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Master Quality Assurance Project Plan

for the former

Naval Surface Warfare Center White Oak

Silver Spring, Maryland

Engineering Field Activity Chesapeake
Naval Facilities Engineering Command

Contract Number N62472-90-D-1298
Contract Task Order 0295

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MASTER QUALITY ASSURANCE PROJECT PLAN FOR THE FORMER NAVAL SURFACE WARFARE CENTER, WHITE OAK SILVER SPRING, MARYLAND

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

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ACRONYMS/ABBREVIATIONS

%R	Percent Recovery
B&R	Brown & Root
BFB	Bromofluorobenzene
BOD	Biological Oxygen Demand
BRAC	Base Realignment and Closure
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CADD	Computer Aided Drafting and Design
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-term Environmental Action Navy
CLP	Contract Laboratory Program
COC	Chain of Custody
CRDL	Contract Required Detection Limit
CRQL	Contract Required Quantitation Limit
CTO	Contract Task Order
CVAA	Cold Vapor Atomic Absorption
DFTPP	Decaflourotriphenyl Phosphine
DDVP	Dichlorvos
DO	Dissolved Oxygen
DQO	Data Quality Objective
DRO	Diesel Range Organics
EFACHES	Engineering Field Activity Chesapeake
FID	Flame Ionization Detector
FOL	Field Operations Leader
FSP	Field Sampling Plan
FTMR	Field Task Modification Request
GC	Gas Chromatograph
GFAA	Graphite Furnace Atomic Absorption
GRO	Gasoline Range Organics
HASP	Health and Safety Plan
HPLC	High Performance Liquid Chromatography
HSS	Health and Safety Supervisor
ICP	Inductively Coupled Plasma
IDL	Instrument Detection Limit

IDW	Investigation Derived Waste
IRP	Installation Restoration Program
LCS	Laboratory Control Sample
MDA	Minimum Detectable Activity
MDL	Method Detection Limit
MS	Mass Spectrophotometer
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NA	Not Applicable
NFESC	Naval Facilities Engineering Service Center
NIST	National Institute of Standards and Technology
NSWC	Naval Surface Warfare Center
ORP	Oxidation Reduction Potential
PAH	Polynuclear Aromatic Hydrocarbon
PARCC	Precision, Accuracy, Representativeness, Comparability, Completeness
PCB	Polychlorinated Biphenyl
PCDD	Polychlorinated Dibenzo-p-dioxin
PCDF	Polychlorinated Dibenzofuran
PCOC	Preliminary Contaminant of Concern
PEM	Performance Evaluation Mixture
PID	Photoionization Detector
PQL	Practical Quantitation Limit
QA	Quality Assurance
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QC	Quality Control
RI	Remedial Investigation
RPD	Relative Percent Difference
RPM	Restoration Project Manager
SDG	Sampling Delivery Group
SOP	Standard Operating Procedure
SOW	Statement of Work
SSO	Site Safety Supervisor
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TBD	To Be Determined
TCL	Target Compound List

TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
TOC	Total Organic Carbon
TOX	Total Organic Halides
TSS	Total Suspended Solids
USEPA	U. S. Environmental Protection Agency
VOC	Volatile Organic Compound
WP	Work Plan

1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

This Master Quality Assurance Project Plan (Master QAPP) outlines the organization, objectives, planned activities, and general Quality Assurance/Quality Control (QA/QC) procedures associated with the Navy Installation Restoration Program (IRP) investigations to be conducted at the former Naval Surface Warfare Center (NSWC) White Oak, Silver Spring, Maryland. Specific protocols for sample collection, sample handling and storage, chain-of-custody, and laboratory and field analyses are also described.

This Master QAPP has been prepared by Brown & Root (B&R) Environmental on behalf of the United States Navy Engineering Field Activity Chesapeake (EFACHES) under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62467-90-D-1298, Contract Task Order (CTO) 0295. Addenda to this Master QAPP will be generated for specific projects and will comply with applicable State of Maryland and United States Environmental Protection Agency (USEPA) Region III requirements, regulations, guidance, and technical standards.

This Master QAPP and other associated documents, including the Master Work Plan (Master WP), Master Field Sampling Plan (Master FSP), and Master Health and Safety Plan (Master HASP), constitute the Master project planning documents for the former NSWC-White Oak.

1.2 FACILITY DESCRIPTION

A discussion of the former NSWC-White Oak, including its location, size and borders, regional geology, hydrogeology, hydrology, etc. is provided in Sections 1.3 and 2.2 of the Master WP.

1.3 PROJECT OBJECTIVES

This section discusses the anticipated target parameters and intended data uses for both field and laboratory analytical data. In addition, this section summarizes the Data Quality Objectives (DQO) process that will be followed during preparation of the project-specific planning documents for IRP work at the former NSWC-White Oak. Specific objectives and associated tasks will be discussed in the project-specific plans.

1.3.1 Overall Project Objectives

The general project objectives for the former NSWC-White Oak are to bring each environmental site into compliance with current environmental regulations. At some sites the data collected will be used to determine if a release has occurred. At other sites the data will be used to identify and potentially select appropriate remedial alternatives, while at other sites it may be used to justify no further action. Project-specific objectives will be developed and detailed in the project-specific planning documents.

1.3.2 Project Target Parameters and Intended Data Uses

This section discusses many or all of the anticipated field and laboratory analytical information to be generated during the course of future investigative activities at the former NSWC-White Oak. This section presents generic information that will be further detailed in the project-specific plans. Field parameters and intended data uses are discussed in Section 1.3.2.1. Laboratory parameters and intended data uses are discussed in Section 1.3.2.2.

1.3.2.1 Field Parameters

Field parameters will include those associated with the completion of soil borings, installation and development of monitoring wells, groundwater sampling and analysis, and test pit excavation and sampling. Field measurements will include only those completed using simple field instrumentation.

Field measurements of total volatile organic compounds (VOCs) will be completed using a photoionization detection (PID) or flame ionization detector (FID) as specified in the project-specific plans. The choice of PID or FID will be specified in the project-specific plans and will be based upon the anticipated potential contaminants of concern (PCOCs) and ambient conditions. These measurements will be used as a screening tool to determine the following: 1) appropriate subsurface sample horizons to be submitted for laboratory analysis; 2) relative spatial distribution of VOC contamination; 3) locations that require additional investigative work; 4) breathing zone conditions of site workers; and 5) gross levels of VOC contamination in investigation derived waste (IDW). In addition to the obvious health and safety advantages, the intention of a PID or FID survey is to aid in the decision process and is typically not intended to be a substitute for conventional methodologies. Rather it is used as a screening tool to enable conventional methods to be used more effectively.

Field parameters including pH, specific conductivity, turbidity, dissolved oxygen (DO), oxidation-reduction potential (ORP), and temperature will be measured for all aqueous phase samples. These measurements will be used to support monitoring well development and purging of stagnant water from well casings.

Specific conductivity and pH can also be used as general indicators of water quality. Field measurements are further discussed in Section 2.5 of the Master FSP.

1.3.2.2 Laboratory Parameters

It is anticipated that some or all of the analytical methods shown in Table 1-1 will be performed for samples collected at the former NSWC-White Oak. Specific analytical programs for environmental samples will be provided in the project-specific addenda to the Master FSP.

Tables 1-2 through 1-14 provide a summary of the anticipated laboratory parameters and their associated Contract Required Quantitation Limits (CRQL) (Target Compound List [TCL] organics), Contract Required Detection Limits (CRDL) (Target Analyte List [TAL] inorganics), and estimated Practical Quantitation Limits (PQL) (all parameters not included in the USEPA Contract Laboratory Program [CLP] TCL or TAL). Quantitation and detection limits are further discussed in Section 7.0 of this QAPP.

1.3.3 Data Quality Objectives

As further discussed in Section 1.2 of the Master WP, DQOs for the former NSWC-White Oak investigative work will be developed in accordance with current USEPA guidance (USEPA, 1993a). The DQO development process is outlined in detail in Section 1.2.2 of the Master WP, and each WP Addendum will present a detailed discussion of project-specific DQOs.

1.4 SAMPLE NETWORK DESIGN AND RATIONALE

The sample network design and rationale for each IRP investigation will be discussed in the project-specific addenda to the Master FSP. Figures displaying the locations of all proposed borings, monitoring wells, and surface water and sediment sampling points will also be provided in these addenda.

1.5 PROJECT SCHEDULE

The project schedule for each IRP investigation will be provided in the project-specific addenda to the Master WP.

TABLE 1-1

ANALYTICAL METHODS SUMMARY
NSWC-WHITE OAK, SILVER SPRING, MARYLAND
PAGE 1 OF 3

Parameter	Aqueous Preparation Method	Aqueous Analytical Method	Solid Preparation Method	Solid Analytical Method
TCL Volatile Organics	CLP OLM03.1[1]	CLP OLM03.1	CLP OLM03.1	CLP OLM03.1
TCL Volatile Organics (low conc.)	CLP OLC02.0[2]	CLP OLC02.0	CLP OLC02.0	CLP OLC02.0
TCL Semivolatile Organics	CLP OLM03.1	CLP OLM03.1	CLP OLM03.1	CLP OLM03.1
TCL Semivolatile Organics (low conc.)	CLP OLC02.0	CLP OLC02.0	CLP OLC02.0	CLP OLC02.0
TCL Organochlorine Pesticides/PCBs	CLP OLM03.1	CLP OLM03.1	CLP OLM03.1	CLP OLM03.1
TCL Organochlorine Pesticides/PCBs (low conc.)	CLP OLC02.0	CLP OLC02.0	CLP OLC02.0	CLP OLC02.0
Oorganophosphorus Pesticides	SW[3] 3510C/3520C	SW 8141A	SW 3540C/ 3541/3550	SW 8141A
Carbamate Pesticides	SW 8318	SW 8318	SW 8318	SW 8318
Chlorinated Herbicides	SW 8151A	SW 8151A	SW 8151A	SW 8151A
TCL Dioxins/Furans	CLP DFLM01.0[4]	CLP DFLM01.0	CLP DFLM01.0	CLP DFLM01.0
Halogenated and Aromatic Volatiles	SW 5030B	SW 8021B	SW 5035	SW 8021B
Gasoline Range Organics (GRO)	SW 5030B	SW 8015B	SW 5035	SW 8015B
Diesel Range Organics (DRO)	SW 3510C/3520C	SW 8015B	SW 3540C/ 3541/3550	SW 8015B
Nitroaromatics (Explosives)	SW 8330	SW 8330	SW 8330	SW 8330
Polynuclear Aromatic Hydrocarbons (PAHs)	SW 3510C/3520C	SW 8310	SW 3540C/ 3541/3550	SW 8310
TAL Metals (total and dissolved) + Cyanide	CLP ILM04.0[5]	CLP ILM04.0	CLP ILM04.0	CLP ILM04.0
Hexavalent Chromium	NA[6]	SW 7196A	SW 3060A	SW 7196A
Nitrate/Nitrite Nitrogen	NA	E[7] 353.3/ E[8] 353.2	NA	NA
Nitrate-Nitrogen	NA	E 353.3/ E[8] 353.2	SW 5050	SW 9056

TABLE 1-1

ANALYTICAL METHODS SUMMARY
NSWC-WHITE OAK, SILVER SPRING, MARYLAND
PAGE 2 OF 3

Parameter	Aqueous Preparation Method	Aqueous Analytical Method	Solid Preparation Method	Solid Analytical Method
Nitrite-Nitrogen	NA	E 353.3/ E[8] 353.2	NA	NA
Total Kjeldahl Nitrogen (TKN)	NA	E 351.3/ E[8] 351.2	NA	NA
Ammonia (as N; specific-ion electrode)	NA	E 350.3/ E[8] 350.1	NA	NA
Alkalinity (as $CaCO_3$)	NA	E 310.1	NA	NA
Hardness (as $CaCO_3$)	NA	E 130.2	NA	NA
Total Dissolved Solids (TDS)	NA	E 160.1	NA	NA
Total Suspended Solids (TSS)	NA	E 160.2	NA	NA
Total Organic Carbon (TOC)	NA	E 415.1	Lloyd Kahn[10]	Lloyd Kahn
Total Organic Halides (TOX)	NA	SW 9020B	NA	NA
Extractable Organic Halogens (EOX)	NA	NA	SW 9023	SW 9023
Biological Oxygen Demand (BOD; 5-day)	NA	E 405.1	NA	NA
Bromide	NA	E 320.1	SW 5050	SW 9056
Chloride	NA	E 325.1	SW 5050	SW 9056
Fluoride	NA	E 340.3	SW 5050	SW 9056
Total Phosphorus	NA	E[8] 365.1	NA	NA
Sulfate	NA	E[8] 375.2	SW 5050	SW 9056
Sulfite	NA	E 377.1	NA	NA
Sulfide	NA	E 376.2	NA	NA
Gross Alpha/Beta	E 900.0/SW 9310	E 900.0/SW 9310	E 900.0	E 900.0
Strontium 89-90	E 905.0	E 905.0	E 905.0	E 905.0

TABLE 1-1

ANALYTICAL METHODS SUMMARY
NSWC-WHITE OAK, SILVER SPRING, MARYLAND
PAGE 3 OF 3

Parameter	Aqueous Preparation Method	Aqueous Analytical Method	Solid Preparation Method	Solid Analytical Method
Tritium	E 906.0	E 906.0	E 906.0	E 906.0
Alpha Spectrometry	See footnote 9	See footnote 9	See footnote 9	See footnote 9
Gamma Spectrometry	E 901.1	E 901.1	E 901.1	E 901.1
TCLP	SW 1311	NA	SW 1311	NA
Paint Filter Test	NA	NA	NA	SW 9095A
Ignitability	NA	SW 1010	NA	SW 1030
Corrosivity	NA	SW 1110	NA	SW 1110
Reactivity	NA	SW Ch 7 (7.3)	NA	SW Ch 7 (7.3)
Bromide	E 300.0	E(8) 300.0	E 300.0	E 300.0
Chloride	E 300.0	E 300.0	E 300.0	E 300.0
Fluoride	E 300.0	E 300.0	E 300.0	E 300.0
o-Phosphate-P	E 300.0	E 300.0	E 300.0	E 300.0
Sulfate	E 300.0	E 300.0	E 300.0	E 300.0
Nitrate/nitrite-Nitrogen	E 300.0	E 300.0	E 300.0	E 300.0
Nitrate-Nitrogen	E 300.0	E 300.0	E 300.0	E 300.0
Nitrite-Nitrogen	E 300.0	E 300.0	E 300.0	E 300.0

