Field Verification Sampling Plan
for
Building 31
Naval Submarine Base
New London
Groton, Connecticut

Northern Division
Naval Facilities Engineering Command

Contract Number N62472-90-D-1298
Contract Task Order 0115

September 1993

Halliburton NUS
CORPORATION

R-07-93-2

FIELD VERIFICATION SAMPLING PLAN
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Northern Division
Environmental Branch, Code 1823
Naval Facilities Engineering Command
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Contract Number N62472-90-D-1298
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1.0 INTRODUCTION AND PROJECT BACKGROUND

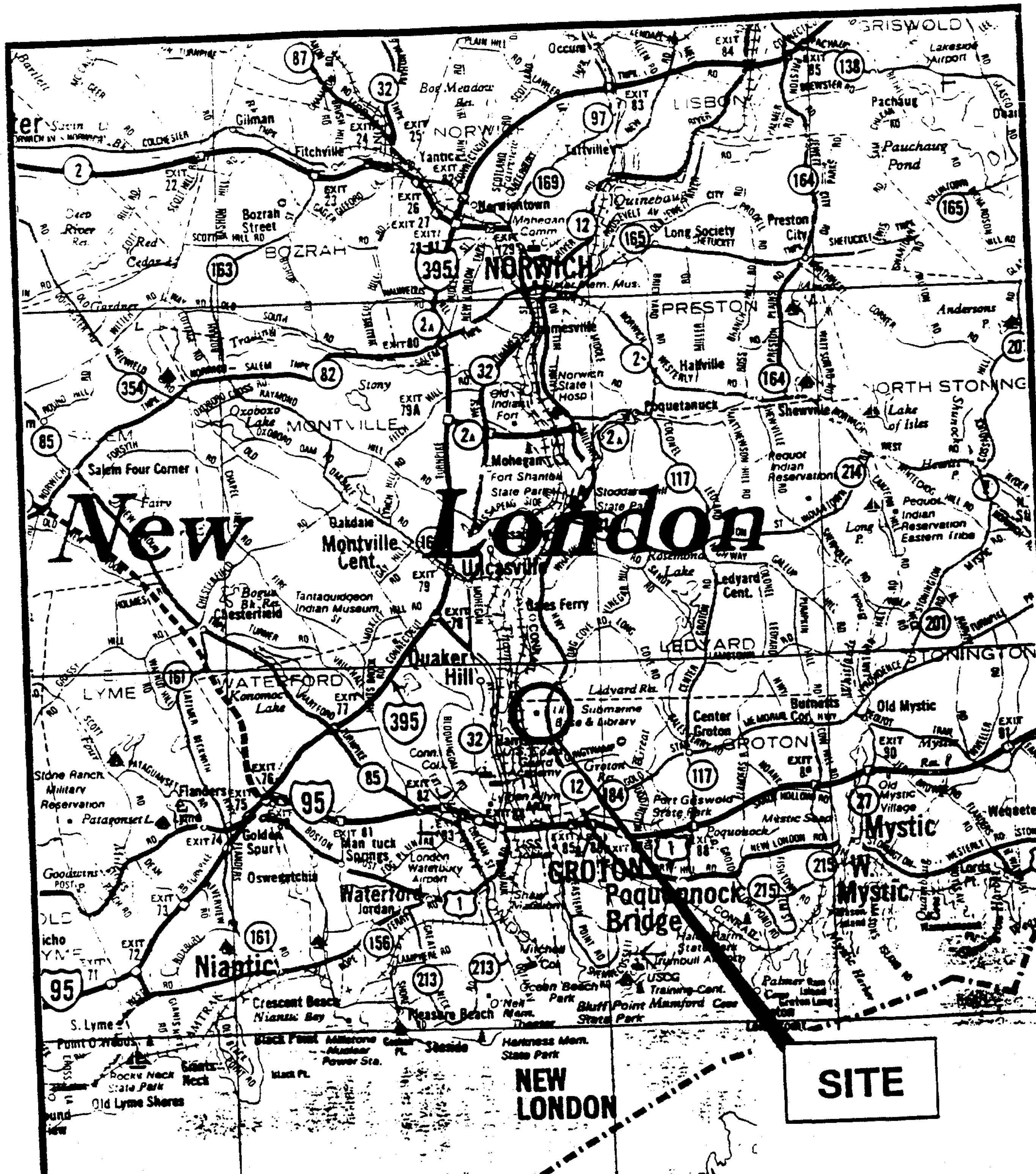
The Northern Division (NORTHDIV) of the Naval Facilities Engineering Command (NAVFAC) has issued a unilateral Contract Task Order (CTO) Number 115 to Halliburton NUS Corporation (Halliburton NUS), under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract No. N62472-90-D-1298.

CTO 115 is for environmental work to support a time-critical removal action at Building No. 31 of the Naval Submarine Base - New London (NSB-NLON) located in Groton, Connecticut. This Field Verification Sampling Plan (FVSP) presents a plan to perform sampling and analysis work to ensure that all cleanup standards for the lead contaminated soil are met during the performance of the remedial work.

1.1 PROJECT BACKGROUND

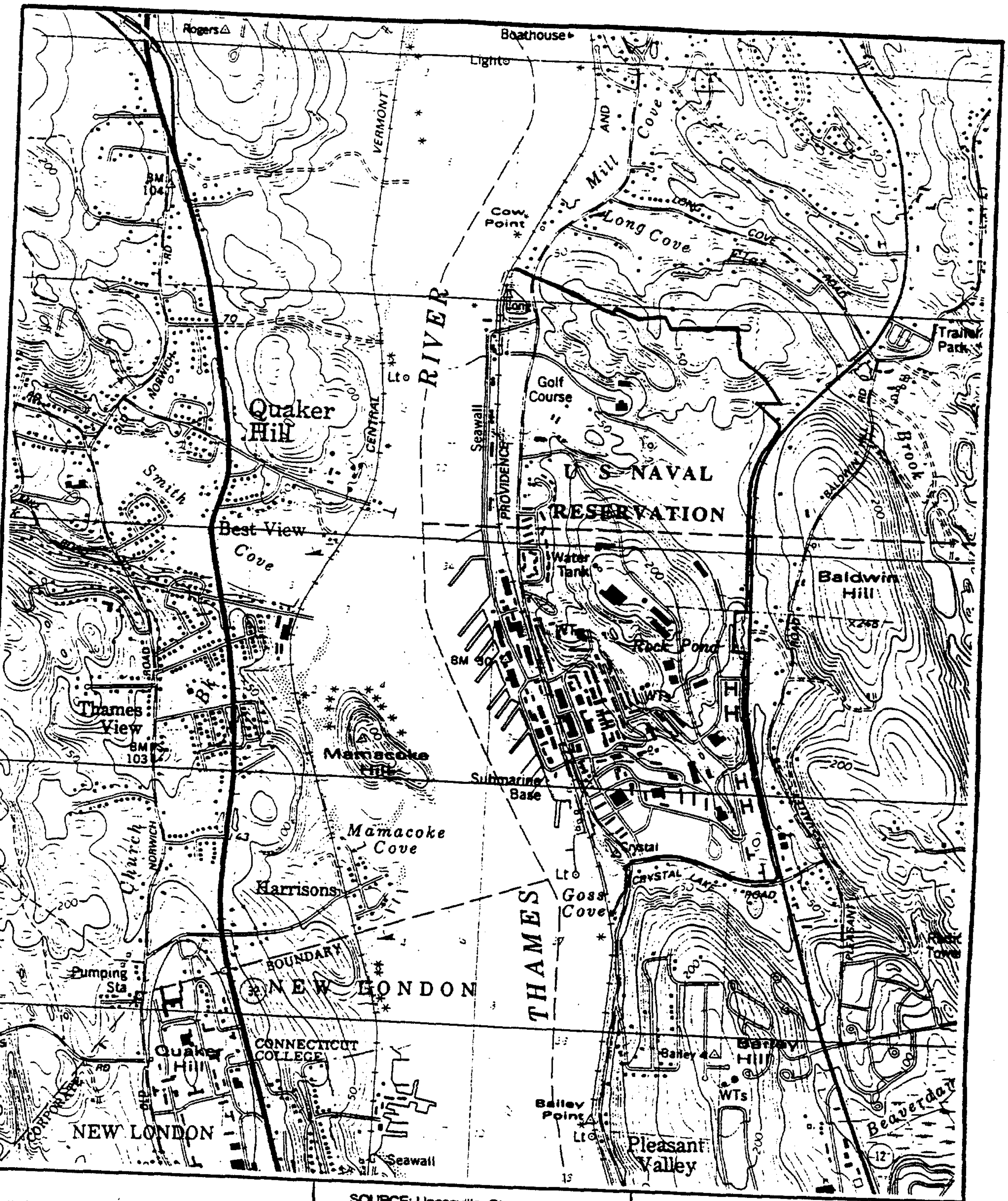
NSB-NLON was placed on the National Priorities List (NPL) on August 28, 1991 by the U.S. Environmental Protection Agency (U.S. EPA) pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980. NSB-NLON consists of approximately 547 acres of land and associated buildings in southeastern Connecticut, in the towns of Ledyard and Groton. NSB-NLON is situated on the east bank of the Thames River, approximately 6 miles north of Long Island Sound. Figures 1-1 and 1-2 show the site vicinity and the site location, respectively. The SUBASE was established as an official Navy yard in July 1886. The site initially moored small craft and obsolete warships and was used as a coaling station for the Atlantic Fleet. The property was officially established as a permanent submarine base in 1916. The overall base facilities were expanded and a submarine school training facility was established in 1917; the Submarine Medical Center was established in 1918. During World Wars I and II, the SUBASE greatly expanded in size and in the number of buildings to support the submarine fleet.

The SUBASE currently provides a base command for naval submarine fleet activities in the Atlantic Ocean. In addition, the SUBASE contains naval housing, submarine training facilities, military offices, medical facilities, and facilities for the maintenance, repair, and overhaul of submarines. Building 31 is located in the lower SUBASE area on Albacore Road as shown in Figure 1-3. Building 31 is used as a hazardous materials storage building and is listed as a Study Area in the Federal Facilities Agreement for future investigation.



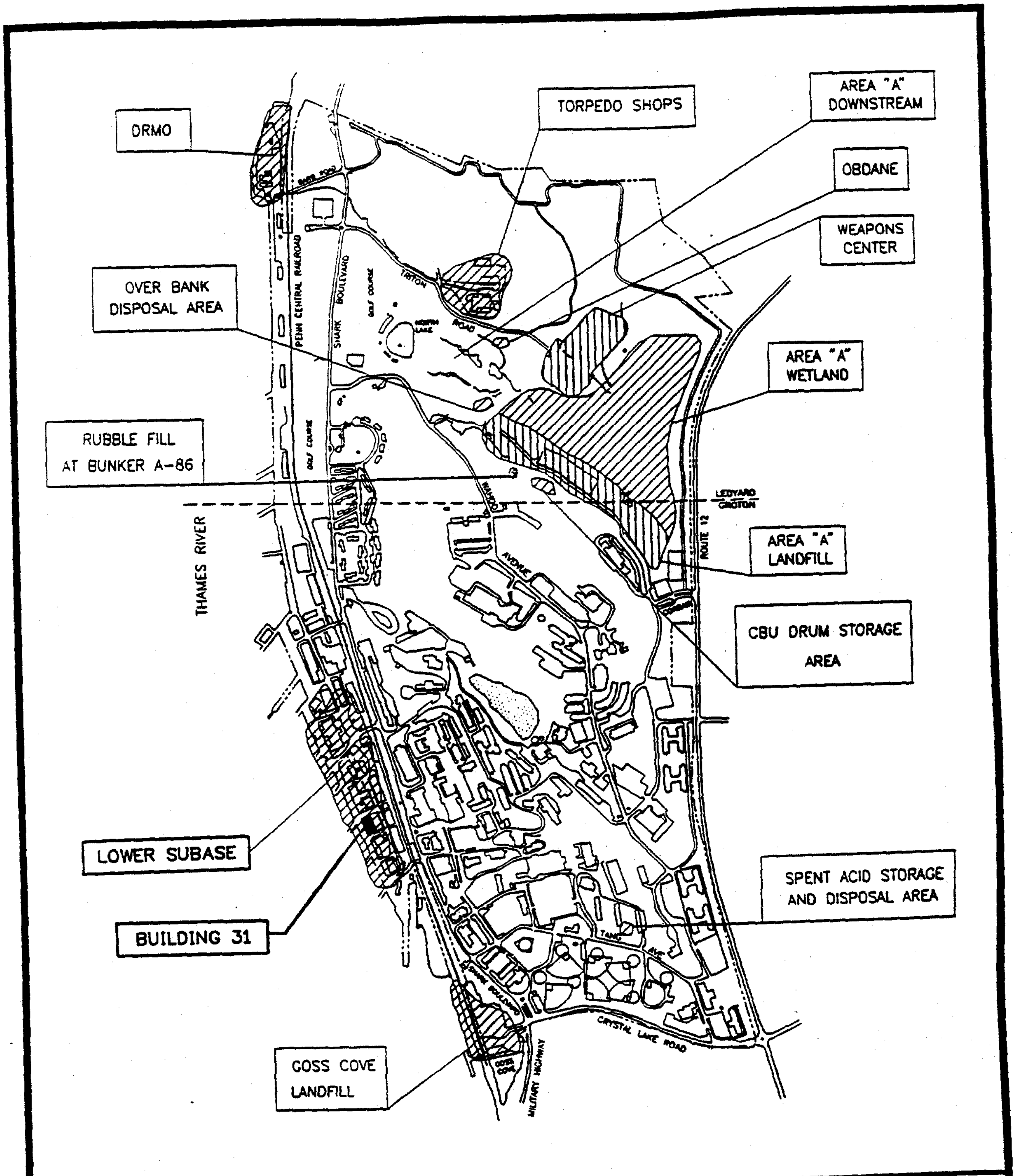
INSTALLATION RESTORATION STUDY NAVAL SUBMARINE BASE - NEW LONDON GROTON, CT	SOURCE: Marshall Penn-York Co. Inc. Miles 0 1 2 3 APPROXIMATE SCALE	FIGURE 1-1 SITE VICINITY ATLANTIC ENVIRONMENTAL SERVICES, INC.

SOURCE: DRAFT NSB–NLON WORK PLAN, NOVEMBER 1992, ATLANTIC ENVIRONMENTAL SERVICES, INC.



INSTALLATION RESTORATION STUDY NAVAL SUBMARINE BASE - NEW LONDON GROTON, CT	SOURCE: Uncasville, Ct. U.S.G.S. Topographic Map 1984 N 0 1000 2000' SCALE	FIGURE 1-2 SITE LOCATION ATLANTIC ENVIRONMENTAL SERVICES, INC.

SOURCE: DRAFT NSB–NLON WORK PLAN, NOVEMBER 1992, ATLANTIC ENVIRONMENTAL SERVICES, INC.



INSTALLATION RESTORATION STUDY NAVAL SUBMARINE BASE - NEW LONDON GROTON, CT	SOURCE: Naval Submarine Base Existing Conditions April 1985 Laureiro Engineering Associates N 0 600 1200 GRAPHIC SCALE IN FEET	FIGURE 1-3 INSTALLATION RESTORATION STUDY SITES ATLANTIC ENVIRONMENTAL SERVICES, INC.

SOURCE: DRAFT NSB-NLON WORK PLAN, NOVEMBER 1992, ATLANTIC ENVIRONMENTAL SERVICES, INC.

It was built in 1917 and was originally used as a battery shop. The SUBASE was in the process of replacing the concrete foundation to comply with RCRA regulations when a yellow discoloration was discovered underneath on the concrete slab. Soil samples were taken at depths of 18 inches and 60 inches and elevated lead levels were found. Lead levels ranged from 0.1 to 400 ppm (TCLP). Materials that exhibit a TCLP lead concentration of 5.0 mg/L or greater are classified as a hazardous waste under RCRA (40 CFR Part 261.24). As a result of this initial soil testing, an additional soil and groundwater investigation was undertaken in February of 1993 to better define the extent of lead and related battery contamination at Building 31 of SUBASE NLON. During this investigation, the following samples were collected, the results of which are listed in Tables 1-1 through 1-4.

- Twenty-seven (27) subsurface soil samples within Building 31 at depths of 0 to 2 feet, 2 to 4 feet, and 4 to 6 feet.

- Six (6) subsurface soil samples outside Building 31 (depths vary as shown.)

- Three (3) surface soil samples between Building 31 and Building 78 at depths of 0 to 6 inches.

- Four (4) groundwater samples at well points located within Building 31 (two rounds of sampling.)

All of the subsurface soil samples collected were analyzed for lead. Eighty-one of the subsurface samples (all those collected within Building 31) were analyzed for pH. Also, one sample from each boring within Building 31 (the one with highest total lead concentration) was analyzed for TCLP lead. Four of the boring having the highest TCLP lead concentrations were also analyzed for Appendix VII metals including arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. In addition, four of the subsurface samples collected were analyzed for full Target Compound List (TCL) and Target Analyte List (TAL) metals plus cyanide, based on field screening by the field sampling team using a HNu meter.

All of the surface soil samples were analyzed for lead.

TABLE 1-1

SUMMARY OF SOIL ANALYTICAL RESULTS - LEAD
BUILDING 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT

Boring No./ Depth (Ft)	pH	Soil Concentration[1] (mg/kg)	TCLP Leachate Concentration[2] (mg/L)
SUBSURFACE SOIL			
SB01-2	7.49	1,490 J	NA
SB01-4	7.58	4,330 J	10.5
SB01-4D	7.50	1,590 J	NA
SB01-6	6.26	1,180 J	NA
SB02-2	9.95	3,390 J	22.8
SB02-4D	9.41	2,720	NA
SB02-4	9.41	3,160	NA
SB02-6	9.41	383 J	NA
SB03-2	4.74	4,790 J	NA
SB03-4	6.74	5,370 J	12.6
SB03-6	6.82	106 J	NA
SB04-2	8.75	492 J	0.591
SB04-4	9.04	177 J	NA
SB04-6	11.90	301 J	NA
SB05-2	7.24	11,900 J	27.5
SB05-4	7.45	2,990	NA
SB05-6	6.44	670	NA
SB06-2	6.49	5.9	NA
SB06-4	6.27	ND (19.3)	NA
SB06-4D	6.64	ND (4.8)	NA
SB06-6	6.50	134	1.7
SB07-2	8.46	13.7	NA
SB07-4	6.81	3.1	NA
SB07-6	7.59	39.5	0.0546
SB08-2	7.97	962	5.81
SB08-4	4.63	8.6	NA
SB08-6	4.95	30	NA
SB09-2	8.96	27.5	0.0293
SB09-4	5.54	9.8	NA
SB09-6	6.43	14.6	NA
SB10-2	7.67	7.9	NA
SB10-4	4.60	13.7	ND (0.026)
SB10-6	4.80	9.1	NA
SB10-6D	4.70	8.76	NA
SB11-2	6.16	9.7	NA

TABLE 1-1
SUMMARY OF SOIL ANALYTICAL RESULTS - LEAD
BUILDING 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT
PAGE TWO

Boring No./ Depth (Ft)	pH	Soil Concentration[1] (mg/kg)	TCLP Leachate Concentration[2] (mg/L)
SUBSURFACE SOIL (Continued)			
SB11-4	5.84	8.4	NA
SB11-6	11.20	799	6.0
SB12-2	7.70	2.8	NA
SB12-4	9.65	2.9	NA
SB12-6	8.83	8.8	0.0698
SB13-2	8.78	186	0.232
SB13-2D	8.67	463	NA
SB13-4	8.71	32.6	NA
SB13-6	10.10	42.9	NA
SB14-2	10.40	3.1	NA
SB14-4	11.80	6.3	ND (0.026)
SB14-6	10.80	5.1	NA
SB15-2	7.10	69.2	0.154
SB15-4	4.40	44.5	NA
SB15-6	5.24	40.0	NA
SB16-2	7.79	1,060	9.13
SB16-4	7.31	713	NA
SB16-6	4.86	339	NA
SB17-2	6.69	25.0	NA
SB17-4	5.67	77.3	NA
SB17-6	7.83	302	5.88
SB18-2	4.64	39.1	NA
SB18-4	4.53	53.9	NA
SB18-6	5.80	9,470J	13.6
SB19-2	5.11	9.7	NA
SB19-4	5.39	15.7	NA
SB19-6	11.00	144	0.815
SB20-2	11.00	229	1.02
SB20-4	8.67	26.4	NA
SB20-4D	9.20	25.8	NA
SB20-6	9.59	49.8	NA
SB21-2	11.60	69.8	0.0932
SB21-4	11.70	9.3	NA

TABLE 1-1
SUMMARY OF SOIL ANALYTICAL RESULTS - LEAD
BUILDING 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT
PAGE THREE

Boring No./ Depth (Ft)	pH	Soil Concentration[1] (mg/kg)	TCLP Leachate Concentration[2] (mg/L)
SUBSURFACE SOIL (Continued)			
SB21-6	10.90	6.8	NA
SB22-2	10.80	5.4	NA
SB22-4	11.50	8.1	NA
SB22-6	11.70	32.6	0.0709
SB23-2	4.51	2.8	NA
SB23-4	4.16	6.7	NA
SB23-6	4.47	7.7	ND (0.026)
SB24-2	6.45	16,900	4.87
SB24-4	5.16	4,550	NA
SB24-6	4.23	4.9	NA
SB25-2	7.80	389	2.89
SB25-4	8.84	26.8	NA
SB25-4D	8.83	351	NA
SB25-6	4.56	7.0	NA
SB26-2	11.50	30.1	0.125
SB26-4	10.10	3.0	NA
SB26-6	11.60	25.4	NA
SB27-2	11.10	19.8	0.196
SB27-4	10.90	4.0	NA
SB27-6	7.37	3.5	NA
SB28-2	6.78	5,840	113
SB28-4	7.20	3,330	NA
SB29-2	6.59	723	NA
SB29-2D	6.56	556	NA
SB29-4	6.90	238	NA
SB29-6	7.46	127	NA
SB30-2	6.45	413	NA
SB30-4	7.04	163	NA
SB30-6	7.84	57.2	NA
SB31-2	8.11	2,330	NA
SB31-2D	8.17	1,980	NA
SB32-2	7.75	31.4	NA
SB33-2	9.63	123	NA

TABLE 1-1
SUMMARY OF SOIL ANALYTICAL RESULTS - LEAD
BUILDING 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT
PAGE FOUR

Boring No./ Depth (Ft)	pH	Soil Concentration[1] (mg/kg)	TCLP Leachate Concentration[2] (mg/L)
SURFACE SOIL			
SO01-1	NA	4,640	NA
SO02-1	NA	2,030	NA
SO03-1	NA	2,290	NA
SO03-1D	NA	2,300	NA

1 Soil concentrations that exceed 500 mg/kg (the recommended EPA cleanup level) are shaded in the table.

2 TCLP lead concentrations of 5.0 mg/L or greater are classified as hazardous waste under RCRA (40 CFR Part 261.24) and are shaded in the table.

J Estimated value
D Duplicate sample
ND Not detected at detection limit shown in parentheses
NA Not analyzed

TABLE 1-2

SUMMARY OF INORGANIC ANALYTICAL RESULTS - SOIL (mg/kg)
BUILDING 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT

Analyte	Average Eastern U.S. Soils[1]	Site-Specific Background[2]	Boring Number/Depth (Feet)								
			SB02-2	SB02-4	SB02-4D	SB05-2	SB14-2	SB18-4	SB18-6	SB22-6	SB28-2
Aluminum	57,000	21,100	NA	9,260	9,240	NA	8,790	10,800	NA	7,220	NA
Antimony	0.76	ND	NA	10.4	8.4	NA	ND (5.2)	5.4	NA	ND (3.6)	NA
Arsenic	7.4	4.60	5.0J	3.0	2.8	4.8J	2.2	1.3	2.5J	1.6	4.6J
Barium	420	69.1	57.5J	55.6	55.8	37.1	43.8	52.9	46.5	37.9	35.8
Beryllium	0.85	1.00	NA	0.32	0.34	NA	0.38	0.36	NA	ND (0.22)	NA
Cadmium	NA	4.54	ND (0.46)	1.4	0.48	ND (0.43)	0.46	ND (0.69)	ND (0.43)	ND (0.67)	ND (0.42)
Calcium	6,300	1,190	NA	3,090	7,390	NA	2,500	3,060	NA	13,800	NA
Chromium	52	25.3	11.9	14.9	15.3	12.4	16.9	14.7	12.5	10.5	11.5
Cobalt	9.2	12.5	NA	5.7	5.9	NA	5.0	4.1	NA	3.7	NA
Copper	22	34.5	NA	36.6	33.2	NA	12.0	65.6	NA	12.4	NA
Iron	25,000	20,500	NA	10,500	9,990	NA	9,440	12,500	NA	7,560	NA
Lead	17	19.3	5,680	3,160	2,720	460	3.1	53.9	689	32.6	8,840
Magnesium	4,600	5,620	NA	2,790	2,670	NA	3,260	3,310	NA	2,660	NA
Manganese	640	245	NA	192	175	NA	155	188	NA	158	NA
Mercury	0.12	0.039	0.45J	0.35	0.56	ND (0.11)	ND (0.11)	0.13	ND (0.11)	ND (0.11)	0.12J
Nickel	18	21.1	NA	9.9	10.3	NA	13.4	11.2	NA	5.2	NA
Potassium	12,000	3,045	NA	2,080	1,870	NA	2,130	958	NA	1,280	NA
Silver	NA	ND	ND (0.85)	ND (0.86)	ND (0.89)	ND (0.85)	ND (1.7)	2.5	ND (0.86)	1.7	ND (0.85)
Sodium	7,800	142	NA	644	886	NA	474	269	NA	530	NA
Vanadium	66	42.3	NA	20.3	19.8	NA	18.9	26.2	NA	14.7	NA
Zinc	52	83.6	NA	848	184	NA	20.4	24.1	NA	49.9	NA

1 Shacklette and Boerngen

2 Preliminary upper tolerance limit values from Atlantic Environmental Services Investigation (September 1993)

J Estimated value

ND Not detected at detection limit shown in parenthese

NA Not analyzed

(shaded) Values that exceed site-specific background.

