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Final

Post-Removal Supplemental Confirmatory Sampling and Analysis Plan Addendum Solid Waste Management Unit (SWMU) 6

Former Naval Ammunition Support Detachment Vieques, Puerto Rico

Prepared for

Department of the Navy

NAVFAC ATLANTIC

Contract No.
N62470-08-D-1000
CTO-113

January 2012

Prepared by

CH2MHILL®

ES100311193441TPA

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Virginia Beach, Virginia

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SAP Worksheets

Acronyms and Abbreviations v
Executive Summary ix
Resumen Ejecutivo xi
SAP Worksheet #9 — Project Scoping Session Participants Sheet 1
SAP Worksheet #10 — Problem Definition 11
SAP Worksheet #11 — Project Quality Objectives/Systematic Planning Process Statements 13
SAP Worksheet #12-1 — Field Quality Control Samples 17
SAP Worksheet #12-2 — Field Quality Control Samples 18
SAP Worksheet #12-3 — Field Quality Control Samples 19
SAP Worksheet #13 — Secondary Data Criteria and Limitations Table 21
SAP Worksheet #14 — Summary of Project Tasks 23
SAP Worksheet #15-1 — Reference Limits and Evaluation Tables 27
SAP Worksheet #15-2 — Reference Limits and Evaluation Tables 28
SAP Worksheet #15-3 — Reference Limits and Evaluation Tables 33
SAP Worksheet #17 — Sampling Design and Rationale 35
SAP Worksheet #18 — Location-Specific Sampling Methods/SOP Requirements Table 37
SAP Worksheet #19 — Field Sampling Requirements Table 39
SAP Worksheet #20 — Field Quality Control Sample Summary Table 41
SAP Worksheet #21 — Project Sampling SOP References Table 43
SAP Worksheet #22 — Field Equipment Calibration, Maintenance, Testing, and Inspection Table 45
SAP Worksheet #23 — Analytical SOP References Table 47
SAP Worksheet #24 — Analytical Instrument Calibration Table 49
SAP Worksheet #25 — Analytical Instrument Calibration Table 51
SAP Worksheet #26 — Sample Handling System 53
SAP Worksheet #28-1 — Laboratory QC Samples Table 55
SAP Worksheet #28-2 — Laboratory QC Samples Table 59
SAP Worksheet #28-3 — Laboratory QC Samples Table 61
SAP Worksheet #30 — Analytical Services Tables 63
SAP Worksheet #34-36 — Data Verification and Validation (Steps I and IIa/IIb) Process Table 65
References 67

Attachments

A Figures

B DoD ELAP Lab Letters

C Standard Operating Procedures

D Fish and Crab Technical Memorandum

E Final Response to EPA and PREQB Comments

Acronyms and Abbreviations

AHA	activity hazard analysis
ALM	adult lead methodology
AOC	Area of Concern
ARAR	applicable or relevant and appropriate requirement
ASTM	American Society for Standards and Materials
AVS/SEM	acid volatile sulfide/simultaneously extractable metals
BLL	Blood Lead Level
CA	corrective action
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-term Environmental Action—Navy
CLP	contract laboratory program
COC	chain of custody
COD	coefficient of determination
CSM	Conceptual Site Model
CTO	Contract Task Order
DDT	dichlorodiphenyltrichloroethane
DO	dissolved oxygen
DoD	U.S. Department of Defense
DOI	Department of the Interior
DQO	Data Quality Objectives
°C	degrees Celsius
DQE	data quality evaluation
DQI	data quality indicator
EBS	Environmental Baseline Survey
EIS	Environmental Information Specialist
ELCR	Excess Lifetime Cancer Risk
EQB	Environmental Quality Board
ERA	Ecological Risk Assessment
ERP	Environmental Restoration Program
FID	Flame Ionization Detector
FTL	Field Team Leader
GC	gas chromatograph
GW	Groundwater
H&S	Health & Safety
HASP	Health and Safety Plan
HDPE	high-density polyethylene
HHRA	Human Health Risk Assessment
ICAL	Initial Calibration
ICP	inductively coupled plasma
ICV	Second Source Calibration Verification
IDL	Instrument Detection Limit

IDW	investigation-derived waste
IEUBK	Integrated Exposure Uptake Biokinetic Model
IR	Navy Installation Restoration
IS	Internal Standards
LCS	laboratory control sample
LCL	lower confidence level
LCSD	Laboratory Control Sample Duplicate
LIMS	Laboratory Information Management Systems
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
MACTEC	MACTEC Inc.
MEC	munitions and explosives of concern
MDL	method detection limit
mg/kg	milligrams per kilogram
ml	milliliter(s)
mm	millimeter(s)
MOV	Municipality of Vieques
MPC	Measurement Performance Criteria
MSA	method of standard additions
MS	mass spectrometer
MS/MSD	matrix spike/matrix spike duplicate
MTBE	methyl tert butyl ether
MW	monitoring well
N/A	not applicable
NaOH	sodium hydroxide
NASD	Naval Ammunition Support Detachment
NAVFAC	Naval Facilities Engineering Command
Navy	Department of the Navy
NIRIS	Navy Installation Restoration Information System
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
ORP	oxidation-reduction potential
OU	operable unit
OVM	organic vapor monitor
PA/SI	Preliminary Assessment/Site Investigation
PAH	polycyclic aromatic hydrocarbons
PAL	project action limit
PCB	polychlorinated biphenyl
PDF	portable document format
PDS	post-digestion spike
PEST/PCB	pesticides/polychlorinated biphenyls
PID	photoionization detector
PM	Project Manager
POC	Point of Contact
PREQB	Puerto Rico Environmental Quality Board
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
RAGs	Risk Assessment Guidance for Superfund
RI	Remedial Investigation
RL	reporting limit
RPD	relative percent difference
RPM	Remedial Project Manager
RRT	relative retention times
RSD	relative standard deviation
RSL	Regional Screening Level
RT	retention time
SAP	Sampling and Analysis Plan
SNEDD	Supplemental Naval Installation Restoration Information Solution Electronic Data Deliverable
SOP	standard operating procedure
SSC	Site Safety Coordinator
SSC-HW	Site Safety Coordinator Hazardous Waste
SVOA	semivolatile organic analytes
SVOC	semivolatile organic compounds
SW	surface water
SWO	Safe Work Observation
TAT	turnaround time
TCLP	Toxicity Characteristic Leaching Procedure
TBD	to be determined
TOC	Total organic carbon
U.S.	United States
UFP	Uniform Federal Policy
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UTL	upper tolerance level
VOA	volatile organic analytes
VOC	volatile organic compound
WCHEM	wet chemistry

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Executive Summary

This Sampling and Analysis Plan (SAP) addendum is prepared to support the supplemental post-removal confirmatory biota sampling at Solid Waste Management Unit (SWMU) 6, located at the former Naval Ammunition Support Detachment (NASD) in the western portion of Vieques, Puerto Rico. In that this is an addendum to the *Supplemental Post-Removal Confirmatory Sampling and Analysis Plan, Solid Waste Management Unit (SWMU) 6, Former Vieques Naval Training Range, Vieques, Puerto Rico* (CH2M HILL, December 2010), it contains only those worksheets that were replaced/revised from those contained in the original SAP. The reader is referred to the original SAP for information not provided in the addendum as it remains applicable to the biota sampling covered under this SAP addendum.

The SWMU 6 post-removal supplemental confirmatory surface water and sediment sampling event conducted under the original SAP included the collection of 7 surface water and 13 sediment (or surface soil in areas where open water was not present) samples. In addition, 10 co-located background surface water and sediment samples were collected from nearby lagoons: 3 from Laguna Kiani, 3 from Laguna El Pobre, and 4 from Laguna Punta Arenas adjacent to Highway 200 to the west of SWMU 6. Qualitative biological surveys of fish and invertebrates were also conducted within SWMU 6 and the background lagoons to support the assessment of ecological conditions.

Based on preliminary evaluation of the surface water and sediment data collected in 2011, risks to human health and ecological receptors are likely acceptable (especially considering the lagoon ecology is likely still developing), with the exception of potential human health risks posed under a hypothetical fish/crab consumption scenario. However, modeling of contaminant uptake from surface water and sediment into biota (such as fish and crab) utilizes conservative bioaccumulation assumptions that are often shown to significantly overestimate actual concentrations and, therefore, potential risk. Therefore, the purpose of the supplemental biota sampling is to collect lagoon biota (fish and crab) to provide actual biota data that can be used to refine the risk estimates, specifically to ensure the remedial action proposed and ultimately selected is commensurate with the risks present due to historical Navy disposal activities.

To satisfy the aforementioned objective, sampling of the available biological media within SWMU 6 and the background lagoons will be performed in January 2012. The SWMU 6 biota sampling event will include the collection of 4 fish and 4 crab samples from within the SWMU 6 lagoon, and 4 fish and 4 crab samples from background lagoons. The samples will be analyzed for those constituents identified as the “primary risk drivers” for fish/crab consumption based on surface water and sediment data. Those constituents are:

- Lead
- Thallium
- Zinc
- PCBs

Gutted fish and whole-body blue crab data for the contaminants listed above will be used to revise the post-removal human health risk assessment that is prepared based on surface water and sediment data. The measured fish (collected species merged) and blue crab concentrations will replace the modeled fish/crab concentrations for those specific analytes (with the remaining modeled concentrations retained in the HHRA) and risk estimates will be recalculated for fish/crab consumers, which will be included in the Feasibility Study for SWMU 6.

This SAP will help ensure that environmental data collected or compiled are scientifically sound, of known and documented quality, and suitable for the intended use (i.e., post-removal human health risk assessment). The laboratory information cited in this SAP addendum is for TestAmerica Laboratories, Inc. of West Sacramento, California, and Brooks Rand Labs of Seattle, Washington, which will provide analytical services for this investigation.

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 HA HECHO TODO LO POSIBLE 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.

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Resumen Ejecutivo

Se ha preparado este apéndice al Plan de Muestreo y Análisis (SAP, por sus siglas en inglés) para apoyar el muestreo de biota suplementario confirmatorio posterior a la remoción en la Unidad de Manejo de Desperdicios Sólidos (SWMU, por sus siglas en inglés) 6, que está localizado en el antiguo Destacamento de Apoyo de Municiones Navales (NASD, por sus siglas en inglés) en el oeste de Vieques, Puerto Rico. Ya que éste es un apéndice al *Plan de Muestreo y Análisis Suplementario Confirmatorio Posterior a la Remoción en la Unidad de Manejo de Desperdicios Sólidos (SWMU) 6 (CH2M HILL, Diciembre 2010),* solamente incluye aquellas hojas de trabajo que fueron reemplazadas/revisadas de las que se encontraban en el SAP original. Se exhorta al lector a que se refiera al SAP original para obtener la información que no se encuentra en el apéndice ya que éste todavía aplica al muestreo de la biota que cubre este apéndice.

El evento de muestreo suplementario confirmatorio de agua superficial y sedimento después de la remoción en SWMU 6 que se llevó a cabo bajo el SAP original incluyó la obtención de 7 muestras de agua superficial y 13 de sedimento (o de suelo sobre la superficie en las áreas donde no se encontró agua). Además, se obtuvieron 10 muestras de agua superficial y sedimento de trasfondo co-localizados de lagunas cercanas: 3 de la Laguna Kiani, 3 de la Laguna El Pobre, y 4 de la Laguna Punta Arenas que se encuentran junto a la Carretera 200 al oeste de SWMU 6. También se llevaron a cabo muestreos biológicos cualitativos de peces e invertebrados dentro de SWMU 6 y de las lagunas de trasfondo para apoyar la evaluación de las condiciones ecológicas.

En base a la evaluación preliminar de los datos de agua superficial y de sedimento obtenidos en el año 2011, los riesgos a la salud humana y a receptores ecológicos son probablemente aceptables (especialmente si se considera que probablemente la ecología de la laguna continua desarrollándose), exceptuando el riesgo potencial a la salud humana que se presenta bajo un escenario hipotético de consumo de pescado y cangrejos. Sin embargo, el modelo de absorción de contaminantes de la biota del agua superficial y de los sedimentos (como son los cangrejos y peces) utiliza supuestos de bioacumulación conservadores que a menudo tienden a sobrestimar significativamente las concentraciones actuales, y por lo tanto, el riesgo potencial. De ahí que, el objetivo del muestreo de biota suplementario es tomar muestras de la biota de la laguna (cangrejos, peces) para obtener datos de biota actuales que puedan ser utilizados para refinar los cálculos de riesgo, específicamente, para asegurar que la acción de remediación propuesta, que en última instancia se seleccione, sea proporcional con los riesgos presentes debido a las actividades históricas de disposición de la Marina.

Para satisfacer el objetivo arriba mencionado, el muestreo de los medios biológicos disponibles dentro de SWMU 6 y de las lagunas de trasfondo se llevará a cabo en enero 2012. El muestreo de biota en SWMU 6 incluirá la obtención de muestras de 4 peces y 4 cangrejos de dentro de la laguna de SWMU 6, y muestras de 4 peces, y 4 cangrejos de las lagunas de trasfondo. Las muestras serán analizadas para los compuestos identificados como "impulsores principales de riesgo" para el consumo de peces/cangrejos basados en los datos del aguas superficial y de sedimento. Estos compuestos son:

- Plomo
- Talio
- Zinc
- PCBs

Se usarán los datos de peces eviscerados y de jueyes enteros para los contaminantes arriba mencionados para revisar las evaluaciones de riesgo para la salud humana (HHRA por sus siglas en inglés) después de la remoción, el cual es preparado en base a los datos de agua superficial y sedimento. Las concentraciones medidas de peces (mezcla de especies capturadas) y de jueyes reemplazarán las concentraciones de peces/ cangrejos del modelo para esos compuestos específicos (el resto de concentraciones del modelo se mantendrán en el HHRA), y los riesgos

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serán re-calculados para las personas que ingieren peces/cangrejos; estas concentraciones se incluirán en el Estudio de Factibilidad para SWMU 6.

Este apéndice ayudará a asegurar que los datos ambientales obtenidos sean científicamente comprobables, de calidad conocida y documentada, y adecuados para el uso previsto (por ejemplo: evaluaciones de riesgo a la salud humana posteriores a la remoción). La información de laboratorio que se cita en este apéndice al SAP es para TestAmerica Laboratories, Inc. de West Sacramento, California, y para Brooks Rand Laboratories of Seattle, Washington, quienes proveerán servicios analíticos para esta investigación.

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SAP Worksheet #9 — Project Scoping Session Participants Sheet

Project Name: Post-Removal Supplemental Confirmatory Sampling - Addendum	
Projected Date(s) of Sampling: January 2012	**Site Name:** SWMU 6
PM: John Swenfurth	**Site Location:** Vieques, Puerto Rico
Dates of Session: August 10 and 11, 2011 **Scoping Session Purpose:** Concur on the path forward for SWMU 6.	

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
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Stacin Martin	Navy Technical Support	Navy	757-322-4780(w)	Stacin.martin@navy.mil	No project-specific role
Daniel Rodriguez	Vieques RPM	USEPA	787-741-5201 787-671-9879 (cell)	Rodriguez.daniel@epa.gov	USEPA POC East Vieques sites
Sergio Lopez	Quality Assurance Technical Support	USEPA		Lopez.sergio@epa.gov	UFP-SAP Addendum QA/QC review
Michael Sivak	Human Health Risk Assessment Lead	USEPA	212-637-4310	Sivak.michael@epa.gov	Technical input and review of human health risk-related portions of SAP Addendum
Diana Cutt	Geology/Hydrogeology Lead	USEPA	212-637-4311	Cutt.diana@epa.gov	Technical input and review of geology/hydrogeology-related portions of SAP Addendum
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Angela Carpenter	EPA Special Projects Branch	USEPA	212-637-4435	Carpenter.Angela@epa.gov	No project-specific role
Julio Vazquez	Vieques RPM	USEPA	212-637-4323	Vazquez.julio@epa.gov	USEPA POC West Vieques sites
Wilmarie Rivera	Vieques RPM	PREQB	787-767-8181 x 6141	wilmarierivera@jca.gobierno.pr	Primary PREQB POC
Katarina Rutkowski	Technical Support Contractor to PREQB, Human Health Risk Assessment Lead	TRC	860-298-6202	krutkowski@trcsolutions.com	Technical input and review of human health risk aspects of SAP Addendum on behalf of EQB; Primary TRC POC
Scott Heim	Technical Support Contractor to PREQB, Ecological Risk Assessment Lead	TRC	978-656-3583(w) 508-320-2678©	sheim@trcsolutions.com	No project-specific role

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

Project Name: Post-Removal Supplemental Confirmatory Sampling - Addendum	
Projected Date(s) of Sampling: January 2012	**Site Name:** SWMU 6
PM: John Swenfurth	**Site Location:** Vieques, Puerto Rico
Dates of Session: August 10 and 11, 2011 **Scoping Session Purpose:** Concur on the path forward for SWMU 6.	

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
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Brett Doerr	Environmental Manager	CH2M HILL	757-671-6219	brett.doerr@ch2m.com	Navy contractor primary environmental POC
Bill Hannah	Project Manager	CH2M HILL	757-671-6277	bill.hannah@ch2m.com	Navy contractor project manager for SWMU 6 (John Swenfurth PM for SAP Addendum work)
John Martin	Ecological Risk Assessor	CH2M HILL	352-384-7122	john.martin@ch2m.com	No project-specific role
Barrie Selcoe	Human Health Risk Assessor	CH2M HILL	281-721-8527	barrie.selcoe@ch2m.com	Navy contractor lead human health risk assessor
John Tomik	Activity Manager	CH2M HILL	757-671-6259	John.Tomik@ch2m.com	No project-specific role
Tim Garretson	Munitions Manager	CH2M HILL	904-374-5633	Timothy.Garretson@ch2m.com	No project-specific role

Comments/Decisions: See meeting minutes from August 22, 2011 Environmental Restoration Program Technical Subcommittee Meeting below.

Action Items: See below

Consensus Decisions: See below

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

SWMU 6 Biota Characterization SAP Scoping Session

Discussion Objective

Concur on the path forward for SWMU 6.

Key Discussion Points

The subcommittee members discussed various options for moving forward on SWMU 6, comprising:

a) Moving forward with full feasibility study (rather than streamlined feasibility study) to evaluate range of potential remedial alternatives based on quantitative human health and ecological risk assessments using the 2011 surface water and sediment data

b) Delaying the feasibility study to conduct biota sampling to help overcome the limitations (likely overestimates) of using surface water/sediment data to model fish tissue concentrations for the human consumption scenario, which is the only scenario likely to show unacceptable risk based on surface water and sediment data

Based on the Navy's fiscal year goals for having remedies in place, the Navy advocated proceeding forward with the feasibility study because it would be conservatively protective and likely achieve a remedy in place by 2014. Because the human health risk assessment (based on modeled tissue concentrations) would likely show unacceptable risk for fish consumption and may lead to selecting a capping alternative for the lagoon, EPA advocated for conducting biota sampling, which it believed would show significantly lower (or absent) contaminant concentrations in biota tissue relative to the modeled concentrations. EPA suggested the following appeared to be the primary risk drivers for fish consumption: methyl mercury, tetraethyl lead, Aroclor-1254, and thallium.

With respect to ecological risk, the team generally concurred that the calculated risks would likely be marginal (based on the conservative assumptions), and that the developing ecosystem may be misinterpreted as an impaired community. Ultimately, the team felt that remedial action for ecological risks would not likely be necessary and that monitoring the developing ecology to ensure the protective nature of the site (following the 2009 removal action) would be sufficient.

Consensus Decisions

Without clear consensus on the most appropriate path forward, the Navy took the action to proceed with a full feasibility study for the site. However, subsequent to the meeting, the Navy submitted a proposal to the regulatory agencies (see August 31, 2011 Technical Memorandum below) to conduct a focused biota sampling (fish and crab) for the primary consumption risk drivers concurrently with preparing the feasibility study. This proposal was submitted to help simultaneously achieve the Navy's remedy-in-place and EPA's biota sampling goals. EPA approved the proposal.

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

TECHNICAL MEMORANDUM

CH2MHILL

Proposal for Integrating Focused Biota Sampling with Feasibility Study for West Vieques SWMU 6

PREPARED FOR: **Julio Vazquez/USEPA**

Wilmarie Rivera/PREQB

Richard Henry/USFWS

PREPARED BY: **CH2M HILL on behalf of the Navy**

DATE: **August 31, 2011**

This memorandum presents a proposal for integrating focused biota sampling at SWMU 6 with a feasibility study (FS) in order to provide data beneficial to evaluating and, ultimately, selecting an appropriate remedy for the site while at the same time adhering to a schedule that meets agency funding and/or milestone targets. Discussions held during the August 2011 Technical Subcommittee Meeting in New York form the basis for this proposal.

Concisely, preliminary human health and ecological risk evaluations performed using post-removal supplemental confirmatory surface water and sediment data identified marginally unacceptable risk (based on conservative assumptions and modeling) for ecological receptors, but significantly higher unacceptable risk (also based on conservative assumptions and modeling) for human consumption of fish/crab.

With respect to the ecological risk evaluation (using surface water and sediment) and the potential to conduct baseline ecological risk assessment (BERA) level data collection to refine the risk estimates, the team recognized that if sediment toxicity, benthic community, and invertebrate tissue analyses are conducted in the near-term, these test results likely cannot distinguish between adverse effects caused by site-related contaminants versus effects related to normal ecological recovery following the relatively recent removal action. Since the removal action occurred 2 years ago, the benthic community likely has not had sufficient time to develop. It was further recognized that the risk estimates for benthic and upper trophic-level receptors were relatively low, even with the conservative assumptions applied. Based on the above information, the team believed that monitored natural recovery (MNR) is likely a viable remedy based on ecological considerations. Therefore, no pre-Record of Decision BERA level sampling will be necessary. Sampling as part of the MNR remedy, should it be selected, will be performed.

With respect to the human health risk evaluation, the team discussed that the unacceptable risk (based on a non-cancer hazard index (HI) above 1.0 and excess lifetime cancer risk (ELCR) above 1×10^{-4}) under a 2 days/week consumption scenario was primarily driven by the constituents listed in the table below. Tetraethyl lead (the form of lead initially and conservatively assumed based on the measured total lead concentration) was also a significant risk driver, but the team determined that because the site was not a fuel site, it could be assumed that tetraethyl lead would not be present.

The fish consumption risk estimates are provided in **Attachment 1** for a fish consumption frequency (8 ounces per meal) of two fish meals/week. Based on the location of the site within a National Wildlife Refuge, the relatively small size and shallowness of the SWMU 6 lagoon, and the availability of other, more appealing fishing spots proximal to populated areas, an exposure frequency of two fish meals/week from SWMU 6 is considered to be realistic (i.e., a reasonable maximum exposure scenario), especially for the purposes of providing refinement information for the FS.

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

COPC in Fish Tissue	Basis of Modeled Concentration	Hazard Quotient Based on Modeled Concentration	Excess Lifetime Cancer Risk Based on Modeled Concentration	Background Comparison for Sediment/Surface Water
Lead	Sediment	90.5% of population with BLL > 10 µg/dL **(see Note 1)**	'--	Mean Site > Mean Bkgd
Methyl Mercury	Surface Water	2400	'--	No background data
Thallium	Surface Water	3000	'--	Mean Site > Mean Bkgd
Zinc	Sediment	1.2	'--	Mean Site > Mean Bkgd
Aroclor-1254	Sediment	15	$9x10^{-5}$	Mean Site > Mean Bkgd

Note 1: Based on Adult Lead Methodology
BLL = blood lead level

Based on the above information, the Navy proposes to proceed forward with preparation of the FS (including completing risk assessments already initiated using the surface water and sediment data), while concurrently collecting edible fish and blue crab tissue samples for HHRA refinement. The data from the fish and crab tissue samples would be used to refine the human health risk estimates provided in the FS assuming the biota data are available and useful by the time the draft FS is submitted. If not, the data will be incorporated into the FS/Proposed Plan/ROD process as soon as they are deemed available and useful.

To ensure the FS timeline is not delayed, several components of the biota sampling process will need to be expedited on the part of the Navy and the regulatory agencies. Therefore, regulatory acceptance of this proposal will need to include acceptance of the review milestones as well. Key milestones for the FS and concurrent Focused Biota Sampling are shown in the table below. The attached Excel schedule provides more detail. Meeting the milestone dates below will ensure a Record of Decision in fiscal year 2013 and implementation of the remedy before the end of fiscal year 2014.

FS/PRAP/ROD Milestone	Milestone Date	Focused Biota Sampling Milestone	Milestone Date
Regulatory review of HHRA pre-interim deliverable and ERA interim deliverable (sw/sed data)	September 2, 2011	Navy submittal of SWMU 6 Post-removal Supplemental Confirmatory Sampling SAP Addendum	October 14, 2011
Resolution of comments on above	September 16, 2011	Regulatory review of SAP Addendum	November 11, 2011
Navy submittal of HHRA interim deliverable	October 7, 2011	Resolution of comments on above	November 25, 2011
Regulatory review of HHRA interim deliverable	October 21, 2011	Final SAP Addendum	January 6, 2012
Resolution of comments on above	November 4, 2011	Focused biota tissue sampling	January 2012
Navy submittal of Draft FS	April 13, 2012	HHRA risk refinement (to be included in FS)	April 13, 2012
Regulatory review of Draft FS	June 15, 2012		
Resolution of comments on above	September 28, 2012		
Final FS	November 9, 2012		
Final PRAP	April 5, 2013		
Public Comment Period	April 8 - May 24, 2013		
Final ROD	June 28, 2013		
Remedy implementation	February/March 2014		

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

ERP/MRP Subcommittee Meeting
Vieques Superfund Site
October 25 - 27, 2011: New York, NY

Agenda Topics

Tuesday, October 25, 2011

1. UXO 15 SAP Addendum approach
2. SWMU 6 SAP Addendum
3. Electronic Document Signatures for Decision Documents
4. Vehicle Wash Sediment Analysis

Wednesday, October 26, 2011

1. Munitions Refresher
2. East Vieques Terrestrial UXO Sites Master SAP Scoping Session
3. Underwater Munitions Distribution Strawman

Thursday, October 27, 2011

1. Munitions Removal Status and Vieques Program Overall Site Closeout Status
2. SWMU 4 RI/FS Report
3. Air Monitoring Status Report
4. East Vieques Terrestrial UXO Sites Master SAP

Tuesday, October 25, 2011

Attendees:

John Tomik/CH2M HILL Activity Manager (CLEAN contractor to Navy)
Forrest Cain/Critigen – GIS Support (CLEAN contractor to Navy)
Daniel Rodriguez/EPA RPM
Sandy Martinez/Fulton Communications (meeting facilitator)
Kevin Cloe/NAVFAC RPM
Daniel Hood/NAVFAC RPM
Bill Hannah/CH2M HILL (CLEAN contractor to Navy)
Brett Doerr/CH2M HILL (CLEAN contractor to Navy)
John Martin/CH2M HILL (CLEAN contractor to Navy)
Dan Waddill/NAVFAC Vieques Coordinator
Barrie Selcoe/CH2M HILL (CLEAN contractor to Navy)
Michael Sivak/EPA Human Health Risk Assessor
Katarina Rutkowski/TRC (technical support contractor to EQB)
Wilmarie Rivera/EQB RPM
Rich Henry/USFWS RPM
Angela Carpenter/EPA Special Projects Branch
Dianna Cutt/ EPA Geologist
Julio Vazquez/EPA RPM
Sergio Lopez/EPA
Mindy Pensak/EPA (by phone)

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

SWMU 6 SAP Addendum

Discussion Objective

Discuss and resolve comments so the Draft Final SWMU 6 SAP Addendum can be produced following the meeting

Key Discussion Points

Brett Doerr/CH2M HILL began the discussion asking the regulatory agencies if they have any questions on the Draft SWMU 6 SAP Addendum. Julio Vazquez/EPA provided one comment EPA had on worksheet #15, which the team discussed. Sergio Lopez/EPA added that he has not reviewed the SAP and still needs to. EPA said that existing comments will be sent to the Navy and response to comments will be prepared while Sergio reviews. Sandy Martinez asked who the points of contacts should be for each agency and if draft reports should be provided to the technical members. Angela Carpenter affirmed that the RPMs are responsible to involve their own appropriate technical staff and forward the submittal correspondence accordingly.

Rich Henry asked for more clarification on the procedures of the freezing of biota tissue, which the team discussed. Danny Rodriguez asked about analyzing the whole body of the crab instead of just the tissue portion. He heard from the public that they boil the whole crab during the cooking process and then use the water as broth for such things as rice. John Martin/CH2M HILL responded that it would be difficult to determine the quantity of constituents that leach from the shell during cooking and that analyzing the whole body crab would overestimate what people would actually consume. The team concurred that although it would overestimate the exposure, it would provide a conservative estimate.

There was also some discussion about increasing the list of parameters, but Brett Doerr noted that at the last meeting there was discussion of focusing only on the constituents that drive risk, which were specifically identified in the meeting and used to procure the lab. If constituents are added to the analytical protocol, it may result in having to recompete the laboratory procurement and cause a significant delay in the finalizing. Angela Carpenter added that consensus from last meeting was not clear and we have to consider how the people of Vieques prepare crabs.

Because of the length of this discussion, the team decided that the human health risk assessors will need to get together to discuss further. The risk assessors met separately to discuss during the next two agenda topics. See **SWMU 6 SAP Addendum** topic under October 27, 2011.

Action Items

EPA - Sergio Lopez will provide any additional comments on the SAP to Julio Vazquez by November 2, 2011. Julio will provide to Kevin Cloe/Navy and Brett Doerr by November 7, 2011.

Wednesday, October 26, 2011

Attendees:

Forrest Cain/Critigen – GIS Support (CLEAN contractor to Navy)
John Tomik/CH2M HILL (CLEAN contractor to Navy)
Barrie Selcoe/CH2M HILL (CLEAN contractor to Navy)
Michael Sivak/EPA Human Health Risk Assessor
Daniel Rodriguez/EPA RPM
Katarina Rutkowski/TRC (technical support contractor to EQB)
Wilmarie Rivera/EQB RPM
Daniel Hood/NAVFAC RPM
Kevin Cloe/NAVFAC RPM
Julio Vazquez/EPA RPM
Rich Henry/USFWS RPM

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

John Martin/CH2M HILL (CLEAN contractor to Navy)
Bill Hannah/CH2M HILL (CLEAN contractor to Navy)
Brett Doerr/CH2M HILL (CLEAN contractor to Navy)
Angela Carpenter/EPA Special Projects Branch
Dianna Cutt/ EPA Geologist
Dan Waddill/NAVFAC Vieques Coordinator
Jim Pastorik/UXOPro (technical support contractor to EQB)
Sandy Martinez/Fulton Communications (meeting facilitator)
Michael Sivak/EPA Human Health Risk Assessor
Mindy Pensak/EPA Ecological Risk Assessor
Tim Garretson/CH2M HILL (CLEAN contractor to Navy), by phone

SWMU 6 SAP Addendum

The team continued the discussion from yesterday on the SWMU 6 SAP Addendum and the results of the human health risk assessor side bar meeting. Various options for modifying the fish/crab sampling approach, based on the potential for whole body fish and crab to be used in the cooking/consumption process were discussed. Some of the key considerations discussed were:

- Whether additional constituents should be analyzed for and the potential affect on the analytical laboratory already selected and the schedule
- Whether bioaccumulation factors for whole body crab can be found or estimated
- Local cooking/eating practices

Consensus on the path forward was not reached during this discussion, but was instead tabled until Thursday October 27, 2011 (see below).

Thursday, October 27, 2011

Attendees:

Forrest Cain/Critigen – GIS Support (CLEAN contractor to Navy)
John Tomik/CH2M HILL (CLEAN contractor to Navy)
Barrie Selcoe/CH2M HILL (CLEAN contractor to Navy)
Michael Sivak/EPA Human Health Risk Assessor
Daniel Rodriguez/EPA RPM
Katarina Rutkowski/TRC (technical support contractor to EQB)
Wilmarie Rivera/EQB RPM
Daniel Hood/NAVFAC RPM
Kevin Cloe/NAVFAC RPM
Julio Vazquez/EPA RPM
Rich Henry/USFWS RPM
John Martin/CH2M HILL (CLEAN contractor to Navy)
Bill Hannah/CH2M HILL (CLEAN contractor to Navy)
Brett Doerr/CH2M HILL (CLEAN contractor to Navy)
Angela Carpenter/EPA Special Projects Branch
Dianna Cutt/ EPA Geologist
Dan Waddill/NAVFAC Vieques Coordinator
Jim Pastorik/UXOPro (technical support contractor to EQB)

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

Sandy Martinez/Fulton Communications (meeting facilitator)
Dianna Cutt/ EPA Geologist
Michael Sivak/EPA Human Health Risk Assessor
Sergio Lopez/EPA
Mindy Pensak/EPA Ecological Risk Assessor (by phone)
Betsy Milenbrink/EPA (by phone)

SWMU 6 SAP Addendum

The team continued the discussion on the SWMU 6 SAP Addendum from the previous couple days. The team concurred that the path forward will be for CH2M HILL, on behalf of the Navy will:

1. Compare surface water and sediment concentrations to background concentrations to identify chemicals detected above background upper tolerance limits (UTLs). For those chemicals above background UTLs, evaluate the potential for these chemicals to accumulate in fish or crab, and identify those considered by EPA to be bioaccumulative as fish/crab chemicals of potential concern (COPCs) for Step 2.
2. Qualitatively evaluate COPCs to assess whether they preferentially accumulate in shell or in tissues/organs.
3. Identify bioaccumulation factors based on whole body fish and whole body crab for COPCs to reflect local food preparation and cooking.
4. Use the bioaccumulation factors to identify chemicals of concern (COCs), which are then the proposed analytes for the fish and crab samples to be collected at SWMU 6.

Action Item

Navy/CH2M HILL – Perform the above step and produce a memo documenting the results for regulatory consideration.

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SAP Worksheet #10 — Problem Definition

This worksheet provides a narrative description of the problems to be addressed during the post-removal biota sampling.

Site Background

See Worksheet #10 of the original SAP (CH2M HILL, 2010).

Investigation History

For investigations prior to the 2011 post-removal supplemental confirmatory sampling, please see Worksheet #10 of the original SAP (CH2M HILL, 2010). As part of the 2011 post-removal supplemental confirmatory sampling the following samples were collected:

- Seven surface water samples plus QC were collected from mid-depth of the water column at SWMU 6 and analyzed for VOCs, SVOCs (PAHs), pesticides, PCBs, total and dissolved inorganic constituents including hexavalent chromium.
- 10 surface water samples plus QC were collected from the background locations and analyzed for total and dissolved inorganic constituents including hexavalent chromium and pesticides.
- Nine sediment samples plus QC were collected at SWMU 6 and analyzed for VOCs, SVOCs (PAHs), pesticides, PCBs, inorganic constituents including hexavalent chromium; and general parameters pH, TOC, grain size, sulfide, ammonia, ORP, and AVS/SEM.
- Two additional samples originally intended to be sediment were identified and collected as surface soil, and analyzed for the same parameters as the above sediment samples. The ecological risk assessment treated one of these samples as sediment, whereas the human health risk assessment treated it as surface soil.
- Two surface soil samples plus QC were collected in the removal area south of the road, and analyzed for PCBs.
- 10 sediment samples plus QC were collected from background locations and analyzed for inorganic constituents including hexavalent chromium, pesticides, pH and ORP.

Release History

Based on data presented in the human health risk assessment (HHRA) Pre-Interim Deliverable (CH2M HILL, 2011), post-removal confirmation samples collected in 2011 detected PCBs, lead, thallium, and zinc in sediment and/or surface water that may pose risks to fish/crab consumers above USEPA action levels, based on modeling uptake of those constituents' concentrations into fish and blue crab.

Conceptual Site Model

The conceptual site model is the same as that presented in the original SAP (CH2M HILL, 2010), with the addition of the fish/crab consumption receptor, as discussed below.

Receptors

Human consumers of edible-size fish and blue crab from the lagoon are the receptors of potential concern at the site based on analytical data from supplemental post-removal surface water and sediment samples, although land use designations discourage frequent fishing/crabbing in the lagoon.

