25550	2.3E-07	0.0E+00	0.0E+00	0%	10950	5.4E-07	2.8E-02	1.9E-05	0%
Mercury	0.1	1E-06	5800	1	0.001	350	30	70	25550	4.4E-09	0.0E+00	0.0E+00	0%	10950	1.0E-08	6.0E-05	1.7E-04	3%
Nickel	2.2	1E-06	5800	1	0.001	350	30	70	25550	7.4E-08	0.0E+00	0.0E+00	0%	10950	1.7E-07	4.0E-03	4.3E-05	1%
Vanadium	8.1	1E-06	5800	1	0.001	350	30	70	25550	2.8E-07	0.0E+00	0.0E+00	0%	10950	6.5E-07	1.4E-03	4.6E-04	8%
TOTAL												2.6E-07					5.7E-03	

SUBSURFACE SOIL PARTICULATE INHALATION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 30)
REMEDIAL INVESTIGATION CTO-0231
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)	Specific
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)	4.63E+09

Note: Inputs are scenario and site specific

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
Aluminum	9.6E+03	4.6E+09	350	20	30	70	25550	2.4E-07	0.0E+00	0.0E+00	0%	10950	5.7E-07	0.0E+00	0.0E+00	0%
Arsenic	8.9E-01	4.6E+09	350	20	30	70	25550	2.2E-11	1.5E+01	3.4E-10	100%	10950	5.2E-11	0.0E+00	0.0E+00	0%
Chromium	1.0E+01	4.6E+09	350	20	30	70	25550	2.6E-10	0.0E+00	0.0E+00	0%	10950	6.0E-10	0.0E+00	0.0E+00	0%
Cobalt	5.4E-01	4.6E+09	350	20	30	70	25550	1.4E-11	0.0E+00	0.0E+00	0%	10950	3.2E-11	0.0E+00	0.0E+00	0%
Copper	3.5E+00	4.6E+09	350	20	30	70	25550	8.9E-11	0.0E+00	0.0E+00	0%	10950	2.1E-10	0.0E+00	0.0E+00	0%
Manganese (soil)	6.8E+00	4.6E+09	350	20	30	70	25550	1.7E-10	0.0E+00	0.0E+00	0%	10950	4.0E-10	0.0E+00	0.0E+00	0%
Mercury	1.3E-01	4.6E+09	350	20	30	70	25550	3.3E-12	0.0E+00	0.0E+00	0%	10950	7.6E-12	8.6E-05	8.9E-08	100%
Nickel	2.2E+00	4.6E+09	350	20	30	70	25550	5.5E-11	0.0E+00	0.0E+00	0%	10950	1.3E-10	0.0E+00	0.0E+00	0%
Vanadium	8.1E+00	4.6E+09	350	20	30	70	25550	2.1E-10	0.0E+00	0.0E+00	0%	10950	4.8E-10	0.0E+00	0.0E+00	0%
TOTAL										3.4E-10					8.9E-08	

SURFACE WATER INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO.7 (SITE 30 - FRENCHS CREEK)
REMEDIAL INVESTIGATION CTO-0231
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

CHANGE!!

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	

Note: Inputs are scenario and site specific

FRENCHS CREEK

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
Aluminum	1.0E+00	0.005	2.6	45	30	70	25550	1.5E-05	0.0E+00	0.0E+00	0%	30	1.2E-02	1.0E+00	1.2E-02	35%
Lead	2.3E-03	0.005	2.6	45	30	70	25550	2.3E-08	0.0E+00	0.0E+00	0%	30	1.9E-05	0.0E+00	0.0E+00	0%
Manganese (water)	1.1E-02	0.005	2.6	45	30	70	25550	1.1E-07	0.0E+00	0.0E+00	0%	30	9.3E-05	6.0E-03	1.9E-02	53%
Mercury	1.5E-04	0.005	2.6	45	30	70	25550	1.6E-09	0.0E+00	0.0E+00	0%	30	1.3E-06	3.0E-04	4.2E-03	12%
TOTAL										0.0E+00					3.5E-02	

SURFACE WATER DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO.7 (SITE 30 - FRENCHS CREEK)
REMEDIAL INVESTIGATION - CTO-0231
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

CHANGE!

Where:	INPUTS
CW = contaminant concentration in water (mg/l)	
SA = skin surface available for contact (cm2)	5800
PC = contaminant specific dermal permeability (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

Note: Inputs are site and scenario specific

FRENCHS CREEK

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
Aluminum	1.3E+00	5800	1.0E-03	2.6	45	30	0.001	70	25550	1.7E-05	0.0E+00	0.0E+00	0%	10950	3.9E-05	2.0E-01	2.0E-04	35%
Lead	2.3E-03	5800	4.0E-06	2.6	45	30	0.001	70	25550	1.0E-10	0.0E+00	0.0E+00	0%	10950	2.4E-10	0.0E+00	0.0E+00	0%
Manganese (water)	1.1E-02	5800	1.0E-03	2.6	45	30	0.001	70	25550	1.3E-07	0.0E+00	0.0E+00	0%	10950	2.9E-07	1.0E-03	2.9E-04	53%
Mercury	1.5E-04	5800	1.0E-03	2.6	45	30	0.001	70	25550	1.7E-09	0.0E+00	0.0E+00	0%	10950	4.0E-09	6.0E-05	6.6E-05	12%
TOTAL												0.0E+00					5.6E-04	

EDIMENT INGESTION EXPOSURE ASSESSMENT
PERABLE UNIT NO. 7 (SITE 30 - FRENCHS CREEK)
EMEDIAL INVESTIGATION CTO-0231
ACB CAMP LEJEUNE, NORTH CAROLINA
URRENT AND FUTURE RESIDENTIAL ADULT

ntake from ingestion of sediment is calculated as follows:

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

CHANGE

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

Note: Inputs are scenario and site specific

FRENCHS CREEK

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
Aluminum	3.4E+03	45	30	100	1E-06	70	25550	2.6E-04	0.0E+00	0.0E+00	0%	10950	8.0E-04	1.0E+00	8.0E-04	88%
Chromium	7.6E+00	45	30	100	1E-06	70	25550	6.0E-07	0.0E+00	0.0E+00	0%	10950	1.4E-06	1.0E+00	1.4E-06	0%
Copper	9.6E+00	45	30	100	1E-06	70	25550	7.2E-07	0.0E+00	0.0E+00	0%	10950	1.7E-06	3.7E-02	4.6E-05	5%
Lead	1.6E+01	45	30	100	1E-06	70	25550	1.2E-06	0.0E+00	0.0E+00	0%	10950	2.7E-06	0.0E+00	0.0E+00	0%
Manganese (soil)	1.9E+01	45	30	100	1E-06	70	25550	1.4E-06	0.0E+00	0.0E+00	0%	10950	3.3E-06	1.4E-01	2.4E-05	3%
Nickel	6.9E+00	45	30	100	1E-06	70	25550	4.4E-07	0.0E+00	0.0E+00	0%	10950	1.0E-06	2.0E-02	5.1E-05	6%
Vanadium	6.0E+00	45	30	100	1E-06	70	25550	4.6E-07	0.0E+00	0.0E+00	0%	10950	1.1E-06	7.0E-03	1.6E-04	17%
Zinc	1.1E+01	45	30	100	1E-06	70	25550	8.6E-07	0.0E+00	0.0E+00	0%	10950	2.0E-06	3.0E-01	6.6E-06	1%
TOTAL										0.0E+00					9.6E-04	

SEDIMENT DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO.7 (SITE 30 - FRENCH'S CREEK)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site specific

FRENCH'S CREEK

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
Aluminum	3.4E+03	1E-06	5800	1	0.001	45	30	70	25550	1.5E-06	0.0E+00	0.0E+00	0%	10950	3.5E-05	2.0E-01	1.7E-04	98%
Chromium	7.9E+00	1E-06	5800	1	0.001	45	30	70	25550	3.5E-08	0.0E+00	0.0E+00	0%	10950	8.1E-08	2.0E-01	4.0E-07	0%
Copper	9.0E+00	1E-06	5800	1	0.001	45	30	70	25550	4.0E-08	0.0E+00	0.0E+00	0%	10950	9.7E-08	7.4E-03	1.3E-05	6%
Lead	1.6E+01	1E-06	5800	1	0.001	45	30	70	25550	6.9E-08	0.0E+00	0.0E+00	0%	10950	1.6E-07	0.0E+00	0.0E+00	0%
Manganese (soil)	1.9E+01	1E-06	5800	1	0.001	45	30	70	25550	8.3E-08	0.0E+00	0.0E+00	0%	10950	1.9E-07	2.8E-02	6.9E-06	3%
Nickel	5.8E+00	1E-06	5800	1	0.001	45	30	70	25550	2.5E-08	0.0E+00	0.0E+00	0%	10950	5.9E-08	4.0E-03	1.5E-05	6%
Vanadium	8.0E+00	1E-06	5800	1	0.001	45	30	70	25550	2.6E-08	0.0E+00	0.0E+00	0%	10950	6.1E-08	1.4E-03	4.4E-05	17%
Zinc	1.1E+01	1E-06	5800	1	0.001	45	30	70	25550	4.9E-08	0.0E+00	0.0E+00	0%	10950	1.2E-07	6.0E-02	1.9E-06	1%
TOTAL												0.0E+00					2.2E-04	

SURFACE WATER INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO.7 (SITE 30)
REMEDIAL INVESTIGATION CTO-0231
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT MILITARY PERSONNEL

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 = exposure time (hours/event)		2.6
EF = exposure frequency (events/yr)		45
ED = exposure duration (yrs)		4
BW = body weight (kg)		70
ATc = averaging time for carcinogen (yr)		70
ATnc = averaging time for noncarcinogen (yr)		4
DY = days per year (days)		365
CSF = cancer slope factor (mg/kg-day)-1	specific	
RfD = reference dose (mg/kg-day)	specific	

