Final
Sampling and Analysis Plan
Laguna La Chiva
Site Inspection/Remedial Investigation

Atlantic Fleet Weapons Training Area - Vieques
Former Vieques Naval Training Range
Vieques, Puerto Rico

Prepared for

Department of the Navy
ATLANTIC

Contract No.
N62470-08-D-1000
CTO-037

April 2013

Prepared by

CH2MHILL

ES060412002410TPA

This page intentionally left blank

FINAL

Sampling and Analysis Plan
Laguna La Chiva
Site Inspection/Remedial Investigation

Atlantic Fleet Weapons Training Area - Vieques
Former Vieques Naval Training Range
Vieques, Puerto Rico

Contract Task Order 0037

April 2013

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Atlantic

Under the

Navy CLEAN III Program
Contract N62470-08-D-1000

Prepared by

CH2MHILL

Virginia Beach, Virginia

Page intentionally left blank

Executive Summary

This Sampling and Analysis Plan (SAP) describes the activities that will be performed to conduct a Site Inspection (SI), and potentially a Remedial Investigation (RI), for Laguna La Chiva at the Former Vieques Naval Training Range (VNTR) on east Vieques, Puerto Rico. Laguna La Chiva is located just north of Playa La Chiva (a.k.a., Blue Beach) and south of Solid Waste Management Unit (SWMU 1) (**Figure 1**).

The objective of an SI is "release assessment." More specifically, an SI is intended to:

- Determine whether a release of hazardous waste or hazardous constituents has occurred from past Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-related activities and, if so,
- Determine whether the suspected release warrants further investigation or action

If a release is suspected that warrants further investigation (beyond an expanded SI), an RI is performed to:

- Delineate the nature and extent of contamination
- Assess the potential human health and ecological risks

In 2005, the National Oceanic and Atmospheric Administration (NOAA) collected fiddler crab and land crab tissue samples from around Laguna La Chiva (**Figure 2**). While pesticides were detected in crab tissue, the Public Health Consultation (PHC) prepared by the Agency for Toxic Substances and Disease Registry (ATSDR), in part using the NOAA data, stated that the level of pesticides found in the land crab samples were much lower than levels reported to cause harmful health effects (ATSDR, 2006). In addition, NOAA evaluated the data and concluded that the pesticide concentrations in crabs did not exceed ecological screening values intended for the protection of crustaceans.

In October 2007, NOAA collected three sediment samples from Laguna La Chiva as part of an island-wide sediment evaluation (NOAA, 2010). Pesticide concentrations (primarily DDT, DDE, and DDD) were detected at concentrations higher than at other lagoons on Vieques sampled by NOAA and the Navy and above various ecological screening levels commonly used on Vieques (**Figure 3**). None exceeded United States Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs), but fish and crab concentrations were not modeled from the sediment concentrations to determine if they may pose an unacceptable risk based on human consumption.

It is possible that the pesticide concentrations detected in lagoon sediment are the result of normal pesticide use associated with historic military training at and adjacent to Blue Beach. Blue Beach was one of the two most frequently used beaches for amphibious landing training (TAMS, 1979). Though there are no records available, it is likely that pesticides were used to control insects during training events, especially in and around the lagoon, which would likely have been (and still is) prime mosquito habitat. While the pesticide concentrations detected in NOAA's samples may be associated with normal pesticide use, rusted pieces of several drums were observed around the lagoon, with the majority being observed on the northeast and west banks of the northwestern branch of the lagoon. Since pesticides would likely have been stored and transported in drums, the drum remnants offer another potential explanation for the source of pesticides in the lagoon (i.e., discarding of drums containing pesticide residues). The drums may also be the source of contaminants not previously analyzed for in Laguna La Chiva sediment samples (i.e., volatile organic compounds (VOCs) and semi-volatile organic compounds [SVOCs]). However, historical aerial photography does not show the area to have been used for disposal.

Although the SWMU 1 landfill is hydraulically upgradient from the Laguna La Chiva and pesticides were detected in the ephemeral stream samples collected adjacent to the landfill, no pesticides were detected in ephemeral stream samples collected closest to Laguna La Chiva. In addition, all of the pesticide concentrations detected in

NOTE: THIS SUMMARY IS PRESENTED IN ENGLISH AND SPANISH FOR THE CONVENIENCE OF THE READER. EVERY EFFORT HAS BEEN MADE FOR THE TRANSLATIONS TO BE AS ACCURATE AS REASONABLY POSSIBLE. HOWEVER, READERS SHOULD BE AWARE THAT THE ENGLISH VERSION OF THE TEXT IS THE OFFICIAL VERSION.

NOTA: ESTE RESUMEN SE PRESENTA EN INGLÉS Y EN ESPAÑOL PARA LA CONVENIENCIA DEL LECTOR. SE HAN HECHO TODOS LOS ESFUERZOS PARA QUE LA TRADUCCIÓN SEA PRECISA EN LO MÁS RAZONABLEMENTE POSIBLE. SIN EMBARGO, LOS LECTORES DEBEN ESTAR AL TANTO QUE EL TEXTO EN INGLÉS ES LA VERSIÓN OFICIAL.

the ephemeral stream samples adjacent to the landfill were orders of magnitude below the levels detected in the lagoon. Further, no VOCs attributable to the SWMU 1 landfill were detected in ephemeral stream samples collected adjacent to the landfill. Two polycyclic aromatic hydrocarbons (PAHs) and bis(2-ethylhexyl)phthalate were detected in the ephemeral stream samples, but all detections were below regulatory screening levels. No VOCs or SVOCs were detected in the ephemeral stream samples closest to Laguna La Chiva. All of this information suggests the landfill is not a source of the pesticides detected in the lagoon (or VOCs and SVOCs potentially present in the lagoon) or, at a minimum, is no longer a source.

Based on the above information, an SI at Laguna La Chiva is warranted. **Figure 4** shows the samples that will be collected during the SI. The data collected during the SI will be evaluated using the 7-step SI decision analysis process shown in **Figure 5**. If the results of the SI suggest an RI is warranted, the RI will be conducted in accordance with this SAP, with any modifications made through joint discussions among representatives of the Navy, USEPA, Puerto Rico Environmental Quality Board (PREQB), and U.S. Fish and Wildlife Service (USFWS) regarding the SI data evaluation. The modifications will be documented in an addendum to this SAP. If an RI is conducted, the data will be evaluated using the 4-step decision process shown in **Figure 6**. If the SI data suggest the detected constituent concentrations are not indicative of a CERCLA-related release warranting further investigation (e.g., pattern and levels of pesticide detections do not identify a likely point source such as the drums, no pesticides or VOCs or SVOCs are detected or are detected but attributable to non-site-related sources such as the laboratory, detected concentrations are less than screening levels or not likely to result in unacceptable risk, etc.), no further investigation or action will be necessary.

Resumen Ejecutivo

Este Plan de Muestreo y Análisis (SAP por sus siglas en inglés) describe las actividades que se realizarán para llevar a cabo una Inspección del Sitio (SI por sus siglas en inglés), y una Investigación para la Remediación (RI por sus siglas en inglés), para Laguna La Chiva en el Antiguo Campo de Adiestramiento Naval de Vieques (VNTR por sus siglas en inglés) en el este de Vieques, Puerto Rico. Laguna La Chiva está localizada justo al norte de Playa La Chiva (también conocida como Blue Beach) y hacia el sur de la Unidad de Manejo de Desperdicios Sólidos (SWMU por sus siglas en inglés) 1 (**Figura 1**).

El objetivo de la Inspección del Sitio (SI por sus siglas en inglés) es la "evaluación del derrame". Más específicamente, lo que intenta hacer el SI es:

- Determinar si ha ocurrido un derrame de desperdicios peligrosos o de compuestos peligrosos relacionados a actividades reguladas por la Ley de Respuesta, Compensación y Responsabilidad Ambiental (CERCLA por sus siglas en inglés), y de ser éste el caso,
- Determinar si estos supuestos derrames ameritan más investigación o acción

Si se sospecha que un derrame amerita más investigación (más allá de un SI expandido), se llevará a cabo un RI para:

- Delinear la naturaleza y extensión de la contaminación
- Evaluar el potencial de que existan riesgos a la salud humana o riesgos ecológicos

En el año 2005, la Administración Nacional del Océano y de la Atmósfera (NOAA por sus siglas en inglés) obtuvo muestras del tejido de cangrejos violinista y jueyes de alrededor de Laguna La Chiva (**Figura 2**). Aunque se detectaron plaguicidas en el tejido de los cangrejos, la Consulta de Salud Pública (PHC por sus siglas en inglés) que fue preparada por la Agencia de Sustancias Tóxicas y Registro de Enfermedades (ATSDR por sus siglas en inglés), en parte usando los datos de NOAA, expresó que los niveles de plaguicidas que se encontraron en los jueyes eran mucho más pequeños que los niveles que han sido reportados que podrían causar efectos adversos a la salud humana (ATSDR, 2006). Además, NOAA evaluó los datos y concluyó que las concentraciones de plaguicidas en los cangrejos no excedieron los valores de evaluación ecológica para la protección de los crustáceos.

En octubre de 2007, NOAA obtuvo tres muestras de sedimento de la Laguna La Chiva como parte de una evaluación de los sedimentos para toda la isla (NOAA, 2010). Se detectaron plaguicidas (principalmente DDT, DDE y DDD) con concentraciones más elevadas que las muestras de otras lagunas de Vieques obtenidas por NOAA y por la Marina, y por encima de varios niveles de evaluación ecológica comúnmente usados para Vieques (**Figura 3**). Ninguna muestra excedió los Niveles de Evaluación Regional (RSLs por sus siglas en inglés) de la Agencia de Protección Ambiental de los EE.UU. (USEPA por sus siglas en inglés), pero las concentraciones de peces y cangrejos no fueron modeladas en relación a las concentraciones de sedimentos para determinar si éstas pudieran presentar un riesgo no aceptable basado en el consumo de estos crustáceos por las personas.

Es posible que las concentraciones de plaguicidas que se detectaron en los sedimentos de la laguna provengan del uso normal de plaguicidas asociado con las actividades de adiestramiento militar históricas cerca de Blue Beach. Blue Beach fue una de las playas usada con más frecuencia para el adiestramiento para desembarque anfibio (TAMS, 1979). Aunque no se dispone de records , es posible que se usaron plaguicidas para controlar insectos durante las actividades de adiestramiento, especialmente en y alrededor de la laguna, donde es posible haya sido (y lo es todavía) un hábitat de mosquitos grande. Mientras que las concentraciones de plaguicidas detectadas en las muestras de NOAA pueden estar asociadas con el uso normal de plaguicidas, se observaron pedazos oxidados de varios contenedores ("drums") alrededor de la laguna, la mayoría en la orilla noreste y oeste de la rama noroeste de la laguna. Ya que es posible que plaguicidas hayan sido almacenados y transportados en

contenedores, la presencia de estos remanentes ofrecen otra explicación potencial para la fuente de plaguicidas en la laguna (por ejemplo, si se dispusieron de contenedores que contenían restos de plaguicidas). Los contenedores pueden también ser la fuente de contaminantes que no fueron analizados previamente en los sedimentos de la Laguna La Chiva (por ejemplo, compuestos orgánicos volátiles (VOCs por sus siglas en inglés) y compuestos orgánicos semi-volátiles [SVOCs por sus siglas en inglés]). Sin embargo, fotografías históricas aéreas no muestras que el área haya sido usada para la disposición de materiales.

Aunque el vertedero de SWMU 1 está hidráulicamente pendiente arriba de la Laguna La Chiva y plaguicidas fueron detectados en las muestras que se obtuvieron del riachuelo efímero junto al vertedero, no se detectaron plaguicidas en las muestras del riachuelo que se obtuvieron más cerca de Laguna La Chiva. Además, todas las concentraciones de plaguicidas que se detectaron en las muestras que se obtuvieron del riachuelo efímero junto al vertedero estuvieron en órdenes de magnitud por debajo de los niveles detectados en la laguna. Además, en las muestras obtenidas del riachuelo efímero cerca del vertedero no se detectaron VOCs que pudieran ser atribuidos al vertedero de SWMU 1. En las muestras del riachuelo efímero se detectaron dos hidrocarburos aromáticos poli cíclicos (PAHs por sus siglas en inglés) y bis(2-etilhexil)falate, pero todas estas detecciones estuvieron por debajo de los niveles de evaluación regulatoria. No se detectaron VOCs o SVOCs en las muestras más cerca a la Laguna La Chiva del riachuelo efímero. Toda esta información sugiere que el vertedero no es una fuente de los plaguicidas que se detectaron en la laguna (o de los VOCs y SVOCs que potencialmente están presentes en la laguna) o como mínimo, ya no es una fuente.

En base a la información arriba mencionada, se justifica un SI en la Laguna La Chiva. La **Figura 4** muestra las muestras que se tomarán durante el SI. Los datos obtenidos durante el SI serán evaluados usando el proceso de análisis de decisión de 7 pasos como se muestra en la **Figura 5**. Si los resultados del SI sugieren que un RI es necesario, se llevará a cabo un RI de acuerdo con este SAP, con cualquier cambio que se realice relacionado a la evaluación de los datos del SI, a través de discusiones conjuntas entre los representantes de la Marina, USEPA, la Junta de Calidad de Puerto Rico (JCA) y del Servicio de Pesca y Vida Silvestre de los EE.UU (USFWS por sus siglas en inglés). Los cambios se documentarían en un anejo a este SAP. Si se lleva cabo un RI, lo datos serán evaluados usando el proceso de análisis de decisión de 4 pasos como se muestra en la **Figura 6**. Si los datos del SI sugieren que las concentraciones de los compuestos detectados no indican que provienen de un derrame relacionad a CERCA que amerita más investigación (por ejemplo, si los patrones y niveles de las detecciones de plaguicidas no identifican una fuente posible como serían los contendores, o si no se detectan plaguicidas, o VOCs, o SVOCs, o si éstos se detectan pero sus concentraciones pueden atribuirse a fuentes que no están relacionadas al sitio, por ejemplo que provienen del análisis de laboratorio, o si las concentraciones detectadas están por debajo de los niveles de evaluación, o si es posible que éstas no presenten un riesgo inaceptable, etc.) no será necesario se realicen más investigaciones o se lleve a cabo otra acción.

Contents

Figures

Attachments

Acronyms and Abbreviations

ASTM	American Society for Standards and Materials
ATSDR	Agency for Toxic Substances and Disease Registry
CA	Corrective Action
CCP	Comprehensive Conservation Plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CLEAN	Comprehensive Long-term Environmental Action-Navy
COC	Contaminant of Concern
COD	coefficient determination
CSM	Conceptual Site Model
DoD	Department of Defense
DL	Detection Limit
DQE	Data Quality Evaluation
DQI	Data Quality Indicator
DQO	Data Quality Objective
EBS	Environmental Baseline Survey
ENCO	Environmental Conservation Laboratories, Inc.
EPA	Environmental Protection Agency, United States
EQB	Environmental Quality Board
ERA	Ecological Risk Assessment
ERP	Environmental Restoration Program
ESI	Expanded Site Investigation
FTL	Field Team Leader
FRC	Federal Records Center
GC	Gas Chromatograph
GC/MS	Gas Chromatograph/Mass Spectrometer
GPS	Global Positioning System
HASP	Health and Safety Plan
HHRA	human health risk assessment
HQ	hazard quotient
ICAL	initial calibration
IDW	investigation-derived waste
LCS	Laboratory Control Sample
LIMS	Laboratory Information Management Systems
LOD	Limit of Detection
LOQ	Limit of Quantitation
LR	laboratory replicate
µg/kg	micrograms per kilogram
MPC	Measurement Performance Criteria
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MSOPPP	Master Standard Operating Procedures, Protocols, and Plans
MTBE	methyl-tert-butyl ether
N/A	not applicable
Navy	U.S. Department of Navy
NOAA	National Oceanic and Atmospheric Administration

PAH	polycyclic aromatic hydrocarbon
PAL	Project Action Limit
PAOC	Potential Area of Concern
PCBs	Polychlorinated Biphenyls
PDF	Project Data Manager
PHC	Public Health Consultation
PM	Project Manager
POC	point of contact
PQOs	Project Quality Objectives
PREQB	Puerto Rico Environmental Quality Board
PT	Proficiency Testing (previously known as performance evaluation (PE) sample)
QA	Quality Assurance
QAMS	Quality Assurance Management Section
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
QL	Quantitation Limit
QSM	Quality Systems Manual
RAB	Restoration Advisory Board
RF	response factor
RI	Remedial Investigation
RPD	Relative Percent Difference
RPM	Remedial Project Manager
RRT	relative retention time
RSD	Relative Standard Deviation
RSL	Regional Screening Level
RT	Retention Time
SAP	Sampling and Analysis Plan
SD	Standard Deviation
SI	Site Inspection
SMP	Site Management Plan
SOP	Standard Operating Procedure
SSC	Site Safety Coordinator
SVOC	Semivolatile Organic Compounds
SW	Surface Water
SWMU	Solid Waste Management Plan
SWO	safe work observation
TAT	turnaround time
TBD	To Be Determined
TOC	total organic carbon
UFP	Uniform Federal Policy
USEPA	United States Environmental Protection Agency
USFWS	US Fish and Wildlife Service
VNTR	Vieques Naval Training Range
VOA	Volatile Organic Analytes
VOC	Volatile Organic Compounds

SAP Worksheet #1—Title and Approval Page

Final
Sampling and Analysis Plan
Laguna La Chiva Site Inspection/Remedial Investigation

Atlantic Fleet Weapons Training Area - Vieques
Former Vieques Naval Training Range
Vieques, Puerto Rico
Contract Task Order – 037
April 2013

Prepared for:

Department of the Navy
Naval Facilities Engineering Command
Atlantic Division
6506 Hampton Boulevard
Norfolk, VA 23508-1278

Prepared by:

5701 Cleveland Street, Suite 200
Virginia Beach, VA 23462
Office phone # 757-671-6219

Prepared under:
Navy CLEAN 1000 Program
Contract N62470-08-D-1000
Contract Task Order – 037

QA Review Signature:

G. Brett Doerr Digitally signed by G. Brett Doerr DN: cn=G. Brett Doerr, o=CH2M HILL, ou, email=brett.doerr@ch2m.com, c=US Date: 2013.04.05 16:57:08 -04'00'

Brett Doerr
Vieques Activity Manager

Other Approval Signatures:

CLOE.KEVIN.R.12 29533947 Digitally signed by CLOE.KEVIN.R.1229533947 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USN, cn=CLOE.KEVIN.R.1229533947 Date: 2013.04.05 16:30:17 -04'00'

Kevin Cloe
NAVFAC – Remedial Project Manager

Daniel Rodriguez Digitally signed by Daniel Rodriguez DN: cn=Daniel Rodriguez, o=US EPA, ou=CEPD/RRB, email=rodriguez.daniel@epa.gov, c=US Date: 2013.04.24 09:03:17 -04'00'

Daniel Rodriguez
USEPA Region 2 – Remedial Project Manager

Wilmarie Rivera Digitally signed by Wilmarie Rivera DN: cn=Wilmarie Rivera, o, ou=Puerto Rico Environmental Quality Board, email=wilmaemerald@jca.gobierno.pr, c=US Date: 2013.04.24 14:19:44 -04'00'

Wilmarie Rivera
PREQB – Remedial Project Manager

Richard Henry 4/25/13

Richard Henry
USFWS – Remedial Project Manager

This page intentionally left blank.

SAP Worksheet #2—Sampling and Analysis Plan Identifying Information

Site Name/Number: La Chiva Lagoon at the former Vieques Naval Training Range (VNTR) Vieques, Puerto Rico.

Operable Unit:

Contractor Name: CH2M HILL

Contract Number: N62470-08-D-1000

Contract Title: Comprehensive Long-term Environmental Action-Navy (CLEAN) Program

Work Assignment Number (optional):

1. This sampling and analysis plan (SAP) was prepared in general accordance with the requirements of the *Uniform Federal Policy for Quality Assurance Plans (UFP-QAPP)* (USEPA 2005) and United States Environmental Protection Agency (USEPA) *Guidance for Quality Assurance Project Plans, EPA QA/G-5*, Quality Assurance Management Section (QAMS) (EPA, 2002).
2. Regulatory program: Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
3. This SAP is a project specific SAP.
4. List organizational partners (stakeholders) and identify the connection with lead organization:

Organization Partners/Stakeholders	Connection	Date
USEPA Region 2	Regulatory stakeholder overseeing CERCLA Vieques environmental restoration program (ERP) implemented by lead organization	
Puerto Rico Environmental Quality Board (PREQB)	Regulatory stakeholder overseeing, on behalf of the Commonwealth of Puerto Rico, CERCLA Vieques ERP implemented by lead organization	
USFWS	Land owner of all DOI land on which CERCLA Vieques ERP actions are being taken. Regulatory stakeholder on actions which may affect vegetation or wildlife on their properties.	

5. Lead organization: U. S. Department of Navy (Navy)
6. The omitted SAP elements excluded and provide an explanation for their exclusion below:
7. Crosswalk table is excluded as all required information is provided in this SAP.

This page intentionally left blank.

SAP Worksheet #3—Distribution List

SAP Recipients	Title	Organization	Telephone Number optional)	E-mail Address or Mailing Address	Draft	Draft Final	Final
Kevin Cloe	Vieques Remedial Project Manager (RPM)/ Lead Agency Point of Contact (POC)	Navy	757-322-4736	kevin.cloe@navy.mil	A	CL	A
Daniel Hood	Vieques RPM/No project-specific role	Navy	757-322-4630	daniel.r.hood@navy.mil	CL	CL	CL
Madeline Rivera	Vieques Environmental Restoration Program Site Manager /On-island Coordination	Navy	757-348-2689 (c)	llamasmad@gmail.com	A		A
Bonnie Capito	Librarian and Records Manager/ Final document archiving	Navy	757-322-4785	bonnie.capito@navy.mil			A
John Martin	Potential Field Team Leader/Site Safety Coordinator	CH2M HILL	352-384-7122	John.Martin@ch2m.com			A
John Swenfurth	Project Manager	CH2M HILL	813-874-0777	john.swenfurth@ch2m.com	A	A	A
Mike Zamboni	Project Chemist	CH2M HILL	703-376-5301	mike.zamboni@ch2m.com			CD
Anita Dodson	Program Chemist	CH2M HILL	757-671-6218	Anita.dodson@ch2m.com			CD
Brett Doerr	Contractor Activity Manager/Navy contractor primary POC	CH2M HILL	757-671-6219	brett.doerr@ch2m.com	A	A	A
Ronnie Wambles	Analytical Laboratory Project Manager	Environmental Conservation Laboratories, Inc (ENCO)	407-826-5314	rwambles@encolabs.com			HC
Tommy A. Jordan	Analytical Laboratory Project Manager	Kemron Environmental Services	404-601-6908	tjordan@kemron.com			HC
Laura Maschoff	Project Manager	DataQual Environmental Services, LLC	314-330-1327	dataqual@charter.net			CD
Daniel Rodriguez	Vieques RPM/ Regulatory agency POC	USEPA	787-741-5201 787-671-9879 (c)	rodriguez.daniel@epa.gov	A	CL	A
Jose Font	Caribbean Environmental Protection Division Director	USEPA	787-977-5814	Font.jose@epa.gov	CL		CL
Bhavana Reddy	Critigen Project Data Manager	Critigen	703-608-1488				CD
Sergio Lopez	QC Specialist/Technical input and draft document review	USEPA	732-321-6778	lopez.sergio@epa.gov	A		A
Michael Sivak	Human Health Risk Assessment (HHRA) Lead/ Technical input and draft document review	USEPA	212-637-4310	sivak.michael@epa.gov	A		A

SAP Worksheet #3—Distribution List (continued)

Name of SAP Recipients	Title/Project Role	Organization	Telephone Number (Optional)	E-mail Address or Mailing Address	D	DF	F
Diana Cutt	Geology/Hydrogeology Lead/ Technical input and draft document review	USEPA	212-637-4311	cutt.diana@epa.gov	A		A
Mindy Pensak	Ecological Risk Assessment (ERA) Lead/Technical input and draft document review	USEPA	732-321-6705	pensak.mindy@epa.gov	A		A
Bradley Martin	Technical Support Consultant for USEPA/USEPA contractor primary POC	TechLaw	312-345-8960	bmartin@techlawinc.com	A		A
Pedro J. Nieves, Esq.	President/No project-specific role	PREQB	787-767-8056	pedronieves@jca.gobierno.pr	CL		CL
Wilmarie Rivera	Vieques RPM/ Regulatory agency POC	PREQB	787-767-8181 (x6129) (w) 787-365-8573 (c)	wilmarierivera@jca.gobierno.pr	A	CL	A
Katarina Rutkowski	Technical Support Consultant for Environmental Quality Board (EQB)/ EQB contractor primary POC	TRC	860-298-6202	krutkowski@trcsolutions.com	A		A
Elizabeth Denly	Technical Support Consultant for EQB// EQB contractor Project Manager (PM)	TRC	978-656-3577 (w) 978-328-2551(c)	edenly@trcsolutions.com	HC		HC
Mike Barandiaran	Refuge Manager/No project-specific role	USFWS	787-741-2138	Mike_barandiaran@fws.gov			A
Susan Silander	Caribbean Islands Refuges Supervisor/ No project-specific role	USFWS	787-851-7258 (x38)	susan.silander@fws.gov	CL		CL
Richard Henry	Vieques RPM/ Land management agency POC	USFWS	732-906-6987	richard_henry@fws.gov	A	CL	A
Felix Lopez Arroyo	Environmental Contaminants Specialist/Technical input and draft document review	USFWS	787-851-7297(x226)	felix_lopez@fws.gov	A		A
Diane Wehner	Regional Resource Coordinator/ Technical input and draft document review	NOAA	732-872-3030	diane.wehner@noaa.gov	A		A
Wanda Bermudez	NA	RAB	787-435-2841	wbromero@yahoo.com		CD	
Colleen McNamara	N/A	RAB	787-380-2545	lacolina@hughes.com		A	
Stacie D. Notine	N/A	RAB	N/A	N/A		HC	
Jorge Fernandez Porto	NA	RAB	787-726-2839	jfporto@onelinkpr.net		CD	
Lionel Sanchez	NA	RAB	787-241-0063	sanchezcarambot@yahoo.com		HC	
Lirio Marquez D'Acunti	NA	RAB	787-726-2839	liriomarquez@gmail.com		N	

Notes:
A=All CL=Cover Letter
D=Draft CD=Compact Disc
DF=Draft Final HC=Hard Copy
F=Final N=None

SAP Worksheet #4—Project Personnel Sign-Off Sheet

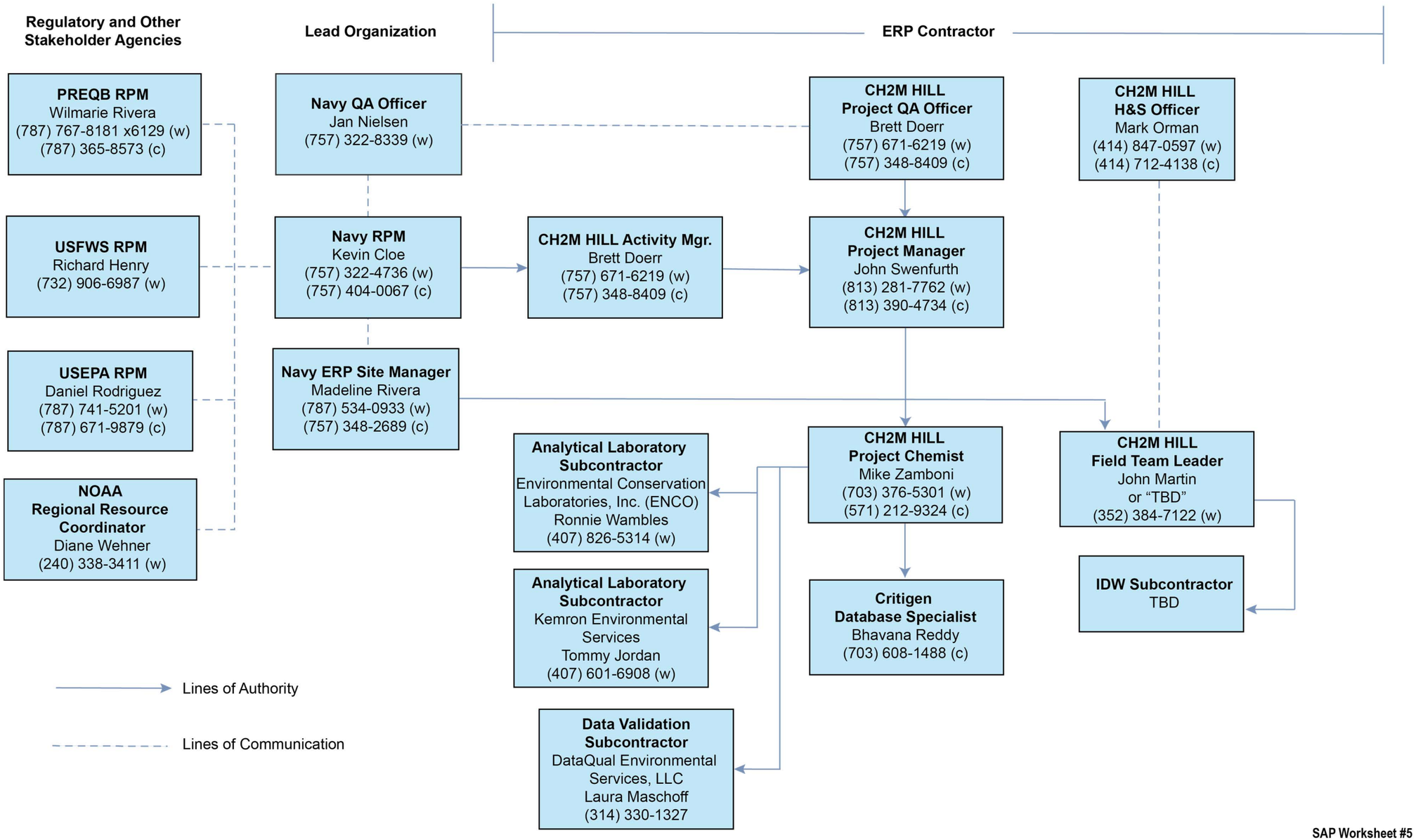
Name	Organization/Title/Project Role	Telephone Number (optional)	Signature/email receipt	SAP Section Reviewed	Date SAP Read
Kevin Cloe	NAVFAC Atlantic/ Vieques RPM/ Lead agency POC	757-322-4736			
Daniel Rodriguez	USEPA/ Vieques RPM/ Regulatory agency POC	787-741-5201 787-671-9879 (c)			
Wilmarie Rivera	PREQB/Vieques RPM/ Regulatory agency POC	787-767-8181 (x6129)			
Anita Dodson	CH2M HILL/Navy Program Chemist/ SAP review	757-671-6218			
Brett Doerr	CH2M HILL/ Contractor Activity Manager/ Navy contractor primary POC, Quality Assurance Officer (QAO)/SAP review	757-671-6219			
John Swenfurth	CH2M HILL/Contractor PM/Logistics and Administration	813-874-0777 (x57762) 813-390-4734 (c)			
Mark Orman	CH2M HILL/Contractor Health and Safety Lead/ Health and Safety Officer	414-847-0597 414-712-4138 (c)			
John Martin	Potential Field Team Leader (FTL)/Site Safety Coordinator (SSC)	352-384-7122			
Mike Zamboni	CH2M HILL/Project Chemist	703-376-5301			
Ronnie Wambles	ENCO Analytical Laboratory/Project Manager	407-826-5314 (w) 407-850-6945 (c)			
Tommy A. Jordan	Kemron Analytical Laboratory Project Manager	404-636-0928 (w) 404-601-6908 (c)			
Bhavana Reddy	Critigen Project/Data Manager	703-608-1488			
TBD	CH2M HILL/Field Team				

Note: CH2MHILL will maintain the signed signature page with the project files.

This page intentionally left blank.

SAP Worksheet #5—Project Organizational Chart

408040.PP.FR.EV



SAP Worksheet #5
Project Organizational Chart
Laguna La Chiva Site Inspection/Remedial Investigation
Former Vieques Naval Training Range
Vieques, Puerto Rico

P:\USNAVFACENGCOM\408040CTO037\La Chiva Lagoon Info \ Worksheet 5-LaChiva Lagoon_V3.ai

ES060412002410TPA

This page intentionally left blank

SAP Worksheet #6—Communication Pathways

Communication Drivers	Responsible Affiliation	Name	Phone Number	Procedure
Communication to/from Navy (e.g., submission of SAP for review; receipt of regulatory comments, etc.) Stop work notices to regulators, notifying regulators of SAP changes or deviations, significant issues and necessary corrective actions by phone or e-mail within 2 weeks of notification of Navy RPM.	Navy RPM	Kevin Cloe	757-322-4736	Primary POC for Navy (via e-mail, telephone, hardcopy, or in-person, as warranted); can delegate communication to other internal or external points of contact.
Communication to/from USEPA (e.g., receipt of SAP for review; submission of USEPA comments)	USEPA RPM	Daniel Rodriguez	787-741-5201 787-671-9879 (c)	Primary POC for USEPA (via e-mail, telephone, hardcopy, or in-person, as warranted); can delegate communication to other internal or external points of contact.
Communication to/from PREQB (e.g., receipt of SAP for review; submission of PREQB comments)	PREQB RPM	Wilmarie Rivera	787-767-8181 (x6129)	Primary POC for PREQB (via e-mail, telephone, hardcopy, or in-person, as warranted); can delegate communication to other internal or external points of contact.
Communication to/from USFWS (e.g., receipt of SAP for review; submission of USFWS comments)	USFWS RPM	Richard Henry	732-906-6987	Primary POC for USFWS (via e-mail, telephone, hardcopy, or in-person, as warranted); can delegate communication to other internal or external points of contact.
Navy Quality Assurance (QA)/Quality Control (QC) input	Navy QAO	Jan Nielsen	757-322-8339	Provides review comments to Navy contractor on pre-draft SAP via e-mail through Kevin Cloe. Provides overall Navy guidance via direct communication with Navy contractor QAO, as warranted.
Communication to/from Navy contractor (e.g., submission of SAP for review; receipt of regulatory comments, updates on project progress, communication of stakeholder expectations, etc.). Stop work notices to Navy RPM, notifying Navy RPM of SAP changes or deviations, significant issues or corrective actions.	CH2M HILL Activity Manager	Brett Doerr	757-671-6219	Primary POC for Navy contractor (via e-mail, telephone, hardcopy, or in-person, as warranted); can delegate communication to other contractor staff, as appropriate.
Project administration and logistics	CH2M HILL PM	John Swenfurth	813-874-0777 (x57762) 813-390-4734 (c)	Direct communication (via e-mail, telephone, hardcopy, or in-person, as warranted) to/from Navy contractor project staff to ensure appropriate project implementation.
Health and safety expectations and procedures	CH2M HILL Health and Safety Officer	Mark Orman	414-847-0597 414-712-4138 (c)	Review of Health and Safety Plan (HASP). Direct communication (via e-mail, telephone, hardcopy, or in-person, will be notified within 24 hours of incident) to/from Navy contractor project staff to ensure implementation of appropriate health and safety procedures.
Implementation of sampling activities; SAP changes in the field	CH2M HILL FTL	John Martin or TBD	352-384-7122 (w) 352-359-5717 (c)	Documentation of deviations from work plan made in field logbooks and rationale for deviations, made within 24 hours of deviation; deviations made only with approval from contractor PM and/or environmental manager. The EPA and PREQB RPMs will be notified within 24 hours of significant SAP changes in the field.
Field corrective actions	CH2M HILL FTL	John Martin or TBD	352-384-7122 (w) 352-359-5717 (c)	See **Worksheet #32** Assessment Findings and Corrective Action (CA) Responses and **Worksheet #32-1** CA Form. The EPA and PREQB RPMs will be notified within 24 hours of significant field corrective actions.

SAP Worksheet #6—Communication Pathways (continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number	Procedure
Daily Field Progress Reports	CH2M HILL FTL	John Martin or TBD	352-384-7122 (w) 352-359-5717 (c)	FTL will e-mail or fax daily field progress reports to contractor PMs weekly; telephone communication with PMs on as-needed basis
Ensure staff health and safety in the field	CH2M HILL SSC	John Martin or TBD	352-384-7122 (w) 352-359-5717 (c)	Daily safety tailgates; daily observations; real-time discussions of observations and changes to be implemented with field staff.
Stop Work Order	CH2M HILL field team, SSC, FTL, or AM	John Martin or TBD	352-384-7122 (w) 352-359-5717 (c)	Any field member can immediately stop work if an unsafe condition which is immediately threatening to human health is observed. The field staff, FTL, or SSC, should notify the CH2M HILL PM and AM immediately along with the Navy RPM. Ultimately, the FTL, PM, and AM can stop work for a period of time. NAVFAC Mid-Atlantic can stop work at any time.
Data tracking from collection through upload to database	CH2M HILL Project Chemist	Michael Zamboni	703-376-5301	Chemist will track data from sample collection through upload to database, ensuring QAPP requirements are met by laboratory and field staff. Tracking involves receipt of electronic and hardcopy data from laboratory and data validator. Chemist communicates with laboratory PM, and data validator PM, as warranted, to ensure adherence to project analysis and validation requirements. Should analytical laboratory issues affect data usability by rendering a significant amount of rejected or unusable data such that the project completeness goal cannot be obtained, the project chemist will notify the project team including the Navy RPM and Navy Quality Assurance Officer (QAO). Chemist also coordinates data upload with contractor database manager.
Uploading project data and maintaining the database to ensure data are stored properly and can be retrieved by the EIS.	Critigen Database Manager	Bhavana Reddy	703-608-1488	Once contractor chemist ensures data are appropriate for upload to database, chemist submits data electronically to contractor database manager, who uploads data to database.
Reporting Lab Data Quality Issues	Laboratory Quality Assurance Manager ENCO	Russell Macomber	407-826-5314 (w)	All QA/QC issues with project field samples will be reported by the lab to the Project Chemist, and Contractor QAO via e-mail within 2 business days.
Quality Control on Laboratory Data	CH2M HILL Project Chemist	Michael Zamboni	703-376-5301	See **Worksheets #24, #25,** and **#28** for analytical CAs.
Validated data	Data Validator PM	Laura Maschoff	314-330-1327	Data validator provides data validation reports (electronic and hardcopy) that provide the data qualifiers and associated explanations.
Release of analytical data for upload to database	CH2M HILL Project Chemist	Michael Zamboni	703-376-5301	Upon review of validated data to ensure adherence to project requirements, project chemist communicates via e-mail to PM that data are ready for release (i.e., upload to database).

SAP Worksheet #7—Personnel Responsibilities Table

Name	Title	Organizational Affiliation	Responsibilities
Kevin Cloe	Vieques RPM	Navy	Environmental restoration program (ERP) activities implemented under this SAP
Jan Nielsen	QAO	Navy	Navy review of SAP and QA input
Madeline Rivera	Vieques ERP Site Manager	Navy	On-island Navy liaison; provides logistical support for implementation of environmental restoration program activities under this SAP
Brett Doerr	Activity Manager	CH2M HILL	Responsible for ERP at Vieques; primary Navy contractor point of contact (POC); assists in data evaluation and interpretation; reviews report
John Swenfurth	PM	CH2M HILL	Project administration; coordinates staffing; monitors project performance; directs and oversees project staff
Mike Zamboni	Project Chemist	CH2M HILL	Establishes laboratory scope of work; ensures selected laboratory can meet project-required analytical protocol; primary communications with laboratory and data validator; performs data quality evaluation to determine availability of analytical data
Mark Orman	Health and Safety Officer	CH2M HILL	Responsible for overall Navy CLEAN program health and safety performance; reviews project-specific HASP; interacts with SSC to ensure project-specific safety of field personnel
John Martin or TBD	FTL and SSC	CH2M HILL	Supervises sampling and coordinates all field activities; ensures onsite compliance with work plan; oversees and ensures safety of onsite personnel
Bhavana Reddy	Database Manager	Critigen	Uploads validated data to environmental database
Ronnie Wambles	Analytical Laboratory Project Manager	ENCO	Laboratory POC and overall manager for analytical work
Laura Maschoff	Project Manager and Data Validator	Data Qual	Responsible for validating analytical data in accordance with project-specific UFP-SAP
TBD	TBD	Investigation-derived Waste (IDW) Subcontractor	Responsible for transport and disposal of IDW deemed necessary for offsite disposal if any IDW generated.

This page intentionally left blank.

SAP Worksheet #8—Special Personnel Training Requirements Table

There are no special personnel training requirements for this project.

This page intentionally left blank.

SAP Worksheet #9—Project Scoping Session Participants Sheet

Project Name: La Chiva Lagoon	**Site Name:** La Chiva Lagoon Investigation
Projected Date(s) of Sampling: December 2012	**Site Location:** La Chiva Lagoon
Project Manager: John Swenfurth	
Date of Session: February 22, 2012	
Scoping Session Purpose: Concur on CSM, technical approach, and data evaluation/decision process for evaluating presence of pesticides in lagoon potentially not attributable to normal pesticide use	

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
John Tomik	CH2M HILL Activity Manager	CH2M HILL	757/671-6259	John.Tomik@ch2m.com	CH2M HILL Vieques Activity Manager
Sergio Lopez	Investigation QC specialist	USEPA	732/321-6778	Lopez.Sergio@epa.gov	No project specific role
Julio Vazquez	West Vieques RPM	USEPA	212/637-4323	Vazquez.Julio@epa.gov	No project specific role
Diane Wehner	Regional Resource Coordinator	NOAA	240/338-3411	Diane.wehner@noaa.gov	No project specific role
Dan Waddill	Navy Activity Manager	Navy			Navy Vieques Coordinator
Kevin Cloe	Vieques RPM	Navy	757-322-4736	Kevin.cloe@navy.mil	Primary Navy POC.
Daniel Hood	Vieques RPM	Navy			No project specific role
Rich Henry	Vieques RPM	USFWS	732-906-6987	Richard_henry@fws.gov	Primary USFWS POC/No project-specific role
Daniel Rodriguez	East Vieques RPM	USEPA	787-741-5201 or 787-671-9879 (c)	Rodriguez.daniel@epamail.gov	Primary USEPA POC
Felix Lopez	Environmental Contaminants Specialist	USFWS	787-851-7297 x226	Felix_lopez@fws.gov	No project-specific role
Wilmarie Rivera	Vieques RPM	PREQB	787-767-8181 x 6129	wilmarierivera@jca.gobierno.pr	Primary PREQB POC
Katarina Rutkowski	Technical Support Contractor Human Health Risk Assessment Lead	TRC	860-298-6202	krutkowski@trcsolutions.com	Technical input and review of human health risk aspects on behalf of EQB. Primary TRC POC.
Barrie Selcoe	Human Health Risk Assessment Lead	CH2M HILL	281/246-4322	Barrie.Selcoe@ch2m.com	Human health risk assessment
John Martin	Ecological risk Assessment Lead	CH2M HILL			
Sandy Martinez	Meeting Facilitator	Fulton Communications	702-834-5877	fultoncom@fultoncom.com	
Brett Doerr	Activity Manager	CH2M HILL	757-671-6219	Brett.doerr@CH2M.com	Scope development and technical review. Primary CH2M HILL POC.
Bill Hannah	Hydrogeologist	CH2M HILL	757-671-6230	Bill.Hannah@ch2m.com	No project specific role
Michael Sivak	Human Health Risk Assessment Lead	USEPA	212-637-4310	Sivak.michael@epa.gov	Technical input and review of human health risk evaluation
Angela Carpenter	Technical Support EPA special projects branch	USEPA	212-637-4435	Carpenter.angela@epa.gov	
Tom Hall	MEC support contractor to EPA	TechLaw		THall@TechLawinc.com	

SAP Worksheet #9—Project Scoping Session Participants Sheet (continued)

Key Discussion Points

- NOAA collected three sediment samples as part of an island-wide sediment evaluation and pesticides were detected above ecological screening criteria. It was also noted that NOAA collected crab samples at the lagoon. Danny requested that the information regarding the crab data collected by NOAA from this lagoon also be included in the SAP.
- The Navy noted the lagoon is not a formal site, but the general vicinity was historically used as a training area for beach landings, which would very likely have involved spraying for mosquitoes. Although a likely source of pesticides in the lagoon may be normal pesticide application during training activities, rusted pieces of drums identified within the lagoon and the SWMU 1 landfill located hydraulically upgradient of the lagoon are also recognized as potential sources.
- The team discussed the ephemeral stream samples collected at and downgradient of SWMU 1, which were collected in the depositional areas of the ephemeral streams. The results from these samples showed only low (orders of magnitude below regulatory screening levels) pesticide concentrations and the sample collected closest to La Chiva Lagoon did not contain pesticides. Therefore, the Navy suggested the landfill is not a source (at least no longer).
- The team discussed the future land use in that the beaches to the south of the lagoon are open to the public, and a bridge over the southwest end of the lagoon provides a public fishing spot on the lagoon.
- The team discussed the sampling approach proposed in the "seed file": Phase 1 is proposed as a site inspection (SI) phase. Kevin Cloe/NAVFAC reminded the team that the initial phase will be to determine if a CERCLA-related release has occurred and if so, the investigation may be expanded further as an RI, which would be implemented as Phase 2. The team had discussions on additional lines of evidence needed to support if the pesticides were from normal application. One suggestion was to also collect soil samples around the lagoon fringe areas to evaluate whether there is a pattern that suggest spraying of the lagoon and immediate surroundings.
- Katarina Rutkowski/TRC requested collecting deeper sediment samples during the SI phase; the deeper sediment data may help in the multiple-line-of-evidence evaluation (release vs. normal application). The team discussed not including the surface water samples as part of Phase 1 (SI) activities since the Navy suggested surface water samples will not likely help to determine if the pesticides are the result of a CERCLA-related release or from normal application. However, if a CERCLA-related release is confirmed in Phase 1, surface water samples could be included in Phase 2 in order to perform the quantitative human health and ecological risk assessments.
- The team discussed the screening criteria to be used. Katarina requested that the data also be screened for fish ingestion modeled scenarios, which the Navy agreed can be done.
- Rich Henry/USFWS suggested adding a decision tree to the SAP to walk through the data evaluation and decision process. Brett responded that the decision tree will be included as part of the SAP. The SAP will be written to cover Phase 1 (SI) and Phase 2 (RI), but will include a meeting with the technical subcommittee to discuss Phase 1 data so that the need for and approach for Phase 2 can be re-evaluated by the team before moving forward.
- Felix added his concern on the sediment depth intervals for the fiddler crab. John added that the statement in the seed file (as provided in the SAP) will be revised to the following: "Preference will be given to shallow water areas (approximately 6-12 inches of water) since this best represents the zone in which small wading birds would forage for invertebrates; however, fiddler crabs from above the water line may also be collected."

SAP Worksheet #9—Project Scoping Session Participants Sheet (continued)

Action Items

Navy/CH2M HILL – include NOAA's crab survey data from La Chiva Lagoon into the SAP Navy/CH2M HILL – add deep sediment samples where the ephemeral streams enter the lagoon and in the area of the drums; and add soil samples around the perimeter of the lagoon to help determine if the concentrations are from application.
Navy/CH2M HILL – incorporate the potential collection of fiddler crabs into Phase 2 of the SAP

Consensus Decisions

The team concurred to move forward with preparation of the La Chiva Lagoon SAP based on the seed file, with the following modifications/key points: 1) add soil samples around perimeter of lagoon; 2) add deep sediment samples (6 to 12 inches) at entrance of ephemeral streams into western end (sample 2, corresponding with drum location as well) and eastern end (sample 14) of lagoon and in the vicinity of the NOAA sample with the highest pesticide levels (sample 6) to help evaluate whether historical releases to lagoon occurred; 3) perform perimeter reconnaissance to identify whether additional drums are present; 4) add NOAA crab data to background information; 5) define Phase 1 and Phase 2 as shown in seed file (with above modifications), including decision trees, but add caveat that after Phase 1, the team will meet to discuss the results and verify Phase 2 should proceed as described in the SAP or be modified based on the Phase 1 information/evaluation.

SAP Worksheet #9—Project Scoping Session Participants Sheet (continued)

Project Name: La Chiva Lagoon	**Site Name**: La Chiva Lagoon Investigation
Projected Date(s) of Sampling: December 2012	**Site Location:** La Chiva Lagoon
Project Manager: John Swenfurth	
Date of Session: March 14, 2012	
Scoping Session Purpose: Concur on sampling locations	

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Diane Wehner	Regional Resource Coordinator	NOAA	240/338-3411	Diane.wehner@noaa.gov	No project specific role
Dan Waddill	Navy Activity Manager	Navy			
Mike Green	Navy Munitions specialist	Navy			
Kevin Cloe	Vieques RPM	Navy	757-322-4736	Kevin.cloe@navy.mil	Primary Navy POC.
Daniel Hood	Vieques RPM	Navy			No project specific role
Daniel Rodriguez	East Vieques RPM	USEPA	787-741-5201 or 787-671-9879 (c)	Rodriguez.daniel@epamail.gov	Primary USEPA POC
Diana Cutt	Geology/hydrogeology lead	USEPA	212/637-4311	Cutt.diana@epa.gov	Technical review of geology/hydrogeology
Felix Lopez	Environmental Contaminants Specialist	USFWS	787-851-7297 ext 226	Felix_lopez@fws.gov	No project-specific role
Rich Henry	Vieques RPM	USFWS	732-906-6987	Richard_henry@fws.gov	Primary USFWS POC/No project-specific role
Mike Barandiaran	FWS Refuge Manager	USFWS	787-741-2138	M_Barandiaran@fws.gov	No project specific role
Law Enforcement-USFWS		USFWS			
Wilmarie Rivera	Vieques RPM	PREQB	787-767-8181 ext 6129	wilmarierivera@jca.gobierno.pr	Primary PREQB POC
Katarina Rutkowski	Technical Support Contractor Human Health Risk Assessment Lead	TRC	860-298-6202	krutkowski@trcsolutions.com	Technical input and review of human health risk aspects on behalf of EQB. Primary TRC POC.
Mary Mahoney	Technical Support Contractor for PREQB	TRC			
Jim Pastorik	Technical support contractor to EQB for munitions	UXO Pro	703/548-5300	jim@uxopro.com	No project specific role
John Martin					
John Tomik	CH2M HILL Activity Manager	CH2M HILL	757/671-6259	John.Tomik@ch2m.com	CH2M HILL Vieques Activity Manager
Brett Doerr	Activity Manager	CH2M HILL	757-671-6219	Brett.doerr@CH2M.com	Scope development and technical review. Primary CH2M HILL POC.
Bill Hannah	Hydrogeologist	CH2M HILL	757-671-6230	Bill.Hannah@ch2m.com	No project specific role
Phil Balvocious	UXO Tech III	CH2M HILL			

SAP Worksheet #9—Project Scoping Session Participants Sheet (continued)

Comments/Decisions

The team walked out to the edge of the lagoon to discuss sampling locations. The total number of sediment samples proposed in the seed file was discussed and determined to be disproportionately high relative to other previously sampled lagoons on Vieques. The team concurred that Dianne Wehner/NOAA and John Martin/ CH2M HILL would paddle around the lagoon the following day and adjust the number and location of sampling stations as appropriate. An additional goal for Diane Wehner was to re-assess the exact positions of two locations previously sampled by NOAA (Stations 46P and 47P where elevated concentrations of DDT/DDD/DDE were identified), considering some location discrepancies in published maps.

The team also discussed the intent of collecting surface soil samples around the lagoon. It was generally concluded that some soil samples should be collected from the salt flat around the perimeter of the lagoon, as well as in the forested area immediately south of the lagoon where Navy training activities historically occurred. No specific number or location of soil stations was discussed.

It was described to the team that the planned boat survey would include a qualitative survey of wildlife and aquatic organisms currently in the lagoon, as well a check on field water quality parameters.

The results of lagoon-wide boat survey conducted March 15, 2012, were as follows:

- Eleven sediment stations were identified for sampling, a reduction from the 14 originally proposed in the seed file.
- Using a Trimble Global Positioning System (GPS) unit (operated by Dennis Ballam/CH2M HILL), Station 46P was re-acquired using NOAA station coordinates. Diane Wehner described that the NOAA sampling team had collected surface sediment from a kayak using a hand scoop in shallow water at the edge of the lagoon. The coordinates placed Station 46P within a dense stand of mangroves along the edge of the lagoon, inaccessible by kayak. In the main lagoon channel on the southern end of the lagoon (in the vicinity of the bridge), the closest to the 46P coordinates the team could get by kayak was about 30 feet to the east. There was also a small, shallow lagoon lobe off the main channel where the NOAA sampling team could have penetrated and collected sediment, but the closest the team could get to the 46P coordinates by kayak was about 10 feet to the north. It was considered by the field team that the coordinates taken at the time of sampling may have been slightly off. In both instances, GPS coordinates were taken to document the two possible sediment sampling locations for 46P. Diane took photos and said she would directly contact the sampling team members before reaching a final decision on which of these two possible locations should be considered as the final 46P location.

  It was also decided that based on the final determination by NOAA of a location for the 46P shoreline station, an additional sediment sample would be collected immediately offshore and in mid-channel in the lagoon to represent deeper water (which was about 5 feet in this area) where there is likely a greater accumulation of organic sediment.

  It was also discussed that a soil sample should be collected in the upland immediately adjacent (southwest) of the 46P sediment station to assess the potential for a nearby upland source of DDT/DDD/DDE.
- Using the Trimble GPS unit, Station 47P was re-acquired using NOAA station coordinates. The coordinates placed Station 47P about 10-20 feet into the dry, perimeter salt flat. As a result, new GPS coordinates for station 47P were taken at the nearest point accessible by kayak where sediment was present and could be collected by the Navy.

SAP Worksheet #9—Project Scoping Session Participants Sheet (continued)

- Field water quality parameters were measured in the vicinity of stations 46P and 47P. The range of measured values were as follows:
  - Dissolved oxygen: 4.90 to 6.61 mg/L
  - Temperature: 26.38 to 26.56 °C
  - Salinity: 38.86 to 39.45 parts per thousand
  - pH: 7.69 to 7.71 units
  - ORP: 65.4 to 76.8 millivolts
- Mammals and birds observed: mongoose, clapper rail, pied-billed grebe, yellow warbler, greater yellowlegs, lesser yellowlegs, stilt sandpiper, spotted sandpiper, black-bellied plover, ruddy turnstone, Wilson's plover, little blue heron, tricolored heron, great egret, snowy egret, green heron, common gallinule, gray kingbird, red-tailed hawk, Antillean crested hummingbird, bananaquit.
- Aquatic species: fiddler crabs (extremely abundant), blue crab, snook, tarpon, ladyfish, white mullet, mojarra.

SAP Worksheet #10—Conceptual Site Model

Introduction

This worksheet provides a summary of site background and key elements of the conceptual site model (CSM), followed by a narrative description of the problems to be addressed during the SI (and potential RI) sampling activities.