1 USEPA, 1994a.
2 USEPA, 1992.
3 USEPA, 1997
4 USEPA, 1991.
5 USEPA, 1995.
6 NA - Not Applicable.
7 USEPA, 1983.
8 USEPA, 1993b.
9 Specialized preparation techniques based on radionuclides of interest. Technique may vary based on laboratory.
10 Lloyd Kahn, Determination of Total Organic Carbon in Sediment, USEPA, Region II

TABLE 1-2

ANALYTICAL DETECTION LIMITS - TCL ORGANICS
NSWC-WHITE OAK, SILVER SPRING, MARYLAND
PAGE 1 OF 4

Parameter	CRQL[1]	
	Aqueous Samples µg/L	Solid Samples µg/kg
Volatile Organic Compounds		
Acetone	10	10
Benzene	10	10
Bromodichloromethane	10	10
Bromoform	10	10
Bromomethane	10	10
2-Butanone	10	10
Carbon disulfide	10	10
Carbon tetrachloride	10	10
Chlorobenzene	10	10
Chloroethane	10	10
Chloroform	10	10
Chloromethane	10	10
Dibromochloromethane	10	10
1,1-Dichloroethane	10	10
1,2-Dichloroethane	10	10
1,1-Dichloroethene	10	10
1,2-Dichloroethene (total)	10	10
1,2-Dichloropropane	10	10
cis-1,3-Dichloropropene	10	10
trans-1,3-Dichloropropene	10	10
Ethylbenzene	10	10
2-Hexanone	10	10
4-Methyl-2-pentanone	10	10
Methylene chloride	10	10
Styrene	10	10
1,1,2,2-Tetrachloroethane	10	10
1,1,1-Trichloroethane	10	10
1,1,2-Trichloroethane	10	10
Trichloroethene	10	10
Tetrachloroethene	10	10
Toluene	10	10
Vinyl chloride	10	10
Xylenes (total)	10	10

TABLE 1-2

ANALYTICAL DETECTION LIMITS - TCL ORGANICS
NSWC-WHITE OAK, SILVER SPRING, MARYLAND
PAGE 2 OF 4

Parameter	CRQL[1]	
	Aqueous Samples µg/L	Solid Samples µg/kg
Semivolatile Organic Compounds		
Acenaphthene	10	330
Acenaphthylene	10	330
Anthracene	10	330
Benzo(a)anthracene	10	330
Benzo(a)pyrene	10	330
Benzo(b)fluoranthene	10	330
Benzo(g,h,i)perylene	10	330
Benzo(k)fluoranthene	10	330
Bis(2-chloroethoxy)methane	10	330
Bis(2-chloroethyl)ether	10	330
Bis(2-ethylhexyl)phthalate	10	330
4-Bromophenyl-phenylether	10	330
Butylbenzylphthalate	10	330
Carbazole	10	330
4-Chloro-3-methylphenol	10	330
4-Chloroaniline	10	330
2-Chloronaphthalene	10	330
2-Chlorophenol	10	330
4-Chlorophenyl-phenylether	10	330
Chrysene	10	330
Dibenz(a,h)anthracene	10	330
Dibenzofuran	10	330
3,3'-Dichlorobenzidine	10	330
Diethylphthalate	10	330
Di-n-butylphthalate	10	330
Di-n-octylphthalate	10	330
4,6-Dinitro-2-methylphenol	25	830
2,4-Dinitrophenol	25	830
2,4-Dinitrotoluene	10	330
1,2-Dichlorobenzene	10	330
1,3-Dichlorobenzene	10	330
1,4-Dichlorobenzene	10	330
2,4-Dichlorophenol	10	330
Dimethylphthalate	10	330

TABLE 1-2

ANALYTICAL DETECTION LIMITS - TCL ORGANICS
NSWC-WHITE OAK, SILVER SPRING, MARYLAND
PAGE 3 OF 4

Parameter	CRQL[1]	
	Aqueous Samples µg/L	Solid Samples µg/kg
2,4-Dimethylphenol	10	330
2,6-Dinitrotoluene	10	330
Fluoranthene	10	330
Fluorene	10	330
Hexachlorobenzene	10	330
Hexachlorobutadiene	10	330
Hexachlorocyclopentadiene	10	330
Hexachloroethane	10	330
Indeno(1,2,3-cd)pyrene	10	330
Isophorone	10	330
2-Methylnaphthalene	10	330
2-Methylphenol	10	330
4-Methylphenol	10	330
Naphthalene	10	330
2-Nitroaniline	25	830
3-Nitroaniline	25	830
4-Nitroaniline	25	830
Nitrobenzene	10	330
2-Nitrophenol	10	330
4-Nitrophenol	25	830
N-nitroso-di-n-propylamine	10	330
N-nitrosodiphenylamine	10	330
2,2'-Oxybis(1-chloropropane)	10	330
Pentachlorophenol	25	830
Phenanthrene	10	330
Phenol	10	330
Pyrene	10	330
1,2,4-Trichlorobenzene	10	330
2,4,5-Trichlorophenol	25	830
2,4,6-Trichlorophenol	10	330
Pesticides/PCBs		
Aldrin	0.050	1.7
alpha-BHC	0.050	1.7
alpha-Chlordane	0.050	1.7
beta-BHC	0.050	1.7

TABLE 1-2

ANALYTICAL DETECTION LIMITS - TCL ORGANICS
NSWC-WHITE OAK, SILVER SPRING, MARYLAND
PAGE 4 OF 4

Parameter	CRQL[1]	
	Aqueous Samples µg/L	Solid Samples µg/kg
4,4'-DDE	0.10	3.3
4,4'-DDD	0.10	3.3
4,4'-DDT	0.10	3.3
delta-BHC	0.050	1.7
Dieldrin	0.10	3.3
Endosulfan I	0.050	1.7
Endosulfan II	0.10	3.3
Endosulfan sulfate	0.10	3.3
Endrin	0.10	3.3
Endrin aldehyde	0.10	3.3
Endrin ketone	0.10	3.3
gamma-BHC (Lindane)	0.050	1.7
gamma-Chlordane	0.050	1.7
Heptachlor	0.050	1.7
Heptachlor epoxide	0.050	1.7
Methoxychlor	0.50	17
Toxaphene	5.0	170
Aroclor-1016	1.0	33
Aroclor-1221	2.0	67
Aroclor-1232	1.0	33
Aroclor-1242	1.0	33
Aroclor-1248	1.0	33
Aroclor-1254	1.0	33
Aroclor-1260	1.0	33

1 CRQL Contract Required Quantitation Limit; as specified in OLM03.1.

TABLE 1-3

ANALYTICAL DETECTION LIMITS - TCL LOW-CONCENTRATION ORGANICS
NSWC-WHITE OAK, SILVER SPRING, MARYLAND
PAGE 1 OF 4

Parameter	CRQL[1] Aqueous Samples µg/L
Volatile Organic Compounds	
Acetone	5
Benzene	1
Bromochloromethane	1
Bromodichloromethane	1
Bromoform	1
Bromomethane	1
2-Butanone	5
Carbon disulfide	1
Carbon tetrachloride	1
Chlorobenzene	1
Chloroethane	1
Chloroform	1
Chloromethane	1
Dibromochloromethane	1
1,2-Dibromo-3-chloropropane	1
1,2-Dibromoethane	1
1,2-Dichlorobenzene	1
1,3-Dichlorobenzene	1
1,4-Dichlorobenzene	1
1,1-Dichloroethane	1
1,2-Dichloroethane	1
1,1-Dichloroethene	1
cis-1,2-Dichloroethene	1
trans-1,2-Dichloroethene	1
1,2-Dichloropropane	1
cis-1,3-Dichloropropene	1
trans-1,3-Dichloropropene	1
Ethylbenzene	1
2-Hexanone	5
4-Methyl-2-pentanone	5
Methylene chloride	2
Styrene	1
1,1,2,2-Tetrachloroethane	1
1,1,1-Trichloroethane	1

TABLE 1-3

ANALYTICAL DETECTION LIMITS - TCL LOW-CONCENTRATION ORGANICS
NSWC-WHITE OAK, SILVER SPRING, MARYLAND
PAGE 2 OF 4

Parameter	CRQL[1] Aqueous Samples µg/L
1,1,2-Trichloroethane	1
Trichloroethene	1
Tetrachloroethene	1
Toluene	1
Vinyl chloride	1
Xylenes (total)	1
Semivolatile Organic Compounds	
Acenaphthene	5
Acenaphthylene	5
Anthracene	5
Benzo(a)anthracene	5
Benzo(a)pyrene	5
Benzo(b)fluoranthene	5
Benzo(g,h,i)perylene	5
Benzo(k)fluoranthene	5
Bis(2-chloroethoxy)methane	5
Bis(2-chloroethyl)ether	5
Bis(2-ethylhexyl)phthalate	5
4-Bromophenyl-phenylether	5
Butylbenzylphthalate	5
4-Chloro-3-methylphenol	5
4-Chloroaniline	5
2-Chloronaphthalene	5
2-Chlorophenol	5
4-Chlorophenyl-phenylether	5
Chrysene	5
Dibenz(a,h)anthracene	5
Dibenzofuran	5
3,3'-Dichlorobenzidine	5
Diethylphthalate	5
Di-n-butylphthalate	5
Di-n-octylphthalate	5
4,6-Dinitro-2-methylphenol	20
2,4-Dinitrophenol	20
2,4-Dinitrotoluene	5

TABLE 1-3

ANALYTICAL DETECTION LIMITS - TCL LOW-CONCENTRATION ORGANICS
NSWC-WHITE OAK, SILVER SPRING, MARYLAND
PAGE 3 OF 4

Parameter	CRQL[1]
	Aqueous Samples µg/L
2,4-Dichlorophenol	5
Dimethylphthalate	5
2,4-Dimethylphenol	5
2,6-Dinitrotoluene	5
Fluoranthene	5
Fluorene	5
Hexachlorobenzene	5
Hexachlorobutadiene	5
Hexachlorocyclopentadiene	5
Hexachloroethane	5
Indeno(1,2,3-cd)pyrene	5
Isophorone	5
2-Methylnaphthalene	5
2-Methylphenol	5
4-Methylphenol	5
Naphthalene	5
2-Nitroaniline	20
3-Nitroaniline	20
4-Nitroaniline	20
Nitrobenzene	5
2-Nitrophenol	5
4-Nitrophenol	20
N-nitroso-di-n-propylamine	5
N-nitrosodiphenylamine	5
2,2'-Oxybis(1-chloropropane)	5
Pentachlorophenol	20
Phenanthrene	5
Phenol	5
Pyrene	5
1,2,4-Trichlorobenzene	5
2,4,5-Trichlorophenol	20
2,4,6-Trichlorophenol	5

TABLE 1-3

ANALYTICAL DETECTION LIMITS - TCL LOW-CONCENTRATION ORGANICS
NSWC-WHITE OAK, SILVER SPRING, MARYLAND
PAGE 4 OF 4

Parameter	CRQL[1]
	Aqueous Samples µg/L
Pesticides/PCBs	
Aldrin	0.01
alpha-BHC	0.01
alpha-Chlordane	0.01
beta-BHC	0.01
4,4'-DDD	0.02
4,4'-DDE	0.02
4,4'-DDT	0.02
delta-BHC	0.01
Dieldrin	0.02
Endosulfan I	0.01
Endosulfan II	0.02
Endosulfan sulfate	0.02
Endrin	0.02
Endrin aldehyde	0.02
Endrin ketone	0.02
gamma-BHC (Lindane)	0.01
gamma-Chlordane	0.01
Heptachlor	0.01
Heptachlor epoxide	0.01
Methoxychlor	0.10
Toxaphene	1.0
Aroclor-1016	0.20
Aroclor-1221	0.40
Aroclor-1232	0.20
Aroclor-1242	0.20
Aroclor-1248	0.20
Aroclor-1254	0.20
Aroclor-1260	0.20

1 CRQL Contract Required Quantitation Limit; as specified in OLC02.0.

TABLE 1-4

ANALYTICAL DETECTION LIMITS - TAL INORGANICS
NSWC-WHITE OAK, SILVER SPRING, MARYLAND

Parameter	CRDL[1]	
	Aqueous Samples	Solid Samples
Target Analyte List Metals	**µg/L**	**mg/kg**
Aluminum	200	40
Antimony	60	12
Arsenic	10	2
Barium	200	40
Beryllium	5	1
Cadmium	5	1
Calcium	5000	1000
Chromium	10	2
Cobalt	50	10
Copper	25	5
Cyanide	10	10
Iron	100	20
Lead	3	0.6
Magnesium	5000	1000
Manganese	15	3
Mercury	0.2	0.1
Nickel	40	8
Potassium	5000	1000
Selenium	5	1
Silver	10	2
Sodium	5000	1000
Thallium	10	2
Vanadium	50	10
Zinc	20	4

1 CRDL Contract Required Detection Limit; as specified in ILM04.0.

TABLE 1-5

ANALYTICAL DETECTION LIMITS - ORGANOPHOSPHORUS PESTICIDES/HERBICIDES
NSWC-WHITE OAK, SILVER SPRING, MARYLAND
PAGE 1 OF 2

Parameter	PQL[1]	
	Aqueous Samples µg/L	Solid Samples µg/kg
Organophosphorus Pesticides		
Azinphos-methyl	5	160
Bolstar (Sulprofos)	5	120
Chlorpyrifos	3	100
Demeton-O	3	100
Demeton-S	3	100
Diazinon	3	100
Dichlorvos (DDVP)	5	120
Dimethoate	2	130
Disulfoton	3	100
EPN	2	66
Ethoprop	3	100
Fensulfothion	3	80
Fenthion	3	100
Malathion	3	250
Merphos	5	120
Mevinphos	5	120
Naled	3	120
Parathion, ethyl	3	100
Parathion, methyl	3	100
Phorate	3	100
Ronnel	3	100
Sulfotepp	8	80
TEPP	3	80
Tetrachlorovinphos (Stirofos)	3	180
Tokuthion (Protothiofos)	3	100
Trichloronate	3	80
Herbicides		
2,4-D	1	50
2,4-DB	3	140
2,4,5-TP (Silvex)	1	25
2,4,5-T	1	25
Dalapon	5	160
Dicamba	1	15
Dichloroprop	3	125

TABLE 1-5

ANALYTICAL DETECTION LIMITS - ORGANOPHOSPHORUS PESTICIDES/HERBICIDES
NSWC-WHITE OAK, SILVER SPRING, MARYLAND
PAGE 2 OF 2

Parameter	PQL[1]	
	Aqueous Samples µg/L	Solid Samples µg/kg
Dinoseb	10	480
MCPA	1100	55000
MCPP	200	660
4-Nitrophenol	1	30
Pentachlorophenol	0.10	6.0