Note: Inputs are scenario and site specific

COPC	Concentration Carcinogen (mg/l)	Contact Rate (l/hour)	Exposure Time (hrs/event)	Exposure Frequency (events/yr)	Exposure Duration (years)	Body Weight (kg)	Averaging Time Carc. (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
Aluminum	1.48	0.005	2.6	45	4	70	25550	1.9E-08	0.0E+00	0.0E+00	0%	1460	3.4E-06	1.0E+00	3.4E-06	35%
Lead	0.0023	0.005	2.6	45	4	70	25550	3.0E-09	0.0E+00	0.0E+00	0%	1460	5.3E-08	0.0E+00	0.0E+00	0%
Manganese (water)	0.0111	0.005	2.6	45	4	70	25550	1.6E-08	0.0E+00	0.0E+00	0%	1460	2.8E-07	6.0E-03	5.1E-05	53%
Mercury	0.00015	0.005	2.6	45	4	70	25550	2.0E-10	0.0E+00	0.0E+00	0%	1460	3.4E-09	3.0E-04	1.1E-05	12%
TOTAL										0.0E+00					9.6E-05	

SURFACE WATER DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO.7 (SITE 30)
REMEDIAL INVESTIGATION - CTO-0231
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT MILITARY PERSONNEL

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)	4
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)	4
DY = days per year (days)	365
CSF = cancer slope factor (mg/kg-day)-1	Specific
RfD = reference dose (mg/kg-day)	Specific

Note: Inputs are site and scenario 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
Aluminum	1.49	5800	1.6E-03	2.6	45	4	0.001	70	25550	3.48E-06	0.0E+00	0.0E+00	0%	1460	8.06E-06	0.0E+00	1.2E-05	35%
Lead	0.0023	5800	1.6E-03	2.6	45	4	0.001	70	25550	5.41E-09	0.0E+00	0.0E+00	0%	1460	9.47E-08	0.0E+00	0.0E+00	0%
Manganese (water)	0.0111	5800	1.6E-03	2.6	45	4	0.001	70	25550	2.61E-08	0.0E+00	0.0E+00	0%	1460	4.57E-07	2.6E-02	1.6E-05	53%
Mercury	0.00015	5800	1.6E-03	2.6	45	4	0.001	70	25550	3.53E-10	0.0E+00	0.0E+00	0%	1460	6.18E-09	1.6E-03	4.1E-08	12%
TOTAL												0.0E+00					3.5E-05	

SEDIMENT INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 30)
REMEDIAL INVESTIGATION CTO-0231
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT MILITARY PERSONNEL

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)	350
ED = exposure duration (yr)	4
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)	4
DY = days per year (days/year)	365
CSF = cancer slope factor (mg/kg-day)-1	Specific
RfD = reference dose (mg/kg-day)	Specific

Note: Inputs are scenario and site specific

COPC	Concentration (mg/kg)	Exposure Frequency (days/yr)	Exposure Duration (yr)	Ingestion Rate (mg/day)	Conversion Factor (kg/mg)	Body Weight (kg)	Averaging Carc. Time (days)	Carc. Dose (mg/kg/day)	Slope Factor (mg/kg/day)-1	Carcinogenic Risk	Percent Carcinogenic Risk	Averaging Noncarc. Time (days)	Noncarc Dose (mg/kg/day)	Reference Dose (mg/kg/day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
Aluminum	3.4E+03	350	4	100	1E-06	70	25550	2.7E-04	0.0E+00	0.0E+00	0%	1460	4.6E-03	1.0E+00	4.6E-03	88%
Chromium	7.9E+00	350	4	100	1E-06	70	25550	6.2E-07	0.0E+00	0.0E+00	0%	1460	1.1E-05	1.0E+00	1.1E-05	0%
Copper	9.5E+00	350	4	100	1E-06	70	25550	7.4E-07	0.0E+00	0.0E+00	0%	1460	1.3E-05	3.7E-02	3.6E-04	6%
Lead	1.6E+01	350	4	100	1E-06	70	25550	1.2E-06	0.0E+00	0.0E+00	0%	1460	2.1E-05	0.0E+00	0.0E+00	0%
Manganese (soil)	1.9E+01	350	4	100	1E-06	70	25550	1.5E-06	0.0E+00	0.0E+00	0%	1460	2.6E-05	1.4E-01	1.9E-04	3%
Nickel	5.8E+00	350	4	100	1E-06	70	25550	4.5E-07	0.0E+00	0.0E+00	0%	1460	7.9E-06	2.0E-02	4.0E-04	6%
Vanadium	6.0E+00	350	4	100	1E-06	70	25550	4.7E-07	0.0E+00	0.0E+00	0%	1460	8.2E-06	7.0E-03	1.2E-03	17%
Zinc	1.1E+01	350	4	100	1E-06	70	25550	8.8E-07	0.0E+00	0.0E+00	0%	1460	1.5E-05	3.0E-01	5.2E-05	1%
TOTAL										0.0E+00					6.8E-03	

SEDIMENT DERMAL CONTACT [illegible]RE ASSESSMENT
OPERABLE UNIT NO.7 (SITE 30)
REMEDIAL INVESTIGATION CTO-0231
MCB CAMP LEJEUNE, NORTH CAROLINA
CURRENT MILITARY PERSONNEL

The intake from dermal contact to sediment is calcuted 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 adherance factor (mg/cm2)	1
Abs = fraction absorbed (unitless) (contaminant specific)	Specific
EF = exposure frequency (events/yr)	350
ED = expsosure duration (years)	4
BW = 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

Note: Inputs are scenario and site specific

COPC	Concentration (mg/kg)	Conversion Factor (kg/mg)	Surface Area (cm2)	Adherence Factor (mg/cm2)	Fraction Absorbed (%)	Exposure Frequency (events/yr)	Exposure Duration (yrs)	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	Averaging Noncarc. Time (days)	Noncarc Dose (mg/kg/day)	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarcinogenic Risk	Percent Noncarcinogenic Risk
Aluminum	3.4E+03	1E-06	5800	1	0.001	350	4	70	25550	1.5E-06	0.0E+00	0.0E+00	0%	1460	2.7E-06	2.0E-01	1.3E-05	88%
Chromium	7.9E+00	1E-06	5800	1	0.001	350	4	70	25550	3.6E-08	0.0E+00	0.0E+00	0%	1460	6.3E-07	2.0E-01	3.1E-06	0%
Copper	8.5E+00	1E-06	5800	1	0.001	350	4	70	25550	4.3E-08	0.0E+00	0.0E+00	0%	1460	7.6E-07	7.4E-03	1.0E-04	5%
Lead	1.6E+01	1E-06	5800	1	0.001	350	4	70	25550	7.0E-08	0.0E+00	0.0E+00	0%	1460	1.2E-06	0.0E+00	0.0E+00	0%
Manganese (soil)	1.9E+01	1E-06	5800	1	0.001	350	4	70	25550	8.6E-08	0.0E+00	0.0E+00	0%	1460	1.5E-06	2.8E-02	5.4E-05	3%
Nickel	5.6E+00	1E-06	5800	1	0.001	350	4	70	25550	2.6E-08	0.0E+00	0.0E+00	0%	1460	4.6E-07	4.0E-03	1.2E-04	6%
Vanadium	6.0E+00	1E-06	5800	1	0.001	350	4	70	25550	2.7E-08	0.0E+00	0.0E+00	0%	1460	4.8E-07	1.4E-03	3.4E-04	17%
Zinc	1.1E+01	1E-06	5800	1	0.001	350	4	70	25550	5.1E-08	0.0E+00	0.0E+00	0%	1460	9.0E-07	6.0E-02	1.5E-05	1%
TOTAL												0.0E+00					2.0E-03	

SUBSURFACE SOIL INGESTION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 30)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site 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	Averaging Carc Time (days)	Carc Dose (mg/kg/day) Adult	Slope Factor (mg/kg/day)-1	Carcinogenic Risk Adult	Percent Carcinogenic Risk Adult	Averaging Noncarc. Time (days)	Noncarc Dose (mg/kg/day) Adult	Reference Dose (mg/kg/day)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
Aluminum	9557.1	90	1	1E-06	480	70	25550	2.3E-04	0.0E+00	0.0E+00	0%	365	1.6E-02	1.0E+00	1.6E-02	66%
Arsenic	0.9	90	1	1E-06	480	70	25550	2.1E-08	1.8E+00	3.7E-08	100%	365	1.5E-06	3.0E-04	5.0E-03	21%
Chromium	10.1	90	1	1E-06	480	70	25550	2.4E-07	0.0E+00	0.0E+00	0%	365	1.7E-05	1.0E+00	1.7E-05	0%
Cobalt	0.5	90	1	1E-06	480	70	25550	1.3E-08	0.0E+00	0.0E+00	0%	365	9.1E-07	6.0E-02	1.5E-05	0%
Copper	3.5	90	1	1E-06	480	70	25550	8.5E-08	0.0E+00	0.0E+00	0%	365	6.0E-06	3.7E-02	1.6E-04	1%
Manganese (soil)	6.8	90	1	1E-06	480	70	25550	1.6E-07	0.0E+00	0.0E+00	0%	365	1.1E-05	1.4E-01	8.2E-05	0%
Mercury	0.1	90	1	1E-06	480	70	25550	3.1E-09	0.0E+00	0.0E+00	0%	365	2.2E-07	3.0E-04	7.3E-04	3%
Nickel	2.2	90	1	1E-06	480	70	25550	5.3E-08	0.0E+00	0.0E+00	0%	365	3.7E-06	2.0E-02	1.8E-04	1%
Vanadium	8.1	90	1	1E-06	480	70	25550	2.0E-07	0.0E+00	0.0E+00	0%	365	1.4E-05	7.0E-03	2.0E-03	8%
TOTAL										3.7E-08					2.4E-02	

SUBSURFACE SOIL DERMAL CONTACT EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 30)
REMEDIAL INVESTIGATION CTO-0231
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