Site Background and Investigation History

During the Environmental Baseline Survey (EBS), Potential Area of Concern (PAOC) W was identified as an area of stagnant, discolored water where the road to Blue Beach crosses the southern arm of Laguna La Chiva (NAVFAC, 2003)). However, the Mangrove Forest Health and Status Report (Geo-Marine, 2002) evaluated this area and attributed the mangrove decline to the area being cut off by the road from the natural circulation with the sea. The discolored water was likely caused by an increase in organic matter from the mangroves around the edge of the lagoon that died when the salinity changed because of the lagoon being cut off from normal sea water circulation. Observations made during a site visit performed by representatives of the Navy, USEPA, PREQB, USFWS, and NOAA in 2007 supported these findings. Therefore, a no action determination was made for PAOC W, which is documented in the No Action Decision Document for 4 Consent Order Sites and 6 PI/PAOC Sites (CH2M HILL, 2009).

In 2005, NOAA collected fiddler crab and land crab tissue samples from around Laguna La Chiva (**Figure 2**) (NOAA and Ridolfi, 2006). While pesticides were detected in crab tissue, the PHC prepared by ATSDR, in part using the NOAA data, stated that the level of pesticides found in the land crab samples were much lower than levels reported to cause harmful health effects (ATSDR, 2006). In addition, NOAA evaluated the data and concluded that the pesticide concentrations in crabs did not exceed ecological screening values intended for the protection of crustaceans.

In October 2007, NOAA collected sediment samples from 78 locations around Vieques, some near-shore marine sediments, and some inland lagoons (NOAA, 2010). Three of the sediment samples were collected from Laguna La Chiva; results for the three samples showed the following:

- Pesticides –pesticide concentrations (primarily DDT, DDE, and DDD) were detected at concentrations higher than at other lagoons on Vieques sampled by NOAA and Navy. Concentrations variously exceeded ecological screening levels. None exceeded EPA RSLs, but it is unknown whether concentrations may pose a risk when uptaken into fish and crab because no modeling or biota sampling was conducted.
- Polychlorinated Biphenyls (PCBs) – PCBs were detected at concentrations much lower than the National Status and Trends mean values for the rest of US coastal waters and lower than or comparable to PCB concentrations detected throughout NOAA's sediment samples (i.e., not likely related specifically to Laguna La Chiva). Most importantly, none exceeded ecological screening levels or EPA RSLs.
- Polycyclic Aromatic Hydrocarbons (PAHs) – PAHs, a subset of SVOCs, were analyzed in the sediment samples collected by NOAA in 2007 (NOAA, 2010). The analyses were conducted in accordance with NOAA's National Status and Trends protocol, as part of nation-wide program that has been in existence for over 20 years. While PAHs were detected in Laguna La Chiva sediment samples, all concentrations were lower than or comparable to National Status and Trends median values for the rest of US coastal waters and generally lower than or comparable to the PAH concentrations detected throughout NOAA's sediment samples (i.e., not likely related specifically to Laguna La Chiva). In fact, the NOAA report concluded: "Overall, the concentrations of total PAHs in sediments were low; none of the concentrations of total PAHs exceeded the sediment quality guidelines examined." Most importantly, none of the PAH concentrations detected in Laguna La Chiva sediment samples exceeded ecological screening levels or EPA RSLs. Based on this multiple-lines-of-evidence approach, PAHs were determined not to warrant further consideration as potential contaminants of concern.

SAP Worksheet #10—Conceptual Site Model (continued)

- Butyltins – Butyltins were detected at concentrations lower than or comparable to butyltin concentrations detected throughout NOAA's sediment samples (i.e., not likely related specifically to Laguna La Chiva). Most importantly no tributyltin TBT) was detected and none of the butyltin concentrations exceeded ecological screening levels or EPA RSLs.
- Explosives – No explosives were detected.
- Metals – Metals concentrations detected are likely attributable to background (i.e., not likely related specifically to Laguna La Chiva).

The 2005 crab data and 2007 sediment data collected by NOAA in and around Laguna La Chiva were used to help identify potential contaminants of interest for further evaluation and may be used in qualitatively in future reporting for Laguna La Chiva. They will not be used in quantitative risk assessments. Further, as demonstrated above, pesticides (other than DDT, DDE, and DDD), PCBs, PAHs, butyltins, explosives, and metals are not potential contaminants of interest for further evaluation.

In March 2009, the Navy collected surface and subsurface soil samples from ephemeral streams upgradient of the lagoon (**Figure 7**) as part of an investigation of the former Camp Garcia landfill (SWMU 1), located topographically upgradient of Laguna La Chiva. As shown in the figure, no pesticides were detected in SS27 or SB27, which were closest to the lagoon. Various pesticides were detected at concentrations well below screening levels in the ephemeral streams immediately adjacent to the former landfill. The details of the investigation of SWMU 1 are presented in the *Streamlined Remedial Investigation/Feasibility Study Report, Solid Waste Management Unit 1 (SWMU 1), Former Vieques Naval Training Range, Vieques, Puerto Rico* (CH2M HILL, 2011).

Conceptual Site Model

Figure 8 presents the generalized conceptual site model of La Chiva Lagoon.

Release Mechanisms

It is possible that the pesticide concentrations detected in Laguna La Chiva sediment are the result of normal pesticide use associated with training at and adjacent to Blue Beach. Blue beach, to the south of the lagoon, was one of the two most frequently used beaches for amphibious landing training (TAMS, 1979). Though there are no records available, it is likely that pesticides were used to control insects during training events, especially in and around the lagoon, which would likely have been (and still is) prime mosquito habitat. While the pesticide concentrations detected in NOAA's samples may be associated with normal pesticide use, rusted pieces of several drums were observed around the lagoon, with the majority being observed on the northeast and west banks of the northwestern branch of the lagoon. Since pesticides would likely have been stored and transported in drums, the drum remnants offer another potential explanation for the source of pesticides in the lagoon (i.e., discarding of drums containing pesticide residues). The drums may also be the source of contaminants not previously analyzed for in Laguna La Chiva sediment samples (i.e., VOCs and SVOCs). However, historical aerial photography does not show the area to have been used for disposal.

During the investigation of SWMU 1, which is hydraulically upgradient of Laguna La Chiva, ephemeral samples were collected adjacent to and downgradient of SWMU 1 to help determine if the ephemeral streams were a means of contaminant transport from the landfill. While pesticides were detected in samples adjacent to and immediately downgradient of the landfill, no pesticides were detected in the ephemeral stream samples collected closest to Laguna La Chiva (i.e., SS27 and SB27) and all of the pesticide concentrations detected in the ephemeral stream samples were orders of magnitude below the levels detected in the lagoon. However, the ephemeral streams are recognized in the CSM as potential contaminant transport pathways, as discussed under "Potential Contaminant Sources and Transport Pathways." To address this potential, samples will be collected where the

SAP Worksheet #10—Conceptual Site Model (continued)

ephemeral streams enter the lagoon, as detailed in Worksheet #17. Further, no VOCs attributable to the SWMU 1 landfill were detected in ephemeral stream samples collected adjacent to the landfill. Two PAHs and bis(2-ethylhexyl)phthalate were detected in the ephemeral stream samples, but all detections were below regulatory screening levels. No VOCs or SVOCs were detected in the ephemeral stream samples closest to Laguna La Chiva. All of this information suggests the landfill is not a source of the pesticides detected in the lagoon (or VOCs and SVOCs potentially present in the lagoon) or, at a minimum, is no longer a source.

Physical Characteristics

- The relatively small size of the lagoon (about 10 acres) and the current lack of ocean access, isolate fish to the lagoon.
- The lagoon bottom consists of very fine grained soft sediments with moderate TOC content.
- The geology of the area is alluvial marsh deposits likely underlain by Cretaceous sandstones, and/or siltstones, and/or volcanics.
- The groundwater level is likely at the level of the lagoon, or within a few inches to feet below the bottom.
- The lagoon water level varies based on the amount of precipitation, with the dry season being between December and April. The mouth of the lagoon is generally blocked by sand at the beach from longshore drift, but may be open to the ocean for short durations during significant events such as hurricanes. When cut off from the open ocean, the lagoon is not likely tidally influenced.

Potential Contaminant Sources and Transport Pathways

If pesticides exist from spraying on land surfaces surrounding the lagoon, overland flow (runoff) from these surrounding areas could have carried pesticides to the lagoon. In addition, direct application of the pesticides to the low-lying areas of the lagoon may have occurred to control mosquitoes. If the drums observed in the lagoon contained pesticide residues or other chemicals (i.e., chemicals containing VOCs and SVOCs), leaking from the drums to the lagoon may have occurred. Historical runoff from the SWMU 1 landfill is another potential contaminant source. However, data collected at and downgradient of SWMU 1 suggest, at a minimum, it is no longer a source of potential contaminants in Laguna La Chiva.

Current and Future Land Use

The former VNTR was transferred to the DOI in 2003 to be managed by USFWS as part of the National Wildlife Refuge System, pursuant to Section 1049 of the National Defense Authorization Act for Fiscal Year 2002 (Public Law 107-107). A Comprehensive Conservation Plan (CCP) for the Vieques National Wildlife Refuge was completed by USFWS, which outlines the land use plan for managing the former VNTR as a wildlife refuge (DOI, 2007). The beaches just south of the lagoon are currently open to the public, and the bridge over the southwest end of the lagoon provides the public potential access to the lagoon. USFWS plans to provide a fishing spot on the new bridge, which is currently under construction.

Receptors and Exposure Pathways

Potential receptors at the site include both human and ecological, as described below.

Human

The following are potential human receptors at Laguna La Chiva. If the results of the SI indicate an RI is warranted, these receptors will be quantitatively evaluated in a human health risk assessment (HHRA).

- Recreational Users/Trespassers/Site Visitors (current/future direct exposure to soil and exposed sediment [as soil], sediment in areas where water is <3 ft deep, and surface water).

SAP Worksheet #10—Conceptual Site Model (continued)

- Maintenance Workers* (hypothetical future direct exposure to soil and exposed sediment [as soil]).
- Industrial Workers (hypothetical future direct exposure to soil and exposed sediment [as soil])
- Construction Workers (hypothetical future direct exposure to soil and exposed sediment [as soil])
- Residents (hypothetical future direct exposure to soil and exposed sediment [as soil])
- Fish/Blue Crab Consumers (current/future ingestion of fish and blue crabs)

* Maintenance workers are assumed to be USFWS workers. However, there is no specific planned future use of the site by USFWS (with the exception of the fishing spot on the new bridge). Therefore, the default maintenance worker presented in the final HHRA Protocol (CH2M HILL, 2010a) will be evaluated in the HHRA for Laguna La Chiva.

Ecological

The following are potential aquatic and terrestrial ecological receptors at Laguna La Chiva. If the results of the SI indicate an RI is warranted, these receptors will be quantitatively evaluated in an ecological risk assessment (ERA).

Potential aquatic receptors are:

- Fish (direct exposure to surface water and sediment)
- Benthic invertebrates (direct exposure to surface water and sediment)
- Aquatic plants (direct exposure to surface water and sediment)
- Aquatic birds: (food web exposures)
  - Green heron (*Butorides virescens*) – aquatic avian invertivore/piscivore - Spotted sandpiper (*Actitis macularia*) – aquatic avian invertivore
  - Cave swallow (*Petrochelidon fulva*) – aerial avian insectivore
  - White-cheeked pintail (*Anas discors*) – aquatic avian omnivore; listed as vulnerable in Puerto Rico
- Aquatic mammals: (food web exposures)
  - Fishing bat (Noctilio leporinus) – mammalian piscivore.
  - Velvet free-tailed bat (Molossus molossus) – aerial mammalian insectivore.

Potential terrestrial receptors are:

- Terrestrial plants - direct exposure to surface soil
- Terrestrial invertebrates - direct exposure to surface soil
- Land crab - direct exposure to surface soil (0 to 2 feet)
- Reptiles - exposure to surface soil
- Terrestrial birds: (food web exposures)
  - Common ground dove (*Columbina passerine*) – terrestrial avian herbivore
  - Cave swallow (*Petrochelidon fulva*) – terrestrial avian insectivore
  - Red-tailed hawk (*Buteo jamaicensis*) - terrestrial avian carnivore.
  - White-cheeked pintail (*Anas discors*) – aquatic avian omnivore (modeled as a herbivore in the SERA portion of the ERA); listed as vulnerable in Puerto Rico
  - Green heron (*Butorides virescens*) – aquatic avian piscivore/invertivore (modeled as a piscivore in the SERA portion of the ERA)

SAP Worksheet #10—Conceptual Site Model (continued)

  - Pearly-eyed thrasher (*Margarops fuscatus*) - terrestrial avian omnivore (modeled as an invertivore in the SERA portion of the ERA)
- Terrestrial mammals: (food web exposures)
  - Norway rat (*Rattus norvegicus*) - terrestrial mammalian omnivore (modeled as a herbivore in the SERA portion of the ERA)
  - Indian mongoose (*Herpestes auropunctatus*) - terrestrial mammalian omnivore (modeled as an invertivore in the SERA portion of the ERA).
  - Velvet free-tailed bat (Molossus molossus) - terrestrial mammalian invertivore

General Problem to Address

DDT was used as part of normal pesticide use at Laguna La Chiva to control mosquitoes during the time military training activities were taking place. However, the presence of DDT in the lagoon may also be attributable to CERCLA-related releases, such as from drums observed in the lagoon. Due to the detection of DDT and daughter products in sediment samples collected by NOAA in 2007 at concentrations above those observed in other lagoons on Vieques and ecological risk-based screening values and because of the presence of drums of unknown origin along the edge of the lagoon, an SI is warranted. If the results of the SI (including the potential for an expanded SI [ESI]) suggest the pesticide concentrations are not indicative of a CERCLA-related release via the multiple-lines-of-evidence approach detailed in Worksheet #11, the presence of pesticides will be attributable to normal pesticide use and no further investigation or action will be necessary. If the results indicate the other contaminants of interest (i.e., VOCs and SVOCs) are not present or are not present at concentrations posing a potentially unacceptable risk, no further investigation or action will be necessary. Otherwise, an RI will be conducted.

The ERP Technical Subcommittee met on February 22, 2012 to discuss and concur upon the rationale and scope, sampling approach, and analyses for the Laguna La Chiva investigation. The team performed a site visit in March 2012 to select SI sampling locations. Based on the meeting and site visit, the environmental questions to be answered by the investigation are provided below. Additional details of the sampling approach, design, and rationale for sampling at Laguna La Chiva are detailed in **Worksheets #14** and **#17**.

Environmental questions to be answered by the Site Inspection

1. Has there been a CERCLA-related release of pesticides to Laguna La Chiva?

Sediment samples will be collected from 12 locations across Laguna La Chiva and analyzed for pesticides to help answer this question. The sediment sample locations were selected to provide broad spatial coverage of the lagoon, as well as target key areas of interest, in order to distinguish a CERCLA-related release (e.g., leaking drums, historical release and runoff from landfill) from normal pesticide use during military training activities. In addition to the sediment samples, seven surface soil samples will be collected in areas surrounding the lagoon and analyzed for pesticides to help determine if normal pesticide application adjacent to the lagoon may have occurred. If so, transport of pesticides from the surrounding soil to the lagoon via runoff may help determine whether the presence of pesticides in the lagoon are from normal application and not a CERCLA-related release (e.g., leaking drums). Determination of whether pesticides in soil are likely from normal application will be accomplished in accordance with the multiple-lines-of-evidence approach discussed in Worksheet #11 under "List the PQOs in the form of if/then qualitative and quantitative statements." This approach is consistent with the approach used for other sites in the release assessment phase of investigation (see Section 1.1.1 of CH2M HILL, 2010b). The rationale for each sample is provided in **Worksheet #17**.

SAP Worksheet #10—Conceptual Site Model (continued)

To answer this question, the data collected as described above will be evaluated via Steps 2 through 4 of the 7-step decision analysis tree (**Figure 5**). Due to the nature of Laguna La Chiva (i.e., similar to the ECA and SWMU 4 lagoons, which are both landlocked lagoons with fluctuating hydrology and salinity), an applicable background lagoon cannot likely be identified. However, pesticide concentrations detected in lagoons around Vieques not associated with sites or suspected releases may be used together with the data collected as described above as part of multiple lines of evidence evaluations to determine whether a CERCLA-related release occurred.

2. Has there been a CERCLA-related release of VOCs and/or SVOCs to Laguna La Chiva?

In addition to pesticide analysis, the sediment samples collected as described above will be analyzed for VOCs and SVOCs (less PAHs since they were eliminated as potential contaminants of concern via a multiple-lines-of-evidence approach, as described previously). To answer this question, the data collected as described above will be evaluated via Steps 2 through 4 of the 7-step decision analysis tree (**Figure 5**). The formation of natural SVOCs, especially under conditions anticipated at Laguna La Chiva, will be considered in the multiple-line-of-evidence approach for data evaluation.

The 2005 crab data and 2007 sediment data collected by NOAA in and around Laguna La Chiva demonstrate pesticides (other than DDT, DDE, and DDD), PCBs, PAHs, butyltins, explosives, and metals are not indicative of a CERCLA-related release and are therefore not potential contaminants of interest for further evaluation.

3. If a CERCLA-related release of pesticides, VOCs, and/or SVOCs is suspected or confirmed, is further investigation or action warranted?

This question will be answered by evaluating the data via Steps 5 through 6a of the 7-step decision analysis tree (**Figure 5**). If it is determined additional data are needed to confidently draw conclusions regarding release assessment, additional samples will be collected as part of an expanded SI (ESI) and the resulting data will be evaluated (with the previously collected data) as described in Step 6 of the 7-step decision analysis tree (**Figure 5**). If further investigation is deemed warranted to evaluate the nature and extent of contamination and quantitatively assess human health and/or ecological risks, an RI will be conducted. Evaluation of the SI data and any recommendation for further investigation via an ESI or RI will be made by the Navy to EPA, PREQB, and FWS prior to its implementation. If an RI is conducted, an addendum to this SAP will be prepared that documents the specific elements of the RI that are not already defined in this SAP (e.g., number and locations of samples, particular analyses, etc.).

4. If an RI is warranted, what is the nature and extent of contamination in Laguna La Chiva?

This question will be answered by collecting samples of other lagoon media (i.e., surface water and biota), analyzing them for constituents of interest based on evaluation of the SI data and discussions among the Vieques Technical Subcommittee, and evaluating the data (including the relevant SI data) using the 4-step decision process in **Figure 6**. Specifics of the RI approach not already included in this SAP will be included in an addendum to this SAP following concurrence among the Vieques Technical Subcommittee members.

5. If an RI is conducted, what are the human health and/or ecological risks posed by contaminants attributable to the CERCLA-related release?

This question will be answered by performing a quantitative HHRA and ERA using applicable data collected during the SI and RI. Data potentially representative of background or non-site-related contamination will not be excluded from the risk assessments, but will be considered following quantification of risks to help determine the relative contribution to the calculated risks of site-related and non-site-related (including background) constituent concentrations.

SAP Worksheet #11—Project Quality Objectives/Systematic Planning Process Statements

1. Who will use the data and what will the data be used for?

The Navy, USEPA, EQB, and USFWS (Vieques Technical Subcommittee) will use the data collected during the SI to determine whether a CERCLA-related release took place and if so, whether further action is warranted. If an RI is conducted, the Vieques Technical Subcommittee will use the data to delineate the nature and extent of contamination and assess related human health and/or ecological risks.

2. What are the Project Action Limits (PALs)?

The PALs are defined in the Master Standard Operating Procedures, Protocols, and Plans (MSOPPPs) (CH2M HILL, 2010a) and are listed, by constituent group and medium, in **Worksheet #15**. In general, the PALs for the SI are:

- Vieques human health screening values for soil and sediment are the current (as of the time the HHRA is being conducted) Residential and Industrial Regional Screening Levels (RSLs) (adjusted for a hazard quotient [HQ] of 0.1 for non-carcinogens) provided by USEPA.
- Vieques ecological screening values for soil and sediment are derived from multiple sources, which are listed in the Vieques Master Ecological Risk Assessment Protocol in the MSOPPP (CH2M HILL, 2010a).
- Results for screening data (e.g., general chemistry parameters such as total organic carbon [TOC]) collected to support the interpretation of potential contaminant data and human and/or ecological risk results will not be compared to strictly-defined PALs, but will be evaluated qualitatively. These parameters are identified in **Worksheet #15**.

Worksheet #15 identifies where the laboratory cannot achieve a Limit of Detection (LOD) less than the PAL for a given constituent. When this occurs, it is useful to compare the Detection Limit (DL) to the PAL. When the DL is less than the PAL, then the laboratory will report the constituent (qualified as applicable) if detected at greater than the PAL. When the PAL is less than the DL, then non-detect results are treated as non-exceedances and the uncertainty surrounding such results is discussed in the Data Quality Evaluation (DQE) report section.

For SVOCs in sediment (**Worksheet #15-2**), the PAL is less than the DL for 2-methylphenol, n-nitroso-di-n-propylamine, hexachloroethane, nitrobenzene, 2,4-dimethylphenol, hexachlorobutadiene, 2,4,6-trichlorophenol, 2,4,5-trichlorophenol, 1,1-biphenyl, dimethyl phthalate, diethylphthalate, n-nitrosodiphenylamine, hexachlorobenzene, di-n-butylphthalate, butylbenzylphthalate, and di-n-octylphthalate. For each of these constituents, there exists a range of uncertainty (between the DL and the PAL) where a detection would not be reported because it cannot be distinguished from noise. Any detection is considered a PAL exceedance, and is qualified if less than the LOQ. Alternative and/or modified methods are not available to achieve lower LOQs. Note that, for comparison, the laboratory-specific LODs (100-300µg/kg) are already similar to CRQLs from Low Soil SVOCs via EPA CLP SOM01.2. Uncertainty associated with LODs which exceed PALs will be discussed in the data quality evaluation of the report.

If an RI is conducted, PALs will be established for the particular analyses to be conducted on the other media to be sampled (i.e., surface water, biota). The PALs for those constituents (by medium) will be provided in an addendum to this SAP.

3. What types of data are needed (matrix, target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)?

- Soil and sediment samples will be submitted to an offsite laboratory for analysis (ENCO-Orlando, with grain size by Kemron-Atlanta)
- Chemicals of interest consist of VOCs, SVOCs (less PAHs), and pesticides, shown in **Worksheet #15**.
- **Worksheets #10, #15**, and **#18** define the matrices, analytical groups, and, where applicable, specific target analytes.

SAP Worksheet #11—Project Quality Objectives/Systematic Planning Process Statements (continued)

4. How "good" do the data need to be in order to support the environmental decision?

- The data will be of the quantity and quality necessary to provide technically sound and defensible assessments of potential releases and associated human and ecological risks at Laguna La Chiva. Laboratory methods will meet CERCLA, USEPA Region 2, and Navy guidance and the data (with the exception of TOC and grain size) will be validated per Region 2 guidelines, methodology, and laboratory SOPs as described in **Worksheet #36.**
- The laboratory will follow the Measurement Performance Criteria (MPC) in **Worksheet #12** for field QC samples and **Worksheet #28** for laboratory QC samples. These MPC are consistent with the Department of Defense (DoD) Quality Systems Manual (QSM) as applicable and laboratory in-house limits where the QSM does not apply.
- Validation of data increases the level of confidence in a data set for a particular data use. Offsite laboratory data will be validated by an independent, third party data validator using guidance from the validation criteria outlined by USEPA. Use of an independent, third party validator may serve to increase the public's confidence in the data because the validator provides an assessment of the data quality outside of any influence by the stakeholder parties. The validation criteria and guidance documents are listed in **Worksheet #36**. These documents will help the validator create a thorough and systematic approach to the validation process. The data validator will also recalculate 10 percent of the results from the raw laboratory data, which may identify laboratory errors in identification or quantification, if present.
- QA/QC samples will be collected with the various media samples as a check on sampling and analytical protocol. Like data validation, the appropriate type and quantity of QA/QC samples is not an absolute. Field duplicates will be collected at a frequency of 1 per 10 field samples. Field duplicates help assess sample collection techniques and laboratory precision. Matrix spike/matrix spike duplicates (MS/MSDs) are collected at a frequency of 1 pair per 20 field samples per matrix. The frequency is such that there is one MS/MSD pair per laboratory analytical batch. MS/MSD samples are often required by the analytical method and/or data validation guidance. Equipment blanks are collected at a frequency of 1 per day per medium sampled when non-disposable equipment is used. Equipment blanks help assess equipment decontamination techniques and identify when contamination may have been carried over from one sample location to another. Equipment blanks will be collected in the field such that they are also subject to ambient field contamination. Trip blanks are collected at a frequency of 1 per cooler containing volatiles. Trip blanks accompany the empty sample containers while they are stored at the laboratory and shipped to the site, and while they are full and shipped back to the laboratory. Trip blanks are useful for assessing whether or not there is any contamination during periods of time when the samples are not directly supervised.

5. How much data should be collected (number of samples for each analytical group, matrix, and concentration)?

- For the SI, **Worksheet #18** contains the number of samples per matrix per analytical group. **Worksheet #15** contains the particular analytes and PALs. Worksheets #10 and #17 provide the rationale for the sampling and analytical approach. If an RI is conducted, additional **Worksheets #15** and **#18** will be included in the addendum to identify the particular analytes and PALs (**Worksheet #15**) and number of samples per matrix (**Worksheet #18**) for the approach concurred upon by the Vieques Technical Subcommittee.

SAP Worksheet #11—Project Quality Objectives/Systematic Planning Process Statements (continued)

- Where, when, and how should the data be collected/generated?
  - Phase 1 (SI) Soil and sediment samples will be collected in the locations identified in **Figure 4**. If a RI becomes necessary, surface water samples will be collected at or in close proximity to the sediment sample locations conducted in the first phase. In addition, eight edible fish and blue crabs will be collected from the lagoon for analysis for the HHRA.
  - It is anticipated that phase 1 (SI) samples will be collected during the spring of 2013. If a second phase (RI) becomes necessary, the schedule will be determined at the time of the decision to go into the RI phase.
  - Data will be collected and generated in accordance with the procedures outlined in the UFP-SAP. Specifically, see **Worksheet #21** and the SOPs in the MSOPPP (CH2M HILL, 2010a) for more details.
- Who will collect and generate the data? How will the data be reported?
  - CH2M HILL field staff will collect the samples.
  - Laboratory analysis will be performed by ENCO-Orlando, with grain size by Kemron-Atlanta.
- How will the data be archived?
  - The data will be archived in accordance to procedures dictated in the Navy CLEAN program/contract. At the end of the project, archived data will be returned to the Navy.
- List the Project Quality Objectives (PQOs) in the form of if/then qualitative and quantitative statements

  The decision analysis process shown in Figure 5 represents the SI PQOs for Laguna La Chiva. The general objectives of the decision analysis process are:
  - To determine if a CERCLA-related release occurred and, if so,

  (1) Whether the release warrants further investigation or action

  The 7-step decision analysis can be subdivided into five PQO categories, as described below.

CERCLA Eligibility (Step 1 of Figure 5)

CERCLA eligibility is determined in general accordance with USEPA guidance (USEPA, 1991, 1999a, and 1999b). The resulting PQO statement is:

- If the site is CERCLA eligible, then collect site-specific samples (if none exist); otherwise, prepare a no further action decision document or defer to another regulatory program.

The decision analysis process potentially applies to all sites initially identified in the Vieques Environmental Restoration Program. For the purposes of the SI, it is assumed that Laguna La Chiva is potentially CERCLA-eligible.

Data Quality Assessment (Step 2 of Figure 5)

The data quality assessment is performed via the DQE (see **Worksheet #37**). The resulting PQO statement is:

- If the DQE indicates the data are available and usable for the intended purpose, then perform the release assessment (see Steps 3 and 4); otherwise, collect sufficient additional samples to achieve an available and useful data set.

SAP Worksheet #11—Project Quality Objectives/Systematic Planning Process Statements (continued)

Release Assessment (Steps 3 and 4 of Figure 5)

The PQO statements for release assessment are:

- If pesticides, VOCs, or SVOCs are detected, then a release potentially occurred; otherwise, make a final evaluation of the adequacy of the data set (see Step 7).
- If a release potentially occurred, then determine if it is CERCLA-related; otherwise, make a final evaluation of the adequacy of the data set (see Step 7).
- If the release is CERCLA-related, then determine if the release warrants further investigation or action (see Steps 5 and 6); otherwise, make a final evaluation of the adequacy of the data set (see Step 7).

A "CERCLA-related release" is a release of hazardous substances, pollutants, and contaminants eligible for CERCLA response as defined in CERCLA Sections 101(14) and 101(33). Examples of constituents that may be detected at sites but may not be CERCLA-related include pesticides, as discussed in Section 1.1.1 of the Final SI/ESI Report (CH2M HILL, 2010b). Determination of whether any pesticides detected in Laguna La Chiva are the result of normal pesticide application or a CERCLA-related release will be done using a multiple-lines-of-evidence approach. These lines of evidence will include, but not necessarily be limited to:

a. Comparison of pesticide concentrations detected in Laguna La Chiva to pesticide concentrations detected in other lagoons (e.g., Laguna Kiani) or sediment samples (e.g., from AOC H) on Vieques to help determine if concentrations in Laguna La Chiva are comparable to concentrations observed elsewhere and attributed to normal pesticide application.
b. Spatial evaluation of pesticide concentrations in Laguna La Chiva with the pesticide concentrations detected in soil adjacent to the lagoon to help determine if pesticides applied to the land area as part of normal use may have been transported with runoff into the lagoon. Determination of whether pesticides in soil are likely from normal application will be accomplished in accordance with the multiple-lines-of-evidence approach used for other sites in the release assessment phase of investigation (see Section 1.1.1 of CH2M HILL, 2010b).
c. Evaluation of any pattern of pesticide concentrations in sediment samples collected adjacent to the ephemeral stream discharge points to help determine if there may have been historical releases of pesticides from SWMU 1 that were transported with runoff via the ephemeral streams to the lagoon.
d. Evaluation of any pattern of pesticide concentrations in sediment samples collected adjacent to drum locations to determine if releases from the drums may have occurred.
e. Evaluation of pesticide vertical profile information from locations where both shallow and deep sediment samples are collected to help determine whether higher concentrations are observed in sediments that may have been present when historical spraying or releases from SWMU 1 could have occurred.
f. Evaluation of the spatial distribution of pesticide concentrations across the lagoon to determine if it suggests relative uniformity or points toward a potential source(s).

Further Investigation or Action Determination (Steps 5 and 6 of Figure 5)

Once a potential CERCLA-related release is suspected, the need for further investigation or action is made by evaluating the data with respect to human health and ecological criteria. The PQO statements associated with these steps are:

- If the constituent concentrations exceed human health and/or ecological screening values, then determine if more realistic evaluations can be performed; otherwise (i.e., if no exceedances), make a final evaluation of the adequacy of the data set (see Step 7).

SAP Worksheet #11—Project Quality Objectives/Systematic Planning Process Statements (continued)

- If more realistic evaluations can be performed that suggest no further investigation or action is warranted, then make a final evaluation of the adequacy of the data set (see Step 7); otherwise, make a determination of whether additional source data would permit more realistic evaluations.
- If additional source data would permit more realistic evaluations, then collect the data as part of an Expanded SI and make the more realistic evaluations; otherwise, make a determination of whether an interim action or RI is warranted.
- If interim action is warranted, then perform interim action and collect confirmatory data for evaluation via the decision analysis process; otherwise, prepare an addendum to this SAP to collect data as part of an RI.

Examples of more realistic evaluations are presented in Section 1.1.2 of the Final SI/ESI Report (CH2M HILL, 2010b).

If an RI is conducted, the decision analysis process shown in **Figure 6** represents the RI PQOs for Laguna La Chiva. The general objectives of the decision analysis process are:

– To delineate the nature and extent of contamination

(2) To assess the potential human health and ecological risks

The 4-step decision analysis can be subdivided into five PQO categories, as described below.

Data Quality Assessment (Step 1 of Figure 6)

The data quality assessment is performed via the DQE (see **Worksheet #37**). The resulting PQO statement is:

- If the DQE indicates the data are available and usable for the intended purpose, then evaluate the nature and extent of contamination and associated risks (see Steps 3 and 4); otherwise, collect sufficient additional samples to achieve an available and useful data set.

Nature and Extent Determination (Step 2 of Figure 6)

The PQO statement for nature and extent determination is:

- If the sample data collected as part of the RI, supplemented with relevant sample data from the SI, indicate the nature and extent of contamination have been adequately delineated (i.e., such that risk assessments can be made with sufficient confidence), then quantitatively assess human health and ecological risks; otherwise, collect additional samples to adequately delineate the nature and extent.

Risk Assessments (Step 3 of Figure 6)

Once the nature and extent of contamination have been adequately delineated, quantitative human health and ecological risk assessments are conducted. The PQO statement associated with this step is:

If the concentrations of detected constituents pose potentially unacceptable human health and/or ecological risks, make a determination of whether associated constituent concentrations are site-related; otherwise, prepare an RI Report with recommendation of no further investigation or action.

Determination of Site-relatedness (Step 4 of Figure 6)

If potentially unacceptable human health and/or ecological risks are calculated, then a determination is made as to whether the unacceptable risk is attributable to site-related contamination or non-site-related constituents (including background). The PQO statement associated with this step is:

If potentially unacceptable human health and/or ecological risks are attributable to site-related contamination, make a determination of whether an interim action or feasibility should be conducted; otherwise, prepare an RI Report with the recommendation of no further investigation or action.

This page intentionally left blank.

SAP Worksheet #12—Field Quality Control Samples

(UFP-QAPP Manual Section 2.6.2)

Due to regulator request, all field QC sample information is within **Worksheet #28** and **Worksheet #12** is not applicable.

This page intentionally left blank.

SAP Worksheet #13—Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation / collection dates)	How Data Will Be Used	Limitations on Data Use
NOAA pesticide results	An Ecological Characterization of the Marine Resources of Vieques, Puerto Rico Part II Field Studies of Habitats, Nutrients, Contaminants, Fish, and Benthic Communities (NOAA, 2010)	Generator: NOAA, pesticide sediment samples collected October 2007	Data used qualitatively as comparison to data to be collected as part of this SAP	Data 4 years old; not collected as part of CERCLA process; sampling/analytical protocol not reviewed/approved by regulatory agencies
SWMU 1 ephemeral stream pesticide results	Streamlined Remedial Investigation/ Feasibility Study Report Solid Waste Management Unit 1 (SWMU 1) Former Vieques Naval Training Range, Vieques, Puerto Rico (CH2M HILL, 2011)	NAVFAC, ephemeral stream pesticide sample data, March 2009	Used to help evaluate potential pesticide migration from landfill to Laguna La Chiva.	None

This page intentionally left blank.

SAP Worksheet #14—Summary of Project Tasks

The *SOPPPs* (CH2M HILL, 2010a) address the protocols and standard operating procedures (SOPs) to be used for this investigation. The proposed field activities for Laguna La Chiva are discussed below. The technical approach and sample design for the proposed field activities are discussed in **Worksheet #17.**

Mobilization

Prior to mobilization, NAVFAC Atlantic, USEPA, PREQB, and USFWS will be notified to allow for appropriate oversight coordination.

As part of the field mobilization, CH2M HILL will procure the following subcontractors to support investigation activities.

- Analytical laboratory
- Data Validation

Mobilization for the field effort includes procurement of necessary field equipment and initial transport to the site. Equipment and supplies will be brought to the site when the field team mobilizes for field activities.

Sample Location Mark-out

Sample locations were agreed to during the March 14, 2012 site visit. At that time GPS coordinates were collected for samples to be collected at NOAA former sample locations 46P and 47P. Other locations were marked in the field on a map at locations agreed by consensus with regulators.

Soil Sampling

Three discrete surface soil samples will be collected from within areas identified as potential land crab area habitat: These discrete surface soil samples will be collected following SOP A2 from the top 24-inches or to the top of the water table or bedrock whichever is shallower from locations SS01, SS05 and SS07. Four discrete surface soil samples will be collected from within areas identified as not being land crab area habitat: These discrete surface soil samples will be collected from the top 12-inches or to the top of the water table or bedrock whichever is shallower from locations SS02, SS03, SS04, and SS06.

Sediment Sampling

At the twelve sediment sampling locations, a total of sixteen sediment samples will be collected following the Vieques Master Protocol SOP G2 (sediment sampling). Depending on the depth of the water, sediments will either be sampled from a canoe or from waders.

Sample Analysis

Details of the laboratory analysis are included in **Worksheet #28**.

The laboratory will maintain, test, inspect, and calibrate analytical instruments (**Worksheet #24** and **#25**). The laboratory will analyze soil and sediment samples for various groups of parameters as shown on **Worksheets #15** and **#18**.

Surface Water Sampling

If the study progresses to an RI, discrete surface water samples will be collected at, or in close proximity to the 12 locations in the lagoon where sediment samples were collected in Phase 1. Depending on the depth of the water, surface water will either be sampled from a canoe or from waders, making an attempt not to suspend sediment in the surface water sampled.

Details of the laboratory analysis will be included in an addendum in **Worksheet #28**.

SAP Worksheet #14—Summary of Project Tasks (continued)

Biota Sampling

As part of the RI phase, edible fish and edible blue crabs will be sampled for the HHRA. Samples consisting of eight edible whole-body fish (gutted) and eight edible whole-body blue crabs from the lagoon will be collected. Details of the laboratory analysis will be included in an addendum in **Worksheet #28**.

Equipment Decontamination

Equipment decontamination will follow the Master Protocols SOP E-1.

Investigation-Derived Waste Management

It is not anticipated that IDW will be generated.

Shipments

All offsite analytical samples will be delivered to the laboratory by FedEx. All samples will be shipped in accordance with the Master SOP H-5 “Packaging and Shipping Procedures for Samples Not Considered Dangerous Goods.”

Quality Control

All quality control samples are listed on **Worksheet #20**. In reference to the field tasks, field work will be overseen by a field team leader, or his delegate, who is responsible for the quality control of the sampling and make sure the proper SOPs are followed for each task.

Data Management

The project chemist, Mike Zamboni, is responsible for data tracking and storage. In addition a third party data validator will receive all analytical data from the laboratory and the data will be validated prior to its use by the Navy. All validated analytical data will be loaded into the NIRIS database.

Procedures for Recording and Correcting Data

Field data will be recorded in field logbooks.

Project Assessment/Audit: **Worksheets #31** and **#32**

Data Validation: **Worksheets #35** and **#36**

Data Usability Assessment: **Worksheet #37**.

SAP Worksheet #15-1—Field Sampling Requirements Table

(UFP-QAPP Manual Section 2.8.1)
Matrix: SD
Analytical Group: VOC

Analyte[1]	CAS No.[1]	RSLs Residential Soil Adjusted[2,6] (µg/kg)	RSLs Industrial Soil Adjusted[2,6] (µg/kg)	Marine Sediment ESVs[3,6] (µg/kg)	Project QL Goal[4] (µg/kg)	Laboratory Specific Limits[5,7] (µg/kg)			A/P Limits (%)		
						LOQs	LODs	DLs	LCL	UCL	%RPD
Dichlorodifluoromethane (Freon-12)	75-71-8	9400	40000	NC	4700	1.0	1.0	0.60	35	135	30
Chloromethane	74-87-3	12000	50000	NC	6000	1.0	1.0	0.60	50	130	30
Vinyl chloride	75-01-4	60	1700	NC	30	1.0	1.0	0.40	60	125	30
Bromomethane	74-83-9	730	3200	NC	365	1.0	1.0	0.80	30	160	30
Chloroethane	75-00-3	1500000	2100000	NC	750000	1.0	1.0	0.50	40	155	30
Trichlorofluoromethane(Freon-11)	75-69-4	79000	340000	NC	39500	1.0	1.0	0.50	25	185	30
1,1-Dichloroethene	75-35-4	24000	110000	NC	12000	1.0	1.0	0.60	65	135	30
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	76-13-1	910000	910000	NC	455000	1.0	1.0	0.60	70	130	30
Acetone	67-64-1	6100000	63000000	NC	3050000	25	12	0.80	20	160	30
Carbon disulfide	75-15-0	82000	370000	NC	41000	5.0	5.0	1.4	45	160	30
Methyl acetate	79-20-9	7800000	29000000	NC	3900000	10	5.0	1.6	70	130	30
Methylene chloride	75-09-2	36000	310000	NC	18000	10	5.0	0.60	55	140	30
trans-1,2-Dichloroethene	156-60-5	15000	69000	NC	7500	1.0	1.0	0.70	65	135	30
Methyl-tert-butyl ether (MTBE)	1634-04-4	43000	220000	NC	21500	1.0	1.0	0.30	58	123	30
1,1-Dichloroethane	75-34-3	3300	17000	NC	1650	1.0	1.0	0.60	75	125	30
cis-1,2-Dichloroethene	156-59-2	16000	200000	NC	8000	1.0	1.0	0.50	65	125	30
2-Butanone	78-93-3	2800000	20000000	NC	1400000	5.0	2.5	1.4	30	160	30
Bromochloromethane	74-97-5	16000	68000	NC	8000	1.0	1.0	0.30	70	125	30
Chloroform	67-66-3	290	1500	NC	145	1.0	1.0	0.40	70	125	30
1,1,1-Trichloroethane	71-55-6	640000	640000	NC	320000	1.0	1.0	0.40	70	135	30
Cyclohexane	110-82-7	120000	120000	NC	60000	2.0	1.0	0.50	70	130	30

SAP Worksheet #15-1—Field Sampling Requirements Table (continued)

(UFP-QAPP Manual Section 2.8.1)
Matrix: SD
Analytical Group: VOC

Analyte[1]	CAS No.[1]	RSLs Residential Soil Adjusted[2,6] (µg/kg)	RSLs Industrial Soil Adjusted[2,6] (µg/kg)	Marine Sediment ESVs[3,6] (µg/kg)	Project QL Goal[4] (µg/kg)	Laboratory Specific Limits[5,7] (µg/kg)			A/P Limits (%)		
						LOQs	LODs	DLs	LCL	UCL	%RPD
Carbon tetrachloride	56-23-5	610	3000	NC	305	1.0	1.0	0.60	65	135	30
Benzene	71-43-2	1100	5400	NC	550	1.0	1.0	0.40	75	125	30
1,2-Dichloroethane	107-06-2	430	2200	NC	215	1.0	1.0	0.30	70	135	30
Trichloroethene	79-01-6	440	2000	41	20.5	1.0	1.0	0.50	75	125	30
Methylcyclohexane	108-87-2	NC	NC	NC	N/A	2.0	1.0	0.30	70	130	30
1,2-Dichloropropane	78-87-5	940	4700	NC	470	1.0	1.0	0.60	70	120	30
Bromodichloromethane	75-27-4	270	1400	NC	135	1.0	1.0	0.40	70	130	30
cis-1,3-Dichloropropene	10061-01-5	1700	8300	NC	850	1.0	1.0	0.30	70	125	30
4-Methyl-2-pentanone	108-10-1	530000	3400000	NC	265000	5.0	2.5	1.4	45	145	30
Toluene	108-88-3	500000	820000	NC	250000	1.0	1.0	0.50	70	125	30
trans-1,3-Dichloropropene	10061-02-6	1700	8300	NC	850	1.0	1.0	0.30	65	125	30
1,1,2-Trichloroethane	79-00-5	160	680	NC	80	1.0	1.0	0.60	60	125	30
Tetrachloroethene	127-18-4	8600	41000	57	28.5	1.0	1.0	0.30	65	140	30
2-Hexanone	591-78-6	21000	140000	NC	10500	5.0	2.5	0.90	45	145	30
Dibromochloromethane	124-48-1	680	3300	NC	340	1.0	1.0	0.20	65	130	30
1,2-Dibromoethane	106-93-4	34	170	NC	17	1.0	1.0	0.30	70	125	30
Chlorobenzene	108-90-7	29000	140000	NC	14500	1.0	1.0	0.50	75	125	30
Ethylbenzene	100-41-4	5400	27000	4	2	1.0	1.0	0.60	75	125	30
o-Xylene	95-47-6	69000	300000	NC	34500	1.0	1.0	0.50	75	125	30
m- and p-Xylene	m&pXYLENE	59000	250000	NC	29500	2.0	2.0	1.0	80	125	30
Styrene	100-42-5	630000	870000	NC	315000	1.0	1.0	0.40	75	125	30
Bromoform	75-25-2	62000	220000	NC	31000	1.0	1.0	0.30	55	135	30
Isopropylbenzene	98-82-8	210000	270000	NC	105000	1.0	1.0	0.50	75	130	30

SAP Worksheet #15-1—Field Sampling Requirements Table (continued)

(UFP-QAPP Manual Section 2.8.1)
Matrix: SD
Analytical Group: VOC

Analyte[1]	CAS No.[1]	RSLs Residential Soil Adjusted[2,6] (µg/kg)	RSLs Industrial Soil Adjusted[2,6] (µg/kg)	Marine Sediment ESVs[3,6] (µg/kg)	Project QL Goal[4] (µg/kg)	Laboratory Specific Limits[5,7] (µg/kg)			A/P Limits (%)		
						LOQs	LODs	DLs	LCL	UCL	%RPD
1,1,2,2-Tetrachloroethane	79-34-5	560	2800	NC	280	1.0	1.0	0.30	55	130	30
1,3-Dichlorobenzene	541-73-1	NC	NC	NC	N/A	1.0	1.0	0.40	70	125	30
1,4-Dichlorobenzene	106-46-7	2400	12000	110	55	1.0	1.0	0.40	70	125	30
1,2-Dichlorobenzene	95-50-1	190000	380000	13	6.5	1.0	1.0	0.40	75	120	30
1,2-Dibromo-3-chloropropane	96-12-8	5.4	69	NC	2.7	1.0	1.0	0.30	40	135	30
1,2,4-Trichlorobenzene	120-82-1	6200	27000	4.8	2.4	1.0	1.0	0.60	65	130	30
1,2,3-Trichlorobenzene	87-61-6	4900	49000	NC	2450	1.0	1.0	0.80	60	135	30

Notes:
1. TCL from SOM01 (no 1,4-Dioxane). Some CAS numbers are contractor-specific.
2. RSLs presented are current as of November, 2012.
3. Marine Sediment ESVs are current as of August, 2010.
4. The PQL Goal is 1/2 the lesser of applicable screening levels.
5. LOQs and LODs presented are as defined by DoD QSM.
6. "NC" - No screening level in this set; If compound has no screening levels, then results are used for presence/absence unless a screening level is established in the future.
7. Results for non-aqueous samples are reported on a dry-weight basis.

DoD QSM v. 4.1 limits are not available. Nominal limits are provided.
DoD QSM v. 4.1 limits are not available. Statistical limits are provided.

SAP Worksheet #15-2—Field Sampling Requirements Table

(UFP-QAPP Manual Section 2.8.1)
Matrix: SD
Analytical Group: SVOC

Analyte[1]	CAS No.	RSLs Residential Soil Adjusted[2,6] (µg/kg)	RSLs Industrial Soil Adjusted[2,6] (µg/kg)	Marine Sediment ESVs[3,6] (µg/kg)	Project QL Goal[4] (µg/kg)	Laboratory Specific Limits[5,7] (µg/kg)			A/P Limits (%)		
						LOQs	LODs	DLs	LCL	UCL	%RPD
Benzaldehyde	100-52-7	780000	1200000	NC	390000	330	100	99	60	83	30
Phenol	108-95-2	1800000	18000000	420	210	330	100	76	40	100	30
bis(2-Chloroethyl)ether	111-44-4	210	1000	NC	105	330	100	92	40	105	30
2-Chlorophenol	95-57-8	39000	510000	NC	19500	330	100	82	45	105	30
2-Methylphenol	95-48-7	310000	3100000	63	31.5	330	100	70	40	105	30
2,2'-Oxybis(1-chloropropane)	108-60-1	4600	22000	NC	2300	330	100	82	20	115	30
Acetophenone	98-86-2	780000	2500000	NC	390000	330	100	83	52	86	30
3 & 4-Methylphenol	106-44-5	610000	6200000	670	335	330	200	160	40	105	30
n-Nitroso-di-n-propylamine	621-64-7	69	250	NC	34.5	330	100	90	40	115	30
Hexachloroethane	67-72-1	4300	43000	73	36.5	330	100	74	35	110	30
Nitrobenzene	98-95-3	4800	24000	21	10.5	330	100	79	40	115	30
Isophorone	78-59-1	510000	1800000	NC	255000	330	100	72	45	110	30
2-Nitrophenol	88-75-5	39000	510000	NC	19500	330	100	78	40	110	30
2,4-Dimethylphenol	105-67-9	120000	1200000	29	14.5	330	100	74	30	105	30
bis(2-Chloroethoxy)methane	111-91-1	18000	180000	NC	9000	330	100	64	45	110	30
2,4-Dichlorophenol	120-83-2	18000	180000	NC	9000	330	100	71	45	110	30
4-Chloroaniline	106-47-8	2400	8600	NC	1200	330	100	92	10	100	30
Hexachlorobutadiene	87-68-3	6100	22000	1.3	0.65	330	100	80	40	115	30
Caprolactam	105-60-2	3100000	31000000	NC	1550000	330	200	100	14	125	30
4-Chloro-3-methylphenol	59-50-7	610000	6200000	NC	305000	330	100	67	45	115	30
Hexachlorocyclopentadiene	77-47-4	37000	370000	NC	18500	330	100	93	24	120	30

SAP Worksheet #15-2—Field Sampling Requirements Table (continued)

(UFP-QAPP Manual Section 2.8.1)
Matrix: SD
Analytical Group: SVOC

Analyte[1]	CAS No.	RSLs Residential Soil Adjusted[2,6] (µg/kg)	RSLs Industrial Soil Adjusted[2,6] (µg/kg)	Marine Sediment ESVs[3,6] (µg/kg)	Project QL Goal[4] (µg/kg)	Laboratory Specific Limits[5,7] (µg/kg)			A/P Limits (%)		
						LOQs	LODs	DLs	LCL	UCL	%RPD
2,4,6-Trichlorophenol	88-06-2	6100	62000	6	3	330	100	60	45	110	30
2,4,5-Trichlorophenol	95-95-4	610000	6200000	3	1.5	330	100	58	50	110	30
1,1-Biphenyl	92-52-4	5100	21000	17	8.5	330	100	95	64	87	30
2-Nitroaniline	88-74-4	61000	600000	NC	30500	330	100	67	45	120	30
Dimethyl phthalate	131-11-3	NC	NC	6	3	330	100	62	50	110	30
2,6-Dinitrotoluene	606-20-2	6100	62000	549	274.5	330	100	69	50	110	30
3-Nitroaniline	99-09-2	NC	NC	NC	N/A	330	100	74	25	110	30
2,4-Dinitrophenol	51-28-5	12000	120000	NC	6000	330	300	120	15	130	30
4-Nitrophenol	100-02-7	4800	24000	NC	2400	330	100	82	15	140	30
Dibenzofuran	132-64-9	7800	100000	110	55	330	100	66	50	105	30
2,4-Dinitrotoluene	121-14-2	1600	5500	NC	800	330	100	72	50	115	30
Diethylphthalate	84-66-2	4900000	49000000	6	3	330	100	75	50	115	30
4-Chlorophenyl-phenylether	7005-72-3	31000	310000	NC	15500	330	100	67	45	110	30
4-Nitroaniline	100-01-6	24000	86000	NC	12000	330	100	82	35	115	30
4,6-Dinitro-2-methylphenol	534-52-1	490	4900	NC	245	330	300	130	30	135	30
N-nitrosodiphenylamine	86-30-6	99000	350000	28	14	330	200	140	50	115	30
1,2,4,5-Tetrachlorobenzene	95-94-3	1800	18000	NC	900	330	100	69	59	81	30
4-Bromophenyl-phenylether	101-55-3	NC	NC	NC	N/A	330	100	73	45	115	30
Hexachlorobenzene	118-74-1	300	1100	6	3	330	100	81	45	120	30
Atrazine	1912-24-9	2100	7500	NC	1050	330	100	74	45	120	30
Pentachlorophenol	87-86-5	890	2700	360	180	330	300	140	25	120	30
Carbazole	86-74-8	NC	NC	NC	N/A	330	100	68	45	115	30
Di-n-butylphthalate	84-74-2	610000	6200000	58	29	330	100	79	55	110	30

SAP Worksheet #15-2—Field Sampling Requirements Table (continued)

(UFP-QAPP Manual Section 2.8.1)

Matrix: SD

Analytical Group: SVOC

Analyte[1]	CAS No.	RSLs Residential Soil Adjusted[2,6] (µg/kg)	RSLs Industrial Soil Adjusted[2,6] (µg/kg)	Marine Sediment ESVs[3,6] (µg/kg)	Project QL Goal[4] (µg/kg)	Laboratory Specific Limits[5,7] (µg/kg)			A/P Limits (%)		
						LOQs	LODs	DLs	LCL	UCL	%RPD
Butylbenzylphthalate	85-68-7	260000	910000	63	31.5	330	100	93	50	125	30
3,3'-Dichlorobenzidine	91-94-1	1100	3800	NC	550	330	100	91	10	130	30
bis(2-Ethylhexyl)phthalate	117-81-7	35000	120000	182	91	330	100	85	45	125	30
Di-n-octylphthalate	117-84-0	73000	740000	61	30.5	330	100	67	40	130	30
2,3,4,6-Tetrachlorophenol	58-90-2	180000	1800000	NC	90000	330	200	74	18	98	30

Notes:

Shading indicates SLs for which the LOD > SL. Refer to Worksheet #11 section "what are the PALs".

1. TCL from SOM01 minus PAHs.
2. RSLs presented are current as of November, 2012.
3. Marine Sediment ESVs are current as of August, 2010.
4. The PQL Goal is 1/2 the lesser of applicable screening levels.
5. LOQs and LODs presented are as defined by DoD QSM.
6. "NC" - No screening level in this set; If compound has no screening levels, then results are used for presence/absence unless a screening level is established in the future.
7. Results for non-aqueous samples are reported on a dry-weight basis.

DoD QSM v. 4.1 limits are not available. Nominal limits are provided.

DoD QSM v. 4.1 limits are not available. Statistical limits are provided.

SAP Worksheet #15-3—Field Sampling Requirements Table

(UFP-QAPP Manual Section 2.8.1)
Matrix: SS, SD
Analytical Group: PEST

Analyte[1]	CAS No.	RSLs Residential Soil Adjusted[2] (µg/kg)	RSLs Industrial Soil Adjusted[2] (µg/kg)	Soil ESVs[3] (µg/kg)	SD Marine ESVs[3] (µg/kg)	Project QL Goal[4] (µg/kg)	Laboratory Specific Limits[5,6] (µg/kg)			A/P Limits (%)		
							LOQs	LODs	DLs	LCL	UCL	%RPD
4,4'-DDD	72-54-8	2000	7200	583	1.22	0.61	1.7	1.0	0.48	30	135	30
4,4'-DDE	72-55-9	1400	5100	114	2.2	1.1	1.7	1.0	0.52	70	125	30
4,4'-DDT	50-29-3	1700	7000	100	1.9	0.95	1.7	1.0	0.66	45	140	30

Notes:
1. TCL is DDT and breakdown products from SOM01.
2. RSLs presented are current as of November, 2012.
3. Soil ESVs and SD Marine ESVs are current as of August, 2010.
4. The PQL Goal is 1/2 the lesser of applicable screening levels.
5. LOQs and LODs presented are as defined by DoD QSM.
6. Results for non-aqueous samples are reported on a dry-weight basis.