1 PQL Estimated Practical Quantitation Limit.

TABLE 1-6

ANALYTICAL DETECTION LIMITS - HALOGENATED VOLATILES VIA SW-846 8010B
NSWC-WHITE OAK, SILVER SPRING, MARYLAND

Parameter	PQL[1]	
	Aqueous Samples µg/L	Solid Samples µg/kg
Halogenated Volatiles		
Bromodichloromethane	1	1
Bromoform	1	1
Bromomethane	1	1
Carbon Tetrachloride	1	1
Chlorobenzene	1	1
Chloroethane	1	1
2-Chloroethylvinyl ether	1	1
Chloroform	1	1
Chloromethane	1	1
Dibromochloromethane	1	1
1,3-Dichlorobenzene	1	1
1,4-Dichlorobenzene	1	1
1,2-Dichlorobenzene	1	1
Dichlorodifluoromethane	1	1
1,1-Dichloroethane	1	1
1,2-Dichloroethane	1	1
1,1-Dichloroethene	1	1
cis-1,2-Dichloroethene	1	1
1,2-Dichloropropane	1	1
cis-1,3-Dichloropropene	1	1
Methylene Chloride	1	1
1,1,2,2-Tetrachloroethane	1	1
Tetrachloroethene	1	1
trans-1,2-Dichloroethene	1	1
trans-1,3-Dichloropropene	1	1
1,1,1-Trichloroethane	1	1
1,1,2-Trichloroethane	1	1
Trichloroethene	1	1
Trichlorofluoromethane	1	1
Vinyl Chloride	1	1

1 PQL Estimated Practical Quantitation Limit.

TABLE 1-7

ANALYTICAL DETECTION LIMITS - AROMATIC VOLATILES VIA SW-846 8020A
NSWC-WHITE OAK, SILVER SPRING, MARYLAND

Parameter	PQL[1]	
	Aqueous Samples µg/L	Solid Samples µg/kg
Aromatic Volatiles		
Benzene	1	1
Chlorobenzene	1	1
1,2-Dichlorobenzene	1	1
1,3-Dichlorobenzene	1	1
1,4-Dichlorobenzene	1	1
Ethylbenzene	1	1
Toluene	1	1
Xylenes	1	1

1 PQL Estimated Practical Quantitation Limit.

TABLE 1-8

ANALYTICAL DETECTION LIMITS - HALOGENATED AND AROMATIC VOLATILES
VIA SW-846 8021A
NSWC-WHITE OAK, SILVER SPRING, MARYLAND
PAGE 1 OF 2

Parameter	PQL(1)	
	Aqueous Samples (µg/L)	Solid Samples (µg/Kg)
Benzene	1	1
Bromobenzene	1	1
Bromochloromethane	1	1
Bromodichloromethane	1	1
Bromoform	1	1
n-Butylbenzene	1	1
sec-Butylbenzene	1	1
tert-Butylbenzene	1	1
Carbon tetrachloride	1	1
Chlorobenzene	1	1
Chlorodibromomethane	1	1
Chloroethane	1	1
Chloroform	1	1
Chloromethane	1	1
2-Chlorotoluene	1	1
4-Chlorotoluene	1	1
1,2-Dibromo-3-chloropropane	1	1
1,2-Dibromomethane	1	1
Dibromomethane	1	1
1,2-Dichlorobenzene	1	1
1,3-Dichlorobenzene	1	1
1,4-Dichlorobenzene	1	1
Dichlorodifluormethane	1	1
1,1-Dichloroethane	1	1
1,2-Dichloroethane	1	1
1,1-Dichloroethene	1	1
cis-1,2-Dichloroethene	1	1
trans-1,2-Dichloroethene	1	1
1,2-Dichloropropane	1	1
1,3-Dichloropropane	1	1
2,2-Dichloropropane	1	1
1,1-Dichloropropene	1	1
cis-1,3-Dichloropropene	1	1
trans-1,3-Dichloropropene	1	1
Ethylbenzene	1	1

TABLE 1-8

ANALYTICAL DETECTION LIMITS - HALOGENATED AND AROMATIC VOLATILES VIA SW-846 8021A
NSWC-WHITE OAK, SILVER SPRING, MARYLAND
PAGE 2 OF 2

Parameter	PQL(1)	
	Aqueous Samples (µg/L)	Solid Samples (µg/Kg)
Hexachlorobutadiene	1	1
Isopropylbenzene	1	1
p-Isopropyltoluene	1	1
Methylene Chloride	1	1
Naphthalene	1	1
n-Propylbenzene	1	1
Styrene	1	1
1,1,1,2-Tetrachloroethane	1	1
1,1,2,2-Tetrachloroethane	1	1
Tetrachloroethane	1	1
Toluene	1	1
1,2,3-Trichlorobenzene	1	1
1,2,4-Trichlorobenzene	1	1
1,1,1-Trichloroethane	1	1
1,1,2-Trichloroethane	1	1
Trichloroethene	1	1
Trichlorofluoromethane	1	1
1,2,3-Trichloropropane	1	1
1,2,4-Trimethylbenzene	1	1
1,3,5-Trimethylbenzene	1	1
Vinyl Chloride	1	1
o-Xylene	1	1
m-Xylene	1	1
p-Xylene	1	1

1 PQL Estimated Practical Quantitation Limit.

TABLE 1-9

ANALYTICAL DETECTION LIMITS - NITROAROMATICS (EXPLOSIVES)
NSWC-WHITE OAK, SILVER SPRING, MARYLAND

Parameter	PQL[1]	
	Aqueous Samples (µg/L)	Solid Samples (µg/kg)
Explosives		
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	0.85	70
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	0.85	50
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.42	40
1,3-Dinitrobenzene (1,3-DNB)	0.42	40
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	0.85	160
Nitrobenzene (NB)	0.42	35
2,4,6-Trinitrotoluene (2,4,6-TNT)	0.42	40
4-Amino-2,6-dinitrotoluene (4-Am-2,6-DNT)	0.42	40
2-Amino-4,6-dinitrotoluene (2-Am-4,6-DNT)	0.42	50
2,4-Dinitrotoluene (2,4-DNT)	0.42	50
2,6-Dinitrotoluene (2,6-DNT)	0.42	50
2-Nitrotoluene (2-NT)	0.85	80
4-Nitrotoluene (4-NT)	0.85	90
3-Nitrotoluene (3-NT)	0.85	80

1 PQL Estimated Practical Quantitation Limit.

TABLE 1-10

ANALYTICAL DETECTION LIMITS - POLYNUCLEAR AROMATIC HYDROCARBONS VIA HPLC NSWC-WHITE OAK, SILVER SPRING, MARYLAND

Parameter	PQL[1]	
	Aqueous Samples (µg/L)	Solid Samples (µg/kg)
Acenaphthene	18	600
Acenaphthylene	23	770
Anthracene	6.6	220
Benzo(a)anthracene	1.3	43
Benzo(a)pyrene	2.3	77
Benzo(b)fluoranthene	0.18	6.0
Benzo(ghi)perylene	0.76	25
Benzo(k)fluoranthene	0.17	6.0
Chrysene	1.5	5.0
Dibenzo(a,h)anthracene	0.30	10
Fluoranthene	2.1	70
Fluorene	2.1	70
Indeno(1,2,3-cd)pyrene	0.43	14
Naphthalene	18	600
Phenanthrene	6.4	210
Pyrene	2.7	90

1 PQL Estimated Practical Quantitation Limit.

TABLE 1-11

ANALYTICAL DETECTION LIMITS - N-METHYLCARBAMATES
NSWC-WHITE OAK, SILVER SPRING, MARYLAND

Parameter	MDL [1]	
	Aqueous Samples (µg/L)	Solid Samples (µg/Kg)
Aldicarb Sulfone	16	440
Methomyl (Lannate)	17	120
3-Hydroxycarbofuran	26	100
Dioxacarb	22	7,500
Aldicarb (Temik)	94	120
Propoxur (Baygon)	24	170
Carbofuran (Furadon)	20	220
Carbaryl (Sevin)	17	310
α-Naphthol [2]	--	--
Methiocarb (Mesurol)	31	320
Promecarb	25	170

1 MDL Method Detection Limit.
2 Breakdown product of Carbaryl.

TABLE 1-12

ANALYTICAL DETECTION LIMITS - TCL DIOXINS/FURANS
NSWC-WHITE OAK, SILVER SPRING, MARYLAND

Parameter	CRQL (1)	
TCL Dioxins/Furans	Aqueous Samples (ng/L)	Solid Samples (ug/Kg)
2,3,7,8-TCDD	10	1.0
2,3,7,8-TCDF	10	1.0
1,2,3,7,8-PeCDF	25	2.5
1,2,3,7,8-PeCDD	25	2.5
2,3,4,7,8-PeCDF	25	2.5
1,2,3,4,7,8-HxCDF	25	2.5
1,2,3,6,7,8HxCDF	25	2.5
1,2,3,4,7,8-HxCDD	25	2.5
1,2,3,6,7,8-HxCDD	25	2.5
1,2,3,7,8,9-HxCDD	25	2.5
2,3,4,6,7,8-HxCDF	25	2.5
1,2,3,7,8,9-HxCDF	25	2.5
1,2,3,4,6,7,8-HpCDF	25	2.5
1,2,3,4,6,7,8-HpCDD	25	2.5
1,2,3,4,7,8,9-HpCDF	25	2.5
OCDD	50	5.0
OCDF	50	5.0
Total TCDD(2)	--	--
Total TCDF	--	--
Total PeCDD	--	--
Total PeCDF	--	--
Total HxCDD	--	--
Total HxCDF	--	--
Total HpCDD	--	--
Total HpCDF	--	--

1 CRQL Contract Required Quantitation Limit; as specified in DFLM01.0

2 Data are reported for the total concentration of all detected PCDDs or PCDFs in the following homologues; however it is not possible to assign CRQL values to total homologue concentrations.

TABLE 1-13

ANALYTICAL DETECTION LIMITS - RADIOLOGICAL PARAMETERS
NSWC-WHITE OAK, SILVER SPRING, MARYLAND

Parameter	MDA[1]	
	Aqueous Samples (pCi/L)	Solid Samples (pCi/g)[4]
Gross Alpha/Beta	1.0-4.0	--
Strontium 89-90	0.05	--
Tritium	350	NA
Alpha Spectrometry	[3]	--
Gamma Spectrometry	[3]	--

1 MDA Minimum Detectable Activity
2 NA Not Applicable.
3 Spectrometry analysis evaluates a series of radio isotopes therefore a specific MDA is not applicable.
4 Soil MDAs are based upon sample weight used in preparation.

TABLE 1-14

ANALYTICAL DETECTION LIMITS
ENGINEERING PARAMETERS AND MISCELLANEOUS PARAMETERS
NSWC-WHITE OAK, SILVER SPRING, MARYLAND

Parameter	PQL[1]	
	Aqueous Samples (mg/L)	Solid Samples (mg/kg)
Total Dissolved Solids	10	NA[2]
Total Suspended Solids	5.0	NA
Alkalinity (as $CaCO_3$)	2.0	NA
Hardness (as $CaCO_3$)	2.0	NA
Nitrate	0.050	0.02
Nitrite	0.050	0.04
Nitrate/Nitrite	0.050	0.05
Total Kjeldahl Nitrogen	0.2	NA
Total Organic Carbon	1.0	50
Total Organic Halogens	0.050	1.0
Gasoline Range Organics	0.5	0.5
Diesel Range Organics	1.0	5.0
Biochemical Oxygen Demand	2.0	NA
Hexavalent Chromium	0.020	0.8
Paint Filter Test	NA	Presence or Absence of Liquids
Ignitability	NA	NA
Corrosivity (pH)	NA	NA
Reactivity: Reactive Cyanide	NA	0.5
Reactive Sulfide	2.0	1.3
Ammonia	0.03	NA
Bromide	2.0	0.1
Chloride	1.0	0.2
Fluoride	0.05	0.1
Phosphorus	0.01	0.03
Sulfate	1.0	0.2
Sulfite	2.0	NA
Sulfide	1.0	NA

1 PQL Estimated Practical Quantitation Limit.
2 NA Not Applicable.

2.0 PROJECT ORGANIZATION

The management and all aspects of the quality assurance organization are the ultimate responsibilities of the Navy, including EFACHES and the former NSWC-White Oak. Each contractor assigned to individual tasks has the responsibility to fulfill the objectives of each task and ensure the quality of the data generated by the task. At the direction of the Navy, B&R Environmental has overall responsibility for the IRP investigations to be performed at the former NSWC-White Oak. The project organization chart for the Navy/B&R Environmental team is provided in Figure 2-1. The various quality assurance and management responsibilities of key B&R Environmental project personnel are defined in the following paragraphs.

CLEAN Program Manager. The B&R Environmental Program Manager is responsible for the execution of all contractual obligations. He serves as the primary program point of contact for the client and provides an interface between the Navy and the project staff. The B&R Environmental Program Manager is Mr. John Trepanowski, P.E.