Note: Inputs are scenario and site 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	Averaging Carc. Time (days)	Carc Dose (mg/kg/day) Adult	Dermal Adjust. Slope Factor (mg/kg-day)-1	Carcinogenic Risk Adult	Percent Carcinogenic Risk Adult	Averaging Noncarc. Time (days)	Noncarc Dose (mg/kg/day) Adult	Dermal Adjust. Reference Dose (mg/kg-day)	Noncarcinogenic Risk Adult	Percent Noncarcinogenic Risk Adult
Aluminum	9.6E+03	1E-06	4300	1	0.001	90	1	70	25550	2.1E-06	0.0E+00	0.0E+00	0%	365	1.4E-04	2.0E-01	7.2E-04	66%
Arsenic	8.9E-01	1E-06	4300	1	0.001	90	1	70	25550	1.9E-10	8.8E+00	1.7E-09	100%	365	1.3E-08	6.0E-05	2.2E-04	21%
Chromium	1.0E+01	1E-06	4300	1	0.001	90	1	70	25550	2.2E-09	0.0E+00	0.0E+00	0%	365	1.5E-07	2.0E-01	7.6E-07	0%
Cobalt	5.4E-01	1E-06	4300	1	0.001	90	1	70	25550	1.2E-10	0.0E+00	0.0E+00	0%	365	8.1E-09	1.2E-02	6.8E-07	0%
Copper	3.5E+00	1E-06	4300	1	0.001	90	1	70	25550	7.6E-10	0.0E+00	0.0E+00	0%	365	5.3E-08	7.4E-03	7.2E-06	1%
Manganese (soil)	6.8E+00	1E-06	4300	1	0.001	90	1	70	25550	1.5E-09	0.0E+00	0.0E+00	0%	365	1.0E-07	2.8E-02	3.7E-06	0%
Mercury	1.3E-01	1E-06	4300	1	0.001	90	1	70	25550	2.8E-11	0.0E+00	0.0E+00	0%	365	2.0E-09	6.0E-05	3.3E-05	3%
Nickel	2.2E+00	1E-06	4300	1	0.001	90	1	70	25550	4.7E-10	0.0E+00	0.0E+00	0%	365	3.3E-08	4.0E-03	8.2E-06	1%
Vanadium	8.1E+00	1E-06	4300	1	0.001	90	1	70	25550	1.8E-09	0.0E+00	0.0E+00	0%	365	1.2E-07	1.4E-03	8.8E-05	8%
TOTAL												1.7E-09					1.1E-03	

SUBSURFACE SOIL PARTICULATE INHALATION EXPOSURE ASSESSMENT
OPERABLE UNIT NO. 7 (SITE 30)
REMEDIAL INVESTIGATION CTO-0231
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)	4.63E+09

Note: Inputs are scenario and site specific

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
Aluminum	9.5E+03	4.6E+09	90	20	1	70	25550	2.1E-09	0.0E+00	0.0E+00	0%	365	1.5E-07	0.0E+00	0.0E+00	0%
Arsenic	8.9E-01	4.6E+09	90	20	1	70	25550	1.9E-13	1.5E+01	2.9E-12	100%	365	1.3E-11	0.0E+00	0.0E+00	0%
Chromium	1.0E+01	4.6E+09	90	20	1	70	25550	2.2E-12	0.0E+00	0.0E+00	0%	365	1.5E-10	0.0E+00	0.0E+00	0%
Cobalt	5.4E-01	4.6E+09	90	20	1	70	25550	1.2E-13	0.0E+00	0.0E+00	0%	365	8.2E-12	0.0E+00	0.0E+00	0%
Copper	3.5E+00	4.6E+09	90	20	1	70	25550	7.7E-13	0.0E+00	0.0E+00	0%	365	5.4E-11	0.0E+00	0.0E+00	0%
Manganese (soil)	6.8E+00	4.6E+09	90	20	1	70	25550	1.5E-12	0.0E+00	0.0E+00	0%	365	1.0E-10	0.0E+00	0.0E+00	0%
Mercury	1.3E-01	4.6E+09	90	20	1	70	25550	2.8E-14	0.0E+00	0.0E+00	0%	365	2.0E-12	8.6E-05	2.3E-08	100%
Nickel	2.2E+00	4.6E+09	90	20	1	70	25550	4.7E-13	0.0E+00	0.0E+00	0%	365	3.3E-11	0.0E+00	0.0E+00	0%
Vanadium	8.1E+00	4.6E+09	90	20	1	70	25550	1.8E-12	0.0E+00	0.0E+00	0%	365	1.2E-10	0.0E+00	0.0E+00	0%
TOTAL										2.9E-12					2.3E-08	

APPENDIX S
SUMMARY OF GROUNDWATER DATA AND AQUIFER CHARACTERISTICS AT MCB CAMP LEJEUNE

TECHNICAL MEMORANDUM

SUMMARY OF GROUNDWATER DATA AND AQUIFER CHARACTERISTICS MARINE CORPS BASE, CAMP LEJEUNE JACKSONVILLE, NORTH CAROLINA

SUMMARY

This study examines the utility of exploratory aquifer tests (pump tests) at investigation sites across Marine Corps Base, Camp Lejeune (MCB-CL). The study reviews the available information on the relevant water-bearing layers, considers the general characteristics and applicability of aquifer tests, and concludes:

- That available information is satisfactorily complete to allow appropriate designs of groundwater systems in the main operating areas of MCB-CL;
- That quantified characterization of the water-bearing layers in explored areas of MCB-CL can be extended to other areas having similar geologic terrain;
- That exploratory tests are not longer routinely required or advisable;
- That reconnaissance testing (well-head tests or slug tests) of each newly installed or otherwise uncharacterized data station is highly advisable; and,
- That performance testing of groundwater extraction systems should be the recommended form of evaluating and adjusting withdrawal systems.

BACKGROUND

This study considers the aquifer characteristics (especially, the Coefficient of Transmissivity) and the production capacities (available discharge rates) of the two water-bearing layers relevant to the studies at MCB-CL. These water-bearing layers are the (shallow or surficial) water table and the Upper Castle Hayne Aquifer.

The water table at MCB-CL occupies the water-bearing zone within 25 to 35 feet of the surface; the Castle Hayne, immediately below this. However, the separation of the water table and the Castle Hayne is not always obvious. Usually, this separation is effected only by the low permeability material of the water table transiting to the significantly more permeable material of the Upper Castle Hayne; there is rarely an aquiclude or aquitard of vertically extensive clay separating the water table from the Castle Hayne.

The data available for this summary derive from three main sources:

- Assessment of Hydrologic and Hydrogeologic Data at Camp Lejeune Marine Crops Base, North Carolina; U. S. Geological Survey, Water-Resources Investigation Report 89-4096; 1989

COMPARABILITY OF DATA ACROSS MCB-CL

The stratigraphic sequences of MCB-CL containing the water table and the Upper Castle Hayne have been well characterized. The available information indicates that the lithology and the hydrologic conditions can be correlated stratigraphically across the base (Tables 1 and 2). From these correlations, aquifer performance can be predicted sufficiently for an engineering design whose final criteria for suitability are performance-based.

The upper water-bearing zone is a highly variable layering and intercalation of clay, silt, and sand. This variability, however, is found within recognizable limits. These limits correspond to the range of hydrologic characteristics described previously. Similar correlation is available for the lithology and hydrology of the Upper Castle Hayne.

In areas not near stations catalogued in Tables 1, 2, and 3, a reconnaissance comparison of well-head tests (slug tests) and an examination of lithologic descriptions will likely be sufficient to support the engineering evaluation of the site. There is ample demonstration that lithology has a significant influence on the hydrology of a site, and that, for a given geologic terrain, the influence is fairly consistent. The geologic terrain of MCB-CL has been broadly characterized and correlated between lithologic (stratigraphic descriptions) and hydrologic (aquifer tests and well-head tests) sequences. Lithologic descriptions can now provide a good indication of hydrologic conditions at MCB-CL in areas of similar terrain.

GENERAL APPLICABILITY OF AQUIFER TESTS

Aquifer (pump) tests are a problemsome activity at contamination sites. While the information available from aquifer tests is required for engineering design of withdrawal systems, aquifer tests should not be a reconnaissance or an initial step in the investigation. Full consideration must be made of the redistribution of contaminants expectable from the test, of the change in structural support of disposal features by relaxation or increase of hydrostatic loading, and so forth.

Consideration must also be made of alternative sources of acceptable data on the aquifer. In the case of MCB-CL, alternatives to exploratory aquifer tests are available from the tabulation and correlation of aquifer characteristics, production performance and geologic terrain presently available.

From the available information and in light of the relative consistency of the geologic terrain of MCB-CL, exploratory tests at MCB-CL are not generally required. Therefore, exploratory tests are not advisable and should not form part of the initial investigation of a site. While they may be useful in certain circumstances after the initial investigation of a site, they should not, in the general case, be part of the investigation. Sufficiently satisfactory information is presently available to allow the initial engineering design of a groundwater response.

While exploratory aquifer tests are not advisable, performance tests of a newly installed system are highly recommended. These tests, to some extent, are a normal part of the initial operation of a system. Only minor additional monitoring and modification of the system during operation would provide data directly relevant to the long-term operation of that system.

In the Coastal Plain of MCB-CL, the information from a n exploratory data station not coincident with the long-term extraction system is not fully transferable. That is, if the test station and the recovery station are not the same, the aquifer parameters and calculations based on those parameters will differ. This means that data from an exploratory station are not more reliably usable that the data presently available, unless the

TABLE 1
CAMP LEJEUNE PUMP TEST DATA

Well Number	Well Depth (ft,BGS)	Well Diameter (in)	Total Aquifer Thickness (ft)	Screened Length (ft)	Screened Interval (ft,BGS)	Water-level Drawdown During Pumping (ft,BGS)	Pumping Rate (Recovery wells) GPM	Duration of Pumping (min)	Specific Capacity (pumping rate/ drawdown)	T (square ft/ day)	K (ft/day)	S	Soils (ft,BGS)
013RW-01*	23	2	15	20	3-23	8.773	1	480	0.11	7.17	0.48	NA	0-10 silt/clay, 10-23 sand.
013MW-18	13	2	15	10	3-13	0.297	NA	480	NA	105.98	7.06	1.40E-02	0-7 silt/clay, 7-13 sand.
013MW-21	14	2	15	10	4-14	0.31	NA	480	NA	82.27	5.48	2.77E-02	0-4 silt/sand, 0-14 clay/silt
108RW-01*	15	2	9	9.1	2.45-11.55	6.38	0.5	485	0.08	5.30	0.59	NA	very fine sand
108MW-04		2	9				NA	485	NA	118.63	13.18	1.33E-02	
108MW-15	12.5	2	9	9.03	2.79-11.82		NA	485	NA	56.78	6.31	7.33E-03	0-8 sand/silt, 8-10 silt/clay
109MW-15		2	15			0.939	NA	460	NA	76.26	5.08	1.11E-02	
109MW-17	14.5	2	15	10	4.5-14.5	0.545	NA	460	NA	163.10	10.87	7.30E-03	0-15 fine sand
109RW-01*	15	2	15	9.5	2-11.5	6.265	3	460	0.48	7.80	0.52	NA	0-4 sand, 4-8 silt, 8-15 sand
110RW-01* (Drawdown,Theis)	21.8	2	50	19.2	2-21.2	9.53	3	475	0.31	200.02	4.00	NA	0-10.5 sand/silt, 10.5-15 sand/clay, 15-21.5 sand/clay, 21.5- sand
110RW-01* (Drawdown,Cooper)										161.86	3.24	NA	
110RW-01* Recovery(Theis)										106.06	2.12	NA	
110DW-01 (Drawdown,Theis)	30.3	2	50	4.8	24.9-29.7	0.02	3	475	NA	7080.48	142.00	4.52E-03	0-4 sand/silt, 4-10.5 clay, 10.5-15.5 sand/silt, 15.5-20.5 clay, 20.5-on sand
110DW-01 (Drawdown,Cooper)									NA	7099.20	142	4.51E-03	
110DW-02 (Drawdown,Theis)	30	2	50	4.7	24.7-29.4	0.52	NA	475	NA	5398.56	108.00	1.51E-03	0-3 sand and silt with clay layers, 3-11 sand and silt, 11-30 sand with some limited clay layers
110DW-02 (Drawdown,Cooper)									NA	5400.00	108	1.51E-03	
110DW-03 (Drawdown,Theis)	30	2	50	4.9	24.5-29.4	0.47	NA	475	NA	2952.00	59.00	7.48E-02	0-6 sand and silt , 6-12 sand, 12-23 sand/clay, 23-30 sand
110DW-03 (Drawdown,Cooper)									NA	3225.60	64	5.85E-02	