TABLE 1-3

SUMMARY OF ORGANIC ANALYTICAL RESULTS - SOIL (µg/kg)
BUILDING 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT

Analyte	SB02-4	SB02-4D	SB14-2	SB18-4	SB22-6
Acetone	ND (120)	ND (55)	130	83	84
2-Butanone	7 J	2 J	ND (11)	ND (10)	ND (12)
4-Methyl-2-pentanone	ND (10)	ND (11)	ND (11)	1 J	ND (12)
Benzene	0.4 J	ND (11)	ND (11)	ND (10)	ND (12)
Toluene	ND (10)	ND (11)	ND (11)	1 J	0.8 J
Ethylbenzene	2 J	2 J	ND (11)	ND (10)	ND (12)
Xylenes	15 J	9 J	ND (11)	11	1 J
Tetrachloroethene	5 J	3 J	ND (11)	2 J	1 J
1,1-Dichloroethene	3 J	0.6 J	ND (11)	ND (10)	ND (12)
1,1,1-Trichloroethane	0.8 J	ND (11)	ND (11)	4 J	6 J
Methylene chloride	39 J	9 J	4 J	5 J	3 J
1,2,4-Trichlorobenzene	31 J	ND (350)	ND (360)	ND (340)	ND (380)
2,4-Dinitrotoluene	22 J	ND (350)	ND (360)	ND (340)	ND (380)
2-Chlorophenol	47 J	ND (350)	ND (360)	ND (340)	ND (380)
4-Chloro-3-methylphenol	45 J	ND (350)	ND (360)	ND (340)	ND (380)
Pentachlorophenol	60 J	ND (850)	ND (880)	ND (830)	ND (930)
Bis(2-ethylhexyl)phthalate	ND (350)	ND (350)	160 J	150 J	260 J
Di-n-octylphthalate	ND (350)	ND (350)	ND (360)	18 J	ND (380)
Di-n-butylphthalate	ND (350)	ND (350)	ND (360)	19 J	20 J
Acenaphthene	54 J	120 J	ND (360)	ND (340)	ND (380)
Acenaphthylene	ND (350)	22 J	ND (360)	ND (340)	ND (380)
Anthracene	100 J	280 J	ND (360)	ND (340)	34 J
Benzo(a)anthracene	260 J	530 J	ND (360)	ND (340)	21 J
Benzo(b)fluoranthene	360 J	560 J	ND (360)	ND (340)	ND (380)
Benzo(k)fluoranthene	310 J	510 J	ND (360)	ND (340)	ND (380)
Benzo(g,h,i)perylene	88 J	120 J	ND (360)	ND (340)	ND (380)
Benzo(a)pyrene	250 J	460 J	ND (360)	ND (340)	ND (380)
Chrysene	330 J	610 J	ND (360)	ND (340)	26 J
Dibenz(a,h)anthracene	58 J	96 J	ND (360)	ND (340)	ND (380)
Fluoranthene	720 J	1,400 J	ND (360)	ND (340)	89 J
Fluorene	26 J	92 J	ND (360)	ND (340)	ND (380)
Indeno(1,2,3-cd)pyrene	160 J	290 J	ND (360)	ND (340)	ND (380)
2-Methylnaphthalene	23 J	42 J	ND (360)	ND (340)	ND (380)
Phenanthrene	410 J	1,000 J	ND (360)	ND (340)	140 J
Pyrene	700 J	1,500 J	ND (360)	ND (340)	61 J
Carbazole	56 J	160 J	ND (360)	ND (340)	ND (380)
Dibenzofuran	19 J	66 J	ND (360)	ND (340)	38 J
Dieldrin	ND (3.5)	ND (3.5)	ND (3.6)	75	ND (3.8)
4,4'-DDT	6.21	4.8 J	ND (360)	ND (3.4)	ND (3.8)

J Estimated value
D Duplicate sample
ND Not detected at detection limit shown in parentheses.

TABLE 1-4

SUMMARY OF INORGANIC ANALYTICAL RESULTS - GROUNDWATER (ug/L)
BUILDING 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT

Analyte	GW01				GW02					GW03				GW04				Background			Maximum Contaminant Level/Goal
	Total			Dissolved	Total			Dissolved		Total		Dissolved		Total		Dissolved		Total		Dissolved	
	Round 1	Round 1 Dup.	Round 2	Round 2	Round 1	Round 2	Round 2 Dup.	Round 2	Round 2 Dup.	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 2	
Aluminum	25,000J	14,800J	NA	NA	75,000J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	15,000J	NA	NA	50-200²
Arsenic	8.3 J	5.1 J	6.8	ND (2.0)	2.7 J	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	3.3	2.4	1.7	ND (2.0)	2.7	2.1	1.2	ND (2.0)	1.8 J	ND (2.0)	ND (2.0)	50/---
Barium	114	69.7	94.1	21.8	609	325	368	24.0	24.0	84.4	106	36.6	44.3	41.8	43.7	18.2	22.2	730	835	64.9	2,000/2,000
Beryllium	1.4	ND (1.0)	NA	NA	6.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.2	NA	NA	1/0
Cadmium	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	4.8	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	5/5
Calcium	9,350	8,760	NA	NA	27,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14,800	NA	NA	---
Chromium	27.0	12.1	26.2	ND (6.0)	78.0	39.0	30.2	ND (6.0)	ND (6.0)	9.8	14.7	ND (6.0)	ND (6.0)	7.4	9.8	ND (6.0)	ND (6.0)	79.4	91.4	ND (6.0)	100/100
Cobalt	9.6	ND (6.0)	NA	NA	47.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	25.2	NA	NA	---
Copper	58.1	35.7	NA	NA	142	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	129	NA	NA	1,300
Iron	17,600J	11,400J	NA	NA	62,200J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	27,400J	NA	NA	300²
Lead	73.4 J	47.5 J	41.6	1.1	392 J	220	216	ND (1.0)	1.0	312	136	7.3	2.2	199	84.0	ND (2.0)	1.2	19.2 J	18.0	ND (1.0)	15¹
Magnesium	4,440	3,130	NA	NA	17,200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6,210	NA	NA	---
Manganese	454	391	NA	NA	3,890	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2,200	NA	NA	50²
Mercury	0.36 J	0.32 J	0.3	ND (0.2)	1.2 J	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.2)	8.9	ND (0.2)	ND (0.2)	ND (0.2)	0.21 J	ND (0.2)	ND (0.2)	2/2
Nickel	90.9	38.4	NA	NA	133	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	36.9	NA	NA	100/100
Potassium	5,570	4,970	NA	NA	11,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7,210	NA	NA	---
Silver	ND (3.0)	ND (2.0)	2.0	ND (2.0)	ND (7.6)	4.2	2.9	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	ND (3.6)	3.9	ND (2.0)	100²
Sodium	28,800J	28,200J	NA	NA	47,900J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	22,400J	NA	NA	---
Vanadium	36.0	21.8	NA	NA	87.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	19.8	NA	NA	---
Zinc	141 J	93.2 J	NA	NA	338 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	161 J	NA	NA	5,000²

1 Action level.
2 Secondary MCL.
--- Not available.
J Estimated value.
NA Not analyzed.
ND Not detected at detection limit shown in parentheses.
[shaded] Values that exceed MCLs.

Five groundwater wells were sampled during two rounds for total and dissolved metals. Dissolved analysis required the samples to be field filtered through a 0.45 micron filter immediately after sampling. Two well points and one background monitoring well were analyzed for the full Target Compound List (TCL) and the full Target Analyte List (TAL) plus cyanide during the first round of groundwater sampling (note that these samples were unfiltered.) The two remaining well points were analyzed for Appendix VII metals during the first round of sampling and all five well were analyzed for Appendix VII metals during the second round.

Building 31 is approximately 76 feet x 140 feet and is supported by both timber piles which are approximately 7 feet below the ground surface and by grade beams which are approximately 3 feet below the ground surface. Any excavation of contaminated soils near the footings must be supported through the use of sheet piling or other approved measures to ensure the structural integrity of Building 31.

1.2 OBJECTIVE AND SAMPLING STRATEGY

The objective of the work described in this Field Verification Sampling Plan is to ensure that the action levels established for the performance of the remedial work are met. The data will be used to document both that all soil above 500 mg/kg has been excavated and that any soil which is placed back into the excavation has Toxic Characteristic Leaching Procedures (TCLP) lead extract concentrations of 5 mg/L or less. In addition, wipe sampling and analysis of debris will be performed to ensure that any debris which is disposed offsite meets the treatment standards for land disposal restrictions.

1.3 PLAN FORMAT

Section 1.0 of this Field Verification Sampling Plan contains an Introduction and Background Information. Section 2.0 describe the Procedures and Methods that will be used to implement the field work. Section 3.0 contains the Site-specific Sampling Plan. Sections 4.0 and 5.0 address Field Measurements and Record Keeping. The Site Management Plan is included in Section 6.0. Forms for Field Activities, Standard Operating Procedures, Health and Safety Plan, and Quality Assurance Project Plan are included in the appendices.

2.0 FIELD OPERATIONS

The remedial work to be performed at Building 31 will consist of removing the existing concrete floor, excavation of contaminated soils containing lead above 500 mg/kg, onsite and offsite solidification/treatment of the contaminated soils, onsite and offsite disposal of the treated soils, and offsite disposal of miscellaneous debris and decontamination residues. Sampling and analysis will be performed to support this in order to ensure that the established action levels are achieved and that the disposed materials meet disposal requirements. The exact number of samples to be taken cannot be accurately projected at this time because the number is dependant on the volume of materials removed and treated. However, an estimation is as follows:

TABLE 2-1

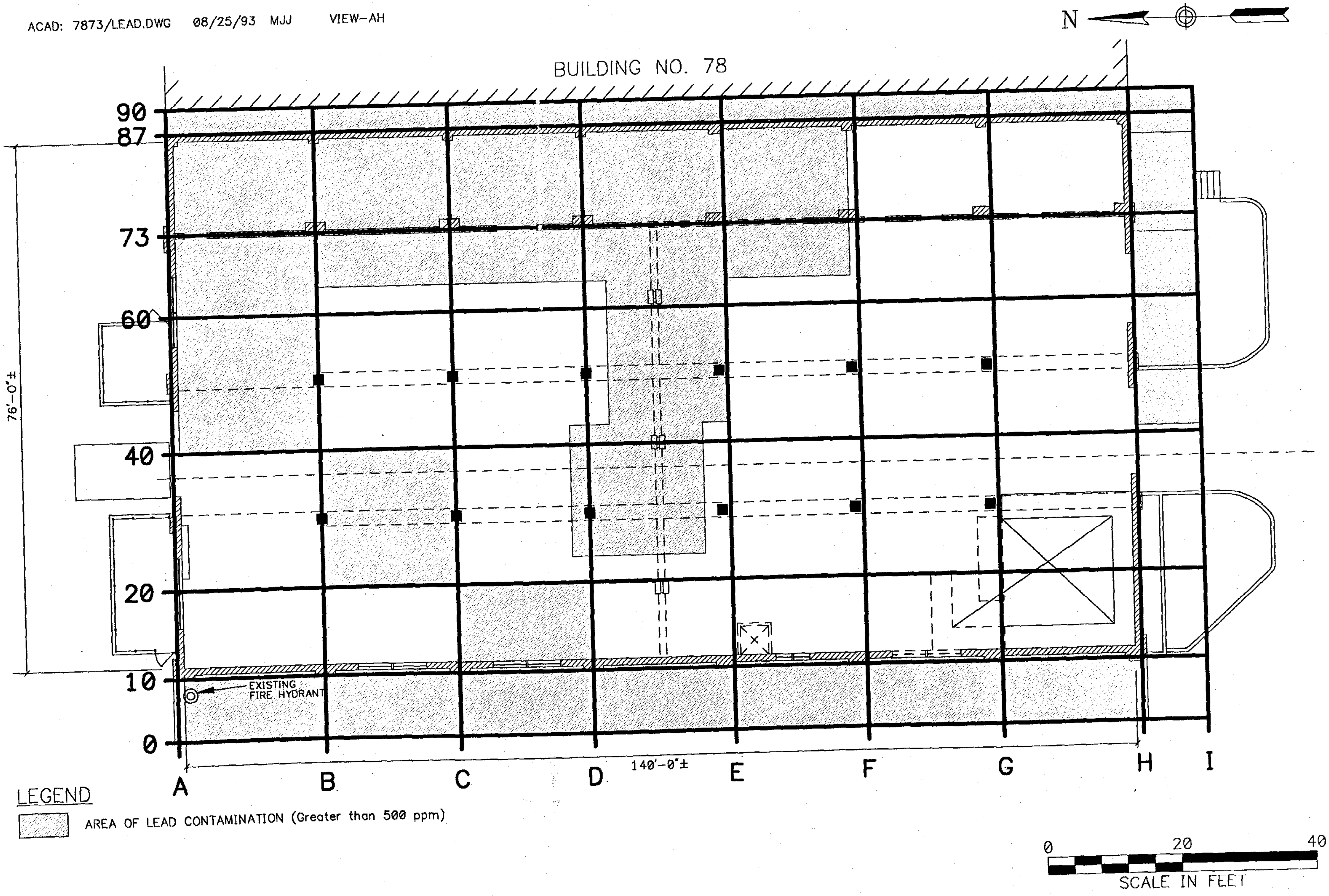
SUMMARY OF SAMPLING

Material to be Sampled	Estimated Material Quantity	Sampling Frequency	Number of Samples
Excavation Testing	34 floor grids and 1,500 feet of sidewall	1 per floor of grid or 400 square feet of floor and 1 per 20 linear feet of sidewall	109 total samples
Treated Soil Testing	974 cubic yards	1 per 20 cubic yards or per batch, whichever is more frequent	49 total samples
Debris Wipe Samples	280 cubic yards of floor and 286 linear feet of railroad track	1 per 5 cubic yard of floor and 1 per 50 linear feet of track	62 total samples

Details of the sampling and analysis program are presented in Section 3.0. The proposed excavation and sampling grid is shown on Figure 2-1.

2.1 MOBILIZATION/DEMOBILIZATION

Following approval of this FVSP, Halliburton NUS will complete laboratory specifications, obtain laboratory subcontractors, and prepare for mobilization. All Halliburton NUS field team members will review this FVSP



R-07-93-2

2-2

FIGURE 2-1

PROPOSED SAMPLING GRID LAYOUT
BUILDING No. 31
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CT.

Halliburton NUS CORPORATION

including the Health and Safety Plan (HASP) and Quality Assurance Project Plan (QAPP) contained in the appendices. In addition, a Halliburton NUS field team orientation meeting will be held to familiarize personnel with the scope of the field activities.

The Halliburton NUS Field Operations Leader (FOL) will also make arrangements for all equipment required to conduct the field verification sampling. The equipment required for the field activities will be packed in Pittsburgh, Pennsylvania, our warehouse location, and shipped to the SUBASE. It is anticipated that more than one shipment will be necessary due to the extended nature of the field effort. After field activities are completed, the FOL will demobilize the equipment and ship it back to the Pittsburgh warehouse.

2.2 EXCAVATION TESTING

Prior to the start of excavation the Halliburton NUS FOL will discuss with the contractor how areas of excavation will be delineated. The Halliburton NUS FOL will then assign a grid system for sampling which has lines running North-South (designated by letters) and East-West (designated by numbers). No grid will be larger than 20 feet by 20 feet. Soil samples will be collected from each excavation when the initial limits of excavation are reached as determined by the Contract Drawings, and following each additional excavation which may be necessary. Samples will be taken from the bottom and the sidewalls of the excavations at the following frequencies:

- 1 excavation bottom sample per grid or per 400 square feet of floor area, whichever is more frequent. Each sample will be a composite of 5 grab samples taken from the center and in each corner of the bottom of the excavated area.

- 1 excavation sidewall sample per 20 linear feet of sidewall. Each sample will be a composite of 3 grab samples taken from the center and each end of the sidewall, within 12 inches of the top of the excavation.

Sampling will be performed using Halliburton NUS Standard Operating Procedure (SOP) SA-1.3, which is contained in Appendix B. If the use of a backhoe is needed to obtain samples due to the depth of the excavation, the bucket must be decontaminated prior to its use in other locations to prevent cross contamination of the verification samples.

During sampling, observations will be made on the depth of the excavation and any circumstances which may have affected excavation (e.g., groundwater was encountered) and this information will be recorded on test pit logs. Also sampling information including location, depth, time, and description will be recorded on sample log sheets. A copy of these forms are included in Appendix A.

2.3 TREATED SOIL TESTING

Following notification by the Contractor that the treated soil has cured for the amount of time specified in his Solidification Work Plan, samples of the treated material will be collected from every 20 cubic yards of treated material or from every batch, whichever is more frequent. Samples will consist of 3 grab samples from distinct locations within the batch or quantity which are composited onsite to make one sample.

Sample information including location, batch number, time, and description will be recorded on sample log sheets. A copy of these form is included in Appendix A.

Sampling will be performed using Halliburton NUS SOP GH-1.3, which is contained in Appendix B.

2.4 WIPE SAMPLING

A total of 62 wipe samples are proposed to be taken following cleaning of the demolished concrete floor and railroad tracks within Building 31. The purpose of the samples is to ensure that no detectable lead contamination exists on the debris prior to its disposal offsite. Samples will be taken following cleaning of the concrete and railroad tracks at a frequency of 1 sample per 5 cubic yards of concrete and 1 sample per 50 linear feet of railroad track. Sampling will be performed using Halliburton NUS Standard Operating Procedure (SOP) SA-1.4, which is contained in Appendix B. This method is modified as follows:

- The sample vials will come prepared from the laboratory with the glass fiber filter and solvent (distilled/deionized water) sealed within.

- Sample the bottom of the concrete slab where it is apparent. Otherwise, sample the largest surface area available.

2.5 EQUIPMENT DECONTAMINATION

The equipment involved in field sampling activities will be decontaminated prior to and during sampling activities. This equipment includes sampling trowels, augers, mixing bowls, and sampling equipment, including the Contractor's backhoe buckets if used. Personal decontamination is addressed in the Health and Safety Plan.

2.5.1 Contractor's Backhoe

These decontamination operations will consist of washing the backhoe bucket using a high-pressure steam wash. All decontamination activities will take place at the Contractor's decontamination area. It is assumed that the Contractor will provide for decontamination of the backhoe bucket.

2.5.2 Sampling Equipment

All direct contact sampling equipment will be decontaminated both prior to beginning field sampling and between samples. The following decontamination steps will be taken:

- Potable water rinse
- Alconox or Liquinox detergent wash
- Potable water rinse
- Nitric acid rinse[a]
- Analyte-free water rinse
- Air dry

2.6 WASTE HANDLING

All disposable sampling and personal protective equipment will be placed in containers, provided onsite by the Contractor. It is assumed that the Contractor will provide for the disposal for the waste.

[a] Not required for stainless steel equipment.

3.0 ENVIRONMENTAL SAMPLING

3.1 SAMPLE ANALYSIS SUMMARY

Samples collected at the site will be submitted for the laboratory analyses presented in Tables 3-1 and 3-2. These tables indicate the analytical parameters, preservation methods, holding times, bottle requirements, and analytical methods for each sample.

3.2 SAMPLING PROCEDURES

All sampling will be performed in accordance with the procedures outlined in Chapter 2 of the FVSP.

3.3 SAMPLE HANDLING

Sample handling includes the field-related considerations concerning the selection of sample containers, preservatives, allowable holding times and analyses requested. In addition, sample identification, packaging and shipping will be addressed.

The EPA User's Guide to the Contract Laboratory Program (EPA, December 1986), and the Federal Register (EPA, October 26, 1984) address the topics of containers and sample preservations. Table 3-2 provides a summary of these sample handling considerations.

3.3.1 Sampling Identification System

Each sample collected will be assigned a unique sample tracking number. The sample tracking number will consist of a three-segment, alpha-numeric code that identifies the sample medium and location, sample depth (in the case of soil samples), and QA designation, if required.

Any other pertinent information regarding sample identification will be recorded in the field log books.

TABLE 3-1

ANALYTICAL PROGRAM SUMMARY
FIELD VERIFICATION SAMPLES
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT

Parameter	Method	Sample Type	No. of Samples	Equipment Rinsate[2]	Field Blanks[3]	Duplicates[4]	Total Samples
Lead	CLP Protocol[5] (3/90)	Wipe Sample	56	0	0	6	62
Lead	CLP Protocol (3/90)	Soil	109	20	10	11	130
TCLP (lead)[1]	SW 1311 SW 6010	Treated Soil	49	0	0	0	49

[1] TCLP = Toxicity Characteristics Leaching Procedure, Lead.

[2] Equipment Blank - Samples obtained by pouring analyte-free water over sample collection equipment (bailer, etc.) after decontamination. Assesses the effectiveness of field decontamination procedure. Obtained at a frequency of 1/day/media/analysis but analyzed every other day unless positive detection are recorded. Number of samples reflects the number of actual laboratory analyses performed.

[3] Field Blank - Samples consisting of the source water used in (1) steam cleaning and/or (2) decontamination. Obtained at a frequency of 1/event/media.

[4] Duplicates - A single sample split into two portions during a single act of sampling. Assess the overall precision of the sampling and analysis program. Obtained at a frequency of 10% of the number of samples.

[5] Wipe Sample Preparation: Entire sample is subjected to ultrasonic extraction using a modified 40 CFR, Chapter 1, Part 50, Appendix G procedure. This extraction process results in formation of an extract comparable in nature and volume to that generated by CLP SOW procedures.

TABLE 3-2

SUMMARY OF ANALYSIS, BOTTLE REQUIREMENTS, PRESERVATION REQUIREMENTS, AND HOLDING TIMES NAVAL SUBMARINE BASE - NEW LONDON GROTON, CONNECTICUT

Media	Analysis	Number of Samples	No. of Containers Per Sample	Container Type	Preservation Requirements	Holding Times
Wipe Sample	Lead (total recoverable)	62	1	40 mL clear glass	Cool to 4°C	6 months
Soil	Lead (total recoverable)	130	1	8 oz. amber glass, wide-mouth	Cool to 4°C	6 months
Treated Soil	TCLP (lead)	49	1	32 oz. amber glass, wide-mouth	Cool to 4°C	6 months

The alpha-numeric coding to be used in the sample system is explained in the diagram and the subsequent definitions:

(Medium & location)	-	(Sample identifier)	-	(QA designation)
4 symbols	-	4 symbols	-	1 symbol

Medium:

WS	=	Wipe sample
EX	=	Excavation sample
TS	=	Treated soil sample

Sample Location:

Wipe sample = sample number (01, 02, etc.), consecutive for the entire job.

Excavation sample = sample identifier:

NW = north wall
EW = east wall
SW = south wall
WW = west wall
BE = bottom of excavation

Treated soil sample = 2-digit batch number as identified by the Contractor.

Sample Identifier:

Identify wipe samples and treated soil samples by the date they were taken using the month and day. For months or days with a single digit insert a "0" prior to that number (e.g., July 14 = 0714, or November 4 = 1104).

Identify the excavation samples by a grid location number which uses letters for the lines which run North-South, and numbers for the lines which run East-West (e.g., A002).

QA Sample Designation:

D = Duplicate (Soil/Groundwater)
B = Equipment Rinsate Blank
F = Field Blank

For example, if the 13th wipe sample was collected on November 4, 1993, the sample number would be designated as:

WS13-1104

An excavation sample taken from the east wall of grid C4 would be designated as:

EXEW - C004

A treated soil sample taken from batch 13 on July 13, 1993 would be designated as:

TS13 - 0713

All QC samples will assigned a sequential sample number. A designation which blinds the sample's QC identity will be used for all field duplicates. The field duplicate (D) matrix spike (MS) and matrix spike duplicate (MSD) samples will be collected from the same station.