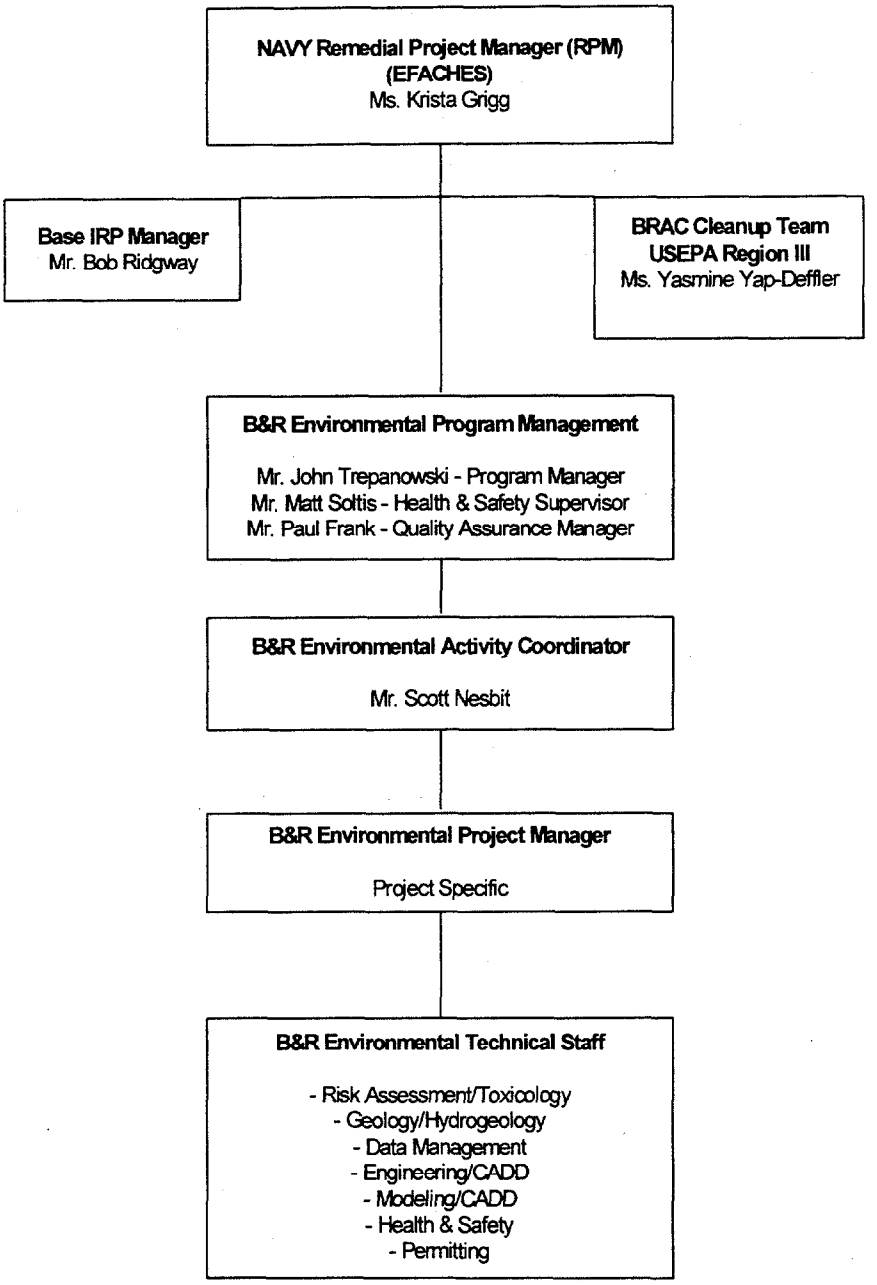
White Oak Activity Coordinator. The Activity Coordinator is responsible for Basewide project performance and team communication. He will aid in the development of the field program, determination of conclusions and recommendations, and preparation of the technical report. The B&R Environmental Activity Coordinator for the former NSWC-White Oak is Mr. Scott Nesbit, P.E.

White Oak Project Manager. The Project Manager is responsible for project performance budget and schedule and for ensuring the availability of necessary personnel, equipment, subcontractors, and services. He/she will direct the development of the field program, evaluation of findings, determination of conclusions and recommendations, and preparation of the technical report. The B&R Environmental Project Manager will be selected based upon technical experience, project needs, and previous NSWC-White Oak experience.

Field Operations Leader. The Field Operations Leader (FOL) provides onsite supervision of day-to-day activities on the project. He/she serves as the primary onsite contact with the client. In addition, he is responsible for all field QA/QC procedures as defined in this QAPP and for safety-related issues as defined in the HASP.

FIGURE 2-1

PROJECT ORGANIZATION
NSWC-WHITE OAK, SILVER SPRING, MARYLAND



Health and Safety Supervisor. The Health and Safety Supervisor (HSS) will review and internally approve the HASP tailored to the specific needs of this investigation. In consultation with the Project Manager and FOL, he will ensure that an adequate level of personal protection exists for anticipated potential hazards for all field personnel. As the HSS does not report to either the Program or Project Manager, his actions are not dictated by any program or project constraints (such as budget and schedule) other than the assurance of appropriate safeguards for staff conducting the investigation activities. Mr. Matthew Soltis, CIH, is the B&R Environmental HSS. The Site Safety Officer (SSO) will be designated by the Project Manager, depending on the tasks being performed on the site at a given time. His or her responsibilities will be to ensure that the provisions of the HASP are being implemented.

Quality Assurance Manager/Sampling Coordinators. The Project Manager and the FOL will coordinate the schedule of field sampling activities with the schedule and capacity requirements of the selected analytical laboratory. All sampling will be coordinated to assure that environmental sampling is conducted in a manner that complies with all QA/QC requirements and delivers samples to the analytical laboratory in compliance with all holding time and analytical procedure requirements. Sampling coordination will be performed by direct communication with the FOL and the Project Manager. All Program-wide quality assurance issues are the responsibility of the Quality Assurance Manager (QAM). Mr. Paul Frank is the B&R Environmental QAM.

3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall QA objective for this project is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide results which are legally defensible in a court of law. Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal QC, audits, preventive maintenance of field and laboratory equipment, and corrective action are described in other sections of this QAPP. The PARCC parameters (precision, accuracy, representativeness, comparability, and completeness) are qualitative and/or quantitative statements regarding the quality characteristics of the data used to support project objectives and ultimately, environmental decisions. These parameters are discussed in the remainder of this section. Specific routine procedures used to assess the quantitative parameters (precision, accuracy, and completeness) are provided in Section 12.0.

3.1 PRECISION

3.1.1 Definition

Precision is a measure of the amount of variability and bias inherent in a data set. Precision describes the reproducibility of measurements of the same parameter for samples under similar conditions. The equation for determining precision is provided in Section 12.2.

3.1.2 Field Precision Objectives

Field duplicate precision monitors the consistency with which environmental samples were obtained and analyzed. Field duplicate results for solid matrix samples are considered to be precise if the relative percent difference (RPD) is less than or equal to 50 percent. Field duplicate results for aqueous matrix samples are considered to be precise if the RPD is less than or equal to 30 percent. Field precision is assessed through the collection and measurement of field duplicates at a rate of one duplicate per 10 environmental samples.

3.1.3 Laboratory Precision Objectives

Laboratory precision QC samples are analyzed at a frequency of 5 percent (i.e., one quality control sample per 20 environmental samples). Laboratory precision is measured via comparison of calculated RPD values and Precision Control Limits specified in the analytical method or by the laboratory's QA/QC Program.

Precision for organic analysis will typically be measured via RPDs for matrix spike/matrix spike duplicate (MS/MSD) samples. Although the Statement of Work (SOW) for low-concentration TCL organic analysis does not require a specific QC sample to monitor precision, the calibration requirements of the method, by requiring specific limits of precision for the calibration standards, do ensure that a sufficient level of precision is achieved. (Calibration is further discussed in Section 6.0.) Precision for inorganic analysis will typically be measured via RPDs for laboratory duplicates. Precision control limits for TCL organics and TAL inorganics are specified in the current CLP SOWs. Table 3-1 presents precision control limits for MS/MSD RPDs for TCL organics; Table 3-2 presents precision control limits for laboratory RPDs for TCL dioxins/furans, and Table 3-3 presents precision control limits for laboratory duplicate RPDs for TAL inorganics. Internal laboratory control limits will be used for evaluation of precision for non-CLP analyses. Internal laboratory control limits for precision are typically three times the standard deviation of a series of RPDs.

3.2 ACCURACY

3.2.1 Definition

Accuracy is the degree of agreement between an observed value and an accepted reference value. The equation for determining accuracy is provided in Section 12.1.

3.2.2 Field Accuracy Objectives

Accuracy in the field is assessed through the use of rinsate and trip blanks and is ensured through the adherence to all sample handling, preservation, and holding time procedures. Accuracy and precision requirements for field measurements (total volatile organics, pH, specific conductivity, temperature, DO, ORP, and turbidity) are ensured through calibration as discussed in Section 6.0.

3.2.3 Laboratory Accuracy Objectives

Accuracy in the laboratory is measured through the comparison of a spiked sample result against a known or calculated value expressed as a percent recovery (%R). Percent recoveries are derived from the analysis of known amounts of compounds spiked into deionized water (i.e., laboratory control sample (LCS) analysis), or into actual samples (i.e., surrogate or matrix spike analysis). LCP analyses measure the accuracy of laboratory operations. Surrogate and matrix spike analyses measure the accuracy of laboratory operations as affected by matrix. LCS and/or matrix spike analyses are performed with a frequency of one per 20 associated samples of like matrix. Surrogate spike analysis is performed for all organic chromatographic analyses. Laboratory accuracy is assessed via comparison of calculated %R

TABLE 3-1

PRECISION CONTROL LIMITS (RPDS)[1]
MATRIX SPIKE/MATRIX SPIKE DUPLICATE SAMPLES
ORGANIC ANALYSIS VIA OLM03.1[2]
NSWC-WHITE OAK, SILVER SPRING, MARYLAND

Chemical	Aqueous Samples	Solid Samples
VOLATILE ORGANICS		
1,1-Dichloroethene	14	22
Trichloroethene	14	24
Benzene	11	21
Toluene	13	21
Chlorobenzene	13	21
SEMIVOLATILE ORGANICS		
Phenol	42	35
2-Chlorophenol	40	50
1,4-Dichlorobenzene	28	27
N-Nitroso-di-n-propylamine	38	38
1,2,4-Trichlorobenzene	28	23
4-Chloro-3-methylphenol	42	33
Acenaphthene	31	19
4-Nitrophenol	50	50
2,4-Dinitrotoluene	38	47
Pentachlorophenol	50	47
Pyrene	31	36
PESTICIDES		
gamma-BHC (Lindane)	15	50
Heptachlor	20	31
Aldrin	22	43
Dieldrin	18	38
Endrin	21	45
4,4'-DDT	27	50

1 RPD - Relative Percent Difference as described in Section 12.0.
2 USEPA 1994a.

TABLE 3-2

PRECISION CONTROL LIMITS (RPDS)[1]
LABORATORY DUPLICATE SAMPLES
DIOXINS/FURANS VIA DFLM01.1[2]
NSWC-WHITE OAK, SILVER SPRING, MARYLAND

Chemical	Aqueous Samples	Solid Samples
PCDD/PCDF		
2,3,7,8-TCDD	50	50
2,3,7,8-TCDF	50	50
1,2,3,7,8-PeCDF	50	50
1,2,3,7,8-PeCDD	50	50
2,3,4,7,8-PeCDF	50	50
1,2,3,4,7,8-HxCDF	50	50
1,2,3,6,7,8-HxCDF	50	50
1,2,3,4,7,8-HxCDD	50	50
1,2,3,6,7,8-HxCDD	50	50
1,2,3,7,8,9-HxCDD	50	50
2,3,4,6,7,8-HxCDF	50	50
1,2,3,7,8,9-HxCDF	50	50
1,2,3,4,6,7,8-HpCDF	50	50
1,2,3,4,6,7,8-HpCDD	50	50
1,2,3,4,7,8,9-HpCDF	50	50
OCDD	50	50
OCDF	50	50

1 RPD - Relative Percent Difference as described in Section 12.0.
2 USEPA, 1991.

TABLE 3-3

PRECISION CONTROL LIMITS (RPDS)[1]
LABORATORY DUPLICATE SAMPLES
INORGANIC ANALYSIS VIA ILM04.0[2]
NSWC-WHITE OAK, SILVER SPRING, MARYLAND

Chemical	Aqueous Samples[3]	Solid Samples[4]
INORGANICS		
Aluminum	20	35
Antimony	20	35
Arsenic	20	35
Barium	20	35
Beryllium	20	35
Cadmium	20	35
Calcium	20	35
Chromium	20	35
Cobalt	20	35
Copper	20	35
Iron	20	35
Lead	20	35
Magnesium	20	35
Manganese	20	35
Mercury	20	35
Nickel	20	35
Potassium	20	35
Selenium	20	35
Silver	20	35
Sodium	20	35
Thallium	20	35
Vanadium	20	35
Zinc	20	35
Cyanide	20	35

1 RPD - Relative Percent Difference as described in Section 12.0.
2 USEPA, 1995.
3 For aqueous sample results less than 5X CRDL, a control limit of ±CRDL is used.
4 For solid sample results less than 5X CRDL, a control limit of ±2X CRDL is used.

values with Accuracy Control Limits specified in the analytical method or by the laboratory's QA/QC Program.

Accuracy for organic analyses will typically be measured via the percent recoveries for surrogate spikes, LCS, and/or MS/MSD. Accuracy for dioxins/furans will be measured via %R of internal standards and matrix spike samples. Accuracy for inorganic analyses will typically be measured via %R for matrix spikes and LCS. Accuracy control limits for TCL organics and TAL inorganics are specified in the current CLP SOWs. Tables 3-4 and 3-5 present control limits for LCS and surrogate spike recoveries, respectively, for low-concentration TCL organics. Tables 3-6 and 3-7 present control limits for matrix and surrogate spike recoveries, respectively, for TCL organics. Table 3-8 presents control limits for internal standard recoveries and matrix spike samples for dioxins/furans. Tables 3-9 and 3-10 present control limits for matrix spike and laboratory control samples, respectively, for TAL inorganics. Internal laboratory control limits will be used for evaluation of accuracy for non-CLP analyses. Internal laboratory control limits for accuracy are typically set at the mean plus or minus three times the standard deviation of a series of %R values.

3.3 COMPLETENESS

3.3.1 Definition

Completeness is a measure of the amount of usable, valid analytical data obtained, compared to the amount expected to be obtained. Valid data is defined as data that have not been rejected. Completeness is typically expressed as a percentage.

The ideal objective for completeness is 100 percent (i.e., every sample planned to be collected is collected; every sample submitted for analysis yields valid data). However, samples can be rendered unusable during shipping or preparation (e.g., bottles broken or extracts accidentally destroyed), errors can be introduced during analysis (e.g., loss of instrument sensitivity, introduction of ambient laboratory contamination), or strong matrix effects can become apparent (e.g., extremely low matrix spike recovery). These instances result in data that do not meet QC criteria. Based on these considerations, 95 percent is considered an acceptable target for the data completeness objective. If critical data points are lost, resampling and/or reanalysis may be required.