T = Transmissivity
K = Hydraulic Conductivity
S = Storativity
* = Pumping well
NA - Not applicable

TABLE 3

BARONE:8SEP94:CL5-1A1:1/5

MCB-CL5 CTO-232 CL5-1B1.wks 8SEP94 MCB-CAMP LEJEUNE

STATION	b ft	Q gpm	Sc gpm/ft	T ft-sq/d	T gpd/ft	K ft/d
013RW-01	15	1.0	0.11	7.2	54	0.5
013MW-1	15			106.0	793	7.1
013MW-2	15			82.3	615	5.5
013MW-03	1					0.8
013MW-04	8					0.3
013MW-11	9					0.4
013MW-21	8					0.5
41GW-07						1.2
41GW-08						0.1
41GW-09						3.7
41GW-10						0.9
41GW-12						4.6
69GW-09						1.7
69GW-10						0.2
69GW-12						0.1
69GW-02DW						0.3
69GW-12DW						6.7
74GW-03A						0.6
74GW-06						6.3
74GW-08						3.6
108RW-01	9	0.5	0.08	5.3	40	0.6
108MW-0	9			118.6	887	13.2
108MW-1	9			56.8	425	6.3
108MW-08	9					0.6
108MW-09	8					0.5
108MW-13	8					0.1
108MW-17	8					0.6
109MW-1	15			76.3	570	5.1
109MW-1	15			163.1	1220	10.9
109RW-01	15	3.0	0.48	7.8	58	0.5
109MW-17	15					9.0
109MW-18	15					5.7
110RW-01	50	3.0	0.31	200.0	1496	4.0
110RW-01	50	3.0	0.31	161.9	1211	3.2
110RW-01	50	3.0		106.1	793	2.1
110DW-01	50			7080	52962	142.0
110DW-01	50			7099	53102	142.0
110DW-02	50			5399	40381	108.0
110DW-02	50			5400	40392	108.0
110DW-03	50			2952	22081	59.0
110DW-03	50			3226	24127	64.0
110MW-07	9					0.1
110MW-09	9					0.2
110DW-03	22					5.8

STATION	PUMPING LEVEL	Q gpm	Sc gpm/ft
HP-602	44	154	3.5
HP-603	30	129	4.3
HP-606	38	267	7.0
HP-607	46	246	5.3
HP-608	21	208	9.9
HP-609	45	199	4.4
HP-610	14	214	15.3
HP-613	17	157	9.2
HP-616	15	178	11.9
HP-620	9	224	24.9
HP-622	55	330	6.0
HP-623	30	210	7.0
HP-628	45	172	3.8
HP-629	45	216	4.8
HP-632	21	224	10.7
HP-633	18	205	11.4
HP-634	36	219	6.1
HP-635	33	151	4.6
HP-636	35	149	4.3
HP-637	40	130	3.3
HP-638	84	201	2.4
HP-639	52	[--]	0.0
HP-640	28	210	7.5
HP-641	44	351	8.0
HP-642	32	[--]	0.0
HP-643	35	269	7.7
HP-644	52	230	4.4
HP-645	40	192	4.8
HP-646	11	154	14.0
HP-647	26	302	11.6
HP-648	84	263	3.1
HP-649	80	100	1.3
HP-650	75	480	6.4
HP-651	69	242	3.5
HP-652	82	216	2.6
HP-653	29	197	6.8
HP-654	30	175	5.8
HP-655		[--]	ERR
HP-660		150	ERR
HP-661	37	275	7.4
HP-662	53	148	2.8
HP-663	23	100	4.3
HP-698	33	216	6.5
HP-699	21	140	6.7

STATION	PUMPING LEVEL	Q gpm	Sc gpm/ft
AS-108	8	226	28.3
AS-131	11	310	28.2
AS-190	60	220	3.7
AS-191	16	220	13.8
AS-203	19	220	11.6
AS-4140	6	110	18.3
AS-4150	10	128	12.8
AS-5001	27	185	6.9
AS-5009	53	111	2.1
BA-164	21	214	10.2
BA-190	17	303	17.8

APPENDIX T
SAMPLING STATION CHARACTERIZATION DATA SHEET

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 1-SD01 Date: 3-23-94 Time: 1605

Samplers: AMB, WJI, MGM Date: — Time: —

Water Body: Drainage Ditch 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: See Habitat Map

Aquatic Vegetation: NA

Estimated Stream Width: 2-3 ft Est. Stream Depth: NA ft Riffle: NA ft Run: NA ft Pool: NA ft

Stream Type: ~~Cold Water~~ ~~Warm Water~~ Velocity: NA 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 ~~None~~

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

Sediment Description: Hard packed, medium grain sand

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
NA					

Water Odors: Normal Sewage Petroleum ~~Chemical~~ Other: _____

Water Surface Oils: Slick ~~Sheen~~ None Secchi: _____ ft.

Turbidity: ~~Clear~~ Slightly Turbid Turbid Opaque Water Color: _____

Weather Conditions: Sunny ~ 70-75°F Tide: NA ~~In~~ ~~Out~~

Comments: The station was located in a drainage ditch w/ no running water. Only a few standing areas. A few days after the sample was collected a petroleum product was discharging into the ditch. Water samples were collected from this discharge

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 1-SD02 Date: 3-22-94 Time: 1600

Samplers: AMB, MGM, WJT Date: — Time: —

Water Body: Drainage Ditch 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: See Habitat Map

Aquatic Vegetation: NA

Estimated Stream Width: 2-3 ft Est. Stream Depth: NA ft. Riffle: NA ft Run: NA ft Pool: NA ft

Stream Type: Cold ~~Water~~ ~~Warm~~ Water Velocity: NA 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: Fine, silty sand, light brown

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
NA					

Water Odors: Normal Sewage Petroleum Chemical Other: NA

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

Turbidity: Clear Slightly Turbid Turbid Opaque Water Color:

Weather Conditions: Sunny ~ 70-75°F Tide: ~~In~~ ~~Out~~

Comments: There were a few puddles of water in the ditch but it was mostly dry.

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 28-NR-SW15D01 Date: March 28, 94 (SD) Time: 1642 (SD)

Samplers: AMB, WJJ, MGM Date: March 28, 94 (SW) Time: 1315 (SW)

Water Body: New River 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: See Habitat Map

Aquatic Vegetation: None

Estimated Stream Width: NM ft Est. Stream Depth: NM 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 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: Coarse Sand / Clay

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	22.5	6.83	11	18000	15

Water Odors: (Normal) Sewage Petroleum Chemical Other:

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

Turbidity: Clear Slightly Turbid (Turbid) Opaque Water Color: Clear

Weather Conditions: Tide: In Out

Comments: NM - Not measured due to large size of river

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 28-NR-SW/SD02 Date: 3-28-94 (SW) Time: 1355 (SW)

Samplers: AMB, WJJ, MGM Date: 3-28-94 (SD) Time: 1045 (SD)

Water Body: New River 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: See Habitat maps

Aquatic Vegetation: None

Estimated Stream Width: *NM ft Est. Stream Depth: NM ft Riffle: — ft Run: 1006 ft Pool: — ft

Stream Type: Cold Water (Warm Water) Velocity: Negligible 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: 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.	22.5	6.94	10.5	18,000	15.5
~~Bottom~~					

Water Odors: (Normal) Sewage Petroleum Chemical Other:

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

Turbidity: Clear Slightly Turbid (Turbid) (Opaque) Water Color:

Weather Conditions: Tide: ? (In) Out

Comments: *NM - Not measured due to large size of river

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 28-NR-SW/SD03 Date: March 25, 94 (SD) Time: 1719 (SD)

Samplers: AMB, WJJ, MKM Date: March 28, 94 (SW) Time: 1710 (SW)

Water Body: New River State: NC County: Onslow

Sample Type: Fish Benthic Macroinvertebrate (Sediment) (Surface Water)

SAMPLING EQUIPMENT: Seine Gill Net Ponar Kemmerer (Sediment Corer) Spoon Other: Drip Method

Riparian Zone/Instream Features

Predominant Surrounding Land Use: (Forest) Urban Industrial Other:

Shore Vegetation: See Habitat Map

Aquatic Vegetation: None

Estimated Stream Width: *NM ft Est. Stream Depth: *NM 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 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.	20.0	7.95	11.0	12,000	15

Water Odors: (Normal) Sewage Petroleum Chemical Other:

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

Turbidity: Clear Slightly Turbid (Turbid) Opaque Water Color: Clear

Weather Conditions: Tide: In Out

Comments: *NM- Not measured due to large size of River

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 28-NR-SW/SD04 Date: March 25, 94 (SD) Time: 1659 (SD)

Samplers: AMB, WJJ, MEM Date: March 29, 94 (SW) Time: 1310 (SW)

Water Body: New River 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: See Habitat Map

Aquatic Vegetation: None

Estimated Stream Width: NM* ft Est. Stream Depth: NM* ft Riffle: — ft Run: 1016 ft Pool: — ft