Information regarding sample labels and tags to be attached before shipment to a laboratory is contained in Section 5.2 of the Halliburton NUS SOP SA-6.1 (see Appendix B).

3.3.2 Sample Packaging and Shipping

Samples will be packaged and shipped in accordance with Halliburton NUS SOP SA-6.2 (see Appendix B). The FOL will be responsible for completion of the following forms:

- Sample Labels
- Chain-of-Custody Forms
- Appropriate labels applied to shipping coolers

- Chain-of-Custody Labels
- Federal Express Air Bills

3.4 SAMPLE CUSTODY

Custody of samples must be maintained and documented at all times. Chain-of-custody begins with the collection of the samples in the field. Section 5.3 of Halliburton NUS SOP SA-6.1 (see Appendix B) provides a description of the chain-of-custody procedures to be followed. A sample chain-of-custody form is attached in Appendix A.

3.5 QUALITY CONTROL SAMPLES

In addition to regular calibration of field equipment and appropriate documentation, quality control (QC) samples will be collected or generated during environmental sampling activities. QC samples include field duplicates, field blanks, and equipment rinsate blanks. Trip blanks will be provided by the analytical laboratory. Additional laboratory QA/QC sample analyses (such as laboratory duplicate and matrix spike analyses are discussed further in Appendix D. Table 3-1 presents the type and number of required QC samples. Each type of field QC sample is defined as follows:

- Field Duplicates - Field duplicates are two samples collected (1) independently at a sampling location in the case of groundwater or (2) a single sample split into two portions in the case of soil. Duplicates are obtained during a single act of sampling and are used to assess the overall precision of the sampling and analysis program. Ten percent of all samples for each media shall be field duplicates. Duplicates shall be analyzed for the same parameters in the laboratory.

- Equipment Rinsate Blanks - Equipment rinsate blanks are obtained under representative field conditions by running analyte-free water through sample collection equipment (bailer, split spoon, corer, etc.) after decontamination and placing it in the appropriate sample containers for analysis. Equipment blanks will be used to assess the effectiveness of decontamination procedures. Equipment blanks will be collected for each type of non-dedicated sampling equipment used and will be submitted at a frequency of one per day per media. Equipment blanks however from only every other day will be analyzed. Equipment blanks not slated for analysis will be marked "hold" on the chain-of-custody reports. Those not analyzed will be retained by the laboratory until completion of field activities. It will be the responsibility of the FOL to communicate to the laboratory whether an equipment blank is, or is not, to be analyzed as stated above.

- Field Blanks - Field blanks are obtained by sampling the water(s) used for decontamination during the field investigation. Samples consist of the source water used in (1) steam cleaning of large equipment and (2) analyte-free water used for decontamination of sampling equipment. Field blanks will be used to confirm the effectiveness of decontamination procedures, and to determine if the analyte-free water or the potable water (used for steam cleaning) may be contributing to sample contamination. Field blanks will be collected for each type of water used for decontamination and will be submitted at a frequency of one per sampling event per media.

4.0 FIELD MEASUREMENTS

It is assumed that no field measurements or monitoring will be taken during performance of the sampling, as a monitoring program will be instituted by the Contractor. However, if monitoring for health and safety is necessary, instruments used in the field will be calibrated according to the procedures described below.

4.1 EQUIPMENT CALIBRATION

Several monitoring instruments which may be used during field activities include:

- HNu photoionization indicator device
- OVA flame ionization indicator device
- Carbon monoxide meter

These instruments will be calibrated daily or according to the manufacturer's operating manual.

Calibration will be documented on an equipment calibration log. A sample calibration log is attached in Appendix A. During calibration, an appropriate maintenance check will be performed on each piece of equipment. If damaged or defective parts are identified during the maintenance check and it is determined that the damage could have an impact on the instrument's performance, the instrument will be removed from service until the defective parts are repaired or replaced.

4.2 EQUIPMENT MAINTENANCE

Measuring equipment used in environmental monitoring or analysis and test equipment used for calibration and maintenance shall be controlled by established procedures. Measuring equipment shall have an initial calibration and shall be recalibrated at scheduled intervals against certified standards. Equipment will be calibrated periodically.

Halliburton NUS maintains a large inventory of sampling and measurement equipment. In the event that failed equipment cannot be repaired, replacement equipment will be shipped to the site by overnight express carrier to minimize downtime.

5.0 RECORD KEEPING

In addition to chain-of-custody records, certain standard forms will be completed for sample description and documentation. These shall include sample log sheets, excavation logs, and logbooks. These forms are attached in Appendix A.

A bound/weatherproof field notebook shall be maintained by the field operations leader (FOL). All information related to sampling or field activities will be recorded in the field notebook. This information will include, but is not limited to, sampling time, weather conditions, unusual events, field measurements, descriptions of photographs, etc.

A bound/weatherproof site logbook shall be maintained by the FOL. The requirements of the site logbook are outlined in Halliburton NUS SOP SA-6.3 (see Appendix B) Section 5 and 7. This book will contain a summary of the day's activities and will reference the field notebooks when applicable.

At the completion of field activities, the FOL shall submit to the Halliburton NUS Project Manager all field records, data, field notebooks, logbooks, chain-of-custody receipts, sample log sheet, drilling logs, daily logs, etc.

6.0 SITE MANAGEMENT

6.1 BASE SUPPORT

The CLEAN Remedial Project Manager (RPM) is

Mark Krivansky
Northern Division
Naval Facilities Engineering Command
Code 1823
10 Industrial Highway
Lester, Pennsylvania 19113-2090
(215) 595-0567

The CLEAN Remedial Design Manager is

James Briggs
Northern Division
Naval Facilities Engineering Command
Code 405
10 Industrial Highway
Lester, Pennsylvania 19113-2090
(215) 595-0590

The NSB-NLON Point of Contact is:

Lt. Commander Mark Whitson
Officer in Charge, NAVFACENGCOM, Contracts
New London Resident Office
Building 135
Box 26
Naval Submarine Base, New London
Groton, Connecticut 06349-5100
(203) 449-3536

The remedial contractor remains to be selected.

Throughout the duration of the remedial work, the Navy will provide support as described below:

- Provide field office space for Halliburton NUS personnel assigned to the verification sampling task.

- Provide storage for Halliburton NUS sampling and personal protective equipment.

- Dispose of all waste generated as a result of the sampling activities in accordance with applicable state and Federal regulations.

- Provide decontamination facilities for Halliburton NUS personnel and equipment.

6.2 CONTINGENCY PLAN

In the event of problems which may be encountered during the sampling activities, the Halliburton NUS Project Manager will be notified immediately, followed by the NSB-NLON Point of Contact. The Halliburton NUS Project Manager will determine a course of action so as to not interfere with the schedule or budget. All contingency plans will be approved by the NSB-NLON point of Contact and the Clean RPM before being enacted.

APPENDIX A

FORMS

TEST PIT LOG **HALLIBURTON NUS**

PROJECT: .... TEST PIT NO.: ....

PROJECT NO.: .... DATE: ....

LOCATION: ....

FIELD GEOLOGIST: ....

DEPTH (ft.)	LITHOLOGY CHANGE (Depth,ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS

Test Pit Cross Section and / or Plan View

REMARKS ....

....

....

....

PHOTO LOG .... TEST PIT ....

....

....

.... PAGE .... OF ....

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

- ☐ Surface Soil
- ☐ Subsurface Soil
- ☐ Sediment
- ☐ Lagoon / Pond
- ☐ Other ________

Page _____ of _____

Case # ____________

By ____________

Project Site Name ______________________ Project Site Number ______________

NUS Source No. ____________________ Source Location ____________________

Sample Method:	Composite Sample Data		
	Sample	Time	Color / Description
Depth Sampled:			
Sample Date & Time:			
Sampled By:			
Signature(s):			
Type of Sample ☐ Low Concentration ☐ High Concentration ☐ Grab ☐ Composite ☐ Grab - Composite			

Sample Data	
Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)

Analysis:	Observations / Notes

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

HALLIBURTON NUS Environmental Corporation and Subsidiaries

CHAIN OF CUSTODY RECORD

PROJECT NO.:	SITE NAME:
SAMPLERS (SIGNATURE):	

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CON-TAINERS							REMARKS

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS:	

NUS 440 REVISED 0891

HALLIBURTON NUS
Environmental Corporation

EQUIPMENT CALIBRATION LOG

Instrument (Name/Model No./Serial No.): ______________________

Manufacturer ______________________ Date Purchased ______________

Calibration Date	Initial Settings	Standard/Gas Used	Procedure	Adjustments Made	Final Settings	Signature	Comments

DAILY ACTIVITIES RECORD - FIELD INVESTIGATION

HALLIBURTON NUS

PROJECT NAME: ____________________ PROJECT NO.: ________
CLIENT: ____________________ LOCATION: ____________________
DATE: ____________ ARRIVAL TIME: ________ DEPARTURE TIME: ________
CONTRACTOR: ____________________ DRILLER: ____________________
BORING NO.: ____________ NUS REPRESENTATIVE: ____________________

ITEM (1)	ORIGINAL QUANTITY (2) ESTIMATE	QUANTITY (2) TODAY	PREVIOUS TOTAL (2) QUANTITY	CUMULATIVE QUANTITY (2) TO DATE

COMMENTS: ____________________

(1) AS LISTED IN SPECS
(2) INCLUDE QUANTITY AND UNITS
(Ex. 20 ft., 6 hrs.)

APPROVED BY:

____
NUS FIELD REPRESENTATIVE

____
DRILLER OR REPRESENTATIVE

APPENDIX B

STANDARD OPERATING PROCEDURES

B.1 Procedure No. GH-1.3, Sec. 5.0: Soil and Rock Sampling
B.2 Procedure No. SA-1.3, Sec. 5.0: Soil Sampling in Test Pits and Trenches
B.3 Procedure No. SA-1.4, Sec. 5.0: Wipe Sampling
B.4 Procedure No. SA-6.1, Sec. 5.0: Sample Identification & Chain-of-Custody
B.5 Procedure No. SA-6.2, Sec. 5.0: Sample Packaging and Shipping
B.6 Procedure No. SA-6.3, Sec. 5.0: Site Logbook

APPENDIX B.1

PROCEDURE NO. GH-1.3, SECTION 5.0: SOIL AND ROCK SAMPLING

sun at all times. Ship samples protected with suitable resilient packing material to reduce shock, vibration, and disturbance.

Thin-walled undisturbed tube samplers are restricted in their usage by the consistency of the soil to be sampled. Often, very loose and/or wet samples cannot be retrieved by the samplers, and soils with a consistency in excess of very stiff cannot be penetrated by the sampler. Devices such as Denison or Pitcher core samplers can be used to obtain undisturbed samples of stiff soils. Using these devices normally increases sampling costs and therefore their use shall be weighed against the increased cost and the need for an undisturbed sample. In any case, if a sample cannot be obtained with a tube sampler, an attempt shall be made with a split barrel sampler at the same depth so that at least a sample can be obtained for classification purposes.

5.1.4 Continuous Core Soil Samples

The CME continuous sample tube system provides a method of sampling soil continuously during hollow stem augering. The 5-foot sample barrel fits within the lead auger of a hollow auger column. The samplng system can be used with a wide range of I.D. hollow stem augers (from 3-1/4-inch to 8-1/4-inch I.D.). This method has been used to sample many different materials such as glacial drift, hard clays and shales, mine tailigs, etc. This method is particularly used when SPT samples are not required and a large volume of material is needed. Also, this method is useful when a visual description of the subsurface lithology is required.

5.2 SURFACE SOIL SAMPLES

For loosely packed earth or waste pile samples, stainless steel scoops or trowels can be used to collect representative samples. For densely packed soils or deeper soil samples, a hand or power soil auger may be used.

The following methods are to be used:

- Use a soil auger for deep samples (6 to 24 inches) or a scoop or trowel for surface samples. Remove debris, rocks, twigs, and vegetation before collection of soil. Mark the location with a numbered stake if possible and locate sample points on a sketch of the site.

- Use a new or freshly-decontaminated sampler for each sample taken. Attach a label and identification tag. Record all required information in the field logbook and on the sample log sheet, Chain-of-Custody record, and other required forms.

- Pack and ship accordingly.

- When a representative composited sample is to be prepared (e.g., samples taken from a gridded area or from several different depths), it is best to composite individual samples in the laboratory where they can be more precisely composited on a weight or volume basis. If this is not possible, the individual samples (all of equal volume, i.e., the sample bottles shall be full) shall be placed in a decontaminated stainless steel bucket, mixed thoroughly using a stainless steel spatula or trowel, and a composite sample collected.

5.3 WASTE PILE SAMPLES

The use of stainless steel scoops or trowels to obtain small discrete samples of homogeneous waste piles is usually sufficient for most conditions. Layered (nonhomogeneous) piles require the use of tube samplers to obtain cross-sectional samples.

- Collect small, equal portions of the waste from several points around the pile, penetrating it as far as practical. Use numbered stakes, if possible, to mark the sampling locations and locate sampling points on the site sketch.

- Place the waste sample in a glass container. Attach a label and identification tag. Record all the required information in the field logbook and on the sample log sheet and other required forms.

For layered, nonhomogeneous piles, grain samplers, sampling triers, or waste pile samplers must be used at several representative locations to acquire a cross-section of the pile. The basic steps to obtain each sample are

- Insert a sampler into the pile at a 0- to 45-degree angle from the horizontal to minimize spillage.

- Rotate the sampler once or twice to cut a core of waste material. Rotate the grain sampler inner tube to the open position and then shake the sampler a few times to allow the material to enter the open slits. Move the sampler into position with slots upward (grain sampler closed) and slowly withdraw from the pile.

5.4 ROCK SAMPLING (CORING) (ASTM D2113-83)

Rock coring enables a detailed assessment of borehole conditions to be made, showing precisely all lithologic changes and characteristics. Because coring is an expensive drilling method, it is commonly used for shallow studies of 500 feet or less, or for specific intervals in the drill hole that require detailed logging and/or analyzing. It can, however, proceed for thousands of feet continuously, depending on the size of the drill rig. It yields better quality data than air rotary drilling, although at a substantially reduced drilling rate. Rate of drilling varies widely, depending on the characteristics of lithologies encountered, drilling methods, depth of drilling, and condition of drilling equipment. Average output in a 10-hour day ranges from 40 to over 200 feet. Downhole geophysical logging or television camera monitoring is sometimes used to complement the data generated by coring.

Borehole diameter can be drilled to various sizes, depending on the information needed. Standard sizes of core barrels (showing core diameter) and casing are shown in Attachment No. 1.

Core drilling is used when formations are too hard to be sampled by soil sampling methods and a continuous solid sample is desired. Usually, soil samples are used for overburden, and coring begins in sound bedrock. Casing is set into bedrock before coring begins to prevent loose material from entering the borehole, to prevent loss of drilling fluid, and to prevent cross contamination of aquifers.

APPENDIX B.2

PROCEDURE NO. SA-1.3, SECTION 5.0: SOIL SAMPLING IN TEST PITS AND TRENCHES

1.0 PURPOSE

This procedure describes the method for logging and sampling of test pits and trenches to determine subsurface soil and rock conditions and recover small-volume or bulk samples. The methods apply only to data collection and do not apply to the construction of excavations.

2.0 SCOPE

The procedure is applicable to the collection of bulk and small-volume samples of subsurface soils for laboratory testing which are exposed through excavating at hazardous substance sites.

3.0 GLOSSARY

Test pit or trench - A pit or trench, either machine or manually excavated, from which large quantities of soil may be removed.

4.0 RESPONSIBILITIES

Site Manager - responsible for determining, in consultation with other project personnel (geologist, geochemist), the need for test pits or trenches, their approximate locations, depths and sampling objectives.

Field Operations Leader (FOL) - responsible for finalizing the location, orientation and depth of test pits/trenches based on on-site conditions and the site geologist's advice. The FOL is ultimately responsible for the proper construction, sampling and backfilling of test pits and trenches, including adherence to OSHA regulations.

Health and Safety Officer (HSO) - responsible for air quality monitoring during test pit construction and sampling, to ensure that workers and offsite (downwind) individuals are not exposed to hazardous levels of airborne contaminants. The HSO may also be required to advise the FOL on other safety-related matters regarding the test pit or trench excavation and sampling, such as mitigative measures to address potential hazards from unstable trench walls, puncturing of drums or other hazardous objects, etc.

Site Geologist/Sampler - responsible for recording all information and data on test pit/trench construction and for the proper collection and logging of samples according to this procedure.

5.0 PROCEDURES

5.1 DATA COLLECTION AND SAMPLING

5.1.1 General

Test pits and trenches are usually logged as they are excavated. Records of each test pit/trench will be made on prepared forms or in a field notebook. If the log is made in a field notebook, it will be transcribed to the prepared forms. These records include plan and profile sketches of the test pit/trench showing materials encountered, their depth and distribution in the pit/trench, and sample locations. These records will also include safety and sample screening information.

Requirements for sampling shall be determined by the Site Manager, and shall be documented in the Project Operation Plan (POP). A copy of this plan shall be maintained by the Field Operations Leader. To expedite sampling, the crew shall have sufficient tools and equipment to sample each pit. The tools and equipment must be properly decontaminated prior to use.

Entry of test pits by personnel is extremely dangerous and shall be avoided unless absolutely necessary. Pits more than 4 feet deep must be shored prior to entry, the "buddy" system must be used, and all applicable H&S and OSHA requirements followed.

The final depth and type of samples obtained from each test pit will be determined at the time the test pit is excavated. Sufficient samples are usually obtained and analyzed to quantify contaminant distribution as a function of depth for each test pit. Additional samples of each waste phase and any fluids encountered in each test pit may be collected.

In some cases, samples of soil may be extracted from the test pit for reasons other than waste sampling and chemical analysis, such as to obtain geotechnical information. Such information would include soil types, stratigraphy, strength, etc., and could therefore entail the collection of disturbed (grab or bulk) or relatively undisturbed (hand-carved or pushed/driven) samples, which can be tested for geotechnical properties. The purposes of such explorations are very similar to those of shallow exploratory or test borings, but often test pits offer a faster, more cost-effective method of sampling than borings.

5.1.2 Sampling Equipment

The following equipment is needed for taking samples for chemical or geotechnical analysis from test pits and trenches:

- Backhoe or other excavating machinery.
- Shovels, picks and hand augers, stainless steel trowels.
- Sample container - bucket with locking lid for large samples and glass bottles for chemical or geotechnical analysis samples.
- Polyethylene bags for enclosing sample; buckets.
- Remote sampler consisting of 10-foot sections of steel conduit (1-inch diameter), hose clamps and right angle adapter for conduit (see Attachment A).

5.1.3 Sampling Methods

The methods discussed in this section refer to test pit sampling from grade level. If test pit entry is required, see Section 5.1.4.

- Excavate trench or pit in several depth increments. After each increment the operator will wait while the sampler inspects the test pit from grade level to decide if conditions are appropriate for sampling. (Monitoring of volatiles by the HSO will also be used to evaluate the need for sampling.) Practical depth increments range from 2 to 4 feet.

The backhoe operator, who will have the best view of the test pit, will immediately cease digging if:

- Any fluid phase or groundwater seepage is encountered in the test pit.
- Any drums, other potential waste containers, obstructions or utility lines are encountered.
- Distinct changes of material are encountered.

This action is necessary to permit proper sampling of the test pit and to prevent a breach of safety protocol. Depending upon the conditions encountered, it may be required to excavate more slowly and carefully with the backhoe.

- Remove loose material to the greatest extent possible with backhoe.
- Secure walls of pit if necessary. (There is seldom any need to enter a pit or trench which would justify the expense of shoring the walls. All observations and samples can generally be taken from the ground surface.)
- Samples of the test pit material will be obtained either directly from the backhoe bucket or from the material once it has been deposited on the ground. The sampler or Field Operations Leader directs the backhoe operator to remove material from the selected depth or location within the test pit/trench. The bucket is brought to the surface and moved away from the pit. The sampler and/or HSO then approaches the bucket and monitors its contents with a photoionization (HNU) or OVA meter. The sample is collected from the center of the bucket or pile and placed in sample jars using a clean stainless steel trowel or spatula.
- If a composite sample is desired, several depths or locations within the pit/trench are selected and a bucket is filled from each area. It is preferable to send individual sample bottles filled from each bucket to the laboratory for compositing under the more controlled laboratory conditions. However, if compositing in the field is required, each sample bottle shall be emptied into a mixing container (e.g., stainless steel bucket) and thoroughly stirred prior to being placed into the sample jars. Composite sampling is not appropriate for samples which will undergo analysis for volatile organic compounds.

- Using the remote sampler shown in Attachment A, samples can be taken at the desired depth from the side wall or bottom of the pit. The face of the pit/trench shall first be scraped (using a long-handled shovel or hoe) to remove the smeared zone that has contacted the backhoe bucket. The sample is then collected directly into the sample jar, by scraping with the jar edge, eliminating the need to utilize samplers and minimizing the likelihood of cross-contamination. The sample jar can be capped, removed from the assembly, and packaged for shipment.

- Prepare shipping papers, labels, and chain-of-custody records, as described in SA-6.2, Sample Packaging and Shipping.

5.1.4 In-Pit Sampling

Samples can also be obtained by personnel entering the test pit/trench. This is necessary when soil conditions preclude obtaining suitable samples from the backhoe bucket (e.g., excessive mixing of soils or wastes within the test pit/trench) or when samples from relatively small discrete zones within the test pit are required. This approach may also be necessary to sample any seepage occurring at discrete levels or zones in the test pit that are not accessible with remote samplers.

In general, personnel shall sample and log pits and trenches from the ground surface, except as provided for by the following criteria:

- The project will benefit significantly from the improved quality of the logging and sampling data obtained if personnel enter a pit or trench rather than conduct such operations from the ground surface.

- There is no practical alternative means of obtaining such data.

- The Site Health & Safety Officer determines that such action can be accomplished without breaching site safety protocol. This determination will be based on actual monitoring of the pit/trench after it is dug (including, at a minimum, measurements of volatile organics, explosive gases and available oxygen).

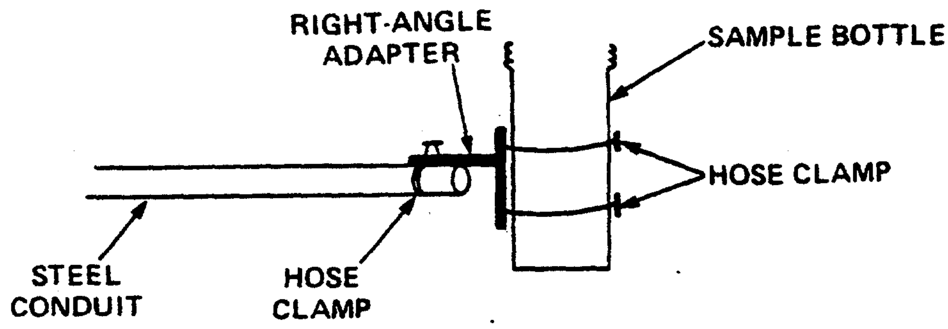
- An experienced geotechnical professional determines that the pit/trench is stable or is made stable prior to entrance of any personnel (by grading the sidewalls or using shoring). OSHA requirements (Reference 1) must be strictly implemented.

If these conditions are satisfied, one person will enter the pit/trench. On potentially hazardous waste sites, this individual will be dressed in safety gear as required by the conditions in the pit, usually Level B. He will be affixed to a safety rope and continuously monitored while in the pit.

A second individual will be fully dressed in protective clothing including a self-contained breathing device and on standby during all pit entry operations. The individual entering the pit will remain therein for as brief a period as practical, commensurate with performance of his work. After removing the smeared zone, samples are obtained with a clean trowel or spoon. As an added precaution, it is advisable to keep the backhoe bucket in the test pit when personnel are working below grade. Such personnel can either stand in or near the bucket while performing sample

ATTACHMENT A
REMOTE SAMPLE HOLDER FOR TEST PIT/TRENCH SAMPLING

REMOTE SAMPLE HOLDER FOR TEST PIT/ TRENCH SAMPLING



APPENDIX B.3

PROCEDURE NO. SA-1.4, SECTION 5.0: WIPE SAMPLING

TCDD analysis requires one full 4 ounce, or one 8 ounce glass jar.

Prior to filling, each sample jar is placed inside a clean plastic baggie held secure with a rubber band. Stainless steel scoops or spoons are used to transfer the homogenized sample to the jar. After filling and capping, the baggie and rubber band are removed, the jar is spray rinsed with 1,1,1-trichloroethane, if visual contamination is present, and the sample jar is placed in a clean baggie. Samples are stored away from light.

5.1.3 Wipe Samples

Wipe samples are often collected to determine the extent of surface contamination. The following procedures will be implemented when collecting wipe samples [redacted]:

- Using clean gloves, preload vials with appropriate filters. The type of filter will depend on the type of analysis to be performed. Glass fiber filters are to be used with HPLC or GC analysis; paper filters are used with any other analysis.