SAP Worksheet #15-4—Field Sampling Requirements Table

(UFP-QAPP Manual Section 2.8.1)
Matrix: SS, SD
Analytical Group: GRAINSIZE

Analyte	CAS No.[1]	Units[2]
GS03 Sieve 3" (75 mm)	SIEVE75.0	% Passing
GS05 Sieve 2" (50 mm)	SIEVE50.0	% Passing
GS06 Sieve 1.5" (37.5 mm)	SIEVE37.5	% Passing
GS07 Sieve 1" (25.0 mm)	SIEVE25.0	% Passing
GS08 Sieve 0.75" (19.0 mm)	SIEVE19.0	% Passing
GS10 Sieve 0.375" (9.5 mm)	SIEVE9.5	% Passing
Sieve No. 004 (4.75 mm)	SIEVE4.75	% Passing
Sieve No. 010 (2.00 mm)	SIEVE2.0	% Passing
Sieve No. 020 (850 um)	SIEVE850	% Passing
Sieve No. 040 (425 um)	SIEVE425	% Passing
Sieve No. 060 (250 um)	SIEVE250	% Passing
Sieve No. 140 (106 um)	SIEVE106	% Passing
Sieve No. 200 (75um)	SIEVE75	% Passing
Gravel (%)	GRAVEL	%
Sand (%)	14808-60-7	%
Coarse Sand (%)	COARSESAND	%
Medium Sand (%)	MEDIUMSAND	%
Fine Sand (%)	FINESAND	%
Fines (%)	FINES	%

Notes:
1. Some CAS numbers are contractor-specific.
2. Results for non-aqueous samples are reported on a dry-weight basis.

SAP Worksheet #15-5—Field Sampling Requirements Table

(UFP-QAPP Manual Section 2.8.1)
Matrix: SS, SD
Analytical Group: WCHEM

Analyte	CAS No.[1]	Units	Laboratory Specific Limits[2,3]		
			LOQs	LODs	DLs
pH	PH	pH units	N/A	N/A	N/A
Total Organic Carbon (TOC)	TOC	mg/kg	500	500	500

Notes:
1. Some CAS numbers are contractor-specific.
2. LOQs and LODs presented are as defined by DoD QSM.
3. Results for non-aqueous samples are reported on a dry-weight basis.

This page intentionally left blank.

SAP Worksheet #16—Project Schedule/Timeline Table (optional format)

The Laguna La Chiva investigation will be implemented in accordance with the schedule provided in the FY13 Site Management Plan (CH2M HILL, 2012), amended as necessary with concurrence among the stakeholder agencies.

This page intentionally left blank.

SAP Worksheet #17—Sampling Design and Rationale

Phased Approach

The general approach for the Laguna La Chiva investigation is to characterize media in two phases, if needed. Phase 1 is the SI and includes characterization of surface soil in the vicinity of Laguna La Chiva and shallow and deep sediment in Laguna La Chiva. If the results of the Phase 1 sampling indicate the pesticide (and/or other contaminants) concentrations in the lagoon sediment are indicative of a CERCLA-related release posing potentially unacceptable risks to human health and/or the environment, the lagoon will be identified as an environmental site and an RI will be conducted (unless it is determined an interim action should be implemented before or instead of an RI [e.g., localized area of contamination that can be removed, thereby obviating the need for an RI]).

Phase 2 is the RI and would likely include data collection for human health and ecological risk assessments including surface water, edible fish and crab tissue sampling, and sediment toxicity testing. Because any sampling conducted for an RI would be based on the findings of the SI, the information provided herein for RI sampling may be modified via an addendum to this SAP once the SI data are evaluated and discussed among the Vieques Technical Subcommittee members.

Sampling Rationale, Method and Approach

Phase 1 (Site Inspection)

As noted in **Worksheet #10**, sediment samples will be collected from 12 locations across Laguna La Chiva (**Figure 4**) in accordance with the applicable Vieques SOPs (CH2M HILL, 2010a). The number, type and location of samples were discussed and agreed upon as being sufficient by all regulatory stakeholders at the February 22/March 14, 2012 project scoping sessions and October 2012 Technical Subcommittee meeting. The rationale for the locations, depths, and analyses of the samples is as follows:

All 12 locations were selected to provide broad spatial coverage across the lagoon to help determine if there are any patterns of pesticide (or other contaminants) distribution. At all locations, sediment will be collected from the top 6 inches (in accordance with Vieques protocol).

Sample locations VENOSD001, 002, 003, and 012 were placed to help evaluate potential transport of contaminants (primarily pesticides) from SWMU 1 or surrounding areas to the lagoon via the western ephemeral stream. Similarly, sample locations VENOSD011, 010, and 009 were placed to perform the same function for the eastern ephemeral stream.

Sample locations VENOSD002 003, and 012 were also placed to help evaluate potential releases from drums observed in those areas. Sample locations VENOSD003 and 012 will be adjusted in the field, as necessary, to be collected in areas having overlying water and in closest proximity to their respective target drums.

Sample locations VENOSD004,005, 007, and 008 were placed to help confirm the historical pesticide concentrations reported by NOAA.

Sample location VENOSD006 was placed to evaluate sediment (together with sample VENOSD007) near the planned fishing spot on the bridge across the southern arm of the lagoon.

At four of the sediment sampling locations, corresponding to where the western ephemeral stream enters the lagoon (VENOSD001, as shown in **Figure 4**); where the eastern ephemeral stream enters the lagoon (VENOSD011); where the majority of the drum remnants were observed (VENOSD002); and where the highest concentrations of pesticides were detected in NOAA's samples (VENOSD004), both shallow (top 6 inches) and deep (6 to 12 inches) sediment samples will be collected to evaluate whether there may be higher concentrations in the deeper sediments, potentially corresponding to sediment present at or closer to the surface when the Navy training activities (including normal pesticide application to control mosquitoes) were taking place.

SAP Worksheet #17—Sampling Design and Rationale (continued)

All sediment samples will be analyzed for pesticides based on the historical sediment data collected by NOAA. Also based on the historical sediment data collected by NOAA and because of the potential presence of other contaminants of interest associated with drum disposal, samples will also be analyzed for VOCs and SVOCs (less

PAHs). See *Site Background and Investigation History* in **Worksheet #10** for the rationale for why there are no other potential contaminants of interest. Samples will also be analyzed for TOC and grain size to aid in the evaluation of the data with respect to potential ecological risk.

In addition to the sediment samples, seven surface soil samples will be collected in areas surrounding the lagoon (**Figure 4**) and analyzed for pesticides to help determine if normal pesticide application adjacent to the lagoon may have occurred. The soil samples will be collected in accordance with standard Vieques protocols and SOPs (CH2M HILL, 2010a) and analyzed for pesticides. If pesticides are found in the surrounding soil, transport of pesticides from the surrounding soil to the lagoon via runoff may help determine whether the presence of pesticides in the lagoon are from normal application and not a CERCLA-related release (e.g., leaking drums).The locations of the soil samples were selected to provide broad spatial coverage around the lagoon, as well as target specific features. Sample VENOSS01 was placed adjacent to where NOAA detected the highest pesticide concentrations in sediment, and is also within an area where land crabs occur. Land crab habitat occurs within most of the forested lagoon perimeter; however, samples VENOSS005 and 007 will conservatively target land crab habitat within the southern perimeter where historic military training operations frequently occurred and where normal terrestrial pesticide application most likely occurred.

A qualitative biological survey will be conducted of lagoon fish, invertebrates, and aquatic plants that may be available for tissue sampling in Phase 2, if necessary, to support human health and ecological risk assessments.

Phase 2 (RI)

If it is determined that an RI is warranted, Phase 2 sampling will be conducted. While there may be modifications to the approach (via an addendum to this SAP) based on evaluation of the SI data, below is the sampling design and rationale for the RI data collection. Actual locations will be provided in the addendum, as will any necessary modifications to the sampling design and rationale based on evaluation of the SI data:

Data Collection for Human Health Risk Assessment

Soil and sediment data will be available from the Phase 1 sampling event. If an RI is warranted at the site, there are two HHRA objectives for additional sampling of the La Chiva Lagoon:

- To assess whether concentrations of pesticides (DDx) and/or other contaminants in edible-size fish and blue crabs pose a potentially unacceptable risk to fish/blue crab consumers above EPA-acceptable levels
- To assess whether concentrations of pesticides (DDx) and/or other contaminants in surface water pose a potentially unacceptable risk to recreational users/trespassers/site visitors above EPA-acceptable levels

To meet these objectives, samples of surface water, whole-body fish (gutted), and whole-body blue crab will be collected as part of the Phase 2 sampling, as follows:

Surface Water

- Discrete sampling of surface water at, or in close proximity to, several of the locations where sediment samples are collected in Phase 1.

Edible Fish and Edible Blue Crabs

- Sampling of eight edible whole-body fish (gutted) and eight edible whole-body blue crabs from Laguna La Chiva.

The goal of fish/blue crab sampling is to collect edible-size fish/blue crabs that may be consumed by anglers/crabbers in the lagoon, and use these data to evaluate fish/blue crab consumption scenarios. Results of

SAP Worksheet #17—Sampling Design and Rationale (continued)

the Phase 1 qualitative biological survey will be used to specify target fish to be sampled in Phase 2, and will support planning for methods of capture. Fish/blue crab will be collected with a variety of nets including cast nets, seines, traps, and gill nets. The collection of fish/blue crab will be targeted in areas representative of the entire lagoon and not specific locations since fish and blue crab are highly mobile.

Data Collection for Ecological Risk Assessment

There are two ERA objectives for additional sampling of the La Chiva Lagoon:

- To assess whether pesticides (DDx) and/or other contaminants in sediment are actually causing toxicity in benthic organisms.
- To determine if actual concentrations of pesticides (DDx) and/or other contaminants in fish and benthic organisms may pose an unacceptable risk to the foraging birds and mammals.

To meet these objectives, samples for sediment toxicity testing, benthic organism tissue, and fish tissue analysis will be collected as part of the Phase 2 sampling.

Sediment Toxicity Testing

Laboratory sediment toxicity testing is a standard tool for evaluating the actual toxicity of site sediment. Key elements of the sediment toxicity evaluation are as follows:

- Sediment used in toxicity testing will be collected from up to 6 of the 12 locations sampled in Phase 1. Selected locations will represent the range of sediment pesticide (DDx) and/or other contaminant concentrations. Co-located sediment samples for DDx and/or other contaminant analysis will be collected with the toxicity test samples to confirm the concentrations present in the tested sediment.
- Laboratory toxicity testing will be done in accordance with Methods for Assessing the Chronic Toxicity of Marine and Estuarine Sediment-associated Contaminants with the Amphipod *Leptocheirus plumulosus*, First Edition (EPA and U.S. Army Corps of Engineers, 2001).

Fish and Invertebrate Tissue Sampling

The goal of tissue sampling would be to collect organisms likely used as a food source for aquatic wildlife that forage in the lagoon, and use these data in the food web model. Results of the Phase 1 qualitative biological survey will be used to specify target fish, invertebrates, and aquatic plants and algae to be sampled in Phase 2, and will support planning for methods of capture.

Target wildlife receptors and associated general food source organisms proposed to be sampled are as follows:

- Green heron (aquatic avian invertivore/piscivore) - macroinvertebrates (e.g., fiddler crabs); small fish (e.g., small mojarra)
- Spotted sandpiper (aquatic avian invertivore) – small infaunal benthic organisms (e.g., polychaetes)
- Cave swallow (aerial avian insectivore) - small infaunal benthic organisms as a surrogate for emerging aquatic insects
- White-cheeked pintail – (protected species - aquatic avian omnivore) - small infaunal benthic organisms (e.g., polychaetes), macroinvertebrates (e.g., fiddler crabs), aquatic plants and algae
- Fishing bat (mammalian piscivore) - small fish (e.g., mojarra)
- Velvet free-tailed bat (aerial mammalian insectivore)- small infaunal benthic organisms as a surrogate for emerging aquatic insects

SAP Worksheet #17—Sampling Design and Rationale (continued)

Macroinvertebrate and infaunal benthic organisms will be collected from eight locations within the lagoon. Preference will be given to shallow water areas (approximately 6-12 inches of water) since this best represents the zone in which small wading birds would forage for invertebrates; however, fiddler crabs from above the water line may also be collected. Invertebrates will be collected by shoveling small amounts of shallow sediment into a sieve, washing with site water, and retaining collected specimens.

Aquatic plants and algae will be collected by hand with small nets or scraping hard substrates such as logs. Samples will be collected from eight locations within the lagoon.

Fish will be collected with a variety of nets including cast nets, seines, traps, and gill nets. The collection of fish will be targeted in areas representative of the entire lagoon and not specific locations since fish are highly mobile. The analytical protocol for Phase 2 will be based on the results of Phase 1, up to and including the same as those for Phase 1 plus percent lipids. A SAP addendum will be written documenting specific protocols if Phase 2 sampling is warranted.

It is assumed that the distribution of SI sediment sampling locations will be sufficient for determining not only whether a release has occurred, but, if so, will be sufficient for delineating sediment contaminant nature and extent. However, if additional sediment samples are deemed necessary to sufficiently delineate the nature and extent of contamination in sediment, they will be collected during Phase 2.

SAP Worksheet #18—Location-Specific Sampling Methods/SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

Sampling Location / ID Number	Matrix	Depth	Analytical Group	Number of Samples[1, 2]	Sampling SOP Reference
Vieques East NOAA Surface Soil					
VENO-SS01 / VENO-SS01-0002	SS	0-2' BGS (land crabs)	PEST, WCHEM, GRAINSIZE	1	See Worksheet #21
VENO-SS01 / VENO-SS01P-0002	SS	0-2' BGS (land crabs)	PEST	1 (FD)	
VENO-SS02 / VENO-SS02-0001	SS	0-1' BGS	PEST, WCHEM, GRAINSIZE	1	
VENO-SS02 / VENO-SS02-0001-MS	SS	0-1' BGS	PEST	1 (MS)	
VENO-SS02 / VENO-SS02-0001-SD	SS	0-1' BGS	PEST	1 (MSD)	
VENO-SS03 / VENO-SS03-0001	SS	0-1' BGS	PEST, WCHEM, GRAINSIZE	1	
VENO-SS04 / VENO-SS04-0001	SS	0-1' BGS	PEST, WCHEM, GRAINSIZE	1	
VENO-SS05 / VENO-SS05-0002	SS	0-2' BGS (land crabs)	PEST, WCHEM, GRAINSIZE	1	
VENO-SS06 / VENO-SS06-0001	SS	0-1' BGS	PEST, WCHEM, GRAINSIZE	1	
VENO-SS07 / VENO-SS07-0002	SS	0-2' BGS (land crabs)	PEST, WCHEM, GRAINSIZE	1	

SAP Worksheet #18—Location-Specific Sampling Methods/SOP Requirements Table (continued)

(UFP-QAPP Manual Section 3.1.1)

Sampling Location / ID Number	Matrix	Depth	Analytical Group	Number of Samples[1, 2]	Sampling SOP Reference
Vieques East NOAA Sediment					
VENO-SD01 / VENO-SD01-000H	SD	0-0.5' BGS	VOC, SVOC, PEST, WCHEM, GRAINSIZE	1	See Worksheet #21
VENO-SD01 / VENO-SD01P-000H	SD	0-0.5' BGS	VOC, SVOC, PEST	1 (FD)	
VENO-SD01 / VENO-SD01-0H01	SD	0.5-1' BGS	VOC, SVOC, PEST, WCHEM, GRAINSIZE	1	
VENO-SD02 / VENO-SD02-000H	SD	0-0.5' BGS	VOC, SVOC, PEST, WCHEM, GRAINSIZE	1	
VENO-SD02 / VENO-SD02-000H-MS	SD	0-0.5' BGS	VOC, SVOC, PEST	1 (MS)	
VENO-SD02 / VENO-SD02-000H-SD	SD	0-0.5' BGS	VOC, SVOC, PEST	1 (MSD)	
VENO-SD02 / VENO-SD02-0H01	SD	0.5-1' BGS	VOC, SVOC, PEST, WCHEM, GRAINSIZE	1	
VENO-SD03 / VENO-SD03-000H	SD	0-0.5' BGS	VOC, SVOC, PEST, WCHEM, GRAINSIZE	1	
VENO-SD04 / VENO-SD04-000H	SD	0-0.5' BGS	VOC, SVOC, PEST, WCHEM, GRAINSIZE	1	
VENO-SD04 / VENO-SD04-0H01	SD	0.5-1' BGS	VOC, SVOC, PEST, WCHEM, GRAINSIZE	1	
VENO-SD05 / VENO-SD05-000H	SD	0-0.5' BGS	VOC, SVOC, PEST, WCHEM, GRAINSIZE	1	
VENO-SD06 / VENO-SD06-000H	SD	0-0.5' BGS	VOC, SVOC, PEST, WCHEM, GRAINSIZE	1	
VENO-SD07 / VENO-SD07-000H	SD	0-0.5' BGS	VOC, SVOC, PEST, WCHEM, GRAINSIZE	1	
VENO-SD07 / VENO-SD07P-000H	SD	0-0.5' BGS	VOC, SVOC, PEST	1 (FD)	
VENO-SD08 / VENO-SD08-000H	SD	0-0.5' BGS	VOC, SVOC, PEST, WCHEM, GRAINSIZE	1	
VENO-SD09 / VENO-SD09-000H	SD	0-0.5' BGS	VOC, SVOC, PEST, WCHEM, GRAINSIZE	1	
VENO-SD10 / VENO-SD10-000H	SD	0-0.5' BGS	VOC, SVOC, PEST, WCHEM, GRAINSIZE	1	
VENO-SD11 / VENO-SD11-000H	SD	0-0.5' BGS	VOC, SVOC, PEST, WCHEM, GRAINSIZE	1	
VENO-SD11 / VENO-SD11-0H01	SD	0.5-1' BGS	VOC, SVOC, PEST, WCHEM, GRAINSIZE	1	
VENO-SD12 / VENO-SD12-000H	SD	0-0.5' BGS	VOC, SVOC, PEST, WCHEM, GRAINSIZE	1	

SAP Worksheet #18—Location-Specific Sampling Methods/SOP Requirements Table (continued)

(UFP-QAPP Manual Section 3.1.1)

Sampling Location / ID Number	Matrix	Depth	Analytical Group	Number of Samples[1, 2]	Sampling SOP Reference
Aqueous Blanks[2]					
VENO-QC / VENO-EB01-MMDDYY-SS	AQ	N/A	PEST	1 (EB)	See Worksheet #21
VENO-QC / VENO-EB01-MMDDYY-SD	AQ	N/A	VOC, SVOC, PEST	1 (EB)	
VENO-QC / VENO-TB01-MMDDYY	AQ	N/A	VOC	1 (TB)	

Notes:

1 For convenience, the location of FDs and MS/MSDs is pre-selected. The field team may collect FDs and MS/MSDs where sample volume is most sufficient. Ideally, the field team shall collect FDs from the "hottest" locations and MS/MSDs from the "coolest" locations. In pratice, the field team must adhere to the frequencies shown on Worksheet #28.

2 This worksheet is prepared based on assumptions (one day of sampling surface soil using decontaminated equipment and one day of sampling sediment using decontaminated equipment). In practice, the field team must adhere to the frequencies shown in Worksheet #28.

This page intentionally left blank.

SAP Worksheet #19—Field Sampling Requirement Table

(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference	Containers	Sample Volume[1]	Preservation Requirements	Maximum Holding Time
SS	PEST	SW-846 8081B / LAB-04, LAB-06	One of 8oz CWM	30g	≤ 6°C but not frozen	14 days / 40 days
SD	VOC	SW-846 8260B / LAB-03	Two of 40mL Vial	5g	DI Water; ≤ 6°C but not frozen	48 hours to freeze / 14 days
			One of 40mL Vial	5g	MeOH; ≤ 6°C but not frozen	14 days
			One of 2oz CWM (if needed[2])	5g	Fill to cpacity; ≤ 6°C but not frozen	48 hours
	SVOC	SW-846 8270D / LAB-04, LAB-05	One of 8oz CWM	30g	≤ 6°C but not frozen	14 days / 40 days
	PEST	SW-846 8081B / LAB-04, LAB-06		30g		14 days / 40 days
SS or SD	WCHEM	SW-846 9045D, Walkley Black / LAB-07, LAB-08	One of 4oz CWM	20g for pH; 1g for TOC	≤ 6°C but not frozen	ASAP (pH); 28 days (TOC)
	GRAINSIZE	ASTM D422 / LAB-09	One of 8oz CWM	120g	N/A	N/A
AQ (blanks)	PEST	SW-846 8081B / LAB-06	Two of 1L Amber	1000mL	≤ 6°C but not frozen	7 days / 40 days
	VOC	SW-846 8260B / LAB-03	Three of 40mL Vial	40mL	HCl to pH < 2; ≤ 6°C but not frozen	14 days
	SVOC	SW-846 8270D / LAB-05	Two of 1L Amber	1000mL	≤ 6°C but not frozen	7 days / 40 days

Notes:

1. Fill to capacity. Minimum amounts are shown.
2. The 2oz jar is needed in the event that SD samples for VOCs cannot be collected properly using the TerraCores syringe. In general, one TerraCore® Sampler will be used per sample, however if one breaks in the middle of sample collection, a second will be used. As per TerraCore® SOP A-6, samples will be extruded immediately upon collection.

This page intentionally left blank.

SAP Worksheet #20—Field Quality Control Sample Summary Table

(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of MS/MSD Pairs	No. of Field Blanks	No. of Equipment Blanks[1]	No. of VOA Trip Blanks	No. of PT Samples	Total No. of Samples to Lab
Vieques East NOAA Surface Soil									
SS	PEST	7	1	1		1			11
	WCHEM	7							7
	GRAINSIZE	7							7
Vieques East NOAA Sediment									
SD	VOC	16	2	1		1	1		22
	SVOC	16	2	1		1			21
	PEST	16	2	1		1			21
	WCHEM	16							16
	GRAINSIZE	16							16

Notes:

1. This worksheet is prepared based on assumptions (one day of sampling surface soil using decontaminated equipment and one day of sampling sediment using decontaminated equipment). In practice, the field team must adhere to the frequencies shown in Worksheet #28.

This page intentionally left blank.

SAP Worksheet #21—Project Sampling SOP References Table

Reference Number	Title, Revision Date and / or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
SOP A-2	Soil Sampling (Reviewed June 2012)	CH2M HILL	Stainless steel hand auger or stainless steel spoon	N	
SOP C-1	Calibration and measurement with Field Instruments (Reviewed June 2012)	CH2M HILL	Multi-parameter surface water monitoring instrument	N	
SOP E-1	Decontamination of Personnel and Equipment (Reviewed June 2012)	CH2M HILL	Decon equipment	N	
SOP G-1	Surface Water Sampling (Reviewed June 2012)	CH2M HILL	Kemmerer or pump	N	
SOP G-2	Sediment Sampling (Reviewed June 2012)	CH2M HILL	Grab sampler	N	
SOP H-1	Preparing Field Log Books (Reviewed June 2012)	CH2M HILL	Log Book	N	
SOP H-4	Chain-of-Custody (Reviewed June 2012)	CH2M HILL	SOP, tape, custody seals, electronic chain of custody forms	N	
SOP H-5	Packaging and Shipping Procedures for Samples Not Considered Dangerous Goods (Reviewed June 2012)	CH2M HILL	SOP	N	
SOP H-6	Equipment Blank Preparation (Reviewed June 2012)	CH2M HILL	Sample containers	N	

This page intentionally left blank.

SAP Worksheet #22—Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Activity	Frequency	Acceptance Criteria	Corrective Action	Resp. Person	SOP Reference	Comments
YSI pH probe	Calibrate probe using YSI auto-calibration standard solution	Daily, before use	Std X – 0.2<Reading< Std X + 0.2	Clean probe with deionized water and calibrate again. Do not use this instrument if unable to calibrate properly.	FTL	SOP C-1	
YSI Specific conductance probe	Calibrate using YSI calibration standard solution	Daily before use	± 3 percent	Clean probe with deionized water and calibrate again. Do not use this instrument if unable to calibrate properly.	FTL	SOP C-1	
Hach turbidity meter	Calibrate probe using Hach calibration standard	Daily before use	0.1 to 10 NTU standard ±10%; 11 to 40 NTU standard ±8%; 41 to 100 NTU standard ±6.5%; >100NTU standard±5%	Clean probe with deionized water and calibrate again. Do not use this instrument if unable to calibrate properly.	FTL	SOP C-1	
YSI Dissolved oxygen and temperature probes	Calibrate probe using YSI calibration standard solution	Daily before use, at the end of the day (if practicable), and when unstable readings occur.	±3 mg/L DO of what the tabulated DO is for the measured temperature.	Clean probe with deionized water and calibrate again. Do not use this instrument if unable to calibrate properly. Follow manufacturer's instructions to remove bubble or replace torn membrane	FTL	SOP C-1	
YSI muntimeter	Calibrate probe using multiple calibration standard solution	Daily before use, at the end of the day (if practicable), and when unstable readings occur.	Stable reading after 3 minutes, pH reads 4.0 ±3% Conductivity reads 4.49±3%	Clean probe with deionized water and calibrate again. Do not use this instrument if unable to calibrate properly.	FTL	SOP C-1	
ORP	Calibrate using ORP standard solution	Daily before use, at the end of the day (if practicable), and when unstable readings occur.	±10mV of the theoretical redox standard value at that temperature.	Clean probe with deionized water and calibrate again. Do not use this instrument if unable to calibrate properly.	FTL	SOP C-1	

This page intentionally left blank.

SAP Worksheet #23—Analytical SOP References Table

(UFP-QAPP Manual Section 3.2.1)

Lab SOP Number	Title, Revision Date, and/or Number	Date Last Revisited if not Revised	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Variance to QSM	Modified for Project Work? (Y/N)
LAB-01	Receiving Samples; 1/23/10; Rev. 10	4/20/2012	N/A	N/A	N/A	ENCO-Orlando	None	N
LAB-02	Waste Disposal and Characterization; 9/16/11; Rev. 6		N/A	N/A	N/A	ENCO-Orlando	None	N
LAB-03	Analysis of Volatile Organic Compounds by GC/MS; 8/26/11; Rev. 17		Definitive	SD / VOC	GC-MS	ENCO-Orlando	None	N
LAB-04	Extraction of Soil/Solid Samples Using Sonication; 3/16/12; Rev. 7		N/A	SS, SD / SVOC, PEST	N/A	ENCO-Orlando	None	N
LAB-05	Semivolatile Organic Compounds by GC/MS; 8/15/11; Rev. 17		Definitive	SD / SVOC	GC-MS	ENCO-Orlando	None	N
LAB-06	Organochlorine Pesticides by GC/ECD; 9/21/11; Rev. 10		Definitive	SS, SD / PEST	GC-ECD	ENCO-Orlando	None	N
LAB-07	pH (Electrometric, Solid/Waste Samples); 1/13/10; Rev. 3	1/10/2012	Screening	SS, SD / WCHEM	pH Probe	ENCO-Orlando	None	N
LAB-08	Total Organic Carbon in Soil Using Walkley Black Titration; 12/23/09; Rev. 1	4/20/2012	Screening	SS, SD / WCHEM	N/A	ENCO-Orlando	None	N
LAB-09	Standard Operating Procedures for Particle Size Analysis of Soils without Hydrometer; 3/16/10; Rev. 0		Screening	SS, SD / GRAINSIZE	Sieve Set	Kemron-Atlanta	None	N

This page intentionally left blank.

SAP Worksheet #24—Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
GC-MS (for VOC)[1]	Tuning	Prior to ICAL and at the beginning of each 12-hour period.	Refer to SW-846 8260B for specific ion criteria.	Retune instrument and verify. Rerun affected samples. Flagging criteria are not appropriate. Problem must be corrected. No samples may be accepted without a valid tune.	Analyst	LAB-03
	Minimum five-point initial calibration (ICAL) for all analytes	ICAL prior to sample analysis.	1. Average response factor (RF) for SPCCs: VOCs ≥ 0.30 for Chlorobenzene and 1,1,2,2-Tetrachloroethane; ≥ 0.1 for Chloromethane, Bromoform, and 1,1-Dichloroethane. 2. RSD for RFs for CCCs: VOCs ≤ 30% and one option below: Option 1: RSD for each analyte ≤ 15%; Option 2: Linear least-squares regression r ≥ 0.995; Option 3: Non-linear regression - coefficient of determination (COD) r^2 ≥ 0.99 (six points shall be used for second order, seven points shall be used for third order).	Correct problem then repeat ICAL. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until ICAL has passed. Calibration may not be forced through the origin.		
	Second source calibration verification (ICV)	Once after each ICAL.	All project analytes within ±20% of true value.	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until calibration has been verified.		
	Retention time window position establishment for each analyte and surrogate	Once per ICAL	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	N/A		
	Evaluation of relative retention times (RRT)	With each sample.	RRT of each target analyte within ±0.06 RRT units.	Correct problem, then rerun ICAL. Flagging criteria are not appropriate. Refer to DoD QSM v. 4.1 Table F-4 for more information.		
	Continuing calibration verification (CCV)	Daily before sample analysis and every 12 hours of analysis time.	1. Average response factor (RF) for SPCCs: VOCs ≥ 0.30 for Chlorobenzene and 1,1,2,2-Tetrachloroethane; ≥ 0.1 for Chloromethane, Bromoform, and 1,1-Dichloroethane. 2. %Difference/Drift for all target compounds and surrogates: VOCs ≤ 20%D (Note: D = difference when using RFs or drift when using least squares regression or non-linear calibration).	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since last acceptable CCV. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since last acceptable CCV. Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.		
GC-MS (for SVOC)[1]	Tuning	Prior to ICAL and at the beginning of each 12-hour period.	Refer to SW-846 8270D for specific ion criteria.	Retune instrument and verify. Rerun affected samples. Flagging criteria are not appropriate. Problem must be corrected. No samples may be accepted without a valid tune.	Analyst	LAB-05
	Minimum five-point initial calibration (ICAL) for all analytes	ICAL prior to sample analysis.	1. Average response factor (RF) for SPCCs: SVOCs ≥ 0.050. 2. RSD for RFs for CCCs: SVOCs ≤ 30% and one option below: Option 1: RSD for each analyte ≤ 15%; Option 2: Linear least-squares regression r ≥ 0.995; Option 3: Non-linear regression - coefficient of determination (COD) r^2 ≥ 0.99 (six points shall be used for second order, seven points shall be used for third order).	Correct problem then repeat ICAL. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until ICAL has passed. Calibration may not be forced through the origin.		
	Second source calibration verification (ICV)	Once after each ICAL.	All project analytes within ±20% of true value.	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until calibration has been verified.		
	Retention time window position establishment for each analyte and surrogate	Once per ICAL	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	N/A		
	Evaluation of relative retention times (RRT)	With each sample.	RRT of each target analyte within ±0.06 RRT units.	Correct problem, then rerun ICAL. Flagging criteria are not appropriate. Refer to DoD QSM v. 4.1 Table F-4 for more information.		
	Continuing calibration verification (CCV)	Daily before sample analysis and every 12 hours of analysis time.	1. Average response factor (RF) for SPCCs: SVOCs ≥ 0.050. 2. %Difference/Drift for all target compounds and surrogates: SVOCs ≤ 20%D (Note: D = difference when using RFs or drift when using least squares regression or non-linear calibration).	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since last acceptable CCV. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since last acceptable CCV. Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.		

SAP Worksheet #24—Analytical Instrument Calibration Table (continued)

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
GC-ECD (for PEST)[1]	Retention time (RT) window width calculated for each analyte and surrogate	At method setup and after major maintenance	RT width is ± 3 times standard deviation for each analyte RT from a 72-hour study.	N/A	Analyst	LAB-06
	Minimum five-point initial calibration (ICAL) for all analytes	ICAL prior to sample analysis.	One of the options below: Option 1: RSD for each analyte ≤ 20%; Option 2: Linear least squares regression: r ≥ 0.995; Option 3: Non-linear regression: coefficient of determination (COD) $r^2 \geq 0.99$ (6 points shall be used for second order, 7 points shall be used for third order).	Correct problem then repeat ICAL. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until ICAL has passed. Calibration may not be forced through the origin.		
	Retention time window position establishment for each analyte and surrogate	Once per ICAL and at the beginning of the analytical shift.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	N/A		
	Second source calibration verification (ICV)	Immediately following ICAL.	All project analytes within established retention time windows. GC methods: All project analytes within ± 20 % of expected value from the ICAL.	Correct problem, rerun ICV. If that fails, repeat ICAL. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until calibration has been verified.		
	Continuing calibration verification (CCV)	Prior to sample analysis, after every 10 field samples, and at the end of the analysis sequence.	All project analytes within established retention time windows. GC methods: All project analytes within ± 20% of expected value from the ICAL.	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification. Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the sample cannot be reanalyzed.		
pH Probe	Initial calibration	Daily	99-101% of true value.	Recalibrate and repeat ICAL	Analyst	LAB-07
	Continuing calibration verification (CCV) using 4.0 (± 0.1) and 10.0 (±0.1)	Daily	99-101% of true value.	Recalibrate. Reanalyze all samples analyzed since the last pH buffer that met limits.		

Notes:

1. DoD QSM v. 4.1 is the basis for specifications on this table for definitive analyses.

SAP Worksheet #25—Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

(UFP-QAPP Manual Section 3.2.3)

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
GC-ECD	Injection port maintenance.	Degradation check performed every 12 hours.	DDT and Endrin breakdown <15%.	Beginning of each 12-hour 8081 sequence.	DDT and Endrin breakdown <15%.	Clip the guard column, replace the injection port liner, replace the gold seal, clean the injection port, and repeat degradation check.	Analyst	LAB-06
GC-MS	Clean sources, maintain vacuum pumps.	Tuning.	Instrument performance and sensitivity.	Service vacuum pumps twice per year. Other maintenance performed as needed.	Tune and CCV pass criteria (refer to **Worksheet #24**)	Recalibrate.	Analyst	LAB-03 and LAB-05
	Change septum, clean injection port, change or clip column, install new liner, change trap.	Sensitivity check.	Instrument performance and sensitivity.	Daily or as needed.	Tune and CCV pass criteria (refer to **Worksheet #24**).	Re-inspect injector port, cut additional column, re-analyze CCV, and/or re-calibrate instrument.		
pH Probe	Clean and change probe fluid.	N/A	Fluid is low or crystals may have formed.	As needed.	N/A	N/A	Analyst	LAB-07

This page intentionally left blank.

SAP Worksheet #26—Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT	
Sample Collection (Personnel/Organization):	Field Team Leader (TBD)/CH2M HILL
Sample Packaging (Personnel/Organization):	Sample Processor (TBD)/CH2M HILL
Coordination of Shipment (Personnel/Organization):	Sample Processor (TBD)/CH2M HILL
Type of Shipment/Carrier:	Overnight/FedEx
SAMPLE RECEIPT AND ANALYSIS	
Sample Receipt (Personnel/Organization):	Sample Receipt Personnel/ENCO-Orlando. Note that all samples are shipped to ENCO-Orlando and they will forward GRAINSIZE fractions to Kemron-Atlanta.
Sample Custody and Storage (Personnel/Organization):	Sample Receipt Personnel/ENCO-Orlando.
Sample Preparation (Personnel/Organization):	Extractions Personnel/ENCO-Orlando.
Sample Determinative Analysis (Personnel/Organization):	Analyst/ENCO-Orlando
SAMPLE ARCHIVING	
Field Sample Storage (No. of days from sample collection):	90 Days
Sample Extract/Digestate Storage (No. of days from extraction/ digestion):	Extracts may be disposed of 90 days after extraction.
Biological Sample Storage (No. of days from sample collection):	N/A
SAMPLE DISPOSAL	
Personnel/Organization:	Environmental Health and Safety Officer/ENCO-Orlando
Number of Days from Analysis:	Samples may be disposed of 90 days after report mail date.

This page intentionally left blank.

SAP Worksheet #27—Sample Custody Requirements

(UFP-QAPP Manual Section 3.3.3)

Sample Labeling

Sample labels will include, at a minimum, client name, site, sample ID, date/time collected, analysis group or method, preservative, and sampler's initials. Labels will be taped to the jar to ensure that they do not separate. Tape is not necessary for pre-tared soil VOCs vials. When tape is not used, waterproof labels and ink will be used.

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory)

Samples will be collected by field team members under the supervision of the field team leader. As samples are collected, they will be placed into containers and labeled, as outlined above. Samples will be cushioned with packaging material and placed into coolers containing enough ice to keep the samples below 4°C until they are received by the laboratory. The chain of custody (COC) will also be placed into the cooler. Coolers will be shipped to the laboratory via FedEx, with the airbill number indicated on the COC (to relinquish custody). Upon delivery, the laboratory will log in each cooler and report the status of the samples.

Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal)

Please refer to LAB-01 for details on sample receipt. Please refer to LAB-02 for details on laboratory waste disposal.

Sample Identification Procedures

Upon opening the cooler, the receiving clerk signs the COC and then takes the temperature using the temperature blank (if absent, then a sample container or infrared thermometer is used). The sample containers in the cooler are unpacked and checked against the client's COC and any discrepancies or breakage is noted on the COC. Next, if any water samples require preservative, the clerk will check the pH values to see if they are in the acceptable pH range. pH is not checked for aqueous VOCs vials prior to analysis. The clerk will deliver the COC (and any other paperwork; e.g. temperature or pH QA notice) to the project manager for Laboratory Information Management Systems (LIMS) entry and client contact (if needed).

The field logbook will identify the sample ID with the location, depth, date/time collected, and the parameters requested. The laboratory will assign each field sample a laboratory sample ID based on information in the chain of custody. The laboratory will send sample log-in forms to the project data manager to check sample IDs and parameters are correct.

Chain-of-Custody Procedures

Chains of custody will include, at a minimum, laboratory contact information, client contact information, sample information, and relinquished by/received by information. Sample information will include sample ID, date/time collected, number and type of containers, preservative information, analysis method, and comments. The chain of custody will also have the sampler's name and signature. The chain of custody will link location of the sample from the field logbook to the laboratory receipt of the sample. The laboratory will use the sample information to populate the LIMS database for each sample.

This page intentionally left blank.

SAP Worksheet #28-1—Laboratory QC Samples Table

(UFP-QAPP Manual Section 3.4)
Matrix: SD
Analytical Group: VOC
Analytical Method / SOP Reference: SW-846 8260B / LAB-03

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Field QA/QC Samples						
Field Duplicate	One per 10 normal field samples per matrix	%RPD < 30%	Assess sampling and laboratory precision. Examine laboratory replicate. Qualify as per Worksheet #36.	PM/FTL, Data Validator	Precision	%RPD < 30%
Trip Blank	One per cooler containing VOCs fractions	Same as method blank (see below)	Assess the potential for sample container contamination during storage or transport. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	PM/FTL, Data Validator	Contamination	Same as method blank (see below)
Equipment Blank	One per day per equipment type (when decontaminated). One per event per equipment type (when disposable).	Same as method blank (see below)	Assess decontamination procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PM/FTL, Data Validator	Contamination	Same as method blank (see below)
Matrix Spike/Matrix Spike Duplicate	Triple volume is provided for one per 20 normal field samples per matrix.	See below.				
Temperature Blank	One per cooler	≤ 6°C but not frozen	Notify project chemist. Assess sample packaging and shipment procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PC, PM/FTL, Data Validator	Representativeness	≤ 6°C but not frozen
Laboratory QA/QC Samples						
Internal Standards Verification	Every field sample, standard, and QC sample.	Retention time ±30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory. If corrective action fails in field samples, apply Q-flag to analytes associated with the non-compliant IS. Flagging criteria are not appropriate for failed standards. Sample results are not acceptable without a valid IS verification.	Analyst	Accuracy	Retention time ±30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v. 4.1).	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.1. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch. Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst	Contamination	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v. 4.1).
Laboratory Control Sample (LCS) containing all analytes to be reported, including surrogates	One per preparatory batch.	Refer to Worksheet #15-1. Limits are as per DoD QSM v. 4.1 Table G-4. Statistical laboratory limits are provided when DoD QSM does not specify. Nominal limits are provided if the laboratory has not established statistical limits.	Correct problem then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch. Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst	Accuracy	Refer to Worksheet #15-1. Limits are as per DoD QSM v. 4.1 Table G-4. Statistical laboratory limits are provided when DoD QSM does not specify. Nominal limits are provided if the laboratory has not established statistical limits.

SAP Worksheet #28-1—Laboratory QC Samples Table (continued)

(UFP-QAPP Manual Section 3.4)
Matrix: SD
Analytical Group: VOC
Analytical Method / SOP Reference: SW-846 8260B / LAB-03

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Matrix Spike (MS)	One per preparatory batch per matrix	Same as for LCS	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy	Same as for LCS
Matrix Spike Duplicate (MSD) or Laboratory Replicate	One per preparatory batch per matrix	Same as for LCS.	Same as MS.	Analyst	Accuracy / Precision	Same as for LCS.
Surrogate Spike	All field and QC samples	1,2-Dichloroethane-d_4: 70-120% 4-Bromofluorobenzene: 75-120% Dibromofluoromethane: 85-115% Toluene-d_8: 85-120% Limits are as per DoD QSM v. 4.1 Table G-3.	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatoraphic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteriar are not met.	Analyst	Accuracy	1,2-Dichloroethane-d_4: 70-120% 4-Bromofluorobenzene: 75-120% Dibromofluoromethane: 85-115% Toluene-d_8: 85-120% Limits are as per DoD QSM v. 4.1 Table G-3.
Results reported between DL and LOQ	N/A	Apply J-flag to all results between DL and LOQ. Nondetect results are reported as U-Values at the LOD.	N/A	Analyst	Accuracy	N/A

Notes:
DoD QSM v. 4.1 is the basis for specifications on this table for laboratory QA/QC samples.

SAP Worksheet #28-2—Laboratory QC Samples Table

(UFP-QAPP Manual Section 3.4)
Matrix: SD
Analytical Group: SVOC
Analytical Method / SOP Reference: SW-846 8270D / LAB-04, LAB-05

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Field QA/QC Samples						
Field Duplicate	One per 10 normal field samples per matrix	%RPD < 30%	Assess sampling and laboratory homogenization procedures and precision. Examine laboratory replicate. Qualify as per Worksheet #36.	PM/FTL, Data Validator	Precision	%RPD < 30%
Equipment Blank	One per day per equipment type (when decontaminated). One per event per equipment type (when disposable).	Same as method blank (see below)	Assess decontamination procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PM/FTL, Data Validator	Contamination	Same as method blank (see below)
Matrix Spike/Matrix Spike Duplicate	Triple volume is provided for one per 20 normal field samples per matrix.	See below.				
Temperature Blank	One per cooler	≤ 6°C but not frozen	Notify project chemist. Assess sample packaging and shipment procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PC, PM/FTL, Data Validator	Representativeness	≤ 6°C but not frozen
Laboratory QA/QC Samples						
Breakdown Check	At the beginning of each 12-hour period, prior to analysis of samples	Degradation ≤ 20% for DDT. Benzidine and pentachlorophenol should be present at their normal responses and should not exceed a tailing factor of 2.	Correct problem then repeat breakdown check. Flagging criteria are not appropriate. No samples shall be run until degradation ≤ 20%.	Analyst	Accuracy	Degradation ≤ 20% for DDT. Benzidine and pentachlorophenol should be present at their normal responses and should not exceed a tailing factor of 2.
Internal Standards Verification	Every field sample, standard, and QC sample.	Retention time ±30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory. If corrective action fails in field samples, apply Q-flag to analytes associated with the non-compliant IS. Flagging criteria are not appropriate for failed standards. Sample results are not acceptable without a valid IS verification.	Analyst	Accuracy	Retention time ±30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v. 4.1).	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.1. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch. Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst	Contamination	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v. 4.1).

SAP Worksheet #28-2—Laboratory QC Samples Table (continued)

(UFP-QAPP Manual Section 3.4)
Matrix: SD
Analytical Group: SVOC
Analytical Method / SOP Reference: SW-846 8270D / LAB-04, LAB-05

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Laboratory Control Sample (LCS) containing all analytes to be reported, including surrogates	One per preparatory batch.	Refer to Worksheet #15-2. Limits are as per DoD QSM v. 4.1 Table G-4. Statistical laboratory limits are provided when DoD QSM does not specify. Nominal limits are provided if the laboratory has not established statistical limits.	Correct problem then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch. Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst	Accuracy	Refer to Worksheet #15-2. Limits are as per DoD QSM v. 4.1 Table G-4. Statistical laboratory limits are provided when DoD QSM does not specify. Nominal limits are provided if the laboratory has not established statistical limits.
Matrix Spike (MS)	One per preparatory batch per matrix	Same as for LCS	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy	Same as for LCS
Matrix Spike Duplicate (MSD) or Laboratory Replicate	One per preparatory batch per matrix	Same as for LCS.	Same as MS.	Analyst	Accuracy / Precision	Same as for LCS.
Surrogate Spike	All field and QC samples	2-Fluorobiphenyl: 50-110% Terphenyl-d_{14}: 50-135% 2,4,6-Tribromophenol: 40-125% 2-Fluorophenol: 20-110% Nitrobenzene-d_5: 40-110% Limits are as per DoD QSM v. 4.1 Table G-3.	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatoraphic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteriar are not met.	Analyst	Accuracy	2-Fluorobiphenyl: 50-110% Terphenyl-d_{14}: 50-135% 2,4,6-Tribromophenol: 40-125% 2-Fluorophenol: 20-110% Nitrobenzene-d_5: 40-110% Limits are as per DoD QSM v. 4.1 Table G-3.
Results reported between DL and LOQ	N/A	Apply J-flag to all results between DL and LOQ. Nondetect results are reported as U-Values at the LOD.	N/A	Analyst	Accuracy	N/A

Notes:
DoD QSM v. 4.1 is the basis for specifications on this table for laboratory QA/QC samples.

SAP Worksheet #28-3—Laboratory QC Samples Table

(UFP-QAPP Manual Section 3.4)
Matrix: SS, SD
Analytical Group: PEST
Analytical Method / SOP Reference: SW-846 8081B / LAB-04, LAB-06

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Field QA/QC Samples						
Field Duplicate	One per 10 normal field samples per matrix	%RPD < 30%	Assess sampling and laboratory homogenization procedures and precision. Examine laboratory replicate. Qualify as per Worksheet #36.	PM/FTL, Data Validator	Precision	%RPD < 30%
Equipment Blank	One per day per equipment type (when decontaminated). One per event per equipment type (when disposable).	Same as method blank (see below)	Assess decontamination procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PM/FTL, Data Validator	Contamination	Same as method blank (see below)
Matrix Spike/Matrix Spike Duplicate	Triple volume is provided for one per 20 normal field samples per matrix.	See below.				
Temperature Blank	One per cooler	≤ 6°C but not frozen	Notify project chemist. Assess sample packaging and shipment procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PC, PM/FTL, Data Validator	Representativeness	≤ 6°C but not frozen
Laboratory QA/QC Samples						
Breakdown check)	At the beginning of each 12-hour period, prior to analysis of samples	Degradation ≤ 15% for both DDT and Endrin.	Correct problem then repeat breakdown check. Flagging criteria are not appropriate. No samples shall be run until degradation ≤ 15% for both DDT and Endrin.	Analyst	Accuracy	Degradation ≤ 15% for both DDT and Endrin.
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results (see Box D-1 of DoD QSM v. 4.1).	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.1. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch. Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst	Contamination	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results (see Box D-1 of DoD QSM v. 4.1).
Laboratory Control Sample (LCS)	One per preparatory batch.	Refer to Worksheet #15-3. Limits are as per DoD QSM v. 4.1 Table G-4.	Correct problem then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch. Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst	Accuracy	Refer to Worksheet #15-3. Limits are as per DoD QSM v. 4.1 Table G-4.

SAP Worksheet #28-3—Laboratory QC Samples Table (continued)

(UFP-QAPP Manual Section 3.4)
Matrix: SS, SD
Analytical Group: PEST
Analytical Method / SOP Reference: SW-846 8081B / LAB-04, LAB-06

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Matrix Spike (MS)	One per preparatory batch per matrix	Same as for LCS	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy	Same as for LCS
Matrix Spike Duplicate (MSD) or Laboratory Replicate	One per preparatory batch per matrix	Same as for LCS	Same as MS.	Analyst	Accuracy / Precision	Same as for LCS
Surrogate Spike	All field and QC samples	Decachlorobiphenyl: 30-135% TCMX: 25-140%	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatoraphic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteriar are not met.	Analyst	Accuracy	Decachlorobiphenyl: 30-135% TCMX: 25-140%
Confirmation of Positive Results (second column or second detector)	All positive results must be confirmed	Calibration and QC criteria same as for initial or primary column analysis. Results between primary and second column RPD ≤ 40%.	Apply J-flag if RPD > 40%. Discuss in the case narrative.	Analyst	Precision	Calibration and QC criteria same as for initial or primary column analysis. Results between primary and second column RPD ≤ 40%.
Results reported between DL and LOQ	N/A	Apply J-flag to all results between DL and LOQ. Nondetect results are reported as U-Values at the LOD.	N/A	Analyst	Accuracy	N/A

Notes:
DoD QSM v. 4.1 is the basis for specifications on this table for laboratory QA/QC samples.

SAP Worksheet #28-4—Laboratory QC Samples Table

(UFP-QAPP Manual Section 3.4)
Matrix: SS or SD
Analytical Group: WCHEM
Analytical Method / SOP Reference: SW-846 9045D, Walkley Black / LAB-07, LAB-08

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Field QA/QC Samples						
Temperature Blank	One per cooler	≤ 6°C but not frozen	Notify project chemist. Assess sample packaging and shipment procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PC, PM/FTL, Data Validator	Representativeness	≤ 6°C but not frozen
pH via SW-846 9045D (LAB-07)						
Laboratory Control Sample (LCS)	One per batch	99-101%R	The LCS is reanalyzed to confirm. If confirmed, all associated samples are reanalyzed.	Analyst	Accuracy	99-101%R
Laboratory Replicate (LR)	One per batch	≤ 25% RPD	If precision between duplicate samples is outside of the acceptance limits, the sample and its duplicate must be reanalyzed	Analyst	Precision	≤ 25% RPD
Total Organic Carbon (TOC) via Walkley Black (LAB-08)						
Method Blank	One per batch	No detections > LOD	Report and narrate.	Analyst	Contamination	No detections > LOD
Laboratory Control Sample (LCS)	One per batch	50-150%R	The LCS is reanalyzed to confirm. If confirmed, all associated samples are reanalyzed.	Analyst	Accuracy	50-150%R
Matrix Spike (MS)[1]	One per batch	50-150%R	Qualify "QM-07" for "The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery".	Analyst	Accuracy	50-150%R
Matrix Spike Duplicate (MSD) or Laboratory Replicate	One per batch	50-150%R; ≤ 25% RPD	Same as MS and/or Qualify "QM-11" for "Precision between duplicate matrix spikes of the same sample was outside acceptance limits".	Analyst	Accuracy/Precision	50-150%R; ≤ 25% RPD
Results reported between DL and LOQ	N/A	Apply J-flag to all results between DL and LOQ. Nondetect results are reported as U-Values at the LOD.	N/A	Analyst	Accuracy	N/A

Notes:
1. MS/MSD is not provided for WCHEM analyses. The specifications are provided in the event the laboratory performs an MS/MSD.

SAP Worksheet #28-5—Laboratory QC Samples Table

(UFP-QAPP Manual Section 3.4)
Matrix: SS and SD
Analytical Group: GRAINSIZE
Analytical Method / SOP Reference: ASTM D422 / LAB-09

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
QA/QC Samples are not required for GRAINSIZE analysis.						

SAP Worksheet #29—Project Documents and Records Table

Document	Where Maintained
Field Notebooks	Electronic portable document format (.pdf) copies in the project file. Hardcopy (bound Field Notebook) in the project file. Archived at project closeout*.
Chain-of-Custody Records	Electronic .pdf copies in the project file. Hardcopy in the project file. Archived at project closeout.
Air Bills	Hardcopy in the project file. Archived at project closeout.
Telephone Logs	Hardcopy in the project file. Archived at project closeout.
Corrective Action Forms	Electronic .pdf copies in the project file. Hardcopy in the project file. Archived at project closeout.
Water quality field parameters collected during surface water sampling	Recorded in Field Notebook. Stored in NIRIS.
Various field measurements	Recorded in Field Notebook.
All field equipment calibration information	Recorded in Field Notebook.
Pertinent telephone conversations	Recorded in Field Notebook.
Field equipment maintenance records	Inspected by Field Team Leader. Not maintained.
Sample Receipt, Custody, and Tracking Records	Electronic .pdf copies in the project file. Hardcopy in the full data package.
Equipment Calibration Logs	Hardcopy in the full data package[1]. Archived at project closeout.
Sample Prep Logs	Hardcopy in the full data package[1]. Archived at project closeout.
Run Logs	Hardcopy in the full data package[1]. Archived at project closeout.
Reported Field Sample Results	Electronic .pdf copies in the project file. Hardcopy in the full data package[1]. Archived at project closeout.
Reported Results for Standards, QC Checks, and QC Samples	Hardcopy in the full data package[1]. Archived at project closeout.
Instrument Printouts (raw data) for Field Samples, Standards, QC Checks, and QC Samples	Hardcopy in the full data package[1]. Archived at project closeout.
Sample Disposal Records	Maintained by the laboratory.
Extraction/Clean-up Records	Hardcopy in the full data package[1].
Raw Data	Hardcopy in the full data package[1]. Archived at project closeout.
Field Sampling Audit Checklists	Hardcopy in the project file. Archived at project closeout.
Fixed Laboratory Audit Checklists	If completed, hardcopy in the project file. Archived at project closeout.
Data Validation Reports	Electronic .pdf copies in the project file. Hardcopy stored with the data package. Archived at project closeout.
Remedial Investigation Report	Electronic .pdf copies in the project file. Hardcopy (bound notebook) in the project file and administrative record. Archived at project closeout.

*The contractor manages the project files until the project is closed. The length of time for maintaining project files is both file-and contract-specific. Once the project is closed, the files are archived and/or returned to the Navy in accordance with contract terms. After completion of the project, project documents required to be maintained will be stored at the Federal Records Center (FRC) in Suitland, MD:

Washington National Records Center
4205 Suitland Road
Suitland, Maryland 20746-8001

1 CH2M HILL requires a “Level 4” package.

This page intentionally left blank.