Stream Type: Cold Water (Warm Water) Velocity: Neg/1.6/0 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: Course Sand w/ high organic content

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	19.0	9.23	7.4	400	0.25

Water Odors: (Normal) Sewage Petroleum Chemical Other:

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

Turbidity: Clear Slightly Turbid (Turbid) Opaque Water Color: Clear

Weather Conditions: Tide: ? In Out

Comments: NM- Not measured due to large size of River
located at mouth of Cadgels creek

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 28-NR-SW/SD05 Date: March 25, 94 (SD) Time: 1606 (SD)

Samplers: AMB, WJJ, MFM Date: March 29, 94 (SW) Time: 1340 (SW)

Water Body: New River 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: See Habitat map

Aquatic Vegetation: None

Estimated Stream Width: NA ft Est. Stream Depth: NA* 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 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: Very clayey

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	19	9.76	10	3800	3.5

Water Odors: (Normal) Sewage Petroleum Chemical Other:

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

Turbidity: Clear Slightly Turbid (Turbid) Opaque Water Color:

Weather Conditions: Tide: ? ~~In~~ ~~Out~~

Comments: *NA- Not ~~Applicable~~ Measured due to large size of river

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 28-CC-SW/SD01 Date: March 26, 94 (SD) Time: 0915 (SD)

Samplers: AMB, WTJ, MGM Date: March 29, 94 (SW) Time: 1250 (SW)

Water Body: Codgels 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: See Habitat Map

Aquatic Vegetation: NONE

Estimated Stream Width: ~30' 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 ☑

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: Organic muck

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	20	8.73	6.0	600	0.25

Water Odors: (Normal) Sewage Petroleum Chemical Other:

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

Turbidity: Clear Slightly Turbid (Turbid) Opaque Water Color:

Weather Conditions: Tide: ? ~~In~~ ~~Out~~

Comments: Sample was collected near the staff guage ~8' from bank due to access problems

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 28-CC-SW/SD02 Date: March 27, 94 (SW) Time: 1017 (SW)

Samplers: AMB, WJJ, MGM Date: March 27, 94 (SD) Time: 1036 (SD)

Water Body: Codgels 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: See Habitat map

Aquatic Vegetation: NONE

Estimated Stream Width: 25-30' ft Est. Stream Depth: NM ft Riffle: — ft Run: 1006 ft Pool: — ft

Stream Type: Cold Water (Warm Water) Velocity: Negligible 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: NA Replicate #2: NA Replicate #3: NA

Sediment Description: Silty muck w/ sand

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface.	22	6.43	7.74	1400	1.
Bottom	22	6.97	7.74	7500	9

Water Odors: (Normal) Sewage Petroleum Chemical Other:

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

Turbidity: Clear Slightly Turbid (Turbid) Opaque Water Color: clear

Weather Conditions: Tide: In (Out)

Comments: NM- Unable to measure due to access -

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 28-CC-SW/SD03 Date: March 27, 94 (SW) Time: 1110 (SW)

Samplers: AMB, WJJ, MGM Date: March 28, 94 (SD) Time: 1655 (SD)

Water Body: Codgels 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: See Habitat map

Aquatic Vegetation: None

Estimated Stream Width: 20 ft Est. Stream Depth: ~3-4 ft Riffle: — ft Run: 100b 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: Silty Sand

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	17	6.82	8.3	350	6.82
Bottom	16	6.79	8.3	9500	6.79

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: Just downstream of road by the staff guage from right bank facing down

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 28-CC-SW/SD04 Date: March 27, 94 (SW) Time: 1153 (SW)

Samplers: AMB, MCM, WJJ Date: March 28, 94 (SD) Time: 1600 (SD)

Water Body: Codgels 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: See Habitat map

Aquatic Vegetation: None

Estimated Stream Width: ~40 ft Est. Stream Depth: ~4.5 ft Riffle: — ft Run: 1006 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: Black organic material / sand

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface.	20.2	7.01	9.9	8,800	6.9

Water Odors: (Normal) Sewage Petroleum Chemical Other:

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

Turbidity: Clear Slightly Turbid (Turbid) Opaque Water Color: tans

Weather Conditions: Tide: In (Out)

Comments: On right side of bank (looking down) between two tribs.

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 28-CC-SW/SD05 Date: March 27, 94 (SW) Time: 1246 (SW)

Samplers: AMB, WJJ, MGM Date: March 27, 94 (SD) Time: 1259 (SD)

Water Body: Codgels 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: See Habitat map

Aquatic Vegetation: None

Estimated Stream Width: 30 ft Est. Stream Depth: 2-3 ft Riffle: — ft Run: 1006 ft Pool: — ft

Stream Type: Cold Water Warm Water Velocity: Negligible 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: NA Replicate #2: NA Replicate #3: NA

Sediment Description: Silty soil w/ peat material

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface.	17.5	6.67	5.6	0	272

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' up from mouth on trib (right bank)

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 28-CC-SW/SD 06 Date: March 27, 94 (SW) Time: 1735 (SW)

Samplers: RMB, WJJ, MGM Date: March 27, 94 (SD) Time: 1755 (SD)

Water Body: Codgels 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: See Habitat map

Aquatic Vegetation: None

Estimated Stream Width: 20 ft Est. Stream Depth: 1-2 ft Riffle: — ft Run: 100 ft Pool: — ft

Stream Type: Cold Water (Warm Water) Velocity: Negligible 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: NA Replicate #2: NA Replicate #3: NA

Sediment Description: Silty muck

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface.	19.5	6.9	4.75	500	0.25

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: ~75' up stream of staff guage

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 28-CC-SW/SD07 Date: March 27, 94 (SW) Time: 1327 (SW)

Samplers: AMB, WJJ, MGM Date: March 27, 94 (SD) Time: 1358 (SD)

Water Body: Codgels 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: See Habitat Map

Aquatic Vegetation: None

Estimated Stream Width: 20 ft Est. Stream Depth: *NM 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: Silty Muck

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
17.5 Surface	17.5	6.73	4.4	335	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: *NM - Not able to measure.

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 28-DP-SW/SD 01 Date: March 28, 94 (SD) Time: 1015

Samplers: AMB, WTJ, MGM Date: March 28, 94 (SD) Time: 1215 (SD)

Water Body: Orde Pond 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: See Habitat map

Aquatic Vegetation: None

Estimated Stream Width: ____ ft Est. Stream Depth: ~8' ft Riffle: — ft Run: — ft Pool: 100' ft

Stream Type: Cold Water (Warm Water) Velocity: NA 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: NA Replicate #2: NA Replicate #3: NA

Sediment Description: clayey silt

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	19.4	6.94	9.0	70	0
Bottom	19.4	7.03	9.0	70	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: Clear

Weather Conditions: Tide: NA In Out

Comments: At left side of pond (w/ back to 1st plant)

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 28-OP-SW/SD02 Date: March 28, 94 (SW) Time: 0955 (SW)

Samplers: AMB, WJJ, MGM Date: March 28, 94 (SD) Time: 1600 (SD)

Water Body: Orde Pond 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: See Habitat Map

Aquatic Vegetation: NONE

Estimated Stream Width: ___ ft Est. Stream Depth: 8' ft Riffle: — ft Run: — ft Pool: 1ac ft

Stream Type: Cold Water (Warm Water) Velocity: NA 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:

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	20	6.79	9.0	72	0
Bottom	19.5	6.83	9.0	88	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: Clear (Slight Green)

Weather Conditions: Tide: NA In Out

Comments: At right side of pond (w/ back to Int Plant)

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 28-FS/BN01 Date: March 23, 94 Time: 0920

Samplers: AMB, WJJ, MGM Date: March 27, 94 (BN) Time: 1415 (BN)

Water Body: Codgols 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 Traps

Riparian Zone/Instream Features

Predominant Surrounding Land Use: (Forest) Urban Industrial Other:

Shore Vegetation: See Habitat Map

Aquatic Vegetation: None

Estimated Stream Width: 30 ft Est. Stream Depth: 1 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) ~75% 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: 5 Replicate #2: 3 Replicate #3: 3

Sediment Description: Fine silt, dark brown, many sticks, debris

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface.	13.3	6.8	4.8	440	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: Sunny Tide: In (Out)

Comments: By ~~28~~ ~~SW~~ 28-CC-SW/SD05

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 28-FS/BN02 Date: March 23, 94 Time: 1010

Samplers: AMB, WJJ, MGM Date: March 27, 94 (BN) Time: 1449 (BN)

Water Body: Codgels 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: Open Meadow

Shore Vegetation: See Habitat Map

Aquatic Vegetation: None

Estimated Stream Width: 40 ft Est. Stream Depth: 1-2 ft. Riffle: — ft Run: 100ft ft Pool: — ft

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

Canopy Cover: Open (Partly Open) — 50% — (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: 3 Replicate #2: 5 Replicate #3: 6

Sediment Description: Fine silt-sand, 25-35% organic debris (sticks, leaves, needles)

Water:

	Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
	Surface	14.5	6.8	6.5	351	0
BN	Surface	17.5	6.92	7.5	320	0
	Bottom	17.5	6.77	6.0	3,100	1.5

Water Odors: (Normal) Sewage Petroleum Chemical Other:

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

Turbidity: Clear (Slightly Turbid) Turbid Opaque Water Color: Tannic

Weather Conditions: Clear Sunny Tide: In (Out)

Comments: By 28-CC-SW/SD04

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 28-FS/BN03 Date: 3-24-94 Time: 1015

Samplers: AMB, WJJ, MGM Date: 3-26-94 Time: 1212

Water Body: Codyels 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: Mixed Hardwoods - Seed Habitat Map

Aquatic Vegetation: None

Estimated Stream Width: 30-40 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 ✓

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: Silty ~~Clay w/ large sand inclusions~~ w/ organic material - shell fragments, no worms observed

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	22.5	3.5	6.8	1150	0
Bottom	22.5	3.5	6.8	1150	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: Just down from staff guage

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 28-FS/BN-04 Date: 3-23-94 Time: 1300

Samplers: AMB, WJJ, MGM Date: 3-26-94 Time: 1315 (BN)

Water Body: New River 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: See Habitat Map

Aquatic Vegetation: None

* Estimated Stream Width: NA ft Est. Stream Depth: NA ft. Riffle: NA ft Run: NA ft Pool: NA 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: 1 Replicate #2: 1 Replicate #3: 1

Sediment Description: 90% Fine sand & 10% shell fragments

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	20.2	7.01	9.9	8,800	6.9

Water Odors: (Normal) Sewage Petroleum Chemical Other:

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

Turbidity: Clear Slightly Turbid (Turbid) Opaque Water Color: Brown

Weather Conditions: Sunny, Warm (60°F) Tide: In ? Out

Comments: * The sample was collected ~ 3-5' from shore in the New River. The depth was ~ 2ft here. Fish collected over several days via gill nets. Debris on beach, rocks, bricks.