- Prepare a rough drawing of each of the locations to be sampled.

- Withdraw filter from vial. Solvents such as hexane, methanol and isopropyl alcohol are often used to wet the filter before wiping. These also depend on the analysis to be performed. In some cases, distilled, deionized water is used.

- Wipe a 4-square inch (100-square centimeter) area.

- Fold the filter with the exposed area in, fold again, place in vial and cap the vial. It is especially important that the sampler change gloves between samples.

- Include at least one blank filter treated in the same manner, excluding wiping, for each sampled area.

5.2 SAMPLE DOCUMENTATION

In order to track each sample through shipping and analysis, the following documents will be prepared:

- Sample Labels and Identification Tags (One per sample bottle).
- Dioxin Shipment Records: One for each sample shipment (up to 24 samples) to an individual laboratory (see Attachment A).
- Chain-of-Custody Records and Seals.
- Airbills (One for each shipment to an individual laboratory).

In addition, a field log book will be kept by the sampling team leader. The log book will include daily entries describing all site and sampling activities.

5.3 SAMPLE PACKAGING AND SHIPPING

In most cases, samples collected for TCDD analysis are to be shipped as high-hazard samples. See Procedure SA-6.2 and Attachment B for proper high-hazard packaging and shipping procedures.

APPENDIX B.4

PROCEDURE NO. SA-6.1, SECTION 5.0:
SAMPLE IDENTIFICATION & CHAIN-OF CUSTODY

4.0 RESPONSIBILITIES

Field Operations Leader - Responsible for determining that chain-of-custody procedures are implemented up to and including release to the shipper.

Field Samplers - Responsible for initiating the Chain-of-Custody Record and maintaining custody of samples until they are relinquished to another custodian, to the shipper, or to the common carrier.

Remedial Investigation Leader - Responsible for determining that chain-of-custody procedures have been met by the sample shipper and analytical laboratory.

5.0 PROCEDURES

5.1 OVERVIEW

The term "chain-of-custody" refers to procedures which ensure that evidence presented in a court of law is what it is represented to be. The chain-of-custody procedures track the evidence from the time and place it is first obtained to the courtroom and, secondly, provide security for the evidence as it is moved and/or passes from the custody of one individual to another.

Chain-of-custody procedures, recordkeeping, and documentation are an important part of the management control of samples. Regulatory agencies must be able to provide the chain of possession and custody of any samples that are offered for evidence, or that form the basis of analytical test results introduced as evidence. Written procedures must be available and followed whenever evidence samples are collected, transferred, stored, analyzed, or destroyed.

5.2 SAMPLE IDENTIFICATION

The method of identification of a sample depends on the type of measurement or analysis performed. When in-situ measurements are made, the data are recorded directly in bound logbooks or other field data records, with identifying information.

5.2.1 Sample Label

Samples, other than in-situ measurements, are removed and transported from the sample location to a laboratory or other location for analysis. Before removal, however, a sample is often divided into portions, depending upon the analyses to be performed. Each portion is preserved in accordance with the Sampling Plan. Each sample container is identified by a sample label (see Attachment B). Sample labels are provided by the PMO. The information recorded on the sample label includes:

- **Project:** EPA Work Assignment Number (can be obtained from the Sampling Plan).
- **Station Location:** The unique sample number identifying this sample (can be obtained from the Sampling Plan).
- **Date:** A six-digit number indicating the day, month, and year of sample collection; e.g., 12/21/85.
- **Time:** A four-digit number indicating the 24-hour time of collection (for example: 0954 is 9:54 a.m., and 1629 is 4:29 p.m.).
- **Medium:** Water, soil, sediment, sludge, waste, etc.

- **Concentration:** The expected concentration (i.e., low, medium, high).
- **Sample Type:** Grab or composite.
- **Preservation:** Type of preservation added and pH levels.
- **Analysis:** VOA, BNAs, PCBs, pesticides, metals, cyanide, other.
- **Sampled By:** Printed name of the sampler.
- **Case Number:** Case number assigned by the Sample Management Office.
- **Traffic Report Number:** Number obtained from the traffic report labels.
- **Remarks:** Any pertinent additional information.

Using just the work assignment number of the sample label maintains the anonymity of sites. This may be necessary, even to the extent of preventing the laboratory performing analysis from knowing the identity of the site (e.g., if the laboratory is part of an organization that has performed previous work on the site).

5.2.2 Sample Identification Tag

A Sample Identification Tag (Attachment F) must also be used for samples collected for CLP (Contract Laboratory Program) analysis. The Sample Identification Tag is a w[illegible]e, waterproof paper label, approximately 3-by-6 inches, with a reinforced eyelet, and string or w[illegible] or attachment to the neck of the sample bottle. The Sample Tag is a controlled document, and i[illegible]ovided by the regional EPA office. Following sample analysis, the Sample Tag is retained by the la[illegible]atory as evidence of sample receipt and analysis.

The following information is recorded on the tag:

- **Project Code:** Work Assignment Number.
- **Station Number:** The middle portion of the Station Location Number, (between the hyphens).
- **Month/Day/Year:** Same as Date on Sample Label.
- **Time:** Same as Time on Sample Label.
- **Designate - Comp/Grab:** Composite or grab sample.
- **Station Location:** Same as Station Location on Sample Label.
- **Samplers:** Same as Sampled By on Sample Label.
- **Preservative:** Yes or No.
- **Analyses:** Check appropriate box(es).

- **Remarks:** Same as Remarks on Sample Label (make sure the Case Number and Traffic Report numbers are recorded).

- **Lab Sample Number:** For laboratory use only.

The tag is then tied around the neck of the sample bottle.

If the sample is to be split, it is aliquoted into similar sample containers. Identical information is completed on the label attached to each split.

Blank, duplicate, or field spike samples shall not be identified as such on the label, as they may compromise the quality control function. Sample blanks, duplicates, spikes, and splits are defined in Procedure SA-6.6.

5.3 CHAIN-OF-CUSTODY PROCEDURES

After collection, separation, identification, and preservation, the sample is maintained under chain-of-custody procedures until it is in the custody of the analytical laboratory and has been stored or disposed of.

5.3.1 Field Custody Procedures

- Samples are collected as described in the site-specific Sampling Plan. Care must be taken to record precisely the sample location and to ensure that the sample number on the label matches the sample log sheet and Chain-of-Custody Record exactly.

- The person undertaking the actual sampling in the field is responsible for the care and custody of the samples collected until they are properly transferred or dispatched.

- When photographs are taken of the sampling as part of the documentation procedure, the name of the photographer, date, time, site location, and site description are entered sequentially in the site logbook as photos are taken. Once developed, the photographic prints shall be serially numbered, corresponding to the logbook descriptions.

- Sample labels shall be completed for each sample, using waterproof ink unless prohibited by weather conditions, e.g., a logbook notation would explain that a pencil was used to fill out the sample label because a ballpoint pen would not function in freezing weather.

5.3.2 Transfer of Custody and Shipment

Samples are accompanied by a Chain-of-Custody Record Form. Chain-of-Custody Record Forms used in EPA Regions I-IV are shown in Attachments A through D. The appropriate form shall be obtained from the EPA Regional Office. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the Record. This Record documents sample custody transfer from the sampler, often through another person, to the analyst in the laboratory. The Chain-of-Custody Record is filled out as follows:

- Enter header information (project number, samplers, and project name -- project name can be obtained from the Sampling Plan).

- Sign, date, and enter the time under "Relinquished by" entry.

- Enter station number (the station number is the middle portion of the station location number, between the hyphens).
- Check composite or grab sample.
- Enter station location number (the same number as the station location on the tag and label).
- Enter the total number of containers per station number and the type of each bottle.
- Enter either the inorganic traffic report number, the organic traffic report number, or the SAS number for each station number in the remarks column.
- Enter the tag number from the bottom of the sample identification tag in the remarks column for each station location.
- Make sure that the person receiving the sample signs the "Received by" entry, or enter the name of the carrier (e.g., UPS, Federal Express) under "Received by." Receiving laboratory will sign "Received for Laboratory by" on the lower line and enter the date and time.
- Enter the bill-of-lading or Federal Express airbill number under "Remarks," in the bottom right corner, if appropriate.
- Place the original (top, signed copy) of the Chain-of-Custody Record Form in the appropriate sample shipping package. Retain the pink copy with field records.
- Sign and date the custody seal, a 1- by 3-inch white paper label with black lettering and an adhesive backing. Attachment G is an example of a custody seal. The custody seal is part of the chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field. Custody seals are provided by ZPMO on an as-needed basis.
- Place the seal across the shipping container opening so that it would be broken if the container is opened.
- Complete other carrier-required shipping papers.

The custody record is completed using black waterproof ink. Any corrections are made by drawing a line through and initialing and dating the change, then entering the correct information. Erasures are not permitted.

Common carriers will usually not accept responsibility for handling Chain-of-Custody Record Forms; this necessitates packing the record in the sample container (enclosed with other documentation in a plastic zip-lock bag). As long as custody forms are sealed inside the sample container and the custody seals are intact, commercial carriers are not required to sign off on the custody form.

If sent by mail, the package will be registered with return receipt requested. If sent by common carrier or air freight, proper documentation must be maintained.

The laboratory representative who accepts the incoming sample shipment signs and dates the Chain-of-Custody Record, completing the sample transfer process. It is then the laboratory's responsibility to maintain internal logbooks and custody records throughout sample preparation and analysis.

5.3.3 <u>Receipt for Samples Form</u>

Whenever samples are split with a private party or government agency, a separate Receipt for Samples Record Form is prepared for those samples and marked to indicate with whom the samples are being split. The person relinquishing the samples to the party or agency shall require the signature of a representative of the appropriate party acknowledging receipt of the samples. If a representative is unavailable or refuses to sign, this is noted in the "Received by" space. When appropriate, as in the case where the representative is unavailable, the custody record shall contain a statement that the samples were delivered to the designated location at the designated time. This form must be completed and a copy given to the owner, operator, or agent-in-charge even if the offer for split samples is declined. The original is retained by the Field Operations Leader.

6.0 REFERENCES

U.S. EPA, 1984. User's Guide to the Contract Laboratory Program, Office of Emergency and Remedial Response, Washington, D.C.

7.0 ATTACHMENTS

Attachment A - Chain-of-Custody Record Form for use in Region I
[redacted]
Attachment E - Sample Label
Attachment F - Sample Identification Tag
Attachment G - Chain-of-Custody Seal

ATTACHMENT A
CHAIN-OF-CUSTODY RECORD FORM FOR USE IN REGION I
(Original is 8-1/2 by 11)

	PROJECT NAME													
SAMPLERS: *(Signature)*														
STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS								REMARKS

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*	Date / Time	Remarks:	

ATTACHMENT E
SAMPLE LABEL

PROJECT: ______________________

STATION LOCATION: ______________________

DATE: ____/____/____ TIME: __________ hrs.

MEDIA: WATER ☐ SOIL ☐ SEDIMENT ☐ __________ ☐

CONCENTRATION: LOW ☐ MED ☐ HIGH ☐

TYPE: GRAB ☐ COMPOSITE ☐

ANALYSIS	PRESERVATION
VOA ☐ BNA's ☐	Cool to 4°C ☐
PCB's ☐ PESTICIDES ☐	HNO_3 to pH <2 ☐
METALS: TOTAL ☐ DISSOLVED ☐	NAOH to pH>12 ☐
CYANIDE ☐	__________ ☐
__________ ☐	

Sampled by: ______________________

Case No.: __________ Traffic Report No.: __________

Remarks:

ACFILE: FORMS\BOTLABL

ATTACHMENT F
SAMPLE IDENTIFICATION TAG

☆ GPO 505-552

Designate: Grab / Comp.

Time

Month/Day/Year

Station No.

Project Code

Samplers (Signatures)

Station Location

Preservative:
Yes ☐ No ☐

ANALYSES	
BOD Anions Solids (TSS) (TDS) (SS)	
COD, TOC, Nutrients	
Phenolics	
Mercury	
Metals	
Cyanide	
Oil and Grease	
Organics GC/MS	
Priority Pollutants	
Volatile Organics	
Pesticides	
Mutagenicity	
Bacteriology	

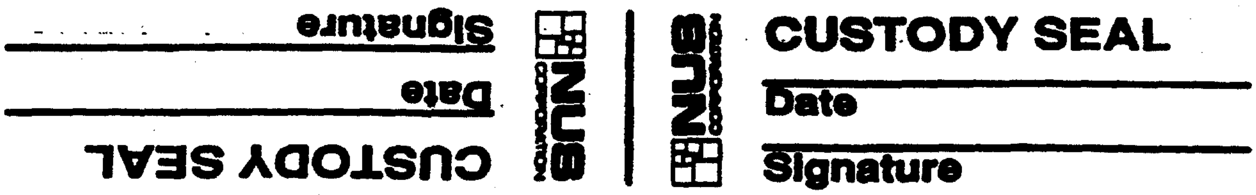
Remarks:

Tag No.	Lab Sample No.
3 60966	

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

EPA

ATTACHMENT G
CHAIN-OF-CUSTODY SEAL



APPENDIX B.5

PROCEDURE NO. SA-6.2, SECTION 5.0: SAMPLE PACKAGING AND SHIPPING

Reportable Quantity (RQ) - A parenthetical note of the form "(RQ-1000/454)" following an entry in the DOT Hazardous Materials table (49 CFR 172.101) indicates the reportable quantity of the substance in pounds and kilograms. If a spill of that amount or more of the substance occurs during transit or storage, a report must be filed with DOT according to §171.15-15 concerning hazardous materials incidents reports. If the material spilled is a hazardous waste, a report must always be filed, regardless of the amount, and must include a copy of the manifest. If the RQ notation appears, it must be shown either immediately before or after the proper shipping name on the shipping paper (or manifest). Most shipping papers and manifests will have a column designated "HM" which may be used for this purpose.

4.0 RESPONSIBILITIES

Field Operations Leader or Team Sampling Leader - responsible for determining that samples are properly packaged and shipped.

Sampling Personnel - responsible for implementing the packaging and shipping requirements.

5.0 PROCEDURES

5.1 INTRODUCTION

Samples collected for shipment from a site shall be classified as either environmental or hazardous material (or waste) samples. In general, environmental samples are collected off-site (for example from streams, ponds, or wells) and are not expected to be grossly contaminated with high levels of hazardous materials. On-site samples (for example, soil, water, and materials from drums or bulk storage tanks, obviously contaminated ponds, lagoons, pools, and leachates from hazardous waste sites) are considered hazardous. A distinction must be made between the two types of samples in order to:

- Determine appropriate procedures for transportation of samples. If there is any doubt, a sample shall be considered hazardous and shipped accordingly.

- Protect the health and safety of laboratory personnel receiving the samples. Special precautions are used at laboratories when samples other than environmental samples are received.

5.2 ENVIRONMENTAL SAMPLES

5.2.1 Packaging

Environmental samples may be packaged following the procedures outlined in Section 5.4 for samples classified as "flammable liquids" or "flammable solids." Requirements for marking, labeling, and shipping papers do not apply.

Environmental samples may also be packed without being placed inside metal cans as required for flammable liquids or solids.

- Place sample container, properly identified and with a sealed lid, in a polyethylene bag, and seal the bag.
- Place sample in a fiberboard container or metal picnic cooler which has been lined with a large polyethylene bag.
- Pack with enough noncombustible, absorbent, cushioning materials to minimize the possibility of the container breaking.
- Seal large bag.
- Seal or close outside container.

5.2.2 Marking Labeling

Sample containers must have a completed sample identification tag and the outside container must be marked "Environmental Sample." The appropriate side of the container must be marked "This End Up" and arrows placed appropriately. No DOT marking or labeling are required.

5.2.3 Shipping Papers

No DOT shipping papers are required. However, the appropriate chain-of-custody forms must be included with the shipment.

5.2.4 Transportation

There are no DOT restrictions on mode of transportation.

5.3 DETERMINATION OF SHIPPING CLASSIFICATION FOR HAZARDOUS MATERIAL SAMPLES

Samples not determined to be environmental samples, or samples known or expected to contain hazardous materials, must be considered hazardous material samples and transported according to the requirements listed below.

5.3.1 Known Substances

If the substance in the sample is known or can be identified, package, mark, label and ship according to the specific instructions for that material (if it is listed) in the DOT Hazardous Materials Table, 49 CFR 172.101.

Unz and Company have published the following steps to help in locating a proper shipping name from the Hazardous Materials Table, 49 CFR 172.101.

1. Look first for the chemical or technical name of the material, for example, ethyl alcohol. Note that many chemicals have more than one technical name, for example, perchloroethylene (not listed in 172.101) is also called tetrachloroethylene (listed 172.101). It may be useful to consult a chemist for all possible technical names a material can have. If your material is not listed by its technical name then. . . . . .

2. Look for the chemical family name. For example, pentyl alcohol is not listed but the chemical family name is: alcohol, n.o.s. (not otherwise specified). If the chemical family name is not listed then. . . . .

3. Look for a generic name based on end use. For example, Paint, n.o.s or Fireworks, n.o.s. If a generic name based on end use is not listed then. . . . .

4. Look for a generic family name based on end use, for example, drugs, n.o.s. or cosmetics, n.o.s. Finally, if your material is not listed by a generic family name but you suspect or know the material is hazardous because it meets the definition of one or more hazardous classes, then. . . . .

5. You will have to go the the general hazard class for a proper shipping name. For example, Flammable Liquid, n.o.s, or Oxidizer, n.o.s.

5.3.2 Unknown Substances

For samples of hazardous substances of unknown content, select the appropriate transportation category according to the DOT Hazardous Materials Classification (Attachment A), a priority system of transportation categories.

The correct shipping classification for an unknown sample is selected through a process of elimination, utilizing Attachment A. Unless known or demonstrated otherwise (through the use of radiation survey instruments), the sample is considered radioactive and appropriate shipping regulations for "radioactive material" followed.

If a radioactive material is eliminated, the sample is considered to contain "Poison A" materials (Attachment B), the next classification on the list. DOT defines "Poison A" as extremely dangerous poisonous gases or liquids of such a nature that a very small amount of gas, or vapor of the liquids, mixed with air is dangerous to life. Most Poison A materials are gases or compressed gases and would not be found in drum-type containers. Liquid Poison A would be found only in closed containers; however,all samples taken from closed drums do not have to be shipped as Poison A, which provides for a "worst case" situation. Based upon information available, a judgment must be made whether a sample from a closed container is a Poison A.

If Poison A is eliminated as a shipment category, the next two classifications are "flammable" or "nonflammable" gases. Since few gas samples are collected, "flammable liquid" would be the next applicable category. With the elimination of radioactive material, Poison A, flammable gas, and nonflammable gas, the sample can be classified as flammable liquid (or solid) and shipped accordingly. These procedures would also suffice for shipping any other samples classified below flammable liquids in the DOT classification table (Attachment A). For samples containing unknown materials, categories listed below flammable liquids/solids on Attachment A are generally not used because showing that these materials are not flammable liquids (or solids) requires flashpoint testing, which may be impractical and possibly dangerous at a site. Thus, unless the sample is known to consist of materials listed as less hazardous than flammable liquid (or solid) on Attachment A, it is considered a flammable liquid (or solid) and shipped as such.

For any hazardous material shipment, utilize the shipping checklist (Attachment C) as a guideline to ensure that all sample-handling requirements are satisfied.

5.4 PACKAGING AND SHIPPING OF SAMPLES CLASSIFIED AS FLAMMABLE LIQUID (OR SOLID)

5.4.1 Packaging

Applying the word "flammable" to a sample does not imply that it is in fact flammable. The word prescribes the class of packaging according to DOT regulations.

1. Collect sample in the prescribed container with a nonmetallic, Teflon-lined screw cap. To prevent leakage, fill container no more than 90 percent full.

2. Complete sample label and sample identification tag and attach securely to sample container.

3. Seal container and place in 2-mil thick (or thicker) polyethylene bag, one sample per bag. Position sample identification tag so that it can be read through bag. Seal bag.

4. Place sealed bag inside metal can and cushion it with enough noncombustible, absorbent material (for example, vermiculite or diatomaceous earth) between the bottom and sides of the can and bag to prevent breakage and absorb leakage. Pack one bag per can. Use clips, tape, or other positive means to hold can lid securely, tightly and permanently. Mark can as indicated in Paragraph 1 of Section 5.4.2, below.

5. Place one or more metal cans (or single 1-gallon bottle) into a strong outside container, such as a metal picnic cooler or a DOT-approved fiberboard box. Surround cans with noncombustible, absorbent cushioning materials for stability during transport. Mark container as indicated in Paragraph 2 of Section 5.4.2.

5.4.2 Marking/Labeling

1. Use abbreviations only where specified. Place the following information, either hand-printed or in label form, on the metal can (or 1-gallon bottle):

   - Laboratory name and address.

   - "Flammable Liquid, n.o.s. UN1993" or "Flammable Solid, n.o.s. UN1325."

Not otherwise specified (n.o.s) is not used if the flammable liquid (or solid) is identified. Then the name of the specific material is listed before the category (for example, Acetone, Flammable Liquid), followed by its appropriate UN number found in the DOT Hazardous Materials table (49 CFR 172.101).

2. Place all information on outside shipping container as on can (or bottle), specifically:

   - Proper shipping name.
   - UN or NA number.
   - Proper label(s).
   - Addressee and sender.

   Place the following labels on the outside shipping container: "Cargo Aircraft Only" and "Flammable Liquid" (or "Flammable Solid"). "Dangerous When Wet" label shall be used if the solid has not been exposed to a wet environment. "Laboratory Samples" and "THIS SIDE UP" or "THIS END UP" shall also be marked on the top of the outside container, and upward-pointing arrows shall be placed on all four sides of the container.

5.4.3 Shipping Papers

1. Use abbreviations only where specified. Complete the carrier-provided bill of lading and sign certification statement (if carrier does not provide, use standard industry form, see Attachment D). Provide the following information in the order listed (one form may be used for more than one exterior container).

   - "Flammable Liquid, n.o.s. UN1993" or "Flammable Solid, n.o.s. UN1325."
   - "Limited Quantity" (or "Ltd. Qty.").
   - "Cargo Aircraft Only."
   - Net weight (wt) or net volume (vol), just before or just after "Flammable Liquid, n.o.s." or "Flammable Solid, n.o.s.," by item, if more than one metal can is inside an exterior container.
   - "Laboratory Samples" (if applicable).

2. Include Chain-of-Custody Record, properly executed in outside container.

3. "Limited Quantity" of "Flammable Liquid, n.o.s." is limited to one pint per inner container. For "Flammable Solid, n.o.s.," net weight of inner container plus sample shall not exceed one pound; total package weight shall not exceed 25 pounds.

5.4.4 Transportation

1. Transport unknown hazardous substance samples classified as flammable liquids by rented or common carrier truck, railroad, or express overnight package services. Do not transport by any passenger-carrying air transport system, even if they have cargo-only aircraft. DOT regulations permit regular airline cargo-only aircraft, but difficulties with most suggest avoiding them. Instead, ship by airline carriers that only carry cargo.

2. For transport by government-owned vehicle, including aircraft, DOT regulations do not apply. However, procedures described above, with the exception of execution of the bill of lading with certification, shall still be used.

6.0 REFERENCES

U.S. Department of Transportation, 1983. Hazardous Materials Regulations, 49 CRF 171-177.

NUS Standard Operating Procedure SA-6.1 - Sample Identification and Chain-of-Custody

NUS Standard Operating Procedure SA-1.2 - Sample Preservation

NUS Standard Operating Procedure SF-1.5 - Compatibility Testing

APPENDIX B.6

PROCEDURE NO. SA-6.3, SECTION 5.0: SITE LOGBOOK

1.0 PURPOSE

This procedure describes the process for keeping a site logbook.

2.0 SCOPE

The site logbook is a controlled document which records all major on-site activities during a Remedial Investigation/Feasibility Study. At a minimum, the following activities/events shall be recorded in the site logbook:

- Arrival/departure of site visitors
- Arrival/departure of equipment
- Sample pickup (chain-of-custody form numbers, carrier, time)
- Sampling activities/sample logsheet numbers
- Start or completion of borehole/trench/monitoring well installation or sampling activities
- Health and Safety issues

The site logbook is initiated at the start of the first on-site activity (e.g., initial reconnaissance survey). Entries are made for every day that on-site activities take place which involve RI/FS contractor personnel. One current site logbook is maintained per site.

The site logbook becomes part of the permanent site file maintained in the RI contractor's office. Because information contained in the site logbook may be admitted as evidence in cost recovery or other legal proceedings, it is critical that this document be properly maintained.

3.0 GLOSSARY

Site Logbook - The logbook is a bound notebook with consecutively numbered pages that cannot be removed. Upon entry of data, the logbook requires signature by the responsible site leader (see Section 5.1).