SAP Worksheet #30—Analytical Services Table

(UFP-QAPP Manual Section 3.5.2.3)

Matrix	Analytical Group	Sample Locations / ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory / Organization	Backup Laboratory / Organization
SS	PEST	7	LAB-06	Standard 28 Calendar-day TAT	ENCO-Orlando 10775 Central Port Drive Orlando, FL 32824 (407) 826-5314 POC: Ronnie Wambles	TBD
SD	VOC	16	LAB-03			
	SVOC		LAB-05			
	PEST		LAB-06			
SS or SD	WCHEM	23	LAB-07, LAB-08			
SS or SD	GRAINSIZE	23	LAB-09	Standard 28 Calendar-day TAT	Kemron-Atlanta 1359-A Ellsworth Industrial Boulevard Atlanta, Georgia 30318 (404) 636-0928 POC: Tommy A. Jordan, P.G.	TBD

This page intentionally left blank.

SAP Worksheet #31—Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (title and organizational affiliation)	Person(s) Responsible for Responding to Assessment Findings (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing CA (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (title and organizational affiliation)
Field Performance Audit	One during sampling activities	Internal	CH2M HILL	MR site manager CH2M HILL	Project Field Team CH2M HILL	John Swenfurth, CH2M HILL	Brett Doerr Activity Manager CH2M HILL
Safe Work Observation	One per week during field activities	Internal	CH2M HILL	John Martin, Field Team Leader CH2M HILL	Project Field Team CH2M HILL	Mark Orman, H&S Officer CH2M HILL	Mark Orman H&S Office CH2M HILL

Notes:

CA corrective action

This page intentionally left blank.

SAP Worksheet #32—Assessment Findings and Corrective Action Responses Table

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
Field Performance Audit	Field Performance Audit Checklist	Field Team PM Environmental Manager	Within one day of audit	Verbal and CA Form	FTL CH2M HILL	Within one day of receipt of CA Form
Safe Work Observation (SWO)	Safe Work Observation Form	FTL Field Team PM	Immediately (person involved or observed person). Following day (field team). Within 1 week if worthy of elevation (H&S officer)	On SWO Form	FTL and individual being observed, and the PM and if elevated to the H&S officer.	Corrected in the field immediately, and within 1 week if elevated.

SAP Worksheet #32-1—Laboratory Corrective Action Form

Person initiating corrective action (CA) _____ Date _____

Description of problem and when identified: _____

_____

_____

Cause of problem, if known or suspected: _____

_____

_____

Sequence of CA: (including date implemented, action planned and personnel/data affected) _____

_____

_____

_____

_____

_____

_____

CA implemented by: _____ Date: _____

CA initially approved by: _____ Date: _____

Follow-up date: _____

Final CA approved by: _____ Date: _____

Information copies to: Anita Dodson/ Navy CLEAN Program Chemist

SAP Worksheet #32-2—Field Performance Audit Checklist

Project Responsibilities

Project No.: _____ **Date:** _____

Project Location: _____ **Signature:** _____

Team Members

Yes _____ No _____ 1) Is the approved work plan being followed?
Comments _____

Yes _____ No _____ 2) Was a briefing held for project participants?
Comments _____

Yes _____ No _____ 3) Were additional instructions given to project participants?
Comments _____

Sample Collection

Yes _____ No _____ 1) Is there a written list of sampling locations and descriptions?
Comments _____

Yes _____ No _____ 2) Are samples collected as stated in the Master SOPs?
Comments _____

Yes _____ No _____ 3) Are samples collected in the type of containers specified in the work plan?
Comments _____

Yes _____ No _____ 4) Are samples preserved as specified in the work plan?
Comments _____

Yes _____ No _____ 5) Are the number, frequency, and type of samples collected as Specified the work plan?
Comments _____

SAP Worksheet #32-2—Field Performance Audit Checklist (continued)

Yes _____ No _____ 6) Are QA checks performed as specified in the work plan?
Comments _____

Yes _____ No _____ 7) Are photographs taken and documented?
Comments _____

Document Control

Yes _____ No _____ 1) Have any accountable documents been lost?
Comments _____

Yes _____ No _____ 2) Have any accountable documents been voided?
Comments _____

Yes _____ No _____ 3) Have any accountable documents been disposed of?
Comments _____

Yes _____ No _____ 4) Are the samples identified with sample tags?
Comments _____

Yes _____ No _____ 5) Are blank and duplicate samples properly identified?
Comments _____

Yes _____ No _____ 6) Are samples listed on a chain-of-custody record?
Comments _____

Yes _____ No _____ 7) Is chain-of-custody documented and maintained?
Comments _____

SAP Worksheet #32-3—Safe Work Observation Form

Project:		**Observer:**	**Date:**
Position/Title of worker observed:		**Background Information/comments:**	
Task/Observation Observed:			

Identify and reinforce safe work practices/behaviors

Identify and improve on at-risk practices/acts

Identify and improve on practices, conditions, controls, and compliance that eliminate or reduce hazards

Proactive PM support facilitates eliminating/reducing hazards (do you have what you need?)

Positive, corrective, cooperative, collaborative feedback/recommendations

Actions & Behaviors	**Safe**	**At-Risk**	**Observations/Comments**
Current & accurate Pre-Task Planning/ Briefing (Project safety plan, STAC, AHA, PTSP, tailgate briefing, etc., as needed)			**Positive Observations/Safe Work Practices:**
Properly trained/qualified/experienced			
Tools/equipment available and adequate			
Proper use of tools			**Questionable Activity/Unsafe Condition Observed:**
Barricades/work zone control			
Housekeeping			
Communication			
Work Approach/Habits			
Attitude			
Focus/attentiveness			**Observer's CAs/Comments:**
Pace			
Uncomfortable/unsafe position			
Inconvenient/unsafe location			
Position/Line of fire			
Apparel (hair, loose clothing, jewelry)			
Repetitive motion			**Observed Worker's CAs/Comments:**
Other…			

This page intentionally left blank.

SAP Worksheet #33—Quality Assurance Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (title and organizational affiliation)	Report Recipient(s) (title and organizational affiliation)
Field Audit Report	One during sampling activities	Submitted with report in which data are analyzed and presented.	Project Manager: John Swenfurth/ CH2M HILL	Regional Health, Safety and Environment and Quality Manager: Mark Orman/CH2M HILL Included in project files.
Data Validation Reports	Once, after analysis by laboratory, for all laboratory analytical data except Grain Size.	Submitted by the data Validator within 14 calendar-days of notification to begin).	Project Manager: Laura Maschoff	Project Chemist: Michael Zamboni/ CH2M HILL Project Manager: John Swenfurth/ CH2M HILL
Data Usability Assessments (Data Quality Evaluation)	Once as an appendix to the report in which the data are analyzed and presented.	Along with the project report	Project Chemist: Michael Zamboni/CH2M HILL	Vieques RPM: Daniel Rodriguez/ USEPA and Vieques RPM Wilmarie Rivera/PREQB

This page intentionally left blank.

SAP Worksheet #34-36—Data Verification and Validation (Steps I and IIa/IIb) Process Table

(UFP-QAPP Manual Section 5.2.1) (UFP-QAPP Manual Section 5.2.2) (Figure 37 UFP-QAPP Manual) (Table 9 UFP-QAPP Manual)

Data Review Input	Description	Responsible for Verification	Step I / IIa / IIb[1]	Internal / External
Field Notebooks	Field notebooks will be reviewed internally and placed into the project file for archival at project closeout.	Field Team Leader/CH2M HILL (TBD)	Step I	Internal
Chains of Custody and Shipping Forms	Chain-of-custody forms and shipping documentation will be reviewed internally upon their completion and verified against the packed sample coolers they represent. The shipper's signature on the chain-of custody will be initialed by the reviewer, a copy of the chain-of-custody retained in the site file, and the original and remaining copies taped inside the cooler for shipment.	Field Team Leader/CH2M HILL (TBD) Michael Zamboni/CH2M HILL (Project Chemist)	Step I	Internal / External
Sample Condition Upon Receipt	Any discrepancies, missing, or broken containers will be communicated to the project data manager in the form of laboratory logins.	Michael Zamboni/CH2M HILL (Project Chemist)	Step I	External
Documentation of Laboratory Method Deviations	Laboratory Method Deviations will be discussed and approved by the project chemist. Documentation will be incorporated into the case narrative which becomes part of the final hardcopy data package.	Michael Zamboni/CH2M HILL (Project Chemist)	Step I	External
Electronic Data Deliverables	Electronic Data Deliverables will be compared against hardcopy laboratory results (10% check).	Michael Zamboni/CH2M HILL (Project Chemist)	Step I	External
Electronic Data Deliverables	Electronic Data Deliverables will be compared against data validation reports and marked-up Form 1s (100% check of all changes made during data validation)	Michael Zamboni/CH2M HILL (Project Chemist)	Step I	External
Case Narrative	Case narratives will be reviewed by the data validator during the data validation process. This is verification that they were generated and applicable to the data packages.	Laura Maschoff/DataQual (Data Validator)	Step I	External
Laboratory Data	All laboratory data packages will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal.	Russell E. Macomber/ENCO (Laboratory QAO) Tommy A. Jordan, P.G./Kemron (Laboratory QAO)	Step I	Internal

SAP Worksheet #34-36—Data Verification and Validation (Steps I and IIa/IIb) Process Table (continued)

(UFP-QAPP Manual Section 5.2.1) (UFP-QAPP Manual Section 5.2.2) (Figure 37 UFP-QAPP Manual) (Table 9 UFP-QAPP Manual)

Data Review Input	Description	Responsible for Verification	Step I / IIa / IIb[1]	Internal / External
Laboratory Data	The data will be verified for completeness by a Project Data Manager (PDM).	Michael Zamboni/CH2M HILL (Project Chemist)	Step I	External
Audit Reports	Upon report completion, a copy of all audit reports will be placed in the site file. If CAs are required, a copy of the documented CA taken will be attached to the appropriate audit report in the QA site file. Periodically, and at the completion of site work, site file audit reports and CA forms will be reviewed internally to ensure that all appropriate CAs have been taken and that CA reports are attached. If CAs have not been taken, the site manager will be notified to ensure action is taken.	Stephen Brand/CH2M HILL (Project Manager) Michael Zamboni/CH2M HILL (Project Chemist)	Step I	Internal / External
Corrective Action Reports	CA reports will be reviewed by the project chemist or PM and placed into the project file for archival at project closeout.	Stephen Brand/CH2M HILL (Project Manager) Michael Zamboni/CH2M HILL (Project Chemist)	Step I	External
Laboratory Methods	Ensure the laboratory analyzed samples using the correct methods.	Michael Zamboni/CH2M HILL (Project Chemist)	Step IIa	External
Target Compound List	Ensure the laboratory reported all analytes from each analysis group as per Worksheet 15.	Michael Zamboni/CH2M HILL (Project Chemist)	Step IIa	External
Reporting Limits	Ensure the laboratory met the project-designated reporting limits as per Worksheet 15. If reporting limits were not met, the reason will be determined and documented.	Michael Zamboni/CH2M HILL (Project Chemist)	Step IIb	External
Laboratory SOPs	Ensure that approved analytical laboratory SOPs were followed.	Laura Maschoff/DataQual (Data Validator)	Step IIa	External
Sample Chronology	Holding times from collection to extraction or analysis and from extraction to analysis will be considered by the data validator during the data validation process.	Laura Maschoff/DataQual (Data Validator)	Step IIa / IIb	External
Raw Data	10 percent review of raw data to confirm laboratory calculations.	Laura Maschoff/DataQual (Data Validator)	Step IIa	External
Onsite Screening	All non-analytical field data will be reviewed against QAPP requirements for completeness and accuracy based on the field calibration records.	Field Team Leader/CH2M HILL (TBD)	Step IIb	Internal
Documentation of Method QC Results	Establish that all required QC samples were run and met limits.	Laura Maschoff/DataQual (Data Validator)	Step IIa	External

SAP Worksheet #34-36—Data Verification and Validation (Steps I and IIa/IIb) Process Table (continued)

(UFP-QAPP Manual Section 5.2.1) (UFP-QAPP Manual Section 5.2.2) (Figure 37 UFP-QAPP Manual) (Table 9 UFP-QAPP Manual)

Data Review Input	Description	Responsible for Verification	Step I / IIa / IIb[1]	Internal / External
Documentation of Field QC Sample Results	Establish that all required QAPP QC samples were run and met limits.	Michael Zamboni/CH2M HILL (Project Chemist) Laura Maschoff/DataQual (Data Validator)	Step IIb	External
Third-Party Data Validation	Validation qualifiers are hand-written or otherwise entered onto the laboratory Form 1s and then re-assembled into the data validation report. Validation qualifiers supersede laboratory qualifiers (for data subject to analytical data validation) and are presented on data tables when produced after validated data have been received. Nevertheless, all qualifiers are defined at the bottom of tables.	Laura Maschoff/DataQual (Data Validator)	Step IIa and IIb	External
Third-Party Data Validation (VOC)[2]	"Validating Volatile Organic Compounds by SW-846 Method 8260B" (SOP HW-24 Rev. 2; August, 2009).	Laura Maschoff/DataQual (Data Validator)	Step IIa and IIb	External
Third-Party Data Validation (SVOC)[2]	"Validating Semivolatile Organic Compounds by SW-846 Method 8270" (SOP HW-22; Rev. 4; August, 2009)			
Third-Party Data Validation (PEST)[2]	"Data Validation SOP of Organochlorine Pesticides by Gas Chromatography SW-846 Method 8081B" (SOP HW-44 Rev. 1; August, 2009).			
Data Validation (WCHEM and GRAINSIZE)	Third-party analytical data validation is not required for screening data. However, they are still subject to the verification and validation procedures described above.	Michael Zamboni/CH2M HILL (Project Chemist)	Step I, IIa, and IIb	External

Notes:

1. I = verification
   IIa = compliance with methods, procedures, and contracts [see Table 10, page 117, UFP-QAPP manual, V.1, March 2005.]
   IIb = comparison with measurement performance criteria in the SAP [see Table 11, page 118, UFP-QAPP manual, V.1, March 2005]
2. Level IV third-party data validation will be performed on 100% of definitive analyses. Of the 100% validated, 10% of results will be recalculated from the raw data in order to verify calculations.

This page intentionally left blank.

SAP Worksheet #37—Usability Assessment

Data usability evaluation comprises critical assessment of the data with respect to the project objective. Given that the primary objective of this effort is to determine if there has been a release of pesticides, VOCs, and SVOCs in soil and sediment associated with Laguna La Chiva, the comprehensive dataset will be reviewed to determine if it is adequate for making the project-specific determinations.

Some specific examples of data availability and usability protocol are:

- For data which are subject to third-party data validation, the third-party data validator is the only party who applies qualifiers to the data. Minor QC exceedances will result in "estimated" data, represented by J, NJ, and UJ qualifiers. Major QC exceedances will result in "rejected" data, represented by R-qualifiers. These are typical qualifiers familiar to EPA Region II. The effect on availability and usability of rejected results will be evaluated.
- The use of "estimated" data will be discussed in the report. "Estimated" data are generally considered usable for all purposes. For results reported between the DL and LOQ the laboratory will apply J-flags.
- While all non-rejected data are available for use to the project team, non-detect (and attributable to blank contamination) results may not be useful if the LOD is greater than the associated project action limit. In these cases, the project team will determine whether or not the laboratory would have reported the contaminant if detected at or above the PAL (i.e., evaluation of the PAL versus the DL).
- Ten percent of hardcopy analytical data will be checked against the electronic data to identify systematic reporting discrepancies. The basis for verifying 10% is traditional and has been shown to be sufficient for this purpose. The check will be performed manually. The check will verify results and laboratory qualifiers. This process is intended to identify discrepancies between the hardcopy and electronic data. If any discrepancies are identified during the ten percent verification, the laboratory will be contacted, the discrepancies will be communicated, and the laboratory will resolve the discrepancies. Separate from this check, 100% of data validation changes (qualifiers, etc.) are verified between the data validation reports, Form 1s, and electronic deliverable.
- If significant deviation is evident between parent samples and their field or laboratory duplicate, the cause will be investigated. The possibility of a switched sample will be considered. Field duplicates are expected to exhibit greater deviation than laboratory duplicates. Field duplicate and laboratory duplicate reproducibility is outlined in **Worksheet #28**.
- Significant biases may be evident based on LCS, MS/MSD, and spiked surrogate exceedances. The third-party data validator will consider QC exceedances and biases when applying qualifiers to data. The project team will consider the direction of bias when determining the usability of qualified data compared to PALs. Low biases are expected to occur more frequently than high biases. In the case of rejected non-detect data, low biases may represent the inability of the laboratory to detect contaminants that may or may not be present at the site. The project team will act conservatively and understand that it is not known whether or not these compounds are present below, at, or above the PAL. High biases indicate that a result may be lower than it is reported. When high-biased data are greater than a PAL, the project team will examine the proximity of the result to the PAL to determine whether additional data are needed or if the result should simply be interpreted as a PAL exceedance.
- After completion of the data validation, the distribution of applied data validation qualifiers will be examined to determine if there are patterns that negatively affect the usability of data. This information will be compiled into a DQE, which will be presented as an appendix to the project report.

SAP Worksheet #37—Usability Assessment (continued)

- Data usability is not decided upon by any one individual or entity. The project team, as a whole, will decide upon the usability of the data.
- Deviations from the SAP sampling and analytical protocols will be reviewed to ascertain whether or not they are significant enough to negatively affect the usability of data.
- Precision is assessed via percent difference or relative percent difference. Percent difference is typically used when one value is considered theoretically correct and relative percent difference is typically used when both values are experimental. Percent difference is calculated by taking the absolute value of the difference divided by the theoretical value. This is also expressed as

  $((|X_1 - X_2|) / X_1) * 100$

  where X_1 is the theoretical value and X_2 is the experimental value. If it is necessary to imply the direction of a bias, such as for percent drift, the absolute value need not be considered. Relative percent difference is calculated by taking the absolute value of the difference divided by the mean. This is also expressed as

  $((|X_1 - X_2|) / ((X_1 + X_2)/2)) * 100$

  where X_1 and X_2 are both measured values. Percent difference and relative percent difference often have upper control limits for precision.
- Accuracy is assessed via percent recovery. This is calculated by taking the measured value divided by the theoretical value. This is also expressed as

  $(X_2 / X_1) * 100$

  where X_1 is the theoretical value and X_2 is the experimental value, both positive numbers because they are 'amounts' or concentrations. Percent recovery can be negative, such as for MS and MSD recovery, if X_2 is calculated by subtracting a parent concentration from an experimental recovery. Percent recovery often has upper and lower control limits for accuracy.
- Completeness is calculated by taking the number of available results divided by the total number of results. This is also expressed as

  $(X_2 / X_1) * 100$

  where X_2 is the number of distinct results deemed "available for use" (not rejected) and X_1 is the total number of distinct results (not excluded). Completeness is calculated for the entire data set, for each matrix, and for each combination of matrix and analysis group. If patterns of rejection are evident in the data set, completeness may also be calculated for select combinations of matrix, analysis group, and analyte or other combinations as applicable for the data quality evaluation. Completeness has a lower control limit (completeness goal) and cannot exceed 100%.

Notes:

1. Completeness is defined as the percentage of measurements that are judged to be available compared to the total number of measurements made. The objective of the overall completeness goal for this project is set at 95% available data. This goal is inclusive of both field and laboratory analytical data.
2. Discussions of precision, accuracy, representativeness, completeness, and comparability will be included in the data quality review to describe the impact of data quality on project data quality objectives and data usability.

References

ATSDR. 2006. *Health Consultation: Land crab evaluation, (National Oceanographic Atmospheric Administration Data) Isla de Vieques, Vieques, Puerto Rico. Agency for Toxic Substances and Disease Registry, Division of Health Assessment and Consultation*. February.

CH2M HILL, 2009. No *Action Decision Document for 4 Consent Order Sites and 6 PI/PAOC Sites, Former Vieques Naval Training Range, Vieques, Puerto Rico*. January.

CH2M HILL, 2010a. *Master Standard Operating Procedures, Protocols, and Plans, Environmental Restoration Program, Vieques, Puerto Rico*. April.

CH2M HILL, 2010b. *Site Inspection/Expanded Site Inspection Report, 7 Consent Order Sites and 16 PI/PAOC Sites, Former Vieques Naval Training Range, Vieques, Puerto Rico*. August.

CH2M HILL, 2011. *Streamlined Remedial Investigation/Feasibility Study Report Solid Waste Management Unit 1 (SWUM 1) Former Vieques Naval Training Range, Vieques, Puerto Rico*. April.

CH2M HILL. 2012. *Final Site Management Plan, Fiscal Year 2013, Atlantic Fleet Weapons Training Area – Vieques, Vieques, Puerto Rico*. September.

Department of Interior (DOI). 2007. *Vieques National Wildlife Refuge Comprehensive Conservation Plan and Environmental Impact Statement.* August.

GeoMarine, Inc. 2002. *Mangrove Forest Health and Status: Vieques Island, Naval Station Roosevelt Roads, Puerto Rico.* March.

NAVFAC, 2003. *Environmental Baseline Survey, Vieques Naval Training Range, Vieques Island, Puerto Rico.* April.

NOAA and RIDOLFI Inc. 2006. *Final Data Report for the Vieques Island Biota Sampling Project, Vieques Island, Puerto Rico*. July.

NOAA, 2010, *An Ecological Characterization of the Marine Resources of Vieques, Puerto Rico Part II: Field Studies of Habitats, Nutrients, Contaminants, Fish, and Benthic Communities*. May.

TAMS-Tippets-Abbett-McCarthy-Stratton and Ecology and Environment, 1979. Draft E*nvironmental Impact Statement, Continued Use of the Atlantic Fleet Weapons Training Facility Inner Range (Vieques).* December.

United States Environmental Protection Agency (USEPA), 1991. *Guidance for Performing Preliminary Assessments Under CERCLA. Office of Emergency Remedial Response, EPA/540/G-91/013*. September.

United States Environmental Protection Agency (USEPA), 1999a*. Improving Site Assessment: Abbreviated Preliminary Assessments. Office of Solid Waste and Emergency Response. EPA-540-F-98-037. OSWER 9375.2-09FS.* October.

United States Environmental Protection Agency (USEPA), 1999b*. Improving Site Assessment: Pre-CERCLIS Screening Assessments. Office of Solid Waste and Emergency Response. EPA-540-F-98-039. OSWER 9375.2-11FS.* October.

United States Environmental Protection Agency (USEPA). 2001. *Methods for assessing the chronic toxicity of marine and estuarine sediment-associated contaminants with the amphipod Leptocheirus plumulosus. First edition.* EPA/600/R-01/020. March.

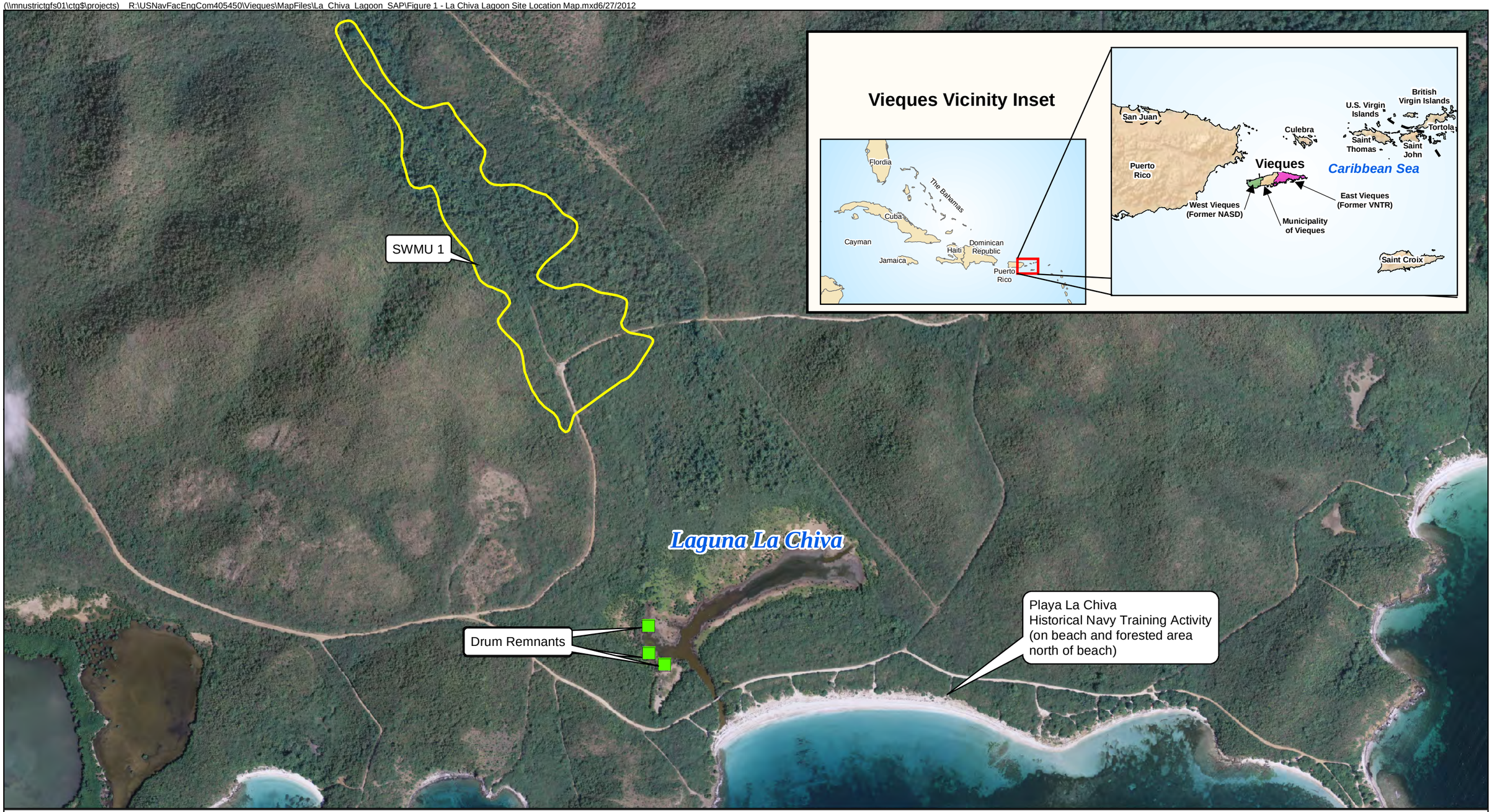
United States Environmental Protection Agency (USEPA), 2002. *EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5, QAMS, EPA/240/R-02/009*. December.

United States Environmental Protection Agency (USEPA), 2005. *Uniform Federal Policy for Quality Assurance Project Plans, Evaluating, Assessing and Documenting Environmental Data Collection and Use Programs, Part 1: UFP-QAPP Manual, Final Version 1*. March.

This page intentionally left blank.

Figures

(\\mnustrictgfs01\ctg$\projects) R:\USNavFacEngCom405450\Vieques\MapFiles\La_Chiva_Lagoon_SAP\Figure 1 - La Chiva Lagoon Site Location Map.mxd6/27/2012



Legend

- Drum Remnants
- SWMU 1

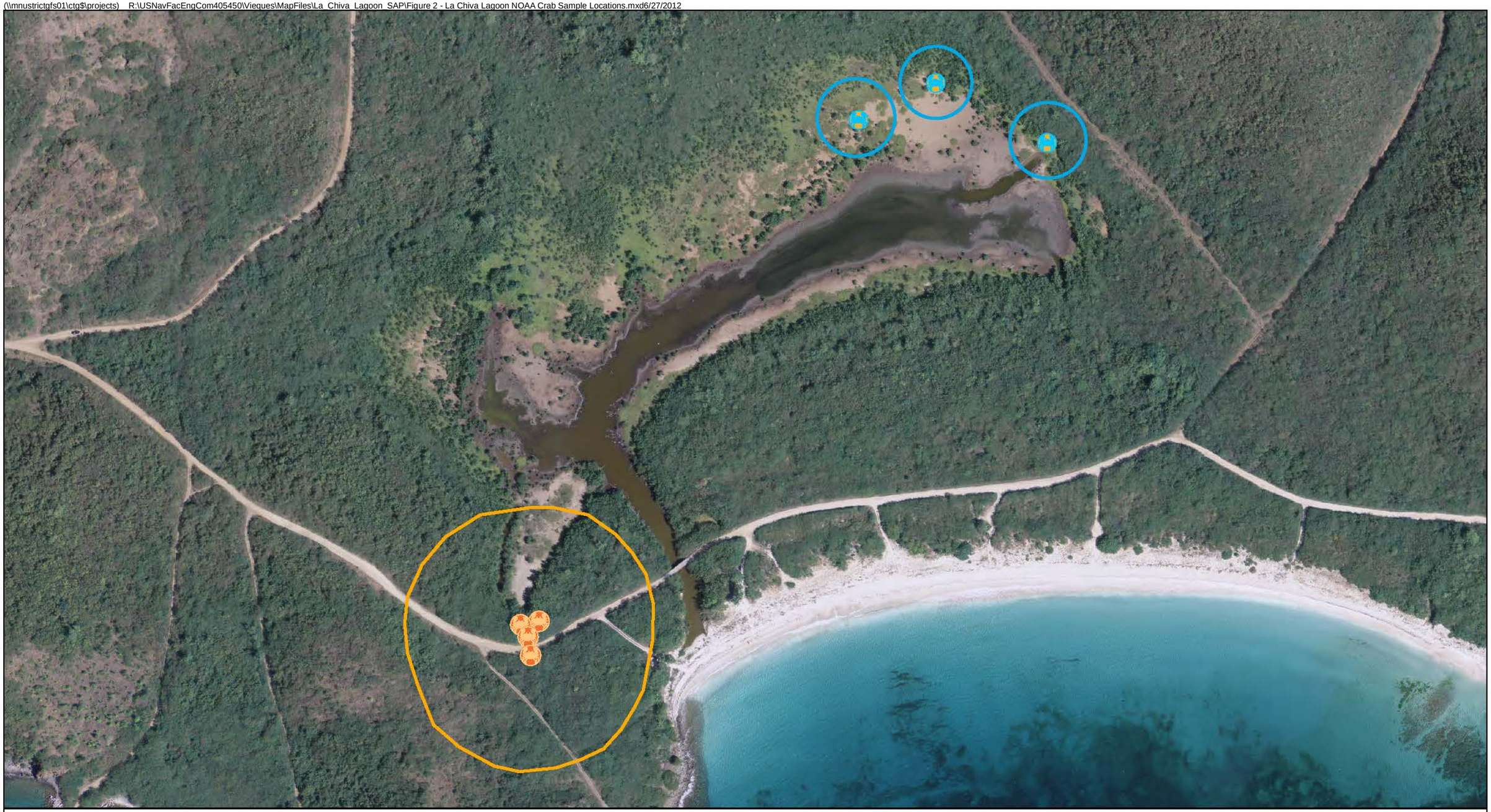
N
W E
S

0 350 700
Feet

Figure 1
Laguna La Chiva Site Location Map
Laguna La Chiva Site Inspection/Remedial Investigation
Former Vieques Naval Training Range
Vieques, Puerto Rico

CH2MHILL

(\\mnustrictgfs01\ctg$\projects) R:\USNavFacEngCom405450\Vieques\MapFiles\La_Chiva_Lagoon_SAP\Figure 2 - La Chiva Lagoon NOAA Crab Sample Locations.mxd6/27/2012



Land Crab Location

Fiddler Crab Location

Sampled Land Crab Habitat Range (100m from burrow)

Sampled Fiddler Crab Habitat Range (30m from burrow)

* An Ecological Characterization of The Marine Resources of Vieques, Puerto Rico. Part II: Field Studies of Habitats, Nutrients, Contaminants, Fish and Benthic Communities. NOAA Technical Memorandum NOS NCCOS 110

N
W E
S

0 250
Feet

Figure 2
Laguna La Chiva NOAA Crab Sample Locations
Laguna La Chiva Site Inspection/Remedial Investigation
Former Vieques Naval Training Range
Vieques, Puerto Rico

CH2MHILL

(\\mnustrictgfs01\ctg$\projects) R:\USNavFacEngCom405450\Vieques\MapFiles\La_Chiva_Lagoon_SAP\Figure 3 - La Chiva Lagoon NOAA Sediment Sample Locs.mxd3/14/2013

46P	10/20/2007	ESV	EqP 2% TOC basis
Dieldrin	0.08	0.715	190.0
Delta HCH	0.43	0.32	2,720
DDMU	39.22 D	No Value	No Value
2,4'-DDD	49.30 D	No Value	No Value
4,4'-DDD	194.95 D	1.22	19.84
2,4'-DDE	5.70	No Value	No Value
4,4'-DDE	122.92 D	2.2	88.39
2,4'-DDT	207.53 D	No Value	No Value
4,4'-DDT	654.05 D	1.19	52.52

47P	10/20/2007	ESV	EqP 2% TOC basis
Dieldrin	ND	0.715	190.0
Delta HCH	0.12	0.32	2,720
DDMU	1.89	No Value	No Value
2,4'-DDD	4.50	No Value	No Value
4,4'-DDD	8.70	1.22	19.84
2,4'-DDE	0.59	No Value	No Value
4,4'-DDE	21.25E	2.2	88.39
2,4'-DDT	ND	No Value	No Value
4,4'-DDT	2.14	1.19	52.52

115S3A	5/22/2007	ESV	EqP 2% TOC basis
Dieldrin	ND	0.715	190.0
Delta HCH	ND	0.32	2,720
DDMU	0.22	No Value	No Value
2,4'-DDD	0.41	No Value	No Value
4,4'-DDD	1.53	1.22	19.84
2,4'-DDE	0.02	No Value	No Value
4,4'-DDE	0.97	2.2	88.39
2,4'-DDT	0.06	No Value	No Value
4,4'-DDT	5.70	1.19	52.52

46P

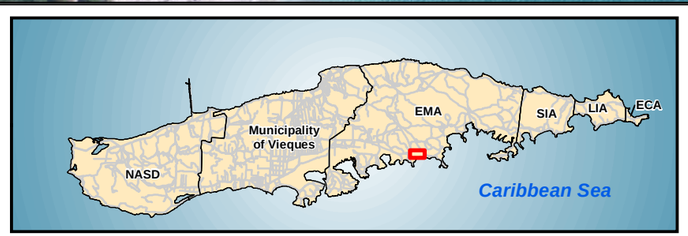
47P

115S3A

Legend

- NOAA Sediment Samples
- PAOC W
- Exceeds Marine Sediment Ecological Screening Value (ESV)
- Exceeds ESV and Marine Sediment ESV based on Equilibrium Partitioning (EqP)

ND = Not Detected
All concentrations listed in µg/kg



N
W E
S

0 175 350
Feet

Figure 3
Laguna La Chiva NOAA Sediment Sample Locations
Laguna La Chiva Site Inspection/Remedial Investigation
Former Vieques Naval Training Range
Vieques, Puerto Rico

CH2MHILL

(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\La_Chiva_Lagoon_SAP\Figure 4 - La Chiva Soil and Sediment Sample Locations.mxd4/5/2013celeftheriadis

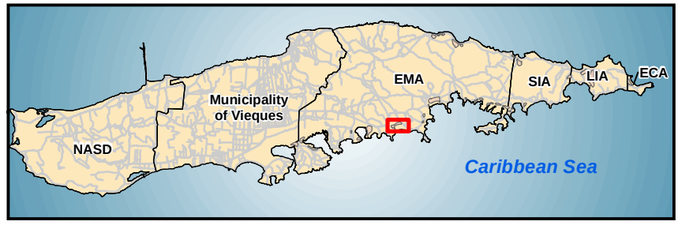
- Proposed Surface Soil Samples (0-1ft bgs)
- Proposed Sediment Sample Location (0-6-in bgs)
- Proposed Surface Sediment (0-6-in. bgs) and Subsurface Sediment (6-12-in. bgs)
- Proposed Surface Soil Sample in Land Crab Habitat (0-2ft bgs)
- NOAA Sediment Samples collected Oct. 2007*

* An Ecological Characterization of The Marine Resources of Vieques, Puerto Rico. Part II: Field Studies of Habitats, Nutrients, Contaminants, Fish and Benthic Communities. NOAA Technical Memorandum NOS NCCOS 110

- Drum Remnants
- Ephemeral Stream

Wetland Type

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Forested/Shrub Wetland



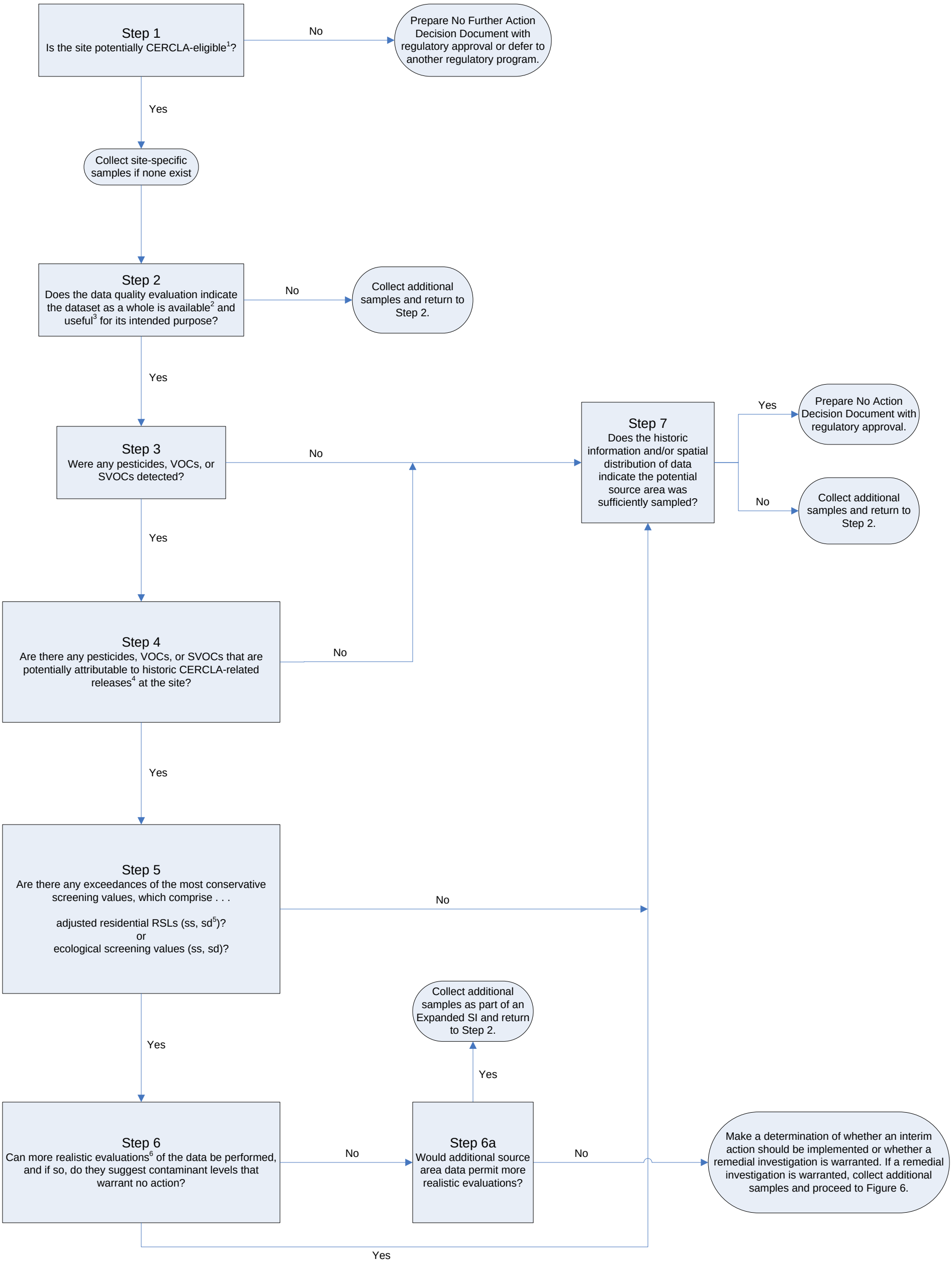
0 100 200
Feet

North

FIGURE 4
Laguna La Chiva Soil and Sediment Sample Locations
Laguna La Chiva Site Inspection/
Remedial Investigation
Former Vieques Naval Training Range
Vieques, Puerto Rico

ES060412002410TPA F4-LaChiva Soil and Sediment Locations.ai

CH2MHILL



Notes:
The decision makers associated with this decision tree are the Navy, USEPA, PREQB, and USFWS.

[1] Determination of CERCLA eligibility is described in Worksheet #11

[2] "Available" data are described in Worksheet #37

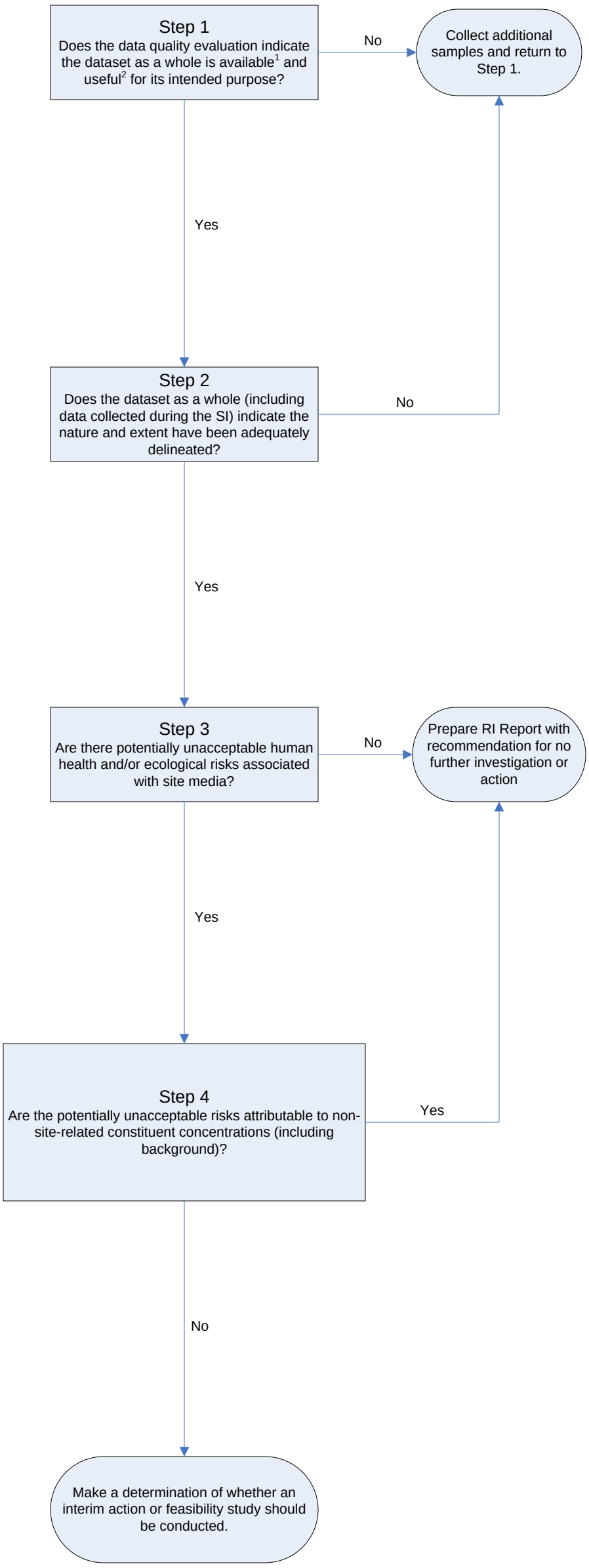
[3] "Useful" data are described in Worksheet #37

[4] CERCLA-related releases are defined in Worksheet #11

[5] ss = surface soil; sd = sediment

[6] Examples of the types of more realistic evaluations that may be performed are described in Section 1.1.2 of the Final SI/ESI Report (CH2M HILL, October 2009)

Figure 5
Site Inspection Evaluation Decision Tree
Site Inspection/Remedial Investigation Sampling and Analysis Plan
Laguna La Chiva
Vieques, Puerto Rico



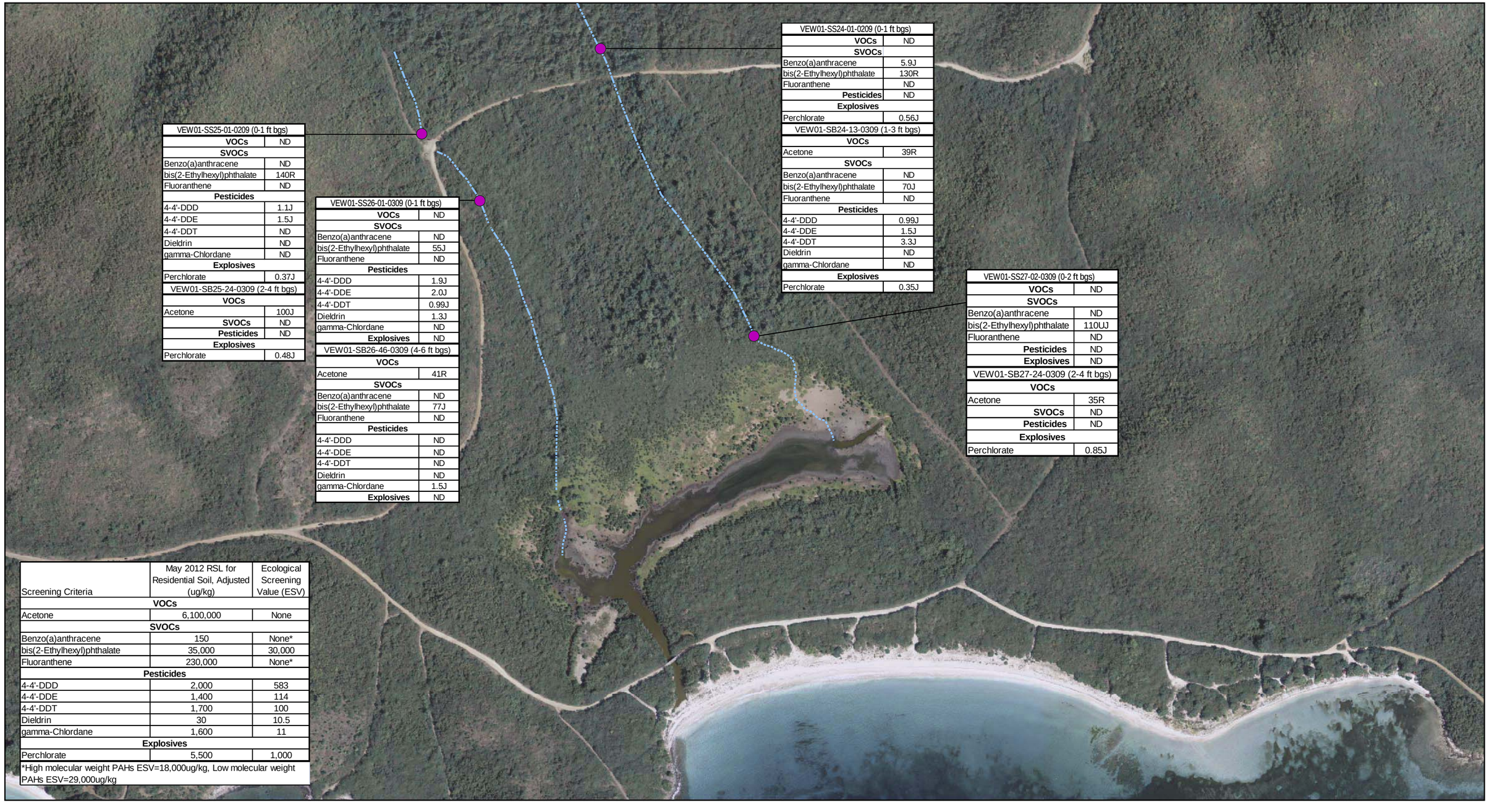
Notes:

The decision makers associated with this decision tree are the Navy, USEPA, PREQB, and USFWS.

[1] "Available" data are described in Worksheet #37

[2] "Useful" data are described in Worksheet #37

Figure 6
Remedial Investigation Evaluation Decision Tree
Site Inspection/Remedial Investigation Sampling and Analysis Plan
Laguna La Chiva
Vieques, Puerto Rico



Screening Criteria	May 2012 RSL for Residential Soil, Adjusted (ug/kg)	Ecological Screening Value (ESV)
VOCs		
Acetone	6,100,000	None
SVOCs		
Benzo(a)anthracene	150	None*
bis(2-Ethylhexyl)phthalate	35,000	30,000
Fluoranthene	230,000	None*
Pesticides		
4-4'-DDD	2,000	583
4-4'-DDE	1,400	114
4-4'-DDT	1,700	100
Dieldrin	30	10.5
gamma-Chlordane	1,600	11
Explosives		
Perchlorate	5,500	1,000

*High molecular weight PAHs ESV=18,000ug/kg, Low molecular weight PAHs ESV=29,000ug/kg

Legend

Ephemeral Stream

Previously Collected Ephemeral Stream Sample Locations

J - Analyte present, value may or may not be accurate or precise

NJ - Presumptively present at approximate quantity

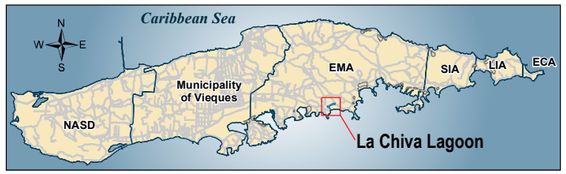
0 250 500 Feet

North

FIGURE 7
SWMU 1 Ephemeral Stream Soil Samples
Laguna La Chiva Site Inspection/ Remedial Investigation
Former Vieques Naval Training Range
Vieques, Puerto Rico

CH2MHILL

ES030513103834TPA F7-SWMU 1 Ephemeral Stream Soil Samples-rev1.ai



Mammalian Piscivore (Fishing Bat): Ingestion of fish

Residents (hypothetical future direct exposure to soil and exposed sediment [as soil])

Avian Piscivore/Invertivore (Green Heron): Ingestion of aquatic fish and invertebrates (modeled as a piscivore in the SERA)

Avian Omnivore (White-cheeked Pintail): Ingestion of aquatic plants and invertebrates (modeled as a herbivore in the SERA)

Construction Workers (hypothetical future direct exposure to soil and exposed sediment [as soil]).

Avian Invertivore (Spotted Sandpiper): Ingestion of aquatic invertebrates and incidental sediment

Fish (snapper, mullet): Direct exposure to surface water and sediment

Aquatic Invertebrates (crabs, snails): Direct exposure to surface water and sediment

Recreational Users/Trespassers/Site Visitors (current/future direct exposure to soil and exposed sediment [as soil], sediment in areas where water is <3 ft deep, and surface water).

Maintenance Workers (hypothetical future direct exposure to soil and exposed sediment [as soil]).

LEGEND

- La Chiva Lagoon Boundary
- Ephemeral Streams
- Former SWMU 1 Investigation Ephemeral Stream Sample Locations
- Drum Remnants

Land Crabs: Direct exposure to surface soil (0 inches to 2 feet)

Terrestrial plants: direct exposure to surface soil

Avian Carnivore (Red-tailed Hawk): Ingestion of small mammals

Mammalian Insectivore (Velvet Free-tailed Bat): Ingestion of terrestrial and aquatic insects

Avian Insectivore (Cave Swallow): Ingestion of terrestrial and aquatic insects

Mammalian Omnivore (Norway Rat): Ingestion of terrestrial invertebrates, plants, and incidental surface soil (modeled as a herbivore in the SERA)

Mammalian Omnivore (Indian Mongoose): Ingestion of terrestrial invertebrates, plants, small mammals, and incidental surface soil (modeled as an invertivore in the SERA)

Terrestrial Reptile (Crested Anole): Ingestion of terrestrial insects

Industrial Workers (hypothetical future direct exposure to soil and exposed sediment [as soil]).