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 28-FS/BN05 Date: 3-24-94 Time: 1015

Samplers: AMB, WJJ, MGM Date: 3-26-94 (BN) Time: 1245

Water Body: New River 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: See Habitat Map

Aquatic Vegetation: None

* Estimated Stream Width: NA ft Est. Stream Depth: NA ft. Riffle: NA ft Run: NA ft Pool: NA 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: 1 Replicate #2: 1 Replicate #3: 1

Sediment Description: Silty Clay w/ some sand inclusions, shell fragments

Water:

	Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
	Surface	25	NA	NA	14,000	13
BN	Surface	21	7.69	10.5	11,800	10.2

Water Odors: (Normal) Sewage Petroleum Chemical Other: ____

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

Turbidity: Clear Slightly Turbid (Turbid) Opaque Water Color: Brown

Weather Conditions: ____ Tide: In Out

Comments: * The sample was collected ~ 3-5' from shore in the New River. The depth was ~1 ft here: Fish were collected over several days via gill nets. Some Fulka trees in area

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 28-OP-BS/BN Date: March 28, 94 (BN) Time: 1330 (BN)

Samplers: AMB, MGM, WJJ Date: _____ Time: _____

Water Body: Onslow Pond State: North Carolina County: Onslow

Sample Type: (Fish) (Benthic Macroinvertebrate) Sediment Surface Water

SAMPLING EQUIPMENT: Seine Gill Net (Ponar) Kemmerer Sediment Corer Spoon Other: Electrofish

Riparian Zone/Instream Features

Predominant Surrounding Land Use: (Forest) Urban (Industrial) Other: _____

Shore Vegetation: See Habitat map

Aquatic Vegetation: None

Estimated Stream Width: ____ ft Est. Stream Depth: 8' ft Riffle: — ft Run: — ft Pool: 100' ft

Stream Type: Cold Water (Warm Water) Velocity: NA 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 ~~HNd~~

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

Sediment Description: Very silty/clay, many red worms w/ some grass

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)

Water Odors: (Normal) Sewage Petroleum Chemical Other: _____

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

Turbidity: (Clear) Slightly Turbid Turbid Opaque Water Color: Clear

Weather Conditions: _____ Tide: NA In Out

Comments: _____

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 30-SW/SD01 Date: 3-23-94 (SW) Time: 1805 (SW)

Samplers: AMB, MGM, WJJ Date: 3-25-94 (SD) Time: ~~1725~~ 1200 (SD)

Water Body: French 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 For SW

Riparian Zone/Instream Features

Predominant Surrounding Land Use: (Forest) Urban Industrial Other:

Shore Vegetation: See Habitat map

Aquatic Vegetation: None

Estimated Stream Width: 2' ft Est. Stream Depth: 0.5 ft. Riffle: — ft Run: 100b 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: ~~Silty w/organic muck~~ Silty muck

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	13.7	4.1	2.2	16.6	0

Water Odors: Normal Sewage Petroleum Chemical Other: None

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: 30-SW/SD02 Date: 3-23-94 (SW) Time: 1753 (SW)

Samplers: AMB, WJJ, MGM Date: 3-24-94 (SD) Time: 1725 (SD)

Water Body: French 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 (SW)

Riparian Zone/Instream Features

Predominant Surrounding Land Use: (Forest) Urban Industrial Other: Adjacent to Road

Shore Vegetation: See Habitat map

Aquatic Vegetation: None

Estimated Stream Width: 3 ft Est. Stream Depth: 1 ft. Riffle: — ft Run: 50% ft Pool: 50% 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: Silty muck

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface	16.4	5.1	6.2	11.5	0

Water Odors: Normal Sewage Petroleum Chemical Other: None

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: Staff gauge - 1.05

SAMPLING STATION CHARACTERIZATION DATA SHEET

Station Number: 30-SW/SD03 Date: 3-23-94 (SW) Time: 1718 (SW)

Samplers: AMB, WJJ, MGM Date: 3-24-94 (SD) Time: 1635 (SD)

Water Body: French 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 (SW)

Riparian Zone/Instream Features

Predominant Surrounding Land Use: (Forest) Urban Industrial Other:

Shore Vegetation: Trees (90%), Scrub/Shrub (5%), Herb (5%), (Hardwood Veg) Both sides bordered by Coniferous Forrest - See Habitat Map

Aquatic Vegetation: None

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

Stream Type: Cold Water (Warm Water) Velocity: 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: Silty/Clayey soil

Water:

Depth	Temp. °C	pH (s.u.)	Dissolved Oxygen (mg/L)	Conductivity (micromhos/cm)	Salinity (ppt)
Surface.	15.6	5.5	5.4	286	0

Water Odors: Normal Sewage Petroleum Chemical Other: None

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

Turbidity: Clear (Slightly Turbid) Turbid Opaque Water Color: Tannic

Weather Conditions: Clear, 70°F, Breezy Tide: NA In Out

Comments: Staff guage - 1.3

APPENDIX U
BIOTA POPULATION

Fish Population - Site 26

SPECIES	COC SAMPLE NO.	ORDE POND OP1 Length (cm)	Mass Weight	Average Weight (g)	COGDELS CREEK FS01 Length (cm)	Weight (g)	FS02 Length (cm)	Weight (g)	FS03 Length (cm)	Weight (g)	NEW RIVER FS04 Length (cm)	Total Weight	Average Weight (g)	FS05 Length (cm)	Weight (g)
Striped Mullet	26-FS04-SM01										44		900		
	26-FS04-SM02										37		405		
	26-FS04-SM03										35.5		375		
	26-FS04-SM04										31		275		
	26-FS04-SM05										35		420		
	26-FS04-SM06										41.5		640		
	26-FS04-SM07										39		520		
	26-FS04-SM08										39.5		560		
	26-FS04-SM09										41.5		700		
	26-FS04-SM10										36.5		500		
	26-FS04-SM11										37		520		
	26-FS04-SM12										38.5		520		
	26-FS04-SM13										40.5		560		
	26-FS05-SM01													32	470
	26-FS05-SM02													39.5	640
	26-FS05-SM03													23.5	100
	26-FS05-SM04													37.5	520
	26-FS05-SM05													35.5	400
	26-FS05-SM06													37.5	500
	26-CC-FS01-SM01				12		20								
	26-FS04										11.1		15		
	COUNT				1		1				14		14	6	6
	AVERAGE				12		20				36.4		496.428571	34.25	436.333333
	MAXIMUM				12		20				44		900	39.5	640
	MINIMUM				12		20				11.1		15	23.5	100
Atlantic Menhaden	26-FS05													19	70
	26-FS05													16.5	50
	26-FS05													16.5	55
	26-FS05													20.5	50
	26-FS04-AM01										16		40		
	26-FS04-AM01										16		40		
	26-FS04-AM01										15.5		20		
	26-FS04-AM01										16.5		50		
	26-FS04-AM01										18.5		65		
	26-FS04-AM01										18.4		60		
	26-FS04-AM01										17.7		60		
	26-FS04-AM01										18		70		
	26-FS04-AM01										18		60		
	26-FS04-AM01										17.5		50		
	26-FS04-AM01										17		50		
	26-FS04-AM01										18.4		50		
	26-FS04-AM01										18.4		70		
	26-FS04-AM01										19.5		80		
	26-FS04-AM01										17		50		
	26-FS04-AM01										17.5		60		
	26-FS04-AM01										18.9		70		
	26-FS04-AM01										16.5		50		
	26-FS04-AM01										17.4		60		
	26-FS04-AM01										17		45		
	26-FS04-AM01										17.5		60		
	26-FS04-AM01										17.5		60		
	26-FS04-AM01										17		55		
	26-FS04-AM01										18		60		
	26-FS04-AM01										17		57		
	26-FS04-AM01										18.5		60		
	26-FS04-AM01										18.5		60		
	26-FS04-AM01										17		50		
	26-FS04-AM01										17.9		60		
	26-FS04-AM0 (composite)										16		40		
											16		40		
											15.5		20		
											16.5		50		
											18.5		65		
											18.4		60		
											17.7		60		
											18		70		
											18		60		
											17.5		50		
											17		50		
											18.4		50		
											18.4		70		
											19.5		80		
											17		50		
											17.5		60		
											18.9		70		
											16.5		50		
											17.4		60		
											17		45		
											17.5		60		
											17.5		60		
											17		5.5		
											18		60		
											17		57		
											18.5		60		
											18.5		60		
											17		50		
											17.9		60		

PECIES	COC SAMPLE NO.	ORDE POND DP1 Length (cm)	Mass Weight	Average Weight (g)	COGDELS CREEK FS01 Length (cm)	Weight (g)	FS02 Length (cm)	Weight (g)	FS03 Length (cm)	Weight (g)	NEW RIVER FS04 Length (cm)	Total Weight	Average Weight (g)	FS05 Length (cm)	Weight (g)
Atlantic Menhaden	28-NR-FS04										17.2			13	
											16.9			60	
											18.5			60	
											18.5			60	
											17.5			60	
											17			60	
											15.5			40	
											15.5			60	
											17		60	60	
											17.5			50	
											18			6	
											17.5		55	55	
											17			50	
											19			60	
											18		55	55	
											17			50	
											17.5			50	
											16.7		55	55	
											17.4			50	
											18.5			60	
											17.5		50	50	
											18.5			60	
											17			50	
											19.5			60	
											15.5			50	
											16.5		50	50	
											17.5			50	
											18.5			60	
											16.5			50	
											16.5			50	
											15.5			55	
											17.7		65	65	
											17.5			50	
											16.5			50	
											16.5			50	
											17		47	47	
											18			60	
											18			60	
											17.5		60	60	
											16			50	
											16			50	
											17.5			50	
											17.3			60	
											18		70	70	
											18			70	
											18.5			70	
											17.5			60	
											17.5		55	55	
											16			50	
											19.5			70	
											18			60	
											18.5			60	
											18		70	70	
											18.5			60	
											16			50	
											18			60	
											18.5			60	
											16.7			60	
											16.5			50	
											17.5			60	
											16.2			50	
											16.5			50	
											17			60	
											18			60	
											18.5			60	
											19.5			60	
											16			50	
											18.5			60	
											17.5			60	
											19			70	
											18			60	
											17.5			60	
											17.5			60	
											17.5			60	
											16.5			50	
											19.5			70	
											16.7			60	
											15			50	
											16.5			60	
											18			60	
											16.8			60	
											18.5			60	
											18			60	
											18.5			60	
											18			60	
											19.2			60	
											17			60	
											16.5			50	
											17.5			60	
											17			60	
											18.5			60	