4.0 RESPONSIBILITIES

The site logbook is issued by the Regional Manager (or his designee) to the Site Manager for the duration of the project. The Site Manager releases the site logbook to the Field Operations Leader or other person responsible for the direction of on-site activities (e.g., Reconnaissance Survey Team Leader, Sampling Team Leader). It is the responsibility of this person (or his designee) to keep the site logbook current while in his possession, and return it to the Site Manager or turn it over to another field team. Following the completion of all fieldwork, the site logbook is returned to the Site Manager for inclusion in the permanent site files.

5.0 PROCEDURES

5.1 GENERAL

The cover of each site logbook contains the following information:

- Project Name
- NUS Project Number
- RI/FS Contractor and Site Manager's Name
- Sequential Book Number

- Start Date
- End Date

Daily entries into the logbook may contain a variety of information. At the beginning of each day the following information must be recorded:

- Date
- Start time
- Weather
- All field personnel present
- Any visitors present

During the day, a summary of all site activities and level of personal protection shall be recorded in the logbook. The information need not duplicate that recorded in other field notebooks (e.g., sample logbook, Site Geologist's notebook, Health and Safety Officer's notebook, etc.), but shall summarize the contents of these other notebooks and refer to the page locations in these notebooks for detailed information. An example of a site logbook page is shown in Attachment A.

The sample logsheet for each sample collected (see Procedure SA-6.6) must be referenced. If measurements are made at any location, the measurements and equipment used must either be recorded in the site logbook or reference must be made to the notebook and page number(s) on which they are recorded (see Attachment A).

All entries shall be made in black pen. No erasures are permitted. If an incorrect entry is made, the data shall be crossed out with a single strike mark, and initialed and dated. At the completion of entries by any individual, the logbook must be signed. It must also be signed by the Field Operations Leader or responsible site leader at the end of each day.

5.2 PHOTOGRAPHS

When movies, slides, or photographs are taken of a site or any monitoring location, they are numbered to correspond to logbook entries. The name of the photographer, date, time, site location, site description, and weather conditions are entered in the logbook as the photographs are taken. A series entry may be used for rapid-sequence photographs. The photographer is not required to record the aperture settings and shutter speeds for photographs taken within the normal automatic exposure range. However, special lenses, films, filters, and other image-enhancement techniques must be noted in the logbook. If possible, such techniques shall be avoided, since they can adversely affect the admissibility of photographs as evidence. Chain-of-custody procedures depend upon the subject matter, type of film, and the processing it requires. Film used for aerial photography, confidential information, or criminal investigation require chain-of-custody procedures. Adequate logbook notation and receipts may be used to account for routine film processing. Once processed, the slides of photographic prints shall be serially numbered and labeled according to the logbook descriptions.

6.0 REFERENCES

None.

7.0 ATTACHMENTS

Attachment A - Typical Site Logbook Entry

ATTACHMENT A
TYPICAL SITE LOGBOOK ENTRY

START TIME: ______________ DATE: ______________

SITE LEADER: ______________________
PERSONNEL:

NUS	DRILLER	EPA

WEATHER: Clear, 68°F, 2-5 mph wind from SE

ACTIVITIES:

1. Steam jenney and fire hoses were set up.

2. Drilling activities at well ______ resumes. Rig geologist was ______________. See Geologist's Notebook, No. 1, page 29-30, for details of drilling activity. Sample No. 123-21-S4 collected; see sample logbook, page 42. Drilling activities completed at 11:50 and a 4 inch stainless steel well installed. See Geologist's Notebook, No. 1, page 31, and well construction details for well ________.

3. Drilling rig No. 2 steam-cleaned at decontamination pit. Then set up at location of well ________.

4. Well ________ drilled. Rig geologist was ______________. See Geologist's Notebook, No. 2, page ______ for details of drilling activities. Sample numbers 123-22-S1, 123-22-S2, and 123-22-S3 collected; see sample logbook, pages 43, 44, and 45.

5. Well ________ was developed. Seven 55-gallon drums were filled in the flushing stage. The well was then pumped using the pitcher pump for 1 hour. At the end of the hour, water pumped from well was "sand free."

6. EPA remedial project manger arrives on-site at 14:25 hours.

7. Large dump truck arrives at 14:45 and is steam-cleaned. Backhoe and dump truck set up over test pit ________.

8. Test pit ________ dug with cuttings placed in dump truck. Rig geologist was ______________. See Geologist's Notebook, No. 1, page 32, for details of test pit activities. Test pit subsequently filled. No samples taken for chemical analysis. Due to shallow groundwater table, filling in of test pit _____ resulted in a very soft and wet area. A mound was developed and the area roped off.

9. Express carrier picked up samples (see Sample Logbook, pages 42 through 45) at 17:50 hours. Site activities terminated at 18:22 hours. All personnel offsite, gate locked.

____
Field Operations Leader

APPENDIX C

HEALTH AND SAFETY PLAN

R-07-93-2

HEALTH AND SAFETY PLAN
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Northern Division
Environmental Branch, Code 1823
Naval Facilities Engineering Command
10 Industrial Highway, Mail Stop #82
Lester, Pennsylvania 19113-2090

Submitted by:
Halliburton NUS Corporation
993 Old Eagle School Road, Suite 415
Wayne, Pennsylvania 19087-1710

Contract Number N62472-90-D-1298
Contract Task Order 0115

September 1993

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1.0 INTRODUCTION

This Health and Safety Plan (HASP) is designed to provide practices and procedures for Halliburton NUS personnel engaged in remediation activities within and around Building 31, Naval Submarine Base - New London, Groton, Connecticut. This plan has been developed to conform to the requirements of OSHA Standard 29 CFR 1910.120 - "Hazardous Waste Operations and Emergency Response: Final Rule" and is based on available information regarding possible contaminants and physical hazards that may, or may not, exist on the site. If more information concerning the nature and/or concentrations of contaminants becomes available, this HASP will be modified accordingly. It will be the Halliburton NUS Project Manager's responsibility to communicate any such information to the CLEAN Health and Safety Manager (Matthew M. Soltis) who will, in turn, determine the need for modifying the HASP.

1.1 KEY PROJECT PERSONNEL AND ORGANIZATION

This section refers to Table 1-1 and establishes responsibility for site safety and health for Halliburton NUS personnel. The Halliburton NUS Project Manager (PM) is responsible for the overall direction and implementation of health and safety for this project. The Halliburton NUS Field Operations Leader (FOL) is responsible for implementation of this HASP with the assistance of an appointed Site Safety Officer (SSO). The activities of the SSO are monitored by the CLEAN Health and Safety Manager (HSM) for compliance with this HASP and the CLEAN Health and Safety Management Plan.

TABLE 1-1

KEY HALLIBURTON NUS PROJECT PERSONNEL AND RESPONSIBILITIES

Name	Responsibility
Jean-Luc Glorieux	Project Manager
TBA	Field Operations Leader
TBA	Site Safety Officer
Matthew M. Soltis, CSP	CLEAN Health and Safety Manager
Donald J. Westerhoff	Industrial Hygienist

The lead remediation contractor will have their own project personnel who, in turn, will be responsible for the Health and Safety of their personnel. The information presented in this HASP applies only to Halliburton NUS personnel. This HASP does not apply to personnel involved in activities that will be performed by the lead remediation contractor. It should be recognized however, that the hazards associated with this project (exposure to lead contaminated soil, CO, excavations, etc.) are related to work performed by both contractors. Hazards associated with the tasks to be performed by the remediation contractor are discussed in this HASP for the purpose of identifying and alerting Halliburton NUS personnel to issues and concerns that indirectly relate to them, since work of two independent contractors will be performed simultaneously. As a result, safety and health issues may be addressed in this HASP for which Halliburton NUS may not be directly involved with.

2.0 SITE/PROJECT BACKGROUND

Building 31 is located in the lower Naval Submarine Base area on Albacore Road. It is approximately 76 feet x 140 feet and was originally used as a battery shop. Naval Submarine Base - New London was in the process of replacing the concrete foundation to comply with RCRA regulations when a yellow discoloration was discovered underneath on the concrete slab. Soil samples were taken from surface to a depth of approximately 60 inches and elevated lead levels were found. Lead levels ranged from 0.1 to 400 ppm (TCLP). The analytical results from subsequent sampling activities is included in Section 1 of the Field Verification Sampling Plan.

3.0 SCOPE OF WORK

This Health and Safety Plan addresses the activities that will be performed by Halliburton NUS personnel. It should be noted that the lead remediation contractor will be involved in separate activities which are related to the overall project and the tasks performed by Halliburton NUS. Many of the activities performed by the contractor will be hazardous to all personnel working at the site. The contractor will submit and be responsible for a separate Health and Safety Plan which will address activities that are to be performed by the contractor. This HASP will then be reviewed and ultimately approved by the Navy. Halliburton NUS will then, either revise this HASP to accommodate the other contractors approved HASP or will follow the contractor's HASP with regard to tasks set fourth in the contractor's scope of work. Where the two subsequent Health and Safety Plans overlap, the more protective measure will apply for Halliburton NUS personnel.

This section outlines the work to be performed at the site by Halliburton NUS personnel and, therefore, defines the work covered by this Health and Safety Plan. If site work other than that listed below must be performed, Halliburton NUS will initiate appropriate actions as stated above.

- Wipe Sampling
- Excavation Soil Sampling
- Treated Material Sampling

A description of each of these tasks can be found in the "Field Verification Sampling Plan."

4.0 HAZARD ASSESSMENT

This section describes the chemical and physical hazards that are associated either directly or indirectly with the tasks and operations described in Section 3.0 of this HASP. Measures to control the hazards presented below can be found in Sections 5.0, 6.0, and 7.0 of this plan.

4.1 SITE CONTAMINANTS

Based upon the nature and extent of contamination associated with Building 31, the potential exists for workers to inhale and/or ingest lead particulate. Overexposure to this material can reduce the oxygen-carrying capacity of the blood and can damage the central nervous system, the peripheral nervous system, the gastrointestinal system, and the renal (kidney) system. In addition, lead can adversely effect the reproductive functions of both males and females (see Attachment 1).

Exposures to lead will likely be greatest during excavating operations and any time contaminated hands, food, and/or tobacco products are brought into contact with the mouth. However, it is believed that such exposures will be insignificant. Specifically, it appears unlikely that inhalation exposures will exceed the current limit of 50 $\mu g/m^3$ and, subsequently, the amount of lead likely to be ingested is expected to be negligible providing basic work practices are enforced.

Aside from the potential for exposure to lead, site personnel may also encounter potentially corrosive (pH <2) battery wastes. Of particular concern is direct skin contact with these wastes which could occur during sampling activities. Such contact could result in chemical burns and permanent damage to the skin, eyes, and mucous membranes.

4.2 CARBON MONOXIDE

Because several tasks involve the use of internal combustion engines to be used within the building, carbon monoxide emissions from these engines will be of particular importance. Carbon monoxide is a lethal, colorless and odorless gas that, even at non-lethal concentrations, can temporarily impair a worker's coordination and thinking due to a decrease in the amount of oxygen being carried to the body tissues (including the brain). The extent of this impairment is highly dependent upon the workers health, the work load, and the amount of carbon monoxide intake from non-occupational sources such a cigarette smoking. If the impairment is significant, a worker performing potentially dangerous operations could become fatally injured as a result of the worker's inability to avoid the hazards of their work. Additional information on the effects of carbon monoxide exposure have been presented as Attachment 2 of this HASP. In order to control this hazard, machinery will be fitted with flexible hoses, by the contractor, to exhaust emissions outdoors. In addition, the level of carbon monoxide in the work area will be closely monitored and, as necessary, the area will be mechanically ventilated to maintain exposures below 25 ppm.

4.3 ADDITIONAL CHEMICAL HAZARDS

Building 31 will most likely be used to store various items that will be required to perform many of the tasks while at the site. These items may include fuel for machinery, components for mixing operations (fly ash, cement, proprietary reagents, etc.), and chemicals for decontamination of equipment and personnel. Many of these products may present various hazards to site workers. At the time that this HASP was created, it was unknown exactly what products will be stored within the building. Once the Navy selects a contractor and the materials are identified, appropriate measures (obtaining MSDS, proper storage methods, instituting standard work practices, revising the HASP, etc.) will be initiated.

4.4 PHYSICAL HAZARDS

In addition to the chemical hazards presented above, certain physical hazards may also be encountered, despite the fact that many of tasks that these hazards would be associated with will not be performed by Halliburton NUS personnel. The most significant of these hazards include:

- The potential for a worker to become struck by or entangled in machinery (backhoe, mixer, etc.)
- The lifting of heavy objects
- Overexposure to noise
- The potential to be engulfed by soil in the event of an excavation cave-in
- Contact with underground and/or overhead utilities
- Uneven/unstable walking and working surfaces
- Cold and heat stress

4.4.1 Heavy Machinery

Many of the tasks that will be performed at the site involve the use of heavy machinery. Backhoes will be used for excavation. Machinery, possibly a pug mill, will be used for mixing. The potential exists for workers to be struck by or entangled in machinery during various tasks. Persons working in close proximity to backhoes performing excavations could be struck by the backhoe bucket, resulting in an injury or fatality. Control measures for these hazards are presented in Section 11.0, "Standard Work Practices."

4.4.2 Lifting Heavy Objects

The potential exists for workers to be injured while lifting heavy objects during the performance of various tasks. During wipe sampling, workers must lift large pieces of rubble in order to obtain the sample. In addition, various tasks may require lifting heavy pieces of equipment. If objects are improperly lifted, debilitating back strain and/or other injuries can result.

4.4.3 Overexposure to Noise

Since many of the tasks to be performed require the use of machinery in Building 31, workers have the potential to be exposed to noise in excess of 85 dB. Excessive noise exposure can cause permanent hearing loss. The use of approved hearing protection shall be use by all personnel within Building 31 during activities which result in elevated noise levels or which require the use of heavy machinery.

4.4.4 Excavation Cave-in

Soil from excavations will be sampled to ensure that all contamination above the action level has been removed. The use of shoring techniques will not be used by the contractor, except along foundation walls, to prevent structural damage. The potential exists for oxygen-deficient and/or toxic atmospheres to be present within excavation pits. In addition, it is anticipated that groundwater will be encountered at relatively shallow depths (approximately 4 to 6 feet). As a result, employees will not, under any circumstances, be permitted to enter an excavation to obtain samples. The use of remote sampling techniques will be employed to obtain all soil samples. Precautions must be taken, however, to eliminate the potential for soil, equipment, and or personnel around the excavation from collapsing into the excavation. A minimum distance of 3 feet should be maintained between equipment and personnel from the edge of any excavation.

4.4.5 Contact with Underground/Overhead Utilities

Building 31 currently contains unsupported overhead electrical wires that were temporarily installed several months ago. Personnel operating equipment must be cognizant of these wires and take precautions to avoid contact with them. In addition, circuit boxes within Building 31 were temporarily wired and may be active and exposed. The potential for workers to be electrocuted should be recognized and precautions taken to ensure that contact with potential current carrying lines be avoided. Workers, when wetting areas down to suppress dust emissions, should be aware of the location of circuit boxes and electrical lines and avoid contact with these areas. Utilities should be located prior to excavating and caution should be taken when performing excavations.

4.4.6 Uneven Walking/Working Surfaces

Previous work conducted within Building 31 has resulted in large piles of rubble debris. Existing flooring is broken and unstable. In addition, segments of reinforcing steel rod are exposed in various places. Activities that will be performed during this phase of work will result in additional open pits and unstable/uneven walking and working surfaces. These hazards can cause workers to lose their footing, thereby resulting in strained muscles, sprained ligaments, cuts and/or abrasions. Workers should be aware of these hazards and avoid such areas as much as possible.

In order to control these hazards, the Standard Work Practices specified in Section 5.0 of this HASP (as well as the other requirements stated in this document) will be implemented and enforced throughout site operations.

4.4.7 Cold and Heat Stress

There is the potential for workers to have cold stress-related illnesses, since work is scheduled to be performed during winter months that for this geographic area have relative cold temperatures. Building 31 is not climate controlled; as a result temperatures can be expected to be the same as ambient temperatures outside. Cold stress is defined as the stress resulting from the net heat loss on the body or the net heat loss on a portion of the body such as feet, hands, limbs, or head. Physiological conditions that are characteristic of exposure to a cold environment include intense sympathetic nerve stimulation (shivering), vasoconstriction, increased oxygen consumption, accelerated respiration and pulse, elevated blood pressure, and significant increase in cardiac output.

Hypothermia, which is defined as an abnormal lowering of the deep body core temperature, is a serious life threat which may be present for workers assigned to work under cold environmental conditions. Lower body temperatures will result in reduced mental alertness, reduction in rational decision making, loss of consciousness, and possible death. Pain in the extremities may be the first early warning of danger to cold stress. During exposure to cold, maximum severe shivering develops when the body temperature has fallen to 95°F. This should be taken as a sign of danger and exposure to cold should be immediately terminated.

Workers should implement the use of thermal underclothing. The practice of using many layers of clothing is often more beneficial than a single heavy piece of clothing for protecting against exposure to cold environments. In addition, warm-up periods in heated ares may be instituted to further limit exposure to the cold.

Heat stress-related injuries are unlikely to occur during winter months for this geographic area. However heat stress-related injuries will be addressed since personal protective equipment that may be used may facilitate workers' susceptibility to heat stress-related injuries. The most serious heat-induced injury is heat stroke. Heat stroke is life threatening and may result in irreversible damage to the body. Other heat-induced illnesses include heat exhaustion, which in its most serious form leads to prostration and can cause serious injury. Heat camps are easily cured if promptly and properly treated. Heat disorders due to excessive heat exposure include electrolyte imbalance, dehydration, skin rashes, heat edema, and loss of physical and mental work capacity.

To minimize the effected of heat-induced illness, workers should take frequent breaks in areas of moderate temperature (70°F is best) and drink plenty of fluids (such as water) of electrolyte-replenishing drinks.

5.0 AIR MONITORING

This section presents requirements for the use of real-time air monitoring instruments during site activities involving potential for exposure to site contaminants. It establishes the types of instruments to be used, the frequency of which they are to be used, techniques for their use, action levels for upgrading/downgrading levels of protection, and methods for instrument maintenance and calibration. It should be noted that any monitoring performed by Halliburton NUS will pertain to Halliburton NUS personnel only. Additional monitoring may be performed by the lead remediation contractor that would pertain to their personnel. At the time at which this HASP was prepared, it was undetermined which contractor would be performing particular air monitoring activities. It is anticipated that the remediation contractor will be performing air monitoring for LEL/O_2, particulates, and possibly carbon monoxide. Halliburton NUS will perform air monitoring which is deemed necessary after determining what monitoring will be performed by the remediation contractor. If the subsequent HASP from the remediation contractor discusses air monitoring, the more protective measures from each HASP will apply. Information obtained by air monitoring instruments should be made available to each contractor.

5.1 INSTRUMENTS AND USE

Direct-reading carbon monoxide monitors will be used monitor the level of carbon monoxide in the vicinity of backhoes and other machinery that utilize internal combustion engines. The monitors will be selective to carbon monoxide and will be capable of measuring concentrations between 0.0 ppm and 100 ppm. They will be equipped with an alarm that will sound at 25 ppm and will either be worn by workers on the backhoes or positioned in the work area to represent worst-case exposures. Use of these monitors are only required while machinery is in operation. No other monitoring equipment is required, providing particulate emissions are adequately suppressed with water spray.

An HNU PI-101 equipped with an 11.7 eV lamp will be used to detect the presence or absence of airborne chemical emissions. Additionally, an LEL/O_2 meter will used during excavation activities and sampling of test pits to detect the presence of flammable/explosive and/or oxygen-deficient atmospheres.

5.2 AIR MONITORING REQUIREMENTS - MIE PDM-3 MINIRAM (OR EQUIVALENT)

Water spray will be used prior to the initiation of any work at the site and periodically thereafter to control particulate emissions during various tasks while at the site. The work area will also be monitored with a direct-reading particulate monitor (MIE PDM-3 Miniram, or equivalent). At the time that this HASP was prepared, it was undetermined whether the contractor or Halliburton NUS would be performing this monitoring. This instrument will provide a real-time, as well as an 8-hour, average measurement of total airborne particulates and, therefore, it will be useful in estimating the concentration of airborne lead. If it is conservatively assumed that the average concentration of lead within the soils is 10,000 mg/kg (1.0% lead), an average reading of 3.0 mg/m^3 on the particulate monitor would represent an average exposure to lead at the OSHA Action Level of 30 $\mu g/m^3$ (i.e., $0.01 \times 3.0\ mg/m^3 \times 1{,}000\ \mu g/mg = 30\ \mu g/m^3$). Therefore, by maintaining total dust exposures below 3.0 mg/m^3, lead exposures will be maintained below the OSHA action level. If exposures exceed this action level, additional water spray will be used to reduce dust emissions or the work will cease until further direction has been given by the CLEAN Health and Safety Manager. If respiratory protection must be used to control lead exposures, all work must conform to the requirements of OSHA 29 CFR 1910.134 and 29 CFR 1910.1025.

5.2.1 Air Monitoring Requirements - HNU

Air monitoring with the HNU PI-101 will be initiated at potential sources of vapor emissions. The following potential sources are anticipated.

- Excavation (Test Pits)
- Sampling activities
- Groundwater encountered during excavations
- Any time chemical odors are perceived

During monitoring with the HNU monitor, if readings in the workers breathing zone exceed background levels, including sustained or repeated intermittent readings, personnel must immediately cease operations in the area affected and await further instruction from the Halliburton NUS Project Manager and/of the Navy CLEAN HSM.

5.2.2 Air Monitoring Requirements - LEL/O_2

Air monitoring with the LEL/O_2 meters will be conducted during all excavating activities. **If elevated LEL/O_2 readings are observed, workers must be advised of the potential explosive nature of the environment and must initiate the use of spark-proof tools. LEL reading in excess of 20% requires cessation of excavating or any other activity until readings subside.** Under no circumstances will work be permitted to be performed in oxygen-deficient or oxygen-rich atmospheres (see Section 3.3, Action Levels).

5.3 ACTION LEVELS

The following action levels will apply to this project:

Carbon Monoxide Monitor	0.0 ppm to 12.4 ppm	Continue Work and Monitoring
	12.5 ppm to 25 ppm	Continue Work and observe workers for symptoms of overexposure. Ventilate area to the extent feasible.
	Greater than 25 ppm	Cease work until mechanical ventilation adequately reduces carbon monoxide levels
Observation	Symptoms of CO poisoning	Cease work and obtain further direction from the PM and CLEAN HSM.
Particulate Monitor	0.0 mg/m^3 to 3.0 mg/m^3	Wet down area, continue work
	Greater than 3.0 mg/m^3	Obtain further direction from the PM and the CLEAN HSM.
LEL/O_2 Monitor	Less than 10% of LEL	Continue work (with proper respiratory protection)
	10% to 25 % of LEL	Continue work with extreme caution, use spark proof equipment.
	Greater than 25% of LEL	Withdraw immediately to safe area

LEL/O_2 Monitor (cont'd)	< 19.5% or > 25% Oxygen	Cease work and obtain further direction from the CLEAN HSM.
	19.5% to 25% Oxygen	Continue work and continue monitoring.

5.4 INSTRUMENT MAINTENANCE AND CALIBRATION

Air monitoring instruments will be maintained and pre-field calibrated by the equipment supplier. Field calibration will be performed daily prior to the initiation of work. An additional calibration will be performed at the end of the day to determine any significant instrument drift. Field maintenance will consist of daily cleaning of the instruments using a damp towel or rag to wipe off the instrument's outer casing and overnight battery recharging.

5.5 RECORDKEEPING

Carbon monoxide readings above 12.5 ppm, LEL/O_2 readings above 10% LEL or <19.5% / >25%, MIE PDM-3 Minram readings above 3.0 mg/m^3, and HNU readings above background levels must be recorded in the field book. This should indicate the date, reading(s) observed, workers potentially affected, and actions taken to reduce exposures. In addition the time-weighted average reading from particulate monitors for each day will be recorded in the field log book.

6.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

This section presents requirements for the use of personal protective equipment for each of the activities being conducted as defined in Section 3.0 of this HASP. This section includes anticipated levels of protection for each of the activities, the criteria used for selecting various levels of protection, and criteria for modifying levels of protection based on monitoring instrument readings and personal observations.

6.1 ANTICIPATED LEVELS OF PROTECTION

All work is anticipated to be performed in a Level D Protection, as defined in Appendix B of OSHA Standard 29 CFR 1910.120 - "Hazardous Waste Operations and Emergency Response: Final Rule." Many sampling activities will require the use of chemical resistant coveralls, gloves, and boot covers as presented in the task breakdown which follows. Where activities overlap, the more protective requirements will be applied. Additionally, it is possible that work will be upgraded to Level C protection (air-purifying respirators equipped with HEPA filters) depending on the results of air monitoring as discussed in Section 5.0 of this HASP. However, upgrading the level of protection for Halliburton NUS personnel will only be performed upon approval of the Halliburton NUS Project Manager and/or the CLEAN HSM.