SAP Worksheet #10 — Problem Definition (continued)

Synopsis of Secondary Data

Figures 1 through **3** summarize VOCs, SVOCs, pesticides/PCBs, and inorganic constituents exceedances above adjusted residential soil RSLs within sediment and soil samples, and inorganic exceedances of adjusted tap water RSLs in surface water samples. The data collected was used for the preliminary human health post-removal risk assessment. The information in these figures helps provide the rationale for the sampling approach presented in this SAP. Preliminary human health risk evaluations performed using this data identified risk estimates (based on conservative assumptions and modeling) for human consumption of fish/blue crab above EPA action levels.

General Problems to Address

Preliminary human health risk evaluations performed using the post-removal confirmation samples in 2011 identified potential risks (based on conservative assumptions and modeling) for human consumption of fish/blue crab above EPA action levels. Therefore, the objectives of the fish/blue crab sampling event are to characterize the concentrations of chemical risk drivers (the primary chemicals causing exceedances of EPA action levels) in fish and blue crab for use in refining the risk estimates for fish/crab consumption. Results of the revised risk estimates will be used to assess the type of risk management needed, if any.

Environmental Questions to be Answered by the Supplemental Confirmatory Sampling

To achieve the objective stated above, the following environmental questions will be answered via implementation of this SAP:

1. **What are the concentrations of lead, thallium, zinc, and PCBs potentially attributable to CERCLA-related releases in edible-size fish and blue crab at SWMU 6?**

   This question will be answered by collecting fish and blue crab samples from the site. Based on historic sediment and surface water sampling activities at the site, mullet and snook are expected to be present at the time of sampling. Answering this question also includes collecting background fish and blue crab samples from a lagoon environment similar to that at SWMU 6. Background fish and whole-body blue crab samples will be collected from Laguna Punta Arenas and analyzed for the same parameters for comparison to site data.

2. **What are the potential human health risks to fish and blue crab consumers posed by the aforementioned contaminants attributable to SWMU 6, based on gutted fish and whole-body crab data?**

   Fish and blue crab data for the contaminants listed above will be used to revise the post-removal human health risk assessment that is prepared based on surface water and sediment data. The measured fish (collected species merged) and blue crab concentrations will replace the modeled fish/crab concentrations for those specific analytes (with the remaining modeled concentrations retained in the HHRA) and risk estimates will be recalculated for fish/crab consumers.

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

- Who will use the data and what will the data be used for?
  - The Navy, USEPA, EQB, and USFWS will use the data collected to characterize post-removal conditions at SWMU 6 and conduct the post-removal human health risk assessment (HHRA). The HHRA will be used to assist in determining if current (post-removal) conditions are sufficiently protective for the site.
- What are the Project Action Limits (PALs)?

  The PALs are listed, by constituent group, in Worksheet #15. In general, the PALs are the June 2011 USEPA Regional Screening Levels (RSLs) (adjusted for a hazard quotient [HQ] of 0.1 for non-carcinogens) calculated using an ingestion rate of 0.227 kg/day and an exposure frequency of 2 days/week.

  Typically, RSLs are used as risk-based screening levels for environmental media. Although RSLs for consumption of fish are not tabulated on EPA's RSL website, the RSL calculator feature was used to calculate fish default RSLs using the same fish ingestion exposure factor values used in the SWMU 6 evaluation (See Table 1). These default RSLs were based on a target HQ of 0.1 or an Excess Lifetime Cancer Risk (ELCR) of $1x10^{-6}$, and the assumption of twice-weekly fish ingestion from the SWMU 6 lagoon. Quantitative toxicity criteria are not currently available for lead; therefore, risk assessments for lead differ from those for other noncarcinogens in that they rely on observed or predicted blood lead levels (BLLs). Using site-specific exposure factors, USEPA's Integrated Exposure Uptake Biokinetic Model (IEUBK) and Adult Lead Methodology (ALM) were used to determine RSLs which would meet acceptable blood lead levels (See Table 2 and 3).

  - Where a specific PAL deviates from the above, it is footnoted in the applicable Worksheet #15 table.
  - Results for general chemistry parameters (% lipids and % solids) collected to support the interpretation of data will not be compared to strictly-defined PALs, but will be evaluated qualitatively. These parameters are identified in Worksheet #15.
  - In addition to listing the particular analytes, PALs, and limits of detection (LODs), Worksheet #15 identifies where LODs are greater than PALs (this occurs for thallium, PCB-126, and PCB-169). Although a few LODs are greater than PALs, the detection limits (DLs) may be closer to or less than PALs. The laboratory will report an analyte, if detected between the DL and the LOQ, qualified as applicable. Therefore, this is not expected to adversely affect the project team's ability to make decisions regarding these particular constituents. For PCB-126 and PCB-169, the DLs are not yet known because they are sample-specific EDLs (refer to Worksheet #15-2). However, the PCB-126 and PCB-169 DLs are likely to be less than or close to the PALs. For this project, thallium nondetects will not be considered as PAL exceedances.
  - Sample-specific detection limits will be compared to risk-based screening levels in the HHRA. Chemicals with elevated detection limits that are nondetect in all samples will not be selected as chemicals of potential concern and human health risks will not be estimated for these chemicals. However, the potential for elevated detection limits to underestimate risks will be addressed in the uncertainty section of the HHRA.
- What types of data are needed (matrix, target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)?
  - Whole-body fish and whole-body blue crab samples will be submitted to an offsite laboratory for analysis (Brooks Rand Laboratory [inorganics] and Test America in West Sacramento [PCB congeners]).
  - Based on existing surface water and sediment data, and conservatively modeled fish concentrations for fish/crab consumers, chemicals of interest are PCB congeners, lead, thallium, and zinc as shown in Worksheet #15.

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

- General parameters consisting of percent lipids and percent solids will be collected to support interpretation of the fish & crab data.
- Worksheets #10, #15, and #18 define the specific target analytes for SWMU 6.

- How "good" do the data need to be in order to support the environmental decisions?
  - The data will be of the quantity and quality necessary to provide technically sound and defensible assessments of the site conditions and associated risks at SWMU 6. Laboratory methods will meet CERCLA, USEPA Region 2, and Navy guidance and the data will be validated by a third-party validator using national functional guidance, methodology, and laboratory Standard Operating Procedures (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 DoD Quality Systems Manual (QSM) as applicable and laboratory in-house limits where the QSM does not apply.
- How much data should be collected (number of samples for each analytical group, matrix, and concentration)?
  - Worksheet #18 contains the number of samples for fish and blue crab per analyte for SWMU 6. Worksheets #15 contain the particular analytes, PALs, and levels of detection (LODs). Worksheet #17 provides the rationale for the particular sampling at the site.
  - 4 edible-size fish samples and 4 blue crab samples will be collected at the site (**Figure 4**). Ideally, each individual crab will be analyzed separately; however, if individual blue crabs are smaller than the sample mass required by the lab, the necessary number of individual blue crabs will be composited together into one sample (for a total of 4 blue crab samples).
  - 4 edible-size fish and 4 blue crab samples will be collected as background samples from Laguna Punta Arenas and analyzed for the same analytical parameters as the SWMU 6 samples (Figure 5). Ideally, each individual crab will be analyzed separately; however, if individual blue crabs are smaller than the sample mass required by the lab, the necessary number of individual blue crabs will be composited together into one sample (for a total of 4 blue crab samples).
  - Laboratory measurements of percent lipids and percent solids will be made for each sample.
- Where, when, and how should the data be collected/generated?
  - Samples will be collected during one field mobilization planned to occur in early 2012.
  - Data will be collected and generated in accordance with the procedures outlined in the UFP-SAP.
- 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 Brooks Rand Laboratory (inorganics) and Test America in West Sacramento (PCB congeners).
  - The data report will include a CLP Level IV-equivalent package. A Level IV equivalent data package includes a case narrative, all field sample results, quality control forms, and raw data. This will include a Supplemental Naval Installation Restoration Information Solution Electronic Data Deliverable (SNEDD) deliverable in Microsoft Excel format and hardcopy of the raw data.
  - The data will be reported in the post-removal risk assessment report.

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

- 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 PQOs in the form of if/then qualitative and quantitative statements

  The general objectives of the decision analysis process are:
  - To determine if potential risks to fish and blue crab consumers exceed USEPA action levels for human health following the removal action.
  - To determine if additional actions are warranted to mitigate potential fish/crab consumption risks.

  The associated PQO statements are:
  - If the HHRA indicates fish/crab consumption risks within the USEPA acceptable risk range at SWMU 6, this exposure pathway will not be addressed in the feasibility study. However, if the HHRA indicates that potential risks remain above USEPA action levels, the feasibility study will incorporate alternatives to mitigate unacceptable fish/crab consumption risks.

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SAP Worksheet #12-1 — Field Quality Control Samples

Matrix:	TI			
Analytical Group:	METAL			
Analytical Method / SOP Reference:	EPA 1638M			
QC Sample[1]	**Analytical Group**	**Frequency**	**Data Quality Indicators**	**Measurement Performance Criteria**
Field Duplicates[2]	METAL	One per 10 field samples (per matrix per site)	Precision	%RPD < 30%
Homogenization Blank	METAL	One per sub-matrix (one for fish and one for crab)	Contamination	The homogenization equipment must contribute less than 1/10th the total element of interest found in the sample.
Temperature Blank	METAL	One per cooler	Representativeness	≤ 6°C but not frozen

Notes:

1. MS/MSD is described on Worksheet 28.

2. Field duplicates are not blind to the laboratory. The field team will place two labels (one for each of normal and field duplicate) on the same container and the laboratory will split the sample after homogenization.

SAP Worksheet #12-2 — Field Quality Control Samples

Matrix:	TI			
Analytical Group:	PCBCONG			
Analytical Method / SOP Reference:	EPA 1668A / WS-ID-0013			
QC Sample[1]	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria
Field Duplicates[2]	PCBCONG	One per 10 field samples (per matrix per site)	Precision	%RPD < 30%
Homogenization Blank	PCBCONG	One per sub-matrix (one for fish and one for crab)	Contamination	The homogenization equipment must contribute less than 1/10th the total element of interest found in the sample.
Temperature Blank	PCBCONG	One per cooler	Representativeness	≤ 6°C but not frozen

Notes:

1. MS/MSD is described on Worksheet 28.

2. Field duplicates are not blind to the tissue processing laboratory. Field duplicates are blind to the analytical laboratory.

SAP Worksheet #12-3 — Field Quality Control Samples

Matrix:	TI
Analytical Group:	WCHEM
Analytical Method / SOP Reference:	SM 2540G and WS-IDP-0013

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria
Field Duplicates[1]	WCHEM	Field duplicates shall be marked for WCHEM (%Lipids and %Solids)	N/A	N/A
Temperature Blank	WCHEM	One per cooler	Representativeness	≤ 6°C but not frozen

Notes:

1. It is not necessary to assess the field precision for WCHEM analyses. However, it is necessary to have %Lipids and %Solids results for field duplicates.

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SAP Worksheet #13 — Secondary Data Criteria and Limitations Table

The table below provides general information on how secondary data will be used in meeting the current project objectives and the limitations on their use in developing the SAP. Secondary data criteria and limitations tables are presented for each site where historical analytical data exist (applicable to the scope of work covered by this SAP), specifically to address the use and limitations of the historical analytical data. However, all data collected prior to the 2011 post-removal confirmatory sampling is presented in Worksheet 13 of the original SWMU 6 SAP, and is not duplicated here.

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
7 surface water and 13 sediment (or surface soil in areas where open water was not present) supplementary confirmation samples. 10 co-located background surface water and sediment samples were also collected from nearby lagoons.	CH2M HILL, Post-Removal Confirmatory Sampling, February 2011	Soil post-removal confirmation samples	Sampling results used in the post-removal risk assessment.	Biota data for the select constituents of interest will be substituted for the modeled fish/crab concentrations based on surface water/sediment data for the same constituents.

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SAP Worksheet #14 — Summary of Project Tasks

The technical approach for the proposed field activities at SWMU 6 is detailed below. Protocols and standard operating procedures (SOPs) are attached (Attachment C) for those not in the current version of The Master Standard Operating Procedures, Protocols, and Plans (MSOPPP) (CH2M HILL, 2010).

Mobilization

Prior to mobilization, NAVFAC Atlantic, USEPA, PREQB, and USFWS will be notified to allow for appropriate oversight and 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 CH2M HILL field team mobilizes for field activities.

Prior to beginning any phase of work, CH2M HILL and its subcontractors will have field meetings to discuss the work items and worker responsibilities, and to familiarize workers with the HSP.

Sampling and Analysis

To meet the objectives of this study, fish species and blue crab that are reasonably expected to be consumed by recreational fishers will be sampled from within the boundary of SWMU 6 (Figure 4), as well as within the background lagoon, Laguna Punta Arenas (Figure 5).

Target species are mullet, snook, and blue crabs. Mullet and blue crabs have been found within SWMU 6 during prior qualitative surveys, while snook have been observed in nearby, directly connected waters and may therefore occur within SWMU 6. These species have also been observed in Laguna Punta Arenas. There is the potential that during the field sampling event these mobile species may not be present because of seasonal migration or other environmental factors, or may occur in very low numbers. In these instances, and based on professional judgment, other species of fish or crab may be collected if they are considered reasonable representatives of seafood species consumed by recreational fishers.

Legal size limits are not established for these species. However, the following minimum practical size limits, intended to limit sampled specimens to those that may reasonably be retained and consumed by fishers, will be applied to the specimens retained for analysis:

- Snook – 9 inches
- Mullet – 6 inches
- Blue Crab – 3 inches (carapace width)

The target number of samples is four fish and four crabs from SWMU 6, and four fish and four crabs from Laguna Punta Arenas (background). The four fish samples from each area are targeted to include two snook and two mullet, but this distribution is subject to change based on actual field collection results. Total length and weight will be measured for all retained fish specimens, and total carapace width, weight, and sex will be determined for retained crab specimens.

Each sample will consist of a single whole specimen. In instances where one specimen may not provide sufficient biomass for analytical requirements, additional specimens will be added to the sample to create the requisite weight. If multiple specimens are combined, they will include specimens of the same species, and will be of similar size; total fish length or total carapace width (crabs) will not vary by more than 15 percent between the multiple specimens.

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

Samples to be analyzed will consist of whole body fish (with guts removed) and whole body blue crab. Whole body fish and crab samples will be shipped from the field to the analytical laboratory (Brooks Rand) where they will be processed. Laboratory tissue processing protocols, which are based on EPA standards, will be followed. The following minimum procedures will be followed:

- Whole fish will require the removal of the entire contents of the gut cavity prior to tissue homogenization. Guts contents predominantly include the heart, liver, stomach, intestines, pyloric caeca (a digestive organ), swim bladder, and gonads (reproductive organs). The laboratory will access the gut cavity by cutting with a decontaminated blade along the belly from the base of the pelvic fin to the vent at the base of the anal fin. Care must be taken to avoid contaminating the fish body with material released from inadvertent puncture of internal organs. The gut contents will be removed using decontaminated tools or gloved hands and discarded. The body cavity will then be flushed with a spray of deionized water to remove any loose remnants. After this preparation the fish body is ready for homogenization, along with any additional prepared fish that may be identified for inclusion in a composite sample. Fish will be ground and homogenized using an automatic grinder or high speed blender or homogenizer.
- Whole crabs will not require any unique laboratory preparation. The entire crab (with all claws) will be homogenized, along with any additional crabs that may be identified for inclusion in a composite sample. Crabs will be ground and homogenized using an automatic grinder or high speed blender or homogenizer.

Multiple types of equipment will be deployed within SWMU 6 and background lagoon areas to capture fish and crabs. Fish will be targeted using gill nets, seines, and cast nets. Blue crabs will be targeted using baited crab traps. All captured target specimens will be retained, regardless of what equipment type was successful; for example, crabs captured in other nets during fish collection will be kept. Protocols for these collection methods are provided in Worksheet #21. Professional judgment will be used for determining locations and durations for deployment of the various sampling gear.

Field water quality parameters to be measured and logged in the field include total depth, temperature, pH, DO, ORP, conductivity, salinity, and turbidity.

Shipments

All analytical samples will be sent by Fed Ex which has on-island staff. All equipment will be shipped to the Camp Garcia CH2M HILL office on Vieques. All samples will be shipped in accordance with the SOP in the Master Protocols Attachment 1 H-9 “Packaging and Shipping Procedures for Low-Concentration Samples.”

Quality Control

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

Sample Analysis

The laboratory will maintain, test, inspect, and calibrate analytical instruments (Worksheets #24 and #25). The laboratory will process the fish and crabs, and analyze the samples for various groups of parameters as shown on Worksheets # 15 and #18.

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

Data Management

The Project data manager 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.

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SAP Worksheet #15-1 — Reference Limits and Evaluation Tables

Matrix:	TI					
Analytical Group:	METAL					
Analyte	**CAS No.**	**HHRA SL[2] (mg/kg)**	**Project QL Goal[1] (mg/kg)**	**Laboratory Specific Limits (mg/kg)**		
				LOQs	**LODs**	**DLs**
Lead	7439-92-1	0.47	0.235	0.040	0.0040	0.0040
Thallium	7440-28-0	0.00046	0.00046	0.0080	0.0020	0.0020
Zinc	7440-66-6	14	7	1.0	0.72	0.28

Notes:
Screening levels are shaded if LOD > screening level. Refer to Worksheet #11 Section "What are the PALs?"

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SAP Worksheet #15-2 — Reference Limits and Evaluation Tables

Matrix:	TI							
Analytical Group:	PCBCONG							
Analyte		**CAS No.[3]**	**WHO 2005 TEFs**	**HHRA SL[2, 5] (pg/g)**	**Project QL Goal[1] (pg/g)**	**Laboratory Specific Limits (pg/g)**		
						LOQs	**LODs**	**DLs[4]**
2-Chlorobiphenyl (1)	PCB-1	2051-60-7			2.0	2.0	1.6	0.18
3-Chlorobiphenyl (2)	PCB-2	2051-61-8			20	20	5.0	0.14
4-Chlorobiphenyl (3)	PCB-3	2051-62-9			2.0	2.0	1.6	0.097
2,2'-Dichlorobiphenyl (4)	PCB-4	13029-08-8			2.0	2.0	1.6	1.1
2,3-Dichlorobiphenyl (5)	PCB-5	16605-91-7			20	20	5.0	0.65
2,3'-Dichlorobiphenyl (6)	PCB-6	25569-80-6			20	20	5.0	0.67
2,4-Dichlorobiphenyl (7)	PCB-7	33284-50-3			20	20	5.0	0.64
2,4'-Dichlorobiphenyl (8)	PCB-8	34883-43-7			20	20	5.0	0.66
2,5-Dichlorobiphenyl (9)	PCB-9	34883-39-1			20	20	5.0	0.73
2,6-Dichlorobiphenyl (10)	PCB-10	33146-45-1			20	20	5.0	0.65
3,3'-Dichlorobiphenyl (11)	PCB-11	2050-67-1			20	20	5.0	0.65
Congeners (13/12)	PCB-12/13	13&12			20	20	5.0	0.65
3,5-Dichlorobiphenyl (14)	PCB-14	34883-41-5			20	20	5.0	0.56
4,4'-Dichlorobiphenyl (15)	PCB-15	2050-68-2			2.0	2.0	1.6	0.55
2,2',3-Trichlorobiphenyl (16)	PCB-16	38444-78-9			20	20	5.0	0.14
2,2',4-Trichlorobiphenyl (17)	PCB-17	37680-66-3			20	20	5.0	0.11
Congeners (30/18)	PCB-18/30	30&18			20	20	5.0	0.10
2,2',6-Trichlorobiphenyl (19)	PCB-19	38444-73-4			2.0	2.0	1.6	0.16
Congeners (28/20)	PCB-20/28	28&20			20	20	5.0	0.15
Congeners (21/33)	PCB-21/33	21&33			20	20	5.0	0.15
2,3,4'-Trichlorobiphenyl (22)	PCB-22	38444-85-8			20	20	5.0	0.16
2,3,5-Trichlorobiphenyl (23)	PCB-23	55720-44-0			20	20	5.0	0.15
2,3,6-Trichlorobiphenyl (24)	PCB-24	55702-45-9			20	20	5.0	0.09
2,3',4-Trichlorobiphenyl (25)	PCB-25	55712-37-3			20	20	5.0	0.15
Congeners (26/29)	PCB-26/29	26&29			20	20	5.0	0.15
2,3',6-Trichlorobiphenyl (27)	PCB-27	38444-76-7			20	20	5.0	0.08
2,4',5-Trichlorobiphenyl (31)	PCB-31	16606-02-3			20	20	5.0	0.14
2,4',6-Trichlorobiphenyl (32)	PCB-32	38444-77-8			20	20	5.0	0.076
2,3',5'-Trichlorobiphenyl (34)	PCB-34	37680-68-5			20	20	5.0	0.15
3,3',4-Trichlorobiphenyl (35)	PCB-35	37680-69-6			20	20	5.0	0.16
3,3',5-Trichlorobiphenyl (36)	PCB-36	38444-87-0			20	20	5.0	0.14
3,4,4'-Trichlorobiphenyl (37)	PCB-37	38444-90-5			2.0	2.0	1.6	0.15
3,4,5-Trichlorobiphenyl (38)	PCB-38	53555-66-1			20	20	5.0	0.15
3,4',5-Trichlorobiphenyl (39)	PCB-39	38444-88-1			20	20	5.0	0.14
Congeners (40/71)	PCB-40/71	40&71			20	20	5.0	0.12

SAP Worksheet #15-2 — Reference Limits and Evaluation Tables (continued)

Matrix:	TI							
Analytical Group:	PCBCONG							
Analyte		**CAS No.[3]**	**WHO 2005 TEFs**	**HHRA SL[2, 5] (pg/g)**	**Project QL Goal[1] (pg/g)**	**Laboratory Specific Limits (pg/g)**		
						LOQs	**LODs**	**DLs[4]**
2,2',3,4-Tetrachlorobiphenyl (41)	PCB-41	52663-59-9			20	20	5.0	0.15
2,2',3,4'-Tetrachlorobiphenyl (42)	PCB-42	36559-22-5			20	20	5.0	0.13
2,2',3,5-Tetrachlorobiphenyl (43)	PCB-43	70362-46-8			20	20	5.0	0.15
Congeners (44/47/65)	PCB-44/47/65	44&47&65			20	20	5.0	0.11
2,2',3,6-Tetrachlorobiphenyl (45)	PCB-45	70362-45-7			20	20	5.0	0.14
2,2',3,6'-Tetrachlorobiphenyl (46)	PCB-46	41464-47-5			20	20	5.0	0.15
2,2',4,5-Tetrachlorobiphenyl (48)	PCB-48	70362-47-9			20	20	5.0	0.12
Congeners (69/49)	PCB-49/69	69&49			20	20	5.0	0.10
Congeners (50/53)	PCB-50/53	50&53			20	20	5.0	0.12
2,2',4,6'-Tetrachlorobiphenyl (51)	PCB-51	68194-04-7			20	20	5.0	0.12
2,2',5,5'-Tetrachlorobiphenyl (52)	PCB-52	35693-99-3			20	20	5.0	0.13
2,2',6,6'-Tetrachlorobiphenyl (54)	PCB-54	15968-05-5			2.0	2.0	1.6	0.097
2,3,3',4-Tetrachlorobiphenyl (55)	PCB-55	74338-24-2			20	20	5.0	0.31
2,3,3',4'-Tetrachlorobiphenyl (56)	PCB-56	41464-43-1			20	20	5.0	0.32
2,3,3',5-Tetrachlorobiphenyl (57)	PCB-57	70424-67-8			20	20	5.0	0.30
2,3,3',5'-Tetrachlorobiphenyl (58)	PCB-58	41464-49-7			20	20	5.0	0.29
Congeners (59/62/75)	PCB-59/62/75	59&62&75			20	20	5.0	0.088
2,3,4,4'-Tetrachlorobiphenyl (60)	PCB-60	33025-41-1			20	20	5.0	0.31
Congeners (61/70/74/76)	PCB-61/70/74/76	61&70&74&76			20	20	5.0	0.29
2,3,4',5-Tetrachlorobiphenyl (63)	PCB-63	74472-34-7			20	20	5.0	0.28
2,3,4',6-Tetrachlorobiphenyl (64)	PCB-64	52663-58-8			20	20	5.0	0.085
2,3',4,4'-Tetrachlorobiphenyl (66)	PCB-66	32598-10-0			20	20	5.0	0.31
2,3',4,5-Tetrachlorobiphenyl (67)	PCB-67	73575-53-8			20	20	5.0	0.28
2,3',4,5'-Tetrachlorobiphenyl (68)	PCB-68	73575-52-7			20	20	5.0	0.27
2,3',5,5'-Tetrachlorobiphenyl (72)	PCB-72	41464-42-0			20	20	5.0	0.29
2,3',5',6-Tetrachlorobiphenyl (73)	PCB-73	74338-23-1			20	20	5.0	0.094
3,3',4,4'-Tetrachlorobiphenyl (77)	PCB-77	32598-13-3	0.0001	240	120	2.0	1.6	0.30
3,3',4,5-Tetrachlorobiphenyl (78)	PCB-78	70362-49-1			20	20	5.0	0.31
3,3',4,5'-Tetrachlorobiphenyl (79)	PCB-79	41464-48-6			20	20	5.0	0.27
3,3',5,5'-Tetrachlorobiphenyl (80)	PCB-80	33284-52-5			20	20	5.0	0.26
3,4,4',5-Tetrachlorobiphenyl (81)	PCB-81	70362-50-4	0.0003	81	40.5	2.0	1.6	0.29
2,2',3,3',4-Pentachlorobiphenyl (82)	PCB-82	52663-62-4			20	20	5.0	0.60
2,2',3,3',5-Pentachlorobiphenyl (83)	PCB-83	60145-20-2			20	20	5.0	0.55
2,2',3,3',6-Pentachlorobiphenyl (84)	PCB-84	52663-60-2			20	20	5.0	0.59
Congeners (117/116/85)	PCB-85/116/117	117&116&85			20	20	5.0	0.41
Congeners (86/87/97/108/119/125)	PCB-86/87/97/108/119/125	86&87&97&108&			20	20	5.0	0.42
Congeners (88/91)	PCB-88/91	88&91			20	20	5.0	0.50
2,2',3,4,6'-Pentachlorobiphenyl (89)	PCB-89	73575-57-2			20	20	5.0	0.53

SAP Worksheet #15-2 — Reference Limits and Evaluation Tables (continued)

Matrix: TI

Analytical Group: PCBCONG

Analyte		CAS No.[3]	WHO 2005 TEFs	HHRA SL[2, 5] (pg/g)	Project QL Goal[1] (pg/g)	Laboratory Specific Limits (pg/g)		
						LOQs	LODs	DLs[4]
Congeners (113/90/101)	PCB-90/101/113	113&90&101			20	20	5.0	0.43
2,2',3,5,5'-Pentachlorobiphenyl (92)	PCB-92	52663-61-3			20	20	5.0	0.51
Congeners (93/100)	PCB-93/100	93&100			20	20	5.0	0.49
2,2',3,5,6'-Pentachlorobiphenyl (94)	PCB-94	73575-55-0			20	20	5.0	0.54
2,2',3,5',6-Pentachlorobiphenyl (95)	PCB-95	38379-99-6			20	20	5.0	0.50
2,2',3,6,6'-Pentachlorobiphenyl (96)	PCB-96	73575-54-9			20	20	5.0	0.068
Congeners (98/102)	PCB-98/102	98&102			20	20	5.0	0.49
2,2',4,4',5-Pentachlorobiphenyl (99)	PCB-99	38380-01-7			20	20	5.0	0.50
2,2',4,5',6-Pentachlorobiphenyl (103)	PCB-103	60145-21-3			20	20	5.0	0.46
2,2',4,6,6'-Pentachlorobiphenyl (104)	PCB-104	56558-16-8			2.0	2.0	1.6	0.060
2,3,3',4,4'-Pentachlorobiphenyl (105)	PCB-105	32598-14-4	0.00003	810	405	2.0	1.6	0.39
2,3,3',4,5-Pentachlorobiphenyl (106)	PCB-106	70424-69-0			20	20	5.0	0.43
Congeners (107/124)	PCB-107/124	107&124			20	20	5.0	0.30
2,3,3',4,6-Pentachlorobiphenyl (109)	PCB-109	74472-35-8			20	20	5.0	0.42
Congeners (110/115)	PCB-110/115	110&115			20	20	5.0	0.37
2,3,3',5,5'-Pentachlorobiphenyl (111)	PCB-111	39635-32-0			20	20	5.0	0.36
2,3,3',5,6-Pentachlorobiphenyl (112)	PCB-112	74472-36-9			20	20	5.0	0.36
2,3,4,4',5-Pentachlorobiphenyl (114)	PCB-114	74472-37-0	0.00003	810	405	2.0	1.6	0.38
2,3',4,4',5-Pentachlorobiphenyl (118)	PCB-118	31508-00-6	0.00003	810	405	2.0	1.6	0.37
2,3',4,5,5'-Pentachlorobiphenyl (120)	PCB-120	68194-12-7			20	20	5.0	0.36
2,3',4,5',6-Pentachlorobiphenyl (121)	PCB-121	56558-18-0			20	20	5.0	0.36
2,3,3',4',5'-Pentachlorobiphenyl (122)	PCB-122	76842-07-4			20	20	5.0	0.42
2,3',4,4',5'-Pentachlorobiphenyl (123)	PCB-123	65510-44-3	0.00003	810	405	2.0	1.6	0.40
3,3',4,4',5-Pentachlorobiphenyl (126)	PCB-126	57465-28-8	0.1	0.24	0.24	2.0	1.6	0.42
3,3',4,5,5'-Pentachlorobiphenyl (127)	PCB-127	39635-33-1			20	20	5.0	0.37
Congeners (128/166)	PCB-128/166	128&166			20	20	5.0	0.24
Congeners (138/163/129)	PCB-129/138/163	138&163&129			20	20	5.0	0.23
2,2',3,3',4,5'-Hexachlorobiphenyl (130)	PCB-130	52663-66-8			20	20	5.0	0.33
2,2',3,3',4,6-Hexachlorobiphenyl (131)	PCB-131	61798-70-7			20	20	5.0	0.30
2,2',3,3',4,6'-Hexachlorobiphenyl (132)	PCB-132	38380-05-1			20	20	5.0	0.30
2,2',3,3',5,5'-Hexachlorobiphenyl (133)	PCB-133	35694-04-3			20	20	5.0	0.30
Congeners (134/143)	PCB-134/143	134&143			20	20	5.0	0.31
Congeners (151/135)	PCB-135/151	151&135			20	20	5.0	0.28
2,2',3,3',6,6'-Hexachlorobiphenyl (136)	PCB-136	38411-22-2			20	20	5.0	0.21
2,2',3,4,4',5-Hexachlorobiphenyl (137)	PCB-137	35694-06-5			20	20	5.0	0.21
Congeners (139/140)	PCB-139/140	139&140			20	20	5.0	0.27
2,2',3,4,5,5'-Hexachlorobiphenyl (141)	PCB-141	52712-04-6			20	20	5.0	0.33
2,2',3,4,5,6-Hexachlorobiphenyl (142)	PCB-142	41411-61-4			20	20	5.0	0.33

SAP Worksheet #15-2 — Reference Limits and Evaluation Tables (continued)

Matrix:	TI							
Analytical Group:	PCBCONG							
Analyte		**CAS No.[3]**	**WHO 2005 TEFs**	**HHRA SL[2, 5] (pg/g)**	**Project QL Goal[1] (pg/g)**	**Laboratory Specific Limits (pg/g)**		
						LOQs	**LODs**	**DLs[4]**
2,2',3,4,5',6-Hexachlorobiphenyl (144)	PCB-144	68194-14-9			20	20	5.0	0.27
2,2',3,4,6,6'-Hexachlorobiphenyl (145)	PCB-145	74472-40-5			20	20	5.0	0.21
2,2',3,4',5,5'-Hexachlorobiphenyl (146)	PCB-146	51908-16-8			20	20	5.0	0.22
Congeners (147/149)	PCB-147/149	147&149			20	20	5.0	0.27
2,2',3,4',5,6'-Hexachlorobiphenyl (148)	PCB-148	74472-41-6			20	20	5.0	0.28
2,2',3,4',6,6'-Hexachlorobiphenyl (150)	PCB-150	68194-08-1			20	20	5.0	0.19
2,2',3,5,6,6'-Hexachlorobiphenyl (152)	PCB-152	68194-09-2			20	20	5.0	0.20
Congeners (153/168)	PCB-153/168	153&168			20	20	5.0	0.20
2,2',4,4',5,6'-Hexachlorobiphenyl (154)	PCB-154	60145-22-4			20	20	5.0	0.25
2,2',4,4',6,6'-Hexachlorobiphenyl (155)	PCB-155	33979-03-2			2.0	2.0	1.6	0.21
Congeners (156/157)	PCB-156/157	156&157	0.00003	810	405	2.0	1.6	0.60
2,3,3',4,4',6-Hexachlorobiphenyl (158)	PCB-158	74472-42-7			20	20	5.0	0.20
2,3,3',4,5,5'-Hexachlorobiphenyl (159)	PCB-159	39635-35-3			20	20	5.0	0.49
2,3,3',4,5,6-Hexachlorobiphenyl (160)	PCB-160	41411-62-5			20	20	5.0	0.31
2,3,3',4,5',6-Hexachlorobiphenyl (161)	PCB-161	74472-43-8			20	20	5.0	0.24
2,3,3',4',5,5'-Hexachlorobiphenyl (162)	PCB-162	39635-34-2			20	20	5.0	0.49
2,3,3',4',5',6-Hexachlorobiphenyl (164)	PCB-164	74472-45-0			20	20	5.0	0.29
2,3,3',5,5',6-Hexachlorobiphenyl (165)	PCB-165	74472-46-1			20	20	5.0	0.23
2,3',4,4',5,5'-Hexachlorobiphenyl (167)	PCB-167	52663-72-6	0.00003	810	405	2.0	1.6	0.43
3,3',4,4',5,5'-Hexachlorobiphenyl (169)	PCB-169	32774-16-6	0.03	0.81	0.81	2.0	1.6	0.57
2,2',3,3',4,4',5-Heptachlorobiphenyl (170)	PCB-170	35065-30-6			20	20	5.0	1.0
Congeners (171/173)	PCB-171/173	171&173			20	20	5.0	0.99
2,2',3,3',4,5,5'-Heptachlorobiphenyl (172)	PCB-172	52663-74-8			20	20	5.0	0.98
2,2',3,3',4,5,6'-Heptachlorobiphenyl (174)	PCB-174	38411-25-5			20	20	5.0	1.1
2,2',3,3',4,5',6-Heptachlorobiphenyl (175)	PCB-175	40186-70-7			20	20	5.0	0.20
2,2',3,3',4,6,6'-Heptachlorobiphenyl (176)	PCB-176	52663-65-7			20	20	5.0	0.14
2,2',3,3',4,5',6'-Heptachlorobiphenyl (177)	PCB-177	52663-70-4			20	20	5.0	1.0
2,2',3,3',5,5',6-Heptachlorobiphenyl (178)	PCB-178	52663-67-9			20	20	5.0	0.21
2,2',3,3',5,6,6'-Heptachlorobiphenyl (179)	PCB-179	52663-64-6			20	20	5.0	0.15
Congeners (180/193)	PCB-180/193	180&193			20	20	5.0	0.79
2,2',3,4,4',5,6-Heptachlorobiphenyl (181)	PCB-181	74472-47-2			20	20	5.0	0.86
2,2',3,4,4',5,6'-Heptachlorobiphenyl (182)	PCB-182	60145-23-5			20	20	5.0	0.18
2,2',3,4,4',5',6-Heptachlorobiphenyl (183)	PCB-183	52663-69-1			20	20	5.0	0.62
2,2',3,4,4',6,6'-Heptachlorobiphenyl (184)	PCB-184	74472-48-3			20	20	5.0	0.15
2,2',3,4,5,5',6-Heptachlorobiphenyl (185)	PCB-185	52712-05-7			20	20	5.0	1.1
2,2',3,4,5,6,6'-Heptachlorobiphenyl (186)	PCB-186	74472-49-4			20	20	5.0	0.15
2,2',3,4',5,5',6-Heptachlorobiphenyl (187)	PCB-187	52663-68-0			20	20	5.0	0.18
2,2',3,4',5,6,6'-Heptachlorobiphenyl (188)	PCB-188	74487-85-7			2.0	2.0	1.6	0.15

SAP Worksheet #15-2 — Reference Limits and Evaluation Tables (continued)

Matrix:	TI							
Analytical Group:	PCBCONG							
Analyte		**CAS No.[3]**	**WHO 2005 TEFs**	**HHRA SL[2, 5] (pg/g)**	**Project QL Goal[1] (pg/g)**	**Laboratory Specific Limits (pg/g)**		
						LOQs	**LODs**	**DLs[4]**
2,3,3',4,4',5,5'-Heptachlorobiphenyl (189)	PCB-189	39635-31-9	0.00003	810	405	2.0	1.6	0.39
2,3,3',4,4',5,6-Heptachlorobiphenyl (190)	PCB-190	41411-64-7			20	20	5.0	0.71
2,3,3',4,4',5',6-Heptachlorobiphenyl (191)	PCB-191	74472-50-7			20	20	5.0	0.70
2,3,3',4,5,5',6-Heptachlorobiphenyl (192)	PCB-192	74472-51-8			20	20	5.0	0.75
2,2',3,3',4,4',5,5'-Octachlorobiphenyl (194)	PCB-194	35694-08-7			20	20	5.0	0.43
2,2',3,3',4,4',5,6-Octachlorobiphenyl (195)	PCB-195	52663-78-2			20	20	5.0	0.49
2,2',3,3',4,4',5,6'-Octachlorobiphenyl (196)	PCB-196	42740-50-1			20	20	5.0	0.33
2,2',3,3',4,4',6,6'-Octachlorobiphenyl (197)	PCB-197	33091-17-7			20	20	5.0	0.19
Congeners (198/199)	PCB-198/199	198&199			20	20	5.0	0.36
2,2',3,3',4,5,6,6'-Octachlorobiphenyl (200)	PCB-200	52663-73-7			20	20	5.0	0.25
2,2',3,3',4,5',6,6'-Octachlorobiphenyl (201)	PCB-201	40186-71-8			20	20	5.0	0.36
2,2',3,3',5,5',6,6'-Octachlorobiphenyl (202)	PCB-202	2136-99-4			2.0	2.0	1.6	0.24
2,2',3,4,4',5,5',6-Octachlorobiphenyl (203)	PCB-203	52663-76-0			20	20	5.0	0.35
2,2',3,4,4',5,6,6'-Octachlorobiphenyl (204)	PCB-204	74472-52-9			20	20	5.0	0.26
2,3,3',4,4',5,5',6-Octachlorobiphenyl (205)	PCB-205	74472-53-0			2.0	2.0	1.6	0.35
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (206)	PCB-206	40186-72-9			2.0	2.0	1.6	0.75
2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (207)	PCB-207	52663-79-3			20	20	5.0	0.49
2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (208)	PCB-208	52663-77-1			2.0	2.0	1.6	0.47
Decachlorobiphenyl (209)	PCB-209	2051-24-3			2.0	2.0	1.6	0.13
Toxic Equivalents (Total TEQ)[6]	TBD	TOTALTEQ			N/A	N/A	N/A	N/A
Polychlorinated biphenyls (PCBs)[7]	TBD	1336-36-3			N/A	N/A	N/A	N/A
Total non-dioxin-like PCBs[8]	TBD	TBD			N/A	N/A	N/A	N/A

Notes:

Screening levels are shaded if LOD > screening level. Refer to Worksheet #11 Section "What are the PALs?"