SPECIES	COC SAMPLE NO.	ORDE POND			COGDELS CREEK						NEW RIVER				
		OP1	Mass	Average	FS01		FS02		FS03		FS04	Total	Average	FS05	
		Length (cm)	Weight	Weight (g)	Length (cm)	Weight (g)	Length (cm)	Weight (g)	Length (cm)	Weight (g)	Length (cm)	Weight	Weight (g)	Length (cm)	Weight (g)
Atlantic Menhaden											17.2		60		
											17		60		
											17		60		
											19		70		
											17.5		60		
											17.5		60		
											14		40		
											18		60		
											20.5		70		
											16		60		
											17.5		60		
											16.5		80		
											18		60		
											16.3		60		
											15.5		50		
											17.1		60		
											16.5		60		
											18		60		
											17		60		
											18		60		
											18		60		
											15.5		50		
											17.5		60		
											18.5		60		
											18		60		
											17.5		60		
											18.5		60		
											17		60		
											19.5		70		
											16		60		
											17.5		60		
											18		60		
											17.5		60		
											15.5		50		
											17.5		60		
											16.5		60		
											18.5		60		
											18.5		60		
											18.5		60		
											16.5		50		
											17		60		
											19		70		
											15		50		
											19		70		
											17.5		60		
											18.5		60		
											17		60		
											17.5		60		
											17		60		
	COUNT										198		198	4	4
	AVERAGE										17.4818182		58.8792929	18.125	56.25
	MAXIMUM										20.5		80	20.5	70
	MINIMUM										14		5.5	16.5	50
Summer Flounder	28-FS04-SMRF01										26.5		225		
	28-FS05-SMRF01													35.5	540
	28-FS05-SMRF02													27.5	215
	28-FS05-SMRF03													31.5	315
	28-FS05-SMRF04													21.5	105
	28-FS05-SMRF05													27.5	210
	28-FS05-SMRF06													37.5	560
	28-FS05-SMRF07													31.5	300
	28-FS04										6		6		
	COUNT										2		2	7	7
	AVERAGE										16.25		115.5	30.3571429	323.571429
	MAXIMUM										26.5		225	37.5	560
	MINIMUM										6		6	21.5	105
Black Drum	28-FS04-BD01										25.5		255		
	COUNT										1		1		
	AVERAGE										25.5		255		
	MAXIMUM										25.5		255		
	MINIMUM										25.5		255		
Spotted Sea Trout	28-FS05-SS01													46.5	960
	COUNT													1	1
	AVERAGE													46.5	960
	MAXIMUM													46.5	960
	MINIMUM													46.5	960

PECIES	COC SAMPLE NO.	ORDE POND			COGDELS CREEK						NEW RIVER				
		OP1 Length (cm)	Mass Weight	Average Weight (g)	FS01 Length (cm)	Weight (g)	FS02 Length (cm)	Weight (g)	FS03 Length (cm)	Weight (g)	FS04 Length (cm)	Total Weight	Average Weight (g)	FS05 Length (cm)	Weight (g)
Largemouth Bass	28-OPFS-LBO1	24		160											
	28-OPFS-LBO2	27		240											
	28-OPFS-LBO3	20.5		95											
	28-OPFS-LBO4	18.5		70											
	28-OPFS-LBO5	30		310											
	28-OPFS-LBO6	21		110											
	25-OPFS	11.5		20											
		9		5											
		13		20											
		13.5		35											
		13		20											
		16		45											
		16.5		55											
	COUNT	13		13											
	AVERAGE	17.9615384615		91.1538461538											
	MAXIMUM	30		310											
	MINIMUM	9		5											
American Eel	28-OPFS-AE01	51		265											
	28-OPFS-AE02	52		245											
	COUNT	2		2											
	AVERAGE	51.5		255											
	MAXIMUM	52		265											
	MINIMUM	51		245											
Redear Sunfish	28-OPFS-RS01	18.5		105											
	28-OPFS-RS02	14.5		40											
	28-OPFS-RS03	14.5		50											
	28-OPFS-RS04	12.5		30											
	28-OPFS-RS05	15		47											
	28-OPFS-RS06	14.5		50											
	28-OPFS-RS07	12.5		35											
	28-OPFS-RS08	16		85											
	28-OPFS	12		30											
		6		4											
		7		4											
		4		4											
		9.5	15	4											
		7		4											
		7		4											
		7.5		4											
		7		5											
		6.5		5											
		10		10											
	OP1A-RD01	14.6													
	OP1A-RD02	15.2													
	OP1A-RD03	17.1													
	OP1A-RD04	15.9													
	OP1A-RD05	15.9													
	OP1A-RD06	14.6													
	OP1A-RD07	13.3													
	OP1A-RD08	14													
	OP1A-RD09	15.2													
	OP1A-RD10	14.6													
	OP1A-RD11	14.6													
	OP1A-RD12	15.2													
	OP1A-RD13	14													
	OP1A-RD14	15.2													
	OP1A-RD15	12.1													
	OP1A-RD16	17.1													
	OP1A-RD17	17.1													
	COUNT	36		19											
	AVERAGE	12.7277777778		27.3684210526											
	MAXIMUM	18.5		105											
	MINIMUM	4		4											
War Mouth	28-OPFS-WM01	14		140											
	28-OPFS-WM02	15.5		150											
	28-OPFS-WM01	19		110											
	28-OPFS	12.5		40											
	28-OPFS/BN	14		140											
		19.5		150											
	COUNT	6		6											
	AVERAGE	15.75		121.666666667											
	MAXIMUM	19.5		150											
	MINIMUM	12.5		40											

SPECIES	COC SAMPLE NO.	ORDE POND			COGDELS CREEK						NEW RIVER				
		DP1	Mess	Average	FS01		FS02		FS03		FS04	Total	Average	FS05	
		Length	Weight	Weight	Length	Weight	Length	Weight	Length	Weight	Length	Weight	Weight	Length	Weight
		(cm)		(g)	(cm)	(g)	(cm)	(g)	(cm)	(g)	(cm)		(g)	(cm)	(g)
Blue Gill	28-OPFS-BG03	15		35											
	28-OPFS	10.5		25											
		10.5		25											
		8		10											
		8.5		10											
		7.5		10											
		6.5		6											
		5.5		5											
		6		6											
		6		6											
		6.5		7											
		5.5		5											
		4		5											
		5.5		5											
		6		6											
		6		6											
		3		5											
		4.5	30	3											
		6		3											
		6		3											
		6		3											
		7.5		3											
		6		3											
		4.5		3											
		5.5		3											
		5.5		3											
		5		3											
		6	30	3											
		5		3											
		4.5		3											
		6		3											
		7		3											
		7		3											
		7		3											
		7		3											
		7.5		3											
		7.5		3											
		7	55	5.5											
		7		5.5											
		5		5.5											
		3		5.5											
		4		5.5											
		5		5.5											
		5		5.5											
		4.5		5.5											
		6.5		5.5											
		7		5.5											
		9	25	5											
		7		4											
		5.5		4											
		5.5		4											
		5		4											
		5.5		4											
		8		10											
		10		15											
		8		10											
		10		15											
		10		15											
		10		15											
		8		10											
		8		10											
		8		10											
		7.5		10											
		8		10											
		8		10											
		8		10											
		5		4											
		5		4											
		5.5		4											
		6		5											
		4.5		4											
		6		5											
		6.5		6											
		7		10											
		9		10											
		7		10											
		7.5	40	3.6											
		6.5		3.6											
		6		3.6											
		6		3.6											
		6.5		3.6											
		6		3.6											
		7		3.6											
		9		3.6											
		7		3.6											
		7		3.6											
		6		3.6											
		9		5.5											

SPECIES	COC SAMPLE NO.	ORDE POND OP1 Length (cm)	Mass Weight	Average Weight (g)	COGDELS CREEK FS01 Length (cm)	Weight (g)	FS02 Length (cm)	Weight (g)	FS03 Length (cm)	Weight (g)	NEW RIVER FS04 Length (cm)	Total Weight	Average Weight (g)	FS05 Length (cm)	Weight (g)
Blue Gill	28-OPFS	8		10											
		6		6											
		5		5											
		7.5		10											
		6		10											
		5.5		5											
		8		10											
		7.5		10											
		6		8											
		5		5											
		8		10											
		6.5		10											
		8		10											
		6		6											
		7.5		10											
		8.5		10											
		5		5											
		7.5		10											
		6		6											
		6		6											
		9		10											
		8		10											
		10		10											
		8		10											
		12		35											
		5.5		5											
		9		10											
		7		10											
		8		10											
		5		5											
		8		10											
		7.5		10											
		6		6											
		6		6											
		8.5		10											
		5		5											
		6.5		7											
		6		6											
		5		5											
		6		6											
		7		10											
		3.5		5											
		6		6											
		4.5		5											
		8		10											
		4		5											
	28-OPFS	5.5		5											
		5		5											
		10		10											
		6.5		10											
		6.5		10											
		6.5		10											
		4.5		5											
		4.5		5											
		5.5		5											
		6.5		10											
		5		5											
		5		5											
		5.5		5											
		9.5		10											
		6		6											
		6		6											
		8		10											
		4		5											
		4		5											
Blue Gill	28-OPFS/BN	3.5	<	5											
		4.5	<	5											
		8.5		10											
		3.5	<	5											
		4	<	5											
		2.5	<	5											
		2.5	<	5											
		4	<	5											
	OP1A-BG01	16.5													
	OP1A-BG02	17.1													
	OP1A-BG03	15.9													
	OP1A-BG04	16.5													
	OP1A-BG05	15.9													
	OP1A-BG06	15.2													
	OP1A-BG07	17.8													
	OP1A-BG08	15.2													
	OP1A-BG09	18.4													
	OP1A-BG10	14.6													
	OP1A-BG11	15.2													
	COUNT	172		161											
	AVERAGE	7.17034883721		7.19316770186											
	MAXIMUM	18.4		35											
	MINIMUM	2.5		3											