6.1.1 Minimum Requirements (All Tasks)

Minimum requirements include steel-toe, steel shank work boots, hard hats, and safety glasses.

6.1.2 Wipe Sampling

Minimum requirements include steel-toe, steel shank work boots and nitrile of neoprene gloves over latex inner gloves. In addition, hard hats and safety glasses will be worn when working in close proximity to machinery and disposable boot covers will be worn when walking/working on potentially contaminated debris or soils. It is not anticipated that the potential for saturation of work closes exists during this task.

6.1.3 Excavation Soil Sampling

Hard hats, safety glasses, steel-toe, steel shank work boots, disposable boot covers, Tyvek coveralls, latex inner gloves, nitrile outer gloves and taped ankle and wrist seams. Since soil within the excavations has the potential to be saturated with water, the use of PVC, or PE-coated Tyvek coveralls are to be worn whenever there is a potential for saturation of work cloths.

6.1.4 Treated Material Sampling

Minimum requirements include steel-toe, steel shank work boots and nitrile or neoprene gloves over latex inner gloves over latex inner gloves. In addition, hard hat and safety glasses will be worn when working in close proximity to machinery and disposable boot covers will be worn when walking/working on potentially contaminated debris or soils.

6.2 PPE SELECTION CRITERIA

Respiratory protection was not selected for use during initial stages of work as it is unlikely that lead exposures will exceed the current exposure limit of 50 $\mu g/m^3$, providing water spray is used during all operations to suppress dust emissions. Nitrile and/or neoprene gloves were selected to provide protection against the potentially corrosive battery waste that could be encountered and to help reduce the amount of lead ingested as a result of incidental hand-to-mouth contact. Hard hats, safety glasses, and work boots were selected to provide protection against some of the physical hazards associated with excavating operations and disposable boot covers were selected to help minimize the spread of contamination. Tyvek coveralls were selected to minimize the potential for contamination of street clothes and PVC coveralls were selected for use to in the event that sampling activities have the potential to result in the saturation of work clothes.

6.3 PPE MODIFICATION CRITERIA

This section presents criteria for upgrading and downgrading chemical-protective clothing and/or respiratory protection. Where uncertainties arise, the more protective requirement will apply.

6.3.1 CPC Modification Criteria

Tyvek coveralls and boot covers must be worn any time there is a reasonable potential for contamination of street clothes. Polyvinyl chloride (PVC) coveralls must be worn anytime there is a reasonable potential for saturation of work clothes.

Nitrile or neoprene gloves must be worn any time there is a reasonable potential for contact with site contaminants. Samples found to have a pH > 2 and < 12 can be handled with surgical latex gloves.

6.3.2 Respiratory Protection Modification Criteria

Half-face or full-face air-purifying respirators equipped with high-efficiency particulate air (HEPA) filters must be worn anytime dusty conditions are observed and these emissions cannot be suppressed with water spray. In addition, respiratory protection will be utilized any time action levels in Section 5.3 are exceeded. However, before the use of respiratory protection is prescribed, the CLEAN Health and Safety Manager must be notified.

7.0 STANDARD WORK PRACTICES

The following standard work practices will apply to all Halliburton NUS personnel as applicable to the work being performed at this site.

7.1 GENERAL REQUIREMENTS (ALL TASKS)

- Excavation areas inside of Building 31 shall be physically cordoned off (using items such as caution tape, hazard cones, etc.) to clearly identify the work area, and to aid in restricting access of unauthorized persons.

- Walking and/or working over the debris (pieces of concrete slab) within the building shall be avoided to the extent possible. When avoidance is not possible, objects must be handled in a manner that does not restrict the workers ability to move safely within the area.

- Objects or debris that cannot be manually handled comfortably shall either be handled by more than one person or with mechanical lifting devices.

- Eating, drinking, chewing gum or tobacco, taking medication, and smoking are prohibited in the exclusion or decontamination zones, or any location where there is a possibility for contact with site contaminants exists.

- Upon leaving the exclusion zone, hands and face must be thoroughly washed with soap and potable water. Any protective outer clothing is to be decontaminated and removed as specified in this HASP, and left at a designated area prior to entering the clean area.

- Contact with potentially contaminated substances must be avoided. Contact with the ground or with contaminated equipment must also be avoided. Monitoring equipment must not be placed on potentially contaminated surfaces.

- No facial hair, which interferes with a satisfactory fit of the mask-to-face seal, is permitted on personnel required to wear respiratory protective equipment.

- All personnel must procure a site-specific Health and Safety Plan from the project Health and Safety Officer prior to commencing work on site. All site personnel must read and understand all components of this HASP.

- All personnel must satisfy medical monitoring procedures.

- Any new analytical data must be promptly conveyed via telephone to the CLEAN Health and Safety Manager.

- All work areas must be kept free of ground clutter.

- Areas must be designated for chemical storage. Acids, bases and flammable materials shall all be stored separately. Storage areas must be labeled as to the contents within the storage area.

- All compressed gas cylinders must be stored and used in an upright position, properly secured and protected from damage, segregated, and labelled as empty or full.

- All site personnel must be complete a medical datasheet, to be maintained on site.

- Site personnel must immediately notify Halliburton NUS Health Sciences of all incidents for OSHA recordkeeping purposes.

- If personnel note any warning properties of chemicals (irritation, odors, symptoms, etc.) or even remotely suspect the occurrence of exposure, they must immediately notify the CLEAN Health and Safety Manager for further direction.

- Site personnel are not to undertake any activity which would be considered a confined-space entry without first being trained in the proper procedures as required by the CLEAN Health and Safety Manager, and without first obtaining a Confined Space/Limited Egress Permit.

- Temporary electrical lines present in Building 31 are to be avoided. If sampling activities require close proximity to these lines (i.e., within 5 feet), the main breaker will be placed in the "OFF" position prior to initiating work.

8.0 DECONTAMINATION

This section describes the steps site personnel will follow to prevent the spread of site contaminants into areas that may affect unprotected, unsuspecting site personnel or the public. It includes requirements for decontamination of personnel and sampling equipment. Equipment used by the contractor in performing excavations and mixing operations will be addressed in the contractors HASP.

8.1 PERSONNEL DECONTAMINATION

The decontamination of personnel and their protective clothing will be performed in three stages.

- Stage 1 includes removing contamination from reusable protective clothing and/or clothing that will be disposed of at sanitary landfills. These efforts will involve washing and rinsing these items in a sequence that begins at the highest level to the lowest level (i.e., from the head down towards the feet).

- Stage 2 will include removal of protective clothing, discarding disposable clothing into a drum conspicuously marked "Contaminated Clothing" and/or storing reusable protective clothing in the contamination reduction zone. Stage 2 efforts involve a structured, segregated process carefully removing PPE items beginning with the outermost item and progressing inward.

- Stage 3 will consist of workers washing their hands and face with potable water and soap each time they leave the exclusion zone, before performing any type of hand-to-mouth activity.

All decontamination fluids and solid waste generated will be contained as described in the field sampling plan. The decontamination area will be physically identified with rope or flagging and well equipped to be conducive for completion of proper decontamination activities.

8.2 SAMPLING EQUIPMENT DECONTAMINATION

Decontamination of sampling tools may involve the use of deionized water, detergents (Alconox), methanol, and/or nitric acid. Requirements for decontaminating sampling equipment are presented in the Field Sampling Plan. Methanol and nitric acid will only be used in well ventilated areas and personnel will avoid breathing vapor and/or mist. Material Safety Data Sheets for the decontamination solutions will be presented during site specific training and maintained on site for reference upon request.

9.0 TRAINING

9.1 INTRODUCTORY AND REFRESHER TRAINING

9.1.1 Requirements for Halliburton NUS Personnel

All Halliburton NUS personnel must complete 40 hours of introductory hazardous waste site training, and a minimum of three days actual field experience under direct supervision prior to performing work at the Naval Submarine Base - New London. Additionally, Halliburton NUS personnel who have had introductory training more than 12 months prior to site work must have completed 8 hours of refresher training within the past 12 months before being cleared for site work.

Documentation of Halliburton NUS introductory and refresher training can be obtained through the CLEAN Health and Safety Manager. Copies of certificates or other official documentation will be used to fulfill this requirement.

9.2 SITE-SPECIFIC TRAINING

Halliburton NUS will provide site-specific training to all Halliburton NUS employees who will perform work at this project. This training will only be provided once and personnel who do not attend will not be permitted to perform work at the Naval Submarine Base - New London. Site-specific training will include:

- Names of personnel and alternates responsible for site safety and health
- Safety, health and other hazards present on site
- Use of personal protective equipment
- Work practices to minimize risks from hazards
- Safe use of engineering controls and equipment
- Medical surveillance requirements
- Signs and symptoms of overexposure
- The contents of the health and safety plan and addendum
- Review of relevant MSDSs

9.2.1 Site-Specific Training Documentation

Halliburton NUS personnel will be required to sign a statement indicating receipt of site-specific training and understanding of site hazards and control measures. Figure 9-2 will be used to document site-specific training.

FIGURE 9-1

OSHA TRAINING CERTIFICATION

The following statements must be typed on company letterhead and signed by an officer of he company:

LOGO
XYZ CORPORATION
555 E. 5th Street
Nowheresville, Kansas 55555

Month, day, year

Mr. Willis C. Isner
Project Manager
Halliburton NUS Corporation
661 Andersen Drive; Foster Plaza 7
Pittsburgh, Pennsylvania 15220

Subject: Hazardous Waste Site Training - Naval Submarine Base - New London

Dear Mr Isner:

The employees listed below have had introductory hazardous waste site training or equivalent work experience as required by 29 CFR 1910.120(e). In addition, those employees listed below who have received their introductory training more than 12 months ago have also received 8 hours of refresher training in accordance with 29 CFR 1910.120 (e)(8).

LIST FULL NAMES OF EMPLOYEES AND THEIR SOCIAL SECURITY NUMBERS HERE

Should you have any questions, please contact me at (555) 555-5555.

Sincerely,

(Name of Company Officer)

FIGURE 9-2

SITE-SPECIFIC TRAINING DOCUMENTATION

My signature below indicates that I am aware of the potential hazardous nature of working at the Naval Submarine Base - New London site and that I have received site-specific training which included the elements presented below:

- Names of personnel and alternates responsible for site safety and health
- Safety, health and other hazards present on site
- Use of personal protective equipment
- Work practices to minimize risks from hazards
- Safe use of engineering controls and equipment
- Medical surveillance requirements
- Signs and symptoms of overexposure
- The contents of the health and safety plan and addendum
- Review of relevant MSDSs

I further state that I have been given the opportunity to ask questions and that all of my questions have been answered to my satisfaction.

NAME (PRINT CLEARLY)	SIGNATURE	DATE

Training Conducted By:____________________ Date:__________

10.0 MEDICAL SURVEILLANCE

10.1 REQUIREMENTS FOR HALLIBURTON NUS PERSONNEL

All Halliburton NUS personnel participating in project field activities will have had a physical examination meeting the requirements of Halliburton NUS' medical surveillance program and will be medically qualified to perform hazardous waste site work using respiratory protection.

Documentation for medical clearances can be obtained from the CLEAN Health and Safety Manager.

FIGURE 10-1

SUBCONTRACTOR MEDICAL APPROVAL FORM

For employees of ____
Company Name

Participant Name: __________________________ Date of Exam: ______________

Part A

The above-named individual has:

1. Undergone a physical examination in accordance with OSHA Standard 29 CFR 1910.120, paragraph (f) and found to be medically -

   ( ) qualified to perform work at the **Naval Submarine Base - New London** work site
   ( ) not qualified to perform work at the **Naval Submarine Base - New London** work site

and,

2. Undergone a physical examination as per OSHA 29 CFR 1910.134(b)(10) and found to be medically -

   ( ) qualified to wear respiratory protection
   ( ) not qualified to wear respiratory protection

My evaluation has been based on the following information, as provided to me by the employer.

( ) A copy of OSHA Standard 29 CFR 1910.120 and appendices.
( ) A description of the employee's duties as they relate to the employee's exposures.
( ) A list of known/suspected contaminants and their concentrations (if known).
( ) A description of any personal protective equipment used or to be used.
( ) Information from previous medical examinations of the employee which is not readily available to the examining physician.

Part B

I, ____________________________, have examined ____________________________
Physician's Name (print) Participant's Name (print)
and have determined the following information:

1. Results of the medical examination and tests (excluding finding or diagnoses unrelated to occupational exposure):

____

____

____

FIGURE 10-1
SUBCONTRACTOR MEDICAL APPROVAL FORM
PAGE TWO

2. Any detected medical conditions which would place the employee at increased risk of material impairment of the employee's health:

____

____

____

3. Recommended limitations upon the employee's assigned work:

____

____

____

____

I have informed this participant of the results of this medical examination and any medical conditions which require further examination of treatment.

Based on the information provided to me, and in view of the activities and hazard potentials involved at the ______________________ work site, this participant

( ) may
( ) may not

perform his/her assigned task.

Physician's Signature ______________________

Address ______________________

Phone Number ______________________

NOTE: Copies of test results are maintained and available at:

____
Address

11.0 SITE CONTROL

Work zones will be delineated by the remediation contractor. Halliburton NUS personnel will use these work zones in conjunction with decontamination procedures to prevent the spread of contaminants into previously unaffected areas of the site. It is anticipated that a three-zone approach will be used during work at this site; exclusion zone, contamination reduction zone, and support zone.

11.1 EXCLUSION ZONE

The exclusion zone will be considered those areas of the site of known or suspected contamination. In many cases, however, significant amounts of surface contamination will not be encountered in the proposed work areas of this site until/unless contaminants are brought to the surface by excavation activities. Furthermore, once such activities have been completed and surface contamination has been removed, the potential for exposure is again diminished and the area can then be reclassified as part of the contamination reduction zone. Therefore, the exclusion zones for this project will be limited to those areas of the site where active work is being performed and/or anywhere there is believed to be the potential for inhalation exposure to site contaminants.

11.2 CONTAMINATION REDUCTION ZONE

The contamination reduction zone (CRZ) will be a buffer area between the exclusion zone and any area of the site where contamination is not suspected. For purposes of this project, the CRZ will considered the area within Building 31 excluding any areas classified as an exclusion zone. In addition, the equipment decontamination area established for this project will be considered as a separate CRZ.

11.3 SUPPORT ZONE

The support zone for this project will be located outside Building 31 and will include a staging area where site vehicles will be parked, equipment will be unloaded, and where food and drink containers will be maintained. In all cases, the support zones will be established at areas of the site where exposure to site contaminants would not be expected during normal working conditions or foreseeable emergencies.

12.0 OTHER MISCELLANEOUS REQUIREMENTS

12.1 CONFINED SPACE ENTRY

No personnel, under any circumstances, are to enter confined spaces. Therefore, it is not applicable to specify procedures for such operations in this Health and Safety Plan. However, buildings without sufficient ventilation, illumination, or with questionable structural stability should not be entered. Sufficient illumination and ventilation exist within Building 31, provided work is to be performed during daylight hours and that windows and roll-up steel doors remain open. The structural stability of the building has not been evaluated but appears to be structurally sound. Excavations must be performed in a manner that will not effect the structural integrity of the building. It should be noted that work to be performed in the building will create gases and vapors and possibly airborne particulates that will not be sufficiently exhausted or diluted by existing ventilation (i.e., open windows and toll-up doors). As a result, the use of direct reading air monitors will be used to alert workers of potential exposures to the contaminants (Section 5.0).

12.2 SPILL CONTAINMENT PROGRAM

It is not anticipated that bulk hazardous materials will be handled as part of this scope of work such that spillage would constitute a danger to human health or the environment. Therefore, a spill containment program has not been developed as part of this HASP.

12.3 MATERIALS AND DOCUMENTS

The Halliburton NUS Field Team Leader shall ensure the following materials/documents are taken to the project site and utilized as required.

- Incident Reports
- Medical Data Sheets
- Material Safety Data Sheets for decon solutions and other substances brought to the site
- Follow-Up Reports (to be completed by the Field Team Leader)
- OSHA Job Safety and Health Poster (posted in site trailer)
- Training Documentation Form (Blank)

- First Aid Supply Usage Form
- Emergency Reference Form (Figure 13-1, extra copy for posting)
- User manuals for CO Monitor, HNU, LEL/O_2, and Particulate Monitor

13.0 EMERGENCY RESPONSE PLAN

13.1 INTRODUCTION

This Emergency Response Plan (ERP) is applicable to emergency situations that could arise as a result of activities associated with Halliburton NUS work at Building 31, Naval Submarine Base - New London and has been prepared to comply with the requirements of OSHA Standard 29 CFR 1910.120 (l) (2) and (3).

13.2 PRE-EMERGENCY PLANNING

Pre-emergency planning activities associated with this project include the following:

- Coordinating with Naval Submarine Base - New London personnel to ensure that Halliburton NUS emergency response activities are compatible with existing facility emergency response procedures. Specifically, Mark Krivansky will be provided with a copy of this ERP for review and comment by the appropriate Naval Submarine Base - New London personnel.

- Establishing and maintaining information at the project staging area (support zone) for easy access in the event of an emergency. This information will include the following and it will be the responsibility of the Halliburton NUS Field Team Leader to ensure the information is available.

  - An inventory of chemical substances used on site, with corresponding Material Safety Data Sheets.

  - Site personnel records regarding medical treatment concerns (medical data sheets).

  - A log book identifying personnel present on site each day.

- Identifying a chain of command for emergency response. In this regard, Naval Submarine Base - New London will assume control of any situation to which they respond and Halliburton NUS personnel will be subject to the orders of the official in charge of the response.

13.3 TYPES OF EMERGENCIES

Personal injuries and accidental overexposure to carbon monoxide are the only type of emergencies that can reasonably be anticipated to occur in the performance of Halliburton NUS' sampling activities at Naval Submarine Base - New London. Therefore, these potential emergencies will be the focus of this ERP. Injuries and illnesses requiring first-aid will not be considered emergencies in the context of this plan.

13.4 PERSONNEL ROLES, LINES OF AUTHORITY, AND COMMUNICATION

The coordination of project-related emergency response activities will be the primary responsibility of the Halliburton NUS Field Team Leader (FOL), with assistance from the Site Safety Officer (SSO). Specific responsibilities of the Halliburton NUS FOL include:

- Ensuring that Base medical resources are contacted immediately upon being informed of an emergency

- Ensuring that Building 31 is not entered by unprotected personnel if carbon monoxide levels are in excess of 100 ppm and ensuring that anyone who enters the building when levels exceed 25 ppm are kept within line of site and evacuated within 15 minutes.

The specific responsibilities of the Halliburton NUS SSO will include:

- Providing assistance to the Halliburton NUS FOL
- Accounting for site personnel if the building has been evacuation
- Air monitoring (as needed) for carbon monoxide

All other site personnel will be responsible for following the directions of the Halliburton NUS FOL. If response from the NSB-NLON Fire Department has been requested, Halliburton NUS personnel will be subject to the orders of their official in charge of the response. This individual should make their identity known to Halliburton NUS at the time of their arrival at the incident scene.

13.5 EMERGENCY RECOGNITION AND PREVENTION

13.5.1 Recognition

As stated in Section 13.3, personal injury/illness are the only emergency situations reasonably anticipated. These situations will generally be recognizable by visual observation. An injury or illness will be considered an emergency if it requires treatment other than first aid (i.e., requires treatment by a medical professional).

13.5.2 Prevention

Halliburton NUS will prevent emergencies by ensuring compliance with the Site-specific Health and Safety Plan.

13.6 SAFE DISTANCES AND PLACES OF REFUGE

In the event that Building 31 must be evacuated, all personnel will immediately stop activities and report to the support zone outside the building. Upon reporting to the refuge location, personnel will remain there until directed otherwise by the Halliburton NUS FOL. The Site Safety officer will take roll at this location, using the log book, to confirm the location of all site personnel.

13.7 SITE SECURITY AND CONTROL

If Building 31 is evacuated, the Halliburton NUS FOL will deploy project personnel to strategic locations to secure the building and prevent entry by unauthorized personnel. Only essential personnel who are properly protected will be permitted to enter the building.

13.8 EVACUATION ROUTES AND PROCEDURES

Building 31 must be evacuated whenever; carbon monoxide levels unexpectedly rise above 25 ppm or whenever personnel show signs or symptoms of carbon monoxide poisoning, LEL/O_2 readings indicate a potentially flammable/explosive and/or oxygen-rich or oxygen-deficient atmosphere, or particulate monitor indicates airborne particulates greater than 3.0 mg/m^3, provided workers are not wearing Level C protection. If the event evacuation of Building 31 is necessary, the Halliburton NUS FOL or the Site Safety Officer will give the verbal order to evacuate. In this event, personnel will proceed immediately out of the building to the support zone. Personnel will remain at this location until instructed otherwise by the Halliburton NUS FOL.

Evacuation procedures will be discussed prior to the initiation of any work at the site. Evacuation from the building is dependent upon the location at which work is being performed within the building. In most cases, workers will evacuate through the large steel roll-up doors located at either end of the building. Workers should become familiar with the building and the location of exits in relation to the areas in which work is being performed.

13.9 DECONTAMINATION PROCEDURES/EMERGENCY MEDICAL TREATMENT

Due to the nature and extent of contamination at this site and the types of emergencies anticipated, personnel decontamination will be secondary to building evacuation. Therefore, once personnel exit the building, contaminated clothing will be removed. If medical treatment is needed, injured/ill persons will be transported to the base medical facility or, if necessary, base medical personnel will be requested at the scene of the incident.

13.10 EMERGENCY ALERTING AND RESPONSE PROCEDURES

Since Halliburton NUS personnel will be working in close proximity to each other, hand signals and voice commands will be sufficient to alert site personnel of an emergency. In addition, Halliburton NUS will utilize the telephone located in Building 20 to request emergency medical assistance from the NSB-NLON Fire Department. The procedure for response will be as follows:

- Step 1 - The victim(s) will remove themselves (if possible) from the hazard or a co-worker may attempt to rescue the victim(s) if rescue can be accomplished simply, timely, and without endangering life or health. Before a rescue is attempted, the rescuer must identify the cause of the injury or illness and ascertain that a rescue can be performed safely. If uncertainty exists, rescue at this time will not to be initiated.

- Step 2 - The victim(s) or witnesses will notify the Halliburton NUS FOL of the nature of the injury/illness.

- Step 3 - The Halliburton NUS FOL will notify the SSO, and (2) notify the NSB-NLON Fire Department (via the telephone in Building 20) if the injury/illness will require medical attention.

- Step 4 - The NSB-NLON Fire Department will deploy a Medical Team as needed and will notify the medical facility who will await the arrival of the injured/ill party at the facility.

- Step 5 - The SSO and an assistant will (1) deploy to the scene appropriately equipped with first-aid supplies, (2) don any protective equipment needed to enter Building 31 if the victim must be rescued from a carbon monoxide atmosphere, (3) provide first-aid services within their capabilities and training, and (4) transport the victim to the support zone and/or to the medical facility (as appropriate) if transport can be accomplished without aggravating an injury.

- Step 6 - The Halliburton NUS FOL will ensure that all persons with chemically-related injuries/illness are examined, by a licensed physician who is in contact with the Halliburton NUS medical consultant, at the earliest possible time following the incident.

- Step 7 - The Halliburton NUS FOL will (1) perform a critique of the incident, (2) determine measures to prevent recurrence, (3) determine measures to improve response efforts, (4) complete an incident report.

13.11 PPE AND EMERGENCY EQUIPMENT

A first-aid kit will be maintained on site and immediately available for use in the event of an emergency.

13.12 PROCEDURES FOR INCIDENT REPORTING

In the event of an emergency situation, the Halliburton NUS FOL, along with the leader from the remediation contractor, will be responsible for determining the need for, and carrying out communications with, the NSB-NLON Fire Department. All emergency situations are to be communicated (via the telephone in Building 20) directly to the NSB-NLON Fire Department. Personnel at that location are authorized to deploy emergency resources if needed. Figure 11-1 provides telephone numbers that may be necessary in the event of an emergency.

13.13 EMERGENCY CRITIQUE AND FOLLOW-UP

Emergencies will be critiqued by the Halliburton NUS FOL with assistance from the SSO. The objective of these critiques will be to identify and improve weaknesses. Once weaknesses have been identified, the Halliburton NUS FOL will follow-up by ensuring that necessary modifications are made to the ERP, the site-specific health and safety plan, and any applicable procedures. In addition, the Halliburton NUS FOL will complete an incident report form.

13.14 EMERGENCY CONTACTS

The primary contact in an emergency situation is the NSB-NLON Fire Department. This department is manned on a 24-hour basis. This department will make the critical decisions regarding where an injured person will be transported. In case of immediate threat of life, the Naval Hospital on NSB-NLON will be used; otherwise, persons will be transported to Lawrence and Memorial Hospital in New London.