1. The PQL Goal is the lesser of applicable screening levels for PCB-126 and PCB-169, is 1/2 the lesser of applicable screening levels for other congeners with a screening level, and is the laboratory-specific LOQ for congeners without a screening level
2. Tissue PCBCONG results are reported on an as-received basis (but accompanied by a result for percent lipids).
3. Some CAS numbers are contractor-specific.
4. For PCBCONG, the DL is set to the EDL. EDLs are sample-specific and calculated for each analyte in each sample. The DLs shown above are examples from a past run (for illustration purposes only). The sample-specific EDL is an estimate made by the instrument of the concentration of a given chemical that would have to be present to produce a signal with a peak height of at least 2.5 times the background signal level. The EDL is adjusted for sample size, dilution, and so forth.
5. The HHRA SL shown for PCB 156/157 is actually for that PCB-156 or PCB-157.
6. Total TEQ is calculated by multiplying each detected dioxin-like congener result by its TEF and summing up. In Region II, the Total TEQ need not be compared to a SL when the individual congeners are compared to screening levels.
7. Total PCBs is the sum of detected concentrations.
8. "Total non-dioxin-like PCBs" is defined as Polychlorinated biphenyls (PCBs) minus the sum of the detected dioxin-like congeners (those with a TEF).

SAP Worksheet #15-3 — Reference Limits and Evaluation Tables

Matrix:	TI					
Analytical Group:	WCHEM					
Analyte	**CAS No.[1]**	**PIL[2] (%)**	**Project QL Goal[3] (%)**	**Laboratory Specific Limits[3] (%)**		
				LOQs	**LODs**	**DLs**
% Solids	%SOLIDS	N/A	N/A	N/A	N/A	N/A
Lipids (%)	LIPIDS	N/A	N/A	N/A	N/A	N/A

Notes:
1. Some CAS numbers are contractor-specific.
2. There are no Project Indicator Limits (PILs) for these constituents because % Solids and % Lipids are used to determine results by either basis.
3. There are no PQL Goals because LOQs (and LODs and DLs) are not applicable to % Solids and % Lipids.

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SAP Worksheet #17 — Sampling Design and Rationale

The proposed sampling locations are shown in **Figures 4** (SWMU 6) **and 5** (Background). Fish and crab collection will be attempted across all areas of the SMWU 6 lagoon. The rationale for each sample is presented below:

- Four gutted, edible-size fish samples (FS01 through FS04) to characterize concentrations of constituents of interest in edible-size fish (expected to be snook and mullet based on previous surface water and sediment sampling efforts) within SWMU 6. If snook and/or mullet are not present, other edible-type fish will be collected.
- Four whole-body, edible-size blue crab samples (CRB01 through CRB04) to characterize concentrations of constituents of interest in edible-size blue crab (3 inches width from point-to-point carapace). If edible-size blue crabs are not present, multiple smaller size blue crab will be collected to obtain the required mass for laboratory analysis of the particular sample.
- Four background gutted, edible-size fish samples (FS05 through FS08) will be collected from Laguna Punta Arenas to characterize background concentrations of constituents of interest in edible-size fish. The goal will be to collect the same fish species and approximate size as the fish samples collected from SMWU 6; fish samples will be collected from SWMU 6 prior to sampling background so that the target fish species and characteristics can be identified.
- Four background whole-body, edible-size blue crab samples (CRB05 through CRB08) will be collected from Laguna Punta Arenas to characterize background concentrations of constituents of interest in edible-size blue crab. If edible-size blue crabs are not present, multiple smaller size blue crab will be collected to obtain the required mass for laboratory analysis of the particular sample.
- All fish and blue crab samples will be analyzed for PCB congeners, lead, thallium, and zinc.

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

Sampling Location / ID Number	Matrix	Depth	Analytical Group	Number of Samples	Sampling SOP Reference
Fish					
VWW06-FS01 / VWW06-FS01-MMYY VWW06-FS01 / VWW06-FS01P-MMYY	Fish Tissue	N/A	METAL, PCBCONG, and WCHEM	2 (FD)	See Worksheet #21
VWW06-FS02 / VWW06-FS02-MMYY				1	
VWW06-FS03 / VWW06-FS03-MMYY VWW06-FS03 / VWW06-FS03-MMYY-MS VWW06-FS03 / VWW06-FS03-MMYY-SD				3 (MS/MSD)	
VWW06-FS04 / VWW06-FS04-MMYY				1	
Fish Background					
VWW06-FS05 / VWW06-FS05-MMYY VWW06-FS05 / VWW06-FS05P-MMYY	Fish Tissue	N/A	METAL, PCBCONG, and WCHEM	2 (FD)	See Worksheet #21
VWW06-FS06 / VWW06-FS06-MMYY				1	
VWW06-FS07 / VWW06-FS07-MMYY VWW06-FS07 / VWW06-FS07-MMYY-MS VWW06-FS07 / VWW06-FS07-MMYY-SD				3 (MS/MSD)	
VWW06-FS08 / VWW06-FS08-MMYY				1	
Crab					
VWW06-TI01 / VWW06-CRB01-MMYY VWW06-TI01 / VWW06-CRB01P-MMYY	Crab Tissue	N/A	METAL, PCBCONG, and WCHEM	2 (FD)	See Worksheet #21
VWW06-TI02 / VWW06-CRB02-MMYY				1	
VWW06-TI03 / VWW06-CRB03-MMYY VWW06-TI03 / VWW06-CRB03-MMYY-MS VWW06-TI03 / VWW06-CRB03-MMYY-SD				3 (MS/MSD)	
VWW06-TI04 / VWW06-CRB04-MMYY				1	
Crab Background					
VWW06-TI05 / VWW06-CRB05-MMYY VWW06-TI05 / VWW06-CRB05P-MMYY	Crab Tissue	N/A	METAL, PCBCONG, and WCHEM	2 (FD)	See Worksheet #21
VWW06-TI06 / VWW06-CRB06-MMYY				1	
VWW06-TI07 / VWW06-CRB07-MMYY VWW06-TI07 / VWW06-CRB07-MMYY-MS VWW06-TI07 / VWW06-CRB07-MMYY-SD				3 (MS/MSD)	
VWW06-TI08 / VWW06-CRB08-MMYY				1	

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SAP Worksheet #19 — Field Sampling Requirements Table

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference	Containers[2]	Sample Volume[1]	Preservation Requirements	Maximum Holding Time
TI	METAL	BR-0070, BR-0060 / EPA 1638M	One of 1gal Ziploc bag (double-bagged)	0.5g (min.); 10g (pref.) 2g (min. for QA/QC); 30g (pref. for QA/QC)	field: ≤ 6°C but not frozen lab: ≤ -15°C	1 year
	PCBCONG	WS-IDP-0013, WS-ID-0013 / EPA 1668A		10g (min.); 15g (pref.) 30g (min. for QA/QC); 45g (pref. for QA/QC)	field: ≤ 6°C but not frozen lab: ≤ -10°C	1 year / 45 days
	WCHEM (%Solids)	BR-1501 / SM 2540G		1g (min.); 5g (pref.) 2g (min. for QA/QC); 15g (pref. for QA/QC)	None (OK to cool)	N/A
	WCHEM (%Lipids)	WS-IDP-0013		20g (min.); 15g (pref.) 30g (min. for QA/QC); 45g (pref. for QA/QC)	None (OK to cool)	N/A

Notes:
1. Mass required for QA/QC sample includes that for the normal sample as well.
2. PCBCONG and %Lipids fractions shall be shipped to Test America-West Sacramento in one of 4oz glass jar (share).

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SAP Worksheet #20 — Field Quality Control Sample Summary Table

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of MS/MSD Pairs	No. of Homogenization Blanks	No. of VOA Trip Blanks	No. of PT Samples	Total No. of Samples to Lab
Site Fish								
TI	METAL	4	1	1	1			8
	PCBCONG	4	1	1	1			8
	WCHEM (%Solids)	4	1					5
	WCHEM (%Lipids)	4	1					5
Background Fish								
TI	METAL	4	1	1				7
	PCBCONG	4	1	1				7
	WCHEM (%Solids)	4	1					5
	WCHEM (%Lipids)	4	1					5
Site Crab								
TI	METAL	4	1	1	1			8
	PCBCONG	4	1	1	1			8
	WCHEM (%Solids)	4	1					5
	WCHEM (%Lipids)	4	1					5
Background Crab								
TI	METAL	4	1	1				7
	PCBCONG	4	1	1				7
	WCHEM (%Solids)	4	1					5
	WCHEM (%Lipids)	4	1					5

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SAP Worksheet #21 — Project Sampling SOP References Table

Reference numbers refer to the SOP number in the Master Protocols.

Reference Number	Title, Revision Date and / or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
SOPs C-1	Calibration and Measurement with Field Instruments	CH2M HILL	Multi-parameter surface water monitoring instrument	N	
SOP	Fish Sampling Using Gill Nets, Seines, and Cast Nets	CH2M HILL	Gill nets, seines, cast nets	Y	New SOP, not yet in Master Protocols document
SOP	Crab Sampling Using Traps	CH2M HILL	Traps	Y	New SOP, not yet in Master Protocols document
SOP	Preparation of Fish and Shellfish Tissue Samples	CH2M HILL	Preparation of fish and shellfish tissue samples	Y	New SOP, not yet in Master Protocols document
SOPs H-1	Preparing Field Log Books	CH2M HILL	Log book	N	
SOPs H-4	Chain-of-Custody	CH2M HILL	SOP, tape, custody seals, electronic chain of custody forms	N	
SOPs H-5	Packaging and Shipping Procedures for Samples Not Considered Dangerous Goods	CH2M HILL	SOP	N	

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

Field Equipment	Calibration Activity	Maintenance Activity	Testing/ Inspection Activity	Frequency	Acceptance Criteria	Corrective Action (CA)	Resp. Person	SOP Reference
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 probe using YSI Calibration Standard Solution			Daily, before use	±3%	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		During calibration of other probes, check these readings against the day's atmospheric pressure and ambient temperature Check sensor for bubbles and membrane for wrinkles or tear	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 multi-meter	Calibrate probe using multiple Calibration Standard Solutions	Check mechanical and electronic parts, verify system continuity, check battery, and clean probes. Calibration check.	Visual Inspection	Daily before use, at the end of the day (if practicable), and when unstable readings occur.	Stable readings 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

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SAP Worksheet #23 — Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and/or Number	Date Last Revisited if not Revised[1]	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Variance to QSM	Modified for Project Work?
BR-0060	Determination of Trace Elements by Inductively Coupled Plasma - Mass Spectrometry using a Perkin Elmer ELAN DRC II; 5/24/10; rev. 003C	6/1/2011	Definitive	TI / METAL	ICP-MS	Brooks Rand Labs, LLC	None	Y[6]
BR-0070	Total Metals Digestion for Biota Matrices; 1/22/10; rev. 003A	5/17/2011	Definitive	TI / METAL	N/A	Brooks Rand Labs, LLC	None	N
BR-0106	Sample Homogenization; 9/3/09; rev. 003		N/A	TI / METAL, PCBCONG	N/A	Brooks Rand Labs, LLC	None	Y[2,5]
BR-0300	Receipt of Samples; 1/29/10; rev. 011		N/A	N/A	N/A	Brooks Rand Labs, LLC	None	N
BR-0301	Sample Custody Maintenance and Tracking; 2/16/09; rev. 006		N/A	N/A	N/A	Brooks Rand Labs, LLC	None	N
BR-0304	Sample Processing; 8/24/09; rev. 007		N/A	N/A	N/A	Brooks Rand Labs, LLC	None	N
BR-1501	Dry Weight Determination; 12/9/09; rev. 005		Screening	TI / WCHEM	None	Brooks Rand Labs, LLC	None	N
WS-ID-0013	PCB Analysis by HRGC/HRMS; 10/8/10; rev. 4		Definitive	TI / PCBCONG	HRGC/HRMS	TestAmerica-West Sacramento	See Note[4]	N[3]
WS-IDP-0013	PCB Preparation for Analysis by HRGC/HRMS (Method 1668A); 9/3/10; rev. 2		Definitive, Screening	TI / PCBCONG, WCHEM	N/A, None	TestAmerica-West Sacramento	None	N
WS-QA-0003	Sample Receipt and Procedures; 6/17/11; Rev. 11.4		N/A	N/A	N/A	TestAmerica-West Sacramento	None	N
WS-WI-0018	Tissue Sample Handling and Extraction for a Variety of Methods; 1/22/10; rev. 3.0		N/A	N/A	N/A	TestAmerica-West Sacramento	None	N

Notes:

The modified metals digestion and analysis methods have been reviewed by the project chemist and Navy QA officer and found suitable for this study.

Highlighted SOPs are in review at the time of preparation of this document (9/27/11).

1. Non-analytical SOPs do not require an annual review cycle.
2. **For Crabs:** Whole crabs will not require any unique laboratory preparation. The entire crab (with all claws) will be homogenized. Crabs will not be boiled or dissected in any way prior to processing. **For Fish:** Whole fish will require removal of the entire contents of the gut cavity prior to tissue homogenization. The laboratory will access the gut cavity by cutting with a decontaminated blade along the belly from the base of the pelvic fin to the vent at the base of the anal fin. All gut contents will be removed and discarded, followed by a deionized water flush of the body cavity to remove any loose remnants.
3. **For EPA 1668A:** The laboratory will adhere to the limits from EPA 1668C, which are described within this UFP-SAP.
4. The 5-point ICAL for PCBCONG will be carried-out only for the congeners required by EPA Method 1668. As per the method, all other congeners will be calculated off a 1-point calibration. Second source samples will be controlled only for the congeners that have a 5-point calibration. The Laboratory Control Sample (LCS) will be spiked and controlled only for the congeners which have a 5-point calibration.
5. The decontamination procedure for tissue processing and homogenization will be modified to include an acetone rinse.
6. Blank subtraction will not be allowed for analysis of metals via BR-0060.

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SAP Worksheet #24 — Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
HRGC/HRMS (PCBCONG)	Tune / Mass Resolution Check (PFK)	At the beginning and the end of each 12-hour period of analysis.	Resolving power ≥ 10,000 at m/z = 304.9842 and m/z = 380.9760 + 5ppm of expected mass. Lock-mass ion between lowest and highest masses for each descriptor and level of reference ≤ 10% full-scale deflection. End of run check must be ≥ 5,000	Retune instrument & verify. Assess data for impact if end resolution is less than 10,000. Narrate or reinject as necessary.	Analyst	WS-ID-0013
	GC Column Performance Check (CPSM/WDM per method)	Prior to ICAL or calibration verification.	The congener pairs 23/34 and 182/187 are checked for chromatographic resolution. The valley between each pair must be less than 40% of the shorter of the two peaks . The CS-3 (CCV) is used to define chromatographic windows. First and last eluter must be present in each window.	1) Readjust windows. 2) Evaluate system. 3) Perform maintenance. 4) Reanalyze CPSM.		
	Minimum five-point initial calibration for target analytes. Lowest concentration standard at or near the reporting limit. (ICAL)	ICAL prior to sample analysis, as needed by the CCV failure, and when a new lot is used as a standard source for CCV, internal standard, or recovery standard solutions.	RSD ≤ 20% for response factors for Toxic/LOC compounds. The toxics/LOC compounds are the 27 congeners that are calibrated by a multipoint curve. They encompass the WHO list toxic congeners and the first and last eluter for each level of chlorination (LOC). All other congeners are quantified off of a daily single point standard.	Evaluate standard and instrument response. If problem with instrument (autosampler failure, response poor, etc) or standards, correct as appropriate, then repeat initial calibration.		
	Second-source calibration verification (ICV)	Immediately following ICAL.	All project analytes within ±30% of the expected value from the ICAL.	Evaluate standards and instrument response. If it is an issue with standards, then repeat the ICV or remake standards and repeat ICV. Repeat ICAL if failure re-occurs.		
	Calibration Verification (CCV)	At the beginning of each 12-hour period.	Ion abundance ratios in accordance with Table II of WS-ID-0013. RF for unlabelled standards within ±30%D of average RF from ICAL for Toxic/LOC compounds (see description in ICAL). RF for labeled standards within ± 50%D of average RF from ICAL.	Correct problem and then repeat CCV. If failure re-occurs, then repeat ICAL and reanalyze all samples analyzed since last successful CCV.		
ICP-MS (METAL)	Instrument Tuning	Prior to ICAL each day	Mass Cal ≤ 0.1 amu from true; resolution < 0.9 amu full width at 10% peak height. Stability, RSD ≤ 5% for 4 replicates.	Retune instrument. Flagging of data is not acceptable. No analysis may be performed without a valid MS tune.	Analyst	BR-0060
	Calibration Standards	Analyze once per analytical day.	Correlation coefficient ≥ 0.995, 1st standard ≤ MRL with ±20% rec.	Reanalyze suspect calibration standard. If criteria still not met, then reprepare standards and recalibrate the instrument.		
	Independent Calibration Verification (ICV)	1 following instrument calibration	Recovery = 90-110%	Correct problem prior to continuing analysis; recalibrate if necessary.		
	Check Calibration Verification (CCV)	At beginning and end and 1 per 10 sample preparations	Recovery = 90-110%	Halt analysis, correct problem, recalibrate, and reanalyze affected samples (Note: If internal standards are not run, then CCV standards must be analyzed at various concentrations.		
	Calibration Check Blank (CCB)	Following each CCV	< LOQ	Determine and eliminate cause of contamination. Affected samples must be reanalyzed.		

Notes:

Analytical methods and laboratory SOPs are the basis for specifications on this table.

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SAP Worksheet #25 — Analytical Instrument Calibration Table

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
ICP-MS	Parameter Setup	Physical Check	Check that the autosampler is functioning as expected. Check pump rate. Check nebulizer gas flow. Check rinse bottle.	Initially, prior to each use.	Autosampler must move to the expected position when activated. Pump rate and nebulizer glass flow within specifications. Fill rinse bottle to mark.	Reset autosampler. If problem persists, perform autosampler troubleshooting prior to instrument use. Adjust pump rate if necessary. Otherwise, perform pump troubleshooting. Adjust gas flow if needed. Otherwise, perform instrument troubleshooting.	Analyst	BR-0060
	Instrument Tuning	Instrument Performance	Refer to Worksheet #24					
	Interference Check Sample	Instrument Performance	Refer to Worksheet #28					
HRGC/HRMS	Parameter Setup	Physical check	Physical check	Initially	Correct Parameters	Reset if incorrect	Analyst	WS-ID-0013
	Tune Check	Instrument Performance	Conformance to instrument tuning.	Initially	Compliance to ion abundance criteria	Correct the problem and repeat tune check		

Notes:

Laboratory SOPs are the basis for specifications on this table.

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SAP Worksheet #26 — Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT	
Sample Collection (Personnel/Organization):	Field Team Leader John Martin/CH2M HILL
Sample Packaging (Personnel/Organization):	Sample Processor or Field Team Member (TBD)/CH2M HILL
Coordination of Shipment (Personnel/Organization):	Sample Processor or Field Team Member (TBD)/CH2M HILL
Type of Shipment/Carrier:	Overnight/FedEx
SAMPLE RECEIPT AND ANALYSIS	
Sample Receipt (Personnel/Organization):	Sample Receipt Personnel/BRL. Sample Receipt Personnel/TA. Note that all samples will be shipped to BRL who will forward PCBCONG fraction to TA.
Sample Custody and Storage (Personnel/Organization):	Sample Receipt Personnel/BRL. Sample Receipt Personnel/TA.
Sample Preparation (Personnel/Organization):	Digestion Personnel/BRL. Extraction Personnel/TA.
Sample Determinative Analysis (Personnel/Organization):	Analyst/BRL. Analyst/TA
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):	90 Days
SAMPLE DISPOSAL	
Personnel/Organization:	Environmental Health and Safety Officer/BRL. Environmental Health and Safety Officer/TA.
Number of Days from Analysis:	Samples may be disposed of 90 days after report mail date.

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SAP Worksheet #28-1 — Laboratory QC Samples Table

Matrix:	TI
Analytical Group:	METAL
Analytical Method / SOP Reference:	EPA 1638M / BR-0060

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
METALs via EPA 1638M						
Field Duplicates	Refer to Worksheet #12-1	Same as Measurement Performance Criteria	Assess laboratory homogenization procedures and precision. Examine laboratory replicate. Qualify as per Worksheet #36.	PM/FTL, Data Validator	Refer to Worksheet #12-1	Refer to Worksheet #12-1
Temperature Blank	Refer to Worksheet #12-1	Same as Measurement Performance Criteria	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, PM/FTL, Data Validator	Refer to Worksheet #12-1	Refer to Worksheet #12-1
Results reported between DL and LOQ	N/A	Apply J-flag to all results between DL and LOQ.	N/A	Analyst	Accuracy	N/A
METALs via EPA 1638M						
Internal Standards (IS)	Each standard, blank, and sample	30-120% recovery compared to calibration blank	If the responses of the internal standards in the following CCB are within the limit, rerun the sample at an additional 2X dilution. If not, then samples must be re-analyzed on a new calibration.	Analyst	Accuracy	30-120% recovery compared to calibration blank
Interference Check Solutions (ICS-A and ICS-AB)	At the beginning of each analytical run	All non-spiked analytes < LOQ. Other analytes within ±20% or ±RL if < 5X RL	Halt analysis. Identify and correct problem. Recalibrate if necessary and reanalyze affected samples.	Analyst	Accuracy	All non-spiked analytes < LOQ. Other analytes within ±20% or ±RL if < 5X RL
Homogenization Blank	One per sub-matrix (one for fish and one for crab)	The homogenization equipment must contribute less than 1/10th the total element of interest found in the sample.	Assess decontamination procedures. Quality as per Worksheet #36.	Analyst, Data Validator	Contamination	The homogenization equipment must contribute less than 1/10th the total element of interest found in the sample.
Method Blank	Minimum of 3 per batch	≤ 1/2 RL or ≤ 10% that in any sample. Or ≤ 10% of any regulatory limit.	Determine and eliminate cause of contamination. Affected samples must be reprepared and reanalyzed.	Analyst	Contamination	≤ 1/2 RL or ≤ 10% that in any sample. Or ≤ 10% of any regulatory limit.
Laboratory Replicate	Minimum of 1 per 10 client samples	RPD ≤ 20% or results within the PQL if < 5X PQL	If RPD criteria are not met, then the sample may be re-reprepared and reanalyzed, but this is not required. Sample matrix may be inhomogeneous. A post-digestion spike (PDS) can be analyzed to evaluate instrument precision.	Analyst	Precision	RPD ≤ 20% or results within the PQL if < 5X PQL
Matrix Spike (MS)	Minimum of 1 per 10 client samples. Note: one MS/MSD pair is submitted for 1 per 20 samples per matrix per site.	Recovery = 80-120%	Examine LCS. If MS (or MSD) recovery is outside specification and LCS recovery is within specification, then report and narrate.	Analyst	Accuracy	Recovery = 80-120%
Matrix Spike Duplicate (MSD)		Same as MS. RPD ≤ 20%	Corrective action due to recovery exceedance is same as MS. MS/MSD RPD exceedance necessitates qualification. Then, same corrective action as for laboratory replicate.	Analyst	Accuracy / Precision	Same as MS. RPD ≤ 20%
Dilution Test	Minimum of 1 per batch. Performed on sample with concentration > 50X LOQ.	Five-fold dilution must be within ±10% of original result.	Perform post-digestion spike addition.	Analyst	Accuracy	Five-fold dilution must be within ±10% of original result.
Post digestion spike addition	When dilution test fails or when all sample results < 100X MDL	Recovery = 75-125%	Samples must be analyzed using MSA or apply J-qualifier to all samples with same matrix for the specific analyte(s) associated with the post-digestion spike addition.	Analyst	Accuracy	Recovery = 75-125%
Laboratory Fortified Blank (LFB)	When no suitable CRM available	Recovery = 80-120%	If LFB recovery is outside of control limits, then the batch must be re-prepared and reanalyzed.	Analyst	Accuracy	Recovery = 80-120%

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

Matrix:	TI
Analytical Group:	METAL
Analytical Method / SOP Reference:	EPA 1638M / BR-0060

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Method of standard additions (MSA)	If post-digestion spike fails	N/A	Document use of MSA	Analyst	N/A	N/A
Laboratory Control Sample (LCS)	One per batch containing all analytes to be reported	Recovery = 80-120%	Correct problem and re-prepare and reanalyze all samples for failed analytes if available sample mass. If cannot re-prepare, then affected results are qualified and explained in the case narrative.	Analyst	Accuracy	Recovery = 80-120%
Standard Reference Material (SRM)	Must be matrix-matched to samples; minimum of 1 per batch	Recovery = 75-125% unless manufacturer limits are wider	If CRM true value is ≥5X the PQL and if the recovery is outside of the control limit, then batch must be re-prepared and reanalyzed. Refer to Section 10.11 of BR-0060.	Analyst	Accuracy	Recovery = 75-125% unless manufacturer limits are wider

Notes:

Analytical laboratory SOPs are the basis for specifications on this table.

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SAP Worksheet #28-2 — Laboratory QC Samples Table

(UFP-QAPP Manual Section 3.4)

Matrix:	TI
Analytical Group:	PCBCONG
Analytical Method / SOP Reference:	EPA 1668A / WS-ID-0013

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Field Duplicates	Refer to Worksheet #12-2	Same as Measurement Performance Criteria	Assess field homogenization procedures. Qualify as per Worksheet #36.	PM/FTL, Data Validator	Refer to Worksheet #12-2	Refer to Worksheet #12-2
Temperature Blank	Refer to Worksheet #12-2	Same as Measurement Performance Criteria	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, PM/FTL, Data Validator	Refer to Worksheet #12-2	Refer to Worksheet #12-2
Results reported between DL and LOQ	N/A	Apply J-flag to all results between DL and LOQ.	N/A	Analyst	Accuracy	N/A
Method Blank	One per preparation batch	No target analytes detected ≥ 1/2 LOQ or ≥ 20% of the associated regulatory limit or ≥ 5% of the sample result for the analyte, whichever is greater.	Verify instrument is not contaminated. Evaluate calibration blank & samples prior to method blank. Then, reanalyze. Evaluate to determine if a systematic issue is present within the laboratory. Correct, then re-prepare and reanalyze the method blank and all samples processed with the contaminated blank. No corrective action or qualification is necessary for totals.	Analyst	Contamination	No target analytes detected ≥ 1/2 LOQ or ≥ 20% of the associated regulatory limit or ≥ 5% of the sample result for the analyte, whichever is greater.
Internal Standards (IS)	Every field sample, standard, and QC sample	Percent recovery for each labeled compound in the sample (prior to dilutions) must be within limits specified within Table 6 of method EPA 1668C. Recovery limits are 5-145% for some labeled compounds and 10-145% for others.	Correct problem, then re-prep and reanalyze any samples associated with a failed IS.	Analyst	Accuracy	Percent recovery for each labeled compound in the sample (prior to dilutions) must be within limits specified within Table 6 of method EPA 1668C. Recovery limits are 5-145% for some labeled compounds and 10-145% for others.
Homogenization Blank	One per sub-matrix (one for fish and one for crab)	The homogenization equipment must contribute less than 1/10th the total element of interest found in the sample.	Assess decontamination procedures. Quality as per Worksheet #36.	Analyst, Data Validator	Contamination	The homogenization equipment must contribute less than 1/10th the total element of interest found in the sample.
Laboratory Control Sample (LCS)	One per preparation batch	Percent recovery within 60-135% for each congener listed in Table 6 ("OPR" column) of method EPA 1668C. Recovery limits are 60-135% for target congeners. Recovery limits are 40-145% for some labeled compounds and 15-145% for others.	Reanalyze the LCS once. If it is acceptable, then report associated data. If not, then re-prep and reanalyze the LCS and all associated samples for failed analytes if sufficient sample is available.	Analyst	Accuracy	Percent recovery within 60-135% for each congener listed in Table 6 ("OPR" column) of method EPA 1668C. Recovery limits are 60-135% for target congeners. Recovery limits are 40-145% for some labeled compounds and 15-145% for others.
Matrix Spike (MS)	One per preparation batch. Note: one MS/MSD pair is submitted for 1 per 20 samples per matrix per site.	Same limits as for LCS.	Identify problem. If not related to matrix interference, then re-extract and reanalyze MS/MSD pair and all associated samples.	Analyst	Accuracy	Same limits as for LCS.
Matrix Spike Duplicate (MSD)		Same recovery limits as for MS. RPD ≤ 20%.	Same as for MS.	Analyst	Accuracy, Precision	Same recovery limits as for MS. RPD ≤ 20%.

Notes:

Analytical methods and laboratory SOPs are the basis for specifications on this table.

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SAP Worksheet #28-3 — Laboratory QC Samples Table

(UFP-QAPP Manual Section 3.4)

Matrix:	TI
Analytical Group:	WCHEM
Analytical Method / SOP Reference:	SM 2540G, WS-IDP-0013 / BR-1501, WS-IDP-0013

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
WCHEM (%Solids) via SW 2540G						
Method Blank	Two per batch	Highest method blank detect must be ≤ MDL or ≤ 1/10 the lowest related sample result.	Reanalyze.	Analyst	Contamination	Highest method blank detect must be ≤ MDL or ≤ 1/10 the lowest related sample result.
Laboratory Replicate	One per 10 field samples	RPD ≤ 15% when results are > 5X MRL. Results within 2X MRL when results are < 5X MRL.	Reanalyze.	Analyst	Precision	RPD ≤ 15% when results are > 5X MRL. Results within 2X MRL when results are < 5X MRL.
WCHEM (%Lipids via WS-IDP-0013 and %Solids via SW 2540G)						
Field Duplicates[1]	Refer to Worksheet #12-3	Same as Measurement Performance Criteria	N/A	N/A	Refer to Worksheet #12-2	Refer to Worksheet #12-3
Temperature Blank	Refer to Worksheet #12-3	Same as Measurement Performance Criteria	Notify project chemist. Assess sample packaging and shipment procedures.	Laboratory PM, PM/FTL	Refer to Worksheet #12-2	Refer to Worksheet #12-3

Notes:
Laboratory SOPs are the basis for specifications on this table.
1. It is not necessary to assess the field precision for WCHEM analyses. However, it is necessary to have %Lipids and %Solids results for field duplicates.