TABLE 3-4

ACCURACY CONTROL LIMITS (%R)[1]
LABORATORY CONTROL SAMPLES
LOW-CONCENTRATION ORGANIC ANALYSIS VIA OLC02.0[2]
NSWC-WHITE OAK, SILVER SPRING, MARYLAND

Chemical	Aqueous Samples
VOLATILE ORGANICS	
Vinyl chloride	60-140
1,2-Dichloroethane	60-140
Carbon tetrachloride	60-140
1,2-Dichloropropane	60-140
Trichloroethene	60-140
1,1,2-Trichloroethane	60-140
Benzene	60-140
cis-1,3-Dichloropropene	60-140
Bromoform	60-140
Tetrachloroethene	60-140
1,2-Dibromoethane	60-140
1,4-Dichlorobenzene	60-140
SEMIVOLATILE ORGANICS	
Phenol	44-120
2-Chlorophenol	58-110
4-Chloroaniline	35-98
2,4,6-Trichlorophenol	65-110
bis(2-Chloroethyl)ether	64-110
N-Nitroso-di-n-propylamine	34-102
Hexachloroethane	32-77
Isophorone	49-110
1,2,4-Trichlorobenzene	44-96
Naphthalene	56-160
2,4-Dinitrotoluene	61-140
Diethylphthalate	76-104
N-Nitrosodiphenylamine	35-120
Hexachlorobenzene	30-95
Benzo(a)pyrene	55-92
PESTICIDES/PCBs	
gamma-BHC (Lindane)	56-123
Heptachlor epoxide	74-150
Dieldrin	33-150
4,4'-DDE	50-150
Endrin	56-121
Endosulfan sulfate	50-100
gamma-Chlordane	33-130

1 %R - Percent Recovery as described in Section 12.0.
2 USEPA, 1992.

TABLE 3-5

ACCURACY CONTROL LIMITS (%R)[1]
SURROGATE SPIKES
LOW-CONCENTRATION ORGANIC ANALYSIS VIA OLC02.0[2]
NSWC-WHITE OAK, SILVER SPRING, MARYLAND

Chemical	Aqueous Samples
VOLATILE ORGANICS	
Bromoflourobenzene	80-120
SEMIVOLATILE ORGANICS	
Nitrobenzene-d5	40-112
2-Fluorobiphenyl	42-110
Terphenyl-d14	24-140
Phenol-d5	17-113
2-Fluorophenol	16-108
2,4,6-Tribromophenol	18-126
PESTICIDES/PCBS	
Tetrachloro-m-xylene	60-150
Decachlorobiphenyl	60-150

1 %R - Percent Recovery as described in Section 12.0.
2 USEPA, 1992.

TABLE 3-6

ACCURACY CONTROL LIMITS (%R)[1]
MATRIX SPIKE/MATRIX SPIKE DUPLICATE SAMPLES
ORGANIC ANALYSIS VIA OLM03.1[2]
NSWC-WHITE OAK, SILVER SPRING, MARYLAND

Chemical	Aqueous Samples	Solid Samples
VOLATILE ORGANICS		
1,1-Dichloroethene	61-145	59-172
Trichloroethene	71-120	62-137
Benzene	76-127	66-142
Toluene	76-125	59-139
Chlorobenzene	75-130	60-133
SEMIVOLATILE ORGANICS		
Phenol	12-110	26-90
2-Chlorophenol	27-123	25-102
1,4-Dichlorobenzene	36-97	28-104
N-Nitroso-di-n-propylamine	41-116	41-126
1,2,4-Trichlorobenzene	39-98	38-107
4-Chloro-3-methylphenol	23-97	26-103
Acenaphthene	46-118	31-137
4-Nitrophenol	10-80	11-114
2,4-Dinitrotoluene	24-96	28-89
Pentachlorophenol	9-103	17-109
Pyrene	26-127	35-142
PESTICIDES/PCBs		
gamma-BHC (Lindane)	56-123	46-127
Heptachlor	40-131	35-130
Aldrin	40-120	34-132
Dieldrin	52-126	31-134
Endrin	56-121	42-139
4,4'-DDT	38-127	23-134

1 %R - Percent Recovery as described in Section 12.0.
2 USEPA, 1994a.

TABLE 3-7

ACCURACY CONTROL LIMITS (%R)[1]
SURROGATE SPIKES
ORGANIC ANALYSIS VIA OLM03.1[2]
NSWC-WHITE OAK, SILVER SPRING, MARYLAND

Chemical	Aqueous Samples	Solid Samples
VOLATILE ORGANICS		
Toluene-d8	88-110	84-138
Bromoflourobenzene	86-115	59-113
1,2-Dichloroethane-d4	76-114	70-121
SEMIVOLATILE ORGANICS		
Nitrobenzene-d5	35-114	23-120
2-Fluorobiphenyl	43-116	30-115
Terphenyl-d14	33-141	18-137
Phenol-d5	10-110	24-113
2-Fluorophenol	21-110	25-121
2,4,6-Tribromophenol	10-123	19-122
2-Chlorophenol-d4	33-110[3]	20-130[3]
1,2-Dichlorobenzene-d4	16-110[3]	20-130[3]
PESTICIDES/PCBS		
Tetrachloro-m-xylene	30-150	30-150
Decachlorobiphenyl	30-150	30-150

1 %R - Percent Recovery as described in Section 12.0.
2 USEPA, 1994a.
3 Advisory limits only.

TABLE 3-8

ACCURACY CONTROL LIMITS (%R)[1]
INTERNAL STANDARDS/MATRIX SPIKE SAMPLES
DIOXINS/FURANS VIA DFLM01.1[2]
NSWC-WHITE OAK, SILVER SPRING, MARYLAND

Chemical	Aqueous Samples	Solid Samples
Internal Standards		
13C-2,3,7,8-TCDF	25-150	25-150
13C-2,3,7,8-TCDD	25-150	25-150
13C-1,2,3,6,7,8-HxCDD	25-150	25-150
13C-1,2,3,4,6,7,8-HpCDF	25-150	25-150
13C-OCDD	25-150	25-150
Matrix Spikes		
2,3,7,8-TCDD	50-150	50-150
2,3,7,8-TCDF	50-150	50-150
1,2,3,7,8-PeCDF	50-150	50-150
1,2,3,7,8-PeCDD	50-150	50-150
1,2,3,6,7,8-HxCDF	50-150	50-150
1,2,3,6,7,8-HxCDD	50-150	50-150
1,2,3,4,6,7,8-HpCDF	50-150	50-150
1,2,3,4,6,7,8-HpCDD	50-150	50-150
OCDD	50-150	50-150
OCDF	50-150	50-150

1 %R - Percent Recovery as described in Section 12.0.
2 USEPA, 1991.

TABLE 3-9

ACCURACY CONTROL LIMITS (%R)[1]
MATRIX SPIKE SAMPLES
INORGANIC ANALYSIS VIA ILM04.0[2]
NSWC-WHITE OAK, SILVER SPRING, MARYLAND

Chemical	Aqueous Samples	Solid Samples
INORGANICS		
Aluminum	75-125	NS[3]
Antimony	75-125	75-125
Arsenic	75-125	75-125
Barium	75-125	75-125
Beryllium	75-125	75-125
Cadmium	75-125	75-125
Calcium	NS[3]	NS[3]
Chromium	75-125	75-125
Cobalt	75-125	75-125
Copper	75-125	75-125
Iron	75-125	75-125
Lead	75-125	75-125
Magnesium	NS[3]	NS[3]
Manganese	75-125	75-125
Mercury	75-125	75-125
Nickel	75-125	75-125
Potassium	NS[3]	NS[3]
Selenium	75-125	75-125
Silver	75-125	75-125
Sodium	NS[3]	NS[3]
Thallium	75-125	75-125
Vanadium	75-125	75-125
Zinc	75-125	75-125
Cyanide	75-125	75-125

1 %R - Percent Recovery as described in Section 12.0.
2 USEPA, 1995.
3 No spike required.

TABLE 3-10

ACCURACY CONTROL LIMITS (%R)(1)
LABORATORY CONTROL SAMPLES
INORGANIC ANALYSIS VIA ILM04.0(2)
NSWC-WHITE OAK, SILVER SPRING, MARYLAND

Chemical	Aqueous Samples	Solid Samples
INORGANICS		
Aluminum	80-120	TBD(3)
Antimony	80-120(4)	TBD
Arsenic	80-120	TBD
Barium	80-120	TBD
Beryllium	80-120	TBD
Cadmium	80-120	TBD
Calcium	80-120	TBD
Chromium	80-120	TBD
Cobalt	80-120	TBD
Copper	80-120	TBD
Iron	80-120	TBD
Lead	80-120	TBD
Magnesium	80-120	TBD
Manganese	80-120	TBD
Mercury	NA(5)	TBD
Nickel	80-120	TBD
Potassium	80-120	TBD
Selenium	80-120	TBD
Silver	80-120(4)	TBD
Sodium	80-120	TBD
Thallium	80-120	TBD
Vanadium	80-120	TBD
Zinc	80-120	TBD
Cyanide	NA	TBD

1 %R - Percent Recovery as described in Section 12.0.
2 USEPA, 1995.
3 TBD - To Be Determined at time of analysis based on LCS lot number.
4 Advisory limits only.
5 NA - Not Applicable.

Typically, 100 percent of the laboratory data for the NSWC-White Oak investigations will be validated in accordance with the Region III Modifications to the "National Functional Guidelines for Organic and Inorganic Data Review Multi-Media, Multi-Concentration" (USEPA, 1994b and 1994c). Non-CLP data will be validated using these Guidelines to the extent possible. Data rejected as a result of the validation process will be treated as incomplete data.

3.3.2 Field Completeness Objectives

Field completeness is a measure of the amount of valid field measurements are obtained from all the field measurements taken in the project. The equation for completeness is presented in Section 12.3. Field completeness for this project is expected to be at least 95 percent.

3.3.3 Laboratory Completeness Objectives

Laboratory completeness is a measure of the amount of valid laboratory measurements are obtained from all the laboratory measurements taken in the project. The equation for completeness is presented in Section 12.3. Laboratory completeness for this project is expected to be at least 95 percent. If critical data points are lost, resampling and/or reanalysis may be required.

3.4 REPRESENTATIVENESS

3.4.1 Definition

Representativeness is an expression of the degree to which the data accurately and precisely depict the actual characteristics of a population or environmental condition existing at an individual sampling point. Use of standardized sampling, handling, analytical, and reporting procedures ensures that the final data accurately represent actual site conditions.

3.4.2 Measures to Ensure Representativeness of Field Data

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the FSP is followed and that proper sampling techniques are used.

3.4.3 Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory is ensured by using the proper analytical procedures, meeting sample holding times, and analyzing and assessing field duplicate samples. The sampling network for the former NSWC-White Oak investigations will be designed to provide data representative of facility

conditions. During development of this network, consideration will be given to past waste disposal practices, existing analytical data, physical setting and processes, and constraints inherent to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program. The rationale of the sampling network will be discussed in detail in the project-specific FSPs.

3.5 COMPARABILITY

3.5.1 Definition

Comparability is defined as the confidence with which one data set can be compared to another (e.g., between sampling points; between sampling events). Comparability is achieved by using standardized sampling and analysis methods, and data reporting formats (including use of consistent units of measure and reporting of solid matrix sample results on a dry-weight basis). Additionally, consideration is given to seasonal conditions and other environmental variations that could exist to influence data results.

3.5.2 Measures to Ensure Comparability of Field Data

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the FSP is followed and that proper sampling techniques are used. It is also dependent on recording field measurements using the correct units. Field measurement units are further discussed in Section 9.1.1.

3.5.3 Measures to Ensure Comparability of Laboratory Data

Planned analytical data will be comparable when similar sampling and analytical methods are used and documented. Results will be reported in units that ensure comparability with previous data and with current state and Federal standards and guidelines. Laboratory measurement units are further discussed in Section 9.1.2.

3.6 LEVEL OF QUALITY CONTROL EFFORT

Trip blank, rinsate blank, ambient condition blank, source water blank, method blank, field and laboratory duplicate, laboratory control, and matrix spike samples will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs. In addition, duplicate field measurements will be completed for temperature, DO, ORP, pH, specific conductance, and turbidity.

External QC measures (i.e., field QC samples) consist of field duplicates, ambient condition blanks, trip blanks, and equipment rinsate blanks. Information gained from these analyses further characterizes the

level of data quality obtained to support project goals. Each of these types of field QC samples undergo the same preservation, analysis, and reporting procedures as the related environmental samples. Each type of field QC sample is discussed below.

3.6.1 Field Duplicates

Field duplicates are either two samples collected independently at a sampling location (e.g., surface water), or a single sample homogenized and split into two portions. Where VOCs are to be analyzed, the VOC sample aliquots are containerized first to avoid loss of constituents, then the remaining sample matrix is homogenized. Field duplicates are collected and analyzed for chemical constituents to measure the precision of the sampling and analysis methods employed. The general level of the QC effort will be one field duplicate for every 10 or fewer investigative samples.

3.6.2 Trip Blanks and Ambient Condition Blanks

Trip blanks and ambient condition blanks, consisting of distilled water, will be submitted to the laboratory to provide the means to assess the quality of the data resulting from the field sampling program. Ambient blanks are not collected using the same sampling equipment as the field samples, but are collected while at the field sampling site by placing distilled water directly into the same type of container, preserved and stored in the same manner, as the field samples. Ambient blank samples are analyzed to check for background contamination at the facility (e.g., vapors, dust, or exhaust fumes that are part of normal operations at the site) which may cause sample contamination. The exposure of the ambient blank to ambient conditions should be similar to the ambient exposure of the field samples. Ambient blanks may be collected based on conditions at the time of sampling at the discretion of the FOL, or as specified in the project-specific FSP.

Trip blanks pertain to VOCs only. Trip blanks are used to assess the potential for contamination of VOCs resulting from contaminant migration into sample containers during sample shipment and storage. Trip blanks are prepared by the laboratory prior to the sampling event, shipped to the site with the sample containers, and kept with the investigative samples throughout the sampling event. They are then packaged for shipment with other VOC samples and sent for analysis. One trip blank should be included in each sample shipping container that contains VOCs. Once the trip blanks have been prepared, the containers must not be opened.

3.6.3 Equipment Rinsate Blanks

Equipment rinsate blanks are obtained under representative field conditions by collecting the rinse water generated by running analyte-free water through sample collection equipment after decontamination and prior to use. One rinsate blank per 20 environmental samples will be collected per each type of sampling equipment used (i.e., bailer, split-spoon sampler, hand tools, etc.). If pre-cleaned, dedicated, or disposable sampling equipment is used, one rinsate blank will be collected as a "batch blank." Rinsate blanks are analyzed for the same chemical constituents as the associated environmental samples.

3.6.4 Source Water Blanks

Source water blanks consist of the potable water used to steam clean large equipment. These blanks are used to determine if the potable water may be contributing to sample contamination. Source water blanks will be collected at a rate of one blank from each potable water source.