13.15 EMERGENCY ROUTE TO HOSPITAL

From Building 31, go north on Capelin or Bullhead road and turn left onto Argonaut Road. Cross Railroad tracks and turn left onto Shark Blvd. Pass Building 338 and turn right onto Wahoo Avenue. Wahoo Avenue becomes Tautog Avenue and Hospital is on the right (Building 449).

FIGURE 13-1

EMERGENCY REFERENCE
NAVAL SUBMARINE BASE - NEW LONDON - GROTON, CONNECTICUT

Contact	Phone Number
Local emergency medical team located at NSB-NLON (ambulance/fire dispatcher):	Dial 449-3333 449-3666
Nearest emergency room (NSB-NLON Hospital): Emergency Room at Lawrence and Memorial Hospital (New London) Groton Police: Groton Fire Department:	911 or 442-0711 911 or 445-2451 911 or 445-2456
Utility Emergencies (electric, gas, water and sewer) NSB-NLON Public Works: Public Works: Authorized Navy Site Personnel:	449-4711
Lieutenant Pat Rios	449-3644
William Mansfield: Mark Krivansky:	449-2276 (215) 595-0567 (Ext. 153)
NSB-NLON Security: National Information Centers:	449-3444
Chemtrec: National Response Center:	(800) 424-9300 (800) 424-8802
Halliburton NUS Project Manager Jean-Luc Glorieux	(412) 921-8568
Halliburton NUS CLEAN Health and Safety Manager Matthew M. Soltis	(412) 921-8912
Halliburton NUS Medical Consultant Dr. Britton	(713) 797-3111

EMERGENCY ROUTE TO HOSPITAL

From Building 31, proceed south of Albacore Road. Bear left and exit lower Subbase at check-point. Cross railroad tracks and turn left onto Shark Boulevard. Pass Building 338 and turn right onto Wahoo Avenue. Wahoo Avenue becomes Tautog Avenue and Hospital is on the right (Building 449).

ATTACHMENT 1

HEALTH HAZARD INFORMATION FOR INORGANIC LEAD

Although the toxicity of lead has been known for 2,000 years, the knowledge of the complex relationship between lead exposure and human response is still being refined. Significant research into the toxic properties of lead continues throughout the world, and it should be anticipated that our understanding of thresholds of effects and margins of safety will be improved in future years. The provisions of the lead standard are found on two prime medical judgements: first, the prevention of adverse health effects from exposure to lead throughout a working lifetime requires that worker blood lead levels be maintained at or below 40 μg/100 g and second, the blood lead levels of workers, male or female, who intend to parent in the near future should be maintained below 30 μg/100 g to minimize adverse reproductive health effects to the parents and developing fetus. The adverse effects of lead on reproduction are being actively researched and OSHA encourages the physician to remain abreast of recent developments in the area to best advise pregnant workers or workers planning to conceive children.

The spectrum of health effects caused by lead exposure can be subdivided into five developmental stages: normal, physiological changes of uncertain significance, pathophysiological changes, overt symptoms (morbidity), and mortality. Within this process there are no sharp distinctions, but rather a continuum of effects. Boundaries between categories overlap due to the wide variation of individual responses and exposures in the working population. OSHA's development of the lead standard focused on pathophysiological changes, as well as later stages of the disease.

1. Heme Synthesis Inhibition. The earliest demonstrated effect of lead involves its ability to inhibit at least two enzymes of the heme synthesis pathway at very low blood levels. Inhibition of delta-aminolevulinic acid dehydrase (ALA-D) which catalyzes the conversion of delta-aminolevulinic acid (ALA) to protoporphyrin is observed at a blood level below 20 μg/100 g whole blood. At a blood level of 40 μg/100 g, more than 20% of the population would have 70% inhibition of ALA-D. There is an exponential increase in ALA excretion at blood lead levels greater than 40 μg/100 g.

   Another enzyme, ferrochelaste, is also inhibited at low blood levels. Inhibition of ferrochelaste leads to increased free erythrocyte protoporphyrin (FEP) in the blood which can then bind to zinc to yield zinc protoporphyrin. At a blood lead level of 40 μg/100 g and the associated ZPP level, which has lead to the development of the ZPP screening test for lead exposure.

While the significance of these effects is subject to debate, it is OSHA's position that these enzyme disturbances are early stages of a disease process which may eventually result in the clinical symptoms of lead poisoning. Whether or not the effects do progress to the later stages of clinical disease, disruption of these enzyme processes over a working lifetime is considered to be a material impairment of health.

One of the eventual results of lead-induced inhibition of enzymes in the heme synthesis pathway is anemia which can be asymptomatic if mild but associated with a wide array of symptoms including dizziness, fatigue, and tachycardia when more severe. Studies have indicated that lead levels as low as 50 μg/100 g can be associated with a definite decreased hemoglobin, although most cases of lead-induced anemia as well as shortened red-cell survival times, occur at lead levels exceeding 80 μg/100 g. Inhibited hemoglobin synthesis is more common in chronic cases whereas shortened erythrocyte life span is more common in acute cases.

In lead-induced anemias, there is usually a reticulocytosis along with the presence of basophilic stippling, and ringed sideroblasts, although none of the above are pathognomonic for lead-induced anemia.

2. Neurological Effects. Inorganic lead has been found to have toxic effects on both the central and peripheral nervous systems. The earliest stages of lead-induced central nervous system effects first manifest themselves in the form of behavioral disturbances and central nervous system symptoms including sleep disturbances, fatigue, vertigo, headache, poor memory, tremor, depression, and apathy. With more severe exposure symptoms can progress to drowsiness, stupor, hallucinations, delirium, convulsions, and coma.

The most severe and acute form of lead poisoning which usually follows ingestion or inhalation of large amounts of lead is acute encephalopathy which may arise precipitously with the onset of intractable seizures, coma, cardiorespiratory arrest, and death within 48 hours.

While there is disagreement about what exposure levels are needed to produce the earliest symptoms, most experts agree that symptoms definitely can occur at blood levels of 60 μg/100 g whole blood and therefore recommend a 40 μg/100 g maximum. The central nervous system effects frequently are not reversible following discontinued exposure or chelation therapy and when improvement does occur, it is almost always only partial.

The peripheral neuropathy resulting from lead exposure characteristically involves only motor function with minimal sensory damage and has a marked predilection for the extensor muscles of the most active extremity. The peripheral neuropathy can occur with varying degrees of severity. The earliest and mildest form which can be detected in workers with blood levels as low as 50 μg/100 g is manifested by slowing of motor nerve conduction velocity often without clinical symptoms. With progression of the neuropathy there is development of painless extensor muscle weakness usually involving the extensor muscles of the fingers and hand in the most active upper extremity, followed in severe cases by wrist drop or, much less commonly, foot drop.

In addition to slowing of nerve conduction, electromyographical studies in patients with blood lead levels greater than 50 μg/100 g have demonstrated a decrease in the number of acting motor unit potentials, an increase in the duration of motor unit potentials, and spontaneous pathological activity including fibrillations and fasciculations. Whether these effects occur at levels of 40 μg/100 g is undetermined.

While the peripheral neuropathies can occasionally be reversed with therapy, again such recovery is not assured particularly in the more severe neuropathies and often improvement is only partial. The lack of reversibility is felt to be due in part to segmental demyelination.

3. Gastrointestinal. Lead may also affect the gastrointestinal system producing abdominal colic or diffuse abdominal pain, constipation, obstipation, diarrhea, anorexia, nausea and vomiting. Lead colic rarely develops at blood lead levels below 80 μg/100 g.

4. Renal. Renal toxicity represents one of the most serious health effects of lead poisoning. In the early stages of disease nuclear inclusion bodies can frequently be identified in proxima renal tubular cells. Renal function remains normal and the changes in this stage are probably reversible. With more advanced disease there is progressive interstitial fibrosis and impaired renal function. Eventually extensive interstitial fibrosis ensures with sclerotic

glomeruli an dilated and atrophied proximal tubules; all represent end stage kidney disease. Azotemia can be progressive, eventually resulting in frank uremia necessitating dialysis. There is occasionally associated hypertension and hyperuricemia with or without gout.

Early kidney disease is difficult to detect. The urinalysis is normal in lead nephropathy and the blood urea nitrogen and serum creatinine increase only when two-thirds of kidney function is lost. Measurement of creatinine clearance can often detect earlier disease as can other methods of measurement of glomerular filtration rate. An abnormal Ca-EDTA mobilization test has been used to differentiate between lead-induced and other nephropathies, but this procedure is not widely accepted. A form of Fanconi syndrome with aminoaciduria, glycosuria, and hyperphosphaturia indicating severe injury to the proximal renal tubules is occasionally seen in children.

5. Reproductive effects. Exposure to lead can have serious effects on reproductive function in both males and females. In male workers exposed to lead there can be a decrease in sexual drive, impotence, decreased ability to produce healthy sperm, and sterility. Malformed sperm (teratospermia) decreased number of sperm (hypospermia), and sperm with decreased motility (asthenospermia) can all occur. Teratospermia has been noted at mean blood lead levels of 53 μg/100 g and hypospermia and asthenospermia at 41 μg/100 g. Furthermore, there appears to be a dose-response relationship for teratospermia in lead exposed workers.

Women exposed to lead may experience menstrual disturbances including dysmenorrhea, menorrhagia and amenorrhea. Following exposure to lead, women have a higher frequency of sterility, premature births, spontaneous miscarriages, and stillbirths.

Germ cells can be affected by lead and cause genetic damage in the egg or sperm cells before conception and result in failure to implant. Miscarriage, stillbirth, or birth defects may result.

Infants of mothers with lead poisoning have a higher mortality during the first year and suffer from lowered birth weights, slower growth, and nervous system disorders.

Lead can pass through the placental barrier and lead levels in the mother's blood are comparable to concentrations of lead in the umbilical cord to birth. Transplacental passage becomes detectable at 12-14 weeks of gestation and increases until birth.

There is little direct data on damage to the fetus from exposure to lead but it is generally assumed that the fetus and newborn would be at least as susceptible to neurological damage as young children. Blood lead level of 50-60 μg/100 g in children can cause significant neurobehavioral impairments and there is evidence of hyperactivity at blood levels as low as 25 μg/100 g. Given the overall body of literature concerning the adverse health effects of lead in children, OSHA feels that blood lead level in children should be maintained below 30 μg/100 g with a population mean of 15 μg/100 g. Blood lead levels in the fetus and newborn likewise should not exceed 30 μg/100 g.

Because of lead's ability to pass through the placental barrier and also because of the demonstrated adverse effects of lead on reproductive function in both the male and female as well as the risk of genetic damage of lead on both the ovum and sperm, OSHA recommends a 30 μg/100 g maximum permissible blood lead level in both males and females who wish to bear children.

6. Other toxic effects. Debate and research continue on the effects of lead on the human body. Hypertension has frequently been noted in occupationally exposed individuals although it is difficult to assess whether this is due to lead's adverse effects on the kidney or if some other mechanism is involved. Vascular and electrocardiographic changes have been detected but have not been well characterized. Lead is thought to impair thyroid function and interfere with the pituitary-adrenal axis, but again these effects have not been well defined.

ATTACHMENT 2

HEALTH HAZARD INFORMATION FOR CARBON MONOXIDE

CARBON MONOXIDE

CAS: 630-08-0

CO: 25 ppm (≈29 mg/m^3)

TLV-TWA:

TLV-STEL: None established

Carbon monoxide is a flammable, colorless, practically odorless gas. Its physicochemical properties include:

Molecular weight: 28.01
Freezing point: -207°C
Condensation point: -190°C
Lower explosive limit: 12.5% by volume in air

It has a density practically the same as that of nitrogen, slightly less than that of air. Sparingly soluble in water (3.3 mL/100 mL of H_2O at 0°C).

CO is an ingredient of gaseous fuels (producer gas, water gas) which have been largely replaced by natural gas. It is chiefly encountered as a product of incomplete combustion of almost any carbonaceous material, especially in the exhausts of internal combustion engines. High concentrations are frequently encountered in blast furnace operations in the steel industry. Space heaters, improperly adjusted oil or gas burners, and fires in buildings are also important sources of carbon monoxide exposure.

Carbon monoxide is a chemical asphyxiant gas whose primary toxic action is a direct result of the hypoxia produced by a given exposure. It rapidly diffuses across the alveolar membrane and is reversibly bound to one of the heme proteins. Complexes of 80-90% with hemoglobin resulting in a reduction in the oxygen-carrying capacity of the blood. The remainder of the CO binds with myoglobin, cytochrome oxidase, cytochrome P-450, and the hydroperoxidases.

A small amount of CO is produced endogenously, mainly from the catabolism of hemoglobin. In healthy male subjects at rest, the average rate of endogenous CO production is approximately 0.4 mL/hr resulting in a carboxyhemoglobin (COHb) saturation of 0.4-0.7%.[1] Hypermetabolism, certain drugs and hemolytic anemia can increase the endogenous production of COHb to 4-6%.[2]

Tobacco smokers are the most heavily exposed, non-industrial segment of the population.[3] COHb saturations in this group range from 4-20% with a mean for one-pack-per-day consumers of 5-6%.[3]

Each molecule of CO combining with hemoglobin reduces the oxygen carrying capacity of the blood and exerts a finite stress on man. Thus, it may be reasoned that there is no dose of CO that is not without an effect on the body. Whether that effect is physiologic or harmful depends upon the dose of CO and the state of health of the exposed individual. The body compensates for this hypoxic stress by increasing cardiac output and blood flow to specific organs, such as the brain or the heart. When this ability to compensate is overpowered or is limited by disease, tissue injury results.

The absorption and elimination of CO is mathematically described by the equation of Coburn et al., which takes into account such important variables as exposure duration, alveolar ventilation, partial pressure of CO in the inhaled air, blood volume, barometric pressure, diffusivity of the lung for CO, rate of endogenous CO production, average partial pressure of oxygen in the lung and capillaries, and the exact ratio of the affinity of blood for CO.[4,5] Of these variable CO concentration, duration of exposure, and alveolar ventilation are the most influential in determining COHb saturation.

Exposure to CO sufficient to produce COHb saturations in the 3-5% range impairs cardiovascular function in patients with cardiovascular disease[6-12] and in normal subjects.[13-15] COHb saturations in the 4-6% range have been shown to significantly reduce the ventricular fibrillation threshold in both normal, anesthetized dogs, and those with acute myocardial injury.[16] These levels also increase myocardial ischemia associated with acute myocardial infarction in dogs.[17]

The question of significant changes in mental function produced by COHb saturation between 2-5% was controversial and has been reviewed.[18] It does appear that an abrupt elevation of COHb saturation to 5% will transiently alter the visual light threshold.[19,20] In the industrial setting, the ability to perform complex tasks requiring both judgment and motor coordination is not affected adversely by saturations below 10%.[18]

A threshold limit value for carbon monoxide of 100 ppm has been extant for many years, but no substantial justification for its validity under ordinary circumstances of work can be found. The often quoted work of Henderson and Haggard,[21] states that a three-hour exposure at 100 ppm produces no effect, but six hours' exposure produces a perceptible effect, and nine hours' exposure causes headache and nausea. Drinker[22] states that the safety constant must be reduced to one-third or less under exercise or work. The Committee believes that the apparent success of the 10 ppm value was due to inurement and accumulation of individuals of low degree of susceptibility. A great deal of confusion has resulted over the years from the summation of thousands of publications on the effects of carbon monoxide on man because of serious difficulty in the determination of low levels of the compound in air and blood. It now seems reasonably certain that an equilibrium exposure of man at 50 ppm of carbon monoxide will result in a COHb value of 8-10%, and that under usual conditions for work and rest periods an "end of work day" level of 5-6% would be expected. A crew of workers in the Holland Tunnel who worked two hours in and two hours out, for eight-hour "swing" shifts in an average tunnel CO concentration of 70 ppm showed an average of 5% COHb with no one above 10%. Under this average exposure of 25-50 ppm, no symptoms or health impairments were found,[23] or would be expected.

Men exposed continuously for many days in a submarine at 50 ppm CO complained of headache, but a 60-day exposure at 40 ppm CO was without effect.[24]

Schulte[25] stated that exposure at 100 ppm of CO for over four hours is excessive and recommends a maximal exposure at 50 ppm CO for over four hours' duration.

Studies made upon a group of healthy young men exposed for a prolonged period at 44 ppm CO produced no adverse reactions on their general health.[26]

The recommended time-weighted TLV of 25 ppm is a concentration that should not result in blood CO levels above 10%, which might cause signs and symptoms of borderline effects.[27]

The primary effect of exposure to low concentrations of CO on workmen results from the hypoxic stress secondary to the reduction in the oxygen-carrying capacity of blood. Healthy workmen are exquisitely sensitive to such stresses and immediately compensate by increasing cardiac output and flow to critical organs. However, workmen with significant disease, both detected and undetected, may not be able to compensate adequately and are at risk of serious injury. For such workers a TLV of 25 ppm, an air concentration that should not result in blood COHb saturations above 4%, might be necessary. Even such a concentration might be detrimental to the health of some workers who might have far advanced cardiovascular disease.

To protect workers with chronic heart disease NIOSH, in its criteria document for CO,[28] recommends a work environment standard of 35 ppm as a TWA, with a ceiling of 200 ppm. Much of the evidence on which this recommendation is based is derived from studies of cigarette smokers.[29]

It would appear to the Committee that the time-weighted TLV of 25 ppm for carbon monoxide might also be too high under conditions of heavy labor, high temperatures, or at high elevations (over 5,000 feet above sea level). For the great majority of workers, however, exposure to carbon monoxide at concentrations below 50 ppm, under a wide range of working conditions, should not result in either mild temporary distress or permanent impairment of health.

Other recommendations: Australia, Finland, West Germany, Belgium, Holland, Switzerland and Yugoslavia have adopted the 50 ppm TLV; Sweden, 35 ppm; East Germany, 30 ppm; Czechoslovakia, Hungary, Poland, Romania, 26 ppm; Bulgaria, USSR, 17 ppm.

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APPENDIX D

QUALITY ASSURANCE PROJECT PLAN

R-07-93-2

QUALITY ASSURANCE PROJECT PLAN
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Northern Division
Environmental Branch, Code 1823
Naval Facilities Engineering Command
10 Industrial Highway, Mail Stop #82
Lester, Pennsylvania 19113-2090

Submitted by:
Halliburton NUS Corporation
993 Old Eagle School Road, Suite 415
Wayne, Pennsylvania 19087-1710

Contract Number N62472-90-D-1298
Contract Task Order 0115

September 1993

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1.0 PROJECT DESCRIPTION

As requested by the U.S. Navy, Halliburton NUS has prepared this Quality Assurance Project Plan (QAPP) for field verification sampling and analysis during remedial work at Building 31 of the Naval Submarine Base - New London (NSB-NLON) located in Groton, Connecticut.

Halliburton NUS has established quality assurance/quality control (QA/QC) measures and a program to ensure that these measures are applied to the collection and interpretation of all environmental quality data at the facility. The QAPP is designed to assure that the precision, accuracy, representativeness, comparability, and completeness (the PARCC parameters) of the data are known, documented, and adequate to satisfy the data quality objectives of the study.

This plan represents the policies, organization, objectives, data-collection activities, and QA/QC activities that will be utilized to ensure that all data collected during, and reported by, this study are representative of existing conditions. Chemical analyses will be conducted by a laboratory subcontractor. The laboratory will possess current Contract Laboratory Program (CLP) certification and will have site-specific Naval Energy and Environmental Support Activity (NEESA) approval. QA/QC procedures for the chemical analyses will satisfy NEESA requirements for Level D QC, which is equivalent to EPA CLP DQO Level IV QC Criteria.

2.0 PROJECT SCOPE OF WORK

Field verification sampling and analysis will be performed to ensure that pre-established remedial goals are met during work at Building No. 31. Details of the sampling, such as the approach, selection of drilling locations, and sample collection activities, are found in Sections 2.0 and 3.0 of the Field Verification Sampling Plan (FVSP). A brief history of the site is contained in Section 1.0 of the FVSP.

A summary of previous investigations at Building No. 31 and existing analytical data are briefly summarized in Section 1.1 of the FVSP.

3.0 SAMPLE MATRICES, PARAMETERS, AND FREQUENCY COLLECTION

As part of the field work, field verification samples will be collected from soil, concrete, and treated soil matrices. A listing of the sample matrices, parameters, and frequency of collection is found in Table 3-1. Sampling protocols to be used in this study are provided in Section 6.0 of this QAPP. As required by NEESA, a sampling rationale is included in Section 2.0 and Section 3.0 of the Field Verification Sampling Plan. All samples submitted for laboratory analysis will be analyzed for lead and the number and type of media are summarized in Table 3-1. In addition, Table 3-2 presents the sample containers, preservatives, and allowable holding times for the required analyses.

TABLE 3-2

SUMMARY OF ANALYSIS, BOTTLE REQUIREMENTS, PRESERVATION REQUIREMENTS, AND HOLDING TIMES
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT

Media	Analysis	Number of Samples	No. of Containers Per Sample	Container Type	Preservation Requirements	Holding Times
Wipe Sample	Lead (total recoverable)	62	1	40 mL clear glass	Cool to 4°C	6 months
Soil	Lead (total recoverable)	130	1	8 oz. amber glass, wide-mouth	Cool to 4°C	6 months
Treated Soil	TCLP (lead)	49	1	32 oz. amber glass, wide-mouth	Cool to 4°C	6 months

4.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Halliburton NUS will be responsible for the overall management of the field verification sampling and analysis. Personnel from Navy will support Halliburton NUS in a number of areas as outlined in Section 6.1 of the Field Verification Sampling Plan.

4.1 NAVY SUPPORT

Mr. Mark Krivansky will be the Northern Division Remedial Project Manager (RPM). He will be the primary Navy point of contact for the project. All project activities, including reporting and field activities, will be coordinated through Mr. Krivansky. Any changes in scope will be approved through Mr. Krivansky prior to implementation. Mr. Krivansky may be contacted at the following address:

Mr. Mark Krivansky
Northern Division Naval Facilities Engineering Command
Code 1823
10 Industrial Highway
Lester, Pennsylvania 19113-2090
(215) 595-0567

Mr. James Briggs will be the Northern Division Remedial Design Manager. Any changes due to differing construction procedures will be coordinated through Mr. Briggs. Mr. Briggs may be contacted at the following address:

Mr. James Briggs
Northern Division Naval Facilities Engineering Command
Code 405
10 Industrial Highway
Lester, Pennsylvania 19113-2090
(215) 595-0590

Lt. Commander Mark Whitson will be the primary point of contact at NSB-NLON. All sampling work will be coordinated through Lt. Commander Whitson; he will notify appropriate personnel (security, etc.) and make arrangements for support facilities that will be provided by the Navy. Lt. Commander Whitson may be contacted at the following address:

Lt. Commander Mark Whitson
Officer in Charge, NAVFACENGCOM, Contracts
New London Resident Office
Building 135
Box 26
Naval Submarine Base, New London
Groton, Connecticut 06349-5100
(203) 449-3536

4.2 PROJECT ORGANIZATION

The project will be staffed with personnel from the Pittsburgh office. The address and main phone number for the Halliburton NUS Pittsburgh office is:

Halliburton NUS Corporation
Foster Plaza VII
661 Andersen Drive
Pittsburgh, Pennsylvania 15220
(412) 921-7090

Key Halliburton NUS management staff and project staff members for this project are as follows:

- John Trepanowski, P.E. - Program Manager (215) 971-0900
- Debra Wroblewski - Deputy Program Manager (412) 921-8968
- Patricia Patton - Contracting Officer (301) 258-8644
- Debra Scheib - Quality Assurance Manager (412) 921-8876
- Matt Soltis - Health and Safety Manager (412) 921-8912
- Jean Luc Glorieux - Project Manager (412) 921-8568
- To Be Determined - Field Operation Leader (412) 921-7090

The Halliburton NUS Project Manager has the primary responsibility for project and technical management of this project. He is responsible for the coordination of all onsite personnel, and for providing technical assistance for all activities that are directly related to the project. If quality assurance problems or deficiencies requiring special action are identified, the Project Manager, Deputy Program Manager, and Quality Assurance Manager will identify the appropriate corrective action. For Halliburton NUS project organization see Figure 4-1.

4.3 FIELD ORGANIZATION

The Halliburton NUS field verification sampling team will team will consist of one person who will serve as both field operations leader (FOL) and sampler.

The FOL will be responsible for the coordination of all field verification sampling, health and safety during sampling, and for the maintenance of all sampling materials/equipment. The FOL will act also as the site Quality Assurance advisor and will be responsible for the completion of all sampling, chain-of-custody documentation in accordance with appropriate SOPs, and will assume custody of all samples and ensure the proper handling and shipping of samples.

The Quality Assurance Manager, although not formally part of the field team, will be responsible for monitoring the adherence to all QA/QC guidelines as defined in this QAPP. Strict adherence to these procedures is critical to the collection of acceptable and representative data.