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SAP Worksheet #30 — Analytical Services Tables

Matrix	Analytical Group	Sample Locations / ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory / Organization	Backup Laboratory / Organization
TI	METAL	32	BR-0070, BR-0060 / EPA 1638M	Expedited 14 Calendar-day TAT	Brooks Rand Labs 3958 6th Ave NW Seattle, WA 98107 POC: Jen Hartmann (206) 753-6143	N/A
	PCBCONG	16	WS-IDP-0013, WS-ID-0013 / EPA 1668A		TestAmerica, Inc. 880 Riverside Parkway West Sacramento, CA 95605 POC: Karen Sellers (916) 374-4442	N/A
	WCHEM (%Solids)	32	BR-1501 / SM 2540G		Brooks Rand Labs, LLC	N/A
	WCHEM (%Lipids)	16	WS-IDP-0013		Test America - West Sacramento	N/A

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

Data Review Input	Description	Responsible for Verification	Step I / IIa / IIb[1]	Internal / External[2]
Field Notebooks	Field notebooks will be reviewed internally and placed into the project file for archival at project closeout.	FTL/CH2M HILL (John Martin)	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.	FTL/CH2M HILL (John Martin) Hillary Ott/CH2M HILL (PDM)	Step I	Internal / External
Sample Condition Upon Receipt	Any discrepancies, missing, or broken containers will be communicated to the PDM in the form of laboratory logins.	Hillary Ott/CH2M HILL (PDM)	Step I	External
Documentation of Laboratory Method Deviations	Laboratory Method Deviations will be discussed and approved by the PC. Documentation will be incorporated into the case narrative which becomes part of the final hardcopy data package.	Michael Zamboni/CH2M HILL (PC)	Step I	External
Electronic Data Deliverables	Electronic Data Deliverables will be compared against hardcopy laboratory results (10% check).	Hillary Ott/CH2M HILL (PDM)	Step I	External
Case Narrative	Case narratives will be reviewed by the DV during the data validation process. This is verification that they were generated and applicable to the data packages.	Laura Maschoff/DataQual (DV)	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.	Frank McFarland/BRL (Laboratory QAO) Doug Weir/TA (Laboratory QAO)	Step I	Internal
Laboratory Data	The data will be verified for completeness by a PDM.	Hillary Ott/CH2M HILL (PDM)	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.	John Swenfurth/CH2M HILL (PM) Michael Zamboni/CH2M HILL (PC)	Step I	Internal
Corrective Action Reports	CA reports will be reviewed by the PC or PM and placed into the project file for archival at project closeout.	John Swenfurth/CH2M HILL (PM) Michael Zamboni/CH2M HILL (PC)	Step I	External
Laboratory Methods	Ensure the laboratory analyzed samples using the correct methods.	Michael Zamboni/CH2M HILL (PC)	Step IIa	External
Target Compounds List / Target Analyte List	Ensure the laboratory reported all analytes from each analysis group as per Worksheet 15.	Michael Zamboni/CH2M HILL (PC)	Step IIa	External
Reporting Limits	Ensure the laboratory met the project-designated quantitation limits as per Worksheet 15. If quantitation limits were not met, the reason will be determined and documented.	Michael Zamboni/CH2M HILL (PC)	Step IIb	External
Laboratory SOPs	Ensure that approved analytical laboratory SOPs were followed.	Laura Maschoff/DataQual (DV)	Step IIa	External
Sample Chronology	Holding times from collection to extraction or analysis and from extraction to analysis will be considered by the DV during the data validation process.	Laura Maschoff/DataQual (DV)	Step IIa / IIb	External
Raw Data	10 percent review of raw data to confirm laboratory calculations.	Laura Maschoff/DataQual (DV)	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.	FTL/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 (DV)	Step IIa	External
Documentation of Field QC Sample Results	Establish that all required QAPP QC samples were run and met limits.	Michael Zamboni/CH2M HILL (PC) Laura Maschoff/DataQual (DV)	Step IIb	External
Third-Party Data Validation (PCBCONG)[3]	SOP HW-46 Revision 1 "Data Validation SOP of Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by HRGC/HRMS"; August 2009. Note that the DV will use the QC limits specified in this UFP-SAP.	Laura Maschoff/DataQual (DV)	Step IIa and IIb	External
Third-Party Data Validation (METAL)[3]	Analytical methods and laboratory SOPs, as presented in this UFP-SAP, will be used to evaluate compliance against QA/QC criteria. QA/QC criteria for field QC samples are presented in Worksheet 12, QLs and PALs are presented in Worksheet 15, QA/QC criteria for calibrations are presented in Worksheet 24, and QA/QC criteria for laboratory QC samples are presented in Worksheet 28. Data may be qualified if QA/QC exceedances have occurred. Data qualifiers will be those presented in "Evaluation of Metals Data for the CLP Program"; SOP HW-2 Rev.13, ILM05.3; February, 2009. Guidance and qualifiers from "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review" (EPA 540-R-10-011, January, 2010) may also be applicable.	Laura Maschoff/DataQual (DV)	Step IIa and IIb	External

Notes:
1. 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. Internal/External is with respect to the data generator.
3. 100% of Definitive data will be third-party validated. Of the 100% validated, the third-party DV will also recalculate 10% of results from the raw data.

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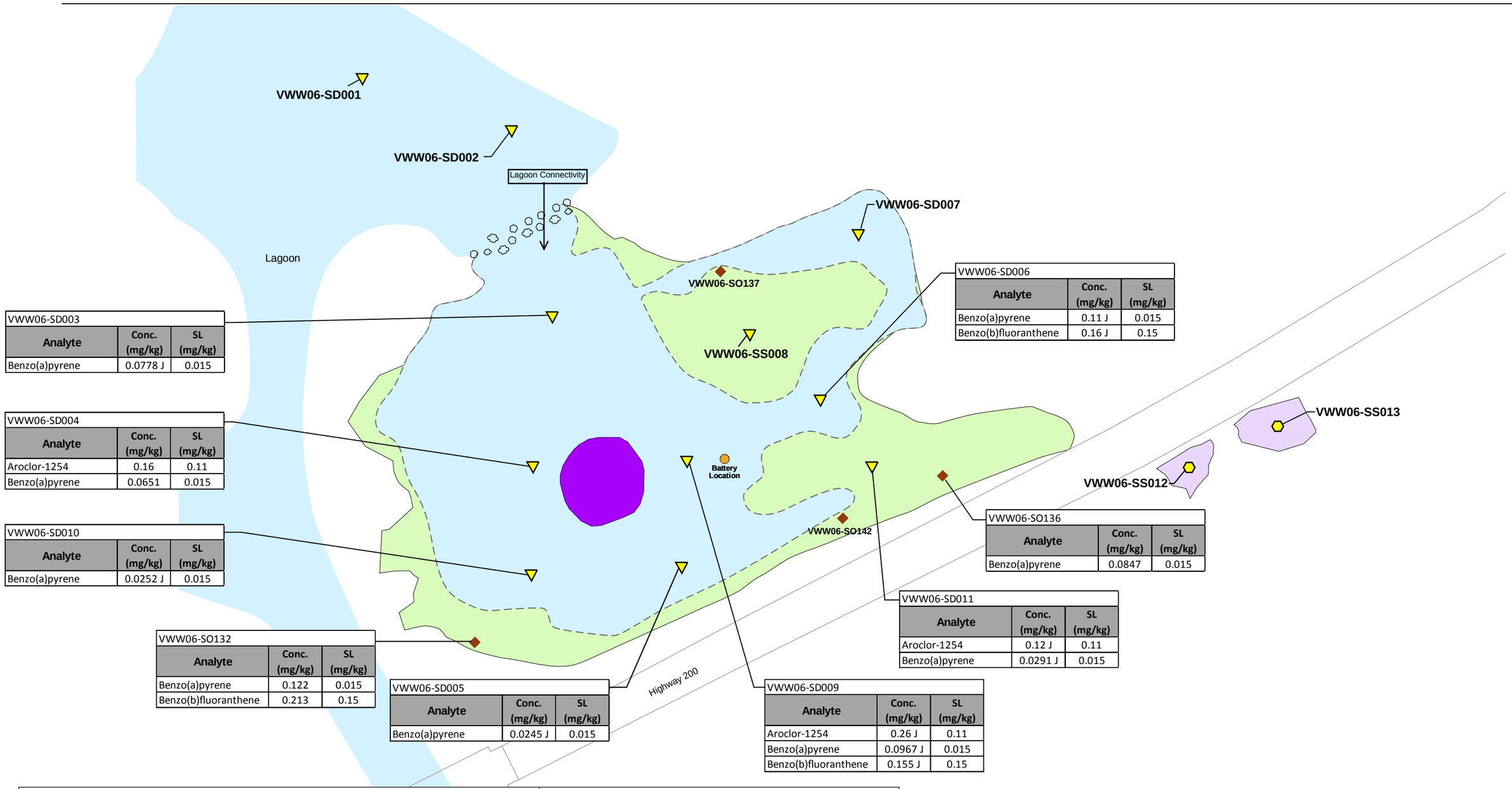
Attachments

Attachment A
Figures



VWW06-SD003

Analyte	Conc. (mg/kg)	SL (mg/kg)
Benzo(a)pyrene	0.0778 J	0.015

VWW06-SD004

Analyte	Conc. (mg/kg)	SL (mg/kg)
Aroclor-1254	0.16	0.11
Benzo(a)pyrene	0.0651	0.015

VWW06-SD010

Analyte	Conc. (mg/kg)	SL (mg/kg)
Benzo(a)pyrene	0.0252 J	0.015

VWW06-SO132

Analyte	Conc. (mg/kg)	SL (mg/kg)
Benzo(a)pyrene	0.122	0.015
Benzo(b)fluoranthene	0.213	0.15

VWW06-SD005

Analyte	Conc. (mg/kg)	SL (mg/kg)
Benzo(a)pyrene	0.0245 J	0.015

VWW06-SD006

Analyte	Conc. (mg/kg)	SL (mg/kg)
Benzo(a)pyrene	0.11 J	0.015
Benzo(b)fluoranthene	0.16 J	0.15

VWW06-SO136

Analyte	Conc. (mg/kg)	SL (mg/kg)
Benzo(a)pyrene	0.0847	0.015

VWW06-SD011

Analyte	Conc. (mg/kg)	SL (mg/kg)
Aroclor-1254	0.12 J	0.11
Benzo(a)pyrene	0.0291 J	0.015

VWW06-SD009

Analyte	Conc. (mg/kg)	SL (mg/kg)
Aroclor-1254	0.26 J	0.11
Benzo(a)pyrene	0.0967 J	0.015
Benzo(b)fluoranthene	0.155 J	0.15

Legend

Sample Locations

- Surface Soil Sample
- Sediment/Soil Sample
- Soil Samples (for PCB analysis only)
- Approximate Original Battery
- Shallow, Sparse Mangroves
- Lead Hot Spot Excavation Area
- Lagoon Outline Low Tide (Approximate)
- Removal Area South of Road
- SWMU 6 Disturbed Area

North

0 15 30 Feet

Notes:

Adjusted EPA Regional Screening Levels (RSLs) (EPA, 05/2011; based on ELCR = $1x10^{-6}$ or HQ=0.1) were used as screening levels (SLs).

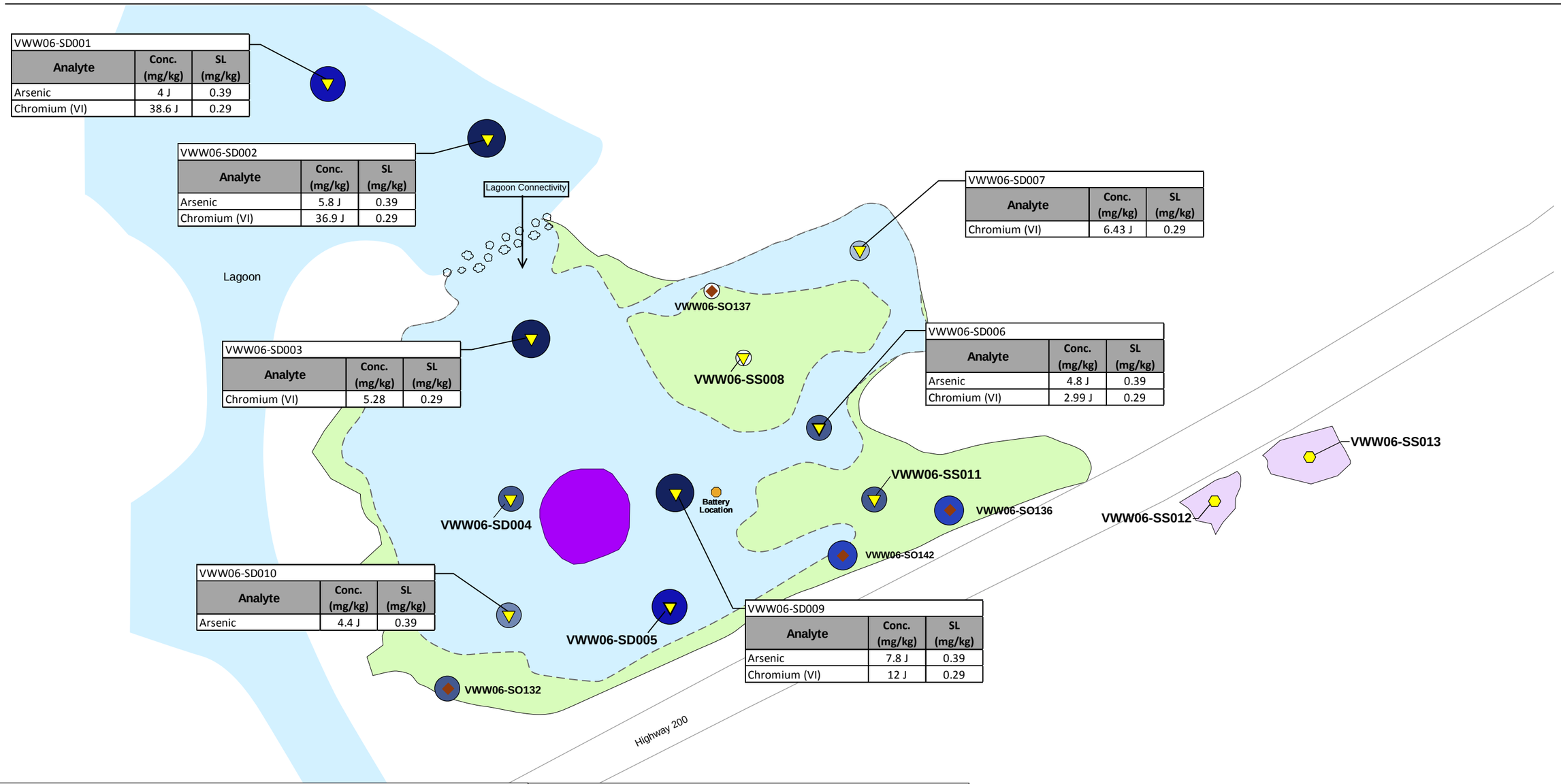
Concentrations exceeding SLs are presented in boxes.

HQ = Hazard Quotient
ELCR = Excess Lifetime Cancer Risk
J = Compound was detected below the reporting limit in the sample

FIGURE 1
Soil and Sediment Sampling Stations with Detected PAH and PCB Concentrations Exceeding Adjusted Residential Soil RSLs
Addendum Post-Removal Confirmatory SAP SWMU-6
Former NASD, Vieques, Puerto Rico

CH2MHILL

ES100311193441TPA F1-SWMU 6 Soil and Sediment PAH and PCB-rev5.ai



Legend

Sample Locations

- Surface Soil Sample
- Sediment/Soil Sample
- Soil Samples (for PCB analysis only)
- Approximate Original Battery
- Shallow, Sparse Mangroves

- Lead Hot Spot Excavation Area
- Lagoon Outline Low Tide (Approximate)
- Removal Area South of Road
- SWMU 6 Disturbed Area

North

0 15 30 Feet

Notes:

Adjusted EPA Regional Screening Levels (RSLs) (EPA, 05/2011; based on ELCR = $1x10^{-6}$ or HQ=0.1) were used as screening levels (SLs).

Metal concentrations exceeding 10x SLs are presented in boxes.

Sampling stations and decision units where metal concentrations exceeded SLs are color-coded based on the number of metals exceedances as follows:

8 7 6 5 4 3 2

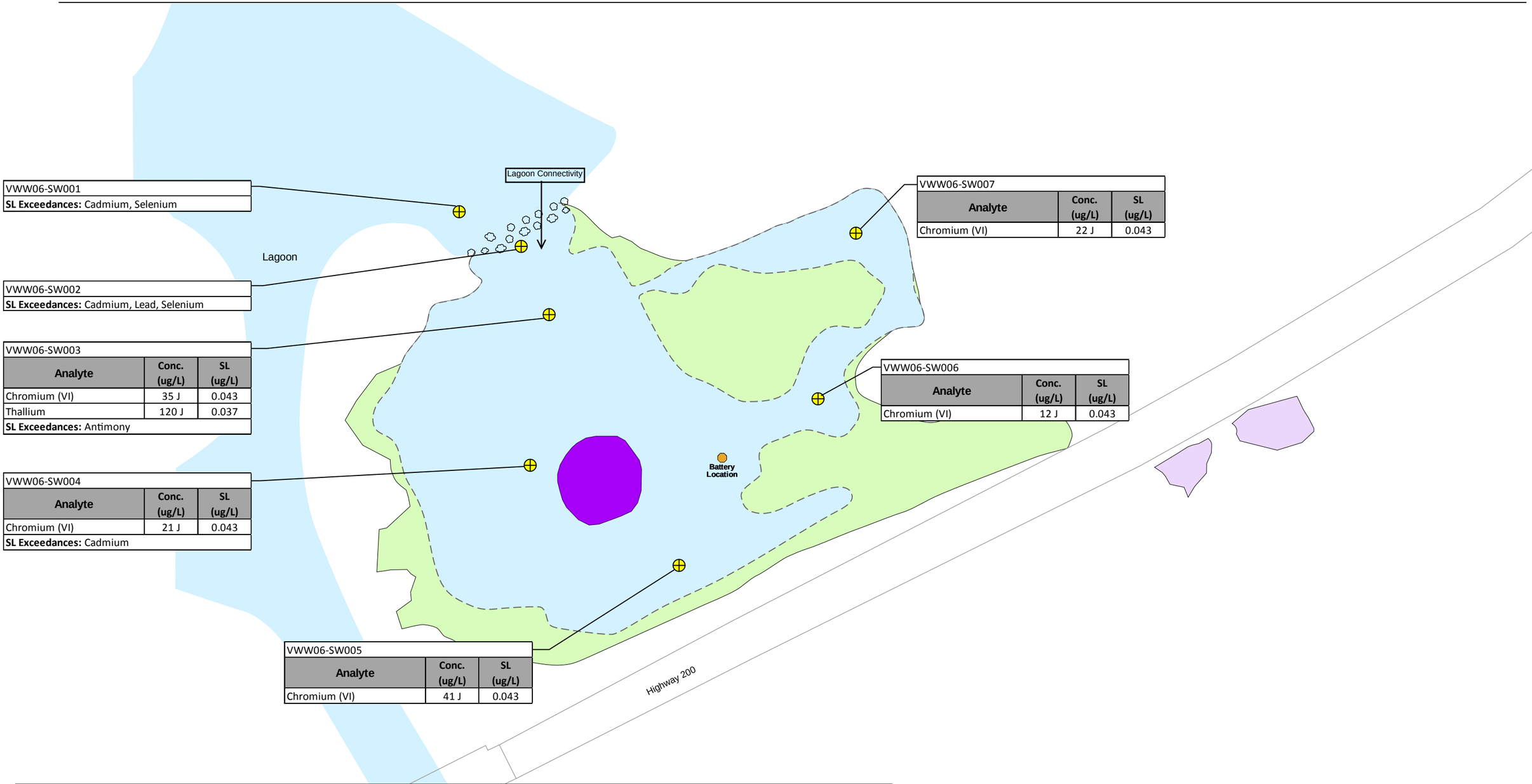
Metals exceeding SLs include aluminum, antimony, arsenic, chromium (VI), cobalt, iron, lead, manganese, thallium, and vanadium.

HQ = Hazard Quotient
ELCR = Excess Lifetime Cancer Risk
J = Compound was detected below the reporting limit in the sample

FIGURE 2
Soil and Sediment Sampling Stations with Detected Metal Concentrations Exceeding Adjusted Residential Soil RSLs
Addendum Post-Removal Confirmatory SAP SWMU-6
Former NASD, Vieques, Puerto Rico

CH2MHILL

ES100311193441TPA F2-SWMU 6 Soil and Sediment Detected Metals-rev4.ai



VWW06-SW001

SL Exceedances: Cadmium, Selenium

VWW06-SW002

SL Exceedances: Cadmium, Lead, Selenium

VWW06-SW003

Analyte	Conc. (ug/L)	SL (ug/L)
Chromium (VI)	35 J	0.043
Thallium	120 J	0.037

SL Exceedances: Antimony

VWW06-SW004

Analyte	Conc. (ug/L)	SL (ug/L)
Chromium (VI)	21 J	0.043

SL Exceedances: Cadmium

VWW06-SW005

Analyte	Conc. (ug/L)	SL (ug/L)
Chromium (VI)	41 J	0.043

VWW06-SW006

Analyte	Conc. (ug/L)	SL (ug/L)
Chromium (VI)	12 J	0.043

VWW06-SW007

Analyte	Conc. (ug/L)	SL (ug/L)
Chromium (VI)	22 J	0.043

Legend

Sample Locations

- Surface Water Sample
- Shallow, Sparse Mangroves
- Lead Hot Spot Excavation Area
- Lagoon Outline Low Tide (Approximate)
- Removal Area South of Road
- SWMU 6 Disturbed Area

North

0 15 30 Feet

Notes:

Adjusted EPA Regional Screening Levels (RSLs) (EPA, 05/2011; based on ELCR=1x10^{-6} or HQ=0.1) were used as screening levels (SLs).

Concentrations exceeding 10x SLs are presented in boxes.

Chemicals whose concentrations exceed SLs but not 10x SLs are listed in the bottom of boxes.

HQ = Hazard Quotient
ELCR = Excess Lifetime Cancer Risk
J = Compound was detected below the reporting limit in the sample

FIGURE 3
Surface Water Sampling Stations with Detected Concentrations Exceeding Adjusted Tapwater RSLs
Addendum Post-Removal Confirmatory SAP SWMU-6
Former NASD, Vieques, Puerto Rico

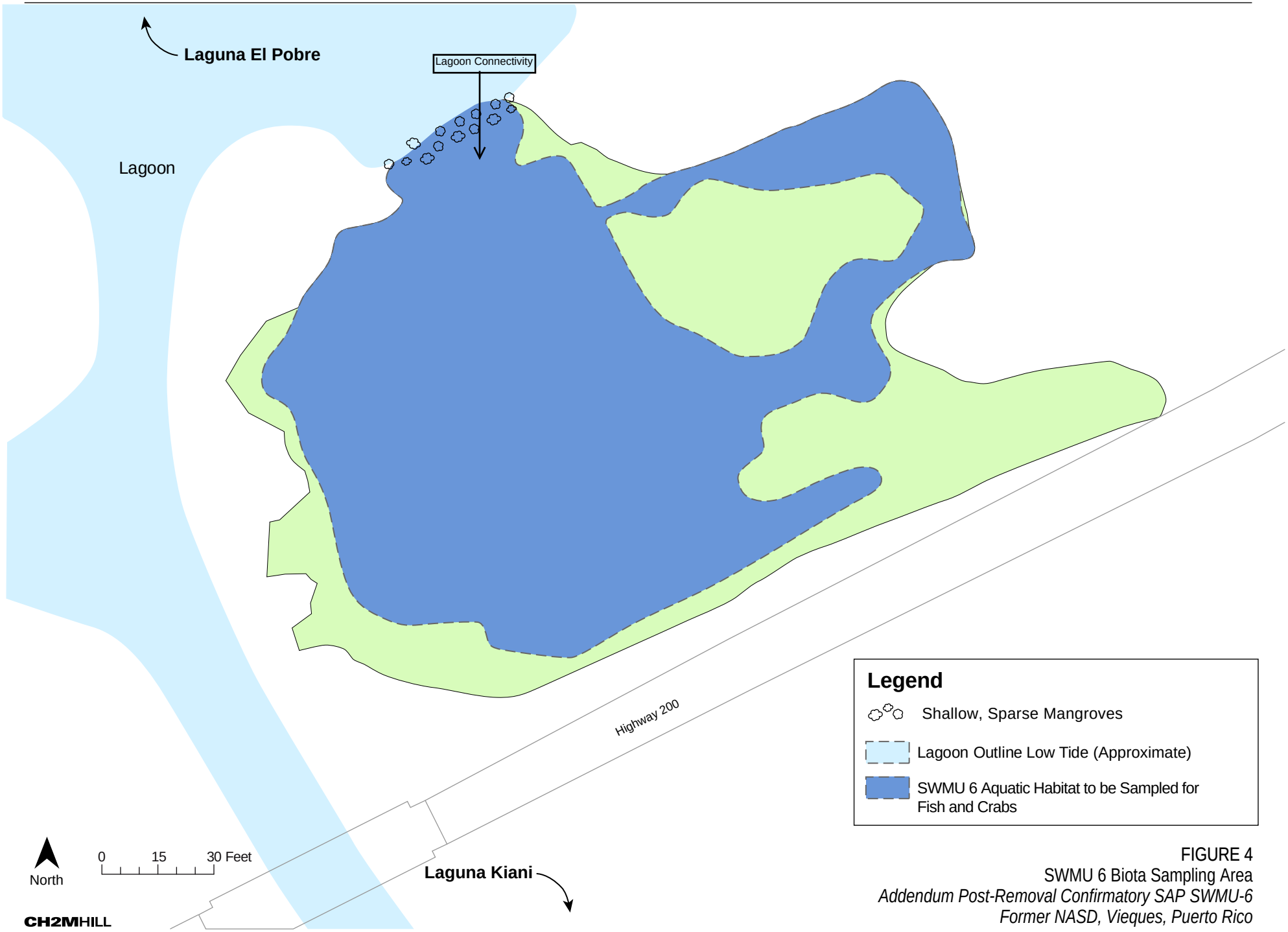
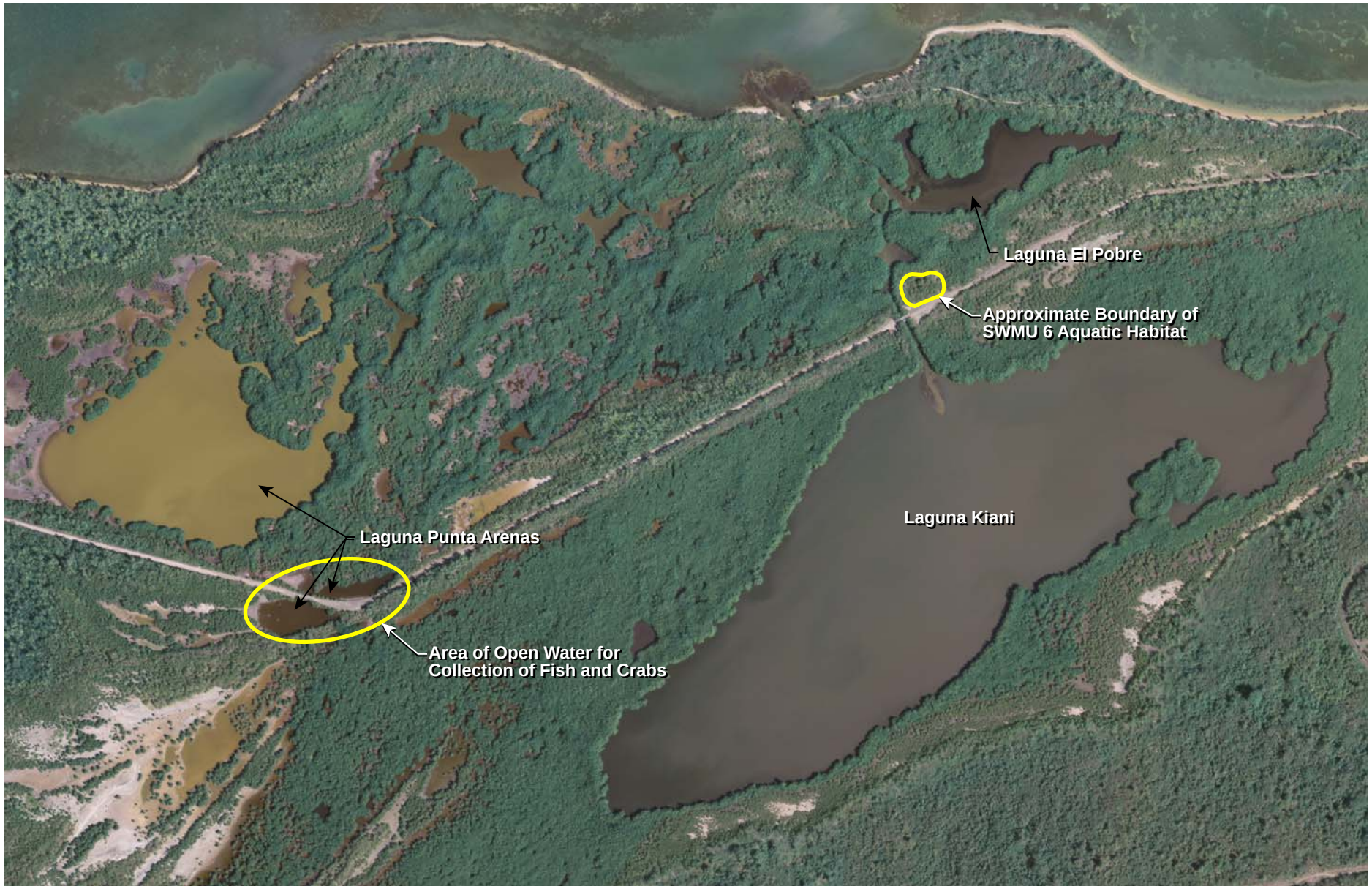


FIGURE 4
SWMU 6 Biota Sampling Area
Addendum Post-Removal Confirmatory SAP SWMU-6
Former NASD, Vieques, Puerto Rico

CH2MHILL

ES100311193441TPA F4-SWMU 6 Biota Sampling Area.ai



North

0 300 600 Feet

CH2MHILL

FIGURE 5
Background Biota Sampling Area
Addendum Post-Removal Confirmatory SAP SWMU-6
Former NASD, Vieques, Puerto Rico

ES100311193441TPA F5-Background Biota Sampling Area.ai

Attachment B
DoD ELAP Lab Letters

The American Association for Laboratory Accreditation

World Class Accreditation

Accredited DoD ELAP Laboratory

A2LA has accredited

TESTAMERICA LABORATORIES
WEST SACRAMENTO

West Sacramento, CA

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 the DoD Quality Systems Manual for Environmental Laboratories (QSM v4.1); 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*).

AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION
CORPORATE SEAL 1978
DISTRICT OF COLUMBIA
A2LA

Presented this 15th day of December 2009.

President & CEO
For the Accreditation Council
Certificate Number 2928.01
Valid to January 31, 2012

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

SCOPE OF ACCREDITATION TO ISO/IEC 17025-2005

TESTAMERICA LABORATORIES WEST SACRAMENTO
880 Riverside Parkway
West Sacramento, CA 95605
Douglas Weir Phone: 916 3744 389

ENVIRONMENTAL

Valid To: January 31, 2012 Certificate Number: 2928.01

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 the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM v4.1)) 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

Inductively Coupled Plasma (ICP), ICP-Mass Spectroscopy, Atomic Absorption Spectroscopy (flame), Gas Chromatography(GC), GC- Mass Spectroscopy, High Resolution Gas Chromatography/High Resolution Mass Spectroscopy, Liquid Chromatography(LC),LC- Mass Spectroscopy, Ion Chromatography, Spectrophotometry, Misc.- Electronic Probes

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
Metals				
Aluminum	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Antimony	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Arsenic	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Barium	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Beryllium	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Cadmium	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Calcium	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Chromium (Total)	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Chromium (Hexavalent)	EPA 7196A	EPA 7196A	-------	EPA 3005A/3010A/3050A
Cobalt	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Copper	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Iron	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Lead	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Magnesium	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A

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Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
Manganese	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Mercury	EPA 7470A/6020	EPA 7471A	-------	EPA 3005A/3010A/3050A
Molybdenum	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Nickel	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Potassium	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Selenium	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Silver	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Sodium	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Thallium	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Vanadium	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Zinc	EPA 6010B/6020A	EPA 6010B/6020A	-------	EPA 3005A/3010A/3050A
Nutrients				
Nitrate	EPA 353.2/9056A/300.0	EPA 353.2/9056A/300.0	-------	----------
Nitrate-nitrite	EPA 353.2/ SM4500-NO3 F	EPA 353.2	-------	----------
Nitrite	EPA 353.2/9056A/300.0	EPA 353.2	-------	----------
Orthophosphate	EPA 9056A/300.0	EPA 9056A/300.0	-------	----------
Wet Chemistry				
Oil and Grease	EPA 1664/9070	EPA 1664/9071	-------	----------
Nitrocellulose	WS-WC-0050	WS-WC-0050	-------	----------
Perchlorate	EPA 6850	EPA 6850	-------	----------
Chloride	EPA 9056A/300.0	EPA 9056A/300.0	-------	----------
Fluoride	EPA 9056A/300.0	EPA 9056A/300.0	-------	----------
Sulfate	EPA 9056A/300.0	EPA 9056A/300.0	-------	----------
TOC	EPA 9060	EPA 9060	-------	----------
Hazardous Waste Characteristics				
TCLP Extractables	----------	EPA 1311	-------	----------
TCLP Inorganics	----------	EPA 1311	-------	----------
Purgeable Organics				
(volatiles)				
Acetone	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Acrolein	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Acrylonitrile	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Allyl Chloride	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Benzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Bromochloromethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Bromodichloromethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Bromoform	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Bromomethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Carbon disulfide	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Carbon tetrachloride	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Chlorobenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
Chloroethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
2-Chloroethyl vinyl ether	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Chloroform	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Chloromethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Chloroprene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Dibromochloromethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,2-Dibromo-3-chloropropane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,2-Dibromoethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Dibromomethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,2-Dichlorobenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,3-Dichlorobenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,4-Dichlorobenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
trans-1,4-dichloro-2-butene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Dichlorodifluoromethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,1-Dichloroethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,2-Dichloroethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,1-Dichloroethene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
trans-1,2-Dichloroethene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
cis-1,2-Dichloroethene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,2-Dichloropropane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,3-Dichloropropane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
2,2-Dichloropropane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,1-Dichloropropene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
cis-1,3-Dichloropropene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
trans-1,3-Dichloropropene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,4-Dioxane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Ethylbenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Ethyl methacrylate	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Hexachlorobutadiene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
2-Hexanone (MBK)	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Iodomethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Isobutyl Alcohol	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Methacrylonitrile	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Methyl tert-butyl ether (MTBE)	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Methylene chloride	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Methyl ethyl ketone	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Methyl methacrylate	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
4-Methyl-2-pentanone (MIBK)	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Naphthalene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Propionitrile	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,1,1,2-Tetrachloroethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,1,2,2-Tetrachloroethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Tetrachloroethene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Toluene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,2,3-Trichlorobenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,2,4-Trichlorobenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,1,1-Trichloroethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,1,2-Trichloroethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Trichloroethene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
Trichlorofluoromethane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,2,3-Trichloropropane	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Vinyl acetate	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Vinyl chloride	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
m & p xylene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
o-xylene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Xylenes, Total	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
tert-amyl methyl ether (TAME)	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
tert-butyl alcohol (TBA)	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Ethyl tert-butyl ether (ETBE)	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Bromobenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
n-Butylbenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
sec-Butylbenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
tert-Butylbenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
2-Chlorotoluene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
4-Chlorotoluene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Isopropylbenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
n-Propylbenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Styrene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,2,4-Trimethylbenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
1,3,5-Trimethylbenzene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Oxygenates	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Gasoline Range Organics (GRO)	EPA 8260B/AK101	EPA 8260B/AK101	-------	EPA 5030A/5030B/5035/5035A
p-Isopropyltoluene	EPA 8260B	EPA 8260B	-------	EPA 5030A/5030B/5035/5035A
Extractable Organics				
(semivolatiles)				
Acenaphthene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/3580A Air: 3542/TO-13A
Acenaphthylene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/3580A Air: 3542/TO-13A
Acetophenone	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
2-Acetylaminofluorene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
4-Aminobiphenyl	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
Aniline	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
Anthracene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/3580A Air: 3542/TO-13A
Aramite	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
Benzaldehyde	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
Benzidine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
Benzo(a)anthracene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/3580A Air: 3542/TO-13A
Benzo(b)fluoranthene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/3580A Air: 3542/TO-13A
Benzo(k)fluoranthene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/3580A Air: 3542/TO-13A
Benzo(g,h,i)perylene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/3580A Air: 3542/TO-13A
Benzo(a)pyrene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/3580A Air: 3542/TO-13A
Benzo(e)pyrene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/3580A Air: 3542/TO-13A
Benzoic acid	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
Benzyl alcohol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
Benzyl butyl phthalate	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
Biphenyl	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
Bis(2-chloroethoxy) Methane	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
Bis(2-chloroethyl) ether	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
Bis(2-chloroisopropyl) ether	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
Di(2-ethylhexyl) phthalate	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
4-Bromophenyl phenyl ether	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
Carbazole	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
4-Chloroaniline	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
4-Chloro-3-methylphenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
1-Chloronaphthalene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
2-Chloronaphthalene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
2-Chlorophenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
4-Chlorophenyl phenyl ether	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
Chrorobenzilate	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/3580A
Chrysene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/3580A