Method blank samples are generated within the laboratory and used to assess contamination resulting from laboratory procedures. Laboratory duplicate samples are analyzed for inorganic parameters to check for sampling and analytical reproducibility. Matrix spikes provide information about the effect of the sample matrix on the digestion and measurement methodology. All matrix spikes for organic analyses are performed in duplicate and are hereinafter referred to as MS/MSD samples.

MS/MSD samples are investigative samples. Soil MS/MSD samples require double the normal sample volume. Aqueous MS/MSD samples must be collected at triple the volume for VOCs and double the volume for extractable organics. One MS/MSD sample will be collected/designated for every 20 or fewer investigative samples per sample matrix (i.e. groundwater, soil).

4.0 SAMPLING PROCEDURES

Field sampling procedures for the former NSWC-White Oak investigations are discussed in detail in Section 3.1 of the Master FSP. In addition, the Master FSP addresses the following sampling procedures and field investigation tasks:

- General field operations - Section 2.1
- Subsurface investigations - Section 2.2
- Monitoring well construction and installation - Section 2.3
- Groundwater-level measurement - Section 2.4
- Field measurements - Section 2.5
- Geophysical investigations - Section 2.6
- Aquifer testing - Section 2.7
- Soil gas surveys - Section 2.8
- Land surveying - Section 2.9
- Decontamination - Section 2.10
- Waste handling and disposal - Section 2.11
- Sample handling - Section 3.2
- Sample custody - Section 3.3
- QC samples- Section 3.4

Standard Operating Procedures (SOPs) regarding sampling, recordkeeping, and field investigation tasks are included in Appendix B of the Master FSP.

Table 3-1 of the Master FSP presents sample container, preservation, and holding time requirements for environmental samples to be collected at the former NSWC-White Oak.

5.0 CUSTODY PROCEDURES

Custody is one of several factors which is necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files. Final evidence files, including all originals of laboratory reports and purge files, are maintained under document control in a secure area. A sample or evidence file is under custody if:

- the item is in the actual physical possession of an authorized person
- the item is in view of the person after being in his or her possession
- the item was placed in a secure area to prevent tampering
- the item is in a designated and identified secure area with access restricted to authorized personnel only

The chain-of-custody (COC) report is a multi-part, standardized form used to summarize and document pertinent sample information, such as sample identification and type, matrix, date and time of collection, preservation, and requested analyses. Furthermore, through the sequential signatures of various sample custodians (e.g., sampler, airbill number, laboratory sample custodian), the COC report documents sample custody and tracking. Custody procedures apply to all environmental and associated field QC samples obtained as part of the data collection system.

5.1 FIELD CUSTODY PROCEDURES

The FOL (or designee) is responsible for the care and custody of the samples until they are relinquished to the analyzing laboratory or entrusted to a commercial overnight courier. COC reports are completed for each sample shipment. The reports are filled out in a legible manner, using waterproof ink, and are signed (and dated) by the sampler. Pertinent notes, such as whether the sample was field filtered, or whether the sample is suspected to be high in contaminant concentration, are also indicated on the COC report. Information similar to that contained in the COC report is also provided on the sample label, which is securely attached to the sample bottle. COC report forms and sample labels will be supplied by the laboratory subcontractor. In accordance with Naval Facilities Engineering Service Center (NFESC) guidelines, samples for chemical constituent analysis must be sent (for next-day receipt) to the laboratory within 24-hours of collection.

Full details regarding sample COC (including use of custody seals and sample shipment protocols) are contained in B&R Environmental SOP SA-6.1, which is provided in Appendix B of the Master FSP. B&R Environmental SOP SA-6.3, also provided in Appendix B of the Master FSP, discusses maintenance of site logbooks, site notebooks, and other field records. Additionally, each of the various sampling SOPs incorporated into the FSP contains a section that addresses relevant sample documentation (i.e., completion of sample logsheets, etc.). All sample records are eventually docketed into the B&R Environmental central project file.

5.2 LABORATORY CUSTODY PROCEDURES

When samples are received by the laboratory subcontractor, the laboratory's sample custodian examines each cooler's custody seals to verify that they are intact and that the integrity of the environmental samples has been maintained. The sample custodian then signs the COC report. The custodian then opens the cooler and measures its internal temperature. The temperature reading is noted on the accompanying COC report. The sample custodian then examines the contents of the cooler. Sample container breakages or discrepancies between the COC report and sample label documentation are recorded. The pH of chemically preserved samples is checked using Hydrion paper and recorded. All problems or discrepancies noted during this process are to be promptly reported to the B&R Environmental Project Manager. Inter-laboratory COC procedures and specific procedures for sample handling, storage, disbursement for analysis, and remnant disposal will be followed as specified in the subcontract laboratory's SOPs and/or QA Plan.

5.3 FINAL EVIDENCE FILES

The B&R Environmental central file will be the repository for all documents which constitute evidence relevant to sampling and analysis activities as described in this QAPP. B&R Environmental is the custodian of the evidence file and maintains the contents of these files for the Remedial Investigation (RI), including all relevant records, reports, logs, field notebooks, photographs, subcontractor reports, and data reviews in a secure, limited access location and under custody of the B&R Environmental facility manager. The control file will include at a minimum:

- field logbooks
- field data and data deliverables
- photographs
- drawings
- soil boring logs

- laboratory data deliverables
- data validation reports
- data assessment reports
- progress reports, QA reports, interim project reports, etc.
- all custody documentation (COC reports, airbills, etc.)

Upon completion of the contract, all pertinent files will be relinquished to the custody of the Navy.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

All instrumentation used to perform chemical measurements must be properly calibrated prior to use in order to obtain valid and usable results. The requirement to properly calibrate instruments prior to use applies equally to field instruments as it does to fixed laboratory instruments. Field instrument calibration is discussed in Section 2.5.1 of the Master FSP. Laboratory instrument calibration is discussed in Section 6.2.

6.1 LABORATORY INSTRUMENT CALIBRATION

Calibration procedures for a specific laboratory instrument will consist of initial calibration (generally three to five points), initial calibration verification (inorganic methods only), and continuing calibration verification. In all cases, the initial calibration will be verified using an independently prepared calibration verification solution. The frequency of calibration will be performed according to the requirements of the specific methods.

All standards used to calibrate analytical instruments must be obtained from National Institute of Standards and Technology (NIST) or through a reliable commercial supplier with a proven record for quality standards. All commercially supplied standards must be traceable to NIST reference standards, where possible, and appropriate documentation will be obtained from the supplier. In cases where documentation is not available, the laboratory will analyze the standard and compare the results to USEPA-supplied known or previous NIST-traceable standard.

The calibration procedures and frequencies used by the subcontract laboratory will comply with the applicable CLP SOW or analytical method. Brief descriptions of calibration procedures for major instrument types follow.

6.1.1 GC/MS Volatile Organic Compound Analyses

For VOCs, the Gas Chromatograph/Mass Spectrophotometer (GC/MS) system will be tuned and calibrated in accordance with the appropriate CLP SOW (low-concentration water - OLC02.0; multi-media/multi-concentration - OLM03.1). A bromofluorobenzene (BFB) instrument performance check (tuning check) must be run prior to the initial and each continuing calibration and must meet all method-specified criteria before analyses may continue. Initial calibration is required before any samples are analyzed and must include a minimum of five different concentrations as specified in the method. A BFB

tuning check and a continuing calibration check, including the mid-range standard and a blank, must be performed at the beginning of each 12-hour shift during which analyses are performed.

6.1.2 GC/MS Semivolatile Organic Compound Analyses

For semivolatile organic compounds (SVOCs), the GC/MS system will be tuned and calibrated in accordance with the appropriate CLP SOW (low-concentration water - OLC02.0; multi-media/multi-concentration - OLM03.1). A decafluorotriphenyl phosphine (DFTPP) instrument performance check (tuning check) must be run prior to the initial and each continuing calibration and must meet all method-specified criteria before analyses may continue. Initial calibration is required before any samples are analyzed and must include five different concentrations as specified in the method. A DFTPP tuning check and a continuing calibration check, including the mid-range standard and a blank, must be performed at the beginning of each 12-hour shift during which analyses are performed.

6.1.3 Organochlorine Pesticide/PCB Analyses

For organochlorine pesticide/PCB analyses, the GC system will be calibrated in accordance with appropriate CLP SOW (low-concentration water - OLC02.0; multi-media/multi-concentration - OLM03.1). Initial calibration is required before any samples are analyzed. An 18-point initial calibration sequence is analyzed using dual column injection. The calibration sequence consists of an instrument blank to show system cleanliness, a resolution check to prove analyte separation, a performance evaluation mixture (PEM) to show endrin and 4,4'-DDT degradation, a single point of each Aroclor, and a three-point calibration of the individual pesticides to prove linearity. A second instrument blank and PEM sample are then analyzed.

If all initial calibration criteria are met, samples may be analyzed for a period of 12 hours after the injection of the second instrument blank. At the end of the 12-hour period, a third instrument blank followed by continuing calibration standard mixtures must be analyzed. If continuing calibration criteria are met, sample analysis may continue for an additional 12 hours. At this point, an instrument blank followed by a PEM is analyzed. The 12-hour clock continues, alternating between the continuing calibration standard mixtures and the PEM, until failure to meet method-specified criteria requires a new initial calibration.

6.1.4 Polychlorinated Dibenzo-p-Dioxin and Polychlorinated Dibenzofuran Analyses

For polychlorinated dibenzo-p-dioxin and dibenzofuran (PCDD/PCDF) organic compounds, the GC/MS system will be tuned and calibrated in accordance with the appropriate CLP SOW (DFLM01.1). Prior to an initial calibration a window defining mix shall be analyzed to evaluate the descriptor switching times.

An initial calibration must be performed and meet all method specific criteria before any samples are analyzed. A continuing calibration check must be performed at the beginning of each 12-hour time period, and meet all method-specific criteria before proceeding with sample analysis. Finally, the lowest calibration standard must be analyzed at the end of each 12-hour time period to demonstrate instrument sensitivity.

6.1.5 Other Gas Chromatographic Analyses

Calibration for GC analyses for chlorinated and aromatic hydrocarbons, gasoline and diesel range organics (GRO and DRO), polynuclear aromatic hydrocarbons (PAH), organophosphorus pesticides, n-methylcarbamates and herbicides will be performed in accordance with the applicable analytical methods. A five-point initial calibration is required before any samples are analyzed. A mid-point continuing calibration is required after every 10 samples and at the end of the analytical run. A method or preparation blank must be included in each analytical batch.

6.1.6 High Performance Liquid Chromatography Nitroaromatics and PAH Analysis

High Performance Liquid Chromatography (HPLC) analysis is used for nitroaromatics (explosives) and PAH analysis. The instrument will be calibrated as specified in the applicable analytical methods. A five-point initial calibration is required before any samples are analyzed. A mid-point continuing calibration is required, at a minimum, at the beginning of the day, at the midpoint of the run, and after the last sample of the day (assuming a sample group of 10 samples or less). A method or preparation blank must be included in each analytical batch.

6.1.7 Metals Analysis

6.1.7.1 Inductively Coupled Argon Plasma Analyses

Inductively coupled plasma (ICP) spectrometry systems will be calibrated for the analysis of TAL metals in accordance with the USEPA CLP protocols outlined in ILM04.0. Initial calibration is required each day before any samples are analyzed and consists of a calibration blank and at least one standard. The standard must be within the demonstrated linear range of the instrument. The linear range is verified quarterly. Following initial calibration, an initial calibration verification sample (obtained from a different source than the solutions used for calibration), an initial calibration blank, and an interference check sample are analyzed. A continuing calibration verification sample and a continuing calibration blank are run every 2 hours or every 10 samples, whichever occurs first. A continuing calibration verification sample, a continuing calibration blank, and an interference check sample are also run after analysis of the

last sample. The initial calibration verification standard, continuing calibration verification standard, and interference check sample each contain analytes of interest at different concentrations. In addition, a standard prepared at a concentration of two times the quantitation limit is analyzed at the beginning and end of each sample analysis run or a minimum of twice per 8-hour period. Linearity spanning the range of analysis is verified using this combination of standards. All calibration standards contain acids at the same concentrations as the sample digestates. If any of the continuing calibration samples fail to yield a response within 90-110 percent of the true value, initial calibration will be repeated, and all field samples analyzed since the last in-control calibration standard will be reanalyzed.

6.1.7.2 Atomic Absorption Analyses

Graphite furnace and cold vapor atomic absorption (GFAA and CVAA) analyses will be calibrated in accordance with the USEPA CLP protocols outlined in ILM04.0 or the applicable analytical method. Initial calibration is required each day before any samples are analyzed and consists of a calibration blank and at least three calibration standards (at least four standards for mercury) covering the range of concentrations of interest. The correlation coefficient of the regression of concentration versus response should be 0.995 or greater. Immediately following initial calibration, an initial calibration verification sample (obtained from a different source than the solutions used for calibration) and an initial calibration blank are analyzed. A continuing calibration verification sample and a continuing calibration blank are run every 2 hours or every 10 samples, whichever occurs first. A continuing calibration verification sample and a continuing calibration blank are also run after analysis of the last sample. If any of the continuing calibration samples fail to yield a response within 90-110 percent, (80-120 percent for mercury), of the true value, initial calibration will be repeated, and all field samples analyzed since the last in-control calibration standard will be reanalyzed.

6.1.8 Cyanide

Calibration for cyanide analyses will be performed as specified in the CLP SOW ILM04.0. Initial calibration is required each day before any samples are analyzed and consists of a calibration blank and at least three calibration standards covering the range of concentrations of interest. The correlation coefficient of the regression of concentration versus response should be 0.995 or greater. Immediately following initial calibration, an initial calibration verification sample (obtained from a different source than the solutions used for calibration) and an initial calibration blank are analyzed. The initial calibration verification must be distilled as are the associated field samples. A continuing calibration verification sample and a continuing calibration blank are run every 2 hours or every 10 samples, whichever occurs first. A continuing calibration verification sample and a continuing calibration blank are also run after analysis of the last sample.

If any of the continuing calibration samples fail to yield a response within 15 percent of the true value, initial calibration will be repeated, and all field samples analyzed since the last in-control calibration standard will be reanalyzed.

6.1.9 Miscellaneous Parameters

Calibration and standardization requirements for the analysis of all miscellaneous and engineering parameters, including radiological analyses, will be performed as specified in the applicable analytical methods.

7.0 ANALYTICAL AND MEASUREMENT PROCEDURES

All groundwater, surface water, soil and sediment samples collected for fixed laboratory analysis during the former NSWC-White Oak investigations will be analyzed by a NFESC-approved laboratory based upon analytical needs and laboratory availability. Laboratories will be solicited and procured on a project-specific basis. Only those analytical laboratories possessing current Navy CLEAN approval will be considered for a project.