A site health and safety officer will be designated prior to field activities and will be responsible for assuring that all team members adhere to the designated health and safety requirements.

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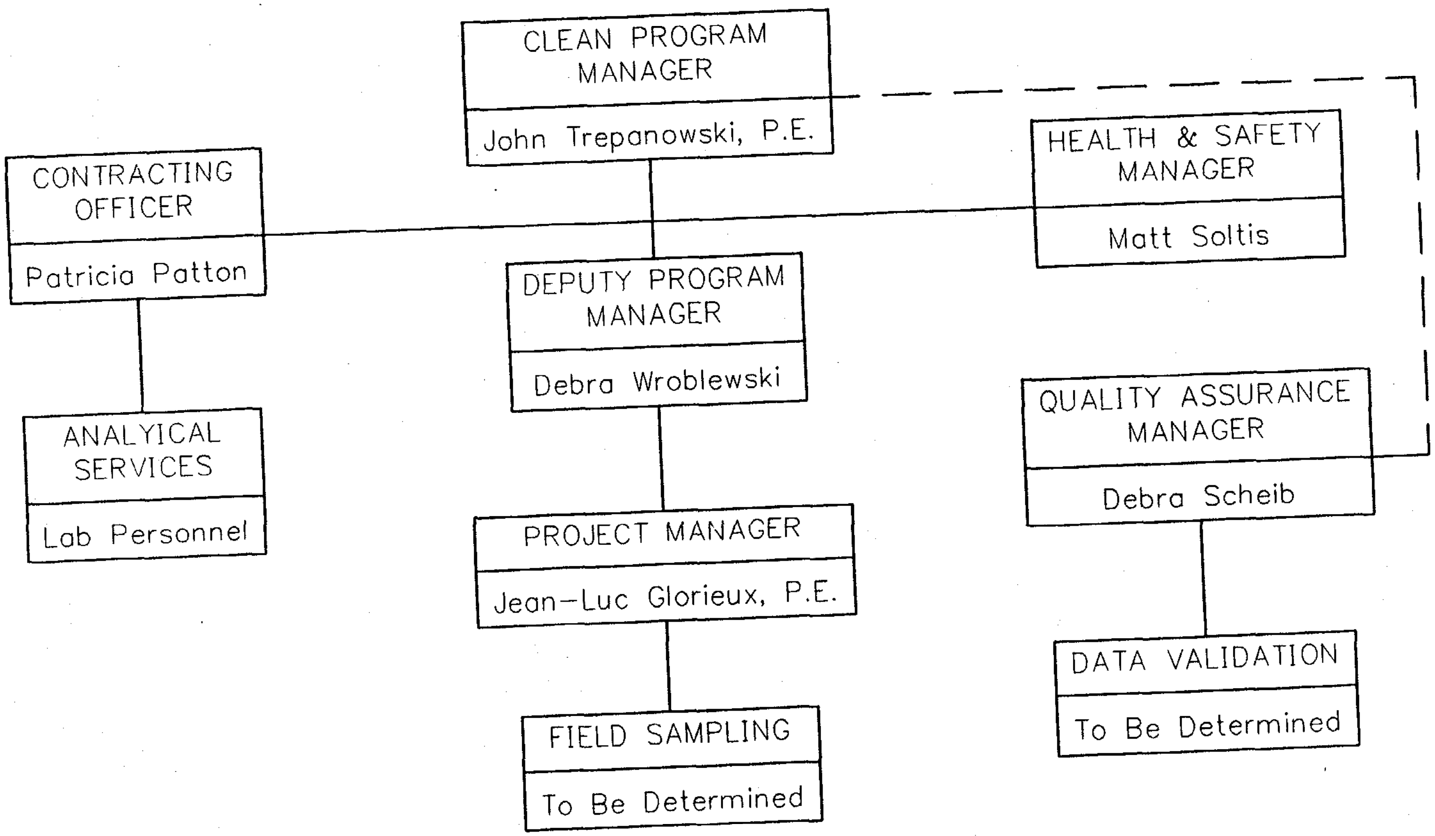
R-07-93-2

FIGURE 4-1
HALLIBURTON NUS PROJECT ORGANIZATION



5.0 QUALITY ASSURANCE OBJECTIVES

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide environmental monitoring data of known and acceptable quality. Specific procedures to be used for sampling, chain-of-custody, calibration of field instruments, laboratory analysis, reporting, internal quality control, audits, preventative maintenance, and corrective actions are described in later sections of this QAPP. The purpose of this section is to address the data quality objectives in terms of the (PARCC) parameters, quantitation and detection limits, field blanks, rinsate blanks, duplicates, and bottleware cleanliness.

5.1 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) are qualitative and/or quantitative statements regarding the quality of data needed to support the project activities. The sampling rationale provided in the Abbreviated Field Sampling Plan explains the choice of sample locations and media which will supply information needed for the project.

5.2 PARCC PARAMETERS

The quality of data set is measured by certain characteristics of the data, namely the PARCC parameters. Some of the parameters are expressed quantitatively, while others are expressed qualitatively. The objectives of the project and the intended use of the data define the PARCC goals. All laboratory data generated for this project will meet NEESA quality Level D standards which are equivalent to EPA DQO Level IV quality criteria. Contract Laboratory Program analytical procedures will be used to generate and report the sample data. Hence, quantitation limits and quality criteria stipulated in the CLP analytical Statement of Work (SOWs) and the corollary National Functional Guidelines documents used for the evaluation of CLP data will be observed. Individual PARCC parameters are discussed below.

5.2.1 Precision

Precision characterizes the amount of variability and bias inherent in a data set. Precision describes the reproducibility of measurements of the same parameter for a sample under the same or similar conditions. Precision is expressed as a range (the difference between two measurements of the same parameter) or as a relative percent difference (the range relative to the mean, expressed as a percent). Range and Relative Percent Difference (RPD) values are calculated as follows:

$$\text{Range} = OR - DR$$

$$RPD = \frac{[OR - DR]}{1/2\ (OR + DR)} \times 100\%$$

where: OR = original sample result

DR = duplicate sample result

The internal laboratory control limits for precision are three times the standard deviation of a series of RPD or range values. RPD values may be calculated for both laboratory and field duplicates, and can be compared to the control limits as a QA check. The control limits established through the National Functional Guidelines documents (as amended for use in EPA Region I) will be used as the evaluation standards. These documents are fully referenced in Section 17.0 of this QAPP. Laboratory duplicates will be analyzed at the rate required by NEESA. Field duplicates will be collected for 10 percent of all samples collected.

5.2.2 Accuracy

Accuracy is the comparison between experimental and known or calculated values expressed as a percent recovery (%R). Percent recoveries are derived from analysis of standards spiked into deionized water (standard recovery) or into actual samples (matrix spike or surrogate spike recovery). Recovery is calculated as follows:

$$\%R = \frac{E}{T} \times 100\%$$

where: E = experimental result

T = true value (theoretical result)

and

$$T = \frac{(\text{sample aliq.})\ (\text{sample conc.}) + (\text{spike aliq.})\ (\text{spike conc.})}{\text{sample aliq.} + \text{spike aliq.}}$$

Control limits for accuracy contained in the National Functional Guidelines documents will be referenced for both CLP and non-CLP procedures.

Accuracy for aqueous and solid samples will be evaluated by use of surrogate and matrix spikes. Out-of-criteria results will be reviewed for data applicability as a part of data validation. The quality control limits established in the National Functional Guidelines documents (as amended for use in EPA Region I) will be referenced.

5.2.3 Representativeness

All data obtained should be representative of actual conditions at the sampling location. The AFSP is designed so that the samples taken will present an accurate representation of actual site conditions. The rationales discussed in the AFSP and QAPP are designed to ensure this. All sampling activities will conform to the protocols given in Section 6.0 of this QAPP. The use of NEESA approved CLP analytical protocols and data deliverables will ensure that analytical results and deliverables are representative, and both consistently performed and reported.

5.2.4 Comparability

Comparability will be achieved by utilizing standardized sampling and analysis methods and data reporting format. Both analytical procedures and sample collection techniques will maximize the comparability of this new data to previous data. Additionally, consideration will be given to seasonal conditions and other environmental conditions that could influence analytical results.

5.2.5 Completeness

Completeness is a measure of the amount of valid data obtained from the measurement program, compared to the total amount collected. For relatively clean, homogeneous matrices, 100 percent completeness is expected. However, as matrix complexity and heterogenicity increase, completeness may decrease. Where analysis is precluded or where DQOs are compromised, effects on the overall investigation must be considered. Whether any particular sample is critical to the investigation will be evaluated in terms of the sample location, the parameter in question, the intended data use, and the risk associated with the error.

Critical data points may not be evaluated until all the analytical results are evaluated. If in the evaluation of results it becomes apparent that the data for a specific medium are of insufficient quality (95 percent), either with respect to the number of samples or an individual analysis, resampling of the deficient data points may be necessary.

5.3 DETECTION AND QUANTITATION LIMITS

Observation detection and quantitation limits as stipulated in the appropriate CLP SOW are required for all data generated for this project using CLP procedures. Where CLP procedures are not used, the detection and quantitation limits stipulated by the specific analytical method will be observed.

5.4 FIELD BLANKS

Field blanks are obtained by sampling the water(s) used in decontamination during the field investigation. Samples consist of the source water used in (1) steam cleaning of large equipment and (2) analyte-free water used for decontamination of sampling equipment. Field blanks will be used to confirm the effectiveness of decontamination procedures, and to determine if the analyte-free water or the potable water (used for steam cleaning) may be contributing to sample contamination. Field blanks will be collected for each type of water used for decontamination and will be submitted at a frequency of one per sampling event per media.

5.5 RINSATE BLANKS

Equipment rinsate blanks are obtained under representative field conditions by running analyte-free water through sample collection equipment (bailer, split spoon, corer, etc.) after decontamination and placing it in the appropriate sample containers for analysis. Equipment blanks will be used to assess the effectiveness of decontamination procedures. Equipment blanks will be collected for each type of non-dedicated sampling equipment used and will be submitted at a frequency of one per day per media. Equipment blanks, however, only from every other day will be analyzed unless positive detections are recorded in the prior sample blank. It will be the responsibility of the FOL to communicate to the laboratory whether an equipment blank is, or is not, to be analyzed as stated above.

5.6 FIELD DUPLICATES

Field duplicates are two samples collected (1) independently at a sampling location in the case of groundwater or surface water, or (2) a single sample split into two portions in the case of soil or sediment. Duplicates are obtained during a single act of sampling and are used to assess the overall precision of the sampling and analysis program. Ten percent of all samples for each media shall be field duplicates. Duplicates shall be analyzed for the same parameters in the laboratory.

5.7 BOTTLEWARE

NEESA requires specific bottleware cleaning procedures. Precleaned bottles will be used for the Project. Precleaned bottles will be provided by the subcontracted laboratory who will also be responsible for providing the required certification.

6.0 SAMPLING PROCEDURES

6.1 SITE BACKGROUND

The site background information is provided in Section 1.0 of the FVSP.

6.2 SAMPLING OBJECTIVES

The objective of the field verification sampling is to ensure that the action levels established for the performance of the remedial work at Building No. 31 are met. The data will be used to document both that all soil above 500 mg/kg has been excavated and that any soil which is place back into the excavation meets TCLP lead requirements. In addition, the data will ensure that any debris which is disposed offsite meets the treatment standards for land disposal restrictions.

6.3 SAMPLE LOCATION AND FREQUENCY

Soil, treated soil, and debris wipe samples will be collected during the field activities. These samples will be analyzed in accordance with NEESA and EPA-approved methodology for lead. A list of the analytes, analytical method, contract required quantification limits, containers, preservatives, and holding times are provided in Table 3-2 of this QAPP.

The sampling program consists of three activities. These activities and the frequency at which they will be performed are as follows and are described in detail in Sections 2.0 and 3.0 of the FVSP.

Wipe sampling	1 sample per 5 cubic yards of concrete and 1 sample per 50 linear feet of railroad track
Excavation testing	1 sample per grid or per 400 square foot area of floor, whichever is more frequent, and 1 sample per sidewall per 20 linear feet
Treated soil testing	1 sample per 20 cubic yards or per batch, whichever is more frequent

6.4 SAMPLE DESIGNATION

6.4.1 Sampling Identification System

Each sample collected will be assigned a unique sample tracking number. The sample tracking number will consist of a three-segment, alpha-numeric code that identifies the sample medium and location, sample depth (in the case of soil samples), and QA designation, if required.

Any other pertinent information regarding sample identification will be recorded in the field log books.

The alpha-numeric coding to be used in the sample system is explained in the diagram and the subsequent definitions:

(Medium & location) - (Sample date) - (QA designation)

Medium:

WS	=	Wipe sample
EX	=	Excavation sample
TS	=	Treated soil sample

Sample Location:

Wipe sample = sample number (01, 02, etc), consecutive for the entire job.
Excavation sample = sample identifier:

NW - north wall
EW - east wall
SW - south wall
WW - west wall
BE - bottom of excavation

Treated soil sample = batch number as identified by the Contractor.

Sample Identifier:

Identify wipe samples and treated soil samples by the date they were taken using the month and day. For months or days with a single digit insert a "0" prior to that number (e.g., July 14 = 0714, or November 4 = 1104).

Identify the excavation samples by a grid location number which uses letters for the lines which run North-South, and numbers for the lines which run east west (e.g. A002).

QA Sample Designation:

D = Duplicate (Soil/Groundwater)
B = Equipment Rinsate Blank
F = Field Blank

For example, if the 13 wipe sample was collected on November 4, 1993, the sample number would be designated as:

WS13-1104

An excavation sample taken from the east wall of grid C4 would be designated as:

EXEW - C004

A treated soil sample taken from batch 13 on July 13, 1993 would be designated as:

TS13 - 0713

All QC samples will assigned a sequential sample number. A designation which blinds the sample's QC identity will be used for all field duplicates. The field duplicate (D) matrix spike (MS) and matrix spike duplicate (MSD) samples will be collected from the same station.

6.5 SAMPLE EQUIPMENT AND PROTOCOLS

The sampling equipment and protocols to be used are presented in Appendix B of the FVSP.

6.6 SAMPLE HANDLING AND ANALYSIS

Sample handling and analysis are presented in Sections 5.0, 6.0, and 7.0 of this QAPP Plan.

6.7 EQUIPMENT DECONTAMINATION

The equipment involved in field sampling activities will be decontaminated prior to and during sampling activities. This equipment includes sampling trowels, augers, mixing bowls, and sampling equipment, including the Contractor's backhoe buckets if used. Personal decontamination is addressed in the Health and Safety Plan.

6.7.1 Contractor's Backhoe

These decontamination operations will consist of washing the backhoe bucket using a high-pressure steam wash. All decontamination activities will take place at the Contractor's decontamination area. It is assumed that the Contractor will provide for decontamination of the backhoe bucket.

6.7.2 Sampling Equipment

All direct contact sampling equipment will be decontaminated both prior to beginning field sampling and between samples. The following decontamination steps will be taken:

- Potable water rinse
- Alconox or Liquinox detergent wash
- Potable water rinse

- Nitric acid rinse[a]
- Analyte-free water rinse
- Air dry

[a] Not required for stainless steel equipment.

8.0 CALIBRATION PROCEDURES

Field equipment such as the photoionization equipment (HNu), the pH and specific conductance meters, and any other equipment used during this project will be calibrated and operated in accordance with the manufacturer's instructions and manuals. A log will be kept documenting the calibration results for each field instrument. The log will include the date, standards, personnel, and results of the calibration. A copy of the calibration form used during the field investigation is included in Appendix A. The SOP for calibration procedures is included in Appendix B.

9.0 ANALYTICAL PROCEDURES

Environmental samples collected during the field investigation for chemical analyses will be analyzed using the appropriate analytical procedures as outlined in Section 3.0 and Table 3-1 of this QAPP.

10.0 DATA REDUCTION, VALIDATION, AND REPORTING

Data reduction, validation, and reporting are basic steps in the control and processing of field and laboratory project-generated data. Data validation procedures are described below.

Data validation consists of a stringent review of an analytical chemical data package with respect to sample receipt and handling, analytical methods, data reporting and deliverables, and document control. The quality of data generated by a laboratory is extremely important; it is an integral part of the investigation and should be clearly tied to the project goals. Data used to develop qualitative trends, for example, will not have the same data validation requirements as data used for litigation purposes.

A qualified Halliburton NUS chemist will review the analytical data packages using EPA procedures. All the environmental samples will be validated. For data generated by CLP procedures, the U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses, dated February 1989, will be used to evaluate the data. (References for these documents are given in Section 17.0.) Method-specific quality control criteria will be used to evaluate generated by non-CLP procedures. After the data is validated, a listing of non-conformities will be generated and used to determine whether the data can be utilized for its intended purpose. Non-conformities require data qualifiers, which are used to alert the data user to inaccurate or imprecise data. For example, if holding times are exceeded, the data reviewer must qualify all positive results as estimated and all sample quantitation limits as estimated. If holding times are grossly exceeded (i.e., exceeded by more than two times the maximum allowance), the data reviewer must qualify all positive results as estimated and must reject all sample quantitation limits. For situations in which there are several quality control criteria out of specification (with regard to the limits specified in the Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program, NEESA 20.2-047B, June 1988), the data validator may make professional judgments and/or comments on the validity of the overall data package. In situations where the validity of an entire data package is in question, it may be necessary for the sample(s) to be re-analyzed. The reviewer will then prepare a technical memorandum presenting changes in the data, if necessary, and the rationale for making such changes.

The net result is a data package that has been carefully reviewed for its adherence to prescribed requirements and is suitable for its intended use. Data validation thus plays a major role in determining the confidence with which key technical evaluations may be made.

The final Post-Removal Action report will include a data summary. The summary of analytical data will exclude non-detected compounds. No subtraction of blanks will be allowed. Data will be flagged if blank contamination occurs. All data flags will follow the result in the summary.

The laboratory data for each sample will be reported in an appendix. These data will be presented in a spreadsheet format with all field, and laboratory blanks marked. The format recommended by NEESA will be used. Field logs and forms will be included in another appendix.

11.0 INTERNAL QUALITY CONTROL CHECKS

Quality control samples generated by Halliburton NUS will include the collection of field duplicates, the preparation of field blanks, and the preparation of equipment/rinsate blanks. An approximate 10 percent duplication (one per 10 samples or one per sample matrix if less than 10 samples) will be collected. See Table 3-1 for the required number of sample duplicates.

As there are limited VOCs analyses to be performed, trip blanks using distilled water will be prepared by the analytical laboratory for this investigation and accompany those samples at all times. Rinsates, prepared by running distilled water through the sampling equipment, will be analyzed to determine whether the sampling procedures may be biasing the data. Field blanks will be prepared at a rate of one per source per event. Procedures for collecting these samples are contained in the Section 6.0 of this QA/QC Plan.

There are two types of quality assurance mechanisms used to ensure the production of analytical data of known and documented quality. The internal quality control procedures for the analytical services are specified under NEESA guidelines and Table 3-1. These specifications include the types of control samples required (sample spikes, surrogate spikes, controls, and blanks), the frequency of each control, the compounds to be used for sample spikes and surrogate spikes, and the quality control acceptance criteria. It will be the laboratory's responsibility to document, in each package, that both initial and on-going instrument and analytical QC criteria are met. This documentation will be included in the data packages generated by contract laboratory.

Analytical results of field-collected quality control samples will also be compared to acceptance criteria, and documentation will be performed showing that criteria have been met. Any samples in nonconformance with the QC criteria will be identified and reanalyzed by the laboratory, if possible. The following procedures will be employed for the samples:

- Proper storage of samples.

- Use of qualified and/or certified technicians.

- Use of calibrated equipment.

- Formal independent confirmation of all computation and reduction of laboratory data and results.

- Use of standardized test procedures.

- Inclusion of replicate samples at a frequency of one replicate per 10 samples or one per sample matrix if less than 10 samples are collected.

12.0 PERFORMANCE AND SYSTEM AUDITS

System audits will be performed as appropriate, to assure that the work is being implemented in accordance with the approved project SOPs and in an overall satisfactory manner.

- The FOL will supervise and check on a daily basis that the monitoring wells are installed and developed correctly, field measurements are made accurately, equipment is thoroughly decontaminated, samples are collected and handled properly, and the field work is accurately and neatly documented.

- The data validator will review (on a timely basis) the data packages submitted by the laboratory. The data validator will check that the data was obtained through the approved methodology, that the appropriate level of QC effort and reporting was conducted, that holding times were met, and that the results are in conformance with the QC criteria. On the basis of these factors, the data validator will evaluate the data quality and limitations.

- The project manager will oversee the FOL and data validator, and check that management of the acquired data proceeds in an organized and expeditious manner.

- System audits for the laboratory are conducted by NEESA on a regular basis as required.

- A formal audit of the field sampling procedures may be conducted in addition to the auditing that is an inherent part of the daily project activities.

- The auditors will check that sample collection, sample handling, decontamination protocols, and instrument calibration and use are in accordance with the approved project SOPs. The auditors will also check that the field documentation logs and chain-of-custody forms are being filled out properly.

The subcontracted analytical laboratory must be either NEESA approved or have worked for the Navy on a recent project, be eligible to perform the required analysis under NEESA protocols, and must have site-specific approval prior to commencement of work.

13.0 PREVENTATIVE MAINTENANCE

Halliburton NUS has established a program for the maintenance of field equipment to ensure the availability of equipment in good working order when and where it is needed. This program consists of the following elements:

- The equipment manager keeps an inventory of the equipment in terms of items (model and serial number) quantity and condition. Each item of equipment is signed out when in use, and its operating condition and cleanliness checked upon return.

- The equipment manager conducts routine checks on the status of equipment and is responsible for the stocking of spare parts and equipment readiness.

- The equipment manager maintains the equipment manual library and trains field personnel in the proper use and care of equipment.

- The FOL is responsible for working with the equipment manager to make sure that the equipment is tested, cleaned, charged, and calibrated in accordance with the manufacturer's instructions and Halliburton NUS SOPs before being taken to the job site and during field activities.

14.0 DATA ASSESSMENT PROCEDURES

14.1 REPRESENTATIVENESS, ACCURACY, AND PRECISION

All data generated in the investigation will be assessed for its representativeness, accuracy, and precision. The completeness of the data will also be assessed by comparing the valid acquired data to the project objectives to see that these objectives are being addressed and met. The specific procedures used to determine data precision, accuracy, and completeness will be provided in the analytical reports. Accuracy will be determined using laboratory spiked samples and laboratory field blanks.

The representativeness of the data will be assessed by determining if the data are consistent with known or anticipated hydrogeologic or chemical conditions and accepted principles. Field measurements will be checked for completeness of procedures and documentation of procedures and results.

Precision and accuracy will be determined using replicate samples and blank and spiked samples, respectively. The specific procedures for determining PARCC parameters are outlined in Section 5.0.

14.2 VALIDATION

100 percent of the analytical data packages for each media will be validated using the U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses, dated February 1989.

14.3 DATA EVALUATION

The evaluation of data collected during the remedial work will be a comparison of these values versus action levels (for the excavation of soil) and treatment standards (for the cleaning of concrete and solidification of soil).

Evaluation will be performed on 100 percent of the data and will be used to either pass or fail an area or batch. All material which fails based on comparison of the treatment standard/action level must be treated further, re-analyzed, and re-evaluated against the evaluation criteria.

15.0 CORRECTIVE ACTION

The QA program will enable problems to be identified, controlled, and corrected. Potential problems may involve nonconformance with the SOPs and/or analytical procedures established for the project or other unforeseen difficulties. Any person identifying an unacceptable condition will notify the project manager. The project manager, with the assistance of the project QA/QC officer, will be responsible for developing and initiating appropriate corrective action and verifying that the correction action has been effective. Corrective actions may include the following: resampling and/or reanalysis of sample, amending or adjusting project procedures. If warranted by the severity of the problem (for example, if a change in the approved AFSP is required), the Navy will be notified in writing and their approval will be obtained prior to implementing any change. Additional work that is dependent on a nonconforming activity will not be performed until the problem has been eliminated.

The laboratory maintains an internal closed-loop corrective action system that operates under the direction of the laboratory QA coordinator.

16.0 QUALITY ASSURANCE REPORTS

The Quality Assurance Manager or her designee will review all aspects of the implementation of the QA/QC Plan on a regular basis and prepare a summary report. Reviews will be performed at the completion of each field activity and reports will be completed at this time. These reports will include an assessment of data quality and the results of system and/or performance audits. Any significant QA deficiencies will be reported and identified, and corrective action possibilities discussed. The laboratory will issue monthly progress reports.

Other QA/QC reports are listed in Section 8.0.

17.0 REFERENCES

American Society of Agronomy, 1986. Methods of Soil Analysis. Madison, Wisconsin.

Naval Energy and Environmental Support Activity (NEESA). June 1988. Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program. NEESA, Port Hueneme, California. NEESA 20.2-047B.

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