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
Diallate	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Dimethoate	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Dibenz(a,j)acridine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Dibenz(a,h)anthracene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/ 3580A Air: 3542/TO-13A
Dibenzofuran	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
1,2-Dichlorobenzene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
1,3-Dichlorobenzene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
1,4-Dichlorobenzene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
3,3'-Dichlorobenzidine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
2,4-Dichlorophenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
2,6-Dichlorophenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Diethyl Phthalate	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
p-Dimethylaminoazobenzene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
7,12-Dimethylbenz(a)anthracene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Dimethoate	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
a-Dimethylphenethylamine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
2,4-Dimethylphenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Dimethyl Phthalate	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Di-n-butyl phthalate	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Di-n-octyl phthalate	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
1,3-Dinitrobenzene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
1,4-Dinitrobenzene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
4,6-Dinitro-2-methylphenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
2,4-Dinitrophenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
2,4-Dinitrotoluene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
2,6-Dinitrotoluene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
1,4-Dioxane	WS-MS-0011	WS-MS-0011	-------	EPA 3500B/3510C
Diphenylamine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
1,2-Diphenylhydrazine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Ethyl methanesulfonate	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Fluoranthene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/ 3580A Air: 3542/TO-13A
Fluorene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/ 3580A Air: 3542/TO-13A
Hexachlorobenzene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Hexachlorobutadiene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Hexachlorocyclopentadiene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Hexachloroethane	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Hexachloropropene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Indeno(1,2,3-c,d)pyrene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/ 3580A Air: 3542/TO-13A
Isophorone	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Isosafrole	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Isodrin	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/
3-Methylcholanthrene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
2-Methyl-4,6-dinitrophenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Methyl methanesulfonate	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
2-Methylnaphthalene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/ 3580A Air: 3542/TO-13A
2-Methylphenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
3-Methylphenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/
4-Methylphenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Naphthalene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/ 3580A Air: 3542/TO-13A
1,4-Naphthoquinone	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
1-Naphthylamine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
2-Naphthylamine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
2-Nitroaniline	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
3-Nitroaniline	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
4-Nitroaniline	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Nitrobenzene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
2-Nitrophenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
4-Nitrophenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
n-Nitrosodi-n-butylamine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
n-Nitrosodiethylamine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
n-Nitrosodimethylamine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
n-Nitrosodi-n-propylamine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
n-Nitrosodiphenylamine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
n-Nitrosomethylethylamine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
n-Nitrosomorpholine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
n-Nitrosopiperidine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
n-Nitrosopyrrolidine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
5-Nitro-o-toluidine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Parathion Ethyl	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Pentachlorobenzene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Pentachloronitrobenzene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Pentachlorophenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Phenacetin	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Phenanthrene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/ 3580A Air: 3542/TO-13A
Phenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
1,4-Phenylenediamine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Phorate	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
2-Picoline	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Pyrene	EPA 8270C/WS-MS-006/WS-MS-0008	EPA 8270C/WS-MS-006/WS-MS-0008	WS-MS-0006	EPA 3500B/3510C/3550B/ 3580A Air: 3542/TO-13A
Pyridine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Safrole	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
Sulfotepp	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
1,2,4,5-Tetrachlorobenzene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
2,3,4,6-Tetrachlorophenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
o-Toluidine	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
1,2,4-Trichlorobenzene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
2,4,5-Trichlorophenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
2,4,6-Trichlorophenol	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
1,3,5-Trinitrobenzene	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
o,o,o-triethyl Phosphorothioate	EPA 8270C	EPA 8270C	-------	EPA 3500B/3510C/3550B/ 3580A
Diesel Range Organics (DRO)	EPA 8015B/AK102	EPA 8015B/AK102	-------	EPA 3500B/3510C/3550B/ 3580A
Residual Range Organics	AK103	AK103	-------	EPA 3500B/3510C/3550B/ 3580A
Dioxins				
2,3,7,8-TeCDD	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
1,2,3,7,8-PeCDD	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
1,2,3,4,7,8-HxCDD	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
1,2,3,6,7,8-HxCDD	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
1,2,3,7,8,9-HxCDD	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
1,2,3,4,6,7,8-HpCDD	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
OCDD	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
2,3,7,8-TeCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
1,2,3,7,8-PeCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
2,3,4,7,8-PeCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
1,2,3,4,7,8-HxCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
1,2,3,6,7,8-HxCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
1,2,3,7,8,9-HxCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
2,3,4,6,7,8-HxCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
1,2,3,4,6,7,8-HpCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
1,2,3,4,7,8,9-HpCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
OCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
Total TCDD	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
Total PeCDD	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
Total HxCDD	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
Total HeptaCDD	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
Total TCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
Total PeCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
Total HxCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------
Total HpCDF	EPA 8280A/8290/1613B	EPA 8280A/8290/1613B	-------	----------

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
Chemical Warfare Degradates				
1,4-Dithiane	WS-MS-0003	WS-MS-0003	-------	----------
Benzothiazole	WS-MS-0003	WS-MS-0003	-------	----------
p-Chlorophenyl methylsulfide	WS-MS-0003	WS-MS-0003	-------	----------
p-Chlorophenyl methylsulfoxide	WS-MS-0003	WS-MS-0003	-------	----------
p-Chlorophenyl methylsulfone	WS-MS-0003	WS-MS-0003	-------	----------
Chloropicrin	WS-MS-0003	WS-MS-0003	-------	----------
Acetophenone	WS-MS-0003	WS-MS-0003	-------	----------
2-Chloroacetophenone	WS-MS-0003	WS-MS-0003	-------	----------
1,4-Oxathiane	WS-MS-0003	WS-MS-0003	-------	----------
Dimethyl Disulfide	WS-MS-0003	WS-MS-0003	-------	----------
Diisopropylmethylphosphate (DIMP)	WS-LC-0004	WS-LC-0004	-------	----------
Dimethylmethylphosphonate (DMMP)	WS-LC-0004	WS-LC-0004	-------	----------
Ethyl methylphosphonic acid (EMPA)	WS-LC-0004	WS-LC-0004	-------	----------
Isopropyl methylphosphonic acid (IMPA)	WS-LC-0004	WS-LC-0004	-------	----------
Methylphosphonic acid (MPA)	WS-LC-0004	WS-LC-0004	-------	----------
Thiodiglycol (2,2'-Thiodiethanol) (TDG)	WS-LC-0004	WS-LC-0004	-------	----------
Nitroaromatics				
2-Amino-4,6-dinitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
4-Amino-2,6-dinitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
3,5-Dinitroaniline	EPA 8330B	EPA 8330B	-------	----------
1,3-Dinitrobenzene	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
2,4-Dinitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
2,6-Dinitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
Ethylene glycol dinitrate	EPA 8330B	EPA 8330B	-------	----------
Glycerol trinitrate (Nitroglycerin)	EPA 8330B	EPA 8330B	-------	----------
Hexahydro-1,3,5-trinitro-1,3,5-triazine (Hexogen)	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
Methyl-2,4,6-trinitrophenylnitramine	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
Nitrobenzene	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
2-Nitrotoluene (o-Nitrotoluene)	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
3-Nitrotoluene (m-Nitrotoluene)	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
4-Nitrotoluene (p-Nitrotoluene)	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
Octahydro-1,3,5,7-tetranitro1,3,5,7-tetracine (Octogen)	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
Picric acid	EPA 8330B	EPA 8330B	-------	----------
Pentaerythritol tetranitrate	EPA 8330B	EPA 8330B	-------	----------
1,3,5-Trinitrobenzene	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
2,4,6-Trinitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B	-------	----------
Nitroguanidine	WS-LC-0010	WS-LC-0010	-------	----------
Nitrosamines				
N-Nitrosodimethylamine (NDMA)	WS-MS-0012	WS-MS-0012	-------	----------
Perfluoro Compounds				
Perfluorooctanoic acid	WS-LC-0020	WS-LC-0020	-------	----------
Perfluorooctane sulfonate	WS-LC-0020	WS-LC-0020	-------	----------
Ammonium perfluorooctanate	WS-LC-0020	WS-LC-0020	-------	----------
Pesticides/PCBs				
Aldrin	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
a-BHC	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
b-BHC	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
d-BHC	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
g-BHC (Lindane)	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
a-Chlordane	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
g-Chlordane	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
4,4'-DDD	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
4,4'-DDE	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
4,4'-DDT	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
Dieldrin	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Endosulfan I	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Endosulfan II	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Endosulfan sulfate	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Endrin	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Endrin aldehyde	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Endrin ketone	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Heptachlor	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Heptachlor epoxide	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Methoxychlor	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Toxaphene	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Mirex	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Diallate	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Isodrin	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Chlorobenzillate	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
Chlordane (technical)	EPA 8081A	EPA 8081A	-------	EPA 3500B/3510C/3550B/3620B/ 3660A
<u>PCB (Aroclors)</u>				
PCB-1016	EPA 8082	EPA 8082	-------	EPA 3500B/3510C/3550B/3580A/3620B/3660A/3665A

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
PCB-1221	EPA 8082	EPA 8082	-------	EPA 3500B/3510C/3550B/3580A/ 3620B/3660A/3665A
PCB-1232	EPA 8082	EPA 8082	-------	EPA 3500B/3510C/3550B/3580A/ 3620B/3660A/3665A
PCB-1242	EPA 8082	EPA 8082	-------	EPA 3500B/3510C/3550B/3580A/ 3620B/3660A/3665A
PCB-1248	EPA 8082	EPA 8082	-------	EPA 3500B/3510C/3550B/3580A/ 3620B/3660A/3665A
PCB-1254	EPA 8082	EPA 8082	-------	EPA 3500B/3510C/3550B/3580A/ 3620B/3660A/3665A
PCB-1260	EPA 8082	EPA 8082	-------	EPA 3500B/3510C/3550B/3580A/ 3620B/3660A/3665A
PCB-1262	EPA 8082	EPA 8082	-------	EPA 3500B/3510C/3550B/3580A/ 3620B/3660A/3665A
PCB-1268	EPA 8082	EPA 8082	-------	EPA 3500B/3510C/3550B/3580A/ 3620B/3660A/3665A
PCB (congeners)				
PCB 1 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 2 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 3 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 4 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 5 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 6 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 7 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 8 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 9 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 10 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 11 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 12 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 13 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 14 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 15 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 16 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 17 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 18 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 19 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 20 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 21 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 22 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 23 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 24 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 25 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 26 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
PCB 27 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 28 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 29 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 30 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 32 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 31 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 33 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 34 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 35 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 36 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 37 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 38 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 39 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 40 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 41 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 42 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 43 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 44 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 45 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 46 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 47 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 48 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 49 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 50 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 51 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 52 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 53 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 54 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 55 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 56 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 57 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 58 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 59 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 60 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 61 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 62 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 63 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 64 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 65 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 66 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 67 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 68 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 69 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 70 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 71 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 72 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 73 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 74 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 75 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 76 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 77 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
PCB 78 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 79 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 80 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 81 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 82 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 83 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 84 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 85 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 86 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 87 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 88 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 89 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 90 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 91 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 92 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 93 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 94 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 95 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 96 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 97 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 98 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 99 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 100 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 101 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 102 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 103 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 104 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 105 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 106 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 108 (BZ)/107 (IUPAC)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 109 (BZ)/108 (IUPAC)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 107 (BZ)/109 (IUPAC)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 110 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 111 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 112 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 113 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 114 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 115 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 116 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 117 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 118 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 119 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 120 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 121 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 122 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 123 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 124 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 125 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 126 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 127 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 128 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
PCB 129 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 130 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 131 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 132 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 133 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 134 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 135 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 136 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 137 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 138 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 139 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 140 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 141 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 142 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 143 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 144 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 145 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 146 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 147 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 148 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 149 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 150 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 151 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 152 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 153 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 154 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 155 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 156 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 157 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 158 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 159 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 160 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 161 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 162 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 163 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 164 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 165 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 166 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 167 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 168 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 169 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 170 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 171 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 172 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 173 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 174 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 175 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 176 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 177 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 178 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 179 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------

Parameter/Analyte	Non potable Water	Solid Hazardous Waste	Air	Associated Prep Methods
PCB 180 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 181 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 182 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 183 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 184 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 185 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 186 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 187 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 188 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 189 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 190 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 191 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 192 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 193 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 194 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 195 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 196 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 197 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 198 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 201 (BZ)/199 (IUPAC)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 199 (BZ)/200 (IUPAC)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 200 (BZ)/201 (IUPAC)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 202 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 203 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 204 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 205 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 206 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 207 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 208 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------
PCB 209 (BZ)	EPA 1668A mod	EPA 1668A mod	-------	----------

CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board/ACLASS
500 Montgomery Street, Suite 625, Alexandria, VA 22314, 877-344-3044

This is to certify that

Brooks Rand Labs, LLC
3958 6th Ave. NW
Seattle, WA 98107

has been assessed by ACLASS
and meets the requirements of

DoD-ELAP

while demonstrating technical competence in the field(s) of

TESTING

Refer to the accompanying Scope(s) of Accreditation for information regarding the types of tests to which this accreditation applies.

ADE-1447
Certificate Number

ACLASS Approval

Certificate Valid: 03/30/2010-03/30/2012
Version No. 001

ANSI-ASQ National Accreditation Board

SCOPE OF DoD-ELAP ACCREDITATION

Brooks Rand Labs, LLC

3958 6th Ave NW, Seattle, WA 98107
Frank McFarland Phone: 206-632-6206

TESTING

Valid to: March 30, 2012 Certificate Number: ADE- 1447

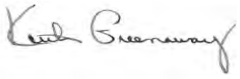
I. Environmental

MATRIX	SPECIFIC TEST or GROUP of ANALYTES	SPECIFICATION OR STANDARD METHOD (all SW846 unless specified)	* KEY EQUIPMENT OR TECHNOLOGY USED
Water	Elemental Analysis	EPA 1638 modified EPA 200.8 modified	ICP-MS ESI SC-4 w/FAST P-E ELAN DRC II Model F
Seawater	Elemental Analysis	EPA 1640 modified	ICP-MS ESI SC-4 w/FAST P-E ELAN DRC II Model F
Water	As speciation Se speciation	BR-0061 rev 000	HPLC-ICP-MS P-E HPLC Series 200 P-E ELAN DRC II Model F
Water	As, Se	BR-0020 rev 008	HGAAS Buck Scientific AAS 205
Water	As speciation	BR-0021 rev 004	HGAAS Buck Scientific AAS 205
Water	Hg	EPA 1631e	CVAFS BRL Model III Hg Detector
Water	Methyl Mercury	EPA 1630	CVAFS BRL Merx Automated Detector
Water	Hardness – total (as $CaCO_3$)	SM 2340 B (20th Ed.) EPA 1638	ICP-MS (calc.) ESI SC-4 w/FAST P-E ELAN DRC II Model F
Water	Total Suspended Solids	SM 2540 D (20th Ed.)	
Solids	Dry weight	SM 2540 E (20th Ed.)	Gravimetric

MATRIX	SPECIFIC TEST or GROUP of ANALYTES	SPECIFICATION OR STANDARD METHOD (all SW846 unless specified)	* KEY EQUIPMENT OR TECHNOLOGY USED
Solids	Elemental Analysis	EPA 1638 modified EPA 200.8 modified	ICP-MS ESI SC-4 w/FAST P-E ELAN DRC II Model F
Solids	Elemental Analysis Extraction	EPA 3051A EPA 3052	
Solids	As, Se	BR-0020 rev 008	HGAAS Buck Scientific AAS 205
Solids	As speciation	BR-0021 rev 004	HGAAS Buck Scientific AAS 205
Solids	Hg	EPA 1631e (appendix)	CVAFS BRL Model III Hg Detector
Solids	Methyl Mercury	EPA 1630	CVAFS BRL Merx Automated Detector
Biological Tissue	Elemental Analysis	EPA 1638 modified	ICP-MS ESI SC-4 w/FAST P-E ELAN DRC II Model F
Biological Tissue	Elemental Analysis Extraction	EPA 3050B	
Biological Tissue	As speciation	BR-0021 rev 004	HGAAS Buck Scientific AAS 205
Biological Tissue	Hg	EPA 1631e (appendix)	CVAFS BRL Model III Hg Detector
Biological Tissue	Methyl Mercury	EPA 1630	CVAFS BRL Merx Automated Detector

Notes:

1. ** = As Applicable*
2. *This scope is part of and must be included with the Certificate of Accreditation No. ADE-1447*



Vice President

DoD ELAP -- PT Performance Summary Review				WP - ALL	
Lab Name :	Brooks Rand Labs, LLC				
City/State :	Seattle, WA				
PT Provider Used :	ERA (WP & DMR-QA Studies) / USGS (SRS RR)				
PartName	PartNumber	NELACCode	AnalyteName	EPAmethod#	Analytes Approved
Trace Metals	PT-TM-WP	1000	Aluminum	EPA 1638 / BR-0060	Approved
Trace Metals	PT-TM-WP	1005	Antimony	EPA 1638 / BR-0060	Approved
Trace Metals	PT-TM-WP	1010	Arsenic	EPA 1638 / BR-0060	Approved
Trace Metals	PT-TM-WP	1015	Barium	EPA 1638 / BR-0060	Approved
Trace Metals	PT-TM-WP	1020	Beryllium	EPA 1638 / BR-0060	Approved
Trace Metals	PT-TM-WP	1025	Boron	EPA 1638 / BR-0060	Approved
Trace Metals	PT-TM-WP	1030	Cadmium	EPA 1638 / BR-0061	Approved
Trace Metals	PT-TM-WP	1040	Chromium	EPA 1638 / BR-0060	Approved
Trace Metals	PT-TM-WP	1050	Cobalt	EPA 1638 / BR-0060	Approved
Trace Metals	PT-TM-WP	1055	Copper	EPA 1638 / BR-0060	Approved
Trace Metals	PT-TM-WP	1070	Iron	EPA 1638 / BR-0060	Approved
Trace Metals	PT-TM-WP	1075	Lead	EPA 1638 / BR-0060	Approved
Trace Metals	PT-TM-WP	1090	Manganese	EPA 1638 / BR-0060	Approved
Trace Metals	PT-TM-WP	1100	Molybdenum	EPA 1638 / BR-0060	Approved
Trace Metals	PT-TM-WP	1105	Nickel	EPA 1638 / BR-0060	Approved
Trace Metals	PT-TM-WP	1140	Selenium	EPA 1638 / BR-0060	Approved
Trace Metals	PT-TM-WP	1150	Silver	EPA 1638 / BR-0060	Approved
Trace Metals	PT-TM-WP	1160	Strontium	EPA 200.8 / BR-0060	Approved
Trace Metals	PT-TM-WP	1165	Thallium	EPA 1638 / BR-0060	Approved
Trace Metals	PT-TM-WP	1185	Vanadium	EPA 1638 / BR-0060	Approved
Trace Metals	PT-TM-WP	1190	Zinc	EPA 1638 / BR-0060	Approved
Mercury	PT-HG-WP	1095	Mercury	EPA 1631e	Approved
Mercury Low Level	PT-HGLL-WP	1095	Mercury	EPA 1631e	Approved
Tin and Titanium	PT-SNTI-WP	1175	Tin	EPA 1638 / BR-0060	Approved
Tin and Titanium	PT-SNTI-WP	1180	Titanium	EPA 1638 / BR-0060	Approved
Minerals	PT-MIN-WP	1035	Calcium	EPA 1638 / BR-0060	Approved
Minerals	PT-MIN-WP	1755	Total Hardness (as CaCO3)	EPA 1638 / BR-0060	Approved
Minerals	PT-MIN-WP	1085	Magnesium	EPA 1638 / BR-0060	Approved
Solids	PT-SOL-WP	1960	Non-Filterable Residue (TSS)	2540D	Approved
Trace Metals	PT-TM-WP	1010	Arsenic	BR-0020	Approved

DoD ELAP -- PT Performance Summary Review				SOIL only	
Lab Name :	Brooks Rand Labs, LLC				
City/State :	Seattle, WA				
PT Provider Used :	ERA				
PartName	PartNumber	NELACCode	AnalyteName	EPAmethod#	Analyte Approvals
Metals	PT-MET-SOIL	1005	Antimony	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1010	Arsenic	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1015	Barium	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1020	Beryllium	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1025	Boron	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1030	Cadmium	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1035	Calcium	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1040	Chromium	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1050	Cobalt	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1055	Copper	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1070	Iron	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1075	Lead	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1085	Magnesium	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1090	Manganese	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1095	Mercury	EPA 1631 / BR-0002	Approved
Metals	PT-MET-SOIL	1100	Molybdenum	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1105	Nickel	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1140	Selenium	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1150	Silver	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1155	Sodium	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1160	Strontium	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1165	Thallium	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1175	Tin	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1180	Titanium	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1185	Vanadium	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1190	Zinc	EPA 200.8 / BR-0060	Approved
Metals	PT-MET-SOIL	1010	Arsenic	BR-0020	Approved
Metals	PT-MET-SOIL	1140	Selenium	BR-0020	Approved

Attachment C
Standard Operating Procedures

STANDARD OPERATING PROCEDURE

Crab Sampling Using Traps

I. Purpose

This standard operating procedure (SOP) describes the sampling equipment and techniques for using crab traps for the collection of shell fish (e.g., blue crab) for the purpose of analyzing tissue for chemical residues. The results from the analyses of these samples can be used to assess the human health and ecological risks associated with the site.

II. Scope

This guideline provides information on proper sampling equipment and techniques for the collection of crabs in bays, and estuaries, and the ocean shoreline.

Review of the information contained herein will facilitate planning of the field sampling effort by describing standard sampling techniques. The techniques described should be followed whenever applicable, noting that site-specific conditions or project-specific plans may require adjustments in methods.

III. Equipment and Materials

The following materials are needed:

- Small boat for deep water areas.
- Commercially available stainless-steel rubber-wrapped crab traps, or similar net enclosed frames outfitted with openings to allow entry of crabs.
- 2-ring crab net
- Bait (fish scraps, chicken/turkey necks, canned pet food, or similar)
- Measuring board.
- Scales for weight measurement (e.g., 0-16 oz scale and 1-4 lb scale).
- Appropriate identification keys for targeted species.
- 5 gallon bucket or live well (large tub with flow through system).
- Small dip net.
- Field log book.
- Large Ziploc storage bags.
- Aluminum foil.
- Ice and sample cooler.
- Personal Protective Equipment as required by the Health and Safety Plan.
- Camera.

IV. Procedures

The primary considerations for collecting crab for tissue analysis include identifying sampling locations, proper sampling techniques, proper handling of samples, and proper documentation of samples.

Trap Deployment

- Place the crab bait (fish scraps, chicken/turkey necks, canned pet food, or similar) into center of trap, ideally contained in a mesh bags or partially opened can to preserve integrity of the bait mass.
- Attach a rope and float to each trap.
- Deploy traps over side of boat. The traps should initially be spaced evenly over each sample area, with the possibility of modifying their location depending on trap yield.
- The GPS coordinates of each trap should be recorded in the field logbook, along with the deployment time and approximate water depth at the time of deployment.
- Traps should be retrieved and crabs removed at least every 24 hours, but traps can be immediately re-baited and redeployed as necessary to collect additional crabs.

Trap Retrieval

- Retrieve traps and empty caught organisms into a 5 gallon bucket or live well approximately one-half full of fresh site water.
- Record approximate numbers of all organisms and species caught in the log book.
- Retrieve target species from the bucket and release non-target species.
- Inspect crab samples to ensure that their exoskeletons have not been cracked or damaged; discard any damaged crabs.

Initial Crab Processing

- Record approximate numbers and species of all crabs caught in the log book.
- Collect a sufficient number of individuals of the target species to achieve the required tissue mass for laboratory analyses as specified in the work plan.
- Place crabs on ice prior to further processing. Transfer specimens to the shore-based crew as soon as practicable for processing (carapace width, weight measurement, and examination).

Record Keeping

The following information will be recorded in the Field Logbook:

- Sample identification (site name, location, sample name/number and location, number of organisms in the sample, time and date, and sampler's identity).
- Field observations and measurements (sample setting, appearance of substrate and habitat, sampling method, and photograph descriptions).
- Additional remarks, as appropriate.

STANDARD OPERATING PROCEDURE

Fish Sampling Using Gill Nets, Seines, and Cast Nets

I. Purpose

The purpose of this SOP is to provide general reference information and technical guidance on the procedure to sample fish using gill nets, seines, and cast nets. The collected samples will be used for chemical analysis of tissues which will support the assessment of potential risk to human health and the environment.

II. Scope

This guideline provides information on proper sampling equipment and techniques for the collection of fish in lagoons. These techniques are most effective in slow moving water, shallow water. Gill nets are preferable in deeper water habitats, especially where there is significant vegetation or debris that would interfere with other more active netting methods. The pulling of a seine is most effective in shallow, wadable, relatively smooth bottom areas. Cast netting can be effective for targeting schools of fish when observed.

Review of the information contained herein will facilitate planning of the field sampling effort by describing standard sampling techniques. The techniques described should be followed whenever applicable, noting that site-specific conditions or project-specific plans may require adjustments in methods.

III. Equipment and Materials

- Sampling boat (canoe)
- Gill nets (the size mesh is dependent on the size fish desired for collection)
- Seine with a top float line, bottom lead line, and solid poles affixed to either end.
- Cast net (the size mesh is dependent on the size fish desired for collection)
- Flotation and anchors to properly set gill nets
- Fish Measuring Board
- 0-16 oz scale, 1-4 lb scale, 1-15 lb scale
- Live Well (large tub) or bucket to temporarily hold fish
- Appropriate sampling keys for species to be sampled, and any required instruments to aid in the identification
- Field sampling data sheets
- Camera
- Required Personal Protective Equipment
- Portable Air Pumps
- Field log book

IV. Procedures

The primary consideration for collecting fish using these various nets is identifying sampling locations where fish activity is most abundant, and underwater obstructions will not significantly interfere with the netting method. Accurate and timely deployment and retrieval of nets is a key variable in the success of the fish collection effort. Detailed procedures for sampling fish utilizing these various nets are described in the following sections:

A. Preliminary Activities

Collect and determine all information pertinent to the fish sampling project, including water depth, station areas, boat access, tidal variation, any waterway obstructions or inconsistencies (e.g. shallow or grassy areas, mangrove roots), species most likely present, and the most appropriate sampling method for the species of interest.

Before sampling occurs, conduct a site reconnaissance. The objective of this exercise is to evaluate habitat types, biotic characteristics of the area including fish species observed, evidence of fisherman use, and aquatic and riparian vegetation. In addition, identify target locations for sampling along with the total area to be sampled.

Set up a live well (e.g., large cooler, 5-gallon container) with site water.

B. Operating Procedure

Gill Net

Field personnel that are setting gill nets from the canoe should be sitting at all times to maintain balance. Place one end of the gill net with a weight or stake attached to the bottom and a buoy attached to the top into the water, stretch the gill net (do not leave slack) across the area to be sampled by pulling it along with the boat.

The net should remain in the sample location for up to 4 hours before retrieving. During retrieval, the net should be pulled slowly from the water and the collected fish removed as the net is being removed from the water. Place the collected fish into the live well.

Seine

Stretch the seine across the area to be sampled, with a minimum of one field personnel on either side of the seine. Ensure that the weighted side of the seine is at the bottom. Best results are achieved when the water level is no deeper than two thirds the height of the slack net.

Rapidly walk through the water at the same speed, while keeping a constant distance apart. As the end of the sampling area approaches, pull the seine rapidly toward the shore and lift the weighted end out of the water. Place the collected fish into the live well.

Cast Net

The throwing of a cast net is a slightly complicated process, and best done by personnel with experience for efficiency. Inexperienced personnel should practice in an area outside the sampling area. There are several methods for throwing cast nets, and thus they will not be detailed here. Instructions are provided with new cast nets, and there are various online tutorials that are useful.

Cast nets should be thrown in areas free of bottom snags. Snags will prevent the net from properly closing, and oftentimes tear significant holes in the net.

Sample Processing

Upon retrieval of the nets, the collected target specimens should be identified to species, and measured for total length and weight. Record individuals with any deformities, fin erosion, lesions, or tumors, and other signs of disease, skeletal anomalies, or any other pertinent information in the logbook.

VI. References

Brower, 1977. James E. Brower and H. Jerrold Zar. *Field and Laboratory Methods for General Ecology*. Wm. C. Brown Company Publishers. 1977.

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U.S. EPA, 1987. U.S. Environmental Protection Agency. *A Compendium of Superfund Field Operations Methods*. Office of Emergency and Remedial Response, Office of Waste Programs Enforcement. December 1987.

U.S. EPA, 1989. Warren-Hicks, William, Parkhurst, Benjamin R., Baker, Samuel S. Jr. *Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference*. U.S. EPA, Environmental Research Laboratory, Corvallis, OR 97333. March 1989.

STANDARD OPERATING PROCEDURE

Preparation of Fish and Shellfish Tissue Samples

I Purpose

The purpose of this SOP is to provide general reference information and technical guidance on the preparation of fish and shellfish tissue samples for chemical analysis. The chemical analysis of tissue provides information used in the determination of the potential bioaccumulation of contaminants for the assessment of risks to human and ecological receptors.

II Scope

This guideline provides information on proper methods for the preparation of fish and shellfish tissue samples for chemical analysis. Review of the information contained herein will facilitate planning of the field sampling effort by describing standard sampling and preparation techniques. The techniques described should be followed whenever applicable, noting that site-specific conditions or project-specific plans may require adjustments to the methods.

III. Equipment and Materials

- Fish Measuring Board or Ruler
- 0-16 oz, 1-4 lb, 1-15 lb spring scales
- Appropriate sampling keys for species to be sampled, and any required instruments to aid in the identification
- Field sampling data sheets
- Dangerous goods shipment procedures (if using dry ice)
- Decontamination supplies

IV. Procedures

The procedures for preparing the fish and shellfish samples for chemical analysis of tissues include collecting, weighing, measuring, and processing the fish and shellfish samples for shipment. The primary concerns in preparing the fish and shellfish for analysis is to ensure the sample size is adequate and the sample is not contaminated by improper handling.

A. Preliminary Activities

Contact a chemical analysis laboratory that has the required capability for tissue analysis and set up a subcontract agreement with them. Review the sample preparation requirements with the laboratory. Have the laboratory send an adequate number of coolers for shipping the tissue samples. Determine from the laboratory what the minimum amount of tissue sample required for analysis of all the specified parameters. In addition, determine the holding time for a processed sample, and any other special instructions the laboratory may have.

Ensure adequate volume of decontamination chemicals for entire trip. If dry ice is necessary for sample preservation (wet ice is normally good enough), determine where dry ice may be purchased within close proximity to the site or hotel, and where the closest FedEx drop-off is, or if FedEx picks up from the hotel.

Determine the recommended target sample weights of composite fish and shellfish tissue samples. Weight requirements are dictated by the chemical analytical laboratory and analytical method used. Because sample size requirements may vary among laboratories and the analytical methods used, determine the minimum amount of tissue required by the analytical laboratory for analysis of all the specified parameters for the specific project.

B. Sample Processing Procedure

Gather fish specimens using the appropriate fish collecting SOP as determined by the site reconnaissance or study design.

The following steps will be taken with each fish and shellfish collected: identify the sample specimen, sort and inspect the samples, rinse the samples with site water and group by target species, and prepare the sample for shipment to the laboratory.

Weigh the collected fish/shellfish to the nearest gram and measure to the nearest tenth of a centimeter. The total length of the fish will be measured by the distance in a straight line from the anterior-most projecting part of the head to the farthest tip of the caudal fin when its rays are squeezed together. The total length of crabs is measured as the distance of the lateral width of the carapace.

D. Preservation of Sample Integrity

Sample integrity is preserved by prevention of a loss of contaminants already existing in the tissue and prevention of extraneous tissue contamination. Sample integrity will be preserved by ensuring the fish skin is not lacerated by the sampling gear and ensuring the shellfish are not cracked. In addition, consideration will be taken in preventing the tissue samples and sample gear from coming directly in contact with grease, engine fluid, engine exhaust, dust, cooler, or ice.

F. Tissue Preparation for Shipment to Laboratory

After the initial processing to determine species, size, and morphological abnormalities, each fish or shellfish will be wrapped individually in aluminum foil and placed in a labeled waterproof freezer bag. If necessary, clean cork stoppers will be placed over the protruding spines or pincers of the shellfish before wrapping in foil,

or spines/pincers will be clipped off. A paper label will be placed inside the bag, identifying the project, station location, date, and sample number. A pencil will be used to mark the label. The outside of the bag also will be labeled with the project, station location, date, and sample number using a black permanent marker. The bags will be stored on wet ice in coolers if shipment to the laboratories is within 48 hours. If longer, the bags will be stored in a freezer.

Carefully pack the samples in the coolers for shipment to the laboratory. Fill the top and bottom of the coolers with a sufficient amount of wet ice, if shipment to the laboratories is within 48 hours, or with a sufficient amount of dry ice. Enclose the chain-of-custody inside the cooler. Place a chain-of-custody seal on the cooler and tape the cooler closed. Attach a completed FedEx airbill to the cooler and drop off at a FedEx office. If dry ice is being used, note on FedEx label and adhere to Dangerous Goods shipment procedures, if necessary.

The following information will be recorded in the Field Logbook:

- Sample identification (site name, location, project no.; sample name/number and location; sample type and matrix; time and date; sampler's identity).
- Field observations and measurements (sample setting, appearance of substrate, sampling method, and photograph descriptions).
- Additional remarks, as appropriate.

Proper chain-of-custody procedures play a crucial role in data gathering. Chain-of-custody forms are considered quality assurance records.

V. References

U.S. EPA, 1993. U.S. Environmental Protection Agency, *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories Volume 1 Fish and Sampling Analyses*. Office of Water. August 1993. EPA 823-R-93-002

Attachment D
Fish and Crab Technical Memorandum

PREPARED FOR: Julio Vazquez/USEPA
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PREPARED BY: CH2M HILL on behalf of the Navy

DATE: December 13, 2011

This technical memorandum presents the analytes identified for fish and blue crab samples to be collected at Solid Waste Management Unit (SWMU) 6 at Vieques. The analytes were identified using a revised selection process based on the approach discussed with U.S. EPA (USEPA) and the Puerto Rico Environmental Quality Board (PREQB) on October 25 - 27, 2011. The following approach was used to identify analytes:

1. Surface water and sediment concentrations were compared to background concentrations; chemicals detected above background upper tolerance limits (UTLs) were identified. The potential for these chemicals to accumulate in fish or crab was evaluated, and those considered by EPA to be bioaccumulative were identified as fish/crab chemicals of potential concern (COPCs) and were carried to Step 2.
2. COPCs were qualitatively evaluated to assess whether they preferentially accumulate in shell or in tissues/organs.
3. Bioaccumulation factors based on whole body fish and whole body crab were identified for COPCs to reflect local food preparation and cooking.
4. The bioaccumulation factors were used to identify chemicals of concern (COCs), which are the proposed analytes for the fish and crab samples to be collected at SWMU 6.

Each of the above steps is discussed in detail below:

Background Comparisons and Potential for Bioaccumulation in Fish/Crab

The maximum detected concentrations in surface water and sediment were compared to the background UTLs (95 percent upper confidence limit of the 95th percentile [95/95 UTL] for surface water and sediment data collected from three nearby lagoons [Laguna Kiani, Laguna El Pobre, and Laguna Punta Arenas]). Derivation of the background dataset is discussed in Attachment 1 of this Technical Memorandum. Chemicals with maximum detected concentrations below the background UTL were not retained as COPCs. The detailed COPC selection process is presented in Tables 2.5 and 2.6 of Attachment 2. Based on the background comparisons and the potential for those chemicals to be bioaccumulative (based on determinations made by EPA), the following chemicals were identified as COPCs:

Environmental Medium	Chemicals of Potential Concern in Fish/Crab
Surface Water	Cadmium[1] and thallium
Sediment	Cadmium[1], chromium, copper, lead, nickel, silver, zinc, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, Aroclor-1254, and tetrachloroethene

Qualitative Evaluation of Site of Accumulation for COPCs

At the request of the agencies on October 27, 2011, because fish-based BSAFs were the only BSAFs available for many COPCs (see Attachment 2, Table 3.5 Supplement A), an additional evaluation was conducted to assess whether the COPCs preferentially accumulate in crab shell or in specific tissues or organs. The concern is that preparation of crab dishes for consumption on Vieques may involve cooking or boiling the crab whole, which

could result in chemicals in the shell being released into the meal. ATSDR's toxicological profiles were reviewed for specific information on the site of accumulation in crabs (and other aquatic organisms, such as fish, when crab information was unavailable). Results of this evaluation are presented in Attachment 3. The ATSDR profiles did not indicate any of the aforementioned COPCs accumulate in crab shells.

Identification of Whole Body Bioaccumulation Factors

Based on agency discussions on October 27, 2011, the Vieques Master HHRA protocol approach for determining biota tissue concentrations was revised to take into account local cultural behaviors which could affect how individuals are exposed to contaminants through consumption of fish and crab. Therefore, whole-body bioaccumulation factors were identified to account for potential consumption of the entire fish and crab in local dishes such as stews. Where available, both fish-specific and crab-specific bioaccumulation factors were identified. BCF and BSAF values are presented on Table 3.4 Supplement A and Table 3.5 Supplement A of Attachment 2.