Avian Omnivore (Pearly-eyed Thrasher): Ingestion of terrestrial invertebrates, terrestrial plants, and incidental surface soil (modeled as an invertivore in the SERA)

Avian Invertivore (Common Ground Dove): Ingestion of terrestrial plants

Soil Invertebrates (earthworms, insects): Dermal exposure and ingestion of surface soil

Fish/Blue Crab Consumers (current/future ingestion of fish and blue crabs)

Figure 8
Conceptual Site Model Laguna La Chiva
Laguna La Chiva Site Inspection/Remedial Investigation
Former Vieques Naval Training Range
Vieques, Puerto Rico

Attachment A
DoD ELAP Letter

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

ENVIRONMENTAL CONSERVATION LABORATORIES – ORLANDO
10775 Central Port Drive
Orlando, FL 32824
Russell Macomber Phone: 407 826 5314
rmacomber@encolabs.com

ENVIRONMENTAL

Valid To: March 31, 2014 Certificate Number: 3000.01

In recognition of the successful completion of the A2LA evaluation process, (including an assessment of the laboratory's compliance with ISO IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in version 4.2 of the DoD Quality Systems Manual for Environmental Laboratories) accreditation is granted to this laboratory to perform recognized EPA methods using the following testing technologies and in the analyte categories identified below:

Testing Technologies

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
Metals	EPA 6020A/200.8	EPA 6020A
Aluminum	EPA 6020A/200.8	EPA 6020A
Antimony	EPA 6020A/200.8	EPA 6020A
Arsenic	EPA 6020A/200.8	EPA 6020A
Barium	EPA 6020A/200.8	EPA 6020A
Beryllium	EPA 6020A/200.8	EPA 6020A
Cadmium	EPA 6020A/200.8	EPA 6020A
Calcium	EPA 6020A/200.8	EPA 6020A
Chromium	EPA 6020A/200.8	EPA 6020A
Cobalt	EPA 6020A/200.8	EPA 6020A
Copper	EPA 6020A/200.8	EPA 6020A
Hardness	SM 2340 B	----------
Iron	EPA 6020A/200.8	EPA 6020A
Lead	EPA 6020A/200.8	EPA 6020A
Magnesium	EPA 6020A/200.8	EPA 6020A
Manganese	EPA 6020A/200.8	EPA 6020A
Mercury	EPA 245.1/7470A	EPA 7471B
Molybdenum	EPA 6020A/200.8	EPA 6020A
Nickel	EPA 6020A/200.8	EPA 6020A
Potassium	EPA 6020A/200.8	EPA 6020A
Selenium	EPA 6020A/200.8	EPA 6020A
Silver	EPA 6020A/200.8	EPA 6020A
Sodium	EPA 6020A/200.8	EPA 6020A
Thallium	EPA 6020A/200.8	EPA 6020A
Tin	EPA 6020A/200.8	EPA 6020A
Titanium	EPA 6020A/200.8	EPA 6020A
Vanadium	EPA 6020A/200.8	EPA 6020A

5301 Buckeystown Pike, Suite 350 | Frederick, Maryland 21704-8373 | Phone: 301 644 3248 | Fax: 301 662 2974 | www.A2LA.org

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
Metals	EPA 6020A/200.8	EPA 6020A
Zinc	EPA 6020A/200.8	EPA 6020A
Microbiology		
Total Coliforms	SM 9222B	----------
Fecal Coliforms	SM 9222D	----------
General Chemistry		
Acidity, as $CaC0_3$	EPA 305.1/SM 2310 B (4A)	----------
Alkalinity as $CaC0_3$	EPA 310.1/SM 2320 B	EPA 310.1/SM 2320 B
Alkalinity as $CaC0_3$	EPA 310.2	EPA 310.2
Biochemical oxygen demand	EPA 405.1/SM 5210 B	----------
Bromide	EPA 300.0/9056A	EPA 9056A
Carbonaceous BOD (CBOD)	SM 5210 B	----------
Chemical oxygen demand	EPA 410.4	----------
Chloride	EPA 300.0/9056A	EPA 9056A
Chromium VI	EPA 7196/ SM 3500-Cr D	EPA 7196
Conductivity	EPA 120.1	----------
Cyanide	EPA 335.2/SM 4500-CN E	EPA 9014
Cyanide, Reactive	----------	SW-846 7.3.3
Ferric iron (calculated)	SM 3500-Fe D	----------
Ferrous iron	SM 3500-Fe D	----------
Fluoride	EPA 300.0/9056A	EPA 9056A
Hardness	EPA 130.2/SM 2340 C	----------
Kjeldahl nitrogen -total	EPA 351.2	EPA351.2
Nitrate as N	EPA 300.0/353.1/9056A	EPA 353.1/9056A
Nitrate-nitrite	EPA 300.0/353.1/9056A	EPA 353.1/9056A
Nitrite as N	EPA 300.0/354.1/9056A/SM 4500-NO_2 B	EPA 9056A/ SM 4500-NO_2 B
Organic nitrogen	EPA 351.2/350.1	EPA 351.2/350.1
Orthophosphate as P	EPA 365.1	----------
Orthophosphate as P	EPA 365.3	----------
pH	EPA 150.1/9040C/SM 4500-H^+-B	EPA 9045D
Phosphorus, total	EPA 365.4	EPA 365.4
Residue-filterable (TDS)	SM 2540 C	----------
Residue-nonfilterable (TSS)	SM 2540 D	----------
Residue-total	SM 2540 B/SM 2540 G/EPA 160.3	SM 2540G/EPA 160.3
Residue-volatile	EPA 160.4	EPA 160.4
Sulfate	EPA 300.0/9056A	EPA 9056A
Sulfide	EPA 376.1/SM 4500-S E	EPA 9030B/9034
Sulfide, Reactive	----------	SW-846 7.3.4
Surfactants -MBAS	SM 5540 C	----------
Total nitrate-nitrite	EPA 9056 A/SM 4500-$N0_3$ H	EPA 9056 A/SM 4500-$N0_3$ H
Total cyanide	EPA 9014	EPA 9014
Total nitrogen	TKN + Total nitrate-nitrite	TKN + Total nitrate-nitrite
Total Organic Carbon	EPA 9060A/SM 5310B	TOC Walkley Black
Total phenolics	EPA 420.1	EPA 420.1
Total, fixed, and volatile residue	SM 2540 G	SM 2540 G
Turbidity	EPA 180.1	----------
Un-ionized ammonia	DEP SOP 10/03/83	DEP SOP 10/03/83
Extractable Organics		
1,2,4-Trichlorobenzene	EPA 8270D/625	EPA 8270D

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
Extractable Organics		
1,2,4,5-Tetrachlorobenzene	EPA 8270D/625	EPA 8270D
1,2-Dichlorobenzene	EPA 8270D/625	EPA 8270D
1,2-Diphenylhydrazine	EPA 8270D/625	EPA 8270D
1,3-Dichlorobenzene	EPA 8270D/625	EPA 8270D
1,4-Dichlorobenzene	EPA 8270D/625	EPA 8270D
1- Methylnaphthalene	EPA 8270D/625/ Scan-Sim	EPA 8270D/ Scan-Sim
2,3,4,6-Tetrachlorophenol	EPA 8270D/625	EPA 8270D
2,4,5-Trichlorophenol	EPA 8270D/625	EPA 8270D
2,4,6-Trichlorophenol	EPA 8270D/625	EPA 8270D
2,4-Dichlorophenol	EPA 8270D/625	EPA 8270D
2,4-Dimethylphenol	EPA 8270D/625	EPA 8270D
2,4-Dinitrophenol	EPA 8270D/625	EPA 8270D
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270D/625/ Scan-Sim	EPA 8270D
2,6-Dichlorophenon	EPA 8270D/625	EPA 8270D
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270D/625	EPA 8270D
2-Chloronaphthalene	EPA 8270D/625	EPA 8270D
2-Chlorophenol	EPA 8270D/625	EPA 8270D
2·Methyl-4,6-dinitrophenol	EPA 8270D/625	EPA 8270D
2-Methylnaphthalene	EPA 8270D/625 Scan-Sim	EPA 8270D Scan-Sim
2-Methylphenol (o-Cresol)	EPA 8270D/625	EPA 8270D
2-Nitroaniline	EPA 8270D/625	EPA 8270D
2-Nitrophenol	EPA 8270D/625	EPA 8270D
3,3'-Dichlorobenzidine	EPA 8270D/625	EPA 8270D
3/4-Methylphenols (m/p-Cresols)	EPA 8270D/625	EPA 8270D
3-Nitroaniline	EPA 8270D/625	EPA 8270D
4-Bromophenyl phenyl ether	EPA 8270D/625	EPA 8270D
4-Chloro-3-methylphenol	EPA 8270D/625	EPA 8270D
4-Chloroaniline	EPA 8270D/625	EPA 8270D
4-Chlorophenyl phenyl ether	EPA 8270D/625	EPA 8270D
4-Nitrophenol	EPA 8270D/625	EPA 8270D
Acenaphthene	EPA 8270D/625 Scan-Sim	EPA 8270D Scan-Sim
Acenaphthylene	EPA 8270D/625 Scan-Sim	EPA 8270D Scan-Sim
4-Melhylphenol (p-Cresol)	EPA 8270D/625	EPA 8270D
4-Nitroaniline	EPA 8270D/625	EPA 8270D
Acetophenone	EPA 8270D/625	EPA 8270D
Anthracene	EPA 8270D/625/ Scan-Sim	EPA 8270D
Atrazine	EPA 8270D/625	EPA 8270D
Benzaldehyde	EPA 8270D/625	EPA 8270D
Benzidine	EPA 8270D/625/ Scan-Sim	EPA 8270D
Benzo(a)anthracene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Benzo(a)pyrene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Benzo(b)fluoranthene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Benzo(g,h,i)perylene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Benzo(k)fluoranthene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Benzyl alcohol	EPA 8270D/625	EPA 8270D
1,1-Biphenyl	EPA 8270D/625	EPA 8270D
bis(2-Chloroethoxy) methane	EPA 8270D/625	EPA 8270D
bis(2-Chloroethyl) ether	EPA 8270D/625	EPA 8270D
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 8270D/625	EPA 8270D
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270D/625	EPA 8270D

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
Extractable Organics		
Butyl benzyl phthalate	EPA 8270D/625	EPA 8270D
Caprolactam	EPA 8270D/625	EPA 8270D
Carbazole	EPA 8270D/625	EPA 8270D
Chrysene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Dibenz(a,h)anthracene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Dibenzofuran	EPA 8270D/625	EPA 8270D
Diethyl phthalate	EPA 8270D/625	EPA 8270D
Dimethyl phthalate	EPA 8270D/625/ Scan-Sim	EPA 8270D
Di-n-butyl phthalate	EPA 8270D/625	EPA 8270D
Di-n-octyl phthalate	EPA 8270D/625	EPA 8270D
Fluoranthene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Fluorene	EPA 8270D/625 Scan-Sim	EPA 8270D Scan-Sim
Hexachlorobenzene	EPA 8270D/625/ Scan-Sim	EPA 8270D
Hexachlorobutadiene	EPA 8270D/625/ Scan-Sim	EPA 8270D
Hexachlorocyclopentadiene	EPA 8270D/625	EPA 8270D
Hexachloroethane	EPA 8270D/625	EPA 8270D
Indeno(1,2,3-cd)pyrene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Isodrin	EPA 8270D/625	EPA 8270D
Isophorone	EPA 8270D/625	EPA 8270D
Naphthalene	EPA 8270D/625 Scan-Sim	EPA 8270D Scan-Sim
Nitrobenzene	EPA 8270D/625	EPA 8270D
n-Nitrosodimethylamine	EPA 8270D/625	EPA 8270D
n-Nitrosodi-n-propylamine	EPA 8270D/625	EPA 8270D
n-Nitrosodiphenylamine	EPA 8270D/625	EPA 8270D
n-Nitrosopyrrolidine	EPA 8270D/625	EPA 8270D
Pentachlorophenol	EPA 8270D/625/ Scan-Sim	EPA 8270D
Phenanthrene	EPA 8270D/625 Scan-Sim	EPA 8270D Scan-Sim
Phenol	EPA 8270D/625	EPA 8270D
Pyrene	EPA 8270D/625 Scan-Sim	EPA 8270D Scan-Sim
Pyridine	EPA 8270D/625	EPA 8270D
Total Petroleum Hydrocarbons (TPH)	FL·PRO	FL·PRO
Volatile Organics		
1,1,1,2-Tetrachloroethane	EPA 8260B/624	EPA 8260B
1,1,1-Trichloroethane	EPA 8260B/624	EPA 8260B
1,1,2,2-Tetrachloroethane	EPA 8260B/624	EPA 8260B
1,1,2-Trichloro-1,2,2-trifluoroethane	EPA 8260B/624	EPA 8260B
1,1,2-Trichloroethane	EPA 8260B/624	EPA 8260B
1,1-Dichloroethane	EPA 8260B/624	EPA 8260B
1,1-Dichloroethene	EPA 8260B/624	EPA 8260B
1,1-Dichloropropene	EPA 8260B/624	EPA 8260B
1,2,3-Trichlorobenzene	8260B/624	EPA 8260B
1,2,3-Trichloropropane	EPA 8260B/624	EPA 8260B
1,2,4-Trichlorobenzene	EPA 8260B/624	EPA 8260B
1,2,4-Trimethylbenzene	EPA 8260B/624	EPA 8260B
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504/8011/8260B	EPA 8260B
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 504/8011/8260B	EPA 8260B
1,2-Dichlorobenzene	EPA 8260B/624	EPA 8260B
1,2-Dichloroethane	EPA 8260B/624	EPA 8260B

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
Volatile Organics		
1,2-Dichloropropane	EPA 8260B/624	EPA 8260B
1,3,5-Trimethylbenzene	EPA 8260B/624	EPA 8260B
1,3-Dichlorobenzene	EPA 8260B/624	EPA 8260B
1,3-Dichloropropane	EPA 8260B/624	EPA 8260B
1,4-Dichlorobenzene	EPA 8260B/624	EPA 8260B
1,4-Dioxane (1,4-Diethylencoxide)	EPA 8260B/8260C SIM/624	EPA 8260B/8260C SIM
2,2-Dichloropropane	EPA 8260B/624	EPA 8260B
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260B/624	EPA 8260B
2-Chloroethyl vinyl ether	EPA 8260B/624	EPA 8260B
2-Chlorotoluene	EPA 8260B/624	EPA 8260B
2-Hexanone	EPA 8260B/624	EPA 8260B
4-Chlorotoluene	EPA 8260B/624	EPA 8260B
4-Methyl-2-pentanone (MIBK)	EPA 8260B/624	EPA 8260B
Acetone	EPA 8260B/624	EPA 8260B
Acetonitrile	EPA 8260B/624	EPA 8260B
Acrolein (Propenal)	EPA 8260B/624	EPA 8260B
Acrylonitrile	EPA 8260B/624	EPA 8260B
Allyl chloride (3-Chloropropene)	EPA 8260B/624	EPA 8260B
Benzene	EPA 8260B/624	EPA 8260B
Bromobenzene	EPA 8260B/624	EPA 8260B
Bromochloromethane	EPA 8260B/624	EPA 8260B
Bromodichloromethane	EPA 8260B/624	EPA 8260B
Bromoform	EPA 8260B/624	EPA 8260B
Carbon tetrachloride	EPA 8260B/624	EPA 8260B
Carbon disulfide	EPA 8260B/624	EPA 8260B
Chlorobenzene	EPA 8260B/624	EPA 8260B
Chloroethane	EPA 8260B/624	EPA 8260B
Chloroform	EPA 8260B/624	EPA 8260B
Chloroprene	EPA 8260B/624	EPA 8260B
cis-1,2-Dichloroethene	EPA 8260B/624	EPA 8260B
cis-1,3-Dichloropropene	EPA 8260B/624	EPA 8260B
Cyclohexane	EPA 8260B/624	EPA 8260B
Dibromochloromethane	EPA 8260B/624	EPA 8260B
Dibromomethane	EPA 8260B/624	EPA 8260B
Dichlorodifluoromethane	EPA 8260B/624	EPA 8260B
Ethyl methacrylate	EPA 8260B/624	EPA 8260B
Hexachlorobutadiene	EPA 8260B/624	EPA 8260B
Ethylbenzene	EPA 8260B/624	EPA 8260B
Iodomethane (Methyl iodide)	EPA 8260B/624	EPA 8260B
Isobutyl alcohol (2-Methyl-l-propanol)	EPA 8260B/624	EPA 8260B
Isopropylbenzene	EPA 8260B/624	EPA 8260B
m+p-Xylenes	EPA 8260B/624	EPA 8260B
Methacrylonitrile	EPA 8260B/624	EPA 8260B
Methyl acetate	EPA 8260B/624	EPA 8260B
Methyl bromide (Bromomethane)	EPA 8260B/624	EPA 8260B
Methyl chloride (Chloromethane)	EPA 8260B/624	EPA 8260B
Methyl methacrylate	EPA 8260B/624	EPA 8260B
Methyl tert-butyl ether (MTBE)	EPA 8260B/624	EPA 8260B
Methylcyclohexane	EPA 8260B/624	EPA 8260B

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
Volatile Organics		
Methylene chloride	EPA 8260B/624	EPA 8260B
Naphthalene	EPA 8260B/624	EPA 8260B
n-Butylbenzene	EPA 8260B/624	EPA 8260B
n-Propylbenzene	EPA 8260B/624	EPA 8260B
o-Xylene	EPA 8260B/624	EPA 8260B
Pentachloroethane	EPA 8260B/624	EPA 8260B
p-Isopropyltoluene	EPA 8260B/624	EPA 8260B
Propionitrile (Ethyl cyanide)	EPA 8260B/624	EPA 8260B
sec-Butylbenzene	EPA 8260B/624	EPA 8260B
Styrene	EPA 8260B/624	EPA 8260B
tert-Butylbenzene	EPA 8260B/624	EPA 8260B
Tetrachloroethene (Perchloroethylene)	EPA 8260B/624	EPA 8260B
Toluene	EPA 8260B/624	EPA 8260B
trans-1,2-Dichloroethene	EPA 8260B/624	EPA 8260B
trans-1,3-Dichloropropene	EPA 8260B/624	EPA 8260B
trans-1,4-Dichloro-2-butene	EPA 8260B/624	EPA 8260B
Trichloroethene (Trichloroethylene)	EPA 8260B/624	EPA 8260B
Trichlorofluoromethane	EPA 8260B/624	EPA 8260B
Vinyl acetate	EPA 8260B/624	EPA 8260B
Vinyl chloride	EPA 8260B/624	EPA 8260B
Xylene (total)	EPA 8260B/624	EPA 8260B
Pesticides-Herbicides-PCBs		
2,4,5-T	EPA 8151A /615	EPA 8151A
2,4-D	EPA 8151A /615	EPA 8151A
2,4-DB	EPA 8151A /615	EPA 8151A
3,5-Dichlorobenzoic acid	EPA 8151A /615	EPA 8151A
4.4'-DDD	EPA 8081B/608	EPA 8081B
4.4'-DDE	EPA 8081B/608	EPA 8081B
4,4'·DDT	EPA 8081B/608	EPA 8081B
4-Nitrophenol	EPA 8151A/615	EPA 8151A
Acifluorfen	EPA 8151A/615	EPA 8151A
Aldrin	EPA 8081B/608	EPA 8081B
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081B/608	EPA 8081B
alpha-Chlordane	EPA 8081B/608	EPA 8081B
Aroclor-1016(PCB-1016)	EPA 8082A/608	EPA 8082A
Aroclor-1221 (PCB-1221)	EPA 8082A/608	EPA 8082A
Aroclor-1232 (PCB-1232)	EPA 8082A/608	EPA 8082A
Aroclor-1242 (PCB-1242)	EPA 8082A/608	EPA 8082A
Aroclor-1248 (PCB-1248)	EPA 8082A/608	EPA 8082A
Aroclor-1254 (PCB-1254)	EPA 8082A/608	EPA 8082A
Aroclor-1260 (PCB-1260)	EPA 8082A/608	EPA 8082A
Aroclor-1262 (PCB-1262)	EPA 8082A/608	EPA 8082A
Aroclor-1268 (PCB-1268)	EPA 8082A/608	EPA 8082A
Azinphos-methyl (Guthion)	EPA 8141B	EPA 8141B
Bentazon	EPA 8151A/615	EPA 8151A
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081B/608	EPA 8081B
Bolstar (Sulprofos)	EPA 8141B	EPA 8141B
Chloramben	EPA 8151A/615	EPA 8151A

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
Pesticides-Herbicides-PCBs		
Chlordane (tech.)	EPA 8081B/608	EPA 8081B
Chlorpynfos	EPA 8141B	EPA 8141B
Coumaphos	EPA 8141B	EPA 8141B
Dacthal (DCPA)	EPA 8151A/615	EPA 8151A
Dalapon	EPA 8151A/615	EPA 8151A
delta-BHC	EPA 8081B/608	EPA 8081B
Demeton, Total	EPA 8141B	EPA 8141B
Diazinon	EPA 8141B	EPA 8141B
Dicamba	EPA 8151A/615	EPA 8151A
Dichlorofenthion	EPA 8141B	EPA 8141B
Dichloroprop (Dichlorprop)	EPA 8151A/615	EPA 8151A
Dlchlorovos (DDVP, Dichtorvos)	EPA 8141B	EPA 8141B
Dieldrin	EPA 8081B/608	EPA 8081B
Dimethoate	EPA 8141B	EPA 8141B
Dinoseb (2-sec-buty1-4 ,6-dinilrophenol, DNB P)	EPA 8151A/615	EPA 8151A
Disulfoton	EPA 8141B	EPA 8141B
Endosulfan I	EPA 8081B/608	EPA 8081B
Endosulfan II	EPA 8081B/608	EPA 8081B
Endosulfan sulfate	EPA 8081B/608	EPA 8081B
Endrin	EPA 8081B/608	EPA 8081B
Endrin aldehyde	EPA 8081B/608	EPA 8081B
Endrin ketone	EPA 8081B/608	EPA 8081B
EPN	EPA 8141B	EPA 8141B
Ethion	EPA 8141B	EPA 8141B
Ethoprop	EPA 8141B	EPA 8141B
fensulfothion	EPA 8141B	EPA 8141B
fenthion	EPA 8141B	EPA 8141B
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081B/608	EPA 8081B
gamma-Chlordane	EPA 8081B/608	EPA 8081B
Heptachlor	EPA 8081B/608	EPA 8081B
Heptachlor epoxide	EPA 8081B/608	EPA 8081B
Isodrin	EPA 8081B/608	EPA 8081B
Malathion	EPA 8141B	EPA 8141B
MCPA	EPA 8151A/615	EPA 8151A
MCPP	EPA 8151A/615	EPA 8151A
Merphos	EPA 8141B	EPA 8141B
Methoxychlor	EPA 8081B/608	EPA 8081B
Methyl parathion (Parathion. methyl)	EPA 8141B	EPA 8141B
Mevinphos	EPA 8141B	EPA 8141B
Mirex	EPA 8081B/608	EPA 8081B
Monocrotophos	EPA 8141B	EPA 8141B
Naled	EPA 8141B	EPA 8141B
Parathion, ethyl	EPA 8141B	EPA 8141B
Pentachlorophenol	EPA 8151A/615	EPA 8151A
Phorate	EPA 8141B	EPA 8141B
Picloram	EPA 8151A/615	EPA 8151A
Ronnel	EPA 8141B	EPA 8141B
Silvex (2A.5-TP)	EPA 8151B/615	EPA 8151B
Stirofos	EPA 8141B	EPA 8141B

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
Pesticides-Herbicides-PCBs		
Sulfotepp	EPA 8141B	EPA 8141B
Tetraethyl pyrophosphate (TEPP)	EPA 8141B	EPA 8141B
Tokuthion (Prothiophos)	EPA 8141B	EPA 8141B
Toxaphene (Chlorinated camphene)	EPA 8081B/608	EPA 8081B
Trichloronate	EPA 8141B	EPA 8141B

Preparation Methods

Fraction	Analytical Method	Preparation Method
Cyanide	EPA 9014 EPA 335.2 /SM 4500-CN E	EPA 9010C
TX	EPA 9056A	EPA 5050
Metal water prep	EPA 6020A/200.8	EPA 3005A
Metals soil prep	EPA 6020A	EPA 3050B
Metals TCLP prep	EPA 6020A/200.8	EPA 3010A
Extractable organics and Pesticides water prep	EPA 8270D/625/8081B/8082A/ 608/ 8141B	EPA 3510C
Extractable organics and Pesticides waste prep	EPA 8270D/625/8081B/8082A/ 608/ 8141B	EPA 3580A
Extractable organics and Pesticides soil prep	EPA 8270D/625/8081B/8082A/ 608/ 8141B	EPA 3550C
Organics water and mid-level soil prep	EPA 8260B/624	EPA 5030B
Organics low-level soil prep	EPA 8260B/624	EPA 5035
Soil/water leachate	Wets	ENCO WETS-88
SPLP	Wets, Organics, and Metals	EPA 1312
TCLP	Wets, Organics, and Metals	EPA 1311

The American Association for Laboratory Accreditation

World Class Accreditation

Accredited DoD ELAP Laboratory

A2LA has accredited

ENVIRONMENTAL CONSERVATION LABORATORIES - ORLANDO

Orlando, FL

for technical competence in the field of

Environmental Testing

In recognition of the successful completion of the A2LA evaluation process that includes an assessment of the laboratory's compliance with ISO/IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in version 4.2 of the DoD Quality System Manual for Environmental Laboratories (QSM); accreditation is granted to this laboratory to perform recognized EPA methods as defined on the associated A2LA Environmental Scope of Accreditation. This accreditation demonstrates technical competence for this defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 29th day of May 2012.

President & CEO
For the Accreditation Council
Certificate Number 3000.01
Valid to March 31, 2014

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Environmental Scope of Accreditation.

Attachment B
Data Management Plan

Version 3

Navy CLEAN
Data Management Plan

Prepared for

Navy CLEAN & Joint Venture Programs

June 2010

CH2MHILL

Preface

This document presents the standardized six-step workflow process for environmental data management being performed for the Navy Comprehensive Long-Term Environmental Action - Navy (CLEAN) and Joint Venture Programs. Included in Appendix A is the responsible, approve, support, consult, and inform (RASCI) diagram along with the associated roles and responsibilities, which is the basis for the Navy CLEAN and Joint Venture Programs Data Management Plan (DMP). Following are the six steps in the workflow process:

1. Project planning and database setup
2. Sample collection and management
3. Laboratory analysis
4. Data validation and loading
5. Data management
6. Data evaluation and reporting

Figure P-1 presents a simplified presentation of the workflow process specific to the Navy CLEAN and Joint Venture Programs.

Figure P-2 presents, in more detail, the tools used in each step of the process. CH2M HILL uses the Sample Tracking Sheet (STS) to initiate the sample collection, documentation, and tracking processes. All field-related data is captured in the Field Data Entry Tool (FDETool). During the laboratory analysis and data validation phase, the SNEDD-QC-Tool software will be used to help evaluate the quality of the data. At the data management step, the SVMTool will be used to format the data and the CH-IMPTool will be used to transfer the data into the Navy CLEAN data warehouse. At the data evaluation stage, the XTabReports Tool will be used to query data from the data warehouse, and the Crosstab Cleanup Tool (CCTool) and the Raw, Detects, and Exceedance (RDE) Formatting Tool will produce and format data tables and comparisons to project action levels. Appropriate section(s) of the DMP include additional details on each of the tools used.

Change Management

This DMP is a "living" document and content may be revised or amended to accommodate changes in the scope of environmental investigations or data management requirements that affect the entire Navy CLEAN and Joint Venture Programs. In addition, the DMP appendices will be subject to modification as new or improved methods of data management are developed and implemented.

Any modifications made to the tools will be communicated to the project team via e-mail. As revisions are finalized, they will be distributed electronically to all users. After revision, it is the user's responsibility to conform to revised portions of the DMP.

Amendments will be versioned and released according to the following naming scheme: [Document Name_v#.#_yymmdd]. If a significant change is made to any of these files, the version number will increase by one integer. The revision history is shown in the following table.

REVISION HISTORY
Navy CLEAN and Joint Venture Programs Data Management Plan

Revision Date	Initiator	Purpose

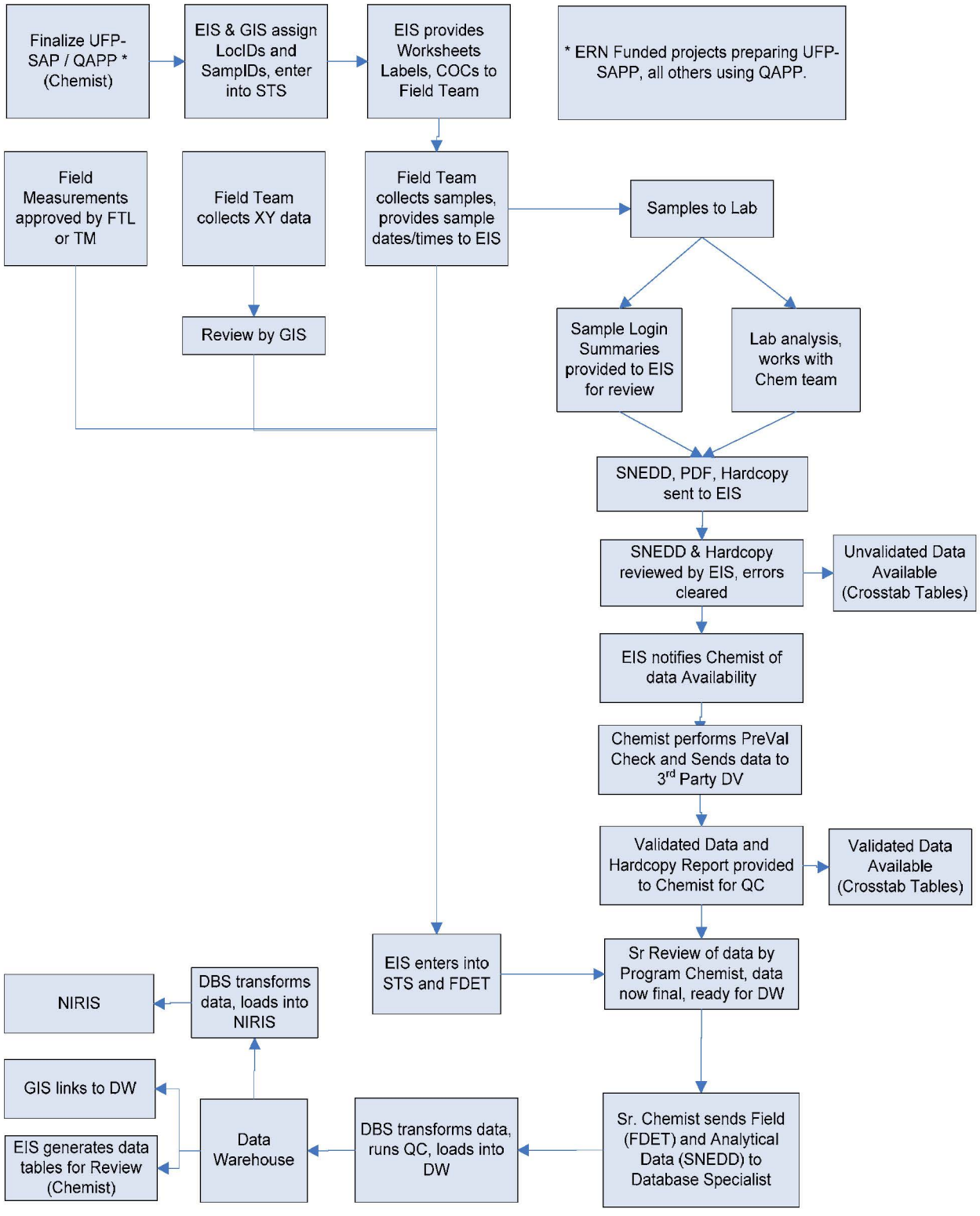


FIGURE P-1
ENVIRONMENTAL DATA MANAGEMENT WORKFLOW PROCESS

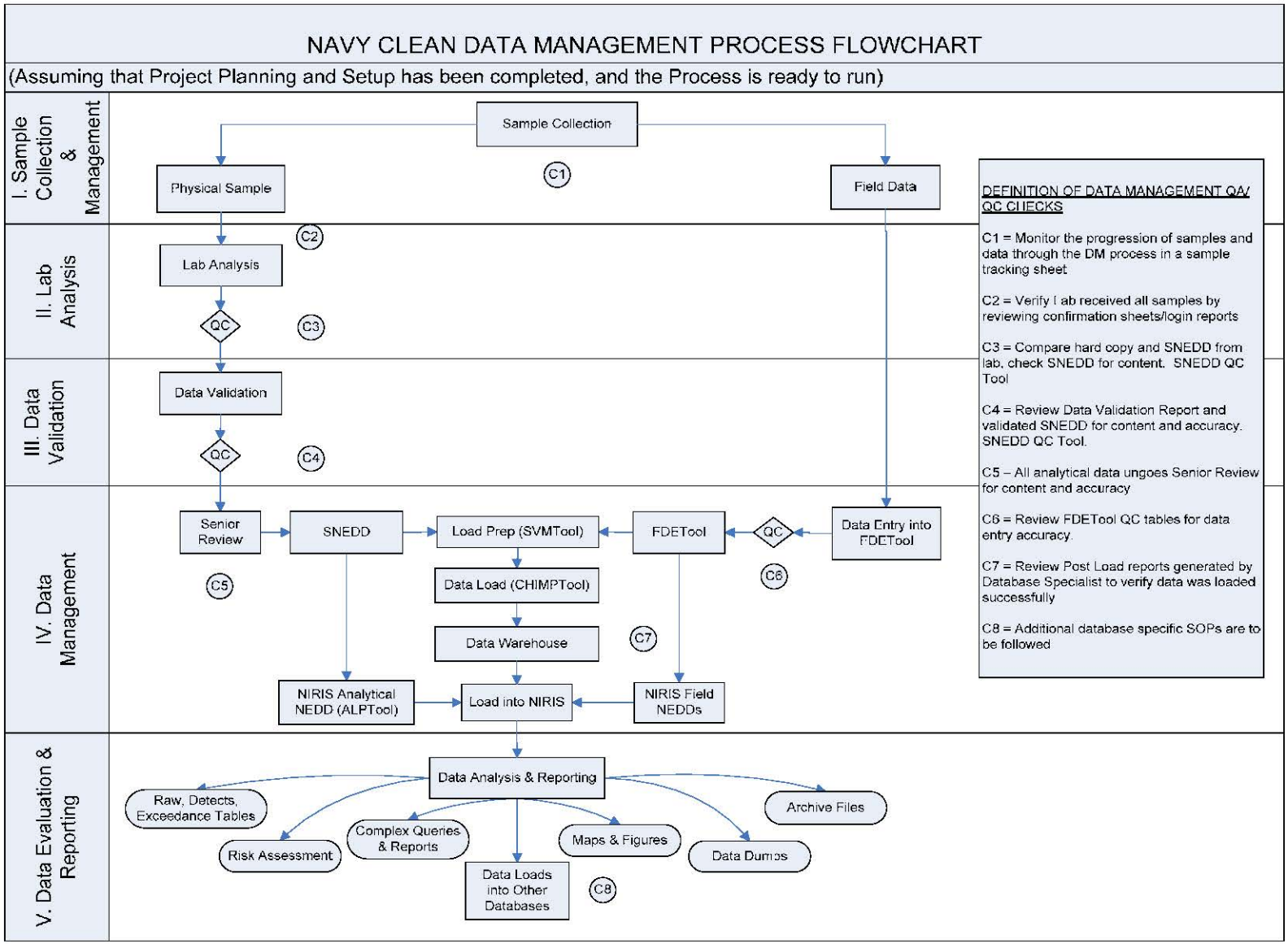


FIGURE P-2
DBMS PROCESS

Contents

Appendices

Tables

Figures

Acronyms and Abbreviations

ALPTool	Archive Load and Prep Tool
AM	Activity Manager
CAD	computer-aided design
COC	chain-of-custody
DBMS	Database Management System
DBS	Database Specialist
EIS	Environmental Information Specialist
DMP	Data Management Plan
EDD	electronic data deliverable
EDM	Environmental Data Management
EMS	Enterprise Management Solutions
ERP	Environmental Restoration Program
ERPIMS	Environmental Restoration Program Information Management System
EVS	Environmental Visualization System
FD	Field Duplicate
FDETool	Field Data Entry Tool
FTL	Field Team Leader
GA	GIS Analyst
GIS	geographic information system
ID	identification
IDW	investigation-derived waste
IRP	Installation Restoration Program
MS	matrix spike
MSD	matrix spike duplicate
N/FD	normal/field duplicate
NAVFAC	Naval Facilities Engineering Command
NEDD	NIRIS Electronic Data Deliverable

NIRIS	Naval Installation Restoration Information Solution
ODBC	open database connectivity
PC	Project Chemist
PCL	Program Chemistry Lead
PDL	Program Data Management Lead
PGL	Program GIS Lead
PM	Project Manager
QA	quality assurance
QC	quality control
RASCI	responsible, approve, support, consult, and inform
RDM	Regional Database Manager
SDG	Sample Delivery Group
SIMS	Site Information Management System
SNEDD	Supplemental NIRIS Electronic Data Deliverable
SOP	standard operating procedure
STS	Sample Tracking Sheet
SVMTool	SNEDD to VDMS Mapping Tool
VDMS	Validated Data Management System

SECTION 1

Introduction

This Data Management Plan (DMP) describes the methods CH2M HILL will use to manage and present environmental data to support work it is conducting for the Navy CLEAN and Joint Venture Programs. These processes and procedures are part of an overall environmental data management system called the SNEDD Approach to the Validation Data Management System (VDMS), hosted by CH2M HILL.

Project members and any subcontractors supporting program data needs for site characterization and remediation activities can use this DMP. It is a living document that is flexible enough to meet the dynamic needs of the teams and stakeholders. Data management program details and procedures are included in the appendices.

1.1 Purpose

This document outlines how environmental data for the Navy CLEAN and Joint Venture Programs will be obtained and managed using an Enterprise Management Solutions (EMS) approach. The systematic approach will facilitate the retrieval of data from project files and the data warehouse when they are needed, help ensure that the required data are collected and are of the appropriate quality, and help ensure that data records are not lost during transfer to the central program database repository.

1.2 Scope of the Data Management Plan

The scope of the data management activities addressed by this plan includes the following:

- **Roles.** Definition of staff roles and responsibilities.
- **Project Planning and Setup.** Use standard templates and database applications; provide guidance and standard operating procedures (SOPs) for formatting, reviewing, and transferring data collected in the field to the Database Management System (DBMS).
    - **Provide a structured, yet flexible data set.** The DBMS will store all types of environmental data and provides a standard framework for all projects within the Navy CLEAN Program to use. The DBMS is organized and structured, yet flexible enough to allow additional data and data types to be added at any time over the life of the program.
    - **Provide data that are well documented.** The DBMS will retain enough descriptive and source information for technical defensibility and legal admissibility of the data.
- **Sample Collection and Management.** Items that will be captured through standardized forms or applications include chains-of-custody (COCs), field parameter information, groundwater elevation data, and sample tracking records.
- **Laboratory Analysis.** Laboratory data will be reported in the Supplemental Naval Installation Restoration Information Solution (NIRIS) Electronic Data Deliverable (SNEDD)

format specifications that analytical laboratories are required to use to transfer analytical data electronically to CH2M HILL. (Provided to laboratories via a scope of work.) Management and archive procedures will be implemented for hard copy and electronic project documentation.

- **Data Validation.** Internal and external data validation will be conducted in accordance with the appropriate Program and EPA requirements. All deliverables will be subjected to Senior Review quality assurance (QA) and quality control (QC) measures. Management and archive procedures will be implemented for hard copy and electronic project documentation.
- **Data Management.** QA and QC measures will be implemented to provide accurate representation of all data collected and to be stored in the DBMS. QA/QC procedures include restricting data import or entry to specific valid value lists that will not allow incorrect data to be included in the DBMS.
- **Data Evaluation and Reporting.** Reporting and delivery support will be provided from a single DBMS source and allow relatively simple and rapid access to stored data for environmental characterization, report generation, modeling, geographic information system (GIS) mapping, statistical analyses, and risk assessments.
    - **Provide data visualization capabilities.** Data will be accurately represented for use in models, GIS, boring log programs (Environmental Visualization System [EVS), computer-aided design (CAD), graphics, and other software used for mapping, graphing, charting, analyzing, and displaying environmental data.
    - **Provide the ability to compare data electronically.** Tools will allow the electronic comparison of project data to specific reference or screening criteria.
    - **Provide the ability to transfer data to different formats.** The DBMS will provide the ability to reformat, convert, and transfer the data to any format as required by specific end-user applications.

SECTION 2

Roles and Responsibilities

The Navy CLEAN and Joint Venture Programs Environmental Data Management (EDM) team will work together to properly execute the DMP and ensure that the project objectives and scope are realized. The EDM team is composed of data management, chemistry, and GIS resources. The EDM team is responsible for all aspects of planning, execution, management and reporting environmental of data. Data are derived from sampling events related to investigative and remedial activities for Navy CLEAN and Joint Venture projects.

Responsibilities related to data management and information solutions functions are grouped into roles, as listed in Table 1. The SNEDD DM Process Checklist referenced in Appendix C documents the specific responsibilities associated with each of these roles.

TABLE 1
Navy CLEAN and Joint Venture Environmental Data Management Program Team
The Navy CLEAN Program Data Management Plan

Title	Name/Address	Phone	Fax	E-mail
Navy CLEAN Activity Manager (AM)	Various	Various	Various	Various
Navy CLEAN Project Manager (PM)	Various	Various	Various	Various
Field Team Leader (FTL)	Various	Various	Various	Various
Program Critigen Team Lead	Mike Dierstein 5700 Cleveland Street Suite 101 Virginia Beach, VA 23462	757-671-6216	757-497-6885	mdierste@critigen.com
Program Data Management Lead (PDL)	Chelsea Leigh 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6208	773-695-1378	cleigh@critigen.com
Database Specialist (DBS)	Bhavana Reddy 15010 Conference Center Dr. Suite 200 Chantilly, VA 20151	703- 462-3784	703- 376-5010	breddy@critigen.com
Program Chemistry Lead (PCL)	Anita Dodson 5700 Cleveland Street Suite 101 Virginia Beach, VA 23462	757-671-6218	757-497-6885	adodson@ch2m.com
Project Chemist (PC)	Mike Zamboni 15010 Conference Center Dr. Suite 200 Chantilly, VA 20151	703-376-5111	703-376-5801	mzamboni@ch2m.com
Project Chemist (PC)	Megan Morrison 15010 Conference Center Dr. Suite 200 Chantilly, VA 20151	703-376-5053	703-376-5801	megan.morrison@ch2m.com

TABLE 1
Navy CLEAN and Joint Venture Environmental Data Management Program Team
The Navy CLEAN Program Data Management Plan

Title	Name/Address	Phone	Fax	E-mail
Project Chemist (PC)	Bianca Kleist 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6281	757-497-6885	bkleist@ch2m.com
Project Chemist (PC)	Juan Acaron 3011 S.W. Williston Road. Gainesville, FL 32608	352-384-7002-		juan.acaron@ch2m.com
Project Chemist (PC)	Kristina Lambert 3011 S.W. Williston Road. Gainesville, FL 32608	352-335-5877		kristina.lambert@ch2m.com
Project Chemist (PC)	Clairette Campbell 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6335	757-497-6885	clairette.campbell@ch2m.com
Environmental Information Specialist (EIS)	Rebekha Shaw 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6279	757-497-6885	rshaw22@ch2m.com
Environmental Information Specialist (EIS)	Gwendolyn Buckley 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-8311	757-497-6885	Gbuckle1@ch2m.com
Environmental Information Specialist (EIS)	Victoria Brynildsen 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6252	757-497-6885	vbrynildsen@ch2m.com
Environmental Information Specialist (EIS)	Troy Horn 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-8311	757-497-6885	troy.horn@ch2m.com

TABLE 1
Navy CLEAN and Joint Venture Environmental Data Management Program Team
The Navy CLEAN Program Data Management Plan

Title	Name/Address	Phone	Fax	E-mail
Environmental Information Specialist (EIS)	Hillary Ott 15010 Conference Center Dr. Suite 200 Chantilly, VA 20151	703-376-5165	703-376-5801	hillary.ott@ch2m.com
Environmental Information Specialist (EIS)	Andrew Louder 15010 Conference Center Dr. Suite 200 Chantilly, VA 20151	703-376-5111	703-376-5801	andrew.louder@ch2m.com
Environmental Information Specialist (EIS)	Angela Krause 1000 Abernathy Road Suite 1600 Atlanta, GA 30328	678-530-4073	703-376-5801	angela.krause@ch2m.com
Program GIS Lead (PGL)	Mike Dierstein 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6216	757-497-6885	mdierstein@critigen.com
GIS Analyst (GA)	Blake Hathaway 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6230	757-497-6885	bhathawa@critigen.com
GIS Analyst (GA)	Mary Beth Artese 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6228	757-497-6885	martese@critigen.com
GIS Analyst (GA)	Mark Unwin 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6261	757-497-6885	munwin@critigen.com
GIS Analyst (GA)	Chris Bowman 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6276	757-497-6885	cbowman@critigen.com

TABLE 1
Navy CLEAN and Joint Venture Environmental Data Management Program Team
The Navy CLEAN Program Data Management Plan

Title	Name/Address	Phone	Fax	E-mail
GIS Analyst (GA)	Matt Rissing 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6243	757-497-6885	mrissing@critigen.com
GIS Analyst (GA)	Forrest Cain 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6271	757-497-6885	fcain@critigen.com

SECTION 3

Data Management System Description

During field investigation, monitoring, and remedial activities, CH2M HILL will collect a variety of environmental information to support data analysis, reporting, and decision-making activities. To meet current regulatory QA requirements, a complete audit trail of the information flow must be implemented. The six steps in the workflow process are (Appendix B):

1. Project planning and database setup
2. Sample collection and management
3. Laboratory analysis
4. Data validation
5. Data management and loading
6. Data evaluation and reporting

Each step in the data management process must be adequately planned, executed, and documented. Figure 1 presents a simplified presentation of the workflow process specific to the Navy CLEAN and Joint Venture Programs. Figure 2 presents, in more detail, the tools used in each step of the process.

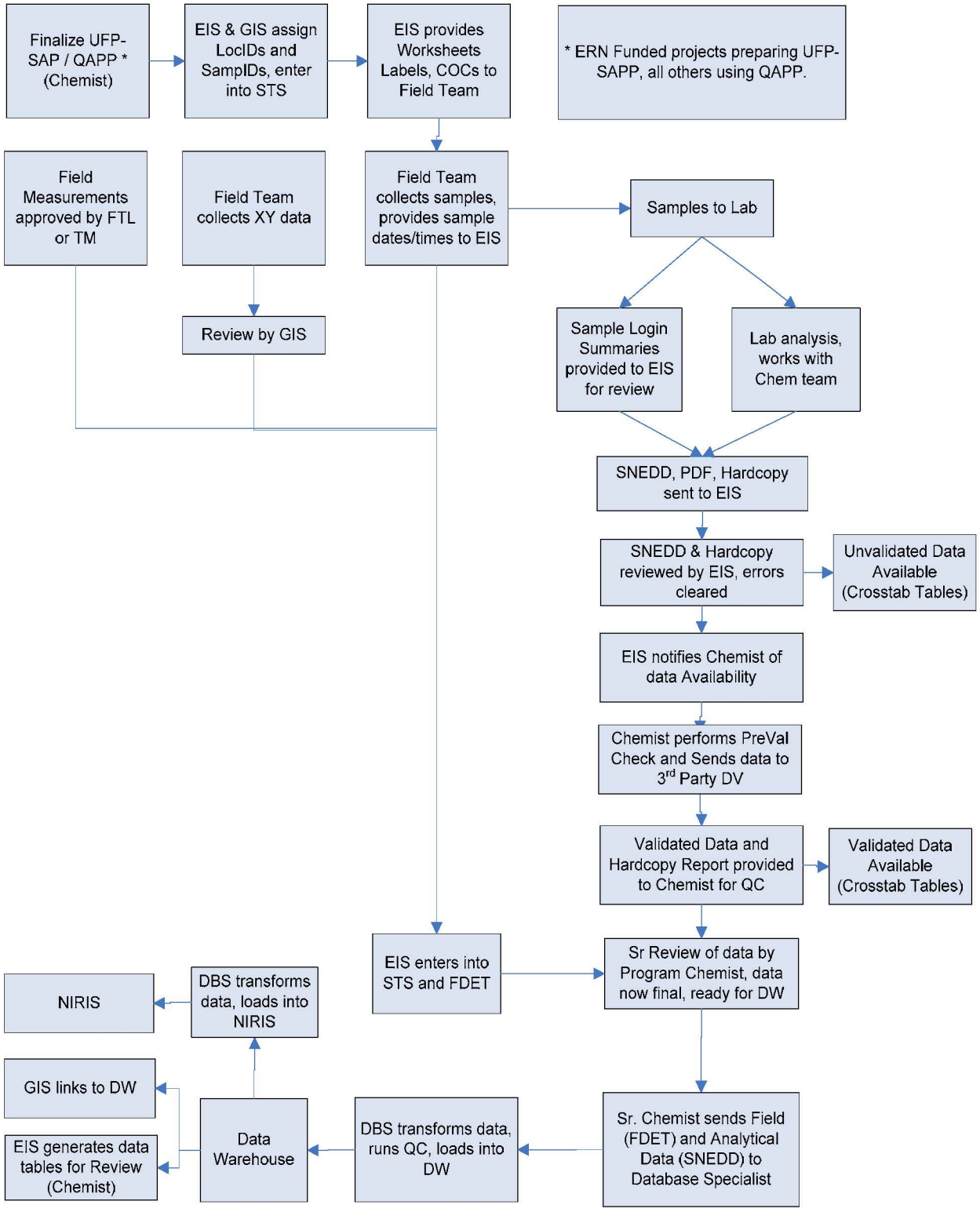


FIGURE 1
ENVIRONMENTAL DATA MANAGEMENT WORKFLOW PROCESS

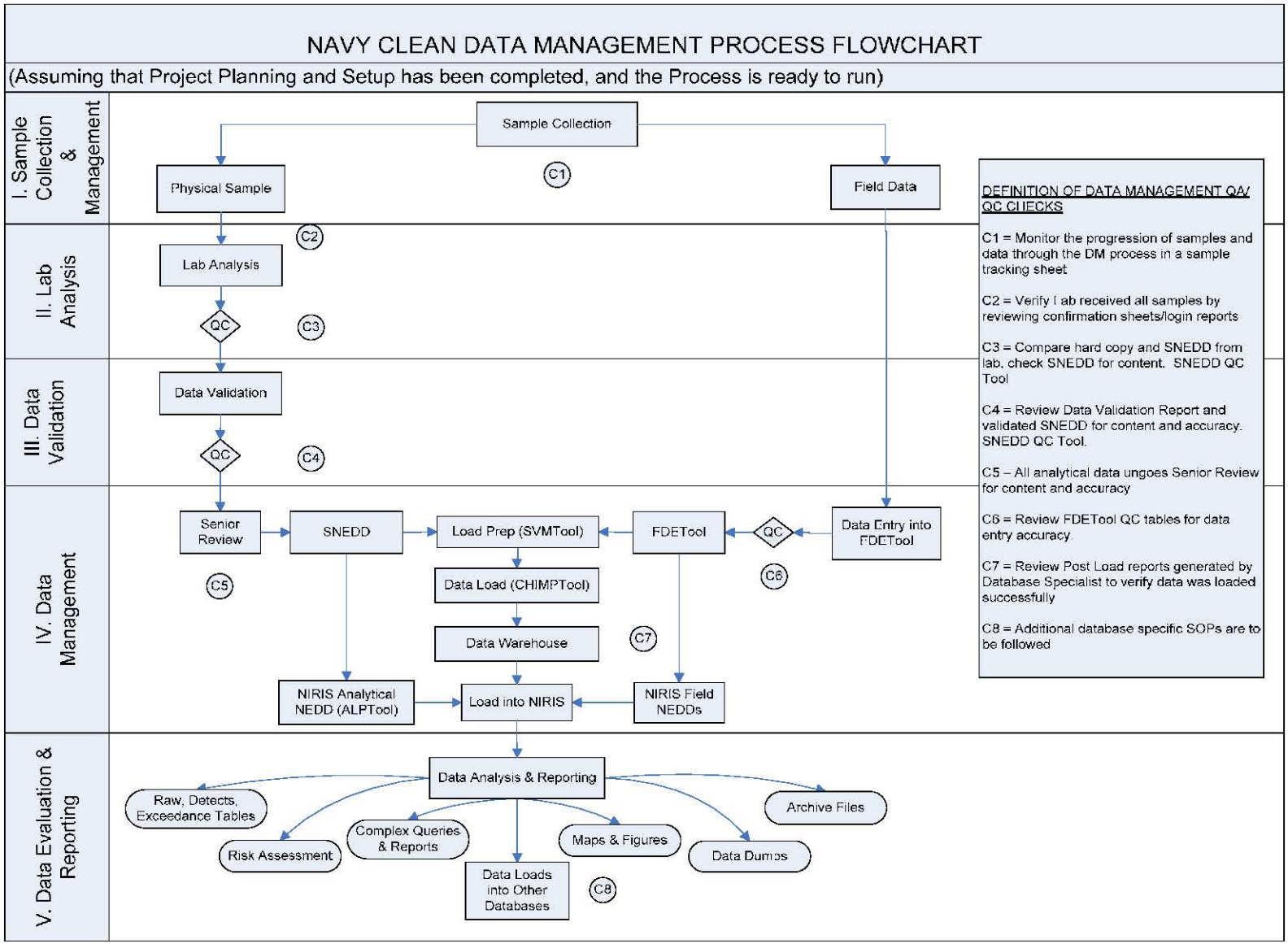


FIGURE 2
DBMS PROCESS

SECTION 4

Phases of Data Management

4.1 Project Planning and Setup

Project planning starts when a new project or task is identified in the program. Evaluation of what is required from data management and visualization occurs to determine the data needs. The Program Critigen Team Lead (Critigen Lead) works with the Program Data Management Lead (PDL) and the project and/or activity manager to determine what is expected and required from the data management and visualization team. Specific items that should be considered are as follows:

- Inputs – Determine what data will be collected and stored in the database. Determine frequency and quantity. Determine what tools will be used to handle data input.
- Historical Data – This is a unique data input and requires special consideration. The PDL ***must*** work with the other technical leads to assess what effort will be required. This step is often missed, and the resulting data quality issues created from inadequate planning in this area can plague the project for its entire duration.
- Outputs – Determine what data will need to be presented in reports, figures, and electronic deliverables. Determine frequency and quality requirements. Determine preliminary data, validated data, and what tools will most effectively handle the output requirements. Discuss how the outputs needed by the team will be requested and documented.
- Visualization – Determine necessity for GIS and CAD.

After the information above is determined, the data management scope, schedule, and budget are developed and endorsed by the Project Manager (PM), PDL, Program GIS Lead (PGL) and Program Chemistry Lead (PCL). The team can then proceed upon client authorization of the overall project budget. Figure 3 shows the process for project planning.

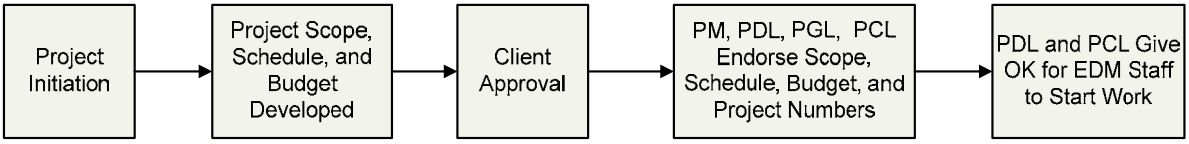


FIGURE 3
PROJECT PLANNING

4.1.1 Database Setup and Administration

CH2M HILL Database

The PDL will oversee the administration of the DBMS, including the design, development, and maintenance of the program database, tools and data management processes. Database and data management process design and development will focus on providing rapid data entry

and data retrieval while promoting data integrity through various automated procedures. The PDL will perform the database maintenance, which consists of the following:

- Assisting with the allocation of sufficient system storage for the program database
- Adding, altering, and deleting users, roles, and privileges
- Periodically defragmenting and compacting the database for more efficient operation
- Upgrading database software and associated applications as necessary
- Maintaining an approved list of valid values for data consistency
- Maintaining redundancy control to ensure that each data record is unique and consistent with conventions
- Performing routine virus checks on incoming and outgoing data

The DBMS is comprised of the Data Warehouse and associated SNEDD-Approach tools, and will support the storage, analysis, display, and reporting of the Navy's environmental, analytical, and geotechnical data. The DBMS will consist of primary data tables that store the environmental data, dependent tables that store more details related to the data in the primary tables, and look-up tables that store valid values to provide input to the primary tables. The EIS will maintain the table content and the PDL will manage it. All SNEDD-Approach tools will adhere to version control procedures to ensure that the most current versions and look-up tables are used at all times.

Valid values are critical to any large relational database. Tables 2 and 3 provide examples of valid values for the Navy CLEAN and Joint Venture Programs' sites, stations, and samples. Inconsistencies in naming conventions, subtle analyte or method spelling differences, and the use of non-standard abbreviations can result in lost data and incorrect conclusions. Most tables and forms in the program database will use look-up tables for acceptable valid values and will not allow the entry of data that do not conform.

The primary purpose of managing data in a relational database environment is to ensure that each data record is unique and that the information contained within each field is consistent with conventions defined in other areas of the database. To ensure that each record is unique, a key field or fields will be identified within each data table. The VDMS Data Warehouse architecture supports this approach and eliminates the possibility of data redundancy.

NIRIS Database

All Navy CLEAN and Joint Venture data must be loaded into the Navy's own internal database system, the Naval Installation Restoration Information Solution (NIRIS). NIRIS is a web-based centralized database that has been implemented across all Naval Facilities Engineering Command (NAVFAC) offices and will be used by the Navy and contractors to manage, evaluate, and visualize data, documents and records for Navy and the Marine Corps sites. NIRIS manages all Environmental Restoration Program (ERP) analytical and spatial data, which includes the Munitions Response and Installation Restoration Program (IRP) data, ensuring institutional memory is preserved, land use controls are maintained, and remedial actions are effective.

CH2M HILL will use the SNEDD Approach to VDMS system to track, collect, review, and prepare Navy-related sample and project data for loading into NIRIS. Project data stored in the VDMS Data Warehouse must be consistent and comparable with data that is loaded and stored within NIRIS. As such, all associations between VDMS and NIRIS valid values, output reports, and data tables will be tracked and maintained.