Table 1-1 provides a summary of the laboratory analytical methods which may be used for solid and aqueous samples collected at the former NSWC-White Oak. A complete list of the target compounds/analytes, CRQLs/CRDLs, and estimated PQLs is also provided in Section 1.4.2.2 of this QAPP. Samples will be subjected to field parameter measurement and will be analyzed for some or all of the listed parameters based on the site under investigation. The analytical programs for environmental samples will be provided in the project-specific addenda to the Master FSP.

Data generated through use of CLP protocols will be reported to the CRQL for organics analysis and the CRDL for inorganics analysis. Analytes which are positively identified and which can be quantitated at concentrations below the CRQL/CRDL will be reported as specified in the appropriate CLP SOW. All environmental data generated through use of non-CLP protocols will be reported to the analyte's PQL. An analyte's PQL is an expression of the method detection limit with consideration given to required adjustments to ensure that the precision and accuracy requirements of the method are attainable. The PQLs provided in the tables in Section 1.4.2.2 are estimated since these values may vary based on the laboratory. In the case of radiological analyses, Minimum Detectable Activity (MDA) is determined on a sample-by-sample basis which is contingent upon sample aliquot.

The quantitation and detection limits shown on the tables in Section 1.4.2.2 for solid matrices are based on wet weight. All solid sample results will be reported on a dry-weight basis. Therefore, actual quantitation/detection limits for solid matrices will be higher based on the percent moisture of each sample. Quantitation and detection limits will also be adjusted for solid and aqueous samples, as necessary, based on dilution and sample aliquot.

8.0 QUALITY CONTROL CHECKS

Field-related QC checks were discussed in Section 3.6. This section provides additional information regarding internal QC checks for the field and the laboratory.

8.1 FIELD QUALITY CONTROL CHECKS

QC procedures for pH, specific conductance, temperature, DO, ORP, and turbidity will include calibrating the instruments as described in B&R Environmental SOP SA-1.1 provided in Appendix B of the Master FSP. Assessment of field sampling precision and bias will be made by collection of field duplicates and rinsate blanks for laboratory analysis, as discussed in Section 3.6 of this document.

8.2 LABORATORY QUALITY CONTROL CHECKS

The subcontract laboratory will have a QC program that ensures the reliability and validity of the analyses performed at the laboratory. Internal QC procedures for CLP analyses (VOCs and SVOCs, organochlorine pesticides/PCBs, dioxins/furans, metals, and cyanide) will comply with the SOWs for low-concentration water organics (OLC02.0), multi-media/multi-concentration organics (OLM03.1), dioxins/furans (DFLM01.1), and inorganics (ILM04.0). Internal QC procedures for non-CLP analyses will comply with applicable analytical method requirements.

Several internal laboratory QC checks are briefly discussed in the remainder of this section.

Laboratory method blanks are prepared and analyzed in accordance with the analytical method employed to determine whether contaminants originating from laboratory sources have been introduced and have affected environmental sample analyses. A method blank generally consists of an aliquot of analyte-free water (or purified sodium sulfate for soil/sediment samples) that is subjected to the same preparation and analysis procedures as the environmental samples undergoing analysis. With the exception of recognized volatile and semivolatile common laboratory contaminants (i.e., methylene chloride, acetone, 2-butanone, and phthalate esters) method blanks must not contain levels of target analytes above the CRQL (above 2.5X the CRQL for methylene chloride and above 5X the CRQL for acetone, 2-butanone, and phthalate esters). If method blank contamination is found to exist above allowable limits, corrective actions indicated in the CLP SOWs or laboratory SOPs must be followed. Under no circumstances are laboratory method blank contaminant values subtracted from environmental sample analysis results.

Instrument blank analysis is performed during organochlorine pesticide/PCB analysis to demonstrate that pesticides/PCB concentrations are less than 0.5 times the CRQL (or not greater than the CRQL for low-concentration analysis) and that the surrogate retention times are within the retention time windows. If analytes are detected at greater than half the CRQL (greater than the CRQL for low-concentration analyses), or the surrogate retention times are outside the retention time windows, all data collection must be stopped and corrective action must be taken. An acceptable instrument blank must be run before additional data is collected. One instrument blank every 12 hours is the minimum contract requirement.

Matrix spike analysis for organic fraction analyses is performed in duplicate as a measure of laboratory precision. For inorganic analyses, one matrix spike analysis and one **laboratory duplicate** analysis are likewise performed for every 20 environmental sample analyses of like matrix. With the exception of VOC MSD analyses, laboratory duplicates are prepared by thoroughly mixing and splitting a sample aliquot into two portions and analyzing each portion following the same analytical procedures that are used for the environmental sample analyses. For VOC MSD analyses, a second sample aliquot is used for analysis in order to avoid VOC constituent loss through the homogenization process. The field crew provides extra volumes of sample matrices designated for laboratory QC analyses, as required. Control limits for matrix spike and laboratory duplicate analyses are specified in the SOWs for CLP analyses and are established by the laboratory for non-CLP analyses.

Surrogates are organic compounds (typically brominated, fluorinated, or isotopically labeled), which are similar in nature to the compounds of concern, and which are not likely to be present in environmental media. Surrogates are spiked into each sample, standard, and method blank prior to analysis, and are used only in organic chromatographic analysis procedures as a check of method effectiveness. Surrogate recoveries are evaluated against control limits specified in the CLP SOW, where applicable, or laboratory-derived control limits. It should be noted that internal standards used for dioxin analysis, in DFLMO1.1, are synonymous with surrogate spikes.

LCS serve to monitor the overall performance of each step during the analysis, including the sample preparation. LCS analysis will be performed in accordance with the analytical method for low-concentration TCL volatiles, TAL metals, and most non-CLP analyses. Aqueous LCS results must fall within the control limits specified in the CLP SOW, where applicable, or established by the laboratory. Solid LCS results must fall within the control limits established by the supplier of the LCS standard, where applicable, or established by the laboratory. Aqueous and solid LCSs shall be analyzed utilizing the same sample preparations, analytical methods, and QA/QC procedures as employed for the samples.

Internal standard performance criteria ensure that GC/MS analysis sensitivity and response are stable during every analytical run. Internal standard area counts for samples and blanks must not vary by more than a factor of two (- 50 percent to + 100 percent) from the associated 12-hour calibration standard (± 40 percent for low-concentration volatile analyses). The retention time of the internal standards in samples and blanks must not vary by more than ±30 seconds from the retention time of the associated 12-hour calibration standard (±20 seconds for low-concentration volatile and semivolatile analyses). Internal standard performance criteria, as specified in this paragraph, does not apply to dioxin analysis.

Additional QC checks include mass tuning for GC/MS analysis, endrin/DDT degradation checks for pesticide/PCB analysis, and second-column confirmation for GC analysis. QC requirements for each of the aforementioned parameters have been established in OLM03.1.

9.0 DATA REDUCTION, VALIDATION, AND REPORTING

This section describes the procedures to be used for data reduction, validation, and reporting for samples collected during the former NSWC-White Oak investigations. All data generated during the course of the proposed activities will be maintained in hardcopy form by B&R Environmental in the Naval Facilities Engineering Command Northern Division central files located in Pittsburgh, Pennsylvania.

In addition to the central files, photocopies of all hardcopy data (as well as electronic data) will be maintained in the Chemistry/Toxicology/Risk Assessment Department database records files located in Pittsburgh. Upon completion of the contract, all files will be relinquished to Navy as per CLEAN Contract requirements.

9.1 DATA REDUCTION

Data reduction will be completed for both field measurements and laboratory-generated analytical data. Field data reduction will be relatively limited versus the degree of laboratory data reduction required for the project. Reduction of both field data and laboratory data are discussed in the remainder of this section.

9.1.1 Field Data Reduction

Field data will be generated as a result of real time measurement of organic vapor concentrations via a PID or FID (for health and safety monitoring and to support selection of samples for shipment to the analytical laboratory) and through on-site water quality testing for general indicator parameters including pH, specific conductivity, turbidity, DO, ORP, and temperature.

Field measurements of organic vapor concentrations (parts per million on a volume/volume basis relative to methane or benzene) and data collected as a result of the use of field test kits will be recorded in the site logbook and incorporated into the project-specific reports. General water quality indicator parameters will also be recorded in the site logbook and on sample logsheets immediately after the measurements are taken and later encoded in the database for the former NSWC-White Oak for presentation in the project-specific report. If an error is made in the logbook, the error will be legibly crossed out (single-line strikeout), initialed and dated by the field member, and corrected in a space adjacent to the original (erroneous) entry. No calculations will be necessary to reduce these data for inclusion in the project-specific report. Field data will be entered in the electronic database manually, and the entries will be verified by an independent reviewer to make sure that no "transcription" errors occurred. General groundwater quality data and field screening data will be recorded and reported in the following units:

- Hydronium ion concentration (standard pH units)
- Temperature (degrees Celsius)
- Specific Conductivity (mS/cm)
- Turbidity (Nephelometric turbidity units)
- Dissolved oxygen (mg/L)
- Oxidation-Reduction Potential (milliVolts)

Standard pH units as specified above is the negative logarithm (base 10) of the hydronium ion concentration in moles/liter.

9.1.2 Laboratory Data Reduction

Data reduction for laboratory analytical data generated via the USEPA CLP analytical methods, QA requirements, and reporting procedures will be completed in accordance with the most current SOWs for Organic and Inorganic Analysis as identified in previous sections of this QAPP. Laboratory data reduction of analytical results generated via non-CLP methods will be completed as specified in the analytical methods.

Laboratory analytical data will be reported using standard concentration units to ensure comparability with regulatory standards/guidelines and previous analytical results. Organic chemicals will be reported in µg/L for aqueous samples and mg/kg for solid samples. Dioxins/furans will be reported in ng/L for aqueous samples and µg/kg for solid samples. Metals and cyanide will be reported in µg/L for aqueous samples and mg/kg for solid samples. Radiological parameters will be reported in pci/L for aqueous samples and pci/g for solid samples. All other miscellaneous and engineering parameters will be reported in mg/L for aqueous samples and mg/kg for solid samples. Reactivity will be reported in mg/kg for solid samples, corrosivity will be reported in mm/yr, ignitability will be reported in °F, and paint filter liquid test results will be reported as the presence or absence of liquid.

Typically, field QC sample results will be included in the database for the former NSWC-White Oak investigations. Specifically, the analytical results for trip blanks, rinsate blanks, source water blanks, and ambient condition blanks will be provided. The results for field QC samples will be considered during the course of data validation (in concert with laboratory method blanks) to eliminate false positive results according to the 5- and 10-times rules specified in the USEPA Region III modifications to the National Functional Guidelines for Organic and Inorganic Data Review (USEPA 1994b and 1994c). The results for laboratory QC samples such as method blanks will not be presented in the former NSWC-White Oak

database. In addition, only the original (unspiked) sample results for MS/MSD samples will be provided in the database.

9.2 DATA VALIDATION

Validation of field measurements and laboratory analytical data are discussed in this section. Validation of field data will be limited to real time "reality" checks whereas laboratory analytical data will be validated in accordance with current USEPA guidance.

9.2.1 Field Measurement Data Validation

Field measurements will not be subjected to a formal data validation process. However, field technicians will ensure that the equipment used for field measurement is performing accurately via compliance with the SOPs included in Appendix B of the Master FSP. As described in Section 9.1.1, all field data entered into the electronic database will be independently reviewed for transcription errors.

9.2.2 Laboratory Data Validation

Typically, 100 percent of the laboratory data will be validated. Validation of analytical data will be completed by the B&R Environmental Chemistry Department located in B&R Environmental's Pittsburgh, PA office. Final review and approval of validation deliverables will be completed by the Department's Data Validation Coordinator.

All CLP laboratory analytical data will be subjected to validation in accordance with USEPA Region III Modifications to the National Functional Guidelines for Organic and Inorganic Data Review (USEPA, 1994b and 1994c). Data validation will be completed to ensure that the data are of evidentiary quality. Particular emphasis will be placed on holding time compliance, equipment calibration, spike recoveries, and blank results, although all required elements of the validation process will be considered.

The analytical results for non-CLP parameters will be validated versus the analytical methods. Validation of these data will conform to the National Functional Guidelines to the greatest extent practicable.

9.3 DATA REPORTING

9.3.1 Field Measurement Data Reporting

Field data will be reported in the units discussed in Section 9.1.1. The RI/FS will typically include a comprehensive database including all field measurements (specifically pH, specific conductance,

temperature, DO, ORP, and turbidity). Field measurements will be transferred from the site logbook or sample logsheets to the electronic database manually and will be reviewed for accuracy by an independent reviewer. Transcription of field measurements to the electronic database will be completed shortly after completion of the field investigation and prior to receipt of laboratory analytical data.

All records regarding field measurements (i.e., field logbooks, sampling logbooks, and sample logsheets) will be placed in the Northern Division central files upon completion of the field effort. Entry of these results in the database will require removal of these results from the files. Outcards will be used to document the removal of any such documentation from the files (date, person, subject matter). Field measurement data will typically be reported in an appendix of the IRP report and may also be reported in summary fashion if they are indicative of the presence of contamination (e.g., high specific conductance readings).

The B&R Environmental Chemistry and Information Management Departments will hold responsibility for field data reporting subject to oversight by the Department Managers. Key data handling personnel within the Departments include the Information Management Systems Group Leader and the Data Validation Coordinator.

9.3.2 Laboratory Data Reporting

Data reported by the laboratory will be in accordance with CLP reporting format, including all non-CLP data (to the extent practicable). All pertinent quality control data including raw data and summary forms for blanks, standards analysis, calibration information, etc., will be provided for the non-CLP analyses. Case narratives will be provided for each Sample Delivery Group (SDG).

Typically, all environmental and field QC sample results (trip blanks, duplicates, rinsate blanks, ambient condition blanks) will be included in the RI/FS as an appendix. The database will include pertinent sampling information such as sample number, sampling date, general location, depth, and survey coordinates (if applicable). Sample-specific detection limits will be reported for nondetected analytes. Units will be clearly summarized in the database and will conform to those identified in Section 9.1.2. The analytical data may also be reported in summary fashion within the body of the RI/FS text in tabular and graphic fashion.

Data will be handled electronically pursuant to the electronic deliverable requirements specified in B&R Environmental's Master Services Agreement with analytical laboratories. This agreement requires the analytical laboratories to provide data in both hardcopy and electronic form. The original electronic

diskettes and the original hardcopy analytical data are maintained in the Northern Division central files as received.