Risk Estimates and Identification of Analytes for Fish/Crab Samples

Surface water/sediment exposure point concentrations and bioaccumulation factors used to estimate chemical intake through consumption of fish and blue crab are presented in Tables 3.5/3.6 and Tables 3.5 Supplement A/3.6 Supplement A, respectively. Risk estimates were calculated for fish and crab ingestion scenarios based on fish/crab ingestion rates of 0.227 kg-fish/meal (adult and youth) and 0.114 kg-fish/meal (child) and an exposure frequency of 2 meals/week for 24 years (adult), 10 years (adolescent), and 6 years (child). The 2 meals/week ingestion scenario is a more realistic exposure scenario for SWMU 6 than the subsistence scenario (which assumes 7 meals/week). Since one of the primary objectives of the biota sampling is to more realistically evaluate potential risks due to fish and crab consumption at SWMU 6, the 2 meals/week ingestion rate was used.

The tables showing estimated intake and risks for COPCs are presented in Tables 7.1 through 7.3 (for the fish consumption exposure scenario) and Tables 7.4 through 7.6 (for the crab consumption exposure scenario) in Attachments 4a and 4b, respectively. A COPC was identified as a COC if its ELCR exceeds $1x10^{-4}$ or the target organ-specific Hazard Index exceeds 1.0.

The ELCR estimates for 4,4-DDE in fish/crab were around 1E-4. As shown in Attachment 5, the fish ELCRs range from 3E-5 to 2E-4, depending on the specific whole-body BSAF used (ranging from 4-35). The highest ELCR (2E-4) was associated with a BSAF for cunner fish, a type that is not found in Puerto Rico, but found only in the Northeast (from Newfoundland, Canada to New Jersey). However, the highest ELCR associated with a BSAF for fish present in the vicinity of Vieques is 1E-4 based on largemouth bass. As shown in Attachment 5, the crab ELCRs range from 3E-5 to 2E-4, depending on the specific BSAF value used (ranging from 6.7 to 32) for burrowing crab. Use of three of the four BSAF values for burrowing crab results in risk estimates within EPA's acceptable risk range. Due to the possible range of risk estimates for the various BSAFs, the slight exceedance of the 1E-4 target risk level using a BSAF not applicable to fish in Puerto Rico and only the most conservative BSAF for burrowing crab, the expected conservatism inherent in the fish/crab uptake models, and the potential for at least some pesticides to be present as a result of normal pesticide use, 4,4-DDE was not identified as a COC for fish/crab.

Based on the above, the following COCs were identified for the fish and crab consumption pathways, and will be the analytes for the upcoming fish and crab sampling at SWMU 6:

Biota	Surface Water	Sediment
Fish	thallium	Lead[1], zinc, and Aroclor-1254[2]
Crab	thallium	Lead[1], zinc, and Aroclor-1254[2]

[1] Lead was identified as a COC in fish and crab tissue, although quantitative oral toxicity values are not available for lead. Fish and crab tissue screening levels of 0.472 mg/kg-biota for child and 1.036 mg/kg-biota for adult were calculated using the IEUBK and ALM models, respectively, based on the 1994 OSWER Directive of no more than 5% of children (or fetuses of exposed women) exceeding 10 µg/dL blood lead. Modeled concentrations of lead in biota (24 mg/kg-biota) exceed screening levels and therefore lead was identified as a COC. These chemicals will be retained for evaluation in the SWMU-6 biota sampling.

[2] Congener-specific PCBs to be analyzed due to the media of interest (fish/crab).

It is noted that the only difference between the analyte list above and the analyte list provided in the *Draft Addendum, Post-Removal Supplemental Confirmatory Sampling and Analysis Plan, Solid Waste Management Unit (SWMU) 6, Former Naval Ammunition Support Detachment, Vieques, Puerto Rico* (CH2M HILL, October 2011) is the elimination of methyl mercury. This is because the mercury concentrations in surface water and sediment at SWMU 6 are less than the background mercury concentrations, which was not considered previously.

Attachment 1

Background Study for Vieques SWMU 6

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DATE: November 21, 2011

Introduction

Background surface water and sediment data associated with the SWMU 6 investigation were collected for metals (total and dissolved for surface water) and selected organics (pesticides/polychlorinated biphenyls [PCBs]). These data are presented in Tables 1A and 1B. An outlier evaluation was performed, resulting in the exclusion of a few of the elevated concentrations for chromium in sediment and antimony, hexavalent chromium (dissolved) and vanadium in surface water. The remaining data were used to calculate 95 percent upper confidence limits of the 95th percentile, known as 95/95 UTLs. These UTLs serve as the background values compared to surface water and sediment concentrations detected at SWMU 6.

Evaluation of Outliers

Outlier analysis was performed for all constituents detected at least once. Per EPA guidance (EPA, 2006), Dixon's Extreme Value test (recommended for sample sizes less than 25) was used. It was applied in such a way that multiple outliers would all be identified as mathematical outliers. With multiple outliers, a given extreme value may be masked by another, slightly lower value and initially be found not to be a mathematical outlier. When testing for multiple outliers, however, both values may actually be outliers. For instance, if the lower of two elevated values was identified as an outlier, both of the values were designated as outliers.

This outlier tests is based on an assumption of normality for those concentrations remaining after the statistical outlier(s) is excluded. Thus, various transformations were considered, based on the Shapiro-Wilk test (a test for normality) to achieve the best adherence to normality with the remaining concentrations (Gilbert, 1987; EPA, 2006). The data were transformed using one of three transformations. These were the square root transformation, the cubic root transformation, and the natural logarithmic transformation. The logarithmic transformation is a standard transformation in environmental applications, while the square root and cubic root transformations offer options that are appropriate for intermediate levels of data skewness.

The mathematical outliers identified via this approach are presented in Table 2. These concentrations were not included in the background data set used to calculate summary

statistics. The transformations used for each outlier analysis are included in Table 2. The concentrations of the outliers relative to the other concentrations are presented in the probability plots shown in Figures 1-5. These five figures are for Sediment-Total Metals, Sediment-Pesticides/PCBs, Surface Water-Total Metals, Surface Water-Dissolved Metals, and Surface Water- Pesticides/PCBs, respectively.

The probability plots show the actual concentrations versus the expected quantiles if the data were normal. The quantiles in these plots are the number of standard deviations from the mean. These graphs help visualize the ascending concentrations so that the most elevated concentrations can be viewed with respect to the lower concentrations. In the probability plots, detected concentrations are plotted as solid circles. Non-detects (NDs) are plotted as open circles. The mathematical outliers are plotted as Xs. As shown in the figures, outliers comprised elevated values for chromium in sediment and antimony, hexavalent chromium (dissolved) and vanadium in surface water.

The calculated outliers were not concentrated in any given sample (each of the four outliers were from a separate sample). It is important to note that the outliers may actually be part of the normal background population of data. Outlier identification was performed by establishing a common, conservative significance value of 0.05 and eliminating any constituent concentration that exceeded this significance value (via the outlier test) from the background UTL calculation. While this process likely eliminates true background "upper tail" concentrations from the background UTL calculations, it does provide a conservative measure to avoid elevating the background UTLs in case outlier concentrations are not representative of background.

Summary Statistics

Using the dataset generated via the outlier evaluations, summary statistics for each detected constituent and depth are presented in Table 3. The statistics comprise the mean, median, standard deviation, minimum RL, maximum RL, minimum detect, maximum detect, number of detects, number of samples, and percent detects for all concentrations retained in the data set, after removal of outliers, and are reported to three significant figures.

These summary statistics include the calculation of 95 percent upper confidence limits of the 95th percentile, known as 95/95 UTLs. These UTLs serve as background values for comparisons to surface water and sediment data for samples collected at SWMU 6. The background threshold values, as 95/95 UTLs, were calculated using either a distributional assumption that appeared most appropriate, or using a nonparametric (distribution free) approach when evidence for a particular distribution is not available. The distribution possibilities included the normal, lognormal, and gamma distributions.

As long as at least 60 percent of the results were detected, the distributions appearing most appropriate via ProUCL's distributional checks were used to calculate the UTL. For such cases, when data include NDs, ProUCL algorithms seek to apply maximum-likelihood-estimate (MLE) or regression on order statistics (ROS) techniques to provide proxy values for the NDs used in the calculation of the UTLs. When a UTL estimated using MLE or ROS techniques is possible within ProUCL's algorithms, that approach was preferred over one using alternate proxy values (e.g., one-half the detection limit). When fewer than 60%

detections were available, the Kaplan Meier approach was used in lieu of establishing specific proxy values for NDs. When all results were detected, but no discernable distribution was available, a nonparametric UTL, based on ranks of the data, was applied.

For ease of use, the final background threshold values are presented alone in Table 4.

Table 1A
SWMU 6 Background Surface Water Data
Former Vieques Naval Training Range, Vieques, Puerto Rico

Station ID	VWW06-SW014	VWW06-SW015	VWW06-SW016	VWW06-SW017	VWW06-SW018	VWW06-SW019	VWW06-SW020	VWW06-SW021	VWW06-SW022	VWW06-SW023	
Sample ID	VWW06-SW014-0211	VWW06-SW015-0211	VWW06-SW016-0211	VWW06-SW017-0211	VWW06-SW018-0211	VWW06-SW019-0211	VWW06-SW020-0211	VWW06-SW021-0211	VWW06-SW022-0211	VWW06-SW023-0211	VWW06-SW023P-0211
Sample Date	02/07/11	02/07/11	02/07/11	02/07/11	02/08/11	02/08/11	02/08/11	02/08/11	02/08/11	02/08/11	02/08/11
Chemical Name											
Pesticide/Polychlorinated Biphenyls (UG/L)											
4,4'-DDD	0.0054 U	0.0055 U	0.0055 U	0.0054 U	0.048 J	0.0054 U	0.0054 U	0.0054 U	0.0054 U	0.0054 U	0.0054 U
4,4'-DDE	0.0079 U	0.008 U	0.0081 U	0.0079 U	0.067	0.0079 U	0.0078 U	0.0079 U	0.0078 U	0.0079 U	0.0079 U
4,4'-DDT	0.0023 U	0.0023 U	0.0023 U	0.0023 U	0.083	0.0023 U	0.0023 U	0.0023 U	0.0023 U	0.0023 U	0.0023 U
Aldrin	0.0033 U	0.0034 U	0.0034 U	0.0033 U	0.0046 NJ	0.0033 U	0.0033 U	0.0033 U	0.0033 U	0.0033 U	0.0033 U
alpha-BHC	0.0062 U	0.0063 U	0.0064 U	0.0062 U	0.0062 U	0.0062 U	0.0062 U	0.0062 U	0.0062 U	0.0062 U	0.0062 U
alpha-Chlordane	0.0062 U	0.0063 U	0.0064 U	0.0062 U	0.045 J	0.0062 U	0.0062 U	0.0062 U	0.0062 U	0.0062 U	0.0062 U
Aroclor-1016	NA	NA	NA	NA	0.02 U	0.021 U	0.021 U	0.02 U	0.021 U	0.021 U	0.021 U
Aroclor-1221	NA	NA	NA	NA	0.02 U	0.021 U	0.021 U	0.02 U	0.021 U	0.021 U	0.021 U
Aroclor-1232	NA	NA	NA	NA	0.016 U	0.016 U	0.016 U	0.016 U	0.016 U	0.016 U	0.017 U
Aroclor-1242	NA	NA	NA	NA	0.02 U	0.021 U	0.021 U	0.02 U	0.021 U	0.021 U	0.021 U
Aroclor-1248	NA	NA	NA	NA	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U
Aroclor-1254	NA	NA	NA	NA	0.0098 U	0.0099 U	0.0099 U	0.0098 U	0.0099 U	0.01 U	0.01 U
Aroclor-1260	NA	NA	NA	NA	0.02 U	0.021 U	0.021 U	0.02 U	0.021 U	0.021 U	0.021 U
beta-BHC	0.0025 U	0.0025 U	0.0026 U	0.0025 U	0.025 J	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U
delta-BHC	0.0062 U	0.0063 U	0.0064 U	0.0062 U	0.012 J	0.0062 U	0.0062 U	0.0062 U	0.0062 U	0.0062 U	0.0062 U
Dieldrin	0.0056 U	0.0057 U	0.0057 U	0.0056 U	0.047 J	0.0056 U	0.0056 U	0.0056 U	0.0056 U	0.0056 U	0.0056 U
Endosulfan I	0.009 U	0.009 U	0.0091 U	0.0089 U	0.049 J	0.0089 U	0.0089 U	0.009 U	0.0089 U	0.009 U	0.009 U
Endosulfan II	0.0033 U	0.0034 U	0.0034 U	0.0033 U	0.04 J	0.0033 U	0.0033 U	0.0033 U	0.0033 U	0.0033 U	0.0033 U
Endosulfan sulfate	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.026 J	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U
Endrin	0.0038 U	0.0038 U	0.0038 U	0.0037 U	0.053	0.0037 U	0.0037 U	0.0038 U	0.0037 U	0.0038 U	0.0038 U
Endrin aldehyde	0.0031 U	0.0032 U	0.0032 U	0.0031 U	0.0053 J	0.0031 U	0.0031 U	0.0031 U	0.0031 U	0.0031 U	0.0031 U
Endrin ketone	0.012 U	0.013 U	0.013 U	0.012 U	0.029 J	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U
gamma-BHC (Lindane)	0.005 U	0.005 U	0.0051 U	0.005 U	0.005 U	0.005 U	0.0049 U	0.005 U	0.0049 U	0.005 U	0.005 U
gamma-Chlordane	0.005 U	0.005 U	0.0051 U	0.005 U	0.026 J	0.005 U	0.0049 U	0.005 U	0.0049 U	0.005 U	0.005 U
Heptachlor	0.0082 U	0.0083 U	0.0084 U	0.0082 U	0.0074 J	0.0082 U	0.0082 U	0.0082 U	0.0082 U	0.0082 U	0.0082 U
Heptachlor epoxide	0.0029 U	0.0029 U	0.003 U	0.0029 U	0.038 J	0.0029 U	0.0029 U	0.0029 U	0.0029 U	0.0029 U	0.0029 U
Methoxychlor	0.0038 U	0.0038 U	0.0038 U	0.0037 U	0.061	0.0037 U	0.0037 U	0.0038 U	0.0037 U	0.0038 U	0.0038 U
Toxaphene	0.38 U	0.38 U	0.38 U	0.37 U	0.37 U	0.37 U	0.37 U	0.38 U	0.37 U	0.38 U	0.38 U
Total Metals (UG/L)											
Aluminum	186 U	186 U	428 J	282 J	1,240 R	2,030 R	800 R	490 R	602 R	640 R	586 R
Antimony	66 U	20 U	20 U	20 U	36.8 J	20 U	20 U	20 U	20 U	72.7 J	20 U
Arsenic	50 U	66.2 U	66.2 U	66.2 U	50 U	50 U	50 U	66.2 U	66.2 U	50 U	50 U
Barium	33.4 J	29.6 J	33.9 J	31.7 J	9.84 J	13 J	10.6 J	8.47 J	10.5 J	10.3 J	9.64 J
Beryllium	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
Cadmium	20 U	14.4 U	9.35 J	11.4 J	14.4 U	8.76 J	9.14 J	9.35 J	11 J	9.5 J	9.58 J
Calcium	519,000	503,000	539,000	512,000	421,000	424,000	410,000	427,000	427,000	425,000	425,000
Chromium	8.6 U	8.6 U	8.6 U	8.6 U	8.6 U	8.6 U	8.6 U	8.6 U	8.6 U	8.6 U	8.6 U
Chromium (hexavalent)	53	44 J	43 J	97 J	21	18 J	29 J	8 J	12 J	29 J	47 J
Cobalt	7.4 U	7.4 U	7.4 U	7.4 U	7.4 U	7.4 U	7.4 U	7.4 U	7.4 U	7.4 U	7.4 U
Copper	50 U	98.6 J	149 J	108 J	46.2 J	45 J	40.7 J	40.7 J	44 J	42 J	37.3 J
Iron	110 U	110 U	201 J	110 U	635 J	1,660 J	331 J	110 UJ	176 J	314 J	227 J
Lead	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Magnesium	1,570,000	1,550,000	1,620,000	1,520,000	1,310,000	1,320,000	1,290,000	1,310,000	1,300,000	1,300,000	1,320,000
Manganese	7 U	7 U	7 U	7 U	7 U	7 U	7 U	7 U	7 U	7 U	7 U
Mercury	0.0514 J	0.0516 J	0.074 UJ	0.074 UJ	0.074 U	0.074 U	0.0426 J	0.074 U	0.074 U	0.074 UJ	0.0405 J
Nickel	18.6 U	18.6 U	18.6 U	18.6 U	18.6 U	18.6 U	18.6 U	18.6 U	18.6 U	18.6 U	18.6 U
Potassium	533,000	514,000	533,000	521,000	433,000	437,000	421,000	435,000	436,000	429,000	430,000
Selenium	113	102	99.6	50.7 J	84.2 J	89.6 J	54.9 J	103	49.3 J	82 U	82 U
Silver	5 U	5 U	10.4 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Sodium	13,600,000	13,600,000	13,800,000	13,200,000	11,000,000	11,200,000	11,100,000	11,000,000	11,000,000	10,800,000	10,800,000
Thallium	88 U	88 U	88 U	88 U	88 U	88 U	88 U	88 U	88 U	88 U	88 U
Vanadium	8.8 U	8.8 U	8.8 U	8.8 U	5.9 J	7.77 J	4.98 J	8.8 U	8.8 U	8.8 U	5.46 J
Zinc	80 U	80 U	80 U	80 U	80 U	80 U	80 U	80 U	80 U	80 U	80 U

Vieques-West
SWMU 6
Surface Water Raw Analytical Results
February 2011

Station ID	VWW06-SW014	VWW06-SW015	VWW06-SW016	VWW06-SW017	VWW06-SW018	VWW06-SW019	VWW06-SW020	VWW06-SW021	VWW06-SW022	VWW06-SW023	
Sample ID	VWW06-SW014-0211	VWW06-SW015-0211	VWW06-SW016-0211	VWW06-SW017-0211	VWW06-SW018-0211	VWW06-SW019-0211	VWW06-SW020-0211	VWW06-SW021-0211	VWW06-SW022-0211	VWW06-SW023-0211	VWW06-SW023P-0211
Sample Date	02/07/11	02/07/11	02/07/11	02/07/11	02/08/11	02/08/11	02/08/11	02/08/11	02/08/11	02/08/11	02/08/11
Chemical Name											
Dissolved Metals (UG/L)											
Aluminum, Dissolved	186 U	186 U	252 J	200 J	186 U	186 U	186 U	186 U	186 U	186 U	186 U
Antimony, Dissolved	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Arsenic, Dissolved	50 U	66.2 U	66.2 U	66.2 U	50 U	50 U	50 U	66.2 U	66.2 U	66.2 U	50 U
Barium, Dissolved	26.4 J	26.6 J	28 J	28.4 J	8.65 J	10.2 J	9.74 J	7.76 J	9.8 J	10.6 J	7.41 J
Beryllium, Dissolved	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
Cadmium, Dissolved	14.4 U	14.4 U	14.4 U	14.4 U	14.4 U	14.4 U	14.4 U	14.4 U	14.4 U	14.4 U	14.4 U
Calcium, Dissolved	535,000	556,000	553,000	548,000	414,000 R	434,000 R	430,000 R	434,000 R	422,000 R	438,000 R	415,000 R
Chromium, Dissolved	8.6 U	8.6 U	8.6 U	8.6 U	8.6 U	8.6 U	8.6 U	8.6 U	8.6 U	8.6 U	8.6 U
Chromium (hexavalent), Dissolved	16 J	19 J	38 J	20 J	15 J	7 J	16 J	7 UJ	4 J	16 J	16 J
Cobalt, Dissolved	7.4 U	7.4 U	7.4 U	7.4 U	7.4 U	7.4 U	7.4 U	7.4 U	7.4 U	7.4 U	7.4 U
Copper, Dissolved	50 U	54 U	54 U	54 U	50 U	50 U	50 U	54 U	54 U	54 U	26 J
Iron, Dissolved	110 U	110 U	110 U	110 U	110 U	110 U	110 U	110 U	110 U	110 U	110 U
Lead, Dissolved	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	11.9 J
Magnesium, Dissolved	1,640,000 J	1,680,000 J	1,690,000 J	1,690,000 J	1,310,000 R	1,340,000 R	1,360,000 R	1,350,000 R	1,310,000 R	1,350,000 R	1,270,000 R
Manganese, Dissolved	7 U	7 U	7 U	7 U	7 U	7 U	7 U	7 U	7 U	7 U	7 U
Mercury, Dissolved	0.0621 J	0.0551 J	0.0469 J	0.053 J	0.074 U	0.074 U	0.074 U	0.074 U	0.0454 J	0.074 UJ	0.074 UJ
Nickel, Dissolved	18.6 U	18.6 U	18.6 U	18.6 U	18.6 U	18.6 U	18.6 U	18.6 U	18.6 U	18.6 U	18.6 U
Potassium, Dissolved	533,000	550,000	552,000	539,000	428,000 R	447,000 R	443,000 R	448,000 R	431,000 R	443,000 R	419,000 R
Selenium, Dissolved	100 J	114 J	82 U	82 U	68.8 J	105	72.8 J	104	96.8	121	65.9 J
Silver, Dissolved	5 U	5 U	10.4 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Sodium, Dissolved	13,900,000	14,500,000	15,600,000	13,700,000	10,900,000	10,900,000	11,300,000	11,100,000	10,900,000	11,400,000	10,500,000
Thallium, Dissolved	88 U	88 U	88 U	88 U	88 U	88 U	88 U	88 U	88 U	88 U	88 U
Vanadium, Dissolved	8.8 U	8.8 U	8.8 U	5.37 J	8.8 U	8.8 U	4.94 J	4.5 J	5.82 J	5.78 J	8.8 U
Zinc, Dissolved	80 U	80 U	80 U	80 U	80 U	80 U	80 U	80 U	80 U	80 U	80 U

Notes:

J - Analyte present, value may or may not be accurate or precise
NA - Not analyzed
NJ - Qualitative identification questionable due to poor resolution, presumptively present at approximate quantity
R - Unreliable Result
U - Not detected or not detected at significantly greater than that in an associated blank.
UJ - Analyte not detected, quantitation limit may be inaccurate
UG/L - Micrograms per liter

Table 1B
SWMU 6 Background Sediment Data
Former Vieques Naval Training Range, Vieques, Puerto Rico

Station ID	VWW06-SD014	VWW06-SD015	VWW06-SD016	VWW06-SD017	VWW06-SD018	VWW06-SD019	VWW06-SD020	VWW06-SD021	VWW06-SD022	VWW06-SD023	
Sample ID	VWW06-SD014-0211	VWW06-SD015-0211	VWW06-SD016-0211	VWW06-SD017-0211	VWW06-SD018-0211	VWW06-SD019-0211	VWW06-SD020-0211	VWW06-SD021-0211	VWW06-SD022-0211	VWW06-SD023-0211	VWW06-SD023P-0211
Sample Date	02/07/11	02/07/11	02/07/11	02/07/11	02/08/11	02/08/11	02/08/11	02/08/11	02/08/11	02/08/11	02/08/11
Chemical Name											
Pesticide/Polychlorinated Biphenyls (UG/KG)											
4,4'-DDD	3.4 UJ	2.2 UJ	3.1 UJ	3.8 UJ	3.9 UJ	3.9 UJ	4.1 UJ	4.2 UJ	4.5 UJ	3.6 UJ	3.5 UJ
4,4'-DDE	1.3 J	1.1 UJ	1.6 UJ	2 UJ	2.1 UJ	2.1 UJ	2.2 UJ	2.2 UJ	2.4 UJ	1.9 UJ	1.8 UJ
4,4'-DDT	2.6 UJ	1.6 UJ	2.3 UJ	2.8 UJ	2.9 UJ	2.9 UJ	3 UJ	3.1 UJ	3.4 UJ	2.6 UJ	2.6 UJ
Aldrin	1 UJ	0.64 UJ	0.92 UJ	1.1 UJ	1.2 UJ	1.2 UJ	1.2 UJ	1.2 UJ	1.3 UJ	1 UJ	1 UJ
alpha-BHC	5 UJ	3.2 UJ	4.6 UJ	5.5 UJ	5.8 UJ	5.8 UJ	6 UJ	6.2 UJ	6.6 UJ	5.2 UJ	5.1 UJ
alpha-Chlordane	1.1 UJ	0.68 UJ	0.98 UJ	1.2 UJ	1.2 UJ	1.2 UJ	1.3 UJ	1.3 UJ	1.4 UJ	1.1 UJ	1.1 UJ
Aroclor-1016	87 UJ	55 UJ	80 UJ	96 UJ	61 UJ	61 UJ	63 UJ	65 UJ	70 UJ	55 UJ	54 UJ
Aroclor-1221	80 UJ	51 UJ	73 UJ	89 UJ	56 UJ	56 UJ	58 UJ	60 UJ	64 UJ	51 UJ	50 UJ
Aroclor-1232	100 UJ	64 UJ	92 UJ	110 UJ	70 UJ	70 UJ	72 UJ	75 UJ	81 UJ	64 UJ	62 UJ
Aroclor-1242	74 UJ	47 UJ	67 UJ	81 UJ	51 UJ	51 UJ	53 UJ	55 UJ	59 UJ	46 UJ	45 UJ
Aroclor-1248	74 UJ	47 UJ	67 UJ	81 UJ	51 UJ	51 UJ	53 UJ	55 UJ	59 UJ	46 UJ	45 UJ
Aroclor-1254	64 UJ	40 UJ	58 UJ	70 UJ	44 UJ	44 UJ	46 UJ	47 UJ	51 UJ	40 UJ	39 UJ
Aroclor-1260	41 UJ	26 UJ	37 UJ	45 UJ	28 UJ	28 UJ	29 UJ	30 UJ	33 UJ	26 UJ	25 UJ
beta-BHC	1 UJ	0.64 UJ	0.92 UJ	1.1 UJ	1.2 UJ	1.2 UJ	1.2 UJ	1.2 UJ	1.3 UJ	1 UJ	1 UJ
delta-BHC	1.9 UJ	1.2 UJ	1.7 UJ	2.1 UJ	2.2 UJ	2.2 UJ	2.2 UJ	2.3 UJ	2.5 UJ	2 UJ	1.9 UJ
Dieldrin	1.1 UJ	0.68 UJ	0.98 UJ	1.2 UJ	1.2 UJ	1.2 UJ	1.3 UJ	1.3 UJ	1.4 UJ	1.1 UJ	1.1 UJ
Endosulfan I	1.5 UJ	0.93 UJ	1.3 UJ	1.6 UJ	1.7 UJ	1.7 UJ	1.8 UJ	1.8 UJ	2 UJ	1.5 UJ	1.5 UJ
Endosulfan II	1.9 UJ	1.2 UJ	1.8 UJ	2.1 UJ	2.2 UJ	2.2 UJ	2.3 UJ	2.4 UJ	2.6 UJ	2 UJ	2 UJ
Endosulfan sulfate	1.3 UJ	0.85 UJ	1.2 UJ	1.5 UJ	1.5 UJ	1.5 UJ	1.6 UJ	1.6 UJ	1.8 UJ	1.4 UJ	1.4 UJ
Endrin	1.7 UJ	1.1 UJ	1.6 UJ	1.9 UJ	2 UJ	2 UJ	2.1 UJ	2.1 UJ	2.3 UJ	1.8 UJ	1.8 UJ
Endrin aldehyde	2.4 UJ	1.5 UJ	2.2 UJ	2.7 UJ	2.8 UJ	2.8 UJ	2.9 UJ	3 UJ	3.2 UJ	2.5 UJ	2.4 UJ
Endrin ketone	1.4 UJ	0.89 UJ	1.3 UJ	1.6 UJ	1.6 UJ	1.6 UJ	1.7 UJ	1.7 UJ	1.9 UJ	1.5 UJ	1.4 UJ
gamma-BHC (Lindane)	1.3 UJ	0.85 UJ	1.2 UJ	1.5 UJ	1.5 UJ	1.5 UJ	1.6 UJ	1.6 UJ	1.8 UJ	1.4 UJ	1.4 UJ
gamma-Chlordane	1.1 UJ	0.72 UJ	1 UJ	1.2 UJ	1.3 UJ	1.3 UJ	1.4 UJ	1.4 UJ	1.5 UJ	1.2 UJ	1.2 UJ
Heptachlor	1.3 UJ	0.85 UJ	1.2 UJ	1.5 UJ	1.5 UJ	1.5 UJ	1.6 UJ	1.6 UJ	1.8 UJ	1.4 UJ	1.4 UJ
Heptachlor epoxide	1 UJ	0.64 UJ	0.92 UJ	1.1 UJ	1.2 UJ	1.2 UJ	1.2 UJ	1.2 UJ	1.3 UJ	1 UJ	1 UJ
Methoxychlor	1.8 U	1.1 UJ	1.6 UJ	2 UJ	2.1 UJ	2.1 UJ	2.2 UJ	2.2 UJ	2.4 UJ	1.9 UJ	1.8 UJ
Toxaphene	170 UJ	110 UJ	150 UJ	180 UJ	190 UJ	190 UJ	200 UJ	200 UJ	220 UJ	170 UJ	170 UJ
Total Metals (MG/KG)											
Aluminum	8,470 J	9,890 J	7,980 J	10,600 J	27,000 J	24,500 J	29,200 J	16,200 J	14,000 J	16,900 J	16,600 J
Antimony	1.33 UJ	0.89 UJ	1.35 UJ	1.51 UJ	1.01 UJ	1.17 UJ	1.03 UJ	1.02 UJ	1.09 UJ	0.974 UJ	0.835 UJ
Arsenic	2.5 UJ	2 J	1.4 UJ	2.1 J	5.9 J	5.5 J	2.6 J	6 J	6.2 J	3.1 J	2.8 J
Barium	8.21 J	7.11 J	9.6 J	11.3 J	14.8 J	14 J	19.8 J	11.6 J	9.56 J	12 J	11.3 J
Beryllium	0.89 UJ	0.593 UJ	0.902 UJ	1 UJ	0.648 J	0.478 J	0.612 J	0.678 UJ	0.38 J	0.395 J	0.339 J
Cadmium	0.175 J	0.185 UJ	0.282 UJ	0.314 UJ	0.211 UJ	0.244 UJ	0.214 UJ	0.212 UJ	0.227 UJ	0.203 UJ	0.174 UJ
Calcium	30,900 J	14,000 J	17,600 J	11,400 J	6,260 J	8,510 J	4,750 J	53,000 J	14,200 J	25,400 J	25,400 J
Chromium	10.9 J	20 J	10.3 J	6.7 J	14.9 J	13.7 J	15 J	14.1 J	14.8 J	15 J	15.1 J
Chromium (hexavalent)	24.8 J	150 J	30.5 J	101 J	33.9 J	36.8 J	34.1 J	24.6 J	9.34 J	30.4 J	36.3 J
Cobalt	3.81 J	3.94 J	3.3 J	4.47 J	8.48 J	7.33 J	7.01 J	5.03 J	5.08 J	5.26 J	5.18 J
Copper	29.7 J	23.4 J	37.1 J	28.5 J	44.6 J	42.4 J	47.6 J	32.1 J	32.5 J	39.6 J	37.4 J
Iron	10,400 J	9,300 J	14,400 J	8,870 J	35,300 J	34,000 J	29,400 J	19,600 J	20,000 J	23,500 J	22,800 J
Lead	3.94 J	4.64 J	6.38 J	7.08 J	12.6 J	11.3 J	12.2 J	6.18 J	6.06 J	6.94 J	6.35 J
Magnesium	13,000 J	9,920 J	11,000 J	15,800 J	9,660 J	9,420 J	8,880 J	9,550 J	10,300 J	9,390 J	8,700 J
Manganese	159 J	115 J	196 J	63 J	359 J	341 J	334 J	174 J	191 J	250 J	248 J
Mercury	0.0988 J	0.0669 J	0.131 J	0.0771 J	0.0985 J	0.0858 J	0.0707 J	0.043 J	0.0611 J	0.0754 J	0.0676 J
Nickel	7.15 J	7.3 J	5.8 J	5.16 J	8.43 J	7.88 J	8.6 J	7.1 J	6.79 J	7.44 J	7.15 J

Vieques-West
SWMU 6
Sediment Raw Analytical Results
February 2011

Station ID	VWW06-SD014	VWW06-SD015	VWW06-SD016	VWW06-SD017	VWW06-SD018	VWW06-SD019	VWW06-SD020	VWW06-SD021	VWW06-SD022	VWW06-SD023	
Sample ID	VWW06-SD014-0211	VWW06-SD015-0211	VWW06-SD016-0211	VWW06-SD017-0211	VWW06-SD018-0211	VWW06-SD019-0211	VWW06-SD020-0211	VWW06-SD021-0211	VWW06-SD022-0211	VWW06-SD023-0211	VWW06-SD023P-0211
Sample Date	02/07/11	02/07/11	02/07/11	02/07/11	02/08/11	02/08/11	02/08/11	02/08/11	02/08/11	02/08/11	02/08/11
Chemical Name											
Potassium	3,720 J	2,750 J	3,260 J	4,190 J	5,360 J	4,860 J	5,290 J	3,860 J	3,750 J	3,910 J	3,490 J
Selenium	2.5 UJ	1.1 UJ	1.4 UJ	2.1 UJ	1.6 UJ	1.4 J	1.9 J	4.4 J	2.6 J	1.6 J	1.5 J
Silver	0.89 UJ	0.593 UJ	0.902 UJ	1 UJ	0.674 UJ	0.78 UJ	0.684 UJ	0.678 UJ	0.726 UJ	0.649 UJ	0.557 UJ
Sodium	62,000 J	39,400 J	56,700 J	74,700 J	36,300 J	37,000 J	30,800 J	37,700 J	40,600 J	32,200 J	28,800 J
Thallium	1.89 UJ	1.26 UJ	1.92 UJ	2.14 UJ	1.43 UJ	1.7 J	1.45 UJ	1.44 UJ	1.54 UJ	1.24 J	0.707 J
Vanadium	29.4 J	42.4 J	20.7 J	58.6 J	54.7 J	46.8 J	56.3 J	44.5 J	43.7 J	33.6 J	35.2 J
Zinc	40.4 J	42.2 J	31.9 J	34.9 J	76 J	70.9 J	67.8 J	43.1 J	43.4 J	51.4 J	49.6 J
Wet Chemistry											
pH (ph)	7.22	7.17	7.26	7.07	7.3	7.25	7.05	7.52	7.3	7.23	6.96
Redox (MV) (mv)	-1.58E+02	-1.48E+02	-1.52E+02	-1.56E+02	-1.21E+02	-1.25E+02	-1.54E+02	-1.19E+02	-1.05E+02	-1.54E+02	-1.51E+02

Notes:

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

NA - Not analyzed

U - Not detected or not detected at significantly greater than that in an associated blank.