SPECIES	COC SAMPLE NO.	ORDE POND			COGDELS CREEK						NEW RIVER				
		OP1	Mass	Average	FS01		FS02		FS03		FS04	Total	Average	FS05	
		Length (cm)	Weight	Weight (g)	Length (cm)	Weight (g)	Length (cm)	Weight (g)	Length (cm)	Weight (g)	Length (cm)		Weight (g)	Length (cm)	Weight (g)
Blue Crab	28-CC-FS01-BC01				10	55									
	COUNT				1	1									
	AVERAGE				10	55									
	MAXIMUM				10	55									
	MINIMUM				10	55									
Pumpkinseed	28-CC-FS01-PS01				15	65									
	28-CC-FS01-PS02				8	10									
	28-OPFS	12.5		40											
	COUNT	1		1	2	2									
	AVERAGE	12.5		40	11.5	37.5									
	MAXIMUM	12.5		40	15	65									
	MINIMUM	12.5		40	8	10									
Silverside Anchovy	28-FS04										10.2		10		
											10.8	sum=30	10		
											9.5		10		
	28-FS04										10.1	sum=15	7.5		
											10.1		7.5		
	COUNT										5		5		
	AVERAGE										10.14		9		
	MAXIMUM										10.8		10		
	MINIMUM										9.5		7.5		

Benthic Macroinvertebrate - Site 28

Scientific Name	Orde Pond	Cogdels Creek			New River	
	28-OP-BN01	28-BN01	28-BN02	28-BN03	28-BN04	28-BN05
NEMERTEA						
Anopla						
Heteronemertea						
Lineidae						
Micrura leidyi				2		
ANNELIDA						
Oligochaeta						
Lumbriculida						
Lumbriculiae						
Eclipidrillus sp.						
Tubificida						
Tubificidae					8	
Limnodrilus hoffmeisteri	9	7	4	3		
Isochaetides freyi						
Spirosperma carolinensis						
Polychaeta						
Ariciida						
Orbiniidae						
Scoloplos fragilis					30	3
Capitellida						
Capitellidae						
Capitella capitata		6	51	28	42	30
Heteromestus filiformis						
Phyllodocida						
Nereidae						
Nereis succinea		8	12	5	15	3
Phyliodocidae						
Eteone heteropoda						
Spionida						
Spionidae						
Polydora sp.					1	
Streblospio benedicti					56	3
Scolecolepides viridis						
Terebellida						
Ampharetidae						
Hypaniola grayi			13			
ARTHROPODA						
Crustacea						
Amphipoda						
Corophiidae						
Corophium lacuatre						
Gammaridae						
Crangonyx pseudogracillus						
Gammarus sp.					1	
Gammarus tigrinus						
Talitridae						
Orchestia grillus				1		
Tanaidacea						
Tanaidae						
Leptochelia rapox						
Decapoda						
Palaemonidae						
Palaemonetes pugic						
Portunidae						
Callinectes sp.					1	
Tanaidacea						
Paratanaidae						
Leptochelia savignyi						1
Insecta						
Coleoptera						
Dytiscidae						
Hydroporus sp.		2				
Elmidae						
Dubiraphis sp.						

Scientific Name	Orde Pond	Cogdels Creek			New River	
	28-OP-BN01	28-BN01	28-BN02	28-BN03	28-BN04	28-BN05
Diptera						
Ceratopogonidae						
Bezzia/Palpomyia sp.	2					
Palpomyia/sphaeromias sp. (biting midges)	2	1				
Chaoboridae						
Chaoborus sp.						
Chironomidae						
Ablabesmyia annulata						
Ablabesmyia ramphe gr.						
Ablabesmyia mallochi						
Chironomus decorus gr.		26	1	3		
Chironomus ochreatus	66					
Cladopelma sp.	1					
Cladotanytarsus mancus gr. (midges)	1	2				
Clinotanypus pinguis						
Cricotopus bicinctus gr.			1			
Cryptochironomus fulvus gr.						
Dicrotendipes modestus	8	3				
Dicrotendipes nervosus						
Epoicladius sp.						
Glyptotendipes sp.						
Larsia sp.	27					
Macropelopia sp.	1					
Nanocladius bicolor gr.			2			
Nilothauma sp.						
Parakiefferiella nigrohalteralis						
Polypedilum illinoense						
Polypedilum scalaenum						
Procladius sp.	2	7				
Pseudochironomus sp.	1					
Thienemannimyia gr		19				
Tanytarsus sp.						
Tribelos lucundum						
Tipulidae						
Antocha sp.			1			
Pseudolimnophila sp.						
Ephemeroptera						
Caenidae						
Caenis punctata	1					
Ephemeroptera						
Ephemeridae						
Hexagenia bilineata						
Megaloptera						
Sialidae						
Sialis sp.						
Odonata						
Coenagrionidae						
Argia sp.						
Enallagma signatum/vesperum	2	1				
Libelluidae						
Pechydiplax longipennis						
Trichoptera						
Polycentropodidae						
Phylacentropus sp.						
MOLLUSCA						
Bivalvia						
Mytiloida						
Mytilidae						
Geukensia demissa					26	1
Veneroida						
Mactridae					30	19
Mulinia lateralis						
Corbiculidae						
Polymesoda caroliniana						
Semelidae					6	
Abra aequalis						
Sphaeriidae						
Pisidium casertanum						
Tellinidae					30	3
Tellina sp.						
Macoma tenta						
Veneridae					5	
Gemma gemma						
Total Taxa	13	11	8	6	13	8
Total Specimens	123	82	85	42	251	63
Species Density	784	523	542	268	1600	402
Shannon-Weiner Diversity	0.651	0.847	0.547	0.493	0.930	0.619
Brillouin's Diversity	0.593	0.765	0.495	0.422	0.890	0.550

Percent Individuals - Benthic Macroinvertebrate - Site 28

	Orde Pond	Cogdels Creek			New River	
Scientific Name	28-OP-BN01	28-BN01	28-BN02	28-BN03	28-BN04	28-BN05
NEMERTEA						
Anopla						
Heteronemertea						
Lineidae						
Micrura leidyi				4.76		
ANNELIDA						
Oligochaeta						
Lumbriculida						
Lumbriculiae						
Eclipidrillus sp.						
Tubificida						
Tubificidae					3.19	
Limnodrilus hoffmeisteri	7.32	8.54	4.71	7.14		
Isochaetides freyi						
Spirosperma carolinensis						
Polychaeta						
Ariciida						
Orbiniidae						
Scoloplos fragilis					11.95	4.76
Capitellida						
Capitellidae						
Capitella capitata		7.32	60.00	66.67	16.73	47.62
Heteromestus filiformis						
Phyllodocida						
Nereidae						
Nereis succinea		9.76	14.12	11.90	5.98	4.76
Phyliodocidae						
Eteone heteropoda						
Spionida						
Spionidae						
Polydora sp.					0.40	
Streblospio benedicti					22.31	4.76
Scolecolepides viridis						
Terebellida						
Ampharetidae						
Hypaniola grayi			15.29			
ARTHROPODA						
Crustacea						
Amphipoda						
Corophiidae						
Corophium lacuatre						
Gammaridae						
Crangonyx pseudogracillus						
Gammarus sp.					0.40	
Gammarus tigrinus						
Talitridae						
Orchestia grillus				2.38		
Tanaidacea						
Tanaidae						
Leptochelia rapox						
Decapoda						
Palaemonidae						
Palaemonetes pugic						
Portunidae						
Callinectes sp.					0.40	
Tanaidacea						
Paratanaidae						
Leptochelia savignyi						1.59
Insecta						
Coleoptera						
Dytiscidae						
Hydroporus sp.		2.44				
Elmidae						
Dubiraphis sp.						

Scientific Name	Orde Pond	Cogdels Creek			New River	
	28-OP-BN01	28-BN01	28-BN02	28-BN03	28-BN04	28-BN05
Diptera						
Ceratopogonidae						
Bezzia/Palpomyia sp.	1.63					
Palpomyia/sphaeromias sp.	1.63	1.22				
Chaoboridae						
Chaoborus sp.						
Chironomidae						
Ablabesmyia annulata						
Ablabesmyia ramphe gr.						
Ablabesmyia mallochi						
Chironomus decorus gr.		31.71	1.18	7.14		
Chironomus ochreatus	53.66					
Cladopelma sp.	0.81					
Cladotanytarsus mancus gr.	0.81	2.44				
Clinotanypus pinguis						
Cricotopus bicinctus gr.			1.18			
Cryptochironomus fulvus gr.						
Dicrotendipes modestus	6.50	3.66				
Dicrotendipes nervosus						
Epoicladius sp.						
Glyptotendipes sp.						
Larsia sp.	21.95					
Macropelopia sp.	0.81					
Nanocladius bicolor gr.			2.35			
Nilothauma sp.						
Paraiauterborniella nigrohaiteralis						
Polypedilum illinoense						
Polypedilum scalaenum						
Procladius sp.	1.63	8.54				
Pseudochironomus sp.	0.81					
Thienemannimyia gr		23.17				
Tanytarsus sp.						
Tribelos lucundum						
Tipulidae						
Antocha sp.			1.18			
Pseudolimnophila sp.						
Ephemeroptera						
Caenidae						
Caenis punctata	0.81					
Ephemeroptera						
Ephemeridae						
Hexagenia bilineata						
Megaloptera						
Sialidae						
Sialis sp.						
Odonata						
Coenagrionidae						
Argia sp.						
Enallagma signatum/vesperum	1.63	1.22				
Libelluiidae						
Pechydiplax longipennis						
Trichoptera						
Polycentropodidae						
Phylacentropus sp.						
MOLLUSCA						
Bivalvia						
Mytiloida						
Mytilidae						
Geukensia demissa						
Veneroida					10.36	1.59
Mactridae						
Mulinia lateralis					11.95	30.16
Corbiculidae						
Polymesoda caroliniana						
Semelidae						
Abra aequalis					2.39	
Sphaeriidae						
Pisidium casertanum						
Tellinidae						
Tellina sp.					11.95	4.76
Macoma tenta						
Veneridae						
Gemma gemma					1.99	
Total Percent	100	100	100	100	100	100