Validation will be completed using the hard copy data. Upon completion of validation of a SDG and review by the Data Validation Coordinator, the validation qualifiers will be entered in the electronic database and will be subjected to independent review for accuracy. During this review process, the electronic database printout will also be contrasted with the hard copy data (Form Is) to ensure that the hard copy data and electronic data are consistent.

The B&R Environmental Chemistry and Information Management Departments will hold responsibility for laboratory data reporting subject to oversight by the Department Managers. Key data handling personnel within the Departments include the Information Management Systems Group Leader and the Data Validation Coordinator. It is not currently planned that copies of all the data validation deliverables will be provided to the USEPA Region III. However, a summary of the validation results (actions taken and completeness, precision, and accuracy) will be provided in the RI/FS and example data validation memoranda and analytical data packages will be provided upon request.

10.0 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits will be performed periodically to ensure that work is being implemented in accordance with the approved Project Plans and in an overall satisfactory manner. Examples of pertinent audits are as follows:

- The FOL will supervise and check daily that the field measurements are made accurately, equipment is thoroughly decontaminated, samples are collected and handled properly, and fieldwork is documented accurately and neatly.

- Performance and system audits for the laboratory will be performed regularly, in accordance with the requirements of the CLP, by a Navy Contractor in accordance with the requirements of the Navy, and by the subcontracted laboratory's QA staff in accordance with the Laboratory QA Plan.

- Data validators will review (on a timely basis) the chemical analytical data packages submitted by the laboratory. The data validators will check that the data were obtained through use of the approved methodology, the appropriate level of QC effort and reporting was conducted, and the results are in conformance with QC criteria. On the basis of these factors, the data validator will generate a report describing data limitations, which will be reviewed internally by the Data Validation Coordinator prior to submittal to the Project Manager.

- A formal audit of the field sampling procedures may be conducted by the B&R Environmental QAM or designee in addition to the auditing that is an inherent part of the daily project activities. The purpose of this audit is to ensure that sample collection, handling, and shipping protocols, as well as equipment decontamination and field documentation procedures, are being performed in accordance with the approved Project Plans and SOPs.

- The Project Manager will maintain contact with the FOL and Data Validation Coordinator to ensure that management of the acquired data proceeds in an organized and expeditious manner. Similarly, the Project Manager will interface with the Risk Assessment and Modeling Coordinators, as applicable.

11.0 PREVENTIVE MAINTENANCE PROCEDURES

Measuring equipment used in environmental monitoring or analysis for the NSWC-White Oak investigations shall be maintained in accordance with the manufacturer's operation and maintenance manuals. Equipment and instruments shall be calibrated in accordance with the procedures, and at the frequency, discussed in Section 6.0 (Calibration Procedures and Frequency). Preventive maintenance for field and laboratory equipment is discussed in the remainder of this section.

11.1 FIELD EQUIPMENT PREVENTIVE MAINTENANCE

B&R Environmental 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 B&R Environmental 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 also maintains the equipment manual library.

- 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 B&R Environmental SOPs before being taken to the job site and during field activities.

- During calibration, an appropriate maintenance check is performed on each piece of equipment. Any problems encountered while operating the instrument will be recorded in the field log book, including a description of the symptoms and corrective actions taken.

- If problem equipment is detected or should require service, the equipment should be logged, tagged, and segregated from equipment in proper working order. Use of the instrument will not be resumed until the problem is resolved.

11.2 LABORATORY INSTRUMENT PREVENTIVE MAINTENANCE

Proper maintenance of laboratory instruments and equipment is essential for ensuring their readiness when needed. Dependent on manufacturer's recommendations, maintenance intervals are established for each instrument. All instruments must be labeled with a model number and serial number, and a maintenance logbook must be maintained for each instrument. An inventory of common replacement parts must also be maintained. Personnel must be alert to the maintenance status of the equipment they are using at all times.

11.2.1 Major Instruments

Table 11-1 provides a summary of preventive maintenance procedures for key analytical instruments typically performed by an environmental analytical laboratory.

Maintenance of key instruments is often covered under service contracts with external firms. These contracts provide for periodic routine maintenance to help guard against unexpected instrument downtime. The contracts also provide for quick response for unscheduled service calls when malfunctions are observed by the operator.

The use of manufacturer recommended grades or better of supporting supplies and reagents is also a form of preventive maintenance. For example, gases used in the various GC and metals instruments are of sufficient grade to minimize fouling of the instrument. The routine use of septa, chromatographic columns, ferrules, AA furnace tubes, and other supporting supplies from reputable manufacturers will assist in averting unnecessary periods of instrument downtime.

11.2.2 Refrigerators/Ovens

The temperatures of refrigerators used for sample storage, drying ovens, and BOD incubators will be monitored a minimum of once daily. The acceptable range for refrigerator temperatures is 4°C ±2°C. Required temperatures of ovens and incubators will vary based on the analytical methods for which they are used. The temperatures will be recorded on temperature logs. The logs will contain the date, temperature, and initials of person performing the check.

Maintenance of the logs is typically the responsibility of the sample custodian. However, assignment of responsibilities for temperature monitoring to specific personnel does not preclude the participation of

TABLE 11-1

TYPICAL PREVENTIVE MAINTENANCE FOR ANALYTICAL INSTRUMENTS NSWC-WHITE OAK, SILVER SPRING, MARYLAND

Instrument	Preventive Maintenance	Maintenance Frequency
GC/MS	Volatiles: Bake oven, replace septum, check carrier gas.	As required.
	Semivolatiles: Replace the septum, clean injection port, replace liner, bake oven, check carrier gas, clean the ion source.	As required.
	Replace solvent washes and clean syringe.	Daily.
GC	Replace solvent washes and clean syringe.	Daily.
	Clip column, clean injection port, replace liner, and bake oven.	As required.
ICP	Change sample introduction tubing, clean nebulizer, clean spray chamber, clean torch, manual profile, and automatic profile optics.	As required.
GFAA	Clean contact cylinders, replace/clean tube, check lamp alignment.	As required.
CVAA	Change sample introduction tubing, change drying cell, re-zero detector.	As required.
TOC Analyzer	Clean furnace, check gas flow.	As required.
Lachat Analyzer	Change pump tubing and bulb.	As required.

other laboratory personnel. If unusual temperature fluctuations are noted, it is the responsibility of the observer to immediately notify the person in charge of the discrepancy before the condition of the samples is compromised.

Unstable or fluctuating temperatures may be indicative of malfunctions in the cooling or heating system. On the other hand, the instability may be due to frequent opening of the door. Regardless of the cause, such an observation must be investigated, and modifications must be made to access procedures or repairs to equipment must be made to prevent jeopardizing the integrity of the samples.

12.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

Compliance with the QC objectives outlined in Section 3.0 will be monitored via two separate mechanisms. Precision and accuracy will be assessed through data validation in accordance with the National Functional Guidelines (to the extent practicable for non-CLP analyses). Compliance with the completeness objectives for field and laboratory data/measurement will be calculated by hand (field measurements) and electronically via a database subroutine (laboratory data). Information necessary to complete the precision and accuracy calculations will be provided in electronic and hardcopy form by the subcontract laboratory. Equations to be used for the precision, accuracy, and completeness assessment are outlined in the remainder of this section.

12.1 ACCURACY ASSESSMENT

To assure the accuracy of the analytical procedures, a minimum of one of every 20 samples is spiked with a known amount of the analyte or analytes to be evaluated. The spiked sample is then analyzed. The increase in concentration of the analyte observed in the spiked sample, because of the addition of a known quantity of the analyte, compared to the reported value of the same analyte in the unspiked sample determines the %R. Control charts are plotted for each commonly analyzed compound and kept on matrix-specific and analyte-specific bases. The %R for a spiked sample is calculated according to the following formula:

$$\%R = \frac{\text{Amount in Spiked Sample} - \text{Amount in Sample}}{\text{Known Amount Added}} \times 100\,\%$$

12.2 PRECISION ASSESSMENT

Duplicate samples (for inorganic analyses) and matrix spike duplicate samples (for organic analyses) are prepared and analyzed at a minimum frequency of one per every 20 environmental samples. Duplicate samples are prepared by dividing an environmental sample into equal aliquots.

Matrix spike duplicate samples are prepared by dividing an environmental sample into equal aliquots and then spiking each of the aliquots with a known amount of analyte. The duplicate samples are then included in the analytical sample set. The splitting of the sample allows the analyst to determine the precision of the preparation and analytical techniques associated with the duplicate samples. The RPD

between the sample (or spike) and duplicate (or duplicate spike) is calculated and plotted. The RPD is calculated according to the following formula:

$$RPD = \frac{\text{Amount in Sample} - \text{Amount in Duplicate}}{0.5\ (\text{Amount in Sample} + \text{Amount in Duplicate})} \times 100\ \%$$

12.3 COMPLETENESS ASSESSMENT

Completeness is the ratio of the number of valid sample results to the total number of samples analyzed with a specific matrix and/or analysis. Following the completion of the analytical testing, the percent completeness will be calculated by the following equation:

$$\text{Completeness} = \frac{(\text{number of valid measurements})}{(\text{number of measurements planned})} \times 100\ \%$$

The results of the data validation process and the completeness assessment will be summarized in the project-specific RI/FS.

13.0 CORRECTIVE ACTION

Under the B&R Environmental QA/QC program, it is required that any and all personnel noting conditions adverse to quality report these conditions immediately to the Project Manager and QAM. These parties, in turn, are charged with performing root-cause analyses and implementing appropriate corrective action in a timely manner. It is ultimately the responsibility of the QAM to document all findings and corrective actions taken and to monitor the effectiveness of the corrective measures performed.

13.1 FIELD CORRECTIVE ACTION

Field nonconformances or conditions adverse to quality must be identified and corrected as quickly as possible so that work integrity or quality of product is not compromised. The need for corrective action may arise based on deviations from Project Plans and procedures, adverse field conditions, or other unforeseen circumstances. Corrective action needs may become apparent during the performance of daily work tasks or as a consequence of internal or external field audits.

Corrective action may include resampling and may involve amending previously approved field procedures. If warranted by the severity of the problem (e.g., if a change in the approved Project Plan documents or SOPs is required), the Navy will be notified in writing via a Field Task Modification Request (FTMR), and Navy approval will be obtained. The FOL is responsible for initiating FTMRs; an FTMR will be initiated for all deviations from the Project Plan documents, as applicable. An example of an FTMR is provided as Figure 13-1. Copies of all FTMRs will be maintained with the onsite project planning documents and will be placed in the final evidence file.

Minor modifications to field activities such as a slight offset of a boring location will be initiated at the discretion of the FOL, subject to approval by the Navy. Approval for major modifications (e.g., elimination of a sampling point) must be obtained via an FTMR.

FIGURE 13-1

BROWN & ROOT ENVIRONMENTAL
FIELD TASK MODIFICATION REQUEST FORM

Client Identification | Project Number | TMR Number

To_____ Location_____ Date_____

Description:

_____
_____
_____
_____

Reason for Change:

_____
_____
_____
_____

Recommended Disposition:

_____
_____
_____
_____

Field Operations Leader (Signature, if applicable) | Date

Disposition:

_____
_____
_____
_____

Project Manager (Signature, if required) | Date

Distribution:
Program Manager
Quality Assurance Officer
Project Manager
Field Operations Leader

Others as required_____
_____
_____
_____

13.2 LABORATORY CORRECTIVE ACTION

In general, laboratory corrective actions are warranted whenever an out-of-control event or potential out-of-control event is noted. The specific corrective action taken depends on the specific analysis and the nature of the event. Generally, the following occurrences alert laboratory personnel that corrective action may be necessary:

- QC data are outside established warning or control limits
- Method blank analyses yield concentrations of target analytes above acceptable levels
- Undesirable trends are detected in spike recoveries or in duplicate RPDs
- There is an unexplained change in compound detection capability
- Inquiries concerning data quality are received
- Deficiencies are detected by laboratory QA staff audits or from performance evaluation sample test results

Corrective actions are documented by laboratory personnel on a corrective action form. Using the corrective action form, any employee may notify the laboratory QA/QC Officer of a problem. The QA/QC Officer initiates the corrective action by relating the problem to the appropriate Laboratory Manager and/or Internal Coordinator, who then investigates or assigns responsibility for investigating the problem and its cause. Once determined, an appropriate corrective action is approved by the QA/QC Officer. Its implementation is verified and documented on the corrective action form and is further documented through audits.

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

QA reports to management will be provided in three primary formats during the course of the NSWC-White Oak investigations. Data validation letter reports will be prepared on a SDG-specific basis and will summarize QA issues for the subcontract laboratory data. In addition, written weekly reports summarizing accomplishments and QA/QC issues during the field investigation will be provided by the FOL. Finally, monthly progress reports are prepared by the Project Manager.

14.1 CONTENTS OF PROJECT QUALITY ASSURANCE REPORTS

The contents of the specific QA reports are as follows. The data validation reports address all major and minor laboratory noncompliances as well as noted sample matrix effects. In the event that major problems occur with the analytical laboratory (e.g., holding time exceedances or calibration noncompliances, etc.) the Data Validation Coordinator notifies the Project Manager, the Program Manager, and the Laboratory Services Coordinator. Such notifications (if necessary) are typically provided via internal memoranda and are placed in the project file. Such reports contain a summary of the noncompliance, a synopsis of the impact on individual projects, and recommendations regarding corrective action and compensational adjustments. Corrective actions are initiated at the program level.

The FOL will provide the Project Manager with weekly reports regarding accomplishments, deviations from the FSP, upcoming activities, and a QA summary during the course of the field investigation. In addition, monthly project review meetings are held for all active Navy CLEAN projects. Issues discussed at the project review meeting include all aspects of budget and schedule compliance, and QA/QC problems. The Project Manager provides a monthly progress report to the Navy which addresses the project budget, schedule, accomplishments, planned activities, required revisions of the QAPP, and QA/QC issues and intended corrective actions.

14.2 INDIVIDUALS RECEIVING/REVIEWING QUALITY ASSURANCE REPORTS

Data validation QA Reports are provided to the Project Manager for inclusion in the project files. In the event that major problems are observed for a given laboratory, the Program Manager, Deputy Program Manager, QAM, Project Manager, and Laboratory Services Coordinator are provided with copies of the QA report. Weekly field progress reports are provided to the Project Manager. Monthly progress reports are provided to the Navy CLEAN Program Manager and the Navy CLEAN Contracting Officers Technical Representative.

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