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

MV - Millivolts

PH - pH units

UG/KG - Micrograms per kilogram

Table 2
Mathematical Outliers from SWMU 6 Background Data (Excluded from Summary Statistics)
Former Vieques Naval Training Range, Vieques, Puerto Rico

Matrix	Constituent	Sample ID	Transformation [1]	Concentration (mg/kg)	Qualifier
SD	Chromium	VWW06-SD015-0211	None	20	J
SW	Antimony	VWW06-SW023-0211	None	72.7	J
SW	Chromium (hexavalent), Dissolved	VWW06-SW016-0211	None	38	J
SW	Vanadium	VWW06-SW019-0211	Logarithm	7.77	J

Notes:

[1] Transformation used to provide closest adherence to normality by the remaining concentrations (aside from the elevated results

Table 3
Summary Statistics for Background Soil Inorganics
CTO 37, ECA, Decision Unit 6
Former Vieques Naval Training Range, Vieques, Puerto Rico

Matrix	Chemical Group	Constituent	Calculated UTL	UTL Basis	Number of Detects	Number of Analyses	Percent Detects	Units	Minimum Detect	Maximum Detect	Minimum RL	Maximum RL	Sample ID of Maximum Detected Concentration	Excluded Outliers
SD	Metal	Aluminum	35000	Normal UTL	10	10	100	mg/kg	7980	29200	NN	NN	VWW06-SD020-0211	
SD	Metal	Arsenic	28.8	Gamma UTL	8	10	80	mg/kg	2	6.2	1.4	2.5	VWW06-SD022-0211	
SD	Metal	Barium	20.5	Normal UTL	10	10	100	mg/kg	7.11	19.8	NA	NA	VWW06-SD020-0211	
SD	Metal	Beryllium	0.718	Kaplan Meier UTL	5	10	50	mg/kg	0.38	0.648	0.593	1	VWW06-SD018-0211	
SD	Metal	Cadmium	NA	Only a Single Detect	1	10	10	mg/kg	0.175	0.175	0.174	0.314	VWW06-SD014-0211	
SD	Metal	Calcium	66700	Gamma UTL	10	10	100	mg/kg	4750	53000	NN	NN	VWW06-SD021-0211	
SD	Metal	Chromium	15.1	Nonparametric UTL	9	9	100	mg/kg	6.7	15.1	NN	NN	VWW06-SD023P-0211	20
SD	Metal	Chromium (hexavalent)	219	Lognormal UTL	10	10	100	mg/kg	9.34	150	NN	NN	VWW06-SD015-0211	
SD	Metal	Cobalt	9.37	Normal UTL	10	10	100	mg/kg	3.3	8.48	NN	NN	VWW06-SD018-0211	
SD	Metal	Copper	54.1	Normal UTL	10	10	100	mg/kg	23.4	47.6	NN	NN	VWW06-SD020-0211	
SD	Metal	Iron	43900	Normal UTL	10	10	100	mg/kg	8870	35300	NN	NN	VWW06-SD018-0211	
SD	Metal	Lead	15.1	Normal UTL	10	10	100	mg/kg	3.94	12.6	NN	NN	VWW06-SD018-0211	
SD	Metal	Magnesium	17500	Gamma UTL	10	10	100	mg/kg	8880	15800	NN	NN	VWW06-SD017-0211	
SD	Metal	Manganese	455	Normal UTL	10	10	100	mg/kg	63	359	NN	NN	VWW06-SD018-0211	
SD	Metal	Mercury	0.138	Normal UTL	10	10	100	mg/kg	0.043	0.131	NN	NN	VWW06-SD016-0211	
SD	Metal	Nickel	9.68	Normal UTL	10	10	100	mg/kg	5.16	8.6	NN	NN	VWW06-SD020-0211	
SD	Metal	Potassium	6090	Normal UTL	10	10	100	mg/kg	2750	5360	NN	NN	VWW06-SD018-0211	
SD	Metal	Selenium	4.34	Kaplan Meier UTL	5	10	50	mg/kg	1.4	4.4	1.1	2.5	VWW06-SD021-0211	
SD	Metal	Sodium	96400	Gamma UTL	10	10	100	mg/kg	30800	74700	NN	NN	VWW06-SD017-0211	
SD	Metal	Thallium	1.69	Kaplan Meier UTL	2	10	20	mg/kg	1.24	1.7	1.26	2.14	VWW06-SD019-0211	
SD	Metal	Vanadium	71.7	Normal UTL	10	10	100	mg/kg	20.7	58.6	NN	NN	VWW06-SD017-0211	
SD	Metal	Zinc	87.3	Normal UTL	10	10	100	mg/kg	31.9	76	NN	NN	VWW06-SD018-0211	
SD	Pesticide/PCB	4,4'-DDE	NA	Only a Single Detect	1	10	10	ug/kg	1.3	1.3	1.1	2.4	VWW06-SD014-0211	
SW	Dissolved Metal	Aluminum, Dissolved	242	Kaplan Meier UTL	2	10	20	ug/L	200	252	186	186	VWW06-SW016-0211	
SW	Dissolved Metal	Barium, Dissolved	28.4	Nonparametric UTL	10	10	100	ug/L	7.76	28.4	NN	NN	VWW06-SW017-0211	
SW	Dissolved Metal	Calcium, Dissolved	NA	Only Four Results	4	4	100	ug/L	535000	556000	NN	NN	VWW06-SW015-0211	
SW	Dissolved Metal	Chromium (hexavalent), Dissolved	31.5	Normal UTL MLE	8	9	89	ug/L	4	20	7	7	VWW06-SW017-0211	38
SW	Dissolved Metal	Copper, Dissolved	NA	Only a Single Detect	1	10	10	ug/L	26	26	50	54	VWW06-SW023P-0211	
SW	Dissolved Metal	Lead, Dissolved	NA	Only a Single Detect	1	10	10	ug/L	11.9	11.9	20	20	VWW06-SW023P-0211	
SW	Dissolved Metal	Magnesium, Dissolved	NA	Only Four Results	4	4	100	ug/L	164000	169000	NN	NN	VWW06-SW016-0211	
SW	Dissolved Metal	Mercury, Dissolved	0.0667	Kaplan Meier UTL	5	10	50	ug/L	0.0454	0.0621	0.074	0.074	VWW06-SW014-0211	
SW	Dissolved Metal	Potassium, Dissolved	NA	Only Four Results	4	4	100	ug/L	533000	552000	NN	NN	VWW06-SW016-0211	
SW	Dissolved Metal	Selenium, Dissolved	126	Normal UTL	8	10	80	ug/L	68.8	121	82	82	VWW06-SW023-0211	
SW	Dissolved Metal	Sodium, Dissolved	156000	Nonparametric UTL	10	10	100	ug/L	109000	156000	NN	NN	VWW06-SW016-0211	
SW	Dissolved Metal	Vanadium, Dissolved	6.25	Kaplan Meier UTL	5	10	50	ug/L	4.5	5.82	8.8	8.8	VWW06-SW022-0211	
SW	Metal	Aluminum	NA	Only Four Results	2	4	50	ug/L	282	428	186	186	VWW06-SW016-0211	
SW	Metal	Antimony	36.8	Only a Single Detect	1	9	11	ug/L	36.8	36.8	20	66	VWW06-SW018-0211	72.7
SW	Metal	Barium	33.9	Nonparametric UTL	10	10	100	ug/L	8.47	33.9	NN	NN	VWW06-SW016-0211	
SW	Metal	Cadmium	12.5	Normal UTL	7	10	70	ug/L	8.76	11.4	14.4	20	VWW06-SW017-0211	
SW	Metal	Calcium	539000	Nonparametric UTL	10	10	100	ug/L	410000	539000	NN	NN	VWW06-SW016-0211	
SW	Metal	Chromium (hexavalent)	99	Normal UTL	10	10	100	ug/L	8	97	NN	NN	VWW06-SW017-0211	
SW	Metal	Copper	152	Kaplan Meier UTL	9	10	90	ug/L	40.7	149	50	50	VWW06-SW016-0211	
SW	Metal	Iron	5270	Gamma UTL	6	10	60	ug/L	176	1660	110	110	VWW06-SW019-0211	
SW	Metal	Magnesium	162000	Nonparametric UTL	10	10	100	ug/L	129000	162000	NN	NN	VWW06-SW016-0211	
SW	Metal	Mercury	0.0548	Kaplan Meier UTL	4	10	40	ug/L	0.0405	0.0516	0.074	0.074	VWW06-SW015-0211	
SW	Metal	Potassium	533000	Nonparametric UTL	10	10	100	ug/L	421000	533000	NN	NN	VWW06-SW014-0211	
SW	Metal	Selenium	126	Normal UTL	9	10	90	ug/L	49.3	113	82	82	VWW06-SW014-0211	
SW	Metal	Sodium	138000	Nonparametric UTL	10	10	100	ug/L	108000	138000	NN	NN	VWW06-SW016-0211	
SW	Metal	Vanadium	6.48	Kaplan Meier UTL	3	9	33	ug/L	4.98	5.9	8.8	8.8	VWW06-SW018-0211	7.77
SW	Pesticide/PCB	4,4'-DDD	NA	Only a Single Detect	1	10	10	ug/L	0.048	0.048	0.0054	0.0055	VWW06-SW018-0211	
SW	Pesticide/PCB	4,4'-DDE	NA	Only a Single Detect	1	10	10	ug/L	0.067	0.067	0.0078	0.0081	VWW06-SW018-0211	
SW	Pesticide/PCB	4,4'-DDT	NA	Only a Single Detect	1	10	10	ug/L	0.083	0.083	0.0023	0.0023	VWW06-SW018-0211	
SW	Pesticide/PCB	Aldrin	NA	Only a Single Detect	1	10	10	ug/L	0.0046	0.0046	0.0033	0.0034	VWW06-SW018-0211	
SW	Pesticide/PCB	alpha-Chlordane	NA	Only a Single Detect	1	10	10	ug/L	0.045	0.045	0.0062	0.0064	VWW06-SW018-0211	
SW	Pesticide/PCB	beta-BHC	NA	Only a Single Detect	1	10	10	ug/L	0.025	0.025	0.0025	0.0026	VWW06-SW018-0211	
SW	Pesticide/PCB	delta-BHC	NA	Only a Single Detect	1	10	10	ug/L	0.012	0.012	0.0062	0.0064	VWW06-SW018-0211	
SW	Pesticide/PCB	Dieldrin	NA	Only a Single Detect	1	10	10	ug/L	0.047	0.047	0.0056	0.0057	VWW06-SW018-0211	
SW	Pesticide/PCB	Endosulfan I	NA	Only a Single Detect	1	10	10	ug/L	0.049	0.049	0.0089	0.0091	VWW06-SW018-0211	
SW	Pesticide/PCB	Endosulfan II	NA	Only a Single Detect	1	10	10	ug/L	0.04	0.04	0.0033	0.0034	VWW06-SW018-0211	
SW	Pesticide/PCB	Endosulfan sulfate	NA	Only a Single Detect	1	10	10	ug/L	0.026	0.026	0.0021	0.0021	VWW06-SW018-0211	
SW	Pesticide/PCB	Endrin	NA	Only a Single Detect	1	10	10	ug/L	0.053	0.053	0.0037	0.0038	VWW06-SW018-0211	
SW	Pesticide/PCB	Endrin aldehyde	NA	Only a Single Detect	1	10	10	ug/L	0.0053	0.0053	0.0031	0.0032	VWW06-SW018-0211	
SW	Pesticide/PCB	Endrin ketone	NA	Only a Single Detect	1	10	10	ug/L	0.029	0.029	0.012	0.013	VWW06-SW018-0211	
SW	Pesticide/PCB	gamma-Chlordane	NA	Only a Single Detect	1	10	10	ug/L	0.026	0.026	0.0049	0.0051	VWW06-SW018-0211	
SW	Pesticide/PCB	Heptachlor	NA	Only a Single Detect	1	10	10	ug/L	0.0074	0.0074	0.0082	0.0084	VWW06-SW018-0211	
SW	Pesticide/PCB	Heptachlor epoxide	NA	Only a Single Detect	1	10	10	ug/L	0.038	0.038	0.0029	0.003	VWW06-SW018-0211	
SW	Pesticide/PCB	Methoxychlor	NA	Only a Single Detect	1	10	10	ug/L	0.061	0.061	0.0037	0.0038	VWW06-SW018-0211	

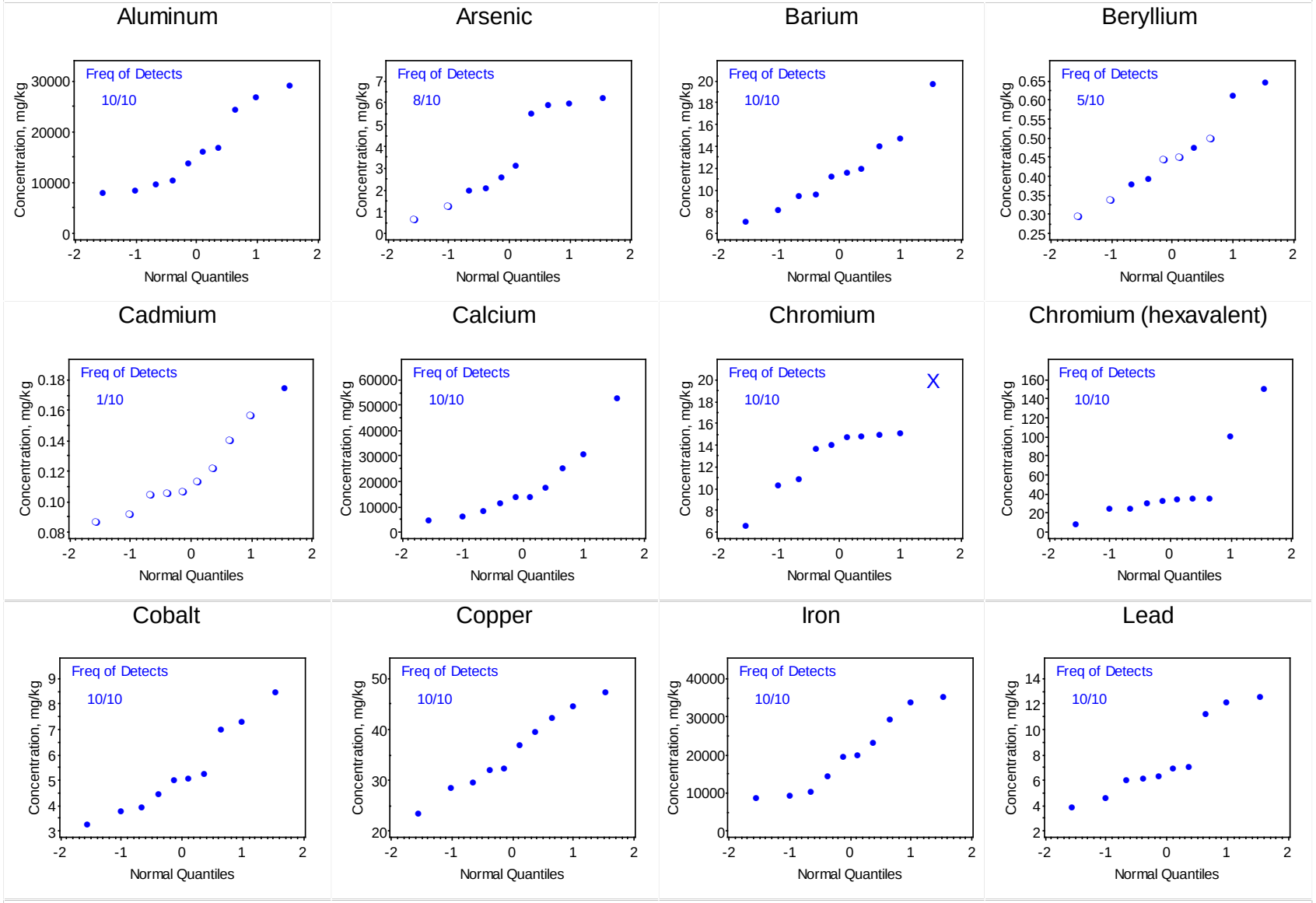
Notes:
All SD concentrations in mg/kg. All SW concentrations in ug/L
NA = Not applicable; no detections or too few observations
RL = reporting limit
NN = not needed; all results were detects

Table 4
East Vieques Background Multiincremental Inorganic UTLs
CTO-37, ECA, Decision Unit 6
Former Vieques Naval Training Range, Vieques, Puerto Rico

Matrix	Chemical Group	Constituent	Background Threshold Value	
SD	Metal	Aluminum	35000	
SD	Metal	Arsenic	28.8	
SD	Metal	Barium	20.5	
SD	Metal	Beryllium	0.718	
SD	Metal	Cadmium	0.175	*
SD	Metal	Calcium	66700	
SD	Metal	Chromium	15.1	
SD	Metal	Chromium (hexavalent)	219	
SD	Metal	Cobalt	9.37	
SD	Metal	Copper	54.1	
SD	Metal	Iron	43900	
SD	Metal	Lead	15.1	
SD	Metal	Magnesium	17500	
SD	Metal	Manganese	455	
SD	Metal	Mercury	0.138	
SD	Metal	Nickel	9.68	
SD	Metal	Potassium	6090	
SD	Metal	Selenium	4.34	
SD	Metal	Sodium	96400	
SD	Metal	Thallium	1.69	
SD	Metal	Vanadium	71.7	
SD	Metal	Zinc	87.3	
SD	Pesticide/PCB	4,4'-DDE	1.3	*
SW	Dissolved Metal	Aluminum, Dissolved	242	
SW	Dissolved Metal	Barium, Dissolved	28.4	
SW	Dissolved Metal	Calcium, Dissolved	556000	*
SW	Dissolved Metal	Chromium (hexavalent), Dissolved	31.5	
SW	Dissolved Metal	Copper, Dissolved	26	*
SW	Dissolved Metal	Lead, Dissolved	11.9	*
SW	Dissolved Metal	Magnesium, Dissolved	169000	*
SW	Dissolved Metal	Mercury, Dissolved	0.0667	
SW	Dissolved Metal	Potassium, Dissolved	552000	*
SW	Dissolved Metal	Selenium, Dissolved	126	
SW	Dissolved Metal	Sodium, Dissolved	156000	
SW	Dissolved Metal	Vanadium, Dissolved	6.25	
SW	Metal	Aluminum	428	*
SW	Metal	Antimony	36.8	
SW	Metal	Barium	33.9	
SW	Metal	Cadmium	12.5	
SW	Metal	Calcium	539000	
SW	Metal	Chromium (hexavalent)	99	
SW	Metal	Copper	152	
SW	Metal	Iron	5270	
SW	Metal	Magnesium	162000	
SW	Metal	Mercury	0.0548	
SW	Metal	Potassium	533000	
SW	Metal	Selenium	126	
SW	Metal	Sodium	138000	
SW	Metal	Vanadium	6.48	
SW	Pesticide/PCB	4,4'-DDD	0.048	*
SW	Pesticide/PCB	4,4'-DDE	0.067	*
SW	Pesticide/PCB	4,4'-DDT	0.083	*
SW	Pesticide/PCB	Aldrin	0.0046	*
SW	Pesticide/PCB	alpha-Chlordane	0.045	*
SW	Pesticide/PCB	beta-BHC	0.025	*
SW	Pesticide/PCB	delta-BHC	0.012	*
SW	Pesticide/PCB	Dieldrin	0.047	*
SW	Pesticide/PCB	Endosulfan I	0.049	*
SW	Pesticide/PCB	Endosulfan II	0.04	*
SW	Pesticide/PCB	Endosulfan sulfate	0.026	*
SW	Pesticide/PCB	Endrin	0.053	*
SW	Pesticide/PCB	Endrin aldehyde	0.0053	*
SW	Pesticide/PCB	Endrin ketone	0.029	*
SW	Pesticide/PCB	gamma-Chlordane	0.026	*
SW	Pesticide/PCB	Heptachlor	0.0074	*
SW	Pesticide/PCB	Heptachlor epoxide	0.038	*
SW	Pesticide/PCB	Methoxychlor	0.061	*

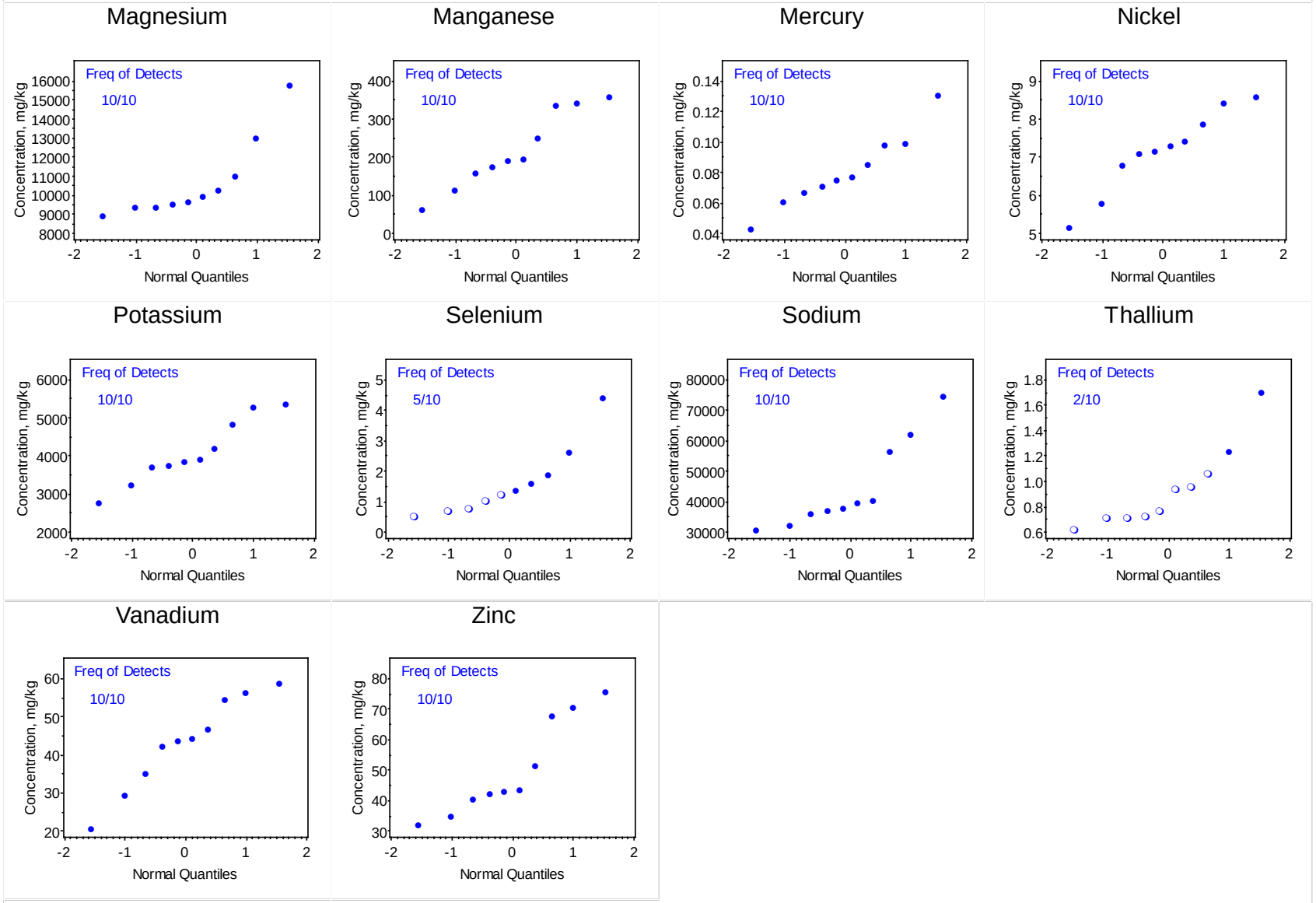
* Most background threshold values are calculated UTLs. Those asterisked do not have a calculated UTL and are instead assigned the maximum detected value.

Figure 1: Probability Plots for Total Metals in Sediment



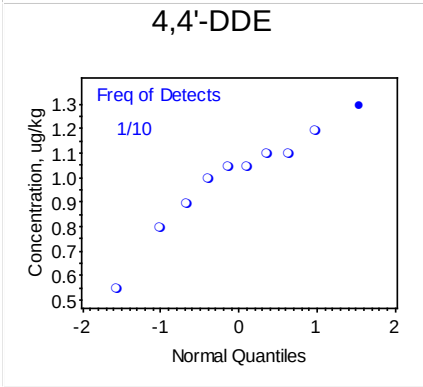
Open Symbol Represents 1/2 DL Proxy for Nondetects; Solid Symbol Represents Detects; X Represents Mathematical Outlier

Figure 1: Probability Plots for Total Metals in Sediment



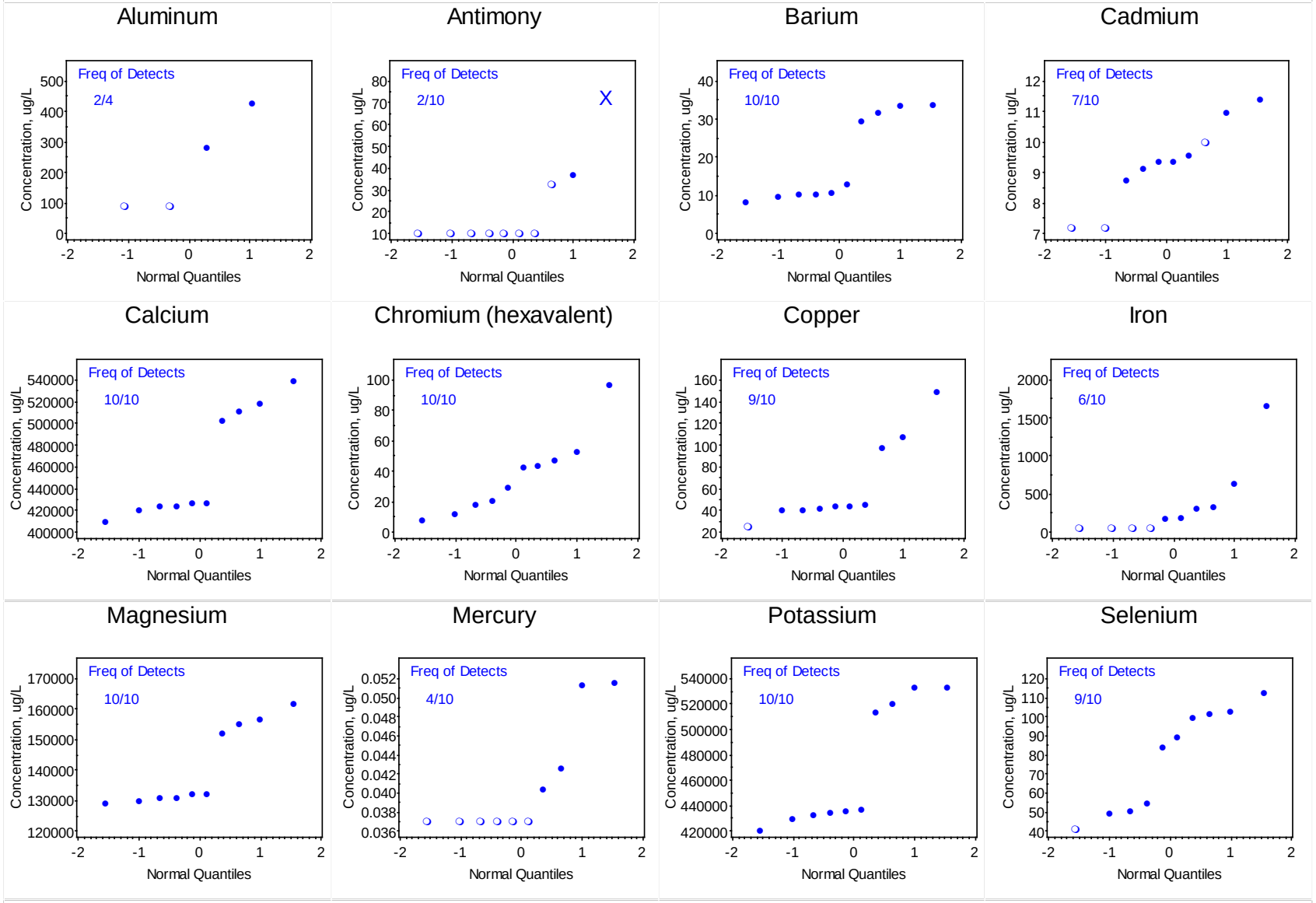
Open Symbol Represents 1/2 DL Proxy for Nondetects; Solid Symbol Represents Detects; X Represents Mathematical Outlier

Figure 2: Probability Plots for Pesticides-PCBs in Sediment



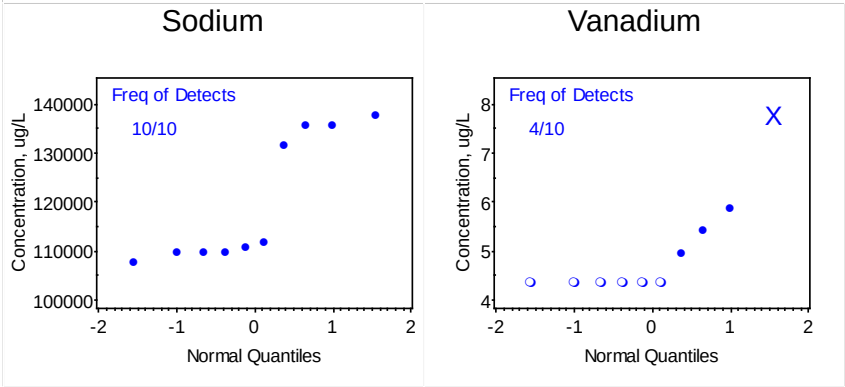
Open Symbol Represents 1/2 DL Proxy for Nondetects; Solid Symbol Represents Detects; X Represents Mathematical Outlier

Figure 3: Probability Plots for Total Metals in Surface Water



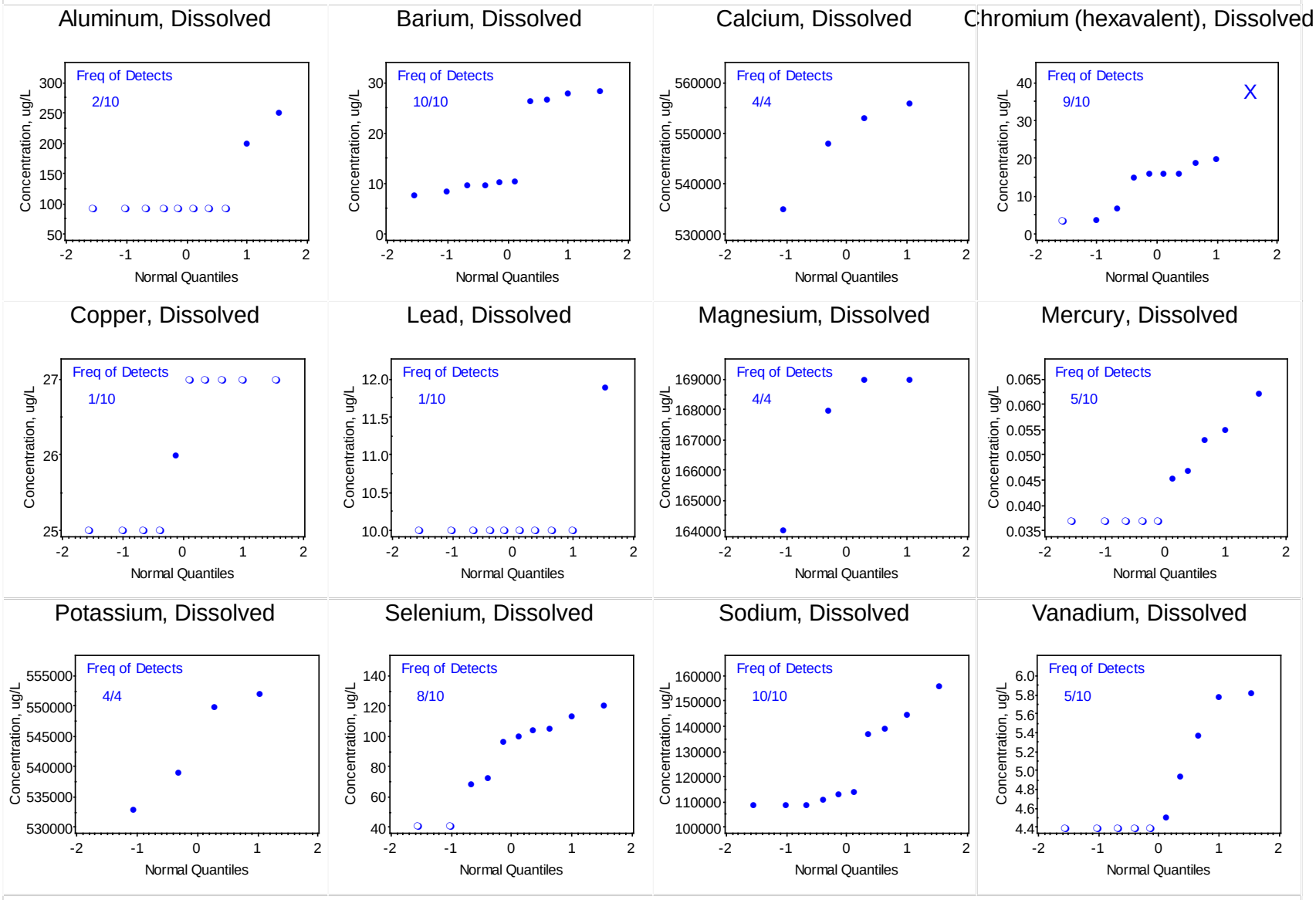
Open Symbol Represents 1/2 DL Proxy for Nondetects; Solid Symbol Represents Detects; X Represents Mathematical Outlier

Figure 3: Probability Plots for Total Metals in Surface Water



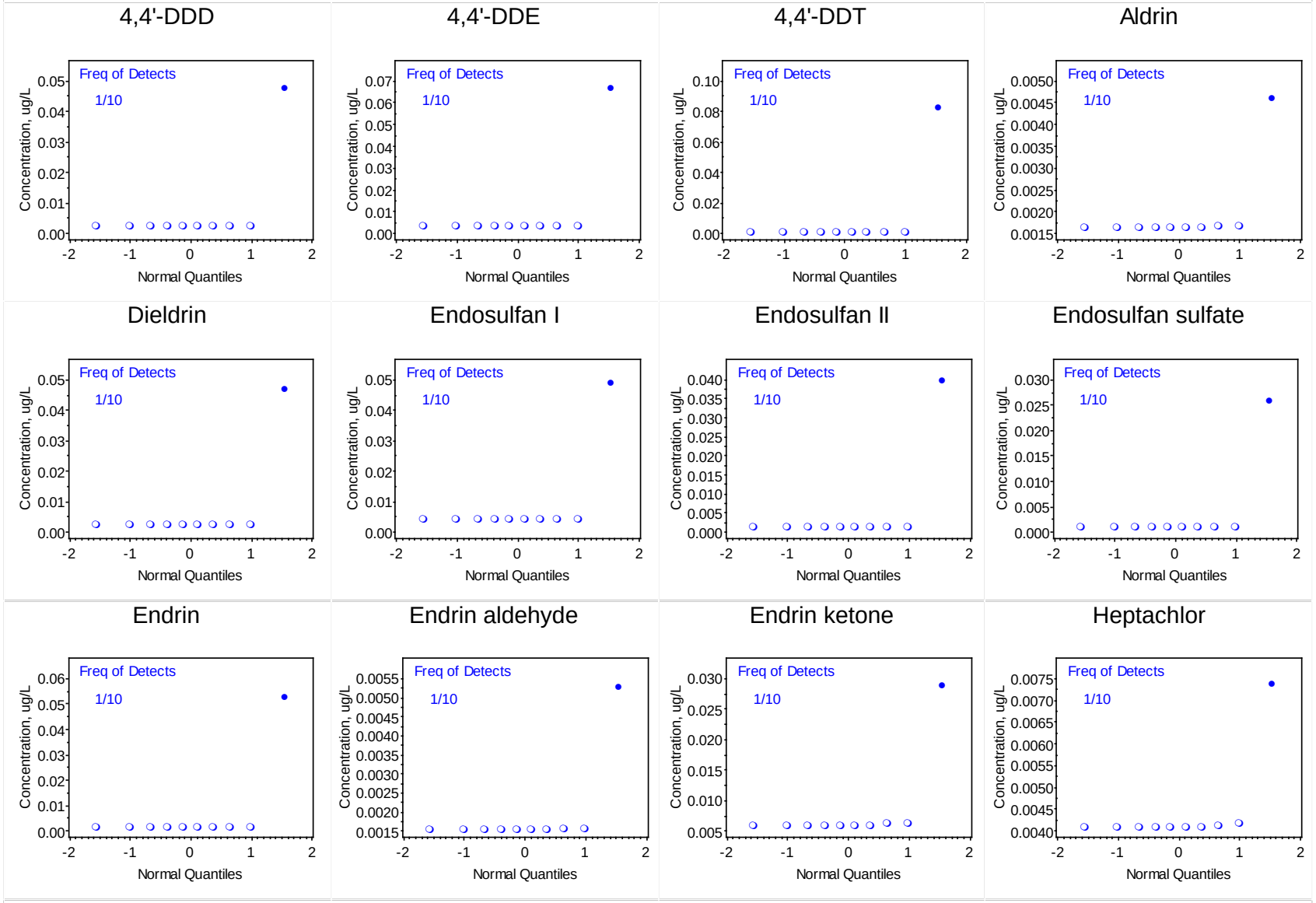
Open Symbol Represents 1/2 DL Proxy for Nondetects; Solid Symbol Represents Detects; X Represents Mathematical Outlier