4.1.2 Data Security Procedures

Some SNEDD Approach to VDMS applications and data are stored in a secure location with login and password protection. Authorized users will have logins and passwords in advance. The PDL will provide security access to these tools. Access2003 must be installed on the computer that the user will be using to run these applications, and proper licenses distributed. Files received from any subcontractors will be scanned for common viruses using industry standard, current virus protection programs. The file servers storing the data must be running current virus software, with automatic virus signature updates.

NIRIS data are stored in a secure location with login and password protection. Users who require access to NIRIS and the data contained therein will need to follow procedures outlined in the SOP Access to NIRIS to procure security certificates, training, and access rights to installation-specific data. Authorized users of NIRIS will be assigned logins and passwords maintained by the Navy. For further information on NIRIS or obtaining NIRIS access, consult with the Critigen Lead or PDL.

4.1.3 Data Backup and Recovery

All project data management files will reside on CH2M HILL's terminal server, "Gaia," and will have a tape backup or equivalent created in accordance with CH2M HILL's network server management policy.

4.2 Sample Collection and Management

Sample control during the sampling phase is required to ensure the integrity of the associated data. Sample control must be maintained and documented from the point of collection through the point of disposal. Sample control will be managed both in the field and in the laboratory, and will be documented using field logbooks and a Chain of Custody (COC). When custody of a sample is transferred from one party to another, the recipient of the sample assumes responsibility for maintaining control of the sample and documenting that control on the COC. Figure 4 shows the process for planning and executing field sampling events.

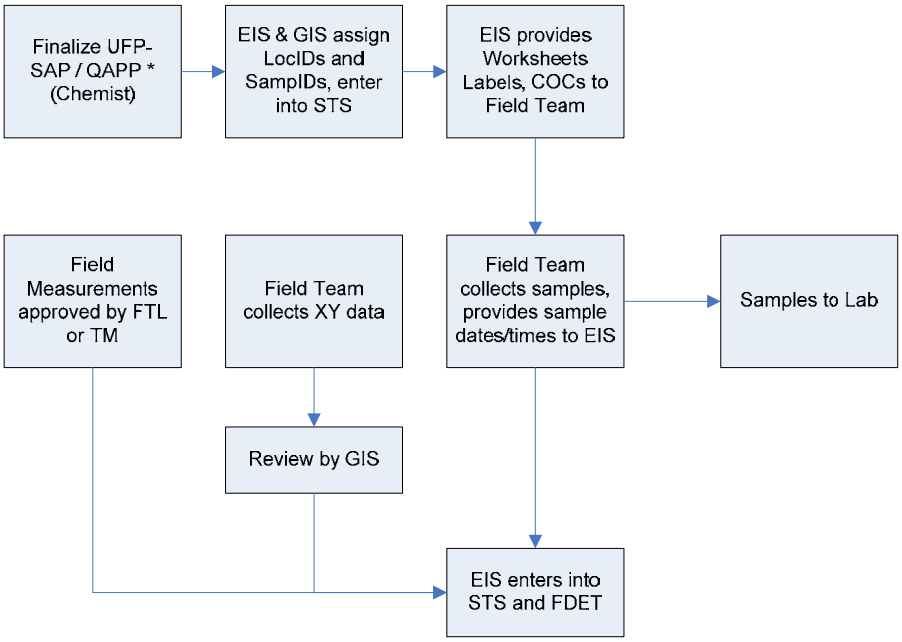


FIGURE 4
FIELD SAMPLING

4.2.1 Sample Tracking Sheet

During the planning stage, the PM specifies the data requirements for the sampling event. The work plan or similar document will provide project-specific data requirements for a given sampling event. The Project Chemist (PC) is responsible for reviewing the Sampling and Analysis Plan and ensuring that the FTL is aware of the number of field and laboratory QC samples required for the sampling event (trip blanks, equipment blanks, field blanks, field duplicates, matrix spikes, and matrix spike duplicates). All of this information is to be entered into the STS.

The STS will be used in advance to identify sampling container and preservation requirements, identify analytical laboratories for samples, aid in the generation of labels for sample bottles before the sampling event, and prepare COC forms after sampling is complete.

4.2.2 Sample Nomenclature Guidelines

The following guidelines are provided for sample nomenclature, COC clarification, and eData expectations.

Station ID (Location)

Field station data are information assigned to a physical location in the field at which some sort of sample is collected. For example, a monitoring well that has been installed will require a name that will uniquely identify it with respect to other monitoring wells or other types of sample locations. The station name provides a key in a database to which any samples collected from that location can be linked to form a relational database structure.

Before beginning fieldwork, the FTL will review the proposed level of effort and coordinate a list of unique station identification names, or station IDs, with the PDL or EIS. The FTL will be

responsible for enforcing the use of the standardized ID system and agreed upon station IDs during all field activities.

Each station will be uniquely identified by an alphanumeric code that will describe the station's attributes. These attributes are facility, Area of Concern (AOC)/Site/Operable Unit (OU) number, station type, sequential station number, and possibly an additional qualifier as needed. The naming scheme to be used for the identification of a sampling station is documented in Table 2.

For example, if the first sample location at next month's event within Yorktown Site 30 is at a soil location, then the location ID could possibly be YS30-SO391 because that was the next available sequence number for soil locations. This should also be reflected in the Sample ID. QC and IDW station IDs must be established for each site that they are associated with.

Please consult with the PDL or EIS should any questions arise. This will avoid complications that could occur if a station is mislabelled and ensure there are unique identifiers for every sampling location. Required deviations to this format in response to field conditions will be documented in the field logbook.

Sample ID

Field sample data are information assigned to a physical piece of material collected in the field for which some sort of analysis will be run. Before collecting samples, the FTL will review the proposed level of effort and coordinate a list of unique sample identification names, or sample IDs, with the PDL or EIS. The FTL will be responsible for enforcing the use of the standardized ID system and agreed upon sample IDs during all field activities.

Each sample will be uniquely identified by an alphanumeric code that will describe the sample's attributes. These attributes are facility, Area of Concern (AOC)/Site/Operable Unit (OU) number, sample/station type, sequential station number, modifier (as needed), depth (as needed), date, and date modifier (as needed). The naming scheme to be used for the identification of samples is documented in Table 3.

The standardized ID system will identify all samples collected during sampling activities. The system will provide a tracking procedure to ensure accurate data retrieval of all samples taken. For example, a surface soil sample collected from station YS30-SO391 reference above in June of 2009 will result in a sample ID of YS30-SS391-0609.

Please consult with the PDL or EIS should any questions arise. This will avoid complications that could occur if a sample is mislabelled and ensure there are unique identifiers for every sample. Required deviations to this format in response to field conditions will be documented in the field logbook.

Navy Clean		
First Segment	**Second Segment**	
Facility, Site Number	Station Type	Station Number, Modifier
AA,ANN	AA	NNN_A
Notes: "A"= alphabetic "N"= numeric		

Facility:

A = ABL
AN = Anacostia
BA = Bainbridge
BW = Bloodsworth Island
BR = Bremerton
CA = Cheatham Annex
CH = Cherry Point
CI = Craney Island
CL = Camp Lejeune
CP = Camp Peary
CR = Carderock
DA = Dahlgren
DN = Dam Neck
DR = Driver
IH = Indian Head
LS = Little Creek
NA = Naval Academy
NB = Naval Station Norfolk
NM = NNMC (Bethesda Naval Hospital)
NN = Norfolk Naval Shipyard
NR = Naval Research Laboratory
NWA = Northwest Annex
OC = Oceana
PA = Pax River
PI = Pineros Islands
QU = Quantico
RO = Rota
RR = Roosevelt Roads
SI = Sigonella
SJ = St. Juliens
SS = Sabana Seca
VE = Vieques East
VW = Vieques West
WN = Washington Navy Yard
WO = White Oak
Y = Yorktown

Site/AOC/SWMU Number – Sequential Number:

Site = S01, S02, S03…
Site Screening Area = SA01, SA02, SA03…
AOC = A01, A02, A03…
AOI = AI01, AI02, AI03…
SWMU = W01, W02…
Building = B01, B02, B03…
Range = R01, R02…
LIA – LI Area, East Vieques

BSxx = Background locations outside of site (BS25 = Background Site 25)
BKL = Background locations outside of the facility
BKG = Background locations (inside base)

QC and IDW Stations
Site ID (First Segment) followed by –QC or -IDW

Station Type:

AGT = Above Ground Tank
AS = Ash
BH = Borehole
CO = Concrete
DP = Direct Push
DR = Drill Rig
EW = Extraction Well
FG = Frog
FS = Fish
GB = Geotechnical Boring
GP = Geoprobe
GV = Gas Vent
HP = Holding Pond/Lagoon
IDW = Investigative Derived Waste
IW = Injection Well
LW = Leach Well
MA = Alluvial Monitoring Well
MB = Bedrock Monitoring Well
MU = UST Monitoring Well
MW = Monitoring Well (GW for Y)
PC = Paint Chip
PW = Production Well
QC = Quality Control
RK = Rock
RC = Recovery Well
RM = Remediation Well
RW = Residential Well
SD = Sediment Location
SG = Soil Gas
SL = Storm Sewer Line Sediment
SO = Soil Location
SP = Seep
ST = Storm Water
SU = Sump
SV = Soil Vapor
SW = Surface Water
SWS = Surface Water Body (for SW and SD)
UST = Underground Storage Tank
TA = Tap Water
TD = Tidal Station
TI = Tissue Sample (general)
TO = Tadpole
TP = Test Pit
TR = Trench Sediment
TS = Treatment System
TW = Temporary Well
WA = Alluvial Extraction Well
WB = Bedrock Extraction Well
WL = Water Supply Well
WN = Pore Water
WP = Wipe Sample
WT = Water Table Piezometer

Station Number:
Sequential Station Number (i.e., 01, 02, 03…)

Modifier (used selectively):
D = Deep monitoring well
S = Shallow monitoring well

Example Station IDs:

YS01-DP02 = Direct push soil location #2 at Yorktown Naval Weapons Station Site 1
CHR05-MW02S = Shallow monitoring well location 2, at the Cheatham Annex facility, Range 5.
NMBKL-SD02 = Background sediment location #2 located outside of NNMC
CHBS03-SO05 = Soil location #5, located in reference area outside of Site 3 in Cherry Point
VEW04-QC = QC Station at East Vieques SWMU-4
CAA08-IDW = IDW Station at Cheatham Annex AOC-8

TABLE 2

STATION ID SCHEME

Navy Clean			
First Segment	**Second Segment**	**3rd Segment**	**Fourth Segment**
Site ID Facility, AOC Number	Station/Sample Type, Station Number, Modifier	Depth (As Needed)	Date (MMYY) A
AA,ANN	$AANNN_A$	A	$NNNN_A$
Notes: "A"= alphabetic "N"= numeric			

A = ABL
AN = Anacostia
BA = Bainbridge
BW = Bloodsworth Island
BR = Bremerton
CA = Cheatham Annex
CH = Cherry Point
CI = Craney Island
CL = Camp Lejeune
CP = Camp Peary
CR = Carderock
DA = Dahlgren
DN = Dam Neck
DR = Driver
IH = Indian Head
LS = Little Creek
NA = Naval Academy
NB = Naval Station Norfolk
NM = NNMC (Bethesda Naval Hospital)
NN = Norfolk Naval Shipyard
NR = Naval Research Laboratory
NWA = Northwest Annex
OC = Oceana
PA = Pax River
PI = Pineros Islands
QU = Quantico
RO = Rota
RR = Roosevelt Roads
SI = Sigonella
SJ = St. Juliens
SS = Sabana Seca
VE = Vieques East
VW = Vieques West
WN = Washington Navy Yard
WO = White Oak
Y = Yorktown

Site/AOC/SWMU – Sequential Number:

Site = S01, S02, S03…
Site Screening Area = SA01, SA02, SA03…
AOC = A01, A02, A03…
AOI = AI01, AI02, AI03…
SWMU = W01, W02…
Building = B01, B02, B03…
Range = R01, R02…
LIA – LI Area, East Vieques

BSxx = Background locations outside of site (BS25 = Background Site 25)
BKL = Background locations outside of the facility
BKG Background locations (inside base)

Sample Type:

AGT = Above Ground Tank
AH = Air - Headspace
AS = Ash
BH = Borehole
CO = Concrete
DR = Drill Rig
DS = Direct Push—Soil
DW = Direct Push—Groundwater
EW = Extraction Well
FG = Frog
FS = Fish
GB = Geotechnical Boring
GP = Geoprobe
GV = Gas Vent
HP = Holding Pond/Lagoon
IW = Injection Well
LF = Free Product
LW = Leach Well
MA = Alluvial Monitoring Well
MB = Bedrock Monitoring Well
MU = UST Monitoring Well
MW = Monitoring Well (GW for Y)
PC = Paint Chip
PW = Production Well
RK = Rock
SW = Surface Water
RC = Recovery Well
RM = Remediation Well
RW = Residential Well
SB = Subsurface Soil
SD = Sediment Location
SG = Soil Gas
SL = Storm Sewer Line Sediment
SO = Soil Location (Composite)
SP = Seep
SS = Surface Soil
SSD = Subsurface Sediment
ST = Storm Water
SU = Sump
SV = Soil Vapor
SW = Surface Water
UST = Underground Storage Tank
TA = Tap Water
TD = Tidal Station
TI = Tissue Sample (general)
TO = Tadpole
TP = Test Pit
TR = Trench Sediment
TS = Treatment System
TW = Temporary Well
WA = Alluvial Extraction Well
WB = Bedrock Extraction Well
WL = Water Supply Well
WN = Pore Water
WP = Wipe Sample
WT = Water Table Piezometer

Station Number:
Sequential Number (e.g., 001, 002, 003)

Modifier (used selectively):
D = Deep monitoring well
S = Shallow monitoring well
P = Duplicate

Depth:

Use only if applicable. A sequential letter is used to reflect varying depths, as actual depths can change in the field after sample planning has occurred. E.g. A, B, C…

Sample Number:

1. Duplicate Samples - Use a 'P' modifier in the second segment of the sample ID, directly after the location number to indicate a duplicate sample. E.g. AB01-MW11P-0506

2. MS/MSD Samples – Append a modifier of '-MS' for matrix spike or '-SD' for matrix spike duplicate to the end of the sample ID.

3. QC & IDW Samples (Blank Samples & Waste Char.) - Format consists of Facility, AOC Number, Qualifier Code, Sequential Qualifier Number-Date (AAANN-AANN-MMDDYY). E.g. LSA05-TB02-061106

Qualifier Codes:
TB = Trip Blank
FB = Field Blank
EB = Equipment Blank
WQ = Source Blank
WS = Waste Char. Soil
WW = Waste Char. Water

4. Drill Rig Samples – Format consists of Facility, AOC Number, Station Type, Station Number, Date. E.g. YS12-DR02-020507

5. Multiple samples - Should multiple samples be collected from the same location in a given day/month (affects only samples not differentiated by depth), a sequential letter will be added to the end of the fourth segment (date). E.g. A, B, C…

Example Sample IDs:

WNA01-MW102S-0105A = The first shallow groundwater sample collected at monitoring well location 102 in January 2005 in AOC01 at the Washington Navy Yard facility.
PIW01-SW023P-0306 = Pineros Island duplicate surface water sample collected at location 23, at SMWU-1 in March 2006.
SSW06-FB01-061106 = The first field blank collected on June 11, 2006 at SMWU-6 in Sabana Seca.

TABLE 3

STATION ID SCHEME

4.2.3 Sample Collection

A photocopy of each field logbook page completed during sampling and of each COC will be made by the FTL and forwarded to the EIS at predefined intervals during sampling events. This information will serve as notification to the EIS of samples being shipped to an offsite lab and of the field crew's sampling progress.

Communication with field and laboratory staff will occur daily during the field event. The EIS will resolve issues that arise in the field (i.e. bottle ware shortage, equipment failure, etc). The lab will be informed of the shipment dates and the number of coolers or samples being sent. Laboratory login reports will be reviewed to ensure samples were received in good condition (i.e. no breakage, within holding time, within designated temperature). The field crew and PM will be notified if there were problems with shipment.

4.2.4 Chain-of-Custody

A single COC number per laboratory / cooler should be generated each day (there can be multiple pages to one COC number). MSs and MSDs will be requested at a set frequency for each project (usually one per 20 samples collected). MS and MSD samples should not be taken from field duplicates (FDs) or field blanks. FDs will be requested at a set frequency for each project (usually one per 10 samples). FDs should not be taken from MSs, MSDs, or field blanks. The MS and MSD samples listed on the COC should be spiked and analyzed by the laboratory.

A 100% QC will be performed on COCs received from the field crew. The field crew and/or lab will be notified if corrections need to be made to the COCs or lab login reports. Any corrections or modifications made will be noted in a Corrections-To-File Letter.

4.2.5 Sample and Document Tracking

The STS will be updated with sample collection and tracking information, and kept current throughout the data management process. All samples collected, resulting deliverables, and deliverable dates will be tracked throughout the data management process to ensure that the project schedule is met and subcontractor invoices are evaluated correctly.

All documentation acquired during the data management process, including Statements of Work (SOWs), Bids, COCs, Field Notes, Sample Tracking Sheets, Login Reports, Corrections-to-File Letters, FDETool QC tables, Post Load Reports, Invoices, and Communication Logs shall be compiled throughout the process to be stored in the appropriate Activity's Project Notebook.

4.2.6 Field Data

Once the field data and samples are collected, necessary field measurements, such as water levels and other data collected in the field should be entered into the FDETool. Any data entered into the FDETool must be exported into an excel file to facilitate a manual QC review of the data. The correction of any anomalies should be verified with the PM and PC. The information entered into the FDETool will be linked with related analytical data reported in the SNEDD within the SVMTool. Field data and laboratory analytical data are linked by sample ID and date/time. This allows verification analytical results for all samples have been received and reported by the laboratory.

4.3 Laboratory Analysis

Figure 5 shows the laboratory analysis process. Upon receipt of samples from the field, the laboratory will verify that the COC forms correctly identify and detail all samples submitted. Each COC form must be signed with the date and time of receipt by the laboratory. Samples will be logged in by the laboratory using information from the COC forms and the project instructions.

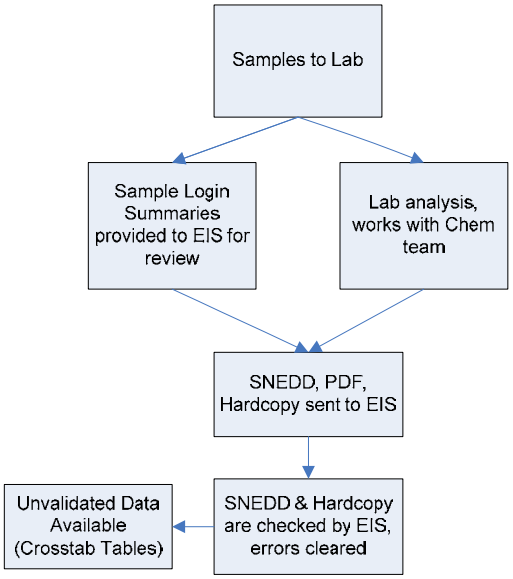


FIGURE 5
LABORATORY ANALYSIS

Samples will be analyzed as specified on the accompanying COC forms and in the Laboratory SOW. Generally, questions or noted inconsistencies identified by the laboratory should be addressed directly to the EIS. Login summaries detailing all samples and analyses received by the lab should be provided daily to the EIS for review. All discrepancies should be corrected to ensure that all samples are analyzed as per project instructions.

The SNEDD-QC-Tool is used to QC the laboratory's SNEDD. Before the laboratory analytical data is formatted into data tables or sent for validation, the laboratory SNEDD must be processed through CH2M Hill's SNEDD-QC-Tool Microsoft Access database application. The SNEDD-QC-Tool includes several automated diagnostic checks to verify format and content compliance with SNEDD specifications. Upon SNEDD receipt at CH2M Hill, the EIS will check the SNEDD using the SNEDD-QC-Tool to verify correct format and content. If errors are found, the laboratory will be notified of the errors, and the SNEDD corrected.

The laboratory will attach the signed COCs to their hard copy data deliverables to officially relinquish control of the data back to the Environmental Contractor within the specified turnaround time. Data archiving forms will be generated and affixed to each laboratory report received per Sample Delivery Group (SDG) for cataloguing, tracking, and archiving purposes.

Hard copy data and SNEDDs will be reviewed to ensure that they are complete and acceptable as outlined in the Data QC Checklist. A 10% comparison between the hard copy and SNEDD content will be conducted to ensure consistency, resolve discrepancies, and document data error issues (for example, EDD re-submissions, turnaround time problems, hard copy incompleteness). All detected errors should be resolved with the laboratory.

These checks ensure the consistency and the validity of the SNEDD and hardcopy content before the data are reported in preliminary tables or sent for validation. The objective of using the SNEDD-QC-Tool is to ensure that the validation process is performed on consistently high-quality data and minimize the chance of finding data errors later in the validation process, which would require the laboratory to resend corrected data and start the validation process over again.

Preliminary raw and detects tables will be generated from data reported in the SNEDD with the SNEDD Crosstab Tool. A separate table must be created for each matrix, and provided to the PM for review.

4.4 Data Validation

Once the preliminary data verification is complete, the PC is notified by the EIS that the data is available for validation. The PC will perform a Prevalidation QC of the data for completeness, and notify the data validator in advance of when to expect data and of any samples or analyses that should not be validated (i.e. grain size should not be validated). For internal data validation, the EIS will notify the PC of data availability, and provide the hardcopy data and a QC Association Table.

Upon receipt of data from CH2M HILL, data validation will be performed in accordance with the Data Validation SOW, UFP SAP, and any other documents required. Generally, questions or noted inconsistencies identified by the validator should be addressed directly to laboratory, with the PC notified of issues and resolutions identified.

4.4.1 External Data Validation

For external data validation, a copy of the SNEDD, hard copy data, and a QC Association Table will be provided to the data validator. The PC will coordinate the return of the data package to CH2M HILL for archiving with the data validator.

Data Validators will provide the following materials to the PC within the required turn around time:

- Hardcopy Data Validation Report
- Validated Version of the SNEDD (external validation)

Once returned to CH2M HILL, the SNEDD will be run through the SNEDD-QC-Tool, which includes automated diagnostic checks for validated data to verify format and content compliance with SNEDD validation specifications. The PC will review the validated data to ensure that they are complete and acceptable as outlined in the Data QC Checklist. A 100% QC check will be performed on the validated results to ensure that the hard copy data matches the SNEDD. All detected errors should be resolved with the data validator.

Data archiving forms will be generated and affixed to each Data Validation Report per SDG received for cataloguing, tracking, and archiving purposes.

Validated raw and detects tables will be generated from data reported in the validated SNEDD by with the SNEDD Crosstab Tool. A separate table must be created for each matrix, and provided to the PM for review.

4.4.2 Internal Data Validation

For internal data validation, a copy of the SNEDD, hard copy data, and a QC Association Table will be provided to the PC.

The PC will evaluate QC information, associated validation logic, and apply qualifiers to data in the SNEDD and on the laboratory Form Is when QC criteria are not achieved. Qualifier criteria will be based on the Quality Assurance Project Plan. A hardcopy data validation report will be generated. Data archiving forms will be generated and affixed to each Data Validation Report per SDG validated for cataloguing, tracking, and archiving purposes

Validated raw and detects tables will be generated from data reported in the validated SNEDD by the Navy RD Formatting Tool – Unval/Val SNEDD. A separate table must be created for each matrix, and provided to the PM for review.

4.4.3 Unvalidated Data Preload Check

Occasionally, unvalidated data will need to be loaded into the database. Although the data will not be validated, it will undergo a basic Preload Check by the PC to ensure laboratory compliance with project guidelines and determine results to be reported as the best result where multiple runs were conducted for a given sample/analysis. The PCL will provide input and oversight to ensure that data flags are applied correctly by the PC.

4.4.4 Senior Review

The PCL will verify that the final SNEDD and hardcopy data are complete and acceptable. Any identified discrepancies will be resolved with the assistance of the PC, EIS, laboratory, or validator as needed.

4.5 Data Preparation and Loading

Once the data are considered final and approved by the PCL, they are exported from the SNEDD to the project Data Warehouse. Field and laboratory data are merged into a format that is amenable to the warehouse. The backbone is a SQL-server-based data warehouse.

4.5.1 Data Preparation

As part of the normal process of loading data into the warehouse, data standardization tasks must be completed. A Database Specialist (DBS) will load data into the warehouse using the following three programs: SNEDD-QC-Tool, SVMTool and Navy CH-IMPTool.

A final QC of the data reported in the SNEDD is conducted with the SNEDD-QC-Tool. Any identified discrepancies will be resolved with the assistance of the PCL, PC, or EIS as needed. SNEDDs that pass all of the QA/QC checks in the SNEDD-QC-Tool are then processed with the SVMTool.

The SVMTool links the field data contained in the FDETool to the analytical data contained in the SNEDD. A series of logical QC checks are run to ensure that all data links correctly minimum data requirements are met. The tool then merges the data into a format compatible with the data warehouse structure.

4.5.2 Data Loading

CH2M HILL Loading

The Navy CH-IMPTool runs an additional series of QC checks and adds project-specific formatting, and loads the data into the warehouse. The following tasks need to be completed to load the data for project use:

- **Unit Standardization:** Analytical units and the associated results, reporting limits, and method detection limits will need to be converted to a consistent set of units as required by the project.
- **Resolve Reanalysis and Dilutions:** All samples that had an associated reanalysis or dilution run by the laboratory must have all of the excluded or rejected results marked as not the best result for reporting.
- **Resolve Analytical Overlap and Split Samples:** Analytical overlap occurs when a sample is analyzed by two or more methods that report the same analyte. To resolve any issues not previously resolved, the following logic is used to select the usable result:
  - If the overlapping results are all non-detections, the lowest non-detection result is selected.
  - If the overlapping results are all detected, the highest detected result is selected.
  - If the overlapping results consist of a mixture of detections and non-detections, the highest detected result is selected.

When data are loaded into the warehouse, an automated script will run to identify the "best" result when more than one analytical result exists.

NIRIS Loading

All Navy CLEAN and Joint Venture data must be loaded into NIRIS. Following the successful loading of data into the data warehouse, the DBS will use the FDETool and ALPTool to generate project NIRIS Electronic Data Deliverables (NEDD) files. Field-related NEDDs will be generated from the final version of the FDETool. The final version of the project SNEDD will be processed through the ALPTool to generate the analytical NEDD.

The DBS will use NIRIS's Data Checker Loader Tool to QC and submit the project NEDD files into NIRIS. The NIRIS Regional Database Manager (RDM) will load the data into NIRIS, and will work with the DBS to resolve any potential issue that may arise during loading. Following

notification of successful data loading from the RDM, the DBS will query the data from NIRIS for review to ensure data integrity and accuracy.

4.5.3 Data Warehouse

The data warehouse is a Microsoft SQL Server 2005 relational database. This database, and all other SNEDD-Approach tools used, has a data structure designed to achieve compliance with NIRIS and Navy data reporting standards specified for Navy CLEAN and the Joint Venture Program.

The warehouse will use valid value tables when applying reference attributes to project data. Such reference data include the names of site objects and sampling locations, sampling matrix and method categories, analyte names, units. These reference tables are critical for maintaining the completeness and accuracy of data sets and are essential for accurate querying of the data.

Data are loaded and stored so that relationships among categories of data are enforced. For instance, all sampling records must be associated with a valid site object such as a planned sediment sampling location. The project repository database and collection, analysis, and reporting tools used in the DBMS are designed to enforce, for any project data record, entries in fields that refer to other types of data as required by the overall data model.

4.6 Data Reporting

Data reporting includes the following tasks:

- Retrieving data from the data warehouse for project deliverables, data visualization, or consumption by third parties
- Reviewing initial data and producing data queries and draft reports to dissect and disassemble the data
- Producing any requested client and regulatory agency data deliverables

Data for project deliverables, data visualization, or consumption by third parties will be retrieved from the warehouse, and will be equivalent to the real-time state of the project repository database. PMs and GIS Analysts (GAs) will work with the EIS and PCL for quality queries and data for reports.

4.6.1 Tables, Figures, and Diagrams

Once the data have been sufficiently analyzed, the list of requested data reports (tables, figures, diagrams) can be developed and finalized by the project team and submitted to the PCL and PM for review.

All requests for figures or graphics are to be directed to the GA assigned as the Point of Contact (POC) for that particular Navy installation. All requests for analytical data (crosstab tables, data dumps, third party deliverables etc) should be directed to the EIS assigned as the POC for that particular Navy installation. The EIS will generate a data deliverable from the data warehouse or NIRIS (as needed) suitable for end use and will provide data support to the end user. All requests for data statistics and calculations should be directed to the Risk Assessor assigned to the project.

4.6.2 GIS

The Navy CLEAN program will utilize ESRI's suite of GIS software for the majority of GIS-related tasks. The GIS data model will consist of one or more geodatabases (GDBs) per installation. Each installation will maintain one common installation GDB, which will store the common infrastructure data such as buildings, roads, topography, hyrdography, utilities, etc. The common installation GDB should adhere, as much as possible, to the Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE) data model. All project specific GDBs shall be developed and named for ease of interpretation by the GA.

All station location information for each installation will be pulled directly from the data warehouse and stored in the common installation GDB as a data table. The data warehouse must contain valid coordinate information for the locations to be displayed correctly. Valid coordinate information will be maintained in the data warehouse by the EIS, and updated as necessary by the DBS.

ESRI's ArcMap 9.3 (or the latest version available) will be utilized for spatially displaying the environmental data within maps and figures, as well as for spatial analysis. The GA will need to coordinate efforts with the EIS on all requests that require the display of environmental sample data on a map to ensure that the appropriate data is queried from the data warehouse and linked to the appropriate station location table within the GIS.

4.6.3 Site Information Management System

This is currently not being used on the Navy CLEAN and Joint Venture Programs.

SIMS is a tool for publishing data of sufficient quality from the project. However, the project data warehouse will remain the database of record for the project.

SIMS provides many standard report formats, all of which are used in conjunction with the Query Tool feature, to isolate and retrieve information. Users can generate and save their queries using a graphical point-and-click tool. Reports in a wide variety of formats also can be requested and produced.

4.6.4 Legacy Data

Legacy data are those collected from any contractor other than CH2M HILL and data collected by CH2M HILL that have not been managed in accordance with Navy CLEAN and Joint Venture Program requirements. Legacy data are commonly compiled from various electronic and hard copy sources including spreadsheets, databases, technical reports, and laboratory hard copy data reports. When working with legacy data, usability assessment must be completed for the project team to be able to use the data with confidence. In order to assess the data properly, the legacy data needs to be evaluated by skilled professionals that are familiar with the type of data being evaluated so that any errors identified in the data can be corrected when possible or qualified in a manner to reflect the limitations of the data's use.

The PM has overall responsibility for the selection for inclusion of legacy data into the data management process. The PDL and PCL will work with the PM to establish the data review and import process, compile a comprehensive data inventory, and identify staff to facilitate data review.

The PDL and PCL will work with the EIS to determine the appropriate intermediary files and tools used to collect the data. The PDL and PCL will oversee the data review and flagging process and approve the data for upload into the Data Warehouse. The EIS is responsible for assembling the field and laboratory data in formats that facilitate data review, aid the PDL and PCL in overseeing the data review and flagging process, schedule, conversion of the data to the proper data warehouse format, and then loading the data into the Data Warehouse after approval by the PDL and PCL.

The GA, PDL, PCL, and PM have the primary responsibility for reviewing the data in their area of expertise and providing the PCL with data usability flags to be associated with each record.

SECTION 5

Project Closeout

The project completion/closeout phase includes the following:

- Archive hard copy and electronic documents
- Conduct project closeout meeting

5.1 Archive Procedures

A large variety of technical data will be generated during the field investigations. The EIS and PC will collect all hard copy and electronic data they are responsible for and verify that the incoming records are legible and in suitable condition for storage. Record storage will be performed in two stages:

- Storage during the project
- Permanent storage following project completion

During the project, CH2M HILL will store data hardcopy reports in CH2M HILL offices. Physical records will be secured in steel file cabinets or shelves, and labelled with the appropriate project identification. Electronic data will be maintained on CH2M HILL's corporate local area network servers.

Information generated from field activities will be documented on appropriate forms and will be maintained in the project file. These include COC records, field logbooks, well construction forms, boring logs, location sketches, and site photographs. In addition, notes from project meetings and telephone conversations will be filed.

Following project completion, both hard copy and electronic data deliverables will be archived. Team staff will provide all hard copies of laboratory and validation reports to the Data Closeout Coordinator to be prepped and shipped to Stone Mountain for archiving. Final laboratory SNEDDs and loading files will be provided to the PDL, to be archived on CH2M HILL's corporate local area network servers.

Any modifications made to the SNEDD-Approach tools, criteria data sets, lookup tables, etc will be communicated to the project team via e-mail. As revisions are finalized, they will be distributed electronically to all users, and old versions will be archived on Gaia. After revision, it is the user's responsibility to conform to revised portions of the DMP.

5.2 Invoice Review and Approval

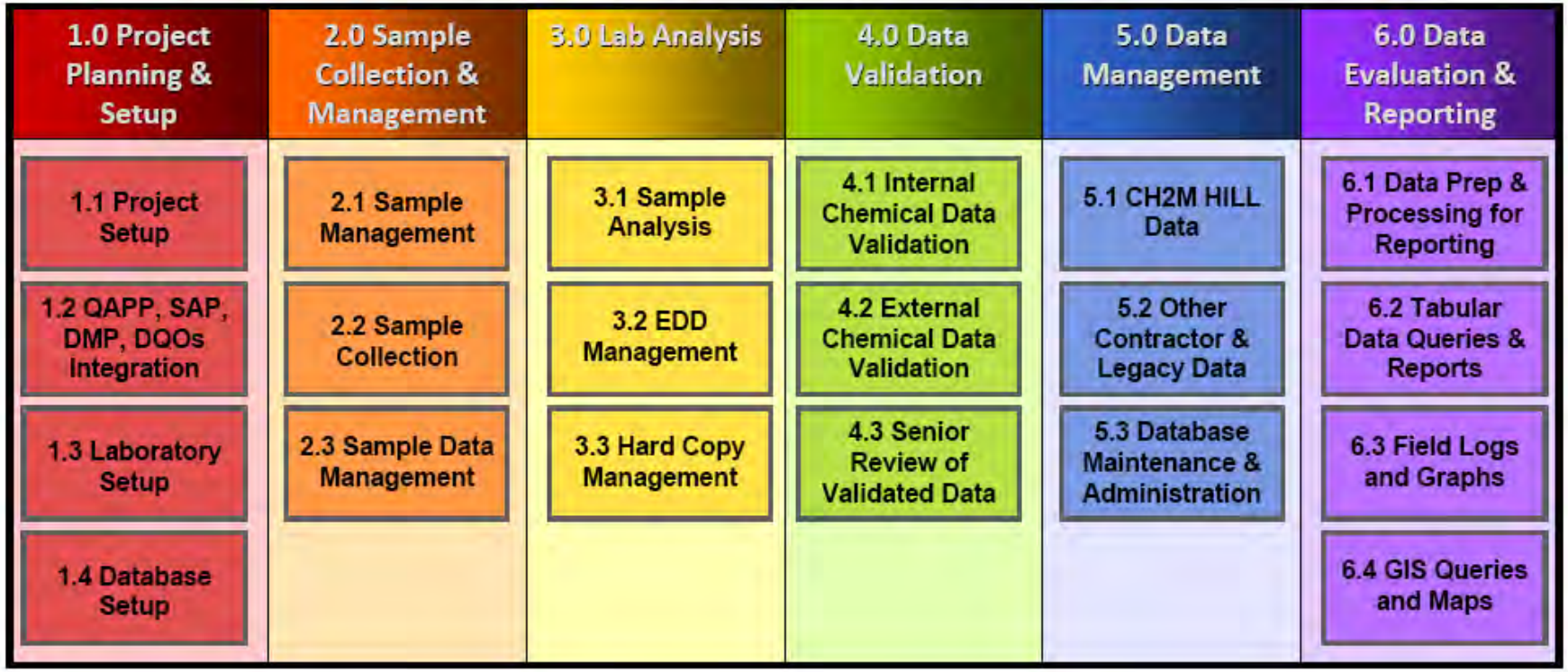
The EIS is responsible for tracking all data deliverables throughout the data management process to ensure that the project schedule is maintained, subcontractors comply with all required turn around times, and data provided are complete and acceptable. Following project completion, EISs are to review and provide comments on all laboratory and data validator invoices regarding data quality and schedule compliance prior to approval by the PM.

5.3 Project Closeout

At the end of each project, the PM will notify team staff of project closeout. The PM will coordinate and verify that all pertinent data has been archived. The PM may also review lessons learned, suggest process improvements, or revisions to the DMP and other project documentation as deemed necessary.

Appendix A
Environmental Data Management Work Process

Environmental Data Management Work Process



Appendix B
Life of a Sample

A Sample's Life

Step-by-Step Outline of Navy CLEAN and JV Data Management Process, and Roles & Responsibilities

Step 1 – Planning Phase

- Staffing Schedules
- Kickoff Meeting – Include the EIS & PC
- Project Instructions (PIs)
  - Sample Nomenclature provided in table
  - Reviewed by DMC (Chelsea Bennet) or Database Specialist

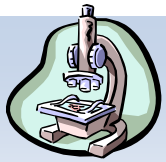
Step 2A – Sample Collection

- Daily collection and shipments of samples
- One COC/cooler; One FedEx slip/cooler
- Coordinate w/ EIS for tracking & Lab notification
- GPS conducted (if applicable)

Step 2B – Sample Tracking

- EIS cross checks COC against PIs
- Also reviews lab confirmation sheets to verify all samples were received and in appropriate condition

Step 3 – Lab Analysis



- Standard 28-day unless otherwise arranged
- EIS reviews data for accuracy and works with lab to resolve discrepancies
- EIS tracks schedule and keeps PM informed
- EIS inputs STSP information from Log Books
- EIS can generate Unvalidated Raw and Detects Data Tables

Step 4 – Data Validation

- PC reviews all data for accuracy against the PIs
- PC sends data from lab to Data Validator
- Delays may occur if there is missing data or data is late from the lab\
- EIS can generate Validated Raw and Detects Data Tables

Step 5 – Data Load

- PCL sends data to Database Specialist to be loaded into the Data Warehouse (DW)
- (Sometimes this involves assistance from PM, FTL, PC, and/or EIS)

Step 6 – Quality Assurance/ Quality Control

- EIS & PC are notified that data is loaded
- EIS verifies info loaded is correct (Sample, Station, Analyses, Result)
- EIS then helps decide whether info needs to be updated or not
- File and archive all Lab and DV deliverables

Step 7 – Report Generation

- Raw, Detects, Exceedance Reports
- Data Requests
- Exceedance Reports (criteria needed prior to this step and selected by PM)
- Human Health Risk Assessment
- Eco Risk Assessment

End of our Sample's Life?

- Data may be used in reports, posted on web, put into GIS, etc
- In that regard, a sample's life doesn't really ever end!
- Hopefully our sample had no exceedances and everyone is happy.

Appendix C
Standard Operating Procedures

The following SOPs can be located on the Ariadne server at the following link:
\\ariadne\Proj\CLEANII\DataMgmt\EIS\Reference Manual\2010

Checklist – Archive and NIRIS Load Prep

Checklist – Data QC

Checklist - EIS Project Start-up Questions

Checklist - Generating RDE Tables

Checklist - Historic Data Cleanup

Checklist - SNEDD DM Process

Roles – Data Management Coordinator

Roles – EIS

Roles – Project Manager

Template – STS & QC Association Table

SOP-114 - CHIMPTool

SOP-126 - XTab Reports Tool

SOP - Access to NIRIS

SOP - Cherry Point Exceedance Formatting Wizard

SOP – CLEAN SNEDD Loading with CHIMPTool

SOP - Corrections to File

SOP - Data Archiving Procedures

SOP - Data Shipping

SOP – FDET

SOP – FDET Setup

SOP – NIRIS Importer Validator Tool

SOP – SVMTool

SOP – Valid Value Setup

Appendix D
Electronic Data Deliverable Specifications

CH2M HILL SNEDD Format			
Field Name	**Field Format**	**REQ**	**Field Description**
Contract_ID	A13	R	Contract ID assigned by Division Contracting Office, not including dashes. Found on Statement of Work. (e.g. D459559365800)
DO_CTO_Number	A4	R	CTO or TO # assigned by Navy. (e.g. CTO-12 = 0012, TO-54 = TO54)
Phase	A8	NR	Task Phase, Annual Quarter, etc (e.g. QTR1)
Installation_ID	A20*	R	Unique identifier for installation. (e.g. WHIDBEY)
Sample_Name	A50	R	CH2M HILL Sample ID (from Chain Of Custody).
CH2M_Code	A4*	R	CH2M HILL Preparation Method Code (e.g. NONS)
Analysis_Group	A9*	R	The CH2M HILL code for the analysis performed on the sample.
Analytical_Method	A20*	R	Analytical Method used to analyze sample fraction. (e.g. 6010)
PRC_Code	A15*	R	NIRIS code for the analytical method category (e.g. PCHAR)
Lab_Code	A10*	R	CH2M HILL Code assigned to laboratory (e.g. COMP)
Lab_Name	A50*	R	The name of the laboratory that conducted the analysis, in all CAPS.
Leachate_Method	A16*	RA	Code for the leachate method used on sample. (e.g. SW1310)
Sample_Basis	A16*	R	Sample basis of analysis; wet weight, dry weight etc. (e.g. DRY)
Extraction_Method	A16*	RA	Code for the extraction method used on sample. (e.g. FLTRES)
Result_Type	A16*	R	Type of results; dilution, reanalysis etc. (e.g. 000)
Lab_QC_Type	A15*	R	Code for Laboratory Sample (MS, MSD, LBLK, LCS)
Sample_Medium	A16*	R	Sample medium reported by the laboratory. (e.g. L)
QC_Level	A16*	R	QC Level of data package : EPA levels I to IV. (e.g. 3)
DateTime_Collected	MM/DD/YYYY 00:00	R	Date and time sample was collected. Use 24 hour clock. (e.g. 02/13/2007 15:34)
Date_Received	MM/DD/YYYY	R	The date the sample was received in the lab (in 10 characters). (e.g. 03/24/2007)
Leachate_Date	YYYYMMDD	RA	Date the sample was leached. Req'd if sample was leached and/or Leachate Method provided. (e.g. March 12, 2007 = 20070312)
Leachate_Time	HH:MM:SS	RA	Time the sample was leached. Use 24 hour clock, with 8 characters. (e.g. 14:30:05). Req'd if sample was leached and/or Leachate Method provided.
Extraction_Date	YYYYMMDD	RA	Date that the lab extracted the sample. Req'd if Extraction Method provided.
Extraction_Time	HH:MM:SS	RA	Time of day lab extracted the sample. Use 24 hour clock, with 8 characters. Req'd if Extraction Method provided. (e.g. 02:15:00)
Analysis_Date	YYYYMMDD	R	Date that the lab performed the analysis.
Analysis_Time	HH:MM:SS	R	Time of day that the lab extracted the sample. Use 24 hour clock, with 8 characters.
Lab_Sample_ID	A20	R	Unique ID assigned to the sample by the laboratory.
Dilution	N10,2	R	Dilution factor used. Default value is 1 (e.g. 10)
Run_Number	N4	R	Number distinguishing multiple or repeat analyses by the same method (incl. RA, RE, DL, etc). Must

CH2M HILL SNEDD Format			
Field Name	**Field Format**	**REQ**	**Field Description**
			be equal to or greater than 1.
Percent_Moisture	N6,3	RA	Percent moisture of the sample. (e.g. 20)
Percent_Lipid	N6,3	RA	Percent lipid of the sample.
Chem_Name	A55*	R	The name of the compound being analyzed.
Analyte_ID	A20*	R	Analyte ID (CAS Number) assigned to the analyte. (e.g. 7440-47-3)
Analyte_Value	N18,7	R	Leave Blank for Validator to enter the final analyte concentration.
Original_Analyte_Value	N18,7	R	Analyte concentration value originally generated by the Laboratory.
Result_Units	A16*	R	Unit of measure for the analyte value. (e.g. UG_L)
Lab_Qualifier	A16*	RA	Lab data qualifier. Values will not be rejected if not in domain table.
Validator_Qualifier	A16*	RA	Leave blank for Validator. Values will not be rejected if not in domain table.
GC_Column_Type	A16*	RA	Data code for the type of GC column used in an analysis.
Analysis_Result_Type	A4*	R	Type of analysis performed (allowed: SURR or TRG).
Result_Narrative	A120	RA	Additional information or comments associated with the result.
QC_Control_Limit_Code	A16*	RA	Type of quality control limit. Req'd if QC criteria and upper/lower accuracy included. (e.g. CLPA)
QC_Accuracy_Upper	N6,3	RA	Upper QC limit of % recovery as measured for a known target analyte spiked into a QC sample. (e.g. 25.45)
QC_Accuracy_Lower	N6,3	RA	Lower QC limit of % recovery as measured for a known target analyte spiked into a QC sample. (e.g. 10.15)
Control_Limit_Date	YYYYMMDD	RA	Date a control limit is established.
QC_Narrative	A120	RA	Leave blank for Validator. Enter DV_Qual_Code.
MDL	N18,7	RA	Method Detection Limit. Required for QSM Version 3.X
Detection_Limit	N18,7	RA	Reported Detection Limit. Required for QSM Version 3.X
QSM_Version	N18,7*	RA	QSM Version of data reported
DL	N18,7	RA	QSM4.1 defined Detection Limit. Required if QSM Version is 4.1 or greater.
LOD	N18,7	RA	QSM4.1 defined Limit of Detection. Required if QSM Version is 4.1 or greater. Non-Detects shall be reported to this value.
LOQ	N18,7	RA	QSM4.1 defined Limit of Quantitation. Required if QSM Version is 4.1 or greater.
SDG	A50	R	Lab code for a group of samples in a data deliverable package.
Analysis_Batch	A20	R	Lab code for a batch of analyses analyzed together.
Validator_Name	A50*	R	Leave Blank. Name of Validator in all CAPS. (e.g. CONTRACTOR INC.)
Val_Date	YYYYMMDD	RA	Populated by Validator/Reviewer. Validation/Review QC date.

Attachment C
NOAA Crab Data

FINAL DATA REPORT
FOR THE
VIEQUES ISLAND BIOTA SAMPLING PROJECT

VIEQUES ISLAND, PUERTO RICO

Prepared by

National Oceanic and Atmospheric Administration
National Ocean Service
Office of Response and Restoration

and

RIDOLFI Inc.

July 2006

RIDOLFI Inc.

NOAA's Office of Response and Restoration

Figure 2-10 Area 10 - Blue Beach

Vieques Crab Sampling - June 2005

1999 NAVFAC true color (0.5'-2') or 2002 IKONOS (1m) orthophotography used as basemap. Crab sampling locations acquired using GPS. All data Puerto Rico State Plane Coordinate System, survey Feet, NAD 1983.

Land Crab Location

Fiddler Crab Location

Land Crab Foraging Area (100m)

Fiddler Crab Sampling Area (30m)

Appendix B-1. Analytical Data
Vieques Is. Land Crab Results

Chemical Name	Area 10: Blue Beach					Area 11: Bahia Tapon					Area 12: Live Impact Area				
	BB-LC-01-01	BB-LC-01-02	BB-LC-01-03	BB-LC-01-05	BB-LC-01-06	BT-LC-01-01	BT-LC-01-02	BT-LC-01-04	BT-LC-01-05	BT-LC-01-06	LI-LC-01-01	LI-LC-01-03	LI-LC-01-04	LI-LC-01-05	LI-LC-01-06
Explosives (mg/kg)															
1,3,5-Trinitrobenzene	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U
1,3-Dinitrobenzene	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U
2,4,6-Trinitrotoluene (TNT)	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U
2,4-Dinitrotoluene	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.1 U	0.08 U	0.08 U
2,6-Dinitrotoluene	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U
2-Amino-4,6-dinitrotoluene	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U
2-Nitrotoluene	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U
3-Nitrotoluene	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U
4-Amino-2,6-dinitrotoluene	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U
4-Nitrotoluene	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.1 U	0.076 U	0.076 U
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ
Nitrobenzene	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.4 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U
Polychlorinated Biphenyls (ug/kg)															
Aroclor 1016	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U
Aroclor 1221	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U
Aroclor 1232	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Aroclor 1242	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U
Aroclor 1248	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U
Aroclor 1254	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U
Aroclor 1260	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 UJ	3.1 UJ	3.1 UJ	3.1 UJ	3.1 UJ
Aroclor 1262	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U
Aroclor 1268	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
Pesticides (ug/kg)															
2,4'-DDD	0.32 U	0.32 U	1 Ui	**1.5**	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U
2,4'-DDE	0.66 Ui	0.15 U	1 Ui	1.2 Ui	0.15 U	0.22 Ui	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U
2,4'-DDT	1 Ui	0.12 U	**5.9 J**	2.5 Ui	**1.8**	**0.98 JP**	1 Ui	0.12 U	1 Ui	0.12 U	1 Ui	**1.2 J**	**5.1 J**	0.16 Ui	**1.2**
4,4'-DDD	**3.2**	0.16 U	**69 J**	**4.9 J**	**0.49 JP**	0.16 U	**0.23 JP**	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	**0.18 J**	0.16 U
4,4'-DDE	**7.2**	**3.2**	**19**	**3.1**	**4.1 J**	**2.6 J**	**17**	4 Ui	**7.8**	**1.9**	0.1 U	0.1 U	0.13 Ui	0.1 U	0.1 U
4,4'-DDT	0.2 U	0.2 U	**0.72 J**	**0.22 J**	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**0.42 JP**	0.2 U	0.2 U	**0.81 JP**
Total DDT (sum of detected values)	**10.4**	**3.2**	**94.62**	**9.72**	**6.39**	**3.58 J**	**17.23**	--	**7.8**	**1.9**	--	**1.62 J**	**5.1 J**	**0.18 J**	**2.01**
Aldrin	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	**0.17 J**	0.15 U	0.15 U	0.15 U	0.17 Ui	0.15 U
alpha-BHC	0.32 U	0.6 Ui	0.51 Ui	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U
alpha-Chlordane	0.11 U	0.22 Ui	0.11 U	0.11 U	0.11 U	0.3 Ui	0.11 U	**0.53 JP**	0.11 U	1 Ui	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U
beta-BHC	0.31 U	0.72 Ui	1 Ui	0.31 U	0.31 U	0.31 U	1.1 Ui	1 Ui	0.31 U	0.54 Ui	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
Chlordane	3.6 UJi	5 UJi	5.3 UJi	8 UJi	2.7 UJi	1.5 UJ	1.5 UJ	1.5 UJ	1.5 UJ	1.5 UJ	3.2 UJi	1.8 UJi	5.6 UJi	2.4 UJi	5.2 UJi
Chlorpyrifos	0.43 UJ	0.43 U	0.45 Ui	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U	0.43 UJ	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U
cis-Nonachlor	0.25 U	1 Ui	1 Ui	5 Ui	0.25 U	0.25 U	1 Ui	1 Ui	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.57 Ui
delta-BHC	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.28 Ui	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U
Dieldrin	1 Ui	1 Ui	1 Ui	0.075 U	0.075 U	0.075 U	0.075 U	0.075 U	0.075 U	0.16 Ui	0.075 U	0.075 U	0.075 U	0.075 U	0.075 U
Endosulfan I	1 Ui	0.74 Ui	0.93 Ui	1.2 Ui	0.17 U	0.85 Ui	0.17 U	0.35 Ui	0.26 Ui	1 Ui	0.17 U	0.17 U	0.17 U	0.26 Ui	0.17 U
Endosulfan II	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U
Endosulfan Sulfate	0.19 U	0.37 Ui	0.19 U	0.95 Ui	0.19 U	0.19 U	1 Ui	0.46 Ui	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Endrin	1 Ui	1 Ui	1.7 Ui	2.1 Ui	1 Ui	0.18 Ui	0.23 Ui	0.075 U	0.13 Ui	0.075 U	1 Ui	0.21 Ui	0.075 U	0.11 Ui	0.17 Ui
Endrin Aldehyde	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.23 Ui	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U
Endrin Ketone	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
gamma-BHC (Lindane)	0.17 U	0.17 U	0.17 U	0.17 U	0.26 Ui	1.1 Ui	0.17 U	1.3 Ui	0.17 U	0.52 Ui	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U
gamma-Chlordane	0.82 Ui	0.75 Ui	1 Ui	0.42 Ui	0.17 U	0.74 Ui	0.17 U	**0.48 J**	0.17 U	0.17 U	0.31 Ui	0.17 U	0.17 U	0.17 U	**0.36 J**
Heptachlor	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
Heptachlor Epoxide	0.34 U	1 Ui	0.34 U	0.34 U	0.34 U	0.34 U	0.34 U	**0.79 J**	**0.44 JP**	0.34 U	0.34 U	0.34 U	0.34 U	0.34 U	0.34 U
Isodrin	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Methoxychlor	0.32 U	0.78 Ui	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.33 Ui	0.32 U	**0.79 JP**	1 Ui	0.32 U	0.32 U
Mirex	0.24 U	0.34 Ui	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	**0.55 J**	**1.2**	**0.65 JP**	0.24 U	**1.7**
Oxychlordane	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
Toxaphene	16 Ui	14 U	18 UJi	18 Ui	14 U	14 U	14 U	14 U	14 U	14 U	14 U	14 U	14 U	14 U	26 Ui
trans-Nonachlor	0.19 U	0.66 Ui	1 Ui	0.78 Ui	0.19 U	0.19 U	1 Ui	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U

Appendix B-1. Analytical Data
Vieques Is. Land Crab Results

Chemical Name	Area 10: Blue Beach					Area 11: Bahia Tapon					Area 12: Live Impact Area				
	BB-LC-01-01	BB-LC-01-02	BB-LC-01-03	BB-LC-01-05	BB-LC-01-06	BT-LC-01-01	BT-LC-01-02	BT-LC-01-04	BT-LC-01-05	BT-LC-01-06	LI-LC-01-01	LI-LC-01-03	LI-LC-01-04	LI-LC-01-05	LI-LC-01-06
Trace Elements (mg/kg)															
Aluminum	**72**	**31.2**	**54.6 J**	**58.1 J**	**144 J**	**81.7 J**	**36.4 J**	**29.7 J**	**37.7 J**	**51.2 J**	**68.1**	**83**	**79.7**	**77**	**36.6**
Arsenic	**0.26**	**0.16**	**0.18**	**0.25**	**1.56**	**0.26**	**0.19**	**0.19**	**0.22**	**0.18**	**0.4**	**0.55**	**0.7**	**0.41**	**0.81**
Barium	**61.5**	**5.47**	**50.4**	**152**	**21**	**67.7**	**28.7**	**42.4**	**47.9**	**41.8**	**31.8**	**37.3**	**23.4**	**23.6**	**39.9**
Beryllium	0.001 U	0.001 U	0.001 U	0.003 U	0.002 U	0.003 U	0.002 U	0.002 U	0.003 U	0.002 U	0.003 U	0.002 U	0.003 U	0.003 U	0.003 U
Cadmium	**0.012**	**0.011**	**0.026**	**0.012**	**0.038**	**0.006**	**0.032**	**0.021**	**0.005**	**0.01**	**0.036**	**0.264**	**0.403**	**0.104**	**0.515**
Calcium	**44200**	**7380**	**45500**	**58700**	**28600**	**74500**	**47700**	**34700**	**67200**	**44000**	**58400 J**	**46700 J**	**56200 J**	**78700 J**	**60700 J**
Chromium	**1.63**	**0.08**	**0.54**	**1.33**	**1.02**	**1.11**	**0.71**	**0.11**	**1.23**	**0.22**	**0.72**	**1.02**	**0.91**	**3.38**	**1**
Cobalt	**0.373**	**0.141**	**0.388**	**0.736**	**0.548**	**0.647**	**0.557**	**0.532**	**0.54**	**0.374**	**0.235**	**0.252**	**0.308**	**0.36**	**0.294**
Copper	**32.7 J**	**25.4 J**	**24.6 J**	**26.9 J**	**68.1 J**	**19.5 J**	**33.9 J**	**28.5 J**	**18.2 J**	**22.4 J**	**26.4**	**20.3**	**15.7**	**32.2**	**20.9**
Iron	**103 J**	**30.3 J**	**62.2 J**	**81.9 J**	**179 J**	**102 J**	**47.2 J**	**33.1 J**	**52.5 J**	**52.3 J**	**88.6**	**84.9**	**103**	**102**	**48.3**
Lead	**0.036**	**0.008**	**0.032**	**0.019**	**0.064**	**0.068**	0.016 U	0.014 U	0.017 U	0.014 U	0.02 U	**0.02**	**0.03**	0.02 U	**0.02**
Magnesium	**3990 J**	**812 J**	**3970**	**5820**	**2790**	**6230**	**4380**	**3090**	**6430**	**3380**	**6040**	**3830**	**5460**	**6900**	**5380**
Manganese	**7.31**	**1.46**	**21.7**	**17**	**10.1**	**11.5**	**7.4**	**5.83**	**13.7**	**5.09**	**8.51**	**15**	**8.85**	**7.35**	**9.38**
Mercury	0.001 U	**0.001**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.005**	**0.003**	0.003 U	0.002 U	**0.004**
Nickel	**7.54**	**1.29**	**4.2**	**7.38**	**5.03**	**7.23**	**4.79**	**3.25**	**7.72**	**4**	**3.41**	**2.97**	**3.74**	**4.39**	**3.11**
Potassium	**1880**	**2590**	**1730**	**1600**	**1810**	**1490**	**2020**	**2510**	**1930**	**2140**	**2330**	**1600**	**1560**	**1330**	**1620**
Selenium	0.1 U	**0.14**	0.1 U	0.13 U	**0.35**	**0.26**	**0.33**	**0.17**	**0.14**	0.1 U	0.14 U	0.12 U	0.13 U	0.17 U	0.13 U
Silver	**0.0145 J**	**0.01 J**	**0.0326**	**0.0756**	**0.101**	**0.0339**	**0.0395**	**0.0139**	**0.0067**	**0.0089**	**0.021**	**0.057**	**0.184**	**0.076**	**0.031**
Sodium	**3890**	**3410**	**3300**	**3920**	**4070**	**4210**	**4250**	**3260**	**3540**	**3510**	**4310**	**3530**	**3640**	**3470**	**3520**
Thallium	**0.0008**	0.0005 U	0.0007 U	0.0017 U	0.0014 U	0.0018 U	0.0016 U	0.0014 U	0.0017 U	0.0014 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Uranium	**0.0056**	**0.0017**	**0.006**	**0.0028**	**0.0222**	**0.0151**	**0.0028**	**0.004**	0.0017 U	**0.0018**	**0.002**	**0.002**	**0.004**	**0.005**	**0.002**
Vanadium	**0.2**	0.1 U	**0.2**	**0.2**	**0.6**	**0.4**	**0.2**	**0.2**	**0.2**	**0.2**	**0.4**	**0.3**	**0.5**	**0.5**	**0.3**
Zinc	**30.8 J**	**70.1 J**	**30.1 J**	**33.6 J**	**36.1 J**	**23.2 J**	**48.7 J**	**51.3 J**	**37.7 J**	**28.2 J**	**49.8**	**32.3 J**	**24.1 J**	**18.2 J**	**22.4 J**

NOTES:

Bold values only are detected
i = elevated MDL due to interference
J = estimated value
P = confirmation criteria exceeded
U = non-detected (at MDL)
MDL = method detection limit

Appendix B-3. Analytical Data
Vieques Is. Fiddler Crab Results

Chemical Name	Ecological Screening Benchmarks	Area 6: Laguna Playa Grande whole body			Area 7: Mosquito Bay whole body			Area 8: Puerto Ferro whole body			Area 9: Red Beach whole body			Area 10: Blue Beach whole body		
		PG-FD-01-01	PG-FD-01-02	PG-FD-01-03	SB-FD-01-01	SB-FD-01-02	SB-FD-01-03	PF-FD-01-01	PF-FD-01-02	PF-FD-01-03/-03b Composite	RB-FD-01-01	RB-FD-01-02	RB-FD-01-03	BB-FD-01-01	BB-FD-01-02	BB-FD-01-03
Explosives (mg/kg)																
1,3,5-Trinitrobenzene		0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U
1,3-Dinitrobenzene		0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U
2,4,6-Trinitrotoluene (TNT)		0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U
2,4-Dinitrotoluene		0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U
2,6-Dinitrotoluene		0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U
2-Amino-4,6-dinitrotoluene		0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U	0.078 U
2-Nitrotoluene		0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U
3-Nitrotoluene		0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U
4-Amino-2,6-dinitrotoluene		0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U
4-Nitrotoluene		0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)		0.1 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)		0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ	0.074 UJ
Nitrobenzene		0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)		0.5 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.1 U	0.2 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U
Polychlorinated Biphenyls (ug/kg)																
Aroclor 1016	7700	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U
Aroclor 1221		2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U
Aroclor 1232		3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Aroclor 1242		1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U
Aroclor 1248		2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U
Aroclor 1254	23000	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	3.9 Ui	0.82 U	0.82 U	0.82 U
Aroclor 1260		3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	4.5 Ui	3.1 U	3.1 U	3.1 U
Aroclor 1262		1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U
Aroclor 1268		1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
Pesticides (ug/kg)																
2,4'-DDD		1 Ui	1 Ui	0.34 Ui	0.32 U	0.4 Ui	**3**	0.32 U	0.32 U	**0.58 J**	0.32 U	**1.1**	**0.7 JP**	**1.2**	0.32 U	0.32 U
2,4'-DDE		1 Ui	0.21 Ui	1 Ui	**1.2 J**	1.2 Ui	0.15 U	0.15 U	0.15 U	0.15 U	1 Ui	1 Ui	1.1 Ui	7.7 Ui	1 Ui	1 Ui
2,4'-DDT		**0.74 JP**	0.65 Ui	**0.51 J**	**1**	**0.95 J**	**1.7 J**	**0.83 J**	**0.48 J**	**0.57 JP**	0.66 Ui	**0.7 J**	**0.85 J**	**1.8**	**1.4**	**1.2**
4,4'-DDD		0.16 U	0.16 U	0.16 U	**0.37 JP**	1 Ui	**3.1**	**0.61 JP**	**0.83 J**	**2.1**	**0.77 JP**	**5.7**	**1.6**	**11**	**1.1 J**	**2**
4,4'-DDE		0.96 Ui	0.88 Ui	0.1 U	**10**	**4.9**	**91**	**9.3**	**20**	**71 J**	**120**	**270**	**120**	**88**	**13**	**23**
4,4'-DDT	130	0.2 U	0.22 Ui	0.49 Ui	0.2 U	**0.27 JP**	**2**	0.2 U	0.2 U	**2.3**	**0.92 JP**	**6.3**	**2**	**1.3**	0.32 Ui	**0.89 JP**
Total DDT (sum of detected values)		**0.74 J**	--	**0.51 J**	**12.57**	**6.12**	**100.8**	**10.74**	**21.31**	**76.55**	**121.69**	**283.8**	**125.15**	**103.3**	**15.5**	**27.09**
Aldrin	733	0.15 U	**0.18 JP**	0.25 Ui	0.23 Ui	0.3 Ui	0.15 U	0.15 U	0.15 U	0.15 U	0.17 Ui	0.15 U	0.53 Ui	0.15 U	0.16 Ui	0.21 Ui
alpha-BHC		0.32 U	0.44 UJi	0.52 Ui	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.36 Ui	0.32 U	0.32 U	0.32 U
alpha-Chlordane		1.2 Ui	1 Ui	1 Ui	0.12 Ui	**0.13 JP**	0.11 U	0.11 U	0.11 U	0.11 U	**0.5 J**	0.33 Ui	0.77 Ui	0.14 Ui	0.15 Ui	0.18 Ui
beta-BHC		0.56 Ui	1 Ui	0.93 Ui	0.32 Ui	0.74 Ui	0.31 U	0.31 U	0.52 Ui	0.31 U	1 Ui	1 Ui	1 Ui	0.31 U	0.31 U	1 Ui
Chlordane	1800	6.4 Ui	11 UJi	10 UJi	7 Ui	2.7 Ui	4.8 Ui	4.4 UJi	10 UJi	2.2 UJi	10 UJi	15 UJi	14 UJi	8.1 Ui	9.8 Ui	5.8 Ui
Chlorpyrifos		2 Ui	1.3 Ui	0.57 Ui	0.43 U	1 UJi	0.43 U	0.43 U	0.9 Ui	0.43 U	0.43 UJ	0.43 U	1.4 Ui	0.43 U	0.43 U	0.43 U
cis-Nonachlor		1 Ui	0.64 Ui	0.25 U	0.25 U	0.6 Ui	1 Ui	0.25 U	0.25 U	0.25 U	1 UJi	1 Ui	1 Ui	1.1 Ui	0.92 Ui	1 Ui
delta-BHC		0.21 U	0.21 U	0.32 Ui	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.75 Ui	0.27 Ui	1.1 Ui	0.21 U	0.21 U	0.21 U
Dieldrin	64	1 Ui	0.2 Ui	0.075 U	0.11 Ui	0.075 U	0.6 Ui	**0.65 J**	**0.62 J**	**1.2**	0.34 Ui	0.14 Ui	0.44 Ui	1 Ui	0.2 Ui	0.075 U
Endosulfan I	550	1 Ui	1 Ui	0.17 U	0.17 U	1 Ui	1 Ui	0.17 U	0.17 U	0.17 U	1 Ui	1.1 Ui	1 Ui	0.17 U	0.17 U	0.17 U
Endosulfan II	550	1 Ui	0.24 U	1 Ui	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.54 Ui	0.29 Ui	1 Ui	0.69 Ui	0.43 Ui	0.28 Ui
Endosulfan Sulfate		0.19 U	1 Ui	0.19 U	0.52 Ui	1 Ui	0.19 U	0.19 U	0.51 Ui	**1 J**	0.27 Ui	0.19 U	0.36 Ui	3.9 Ui	1.1 Ui	1.4 Ui
Endrin	8	0.37 Ui	0.52 Ui	0.075 U	1 Ui	0.39 Ui	1 Ui	0.56 Ui	0.075 U	0.15 Ui	0.53 Ui	0.38 Ui	0.67 Ui	1 Ui	0.44 Ui	0.14 Ui
Endrin Aldehyde		0.3 Ui	0.17 UJ	0.27 Ui	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.52 Ui	0.99 Ui	0.59 Ui	1 Ui	**1.2 J**	0.53 Ui
Endrin Ketone		0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 U	0.4 U	0.4 U	**1.1 J**	1 UJi	**1.7 J**	0.4 UJ	0.4 UJ	0.4 UJ
gamma-BHC (Lindane)		0.79 Ui	0.51 Ui	0.54 Ui	0.32 Ui	0.17 U	0.29 Ui	0.3 Ui	0.17 U	0.17 U	0.41 Ui	0.25 Ui	1 Ui	0.43 Ui	0.41 Ui	0.5 Ui
gamma-Chlordane		0.28 Ui	0.21 Ui	0.17 U	0.53 Ui	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	1 Ui	1 Ui	1.2 Ui	1 Ui	1 Ui
Heptachlor		0.31 U	0.31 UJ	0.31 U	0.31 U	0.32 Ui	0.31 U	0.31 U	0.31 U	0.31 U	0.37 Ui	0.31 U	0.51 Ui	0.31 U	0.31 U	0.31 U
Heptachlor Epoxide		0.34 U	0.35 Ui	0.51 Ui	0.34 U	**0.69 J**	0.34 U	0.34 U	0.34 U	0.34 U	1 Ui	1 Ui	0.34 U	1 Ui	0.39 Ui	**0.77 JP**
Isodrin		0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Methoxychlor	100	1 Ui	1.7 UJi	0.32 U	1 Ui	1.1 Ui	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	1.2 Ui	0.32 U	0.32 U	0.32 U
Mirex	20	0.24 UJ	1 UJi	0.24 UJ	0.24 UJ	0.34 UJi	0.24 UJ	0.24 U	0.24 U	0.24 U	0.24 UJ	0.87 UJi	0.24 UJ	1 UJi	0.24 UJ	0.75 UJi
Oxychlordane		0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.55 Ui	1.7 Ui	0.39 U	0.39 U
Toxaphene	29300	52 UJi	41 UJi	31 UJi	14 UJ	17 UJi	28 UJi	14 U	29 Ui	16 Ui	17 UJi	42 UJi	30 UJi	37 UJi	33 UJi	17 UJi
trans-Nonachlor		**0.29 J**	0.22 Ui	0.19 U	0.29 Ui	0.86 Ui	1 Ui	0.19 U	0.19 U	0.19 U	1 Ui	1 Ui	1 Ui	0.19 U	0.19 U	0.19 U

Appendix B-3. Analytical Data
Vieques Is. Fiddler Crab Results

Chemical Name	Ecological Screening Benchmarks	Area 6: Laguna Playa Grande whole body			Area 7: Mosquito Bay whole body			Area 8: Puerto Ferro whole body			Area 9: Red Beach whole body			Area 10: Blue Beach whole body		
		PG-FD-01-01	PG-FD-01-02	PG-FD-01-03	SB-FD-01-01	SB-FD-01-02	SB-FD-01-03	PF-FD-01-01	PF-FD-01-02	PF-FD-01-03/-03b Composite	RB-FD-01-01	RB-FD-01-02	RB-FD-01-03	BB-FD-01-01	BB-FD-01-02	BB-FD-01-03
Trace Elements (mg/kg)																
Aluminum	3.825	613	814	422	253	205	371	144	156	262	116	33.2	45	611	1100	826
Arsenic	0.25	1.36	1.81	1.55	2.05	1.9	1.83	1.51	1.53	1.21	4.01	3.79	2.2	1.09	1.23	1.01
Barium	17.2	54.8	44.7	35.6	19	19	22.3	17.2	14	21	9.42	9.73	4.19	30.8	28.2	31
Beryllium	2.42	0.006	0.007	0.004	0.003	0.002	0.004	0.001 U	0.001 U	0.001	0.002 U	0.003 U	0.002 U	0.002 U	0.012	0.007
Cadmium	0.13	0.144	0.137	0.053	0.018	0.013	0.023	0.047	0.064	0.122	0.059	0.066	0.054	0.123	0.193	0.171
Calcium		47500 J	50600 J	54500 J	52300 J	57400 J	45100 J	53900	50100	46100	60000 J	58400 J	29500 J	61900 J	45900 J	54600 J
Chromium	0.83	1.6	1.07	1.94	1.15	1.17	0.83	0.64	0.64	2.83	0.9	2.65	0.34	4.06	7.89	1.85
Cobalt		0.276	0.341	0.269	0.234	0.245	0.268	0.436	0.437	0.491	0.206	0.206	0.121	0.453	0.613	0.396
Copper	38.9	50	64.3	52.5	39	29.8	39.9	38.2 J	45.8 J	51.5 J	56.7	58.4	38.6	42.5	59.8	49.7
Iron		561	733	420	255	214	316	186 J	232 J	300 J	113	67.6	44.6	541	915	671
Lead	0.94	0.88	0.52	0.21	0.08	0.09	0.12	0.315	0.551	0.422	0.21	0.27	0.12	0.31	0.74	0.42
Magnesium		3880 J	4020 J	4670 J	4870 J	5140 J	4140 J	4670 J	4050 J	4240 J	4780 J	4890 J	2100 J	4950	3710 J	4520 J
Manganese	322	58.4	107	41.8	11	13.4	16.3	12	13.7	19.2	5.49	3.53	1.96	42.2	68	42.3
Mercury	1.23	0.006	0.008	0.01	0.015	0.014	0.01	0.006	0.008	0.009	0.01	0.006	0.011	0.009	0.011	0.01
Nickel	64.08	2.4	2.37	3.1	2.73	3.25	2.64	4.7	4.1	6.95	2.5	3.44	1.4	4.89	8.59	3.37
Potassium		1630	1810	1850	1690	1570	1560	1400	1350	1430	1760	1650	905	1710	1640	1550
Selenium	0.331	0.77	0.83	0.45	0.2	0.13	0.2	0.15	0.13	0.26	0.56	0.43	0.28	0.39	0.49	0.54
Silver		0.031	0.046	0.029	0.012	0.008	0.011	0.0288 J	0.0432 J	0.0302 J	0.116	0.137	0.119	0.021	0.043	0.029
Sodium		3110	3180	3620	3720	3790	4090	3130	2720	3780	3940	3700	1820	3880	3760	3720
Thallium	0.027	0.011	0.004	0.002	0.002	0.002 U	0.002	0.0012	0.0016	0.0008	0.003	0.004	0.003	0.002 U	0.003	0.004
Uranium	5.981	0.044	0.039	0.023	0.077	0.055	0.042	0.0325	0.029	0.0345	0.049	0.026	0.022	0.011	0.015	0.014
Vanadium	0.2	2.1	2.6	1.6	0.9	0.7	1	0.7	0.9	1	0.5	0.3	0.2	1.6	3.2	2.3
Zinc	12	21.8 J	26.5 J	23.6 J	23.5 J	21.5 J	23.8 J	19.4 J	19.2 J	21.7 J	31.5 J	33.8 J	18.8 J	25.3 J	27.8 J	21.1 J

NOTES:
Bold values only are detected
Shaded values exceed ecological screening benchmark values
i = elevated MDL due to interference
J = estimated value
P = confirmation criteria exceeded
U = non-detected (at MDL)
MDL = method detection limit

Attachment D
NOAA Sediment Data

An Ecological Characterization of the Marine Resources of Vieques, Puerto Rico Part II: Field Studies of Habitats, Nutrients, Contaminants, Fish, and Benthic Communities

Biogeography Branch / Coastal and Oceanographic Assessment, Status and Trends (COAST) Branch
Center for Coastal Monitoring and Assessment (CCMA)
NOAA/NOS/National Centers for Coastal Ocean Science
1305 East-West Highway (SSMC-4, N/SCI 1)
Silver Spring, MD 20910

Center for Coastal Fisheries and Habitat Research (CCFHR)
NOAA/NOS/National Centers for Coastal Ocean Science
101 Pivers Island Road
Beaufort, NC 28516

NOAA Technical Memorandum NOS NCCOS 110

May 2010

Editors:
Laurie J. Bauer
Matthew S. Kendall

Authors:
Timothy A. Battista
Laurie J. Bauer
John S. Burke
John D. Christensen
Brian Degan
S. Ian Hartwell
Matthew S. Kendall
W. Judson Kenworthy
Brooke Landry
Andrew L. Mason
Anthony S. Pait
Jenny Vander Pluym
Varis Ransiibrahmanakul
David R. Whitall
Adam G. Zitello

United States Department of Commerce
Gary Locke
Secretary

National Oceanic and Atmospheric Administration
Jane Lubchenco
Administrator

National Ocean Service
David Kennedy
Acting Assistant Administrator

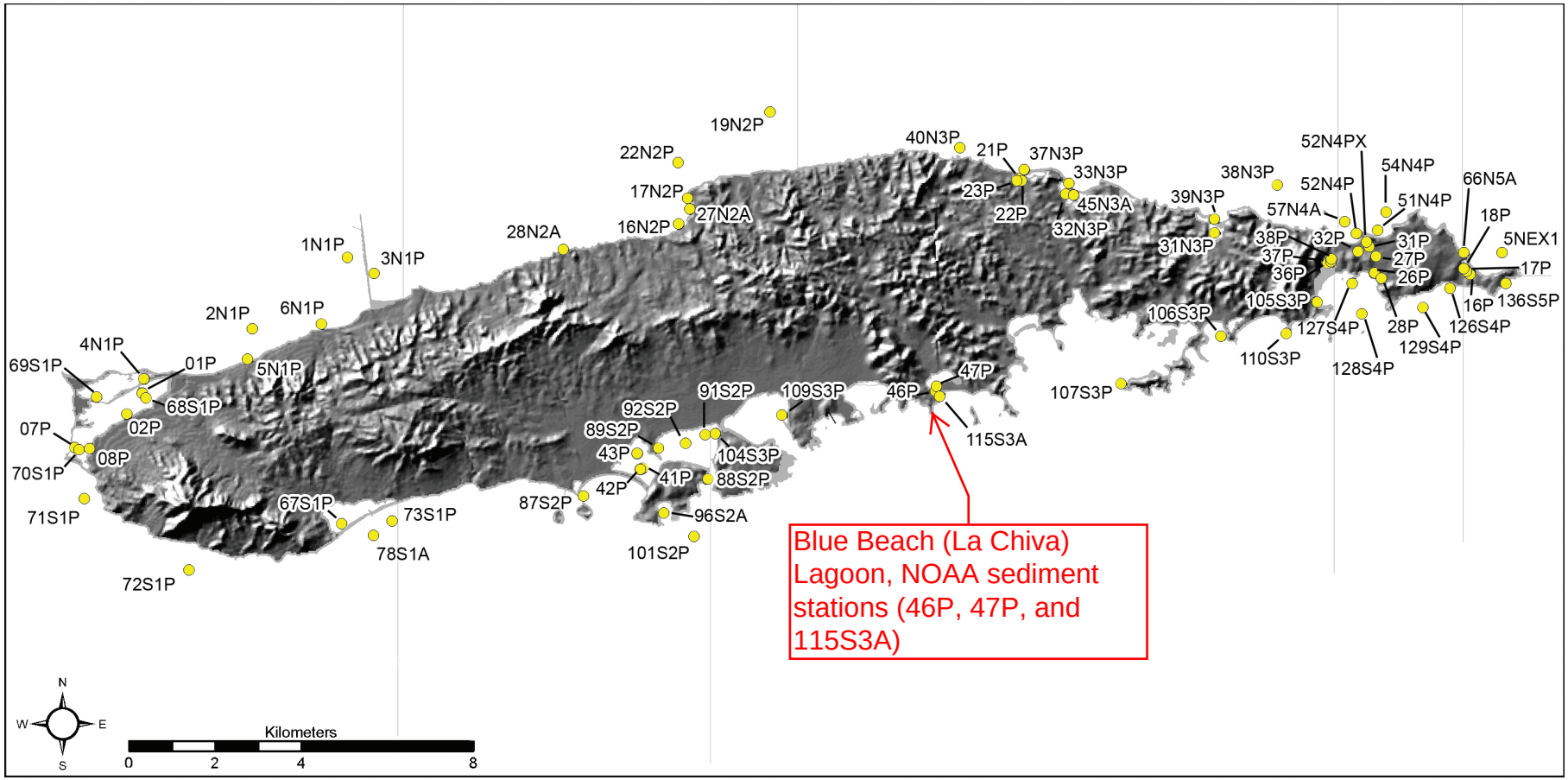


Figure 5.1. Sediment sites analyzed in Vieques (May and October 2007). Letters represent primary or alternate (P or A) sites or sites on the north or south (N or S) shore of Vieques. Three letter designations (e.g., 08P) represent October 2007 inland lagoon site designations.

Appendix C. Total organic carbon and grain size analysis results from the sediment samples (continued).

Site	TOC (%)	TIC (%)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Fines (%)
46P	6.80	0.61	0.00	12.36	46.36	41.28	87.64
47P	2.76	1.48	0.00	6.29	55.15	38.56	93.71
51N4P	0.56	11.08	1.90	90.91	3.33	3.86	7.19
52N4P	1.07	10.27	1.38	94.55	1.42	2.65	4.07
52N4PX	0.26	1.60	3.30	67.62	24.08	5.00	29.08
54N4P	0.48	11.26	5.44	77.56	13.92	3.08	17.00
57N4A	1.10	10.76	0.52	90.48	6.92	2.08	8.99
66N5A	1.11	10.58	0.00	98.43	0.10	1.47	1.57
67S1P	4.04	3.79	0.00	8.60	51.70	39.70	91.40
69S1P	8.32	3.80	0.00	15.58	28.14	56.28	84.42
70S1P	20.02	2.40	0.00	19.93	24.37	55.70	80.06
71S1P	0.55	6.92	1.11	83.37	12.51	3.01	15.52
72S1P	0.29	7.68	0.31	93.74	5.11	0.84	5.95
73S1P	0.49	7.18	0.84	96.06	2.96	0.14	3.11
78S1A	0.14	7.38	2.55	97.28	0.17	0.00	0.17
87S2P	0.21	7.04	0.00	93.81	3.35	2.84	6.19
88S2P	1.26	10.12	0.00	49.39	34.09	16.52	50.61
89S2P	0.77	0.75	0.00	73.70	16.33	9.97	26.30
91S2P	8.59	1.56	0.00	6.99	68.06	24.95	93.01
92S2P	2.42	4.19	5.03	16.67	67.49	10.81	78.30
96S2A	1.55	10.63	14.23	58.15	14.93	12.69	27.62
101S2P	0.85	10.88	1.16	97.81	1.03	0.00	1.03
104S3P	7.44	1.05	0.00	11.08	54.82	34.10	88.92
105S3P	1.35	10.74	0.00	83.32	6.81	9.87	16.68
106S3P	1.13	10.18	0.00	81.10	10.35	8.55	18.90
107S3P	1.41	8.70	4.78	75.43	8.81	10.98	19.79
109S3P	2.45	8.53	9.28	34.28	41.03	15.41	56.44
110S3P	2.59	9.21	10.68	82.46	4.81	2.05	6.86
115S3A	2.57	8.95	1.90	96.38	0.86	0.86	1.71
126S4P	0.37	11.08	3.73	83.34	2.25	10.68	12.93
127S4P	0.93	10.77	18.17	58.42	17.59	5.82	23.40
128S4P	3.02	8.80	24.27	71.04	2.41	2.28	4.69
129S4P	1.97	9.87	0.00	84.34	6.59	9.07	15.66
136S5P	0.99	11.04	17.20	82.50	0.10	0.20	0.29
137S5P	2.94	9.03	2.68	92.52	4.04	0.76	4.80

Abbreviations: TOC, total organic carbon; TIC, total inorganic carbon

Appendix D. Total polycyclic aromatic hydrocarbons (PAHs) in sediments (ng/ dry g) (continued).

Compound	39N3P	40N3P	41P	42P	43P	45N3A	46P	47P	51N4P	52N4P	52N4PX	54N4P
Decalin	0 U	0 U	7	0 U	6	0 U	6.4	3.1	0 U	0 U	0 U	0 U
C1-Decalins	0 U	0 U	4.3	0 U	5.2	0 U	3.6	2.6	0 U	0 U	0 U	0 U
C2-Decalins	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C3-Decalins	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C4-Decalins	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Naphthalene	0.3	0.2	1.4	1	1.1	1.8	1.3	0.6	0.2	0.3	0.7	0.4
C1-Naphthalenes	0.1 J	0.1 J	1.3	1.3	0.8	1.4	0.9	0.9	0.1 J	0.1 J	0.3 J	0.2 J
C2-Naphthalenes	0 U	0 U	3	3	2.1	2.7	2.5	2.1	0.5	0 U	0.5	0.5
C3-Naphthalenes	0 U	0 U	2.7	2.8	1.8	3.3	2.3	2.4	0.7	0 U	0 U	0 U
C4-Naphthalenes	0 U	0 U	3.2	3.7	0 U	3.5	2.6	2.9	0 U	0 U	0 U	0 U
Benzothiophene	0 U	0 U	0.2	0.2	0 U	0.1 J	0 U	0 U	0 U	0 U	0 U	0 U
C1-Benzothiophenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C2-Benzothiophenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C3-Benzothiophenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Biphenyl	0.5	0.1 J	0.7	0.4	0.3	1.1	0.4	0.4	0.1 J	0.1 J	0.3	0.2
Acenaphthylene	0 U	0 U	0.3	0.5	0.5	0.2	0.7	0.3	0 U	0 U	0.1 J	0 U
Acenaphthene	0.1 J	0.1 J	4.6	3.7	3.3	1	1	2	0 U	0.1 J	0.2	0 U
Dibenzofuran	0.2 J	0.1 J	0.9	0.7	0.5	2.1	0.5	0.6	0.1 J	0.1 J	0.3	0.2 J
Fluorene	0.1 J	0.1 J	7.6	5.8	4.7	2.7	4.1	2.7	0.1 J	0.4	0.3	0.1 J
C1-Fluorenes	0 U	0.3 J	0 U	0 U	0 U	0 U	2.6	2.3	0.3 J	0 U	0.5	0 U
C2-Fluorenes	0 U	0.5	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C3-Fluorenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Anthracene	0 U	0 U	1.5	1.5	1.2	0.3	2.1	0.5	0 U	0.1 J	0.1 J	0.1 J
Phenanthrene	0.4	0.3	3.7	4.4	1.9	4.8	2.2	2.7	0.5	0.9	1.4	0.6
C1-Phenanthrene/Anthracenes	0 U	0.4	4.2	4.7	2.9	2.6	12.5	1.9	0.3	0.5	0.5	0.2 J
C2-Phenanthrene/Anthracenes	0 U	0.8	9.1	8.3	0 U	0 U	0 U	0 U	0.5	0.7	0 U	0 U
C3-Phenanthrene/Anthracenes	0 U	0.8	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C4-Phenanthrene/Anthracenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Dibenzothiophene	0.1 J	0 U	0.9	0.7	0.3	0.4	0.5	0.3	0.1 J	0.1 J	0.2	0 U
C1-Dibenzothiophenes	0 U	0 U	1	0 U	0.4	0 U	0 U	0.6	0 U	0 U	0 U	0 U
C2-Dibenzothiophenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C3-Dibenzothiophenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Fluoranthene	0.2 J	0.1 J	1.9	2.8	2.9	1.4	4.1	2.1	0.1 J	0.7	0.7	0.4
Pyrene	0.1 J	0.1 J	1.7	2.7	3.2	0.8	3.3	1.5	0.1 J	0.6	0.7	0.4
C1-Fluoranthenes/Pyrenes	0 U	0.5	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0.4	1.7	0.4
C2-Fluoranthenes/Pyrenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	2.7	0 U
C3-Fluoranthenes/Pyrenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Naphthobenzothiophene	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C1-Naphthobenzothiophenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C2-Naphthobenzothiophenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C3-Naphthobenzothiophenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Benz(a)anthracene	0.1 J	0.1 J	1.2	2.2	3.4	1.4	1.6	1.1	0 U	0.2	0.2	0.2
Chrysene	0 U	0.1 J	2	1.6	1.5	0.7	6.1	1.3	0.1 J	0.4	0.4	0.2
C1-Chrysenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C2-Chrysenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C3-Chrysenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C4-Chrysenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Benzo(b)fluoranthene	0.2 J	0 U	1.6	1.8	2.6	1	4.9	2.1	0.1 J	0.5	0.6	0.4
Benzo(k)fluoranthene	0 U	0 U	0.4	0.5	0.9	0.2 J	1.8	0.8	0 U	0.1 J	0.1 J	0.1 J
Benzo(e)pyrene	0 U	0 U	0.8	1.4	1.7	0.5	3.5	1.5	0 U	0.3 J	0.2 J	0.2 J
Benzo(a)pyrene	0 U	0 U	0.9	1	1.4	0.2 J	2.2	1	0 U	0.3	0.1 J	0.2 J
Perylene	0 U	0 U	1.5	0 U	1.5	2.2	106	8.6	0 U	0.1 J	0.1 J	0.2 J
Indeno(1,2,3-c,d)pyrene	0 U	0 U	1.2	1.4	1.9	0.5	3.1	1.3	0 U	0.2 J	0.5	0.2 J
Dibenzo(a,h)anthracene	0 U	0 U	14.9	16.4	18.3	8.3	25.9	0 U	0 U	0.1 J	2.1	0 U
C1-Dibenzo(a,h)anthracenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C2-Dibenzo(a,h)anthracenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C3-Dibenzo(a,h)anthracenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Benzo(g,h,i)perylene	0 U	0 U	0.9	0.7	1.1	0.9	1.6	0.6	0 U	0.2	0.6	0.2
Total PAHs	2.5	4.7	86.6	75.2	73.4	46.9	210.3	50.8	3.9	7.6	16.2	5.6
Individual Isomers*												
2-Methylnaphthalene	0.1 J	0.1 J	1.2	1.2	0.7	1.5	0.9	0.9	0.1 J	0.1 J	0.3	0.1 J
1-Methylnaphthalene	0.1 J	0.1 J	0.7	0.8	0.5	0.8	0.5	0.5	0.1 J	0.1 J	0.2	0.1 J
2,6-Dimethylnaphthalene	0 U	0 U	1.8	1.3	1	1.5	1.4	1.1	0.2 J	0 U	0.2 J	0.2 J
1,6,7-Trimethylnaphthalene	0 U	0 U	0.1	0.3	0.1	0.4	0.3	0.3	0.1	0 U	0 U	0 U
1-Methylphenanthrene	0 U	0.1 J	1	1.3	0.6	0.7	1.9	0.5	0.1 J	0.1 J	0.1 J	0.1 J
C29-Hopane	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0	0 U	0 U	0 U	0 U
18a-Oleanane	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0	0 U	0 U	0 U	0 U
C30-Hopane	0 U	0 U	488	806	898	0 U	152	222	3.7	15	43.9	3.8

Note: J, below method detection level, MDL; U, not detected
*Individual isomers contained in alkylated (C1-C4) sums

Appendix D. Total polycyclic aromatic hydrocarbons (PAHs) in sediments (ng/ dry g) (continued).

Compound	89S2P	91S2P	92S2P	96S2A	101S2P	104S3P	105S3P	106S3P	107S3P	109S3P	110S3P	115S3A
Decalin	0 U	0 U	0 U	0 U	0 U	0 U	8.1	4.2	0 U	3.3	0 U	0 U
C1-Decalins	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C2-Decalins	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C3-Decalins	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C4-Decalins	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Naphthalene	0.3	0.8	1.1	0.3	0.1 J	1.7	0.4	0.3	0.2	1	0.2	0.2
C1-Naphthalenes	0.2 J	0.6	0.9	0.2 J	0.1 J	1.2	0.2 J	0.2 J	0.1 J	0.7	0.1 J	0.1 J
C2-Naphthalenes	0.8	6	4	0 U	0 U	4.1	1.5	0 U	0 U	1.6	0 U	0.7
C3-Naphthalenes	0.6	1	2.7	0 U	0 U	2.9	0 U	0 U	0 U	1.2	0 U	0 U
C4-Naphthalenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Benzothiophene	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C1-Benzothiophenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C2-Benzothiophenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C3-Benzothiophenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Biphenyl	0.2	0.4	0.3	0.3	0.1 J	0.8	0.1 J	0.2	0.1 J	0.2	0.1 J	0.1 J
Acenaphthylene	0.1 J	0.2	0.3	0.1 J	0 U	0.2	0 U	0 U	0 U	0.8	0 U	0 U
Acenaphthene	0.1 J	0.2	2.1	0.1 J	0 U	0.5	0.1 J	0.5	0 U	0.2	0 U	0.1 J
Dibenzofuran	0.2 J	0.4	0.5	0.3	0.1 J	1.5	0.2 J	0.2 J	0.1 J	0.4	0.2 J	0.1 J
Fluorene	1.6	4.2	8.5	0.8	0 U	11.1	0.6	0.5	0.2	2.3	0.3	0.2
C1-Fluorenes	0 U	2.8	2.9	0 U	0 U	5.3	0.4	0 U	0 U	1.1	0 U	0 U
C2-Fluorenes	0 U	5.2	0 U	0 U	0 U	4.3	2.1	0 U	0 U	0 U	0 U	0 U
C3-Fluorenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Anthracene	0.1 J	2.5	0.8	0.1 J	0 U	3.7	0 U	0 U	0 U	0.9	0 U	0 U
Phenanthrene	0.5	1.5	1.7	0.7	0.1 J	4.5	0.4	0.5	0.2	3.3	0.7	0.5
C1-Phenanthrene/Anthracenes	0.6	11.1	1.8	0.4	0 U	7.7	0.4	0.4	0 U	4.2	0.3	0.3
C2-Phenanthrene/Anthracenes	0 U	7.9	0 U	0.6	0 U	5.5	0 U	0.7	0 U	10.8	0.3	0 U
C3-Phenanthrene/Anthracenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C4-Phenanthrene/Anthracenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Dibenzothiophene	0.1 J	0.6	0.3	0.1 J	0 U	1.2	0 U	0.1 J	0 U	0.4	0.1 J	0.1 J
C1-Dibenzothiophenes	0 U	0 U	0 U	0 U	0 U	0.6	0 U	0 U	0 U	1.6	0 U	0 U
C2-Dibenzothiophenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C3-Dibenzothiophenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Fluoranthene	0.5	1.2	1.7	0.2 J	0 U	3.2	0.3	0.2 J	0.1 J	8.9	0.2 J	0.2 J
Pyrene	0.4	1.6	1.2	0.1 J	0 U	2.3	0.2	0.2	0.1 J	10.1	0.1 J	0.2
C1-Fluoranthenes/Pyrenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	9.4	0 U	0 U
C2-Fluoranthenes/Pyrenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	16.3	0 U	0 U
C3-Fluoranthenes/Pyrenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	5.3	0 U	0 U
Naphthobenzothiophene	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C1-Naphthobenzothiophenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C2-Naphthobenzothiophenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C3-Naphthobenzothiophenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Benz(a)anthracene	0.6	17.2	0.9	0 U	0 U	2.8	0.2	0 U	0.1 J	6.2	0 U	0 U
Chrysene	0.6	11.5	0.9	0.1 J	0 U	2.5	3.1	0 U	0.1 J	7.2	0 U	0.2
C1-Chrysenes	0.8	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	6.9	0 U	0 U
C2-Chrysenes	1	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	8.4	0 U	0 U
C3-Chrysenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C4-Chrysenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Benzo(b)fluoranthene	1.2	1.8	2	0.5	0 U	1.8	0.2 J	0.2 J	0.3	9.6	0.1 J	0.2 J
Benzo(k)fluoranthene	0.4	0.4	0.5	0.1 J	0 U	0.2 J	0.1 J	0.1 J	0.1 J	3.3	0 U	0 U
Benzo(e)pyrene	0.6	0.7	1.1	0.1 J	0 U	0.6	0.1 J	0.1 J	0.1 J	6.1	0 U	0.2 J
Benzo(a)pyrene	0.7	0.9	1.1	0.1 J	0 U	0.5	0.1 J	0 U	0.2 J	7	0 U	0.1 J
Perylene	0.6 J	7.1	2.2	0.2 J	0 U	3.7	0.3 J	0 U	0.2 J	2.1	0 U	0.3 J
Indeno(1,2,3-c,d)pyrene	1	1	1.2	0.1 J	0 U	1.1	0.1 J	0.1 J	0.3	4.9	0 U	0.1 J
Dibenzo(a,h)anthracene	2.9	24.8	9.8	0 U	0 U	11.2	3.4	0.3	0.3	5	0 U	0.4
C1-Dibenzo(a,h)anthracenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C2-Dibenzo(a,h)anthracenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
C3-Dibenzo(a,h)anthracenes	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Benzo(g,h,i)perylene	1	1	1.2	0.2	0 U	0.8	0.2	0 U	0.3	4.4	0 U	0.1 J
Total PAHs	17.8	114.9	52	6	0.5	88.1	27	9.3	3.1	155.4	2.8	4.5
Individual Isomers*												
2-Methylnaphthalene	0.2 J	0.5	0.9	0.2 J	0.1 J	1.3	0.2 J	0.2 J	0.1 J	0.6	0.1 J	0.1 J
1-Methylnaphthalene	0.2	0.5	0.4	0.1 J	0.1 J	0.7	0.1 J	0.2	0.1 J	0.4	0.1 J	0 U
2,6-Dimethylnaphthalene	0.6	8.9	3.3	0 U	0 U	1.9	1.9	0 U	0 U	0.9	0 U	0.4
1,6,7-Trimethylnaphthalene	0.1	0.3	0.2	0 U	0 U	0.4	0 U	0 U	0 U	0.1	0 U	0 U
1-Methylphenanthrene	0.1 J	1.6	0.4	0.1 J	0 U	2	0.1 J	0.2 J	0 U	1.1	0.1 J	0 U
C29-Hopane	7.1	0 U	24.2	0 U	0 U	0 U	7.1	0 U	0 U	15.4	0 U	0 U
18a-Oleanane	1.5	0 U	0 U	0 U	0 U	0 U	3	0 U	0 U	0 U	0 U	0 U
C30-Hopane	10.5	0 U	87.8	0 U	0 U	0 U	7.7	0 U	0 U	53	0 U	6.3

Note: J, below method detection level, MDL; U, not detected
*Individual isomers contained in alkylated (C1-C4) sums

Appendix H. Total polychlorinated biphenyls (PCBs) in sediments (ng/dry g) (continued).

Compound	43P	101S2P	46P	47P	51N4P	52N4P	52N4PX	54N4P
PCB8/5	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB18	0.24	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB28	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB29	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB31	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB44	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB45	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB49	0.00 U	0.00 U	0.00 U	0.06 J	0.00 U	0.00 U	0.00 U	0.00 U
PCB52	0.00 U	0.00 U	0.34	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB56/60	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB66	0.00 U	0.00 U	0.00 U	0.04 J	0.00 U	0.00 U	0.00 U	0.00 U
PCB70	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB74/61	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB87/115	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB95	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB99	0.00 U	0.00 U	0.40	0.00 U	0.00 U	0.00 U	0.01 J	0.00 U
PCB101/90	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB105	0.00 U	0.00 U	0.00 U	0.01 J	0.00 U	0.00 U	0.00 U	0.00 U
PCB110/77	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.01 J	0.00 U
PCB118	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.02 J	0.00 U
PCB128	0.00 U	0.00 U	0.00 U	0.02 J	0.00 U	0.00 U	0.00 U	0.00 U
PCB138/160	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB146	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB149/123	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB151	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB153/132	0.00 U	0.00 U	0.00 U	0.01 J	0.00 U	0.00 U	0.00 U	0.00 U
PCB156/171/202	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB158	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB170/190	0.00 U	0.00 U	0.00 U	0.27	0.00 U	0.00 U	0.00 U	0.00 U
PCB174	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB180	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB183	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB187	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB194	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB195/208	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB199	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB201/157/173	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB206	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB209	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Total PCB	2.72	2.19	2.93	2.95	2.19	2.19	2.23	2.19

Qualifiers: J = Below the method detection level (MDL); U = not detected.

Appendix H. Total polychlorinated biphenyls (PCBs) in sediments (ng/dry g) (continued).

Compound	101S2P	104S3P	105S3P	106S3P	107S3P	109S3P	110S3P	115S3A
PCB8/5	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB18	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB28	0.00 U	0.25	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB29	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB31	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB44	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB45	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB49	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB52	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB56/60	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB66	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB70	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB74/61	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB87/115	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB95	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB99	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB101/90	0.00 U	0.00 U	0.07	0.08	0.00 U	0.00 U	0.00 U	0.00 U
PCB105	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB110/77	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB118	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB128	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB138/160	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB146	0.00 U	2.43	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB149/123	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB151	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB153/132	0.00 U	0.00 U	0.01 J	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB156/171/202	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB158	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB170/190	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB174	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB180	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB183	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB187	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB194	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB195/208	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB199	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB201/157/173	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB206	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
PCB209	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Total PCB	2.19	2.75	2.37	2.36	2.19	2.19	2.19	2.19

Qualifiers: J = Below the method detection level (MDL); U = not detected.

Appendix L. Organochlorine pesticides in sediments (ng/dry g) (continued).

Compound	37P	38N3P	38P	39N3P	40N3P	41P	42P	43P	45N3A	46P	47P
Aldrin	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.02 J	0.00 U	0.00 U	0.00 U
Dieldrin	0.03 J	0.00 U	0.03 J	0.00 U	0.00 U	0.00 U	0.10	0.00 U	0.00 U	0.08	0.00 U
Endrin	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Heptachlor	0.00 U	0.00 U	0.01 J	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Heptachlor-Epoxide	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Oxychlordane	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Alpha-Chlordane	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.18	0.09	0.00 U	0.00 U	0.00 U
Gamma-Chlordane	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.38	0.00 U	0.00 U
Trans-Nonachlor	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Cis-Nonachlor	0.00 U	0.01 J	0.00 U	0.00 U	0.00 U	0.04 J	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Alpha-HCH	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Beta-HCH	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Delta-HCH	0.03 J	0.02 J	0.00 U	0.03 J	0.00 U	0.00 U	0.06	0.08	0.00 U	0.43	0.12
Gamma-HCH	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.09	0.00 U	0.00 U	0.04	0.00 U	0.00 U
DDMU	0.00 U	0.00 U	0.14	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.92	39.22 D	1.89
2,4'-DDD	0.00 U	0.00 U	0.04 J	0.00 U	0.00 U	5.97	2.33	1.03	7.00	49.30 D	4.50
4,4'-DDD	0.00 U	0.00 U	0.12	0.02 J	0.00 U	3.91	0.71	0.41	4.94	194.95 D	8.70
2,4'-DDE	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.48	5.70	0.59
4,4'-DDE	0.43	0.00 U	0.67	0.01 J	0.00 U	14.10	9.45	6.59	18.76	122.92 D	21.25 E
2,4'-DDT	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	207.53 D	0.00 U
4,4'-DDT	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.01 J	0.00 U	0.10	654.05 D	2.14
1,2,3,4-Tetrachlorobenzene	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
1,2,4,5-Tetrachlorobenzene	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Hexachlorobenzene	0.00 U	0.00 U	0.01 J	0.00 U	0.00 U	0.00 U	0.01 J	0.01 J	0.12	0.00 U	0.02 J
Pentachloroanisole	0.05 J	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.09	0.00 U	0.00 U
Pentachlorobenzene	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.03 J	0.00 U	0.00 U
Endosulfan II	0.00 U	0.00 U	0.22	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.16	0.00 U	0.00 U
Endosulfan I	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.19	0.00 U	0.08 J
Endosulfan Sulfate	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Mirex	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Chlorpyrifos	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.27	0.33	0.15	0.00 U	0.00 U	0.27
Total HCH	0.03	0.02	0.00	0.03	0.00	0.09	0.06	0.08	0.04	0.43	0.12
Total Chlordane	0.00	0.01	0.01	0.00	0.00	0.04	0.18	0.09	0.38	0.00	0.00
Total DDT	0.43	0.00	0.97	0.03	0.00	23.98	12.50	8.04	32.20	1273.66	39.06

Qualifiers: J = Below the method detection level (MDL); U = not detected.

Appendix L. Organochlorine pesticides in sediments (ng/dry g) (continued).

Compound	105S3P	106S3P	107S3P	109S3P	110S3P	115S3A	126S4P	127S4P	128S4P	129S4P	136S5P	137S5P
Aldrin	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Dieldrin	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Endrin	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Heptachlor	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.04 J	0.00 U	0.01 J	0.03 J	0.00 U	0.00 U
Heptachlor-Epoxide	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Oxychlordane	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Alpha-Chlordane	0.00 U	0.01 J	0.02 J	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Gamma-Chlordane	0.00 U	0.00 U	0.01 J	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Trans-Nonachlor	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Cis-Nonachlor	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Alpha-HCH	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Beta-HCH	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Delta-HCH	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Gamma-HCH	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.05	0.00 U	0.00 U	0.00 U	0.03 J	0.00 U
DDMU	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.22	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
2,4'-DDD	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.41	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
4,4'-DDD	0.01 J	0.01 J	0.00 U	0.17	0.00 U	1.53	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
2,4'-DDE	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.02 J	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
4,4'-DDE	0.02 J	0.05	0.00 U	1.69	0.00 U	0.97	0.00 U	0.00 U	0.00 U	0.00 U	0.01 J	0.00 U
2,4'-DDT	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.06	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
4,4'-DDT	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	5.70	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
1,2,3,4-Tetrachlorobenzene	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
1,2,4,5-Tetrachlorobenzene	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Hexachlorobenzene	0.00 U	0.01 J	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.02 J	0.03 J	0.00 U
Pentachloroanisole	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Pentachlorobenzene	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.01 J	0.01 J	0.00 U	0.00 U
Endosulfan II	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Endosulfan I	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.01 J	0.00 U	0.00 U	0.00 U
Endosulfan Sulfate	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Mirex	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Chlorpyrifos	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Total HCH	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.03	0.00
Total Chlordane	0.00	0.01	0.03	0.00	0.00	0.00	0.04	0.00	0.01	0.03	0.00	0.00
Total DDT	0.03	0.06	0.00	1.87	0.00	8.92	0.00	0.00	0.00	0.00	0.01	0.00

Qualifiers: J = Below the method detection level (MDL); U = not detected.

Appendix N. Energetics detected in Vieques sediments (µg/dry /g) (continued).

Compound	46P*	47P*	51N4P	52N4P	52N4PX	54N4P	57N4A
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	ND i	ND	ND	ND	ND	ND	ND
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trinitrobenzene	ND i	ND i	ND	ND	ND	ND	ND
1,3-Dinitrobenzene	ND	ND	ND	ND	ND	ND	ND
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	ND	ND i	ND	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND	ND	ND	ND
4-Amino-2,6-dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2-Amino-4,6-dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trinitrotoluene (TNT)	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2-Nitrotoluene	ND	ND	ND	ND	ND	ND	ND
4-Nitrotoluene	ND	ND	ND	ND	ND	ND	ND
3-Nitrotoluene	ND	ND	ND	ND	ND	ND	ND
Perchlorate**	NA	ND	NA	NA	ND	NA	NA

Compound	66N5A	67S1P	68S1P*	69S1P	70S1P	71S1P	72S1P
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	ND	ND	ND	ND	ND	ND	ND
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trinitrobenzene	ND	ND	ND i	ND	ND	ND	ND
1,3-Dinitrobenzene	ND	ND	ND	ND	ND	ND	ND
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND	ND	ND	ND
4-Amino-2,6-dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2-Amino-4,6-dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trinitrotoluene (TNT)	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2-Nitrotoluene	ND	ND	ND	ND	ND	ND	ND
4-Nitrotoluene	ND	ND	ND	ND	ND	ND	ND
3-Nitrotoluene	ND	ND	ND	ND	ND	ND	ND
Perchlorate**	NA	NA	ND	NA	ND	NA	NA

Compound	73S1P	78S1A	87S2P	88S2P	89S2P	91S2P	92S2P
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	ND	ND	ND	ND	ND	ND	ND
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trinitrobenzene	ND	ND	ND	ND	ND	ND	ND
1,3-Dinitrobenzene	ND	ND	ND	ND	ND	ND	ND
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND	ND	ND	ND
4-Amino-2,6-dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2-Amino-4,6-dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trinitrotoluene (TNT)	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2-Nitrotoluene	ND	ND	ND	ND	ND	ND	ND
4-Nitrotoluene	ND	ND	ND	ND	ND	ND	ND
3-Nitrotoluene	ND	ND	ND	ND	ND	ND	ND
Perchlorate**	NA	NA	NA	NA	NA	NA	NA

Qualifiers: ND, not detected; NA, not analyzed; *, Sediment sample reanalyzed using LC/MS/MS (Liquid Chromatograph/Mass Spectrometry/ Mass Spectrometry; i, the Method Reporting Limit (MRL)/Method Detection Limit (MDL) has been elevated due to a chromatographic interference; **Perchlorate was not analyzed in all samples, and results for perchlorate are in ng/g (ppb).

Appendix N. Energetics detected in Vieques sediments (µg/dry g) (continued).

Compound	96S2A	101S2P	104S3P	105S3P	106S3P	107S3P	109S3P
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	ND	ND	ND	ND	ND	ND	ND
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trinitrobenzene	ND	ND	ND	ND	ND	ND	ND
1,3-Dinitrobenzene	ND	ND	ND	ND	ND	ND	ND
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND	ND	ND	ND
4-Amino-2,6-dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2-Amino-4,6-dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trinitrotoluene (TNT)	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2-Nitrotoluene	ND	ND	ND	ND	ND	ND	ND
4-Nitrotoluene	ND	ND	ND	ND	ND	ND	ND
3-Nitrotoluene	ND	ND	ND	ND	ND	ND	ND
Perchlorate**	NA	NA	NA	NA	NA	NA	NA

Compound	110S3P	115S3A	126S4P	127S4P	128S4P	129S4P	136S5P	137S5P
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	ND	ND	ND	ND	ND	ND	ND	ND
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trinitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dinitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND
4-Amino-2,6-dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND
2-Amino-4,6-dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trinitrotoluene (TNT)	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND
3-Nitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND
Perchlorate**	NA	NA	NA	NA	NA	NA	NA	NA

Qualifiers: ND, not detected; NA, not analyzed; *, Sediment sample reanalyzed using LC/MS/MS (Liquid Chromatograph/Mass Spectrometry/ Mass Spectrometry; i, the Method Reporting Limit (MRL)/Method Detection Limit (MDL) has been elevated due to a chromatographic interference; **Perchlorate was not analyzed in all samples, and results for perchlorate are in ng/g (ppb).

Appendix O. Butyltins detected in Vieques sediments (ng Sn/dry g).

Site	01P	1N1P	02P	2N1P	3N1P	4N1P	5N1P	07P
Monobutyltin	0.23 J	0.00 U	0.15 J	0.00 U	0.00 U	0.21 J	0.00 U	0.35 J
Dibutyltin	0.15 J	0.38 J	0.11 J	0.42	1.27	0.26 J	0.33 J	0.08 J
Tributyltin	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Tetrabutyltin	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U

Site	08P	16N2P	16P	17N2P	17P	18P	19N2P	21P
Monobutyltin	0.20 J	0.00 U	0.23 J	0.00 U	0.19 J	0.15 J	0.18 J	0.12 J
Dibutyltin	0.10 J	0.49	0.00 U	0.95	0.00 U	0.09 J	0.24 J	0.00 U
Tributyltin	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Tetrabutyltin	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U

Site	22N2P	22P	23P	26P	27N2A	27P	28N2A	28P
Monobutyltin	0.00 U	0.22 J	0.17 J	0.26 J	0.43 J	0.18 J	0.00 U	1.33
Dibutyltin	0.08 J	0.09 J	0.13 J	0.27 J	0.27 J	0.16 J	0.12 J	0.00 U
Tributyltin	0.00 U	0.00 U	0.00 U	0.00 U	0.13 J	0.00 U	0.00 U	0.00 U
Tetrabutyltin	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U

Site	31N3P	31P	32N3P	32P	33N3P	36P	37N3P	37P
Monobutyltin	0.00 U	1.89	0.00 U	1.40	0.13 J	0.86	0.00 U	0.52 J
Dibutyltin	0.50	0.09 J	0.17 J	0.00 U	0.62	0.00 U	0.28 J	0.00 U
Tributyltin	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.0 U	0.00 U
Tetrabutyltin	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U

Site	38N3P	38P	39N3P	40N3P	41P	42P	43P	45N3A
Monobutyltin	0.55 J	0.78	0.15 J	0.00 U	0.75 J	2.67	2.23	0.00 U
Dibutyltin	0.70	0.07 J	0.76	0.19 J	0.66 J	0.53	0.20 J	0.57
Tributyltin	0.00 U	0.07 J	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U
Tetrabutyltin	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U

Site	46P	47P	51N4P	52N4P	52N4PX	54N4P	57N4A	66N5A
Monobutyltin	1.19	1.62	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.29 J
Dibutyltin	0.11 J	0.09 J	0.20 J	0.26 J	0.08 J	0.09 J	0.20 J	0.26 J
Tributyltin	0.00 U	0.00 U	0.00 U	0.18 J	0.00 U	0.00 U	0.00 U	0.00 U
Tetrabutyltin	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U

Appendix O. Butyltins detected in Vieques sediments (ng Sn/dry g) (continued).

Site	67S1P	68S1P	69S1P	70S1P	71S1P	72S1P	73S1P	78S1A
Monobutyltin	0.12 J	0.00 U	0.00 U	0.32 J	0.00 U	0.00 U	0.00 U	0.00 U
Dibutyltin	0.20 J	0.21 J	0.22 J	0.56	0.34 J	0.17 J	0.14 J	0.20 J
Tributyltin	0.00 U	0.0 U	0.00 U	0.11 J	0.00 U	0.00 U	0.00 U	0.00 U
Tetrabutyltin	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U

Site	87S2P	88S2P	89S2P	91S2P	92S2P	96S2A	101S2P	104S3P
Monobutyltin	0.00 U	0.00 U	0.86	0.21 J	0.28 J	0.32 J	0.23 J	0.00 U
Dibutyltin	0.23 J	0.19 J	1.04	0.24 J	0.34 J	0.22 J	0.08 J	0.25 J
Tributyltin	0.0 U	0.00 U	1.23	0.15 J	0.10 J	0.00 U	0.00 U	0.00 U
Tetrabutyltin	0.00 U	0.00 U	0.00 U	0.00 U	0.22 J	0.00 U	0.00 U	0.00 U

Site	105S3P	106S3P	107S3P	109S3P	110S3P	115S3A	126S4P	127S4P
Monobutyltin	0.00 U	0.00 U	0.21 J	0.00 U	0.18 J	0.00 U	0.37 J	0.12 J
Dibutyltin	0.21 J	0.20 J	0.09 J	0.19 J	0.34 J	0.10 J	0.47	0.18 J
Tributyltin	0.00 U	0.00 U	0.00 U	0.07 J	0.00 U	0.00 U	1.03	0.07 J
Tetrabutyltin	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U	0.00 U

Site	128S4P	129S4P	136S5P	137S5P
Monobutyltin	0.00 U	0.12 J	0.00 U	0.00 U
Dibutyltin	0.31 J	0.21 J	0.25 J	0.18 J
Tributyltin	0.00 U	0.00 U	0.00 U	0.00 U
Tetrabutyltin	0.00 U	0.00 U	0.00 U	0.00 U

Appendix Q. Trace and major elements in Vieques sediments (µg/dry g) (continued).

Compound	39N3P	40N3P	41P	42P	43P	45N3A
Ag	0.139	0.0896	0 U	0 U	0 U	0.478
Al	3,390	3,330 B	63,300	80,900	89,800	118,000
As	2.48	4.31	2.98	2.95	3.1	2.76
Cd	0 U	0 U	0 U	0 U	0 U	0.306
Cr	6.57	8.63	13.6	16.1	15.6	43.3
Cu	3.42	2.52	40.9	51.6	53.6	87.6
Fe	1,640	1,490 B	30,600	39,300	43,200	50,200
Hg	0 U	0 U	0.0402	0.0469	0.0383	0.0609
Mn	44.1	42.5 B	307	497	531	594
Ni	0 U	0 U	6.49	9.1	9.54	22.6
Pb	1.65	0.661	8.36	10.6	11.2	16.4
Sb	0 U	0 U	0.287	0.321	0.322	0.84
Se	0 U	0 U	0.563	0.564	0.397	1.2
Si	16,800	32,500	161,000	203,000	230,000 B	224,000
Sn	0 U	0 U	0.698	0.922	0.942	2.51
Zn	3.73	4.89	44.8 B	56.2 B	55.5 B	96.7

Compound	46P	47P	51N4P	52N4P	52N4PX	54N4P
Ag	0.0411	0 U	0.137	0.0978	0.085	0.0964
Al	72,400	76,200	2,770	5,730	74,000	1,580
As	3.96	2.26	2.57	1.89	9.86	1.98
Cd	0.259	0.118	0 U	0 U	0.179	0 U
Cr	34.3	35.2	9.71	9.78	178	7.66
Cu	58.6	53.1	1.56	2.38	46.9	1.13
Fe	45,100	38,000	1,060	2,040	45,300	593
Hg	0.0467	0.0296	0 U	0 U	0.0366	0 U
Mn	618	384	33.1	67.4	632	21.7
Ni	19.2	16.7	0 U	0 U	38.3	0 U
Pb	9.21	7.91	1.13	0.923	4.86	0.701
Sb	0.556	0.521	0 U	0 U	0.838	0 U
Se	0.587	0.322	0 U	0 U	0 U	0.142
Si	209,000 B	248,000 B	20,000	36,100	228,000	16,700
Sn	1.27	1.2	0 U	0 U	0.592	0 U
Zn	39.4 B	35.1 B	2.74	4.31	63	4.74

Qualifiers (Q): B=Analyte detected in the procedural blanks greater than 3X MDL;
J=Below the MDL; U=Not detected

Appendix Q. Trace and major elements in Vieques sediments (µg/dry g) (continued).

Compound	89S2P	91S2P	92S2P	96S2A	101S2P	104S3P
Ag	0.0685	0.0809	0.105	0.0894	0.203	0.0884
Al	70,900	58,300	58,900 B	2,910	1,880	72,300
As	3.62	7.34	12.6	2.66	2.22	3.83
Cd	0 U	0.149	0.11	0 U	0 U	0.133
Cr	13	16.4	18.6	7.35	7.3	15.5
Cu	31.6	52.5	36.1	3.7	1.78	49.1
Fe	35,400	28,600	28,100 B	1,330	670	24,700
Hg	0.0219	0.0498	0.0375	0 U	0 U	0.0351
Mn	667	194	313 B	38.6	31.4	175
Ni	6.68	7.62	7.09	0 U	0 U	6.33
Pb	9.55	5.46	5	1.28	0.878	4.77
Sb	0.336	0.278	0.282	0 U	0 U	0.364
Se	0.135	1.12	0.797	0.217	0.107	0.879
Si	291,000	127,000	120,000	10,100	14,900	185,000
Sn	0.98	0.729	0.691	0 U	0 U	0.653
Zn	44.4	53.2	50.6	5.03	2.76	42.6

Compound	105S3P	106S3P	107S3P	109S3P	110S3P	115S3A
Ag	0.0978	0.0758	0.0814	0.101	0.0604	0.0897
Al	4,200 B	8,480 B	14,500	24,800	1,900	6,630
As	1.83	2.66	2.21	6.44	2.65	2.33
Cd	0 U	0 U	0 U	0.0928	0 U	0 U
Cr	12.6	7.34	8.94	15.9	8.69	6.26
Cu	3.58	5.95	7.99	29.1	3.28	3.06
Fe	1,800 B	3,910 B	6,170	13,500	1,070	2,880
Hg	0 U	0 U	0 U	0.066	0 U	0 U
Mn	37 B	93.2 B	154	146	34	83
Ni	2.24	2.24	1.95	4.7	0 U	0 U
Pb	0.74	1.06	1.51	5.2	0.769	1.34
Sb	0 U	0 U	0 U	0 U	0 U	0 U
Se	0 U	0 U	0 U	0.698	0.135	0 U
Si	20,900	32,900	57,600	62,400	15,200	30,100
Sn	0 U	0 U	0 U	0.524	0 U	0 U
Zn	4.58	8.15	27.2	26.5	3.37	5.19

Qualifiers (Q): B=Analyte detected in the procedural blanks greater than 3X MDL;
J=Below the MDL; U=Not detected

Attachment E
Final Responses to USEPA and PREQB Comments

FINAL RESPONSES TO USEPA COMMENTS ON THE

DRAFT SAMPLING AND ANALYSIS PLAN
LAGUNA LA CHIVA
SITE INSPECTION/REMEDIAL INVESTIGATION

FORMER VIEQUES NAVAL TRAINING RANGE
VIEQUES, PUERTO RICO

DATED JULY 2012

Presented below are review comments on the *Draft Sampling and Analysis Plan, Laguna La Chiva Site Inspection/Remedial Investigation, Former Vieques Naval Training Range, Vieques, Puerto Rico;* dated July 2012 (hereinafter referred to as the SAP).

General Comments

1. The SAP discusses a landfill, Solid Waste Management Unit (SWMU) 1, and indicates it is not a source of contaminants, or not currently a source for Laguna La Chiva. However, it is unclear if this landfill has been closed or if the landfill is still active. Revise the SAP to clarify if SWMU 1 is a current or former landfill.

   Navy Response:

   The last paragraph under "Site Background and Investigation History" in Worksheet #10 has been revised to read (new text underlined):

   "In March 2009, the Navy collected . . . as part of an investigation of <u>the former Camp Garcia landfill</u> (SWMU 1), located topographically upgradient of Laguna La Chiva. As shown in the figure, . . . adjacent to the <u>former</u> landfill. <u>The details of the investigation of SWMU 1 are presented in the *Streamlined Remedial Investigation/Feasibility Study Report, Solid Waste Management Unit 1 (SWMU 1), Former Vieques Naval Training Range, Vieques, Puerto Rico* (CH2M HILL, 2011).</u>"

2. The number of samples to be collected is inconsistently presented in the SAP. For example, Worksheet #14 states 11 sediment samples will be collected. However, Worksheet #18 indicates that 15 sediment samples will be collected. Revise the SAP to consistently indicate the number of samples that will be collected.

   Navy Response:

   As concurred upon during the October 2012 Vieques Technical Subcommittee meeting (see October 2012 Meeting Minutes), an additional sediment sample will be added adjacent to the "middle" drum location and sediment sample SD003 will be moved to be adjacent to the "southernmost" drum (drum locations shown in Figure 4), keeping all locations within the lagoon. With this additional sample, sediment samples will now be collected from 12 locations across Laguna La Chiva, and at 4 of these locations, sediment samples will be collected from two depths. Therefore, a total of 16 sediment samples will be collected from the 12 sediment sampling locations. The sediment sample information in Worksheets #10, #11, #14, #17, and #18 and Figure 4 has been revised to reflect this information (see also the response to Specific Comment #10).

EPA additional comment:

Please note that revised Worksheets # 10, #11, #14, and #17 have not been provided, so that it cannot be determined whether the appropriate number of sediment samples have been included in these worksheets.

Navy Response to additional comment:

Worksheets 10, 11, 14, and 17 have been updated in accordance with the response and included in the Draft Final SAP.

3. Worksheet #17 states that the eastern ephemeral stream enters the lagoon at sample VENOSD011. However, Figures 7 and 8 show that the eastern ephemeral stream never enters the lagoon. Also, Figure 4 shows sample VENOSD011 to be inside the lagoon and not associated with the ephemeral steam. Revise the SAP to correct these apparent discrepancies.

Navy Response:

Figure 4 does show that VENOSD011 is located where an eastern ephemeral stream enters the lagoon. However, to make it clearer, Figures 4, 7, and 8 have been updated to show the approximate paths of the ephemeral streams entering Laguna La Chiva near samples VENOSD001 and VENOSD011.

EPA additional comment:

Please note that revised Figure 7 has not been provided for review. Figure 8 contains the Conceptual Site Model which illustrates where ephemeral stream samples were collected. It should be clearly indicated that these sample locations (designated by yellow circles) were part of the SWMU 1 investigation, and will not be sampled as part of the Laguna La Chiva investigation.

Navy Response to additional comment:

Figures 7 and 8 have been updated to make it clearer that SWMU 1 stream sediment samples are previously collected samples, not part of this investigation. All revised figures are included in the Draft Final SAP.

4. The SAP does not provide the laboratory specific standard operating procedures (SOPs) or all of the statistically derived quality control (QC) acceptance limits (e.g., matrix spike/matrix spike duplicate [MS/MSD], surrogate, internal standard, and laboratory control sample [LCS] limits). Without this information, it is unclear if the laboratory procedures are acceptable or if the laboratory can meet the QC criteria presented in this SAP. Revise the SAP to include all applicable laboratory-specific SOPs and QC acceptance limits.

Navy Response:

The laboratory-specific SOPs listed in Worksheet #23 are not provided by default, but are available upon request and have been provided in response to this comment. All QC acceptance limits are already provided. For example, for sediment VOCs, please refer to Worksheet #28-1. For MS/MSD and LCS accuracy and precision limits, please refer to Worksheet #15-1. Laboratory-specific lower control limits, upper control limits, and relative percent difference limits for each compound are provided, along with their basis. For surrogates and internal standards, the limits are provided in Worksheet #28-1. The same is true for each combination of matrix and fraction.

5. The rationale for the number, type, and/or location of samples is insufficiently detailed. For example, although Worksheets #9 and #14 indicate that the locations of sediment samples were determined during a site visit, the SAP does not discuss why 15 sediment samples from the proposed depths are deemed sufficient. In addition, it is unclear why seven soil samples are considered sufficient to characterize the soil adjacent to the lagoon. Further, the SAP does not discuss the rationale for why the locations of soil samples VENOSD002,

VENOSD003, VENOSD004, and VENOSD006 were determined to sufficiently characterize the soil surrounding the lagoon. Finally, the SAP does not discuss the proposed sample type (i.e., grab or composite sample), and the rationale for why it is considered sufficient. Revise the SAP to provide additional detail regarding the rationale for the selected number, type and location of samples.

Navy Response:

The Navy feels the rationale for the number, type, and location of samples is sufficiently discussed in Worksheets #10 and #11, and especially Worksheet #17 where the rationale for each sample is detailed. The number, type and/or location of samples were discussed in detail, adjusted, and then agreed upon as being sufficient by all regulatory stakeholders at the February 22/March 14 2012 project scoping sessions and the October 2012 Technical Subcommittee meeting. The following sentence has been added under "Sampling Rationale, Method and Approach" of Worksheet #17:

"The number, type and location of samples were discussed and agreed upon as being sufficient by all regulatory stakeholders at the February 22/March 14, 2012 project scoping sessions and October 2012 Technical Subcommittee meeting."

6. It is unclear if the proposed project action limits (PALs) are sufficient. Worksheet #15 indicates the adjusted Industrial Regional Screening Levels (RSLs) from November 2011 and Ecological Screening Levels (ESVs) are presented. However, Worksheet #10 indicates that residents are a potential receptor. Additionally, it appears that the RSLs in Worksheet #15 are the current May 2012 Residential RSLs. Revise the Worksheet #15 to clarify that the current Residential RSLs will be used.

Navy Response:

The document has been updated throughout to reflect November 2012 RSLs. Adjusted residential RSLs have been added to Worksheet #15 in addition to adjusted industrial RSLs.

7. The SAP does not present sufficiently detailed decision criteria. For example, Worksheet #11 presents the lines of evidence for determining if there is a CERCLA-related release, which includes a comparison of concentrations detected in Laguna La Chiva to pesticide concentrations detected in other lagoons (e.g., Laguna Kiani) or sediment samples (e.g., from AOC H) on Vieques. However, the SAP does not present a comprehensive list of areas that will be compared or indicate why the examples are appropriate for comparison. Further, the SAP does not specify what values above the concentrations found in the example areas would indicate a CERCLA-related release. Further, the SAP does not specify how many of the lines of evidence will be used to positively determine a CERCLA release occurred. Lastly, Step 7 of Figure 5 is not discussed in Worksheet #11, and it is unclear how it will be determined that the sediment and soil contamination are sufficiently delineated or that additional samples are needed. Revise the SAP to present detailed decision criteria that will be used for determining whether the release is CERCLA-related and that contamination is delineated or whether additional characterization will be necessary.

Navy Response:

Decisions regarding release assessment, especially associated with pesticides, and whether contamination has been sufficiently delineated are subjective and the Navy feels the decision criteria for the SI and RI, as discussed in Worksheets #10 and #11 and detailed in Figure 5 (Site Inspection Evaluation Decision Tree) and Figure 6 (Remedial Investigation Evaluation Decision Tree) are sufficient and are comparable to the decision criteria approved by EPA for previous site inspections and remedial investigations conducted on Vieques. Further, as with any investigation conducted on Vieques, the regulatory agencies have the opportunity to review and comment on the interpretation of the data and conclusions drawn by the Navy.

8. The SAP discusses the analysis of polycyclic aromatic hydrocarbons (PAHs) in a previous study and indicates that since PAHs were analyzed previously, they are not included in the current SAP. However, the SAP does

not discuss the method of analysis used previously. Additionally, the SAP does not indicate if the PAH limits of quantitation (LOQs) were lower than the PALs, discuss the source of the PAH PALs, or discuss any uncertainty associated with the PAH data. Since the SAP is using the previously collected PAH data as justification for not including PAHs in this effort, the SAP should be revised to discuss how the PAHs were analyzed, discuss if the PAH LOQs were less than the PALs, reference the source of the PAH PALs, and discuss any uncertainty associated with the PAH results.

Navy Response:

Please note that PAHs are not excluded from analysis simply because they were analyzed previously; they are excluded from analysis since none of the detected concentrations exceeded ecological screening levels or EPA RSLs, as stated under "Site Background and Investigation History" in Worksheet #10. To clarify, the third bullet under "Site Background and Investigation History" in Worksheet #10 has been revised to read:

> "PAHs, a subset of SVOCs, were analyzed in the sediment samples collected by NOAA in 2007 (NOAA, 2010). The analyses were conducted in accordance with NOAA's National Status and Trends protocol, as part of nation-wide program that has been in existence for over 20 years. While PAHs were detected in Laguna La Chiva sediment samples, all concentrations were lower than or comparable to National Status and Trends median values for the rest of US coastal waters and generally lower than or comparable to the PAH concentrations detected throughout NOAA's sediment samples (i.e., not likely related specifically to Laguna La Chiva). In fact, the NOAA report concluded: "Overall, the concentrations of total PAHs in sediments were low; none of the concentrations of total PAHs exceeded the sediment quality guidelines examined." Most importantly, none of the PAH concentrations detected in Laguna La Chiva sediment samples exceeded ecological screening levels or EPA RSLs. Based on this multiple-lines-of-evidence approach, PAHs were determined not to warrant further consideration as potential contaminants of concern."

In addition to the above revision, the first sentence of the second Environmental Question to be Answered in Worksheet #10 has been revised to read:

> "In addition to pesticide analysis, the sediment samples collected as described above will be analyzed for VOCs and SVOCs (less PAHs since they were eliminated as potential contaminants of concern via a multiple-lines-of-evidence approach, as described previously). To answer this question, . . . "

9. The SAP does not consistently indicate the analyses to be performed on the samples. For example, Worksheets #18, #19, #20, and #30 do not indicate that sediment samples will be analyzed for pesticides. However, Worksheets #10 and #17 state that sediment samples will be analyzed for pesticides. Revise the SAP to consistently discuss the analyses to be performed on all samples.

Navy Response:

Worksheets #15-3, #18, #19, #20, #23, #28-3, and #30 have been updated to include pesticide analysis for sediment samples.

10. The SAP indicates that the Remedial Investigation (RI) sampling locations will be detailed in a SAP addendum prior to implementation. Further, Worksheet #17 states that the rationale and sampling design for the RI is presented in this SAP. However, the rationale and sampling design for the RI are insufficiently detailed. Revise the SAP to ensure that a detailed sample design and rationale (i.e., why the proposed number, type and location of samples were deemed sufficient to address the study questions) will be presented in the SAP addendum.

Navy Response:

The following modifications have been made under "Phase 2 (RI)" in Worksheet #17 (added text underlined):

"If it is determined that an RI is warranted, Phase 2 sampling will be conducted. While there may be modifications to the approach (via an addendum to this SAP) based on evaluation of the SI data, below is the sampling design and rationale for the RI data collection. Actual locations will be provided in the addendum, as will any necessary modifications to the sampling design and rationale based on evaluation of the SI data:

Data Collection for Human Health Risk Assessment

Soil and sediment data will be available from the Phase 1 sampling event. If an RI is warranted at the site, there are two HHRA objectives for additional sampling of the La Chiva Lagoon:

- To assess whether concentrations of pesticides (DDx) and/or other contaminants in edible-size fish and blue crabs pose a potentially unacceptable risk to fish/blue crab consumers above EPA-acceptable levels
- To assess whether concentrations of pesticides (DDx) and/or other contaminants in surface water pose a potentially unacceptable risk to recreational users/trespassers/site visitors above EPA-acceptable levels

To meet these objectives, samples of surface water, whole-body fish (gutted), and whole-body blue crab will be collected as part of the Phase 2 sampling, as follows:

Surface Water

- Discrete sampling of surface water at, or in close proximity to, several of the locations where sediment samples will be collected in Phase 1

Edible Fish and Edible Blue Crabs

- Sampling of eight edible whole-body fish (gutted) and eight edible whole-body blue crabs from Laguna La Chiva.

The goal of fish/blue crab sampling is to collect edible-size fish/blue crabs that may be consumed by anglers/crabbers in the lagoon, and use these data to evaluate fish/blue crab consumption scenarios. Results of the Phase 1 qualitative biological survey will be used to specify target fish to be sampled in Phase 2, and will support planning for methods of capture. Fish/blue crab will be collected with a variety of nets including cast nets, seines, traps, and gill nets. The collection of fish/blue crab will be targeted in areas representative of the entire lagoon and not specific locations since fish and blue crab are highly mobile."

11. The SAP does not include the collection of sediment and soil for the percent moisture determination in Worksheet #19, or the laboratory SOP for this analysis in Worksheet #23. Revise these worksheets to include the information for the collection of sediment and soil to determine the percent moisture.

Navy Response:

Because results for all non-aqueous samples are always reported on a dry-weight basis (except in unusual circumstances such as tissue samples), the laboratory must always determine percent moisture to support the result calculation. When non-volatiles fractions (such as extractables) are collected, additional sediment and soil are not required for percent moisture determination. Because each field sample is analyzed for at least one non-volatiles fraction (such as pesticides), no additional soil or sediment is needed and therefore no changes are necessary to Worksheet #19. Furthermore, the use of percent moisture data (by the laboratory) is discussed in the analysis and/or preparation SOPs; therefore, no addition is necessary for Worksheet #23.

Specific Comments

1. **Worksheet #10, Conceptual Site Model-Release Mechanisms, Page 24:** This section states that pesticides were not detected in the ephemeral stream samples closest to Laguna La Chiva. However, according to Figure 7 no samples were collected from the western ephemeral stream near Laguna La Chiva. It is unclear why this stream was not sampled as it approached Laguna La Chiva. Revise the SAP to discuss this apparent data gap and how it will be addressed by the sampling proposed in this SAP.

   Navy Response:

   The second paragraph under "Release Mechanisms" in Worksheet #10 was revised for clarity as follows (added text underlined):

   > <u>During the investigation of SWMU 1, which is hydraulically upgradient of Laguna La Chiva, ephemeral samples were collected adjacent to and downgradient of SWMU 1 to help determine if the ephemeral streams were a means of contaminant transport from the landfill. While pesticides were detected in samples adjacent to and immediately downgradient of the landfill, no pesticides were detected in the ephemeral stream samples collected closest to Laguna La Chiva (i.e., SS27 and SB27)</u> and all of the pesticide concentrations detected in the ephemeral stream samples were orders of magnitude below the levels detected in the lagoon. <u>However, the ephemeral streams are recognized in the CSM as potential contaminant transport pathways, as discussed under "Potential Contaminant Sources and Transport Pathways." To address this potential, samples will be collected where the ephemeral streams enter the lagoon, as detailed in Worksheet #17.</u> Further, no VOCs attributable . . . "

2. **Worksheet #10, Conceptual Site Model (CSM), Page 26:** It is unclear from the SAP why an aquatic avian herbivore will not be evaluated. Figure 8, Conceptual Site Model, includes the White Cheeked Pin Tail and indicates that this organism is an invertivore, although it is considered an omnivore for this risk assessment. However, as per previous screening level ecological risk assessments (SLERA), in order to provide more conservative calculations, receptors should be considered either herbivores, invertivores or piscivores during the SLERA and may be considered omnivores (as appropriate) during the baseline ecological risk assessment (BERA). Revise listing of organisms to clearly indicate that an aquatic avian herbivore will be modeled, as necessary.

   Navy Response:

   As noted in the comment, per the ERA protocol, the SERA evaluates receptors more conservatively using exclusive diets (that is, as either herbivores, invertivores, carnivores, or piscivores), whereas the BERA incorporates more specific dietary compositions that can span two or more of these categories (thus making the receptor an omnivore). Considering these distinctions, the following updated species descriptions have been substituted in Worksheet #10 to more clearly depict the dietary exposures that will be assessed in the ERA:

   - White-cheeked pintail (*Anas discors*) – aquatic avian omnivore (modeled as a herbivore in the SERA portion of the ERA); listed as vulnerable in Puerto Rico
   - Green heron (*Butorides virescens*) – aquatic avian piscivore/invertivore (modeled as a piscivore in the SERA portion of the ERA)
   - Pearly-eyed thrasher (*Margarops fuscatus*) - terrestrial avian omnivore (modeled as an invertivore in the SERA portion of the ERA)

- Norway rat (*Rattus norvegicus*) - terrestrial mammalian omnivore (modeled as a herbivore in the SERA portion of the ERA)
- Indian mongoose (*Herpestes auropunctatus*) - terrestrial mammalian omnivore (modeled as an invertivore in the SERA portion of the ERA).

These updates have also been made to the CSM (Figure 8).

EPA Additional Comment:

The response addresses revisions which have been made to Worksheet # 10 and Figure 8. Please note that Worksheet # 10 has not been provided for review. The proposed language contained in the response is appropriate and in agreement with the Vieques Ecological Risk Assessment Protocol. However, Figure 8 incorrectly identifies both the Indian mongoose and Pearly-eyed thrasher as herbivores in the SERA portion of the risk assessment process, rather than invertivores. Please revise Figure 8 as appropriate.

Navy Response To Additional Comment:

Worksheet 10 and an updated Figure 8 have been included in the Draft Final SAP. Figure 8 has been changed to identify the Indian mongoose and Pearly-eyed thrasher as invertivores.

3. **Worksheet #11, Project Quality Objectives/Systematic Planning Process Statements, Page 29:** The text states that several semi-volatile organic compounds (SVOCs) have PALs that are less than the detection limits (DLs), but that the data will not be impacted because "the Limit of Quantitation (LOQ) is above the PAL and will be reported as estimated." However, the DL is the lowest resolvable concentration from zero, and therefore concentrations below this level would not be able to be measured. Revise the SAP to propose the use of alternative and/or modified methods to achieve lower LOQs. Alternatively, revise the SAP to discuss the uncertainty associated with results where the PAL is less than the DL and why this uncertainty was deemed acceptable to meet the project data quality objectives (DQOs).

Navy Response:

The statement in question (last sentence in Worksheet #11, question 2, paragraph beginning "For SVOCs in Sediment. . .") has been revised to read:

"For each of these constituents, there exists a range of uncertainty (between the DL and the PAL) where a detection would not be reported because it cannot be distinguished from noise. Any detection is considered a PAL exceedance, and is qualified if less than the LOQ. Alternative and/or modified methods are not available to achieve lower LOQs. Note that, for comparison, the laboratory-specific LODs (100-300ug/kg) are already similar to CRQLs from Low Soil SVOCs via EPA CLP SOM01.2. Uncertainty associated with LODs which exceed PALs will be discussed in the data quality evaluation of the report."

4. **Worksheet #14, Summary of Project Tasks, Page 39:** The worksheet does not indicate how soil samples will be collected. Further, this worksheet indicated that sediment samples will be collected following the Vieques Master Protocol SOP G2, but does not discuss the specific procedure that will be followed. Revise the SAP to specify the method for collecting soil samples, and the specific procedure and equipment that will be used to collect soil and sediment samples.

Navy Response:

The first sentence under "Soil Sampling" in Worksheet #14 has been revised to read: "Three discrete . . . habitat: These discrete surface soil samples will be collected following SOP A2 from the top 24 inches . . . "

With respect to how soil and sediment samples will be collected, the SOPs referenced in the text provide the necessary specificity. It is recognized that the SOPs provide some flexibility with respect to the specific

equipment due to site-specific conditions that may be encountered or the availability of equipment, but all equipment and procedures defined in the SOPs have been approved by the regulatory agencies.

5. **Worksheet #15, Reference Limits and Evaluation Table, Pages 41 to 42:** The limits of detection (LODs) and LOQs in this table are the same for most analytes. However, the Department of Defense (DOD) Quality Systems Manual (QSM) defines the LOQ and LOD as different concentration levels, where the LOQ is the lowest concentration that produces a quantitative result, and the LOD is the lowest detectable amount in a sample. Revise the SAP to provide different LODs and LOQs, or indicate why the LODs and LOQs are the same values.

   Navy Response:

   The LOQs and LODs presented are as defined by DoD QSM. Various factors are used to set reporting limits (prior to verification) and they can be scientifically-determined or based on laboratory expertise. There are also various legitimate reasons why LOQs and LODs may be at the same level. If a reporting convention dictates that nondetect U-Values are reported at the LOQ, then the laboratory can set their LODs at the same level as their LOQs. A footnote has been added to Worksheet #15 that states: "LOQs and LODs presented are as defined by DoD QSM."

6. **Worksheet #15, Reference Limits and Evaluation Table, Pages 41 to 44:** PALs are not identified for several compounds (e.g., methylcyclohexane, 1,3-dichlorobenzene, 3-nitroaniline, 4-bromophenyl-phenylether, and carbazole, are all marked as "NC" in Worksheet #15). It is unclear how these compounds will be evaluated, and what "NC" signifies in this table. Revise the SAP to discuss how compounds without PALs will be evaluated, and to define "NC".

   Navy Response:

   The following footnote has been added to each of Worksheets #15-1 and #15-2: "NC". No screening level in this set; if constituent has no screening levels, then results are used for presence/absence unless a screening level is established in the future."

7. **Worksheet #15, Reference Limits and Evaluation Table, Pages 41 to 45:** The PALs for pesticides in sediment do not appear to be provided (e.g., Vieques pesticides concentrations, RSLs, and ESVs). Revise this worksheet to include the PALs for pesticides in sediment.

   Navy Response:

   Worksheet #15-3 has been revised to include the PALs for pesticides in sediment.

8. **Worksheet #15, Reference Limits and Evaluation Table, Pages 41 to 45 and 47:** It is unclear if the sediment and soil sample results will be corrected for percent moisture and reported on a dry weight basis. Revise Worksheet #15 to indicate that results will be reported on dry weight basis and that these results will be compared to PALs.

   Navy Response:

   A footnote has been added to each of Worksheets #15-1, #15-2, #15-3, #15-4, and #15-5 to indicate that results are reported on a dry-weight basis.

9. **Worksheet #16, Project Schedule/Timeline Table (optional format), Page 49:** This worksheet indicates that the schedule will be distributed and updated separately in the Site Management Plan, but it is unclear when the schedule will be submitted. Revise this worksheet to provide the anticipated schedule, or to indicate when the official schedule will be distributed.

Navy Response:

The schedule shown in Worksheet #16 has been replaced with the following: "The Laguna La Chiva investigation will be implemented in accordance with the schedule provided in the FY13 Site Management Plan (CH2M HILL, 2012), amended as necessary with concurrence among the stakeholder agencies."

The following reference has been added to the list of References:

CH2M HILL. 2012. *Final Site Management Plan, Fiscal Year 2013, Atlantic Fleet Weapons Training Area – Vieques, Vieques, Puerto Rico*. September.

10. **Worksheet #17, Sampling Rationale, Method and Approach Page 51:** This section states that sample locations VENOSD002 and 003 were placed to help evaluate potential releases from drums observed in those areas. However, according to Figure 4, sample VENOSD002 is the only surface/subsurface sediment sample located on/near drum remnants. Revise the SAP to clarify why a sample was not placed closer to the other drum remnants identified in Figure 4. As discussed during the subcommittee meeting on October 23, 2012 an additional sediment sample will be added closer to the drum remnants. Therefore this comment may be deleted.

Navy Response:

As agreed in the referenced subcommittee meeting, one sediment sample location has been added in close proximity to the middle drum location (VENOSD012), and VENOSD003 has been moved to be in close proximity to the southernmost drum location. Figure 4 has been revised with these updates. These two sample locations are approximate and will be adjusted in the field as necessary to be collected in areas having overlying water and in closest proximity to their respective target drums.

As a result of the increased number of sediment samples, the following SAP updates have been made:

In Worksheet #14, under the Sediment Sampling subheading, the first sentence has been replaced with the following:

"At the 12 sediment sampling locations, a total of 16 sediment samples will be collected following the Vieques Master Protocol SOP G2 (sediment sampling)."

In Worksheet #14, under the Surface Water Sampling subheading, the first sentence has been replaced with the following:

"If the study progresses to an RI, discrete surface water samples will be collected at, or in close proximity to, the 12 locations in the lagoon where sediment samples were collected in Phase 1."

In Worksheet #17, the following changes (as underlined) have been made to the Phase 1 (Site Inspection) subsection, first four paragraphs:

"As noted in Worksheet #10, sediment samples will be collected from 12 locations across Laguna La Chiva (Figure 4) in accordance with the applicable Vieques SOPs (CH2M HILL, 2010a). The rationale for the locations, depths, and analyses of the samples is as follows:

All 12 locations were selected to provide broad spatial coverage across the lagoon to help determine if there are any patterns of pesticide (or other contaminants) distribution. At all locations, sediment will be collected from the top 6 inches (in accordance with Vieques protocol).

Sample locations VENOSD001, 002, 003, and 012 were placed to help evaluate potential transport of contaminants (primarily pesticides) from SWMU 1 or surrounding areas to the lagoon via the western ephemeral stream. Similarly, sample locations VENOSD011, 010, and 009 were placed to perform the same function for the eastern ephemeral stream.

Sample locations VENOSD002, 003, and 012 were also placed to help evaluate potential releases from drums observed in those areas. Sample locations VENOSD003 and 012 will be adjusted in the

field, as necessary, to be collected in areas having overlying water and in closest proximity to their respective target drums."

In Worksheet #17, under the Sediment Toxicity Testing subheading, the first sentence has been replaced with the following:

"Sediment used in toxicity testing will be collected from up to 6 of the 12 locations sampled in Phase 1."

Worksheets 18 and 20 have been updated to add sediment sample VENOSD012 and associated QC samples.

11. **Worksheet #17, Sampling rationale, Method and Approach Page 52:** This section states that samples VENOSS005 and 007 will target land crab habitat. Figure 2 shows the 2005 study where land crabs were sampled. Samples VENOSS005 and 007 are significantly east from the 2005 land crab study locations. Revise the SAP to clarify why VENOSS005 and 007 are considered sufficient to represent land crab habitat.

Navy Response:

Though NOAA collected land crabs at the southwestern end of Laguna La Chiva (see Figure 2), land crab habitat is also present around most of the lagoon perimeter. NOAA also concluded that pesticide concentrations in these land crab samples were below human health and ecological screening values; therefore, media sampling at the NOAA land crab sampling location is not warranted.

The last two sentences of the first full paragraph on page 52 have been replaced with the following:

"Sample VENOSS001 was placed adjacent to where NOAA detected the highest pesticide concentrations in sediment, and is also within an area where land crabs occur. Land crab habitat occurs within most of the forested lagoon perimeter; however, samples VENOSS005 and 007 will conservatively target land crab habitat within the southern perimeter where historic military training operations frequently occurred and where normal terrestrial pesticide application most likely occurred."

12. **Worksheet #19, Field Sampling Requirements Table, Page 57:** The two ounce container indicated for sediment samples to be collected for analysis of volatile organic compounds (VOCs) if the TerraCores are unsuccessful is identified to have a 14 day holding time, but no preservative is added. However, this procedure and holding time are only acceptable for high concentration samples. Revise this table to indicate that the two ounce container will be preserved or analyzed within 48 hours if used instead of the TerraCore sampler.

Navy Response:

The procedure has been approved in previous Vieques SAPs as acceptable in the event that samples cannot be properly collected using the TerraCores device and not just for high concentration samples. The holding time for the 2-oz jar has been updated to 48 hours.

13. **Worksheet #19, Field Sampling Requirements Table, Page 57:** The footnotes discuss the use of TerraCores, but this table does not indicate the number of TerraCores to be used for each sample location. Additionally, the maximum length of time from TerraCore collection to preservation is not presented. Revise Worksheet #19 to provide the number of TerraCores that will be collected per location and to ensure that the samples will be immediately extruded into a VOC vial (i.e. TerraCores will not be used to store samples).

Navy Response:

Worksheet #19 footnote 2 has been appended with "In general one Terra Core® Sampler will be used per sample; however, if one breaks in the middle of sample collection, a second will be used. As per Terra Core® SOP A-6, samples will be extruded immediately on collection."

14. **Worksheets #34 - #36, Data Verification and Validation (Steps I and IIa/IIb) Process Table, Page 99:** The validation SOPs referenced for VOCs and pesticides are not consistent with the methods used for these analyses. The validation SOP for VOCs (to be analyzed by Method 8260B) is identified as SOP HW-44 for pesticides by Method 8081B. The validation SOP for pesticides (to be analyzed by Method 8081B) is indicated to be HW-22 for SVOCs by Method 8270. Revise this table to provide corrected references to the validation SOPs consistent with the proposed methods of analysis.

Navy Response:

The requested change has been made (please also refer to the response to PREQB worksheet-specific comment #13).

15. **Worksheet #37, Usability Assessment, Page 101:** This worksheet references sampling for polychlorinated biphenyls (PCBs) in surface soil and PAHs in sediment in the discussion of the data usability assessment. However, PCBs and PAHs are not proposed for analysis. Revise this worksheet to discuss how the usability assessment will be performed with respect to the proposed investigation of pesticides, VOCs, and SVOCs in sediment and soil.

Navy Response:

The second sentence in Worksheet #37 has been revised to read: "Given that the primary objective of this effort is to determine if there has been a release of pesticides, VOCs, and SVOCs in soil and sediment associated with Laguna La Chiva, the comprehensive dataset will be reviewed to determine if it is adequate for making the project-specific determinations."

New Comment Submitted by EPA on 3/4/13

SAP Worksheet 10: Please confirm that the maintenance worker is the same as the USFWS worker.

Navy Response:

An asterisk has been placed on "Maintenance Workers" in the bulleted list under "Human" [Receptors and Exposure Pathways] in Worksheet #10. The asterisk has been defined beneath the bulleted list as follows: "Maintenance workers are assumed to be USFWS workers. However, there is no specific planned future use of the site by USFWS (with the exception of the fishing spot on the new bridge). Therefore, the default maintenance worker presented in the final HHRA Protocol (CH2M HILL, 2010b) will be evaluated in the HHRA for Laguna La Chiva."

FINAL RESPONSES ON PREQB TECHNICAL REVIEW
OF THE

DRAFT SAMPLING AND ANALYSIS PLAN
LAGUNA LA CHIVA, SITE INSPECTION/REMEDIAL INVESTIGATION

FORMER VIEQUES NAVAL TRAINING RANGE
VIEQUES, PUERTO RICO

Worksheet-Specific Comments

1. Worksheet 10:
   a. Page 23:
      i. As per page 18 of Worksheet #9, please include the information regarding the crab data collected by NOAA in 2005. Please include a table summarizing the results of the NOAA crab analyses.

Navy Response:

The relevant NOAA crab data are discussed in Worksheet #10, "Site Background and Investigation History," 2nd paragraph. The NOAA crab data have been attached to the SAP as Appendix C.

PREQB Evaluation of Response:

Please provide Appendix C for agency review prior to finalizing the document.

Navy Response to Evaluation:

Appendix C has been included in the Draft Final SAP.

      ii. Please include a table summarizing the results of all sediment samples collected by NOAA in 2007. This table is critical to demonstrating that analyses being conducted for the current investigation are appropriate. In particular, the Navy has proposed that sediment samples will be analyzed for SVOCs (minus the PAHs) since PAHs were analyzed in sediment samples collected by NOAA in 2007. However, it is not clear if the LODs for the PAHs from the 2007 samples met the ecological screening levels or the EPA RSLs. In addition, it is not clear from the SAP whether the PAH data from 2007 will be used in future risk assessments, if required. The NOAA PAH data are not included in Worksheet 13 as Secondary Data, indicating that these data will not be utilized. Please clarify.

Navy Response:

The 2007 NOAA sediment sampling data have been attached to the SAP as Appendix D. The PAH data from 2007 will not be used in future risk assessments; their purpose was to demonstrate PAHs are not constituents of potential concern for further evaluation at Laguna La Chiva. The following paragraph has been added after the last bullet summarizing the 2007 NOAA sediment data under "Site Background and Investigation History" in Worksheet #10:

"The 2005 crab data and 2007 sediment data collected by NOAA in and around Laguna La Chiva were used to help identify potential contaminants of interest for further evaluation and may be used in qualitatively in future reporting for Laguna La Chiva. They will not be used in quantitative risk assessments. Further, as demonstrated above, pesticides (other than DDT, DDE, and DDD), PCBs, PAHs, butyltins, explosives, and metals are not potential contaminants of interest for further evaluation."

PREQB Evaluation of Response:

Please provide Appendix D for agency review prior to finalizing the document.

Navy Response to Evaluation:

Appendix D has been included in the Draft Final SAP.

b. Page 26:

i. General Problem to Address: This section states "If the results of the SI (including the potential for an expanded SI [ESI]) suggest the pesticide concentrations are not indicative of a CERCLA-related release (e.g., pattern and levels of detections do not identify a likely point source such as the drums) the presence of pesticides will be attributable to normal pesticide use… "Please clarify why identification of a point source if required for contamination to be considered a CERCLA release. Please also clarify if the transport of pesticides to a waterway is considered normal pesticide use (i.e., use as intended) under CERCLA.

Navy Response:

The statement regarding a point source was provided as just an example of the kind of information that may help distinguish the presence of pesticides due to a CERCLA-related release from those attributable to normal pesticide use. However, to avoid potential misinterpretation, the parenthetical statement has been replaced such that the sentence now reads:

". . . suggest the pesticide concentrations are not indicative of a CERCLA-related release via the multiple-lines-of-evidence approach detailed in Worksheet #11, the presence of pesticides will be attributable to normal pesticide use . . . ."

In addition, the following has been added as the first sentence under "General Problem to Address":

"DDT was used as part of normal pesticide use at Laguna La Chiva to control mosquitoes during the time military training activities were taking place. However, the presence of DDT in the lagoon may also be attributable to CERCLA-related releases, such as from drums observed in the lagoon."

In addition, the following has been added after the paragraph under Environmental Question to be answered #2:

"The 2005 crab data and 2007 sediment data collected by NOAA in and around Laguna La Chiva demonstrate pesticides (other than DDT, DDE, and DDD), PCBs, PAHs, butyltins, explosives, and metals are not indicative of a CERCLA-related release and are therefore not potential contaminants of interest for further evaluation."

ii. Potential terrestrial receptors and exposure pathways are identified in this worksheet. For the land crab, direct exposure to deeper surface soil (2 inches to 2 feet) is noted as an exposure pathway. It would appear that land crabs would also be exposed to the upper 2 inches of surface soil (as discussed in the Master Ecological Risk Protocol. Please revise the land crab exposure to represent 0 to 2 feet of soil.

Navy Response:

The "Land Crab" bullet under "Potential Terrestrial Receptors" in Worksheet #10 has been revised to read: "direct exposure to surface soil (0 to 2 feet)"

c. Page 27: Please clarify why metals are not included in the analytical suite as the origin of the drums is unknown.

Navy Response:

Please see the response to Comment 1.a.ii. Further, inter-agency consensus was reached (and recorded via consensus statement) at the February 2012 Vieques Technical Subcommittee meeting to proceed with the SAP preparation as presented in the scoping seed file without any revision of analytical protocol.

2. Worksheet 11:

   a. Page 29: Question #2: Please include di-n-octylphthalate in the list of SVOCs with LODs above PALs.

   Navy Response:

   Di-n-octylphthalate has been added to the list of SVOCs on Worksheet #11 Question 2. Please note that the list is of PALs lower than DLs.

   b. Page 32: A comparison of pesticide concentrations detected in sediments of Laguna La Chiva with other lagoons is proposed as a line of evidence to determine whether a CERCLA-related release of pesticides has occurred at Laguna La Chiva. Although not stated, it is assumed that this comparison will be statistically based if pesticides are detected in a sufficient number of samples and will include parametric or nonparametric statistical methods depending on the distribution of the sediment data (normal or non-normal distribution). Please confirm.

   Navy Response:

   Statistically-based approaches will not be used in the pesticide data evaluation. Statistically-based evaluations have not been utilized for pesticide data evaluation on other Vieques sites (see Section 1.1.1 of the *Site Inspection/Expanded Site Inspection Report 7 Consent Order Sites and 16 PI/PAOC Sites, Former Vieques Naval Training Range Vieques, Puerto Rico, August 2010*), specifically because the concentrations of pesticides are not singley used for determining whether a release is the result of normal application or disposal. This approach is consistent with the guidance provided in a Public Works Technical Bulletin prepared by the U.S. Army Corps of Engineers (USACE), which states:

   > "*Concentrations of chlordane should not be used as the basis for concluding whether a spill occurred. It was DoD practice to periodically reapply pesticide, thus chlordane may have accumulated without being indicative of a spill. The location of chlordane, rather than its concentration, should be used as the basis for determining whether it is reasonably present due to intentional use."* (USACE, 2004)

   Although it specifically references chlordane, the process is equally applicable to other pesticides registered under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). As has been done for other Vieques site where pesticides are a potential contaminant of interest, pesticide concentrations at the particular study site versus those observed at other sites are used qualitatively as one of the multiple lines of evidence in making the release determination.

   PREQB Evaluation of Response:

   PREQB agrees that the proposed comparison of site pesticide concentrations with other lagoon data is consistent with what has been done at other sites on Vieques. However, PREQB is concerned that application of the USACE's technical bulletin cited above to sites in Puerto Rico may result in adverse impacts to human health and the environment associated with pesticide releases if the concentrations of pesticides detected at sites is not considered in determining if a release has occurred. However, PREQB will defer to EPA as to whether the USACE technical memorandum, which states that the "…[c]oncentration of chlordane should not be used as the basis for concluding whether a spill occurred…", and which the Navy is applying to all pesticides, is appropriate in determining whether a CERCLA release has occurred that requires further action.

Navy Response to Evaluation:

Pesticide concentrations will be considered when making the release assessment determination. However, as stated on page 32, the concentrations will be used as one of the lines of evidence that will be considered.

3. Worksheets 15-1 to 15-3: Please clarify why residential RSLs are not listed on the table. For other risks assessments conducted on Vieques, residential RSLs are used for screening purposes to identify chemicals of potential concern for recreational receptors.

Navy Response:

Worksheets 15-1 to 15-3 have been revised to screen against residential RSLs in addition to industrial RSLs and Question 2 of Worksheet #11 has been updated accordingly.

4. Worksheet 15-3, Page 45:

   a. The list of pesticides to be included in the analysis include only 4,4'-DDD, 4,4'-DDT and 4,4'-DDE based on previous NOAA results. However, since the source of pesticides may be potentially from drums of unknown origin (as per Worksheet 10), please include the full list of pesticides (and potentially metals) during the SI in order to determine if this is a CERCLA-related release.

   Navy Response:

   Please see the response to Comment 1.a.ii.

   b. Previous samples collected by NOAA also detected the 2,4 isomers of DDD, DDE and DDT. Please clarify if these pesticides should also be included for this SI.

   Navy Response:

   The 2,4 isomers of DDD, DDE, and DDT are not on the TCL and do not have ecological or human health screening values. Therefore, they will not be included on the analyte list for this SI.

5. Worksheet 17:

   a. Page 51: Please refer to comments on Worksheet 10 related to the proposed sediment analytical suite.

   Navy Response:

   Please see the responses to Comments 1.a.ii, 1.c, and 4.a.

   b. Page 52:

      i. Please clarify why additional sediment samples are not proposed for the RI. It seems that additional sediment samples may be warranted to delineate the extent of sediment contamination.

      Navy Response:

      The following paragraph has been added at the end of Worksheet #17:

      "It is assumed that the distribution of SI sediment sampling locations will be sufficient for determining not only whether a release has occurred, but, if so, will be sufficient for delineating sediment contaminant nature and extent. However, if additional sediment samples are deemed necessary to sufficiently delineate the nature and extent of contamination in sediment, they will be collected during Phase 2."

ii. The text states that surface water sampling in Phase 2 would be performed at several of the locations where sediment samples will be collected in Phase 1. However, Worksheet #14 (Page 39) indicates that surface water samples will be collected at all 11 sediment locations. Please clarify.

Navy Response:

The statement in Worksheet #17 has been corrected to say:

"Surface Water - Discrete sampling of surface water at, or in close proximity to, the locations where sediment samples are collected in Phase 1."

6. Worksheet 18, Page 55: Please correct the sample ID for VENO-SD11/VENO-SD11-000H from 0-0.5' bgs to reflect "11" instead of "1".

Navy Response:

The requested correction has been made.

7. Worksheet 19, Page 57:

a. Please clarify why the Walkley Black method is being used for TOC instead of the EPA Region 2 Lloyd Kahn method. This comment applies to Worksheet 23 also.

Navy Response:

Walkley Black, rather than Lloyd Kahn, is proposed because relatively high concentrations of TOC are expected based on the lagoon characteristics. Based on contractor and laboratory experience, Lloyd Kahn is more applicable at lower concentrations and often requires reduced aliquot sizes for samples containing high TOC concentrations, sometimes to the point that the laboratory feels they are no longer representative. The Walkley Black method is sufficient for generating the data, especially at the relatively high TOC conditions anticipated.

b. Currently, the QAPP states that for VOCs in sediment, a 2-oz jar is used only if samples cannot be collected properly using the TerraCore samplers. If the sediment samples cannot be collected properly using the TerraCore sampler due to high moisture content, a stainless steel spoon needs to be used to transfer the sediment as quickly as possible into the pre-weighed, pre-preserved vials. Collection and transportation of sediment in the 2-oz jar will more significantly compromise the representativeness and accuracy of the sample results. Please revise to remove this as an option for collection of samples for VOCs.

Navy Response:

The Master Protocols SOP for VOC sampling sediment/soil (Master Standard Operating Procedures, Protocols, and Plans, Environmental Restoration Program Vieques, Puerto Rico, April 2010) will be followed. The approach was specifically developed and approved by all agencies based on issues using a TerraCore sampler at SWMU 6. Please also see the October 2012 Vieques Technical Subcommittee meeting minutes regarding this comment.

PREQB Evaluation of Response:

PREQB previously commented on this as part of the review of the SOPs in 2009 and stated that sediment samples that could not be collected with TerraCore or EnCore samplers must be placed into pre-preserved vials. Further, the response refers to the October 2012 Vieques Technical Subcommittee meeting minutes which states that this approach was used at SWMU 6 and was not accepted by EPA. Therefore, PREQB is concerned that sediment samples may not be adequately preserved for VOC analysis if the TerraCore sampler does not work. However, PREQB will defer to EPA on this issue.

Navy Response to Evaluation:

It appears PREQB is mis-interpreting what the October 2012 minutes state. The approach that was used at SWMU 6 (by another contractor) was not accepted by EPA. It was specifically because of this that a revised approach was developed, which became the approach documented in the Master Standard Operating Procedures, Protocols, and Plans (CH2M HILL, 2010), which was approved by both EPA and PREQB.

8. Worksheet 21, Page 61: This worksheet indicates that field SOPs were updated in June 2012. Please provide the most recent versions of the SOPs for review.

Navy Response:

The field SOPs were reviewed and remain unchanged. This has been clarified in Worksheet #21.

9. Worksheet 23, Page 65: As the proposed laboratory is new to the Vieques programs, please provide their SOPs listed in this worksheet.

Navy Response:

The lab SOPs have been provided in response to this request.

PREQB Evaluation of Response:

The SOP for pesticide analysis is not included with the SOPs that were provided. Please provide for agency review.

Navy Response to Evaluation:

The SOP described was inadvertently not included on the website for review. It has now been added to the website and is identified as LAB-06. Additionally LAB-07, LAB-08, and LAB-09 SOPs were also not included but have now been added.

10. Worksheet 24, Page 68: Please add calibration criteria associated with the TOC analysis.

Navy Response:

Being a titration, there is no calibration procedure for this method.

11. Worksheet 25, Page 69: Please add equipment maintenance information associated with the TOC analysis.

Navy Response:

There is no equipment (i.e., instrument) requiring maintenance for this method.

12. Worksheet 28-1, Pages 75-82:

    a. For Worksheets #28-1 through 28-3, please add text for field duplicates that states these are collected to assess sampling and laboratory procedures.

    Navy Response:

    The requested text has been added.

    b. For Worksheet 28-1, please remove text relating to laboratory homogenization procedures. There will be no homogenization performed for the VOC analysis.

Navy Response:

The homogenization text has been removed.

13. Worksheets 34-36, Page 99: Please correct the cited validation guidelines for VOCs and Pesticides to the current and appropriate EPA Region 2 data validation guidelines.

Navy Response:

The following changes have been made: For VOCs: "Validating Volatile Organic Compounds by SW-846 Method 8260B" (SOP HW-24 Rev. 2; August, 2009). For PESTs: "Data Validation SOP of Organochlorine Pesticides by Gas Chromatography SW-846 Method 8081B" (SOP HW-44 Rev. 1; August, 2009).

14. Worksheet 37, Page 101: Please correct the second sentence of this worksheet which appears to be leftover from a different SAP.

Navy Response:

The first phrase of the sentence has been removed such that the sentence now reads: "The comprehensive dataset…project-specific determinations."

15. Figure 3:

    a. Concentrations of pesticides detected in the 2007 sediment samples collected by NOAA are presented in this figure. Please indicate the units reported in the figure.

    Navy Response:

    Figure 3 has been updated to show the units are in µg/kg.

    b. Please add units to the values presented on this figure.

    Navy Response:

    The units µg/kg have been added.