Figure 4: Probability Plots for Dissolved Metals in Surface Water



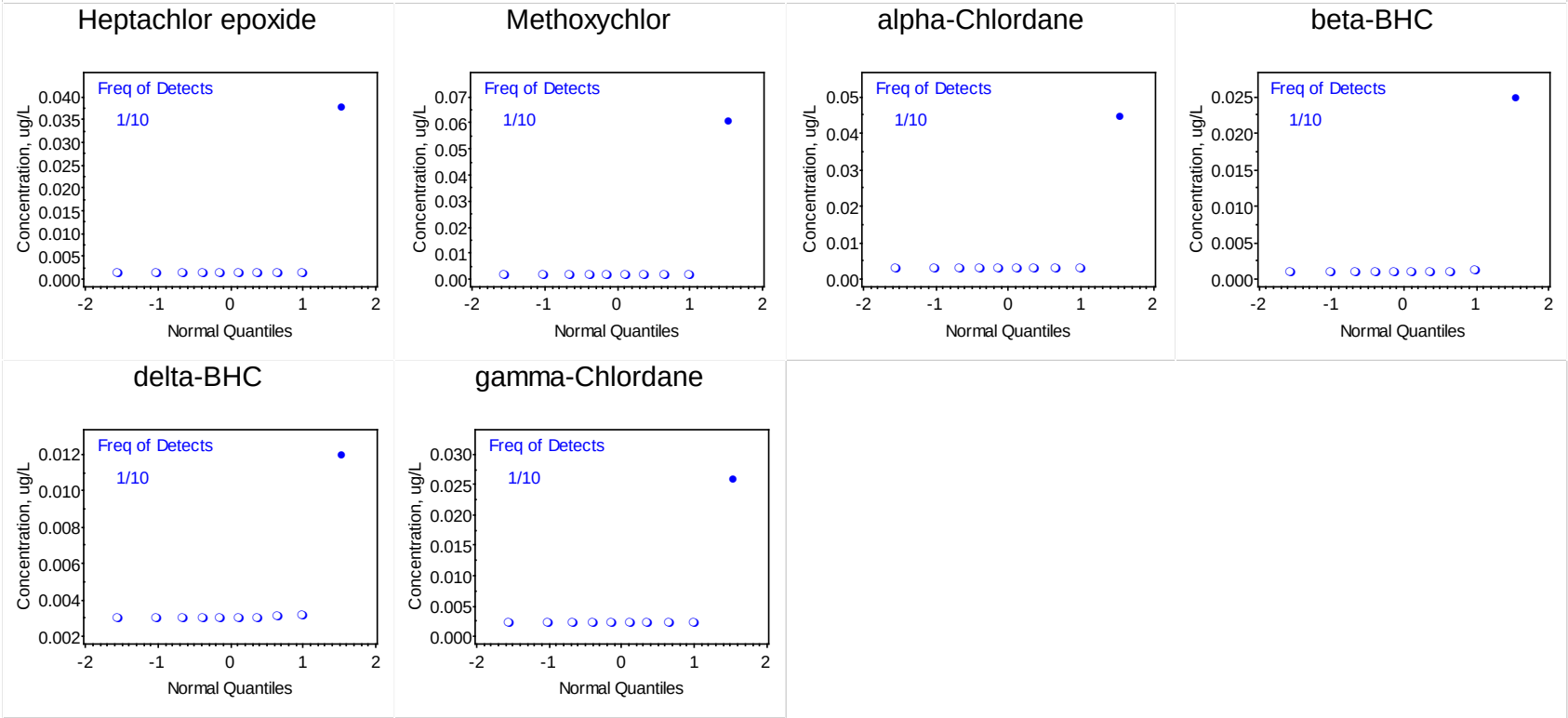
Open Symbol Represents 1/2 DL Proxy for Nondetects; Solid Symbol Represents Detects; X Represents Mathematical Outlier

Figure 5: Probability Plots for Pesticides-PCBs in Surface Water



Open Symbol Represents 1/2 DL Proxy for Nondetects; Solid Symbol Represents Detects; X Represents Mathematical Outlier

Figure 5: Probability Plots for Pesticides-PCBs in Surface Water



Open Symbol Represents 1/2 DL Proxy for Nondetects; Solid Symbol Represents Detects; X Represents Mathematical Outlier

Attachment 2

TABLE 2.5
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 6
Former NASD, Vieques, Puerto Rico

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Fish/Blue Crab (Fish Consumer/Crab Consumer)

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier		Maximum Concentration Qualifier		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3)	Bioaccumulative (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Selection or Deletion (5), (6)
Lagoon	7440-36-0	Antimony	1.03E+01	J	1.03E+01	J	UG/L	VWW06-SW003	1 / 5	1.00E+01 - 1.00E+02	1.03E+01	3.68E+01	6.4E+02	No	5.6	WQS	No	BSL
	7440-39-3	Barium	5.74E+00	J	1.61E+01	J	UG/L	VWW06-SW004	5 / 5	4.40E+00 - 4.40E+00	1.61E+01	3.39E+01	1.0E+03	No	NA	NA	No	BSL
	7440-43-9	Cadmium	1.59E+01	J	1.59E+01	J	UG/L	VWW06-SW004	1 / 5	4.20E+00 - 1.44E+01	1.59E+01	1.25E+01	5.0E+00	Yes	5	WQS	Yes	ASL (7)
	7440-70-2	Calcium	4.19E+05	J	5.23E+05	J	UG/L	VWW06-SW004	5 / 5	7.80E+02 - 7.80E+02	5.23E+05	5.39E+05	NUT	No	NA	NA	No	NUT
	7439-89-6	Iron	3.92E+02	J	8.13E+02	J	UG/L	VWW06-SW004	3 / 5	1.10E+02 - 1.10E+02	8.13E+02	5.27E+03	3.0E+02	No	NA	NA	No	BKG
	7439-95-4	Magnesium	1.18E+06	J	1.36E+06	J	UG/L	VWW06-SW004, VWW06-SW006	5 / 5	1.96E+02 - 1.96E+02	1.36E+06	1.62E+05	NUT	No	NA	NA	No	NUT
	7439-97-6	Mercury	4.11E-02	J	4.11E-02	J	UG/L	VWW06-SW003	1 / 5	3.70E-02 - 3.70E-02	4.11E-02	5.48E-02	NA	Yes	0.05	WQS	No	BKG
	7440-09-7	Potassium	4.33E+05		5.44E+05		UG/L	VWW06-SW004	5 / 5	1.43E+03 - 1.43E+03	5.44E+05	5.33E+05	NUT	No	NA	NA	No	NUT
	7440-23-5	Sodium	1.08E+07		1.59E+07		UG/L	VWW06-SW004	5 / 5	9.00E+03 - 1.80E+04	1.59E+07	1.38E+05	NUT	No	NA	NA	No	NUT
	7440-28-0	Thallium	1.21E+02	J	1.21E+02	J	UG/L	VWW06-SW003	1 / 5	8.80E+01 - 8.80E+01	1.21E+02	NA	4.7E-01	No	0.24	WQS	Yes	ASL
	86-73-7	Fluorene	4.30E-02	J	5.50E-02	J	UG/L	VWW06-SW007	3 / 5	2.00E-02 - 2.10E-02	5.50E-02	NA	5.3E+03	No	1100	WQS	No	BSL
	85-01-8	Phenanthrene	6.40E-02		7.90E-02	J	UG/L	VWW06-SW007	3 / 5	2.00E-02 - 2.10E-02	7.90E-02	NA	NA	No	NA	NA	No	NBAC
	18540-29-9	Chromium (hexavalent)	1.20E+01	J	4.10E+01	J	UG/L	VWW06-SW005	5 / 5	3.50E+00 - 3.50E+00	4.10E+01	9.90E+01	1.0E+02	Yes	NA	NA	No	BSL

(1) Maximum concentration is used for screening.

(2) Background values are the 95 percent upper confidence limit of the 95th percentile (95/95 UTL) and were calculated using surface water data collected from three nearby lagoons (Laguna Kiani, Laguna El Pobre, and Laguna Punta Arenas).

(3) National Recommended Water Quality Criteria (EPA, 2009). Values are for the consumption of an organism. If a value for the consumption of an organism was not available, the value for consumption of an organism and water was used.

(4) Organic chemicals considered bioaccumulative if Kow exceeded 3 and inorganic chemicals considered bioaccumulative according to EPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment - Status and Needs (EPA, 2000). According to the Toxicological Profile for Polycyclic Aromatic Hydrocarbons (ATSDR, 1995), PAHs are readily metabolized by fish and are not expected to bioaccumulate in fish tissue.

(5) Bioaccumulative chemicals with concentrations less than the NRWQC or background were not selected as COPCs.

Rationale Codes
Selection Reason: Above Screening Levels (ASL)
Deletion Reason: Below Screening Level (BSL)
Essential Nutrient (NUT)
Not Bioaccumulative (NBAC)
Below Background (BKG)

(6) Kow values (Oak Ridge National Laboratory, 2011). Available online: http://rais.ornl.gov/cgi-bin/tools/TOX_search

Fluorene	4.2E+00
Phenanthrene	4.5E+00

(7) Cadmium was identified as a COPC in both surface water and sediment for the fish and blue crab consumption exposure pathways; therefore, potential exposures and risks will only be quantified using sediment data, consistent with the Vieques Master HHRA protocol.

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
ATSDR = Agency for Toxic Substances and Disease Registry
ca = Carcinogenic
COPC = Chemical of Potential Concern
HHRA = Human Health Risk Assessment
J = compound was detected below the reporting limit in the sample
NA = Not available
nc = Noncarcinogenic
NRWQC = National Recommended Water Quality Criteria
PAH = Polycyclic Aromatic Hydrocarbons
SL = Screening Level
WQS = Water Quality Standard from the Puerto Rico Water Quality Standards Regulations (March, 2010). The protection for the water body or aquatic life for

TABLE 2.6

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

SWMU 6

Former NASD, Vieques, Puerto Rico

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Fish/Blue Crab (Fish Consumer/Crab Consumer)

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier		Maximum Concentration Qualifier		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Background Value (1)	Screening Toxicity Value (2)	Bioaccumulative (3)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Selection or Deletion (4)
Lagoon	7429-90-5	Aluminum	5.46E+03	J	1.44E+04	J	MG/KG	VWW06-SD009	7 / 7	1.62E+01 - 2.97E+01	3.50E+04	NA	No	NA	NA	No	NBAC
	7440-36-0	Antimony	3.96E-01	J	3.88E+00	J	MG/KG	VWW06-SD006	5 / 7	2.76E-01 - 5.90E-01	NA	NA	No	NA	NA	No	NBAC
	7440-38-2	Arsenic	1.20E+00	J	7.80E+00	J	MG/KG	VWW06-SD009	7 / 7	4.20E-01 - 1.00E+00	2.88E+01	NA	Yes	NA	NA	No	BKG
	7440-39-3	Barium	7.39E+00	J	3.38E+01	J	MG/KG	VWW06-SD009	7 / 7	1.36E+00 - 2.50E+00	2.05E+01	NA	No	NA	NA	No	NBAC
	7440-43-9	Cadmium	9.03E-01	J	5.69E+00	J	MG/KG	VWW06-SD009	7 / 7	4.27E-01 - 7.83E-01	1.75E-01	NA	Yes	NA	NA	Yes	BAC
	7440-70-2	Calcium	7.29E+04	J	1.40E+05	J	MG/KG	VWW06-SD006	7 / 7	2.82E+01 - 5.17E+01	6.67E+04	NA	No	NA	NA	No	NUT
	7440-47-3	Chromium	5.90E+00	J	3.70E+01	J	MG/KG	VWW06-SD009	7 / 7	1.60E-01 - 3.90E-01	1.51E+01	NA	Yes	NA	NA	Yes	BAC
	7440-48-4	Cobalt	1.77E+00	J	9.00E+00	J	MG/KG	VWW06-SD009	7 / 7	4.27E-01 - 7.83E-01	9.37E+00	NA	No	NA	NA	No	NBAC
	7440-50-8	Copper	1.36E+01	J	2.04E+02	J	MG/KG	VWW06-SD009	7 / 7	1.36E+00 - 2.50E+00	5.41E+01	NA	Yes	NA	NA	Yes	BAC
	7439-89-6	Iron	6.75E+03	J	4.59E+04	J	MG/KG	VWW06-SD009	7 / 7	5.12E+00 - 9.39E+00	4.39E+04	NA	No	NA	NA	No	NBAC
	7439-92-1	Lead	1.18E+01	J	6.12E+02	J	MG/KG	VWW06-SD009	7 / 7	2.90E+00 - 5.32E+00	1.51E+01	NA	Yes	NA	NA	Yes	BAC
	7439-95-4	Magnesium	3.58E+03	J	1.19E+04	J	MG/KG	VWW06-SD009	7 / 7	2.48E+01 - 4.54E+01	1.75E+04	NA	No	NA	NA	No	NUT
	7439-96-5	Manganese	6.01E+01	J	3.56E+02	J	MG/KG	VWW06-SD009	7 / 7	1.36E+00 - 2.50E+00	4.55E+02	NA	No	NA	NA	No	NBAC
	7439-97-6	Mercury	2.05E-02	J	1.29E-01	J	MG/KG	VWW06-SD009	7 / 7	3.14E-03 - 6.52E-03	1.38E-01	NA	Yes	NA	NA	No	BKG
	7440-02-0	Nickel	6.41E+00	J	1.91E+01	J	MG/KG	VWW06-SD009	6 / 7	1.36E+00 - 2.50E+00	9.68E+00	NA	Yes	NA	NA	Yes	BAC
	7440-09-7	Potassium	1.17E+03	J	3.45E+03	J	MG/KG	VWW06-SD009	7 / 7	4.27E+01 - 7.83E+01	6.09E+03	NA	No	NA	NA	No	NUT
	7440-22-4	Silver	2.46E-01	J	2.95E-01	J	MG/KG	VWW06-SD003	2 / 7	1.84E-01 - 3.94E-01	NA	NA	Yes	NA	NA	Yes	BAC
	7440-23-5	Sodium	8.01E+03	J	2.78E+04	J	MG/KG	VWW06-SD009	7 / 7	8.54E+01 - 1.56E+02	9.64E+04	NA	No	NA	NA	No	NUT
	7440-28-0	Thallium	5.17E+00	J	5.17E+00	J	MG/KG	VWW06-SD005	1 / 7	2.90E+00 - 5.32E+00	1.69E+00	NA	No	NA	NA	No	NBAC
	7440-62-2	Vanadium	1.76E+01	J	6.61E+01	J	MG/KG	VWW06-SD009	7 / 7	1.36E+00 - 2.50E+00	7.17E+01	NA	No	NA	NA	No	NBAC
	7440-66-6	Zinc	2.54E+01	J	8.49E+02	J	MG/KG	VWW06-SD009	7 / 7	2.82E+00 - 5.17E+00	8.73E+01	NA	Yes	NA	NA	Yes	BAC
	72-54-8	4,4'-DDD	2.80E-03	J	5.90E-02	J	MG/KG	VWW06-SD003	6 / 7	1.30E-03 - 2.50E-03	NA	6.02E+00	Yes	NA	NA	Yes	BAC
	72-55-9	4,4'-DDE	5.90E-03	J	9.40E-02	J	MG/KG	VWW06-SD003	6 / 7	6.90E-04 - 1.30E-03	NA	6.51E+00	Yes	NA	NA	Yes	BAC
	50-29-3	4,4'-DDT	3.20E-03	J	3.20E-03	J	MG/KG	VWW06-SD003	1 / 7	9.80E-04 - 1.90E-03	NA	6.91E+00	Yes	NA	NA	Yes	BAC
	11097-69-1	Aroclor-1254	3.00E-02	J	2.60E-01	J	MG/KG	VWW06-SD009	5 / 7	1.20E-02 - 2.30E-02	NA	6.79E+00	Yes	NA	NA	Yes	BAC
	83-32-9	Acenaphthene	1.19E-02	J	1.19E-02	J	MG/KG	VWW06-SD004	1 / 7	2.00E-03 - 1.66E-02	NA	3.92E+00	No	NA	NA	No	NBAC
	208-96-8	Acenaphthylene	2.00E-02	J	2.00E-02	J	MG/KG	VWW06-SD006	1 / 7	2.00E-03 - 1.66E-02	NA	3.94E+00	No	NA	NA	No	NBAC
	120-12-7	Anthracene	1.88E-02	J	2.82E-02		MG/KG	VWW06-SD004	2 / 7	2.00E-03 - 1.66E-02	NA	4.45E+00	No	NA	NA	No	NBAC
	56-55-3	Benzo(a)anthracene	4.70E-03	J	1.02E-01	J	MG/KG	VWW06-SD006	7 / 7	2.10E-03 - 1.74E-02	NA	5.76E+00	No	NA	NA	No	NBAC
	50-32-8	Benzo(a)pyrene	6.70E-03	J	1.10E-01	J	MG/KG	VWW06-SD006	7 / 7	2.80E-03 - 2.24E-02	NA	6.13E+00	No	NA	NA	No	NBAC
	205-99-2	Benzo(b)fluoranthene	1.07E-02	J	1.60E-01	J	MG/KG	VWW06-SD006	7 / 7	2.90E-03 - 2.37E-02	NA	5.78E+00	No	NA	NA	No	NBAC
	191-24-2	Benzo(g,h,i)perylene	3.88E-02		6.22E-02	J	MG/KG	VWW06-SD006	4 / 7	4.70E-03 - 3.86E-02	NA	6.63E+00	No	NA	NA	No	NBAC
	207-08-9	Benzo(k)fluoranthene	4.20E-03	J	6.34E-02	J	MG/KG	VWW06-SD006	7 / 7	3.20E-03 - 2.62E-02	NA	6.11E+00	No	NA	NA	No	NBAC
	218-01-9	Chrysene	6.80E-03	J	9.24E-02	J	MG/KG	VWW06-SD006	7 / 7	2.00E-03 - 1.62E-02	NA	5.81E+00	No	NA	NA	No	NBAC
	206-44-0	Fluoranthene	8.50E-03	J	1.22E-01	J	MG/KG	VWW06-SD006	7 / 7	2.00E-03 - 1.66E-02	NA	5.16E+00	No	NA	NA	No	NBAC
	86-73-7	Fluorene	1.16E-02	J	1.16E-02	J	MG/KG	VWW06-SD004	1 / 7	2.00E-03 - 1.66E-02	NA	4.18E+00	No	NA	NA	No	NBAC
	193-39-5	Indeno(1,2,3-cd)pyrene	3.49E-02		6.14E-02	J	MG/KG	VWW06-SD006	4 / 7	4.60E-03 - 3.74E-02	NA	6.70E+00	No	NA	NA	No	NBAC
	85-01-8	Phenanthrene	8.70E-03	J	1.11E-01		MG/KG	VWW06-SD004	6 / 7	2.00E-03 - 1.66E-02	NA	4.46E+00	No	NA	NA	No	NBAC
	129-00-0	Pyrene	7.30E-03	J	1.25E-01		MG/KG	VWW06-SD004	7 / 7	2.00E-03 - 1.66E-02	NA	4.88E+00	No	NA	NA	No	NBAC
	78-93-3	2-Butanone	5.60E-03	J	4.73E-02	J	MG/KG	VWW06-SD009	6 / 7	2.00E-03 - 4.90E-03	NA	2.90E-01	No	NA	NA	No	NBAC
	67-64-1	Acetone	2.96E-02	J	1.58E-01	J	MG/KG	VWW06-SD009	7 / 7	1.80E-03 - 4.60E-03	NA	-2.40E-01	No	NA	NA	No	NBAC
	75-15-0	Carbon disulfide	3.40E-03	J	1.30E-02	J	MG/KG	VWW06-SD009	3 / 7	2.10E-03 - 5.20E-03	NA	1.94E+00	No	NA	NA	No	NBAC
	127-18-4	Tetrachloroethene	1.60E-03	J	2.80E-03	J	MG/KG	VWW06-SD003	5 / 7	1.30E-03 - 3.20E-03	NA	3.40E+00	Yes	NA	NA	Yes	BAC
	18540-29-9	Chromium (hexavalent)	1.92E+00	J	1.20E+01	J	MG/KG	VWW06-SD009	5 / 7	3.87E-01 - 7.93E-01	2.19E+02	NA	Yes	NA	NA	No	BKG

(1) Background values are the 95 percent upper confidence limit of the 95 th percentile (95/95 UTL) and were calculated using .

(2) Kow values (Oak Ridge National Laboratory, 2011). Available online: http://rais.ornl.gov/cgi-bin/tools/TOX_search

(3) Organic chemicals (except PAHs) considered bioaccumulative if Kow exceeded 3 and inorganic chemicals considered bioaccumulative according to EPA's Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment - Status and Needs (EPA, 2000). According to the Toxicological Profile for Polycyclic Aromatic Hydrocarbons (ATSDR, 1995), PAHs are readily metabolized by fish and are not expected to bioaccumulate in fish tissue.

(4) Rationale Codes

Selection Reason: Bioaccumulative (BAC)
Deletion Reason: Not Bioaccumulative (NBAC)
Essential Nutrient (NUT)
Below Background (BKG)

COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
NA = Not available or not applicable
J = compound was detected below the reporting limit in the sample
ATSDR = Agency for Toxic Substances and Disease Registry

PAH = Polycyclic Aromatic Hydrocarbons

TABLE 3.4.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

SWMU 6

Former NASD, Vieques, Puerto Rico

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Fish/Blue Crab (Fish Consumer/Crab Consumer)

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL	Maximum Concentration (Qualifier)		Exposure Point Concentration			
							Value	Units	Statistic	Rationale
Lagoon	Thallium	ug/L	NA	NA	1.2E+02	J	1.2E+02	ug/L	Maximum Detected Concentration	(1)

(1) The maximum detected concentration was used for this chemical because there were less than 8 total samples.

ug/L= micrograms/liter
J = compound was detected below the reporting limit in the sample
NA = Not applicable

TABLE 3.4.RME Supplement A

BIOACCUMULATION AND BIOCONCENTRATION FACTORS FOR COPCS IN SURFACE WATER

REASONABLE MAXIMUM EXPOSURE

SWMU 6

Former NASD, Vieques, Puerto Rico

CAS Number	COPC	BCF Value (L-sw/kg-biota)	BCF Source	Surface Water EPC (mg/L-sw) (1)	Fish/Crab EPC (mg/kg-biota)
7440-28-0	Thallium	1.2E+02	EPA, 2002	1.2E-01	1.4E+01

Notes:

(1) Surface water EPCs are presented in Table 3.4.

BCF - bioconcentration factor
COPC - chemical of potential concern
EPC - exposure point concentration
NA - not available / not applicable

Sources:

EPA, 2002: National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. November 2002.

TABLE 3.5.RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 6
Former NASD, Vieques, Puerto Rico

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Fish/Blue Crab (Fish Consumer/Crab Consumer)

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL	Maximum Concentration (Qualifier)		Exposure Point Concentration			
							Value	Units	Statistic	Rationale
Lagoon	Cadmium	mg/kg	NA	NA	5.7E+00	J	5.7E+00	mg/kg	Maximum Detected Concentration	(1)
	Chromium	mg/kg	NA	NA	3.7E+01	J	3.7E+01	mg/kg	Maximum Detected Concentration	(1)
	Copper	mg/kg	NA	NA	2.0E+02	J	2.0E+02	mg/kg	Maximum Detected Concentration	(1)
	Lead	mg/kg	NA	NA	6.1E+02	J	6.1E+02	mg/kg	Maximum Detected Concentration	(1)
	Nickel	mg/kg	NA	NA	1.9E+01	J	1.9E+01	mg/kg	Maximum Detected Concentration	(1)
	Silver	mg/kg	NA	NA	3.0E-01	J	3.0E-01	mg/kg	Maximum Detected Concentration	(1)
	Zinc	mg/kg	NA	NA	8.5E+02	J	8.5E+02	mg/kg	Maximum Detected Concentration	(1)
	4,4'-DDD	mg/kg	NA	NA	5.9E-02	J	5.9E-02	mg/kg	Maximum Detected Concentration	(1)
	4,4'-DDE	mg/kg	NA	NA	9.4E-02	J	9.4E-02	mg/kg	Maximum Detected Concentration	(1)
	4,4'-DDT	mg/kg	NA	NA	3.2E-03	J	3.2E-03	mg/kg	Maximum Detected Concentration	(1)
	Aroclor-1254	mg/kg	NA	NA	2.6E-01	J	2.6E-01	mg/kg	Maximum Detected Concentration	(1)
	Tetrachloroethene	mg/kg	NA	NA	2.8E-03	J	2.8E-03	mg/kg	Maximum Detected Concentration	(1)

(1) The maximum detected concentration was used for this chemical because there were less than 8 total samples.

mg/kg= milligrams/kilograms
J = compound was detected below the reporting limit in the sample
NA = Not applicable

TABLE 3.5.RME Supplement A

BIOTA-TO-SEDIMENT ACCUMULATION FACTORS FOR COPCS IN SEDIMENT

REASONABLE MAXIMUM EXPOSURE

SWMU 6

Former NASD, Vieques, Puerto Rico

					Fish					Crab				
CAS Number	COPC (1)	Kow	Log Kow Reference	Sediment EPC (2) (mg/kg-sediment)	BSAF (3) Value Unitless	Organism Used for Deriving BSAF	Tissue Used for Deriving BSAF	BSAF Reference	Fish EPC (6) (mg/kg-biota)	BSAF (3) Value Unitless	Organism Used for Deriving BSAF	Tissue Used for Deriving BSAF	BSAF Reference	Crab EPC (6) (mg/kg-biota)
7440-43-9	Cadmium	NA	NA	5.7E+00	1.8E-01	Carnivorous, Omnivorous, and Herbivorous Fish	Whole body	WDE, 1995	2.6E-01	1.8E-01	Carnivorous, Omnivorous, and Herbivorous Fish	Whole body	WDE, 1995	2.6E-01
7440-47-3	Chromium	NA	NA	3.7E+01	4.3E-02	Fish (Perca flavescens)	Whole body	WDE, 1995	4.0E-01	4.3E-02	Fish (Perca flavescens)	Whole body	WDE, 1995	4.0E-01
7440-50-8	Copper	NA	NA	2.0E+02	3.4E-01	Mollusc (Elliptio complanata)	Whole body	WDE, 1995	1.7E+01	3.4E-01	Mollusc (Elliptio complanata)	Whole body	WDE, 1995	1.7E+01
7439-92-1	Lead	NA	NA	6.1E+02	1.6E-01	Carnivorous, Omnivorous, and Herbivorous Fish	Whole body	WDE, 1995	2.4E+01	1.6E-01	Carnivorous, Omnivorous, and Herbivorous Fish	Whole body	WDE, 1995	2.4E+01
7440-02-0	Nickel	NA	NA	1.9E+01	1.0E+00	--	--	(4)	4.8E+00	1.0E+00	--	--	(4)	4.8E+00
7440-22-4	Silver	NA	NA	3.0E-01	1.0E+00	--	--	(4)	7.4E-02	1.0E+00	--	--	(4)	7.4E-02
7440-66-6	Zinc	NA	NA	8.5E+02	1.3E+00	Carnivorous, Omnivorous, and Herbivorous Fish	Whole body	WDE, 1995	2.8E+02	1.3E+00	Carnivorous, Omnivorous, and Herbivorous Fish	Whole body	WDE, 1995	2.8E+02
72-54-8	4,4'-DDD	6.0E+00	ORNL, 2011	5.9E-02	1.5E+00	Bluegill (Lepomis macrochirus)	Whole body	EPA, 2008	5.4E-02	3.0E+00	Burrowing Crab (Chasmagnathus granulata)	Whole body	USACE, 2009	8.0E-02
72-55-9	4,4'-DDE	6.5E+00	ORNL, 2011	9.4E-02	2.0E+01	Largemouth Bass (Micropterus salmoides)	Whole body	EPA, 2008	1.1E+00	3.2E+01	Burrowing Crab (Chasmagnathus granulata)	Whole body	USACE, 2009	1.4E+00
50-29-3	4,4'-DDT	6.9E+00	ORNL, 2011	3.2E-03	1.1E+02	Bluegill (Lepomis macrochirus)	Whole body	EPA, 2008	2.1E-01	2.2E+00	Burrowing Crab (Chasmagnathus granulata)	Whole body	USACE, 2009	3.2E-03
11097-69-1	Aroclor-1254	6.8E+00	ORNL, 2011	2.6E-01	3.3E+01	Largemouth Bass (Micropterus salmoides)	Whole body	EPA, 2008	5.2E+00	4.6E+00	Blue crab (Callinectes sapidus)	Whole body	EPA, 2008 (5)	5.4E-01
127-18-4	Tetrachloroethene	3.4E+00	ORNL, 2011	2.8E-03	1.0E+00	--	--	(4)	1.7E-03	1.0E+00	--	--	(4)	1.3E-03

Notes:

(1) COPCs identified for sediment are presented in Table 2.4.

(2) Sediment EPCs are presented in Table 3.5.

(3) BSAFs for metals are presented in kg-sed[dw]/kg-biota [dw]; BSAFs for organics are presented in kg-OC[dw]/kg-lipid[dw].

(4) A default value of 1 was assumed if no BSAF was available.

(5) Total PCBs were used to represent Aroclor-1254.

(6) Fish/Crab EPCs were calculated using the following equations:

Metals: Fish/Crab EPC (mg/kg-biota [ww]) = Sed EPC (mg/kg-sed [dw]) x BSAF (kg-sed [dw]/kg-biota [dw]) x 0.25 (kg-biota [dw]/kg-biota [ww]).

Organics: Fish/Crab EPC (mg/kg-biota [ww]) = Sed EPC (mg/kg-sed [dw]) x lipid normalized BSAF (kg-OC [dw]/kg-lipid [dw]) x (%lipid / %OC) x 0.25 (kg-biota [dw]/kg-biota [ww]).

Fish/Crab EPCs were calculated assuming 2.1% organic carbon (site-specific) in sediment and 5% lipid for fish (EPA, 2000), 3.8% lipid for crab (USACE, 2009), and 75% moisture in fish/crab (EPA, 1993).

COPC - chemical of potential concern
EPC - exposure point concentration
BSAF - biota-sediment accumulation factor
OC - organic carbon
Kow - octanol/water partition coefficient

ORNL - Oak Ridge National Laboratory
USACE - United States Army Corps of Engineers
WDE - Washington Department of Ecology
NA - not available / not applicable

dw - dry weight basis
ww -wet weight basis

Sources:

EPA, 1993. Wildlife exposure factors handbook. Volume I of II. EPA/600/R-93/187a

EPA, 2000. Bioaccumulation testing and interpretation for the purpose of sediment quality assessment - status and needs. EPA/823/R-00/001.

EPA, 2008. Biota-Sediment Accumulation Factor Data Set, Version 1.0. Prepared for the U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Mid-Continent Ecology Division (MED), Duluth, Minnesota. Prepared Computer Sciences Corporation Duluth, Minnesota Contract 68 W-02 032, Task 5003 and 5004. January 2008. http://www.epa.gov/med/Prods_Pubs/bsaf.htm

Oak Ridge National Laboratory (ORNL), 2011. Risk Assessment Information System. URL: http://rais.ornl.gov/cgi-bin/tools/TOX_search

United States Army Corps of Engineers (USACE), 2009. BSAF Database. Available online: http://el.erdc.usace.army.mil/bsafnew/bsaf.html

Washington Department of Ecology (WDE), 1995. Bioaccumulation Factor Approach Analysis for Metals and Polar Organic Compounds.

Attachment 3

Table 1
Organ Accumulation of SWMU 6 Fish and Crab COPCs
SWMU 6
Former NASD, Vieques, Puerto Rico

Contaminant	Primary Organ of Accumulation	Excerpted Text from ATSDR
Aroclor-1254	Hepatopancreas	"The highest levels of PCBs occurred in hepatopancreas samples from crustaceans, which are typically not consumed."
Tetrachloroethene	Crab specific information was not available. Liver and other tissues in fish.	Levels of 1-41 ppb (wet weight) in liver tissue, and up to 11 ppb (wet weight) in other tissue, were found in various species of fish collected off the coast of Great Britain near several organochlorine plants (Pearson and McConnell 1975)."
Cadmium	Hepatopancreas and Muscle	"Cadmium is accumulated mainly in the hepatopancreas (digestive gland) of the crab, and cadmium levels as high as 30–50 ppm have been detected in this edible part of the animal."
Chromium	Information was not available to suggest chromium accumulates in any specific organ.	"It is generally believed that chromium does not bioconcentrate in fish (EPA 1980, 1984a; Fishbein 1981; Schmidt and Andren 1984) and there is no indication of biomagnification of chromium along the aquatic food chain (Cary 1982)." "Based on this information, chromium is not expected to biomagnify in the aquatic food chain."
Copper	Crab specific information was not available. Sampling activities in fish are primarily concerned with accumulation of copper in the muscle, liver, and tissues of fish.	In bluefin tuna caught in the northwest Atlantic off Newfoundland, the mean copper concentration in muscle tissue has been measured at 1.0 ppm (dry weight) (Hellou et al. 1992a). In cod caught off the coast of Newfoundland, mean copper concentrations of <1.2–1.5 µg/g (dry weight) in muscle and 5– 10 ppm (dry weight) in liver have been determined (Hellou et al. 1992b). Respective mean and median copper concentrations of 127 samples of finfish from Chesapeake Bay and its tributaries were 1.66 and 0.36 ppm in 1978, and 1.85 and 0.61 ppm in 1979 (Eisenberg and Topping 1986). In striped bass taken from Turkey Point in the bay, copper levels were below the detection limit of the study (<0.1 µg/g) in muscle, but were higher in liver tissue ranging from 0.86 to 23.5 µg/g. In gonad tissue obtained from tissue from a different site on the bay, there was also an increase in the mean copper concentration in this tissue (4.25 µg/g) as compared to muscle (0.76 µg/g). The copper content of muscle tissue of several species of fish collected from metal-contaminated lakes near Sudbury, Ontario, ranged from 0.5 to 1.4 ppm (dry weight). No major pattern in variation was evident among species or among the study lakes (Bradley and Morris 1986). The copper concentration in the livers, however, ranged from 5 to 185 ppm (dry weight) and differed significantly among species and among lakes. Unlike muscle tissue, liver tissue is a good indicator of
Lead	Crab specific information was not available. Blood and tissues in fish.	"Exposure of a fresh-water fish to several sublethal concentrations of lead for a period of 30 days showed significant accumulation of lead in the blood and tissues." "Lead is toxic to all aquatic biota, and organisms higher up in the food chain may experience lead poisoning as a result of eating lead-contaminated food."
Zinc	Hepatopancreas and muscle	"Zinc bioconcentrates moderately in aquatic organisms; bioconcentration is higher in crustaceans and bivalve species than in fish." "Blue crabs (Callinectes sapidus) from the Quinnipac and Connecticut Rivers (Connecticut), which are mostly harvested for personal consumption, contained zinc in muscle and heltopancreas tissues at concentrations of 31–33 and 27–28 mg/kg wet weight, respectively (Jop et al.1997)."
DDT, DDE, DDD	Fatty Tissues	DDT, DDE, and DDD are highly lipid soluble, as reflected by their log octanol-water partition coefficients (log Kow) of 6.91, 6.51, and 6.02, respectively for the p,p'- isomers and 6.79, 6.00, and 5.87, respectively, for the o,p'- isomers (Howard and Meylan 1997). This lipophilic property, combined with an extremely long half-life is responsible for its high bioconcentration in aquatic organisms (i.e., levels in organisms exceed those levels occurring in the surrounding water). Organisms also feed on other animals at lower trophic levels. The result is a progressive biomagnification of DDT in organisms at the top of the food chain. Biomagnification is the cumulative increase in the concentration of a persistent contaminant in successively higher trophic levels of the food chain (i.e., from algae to zooplankton to fish to birds).
Silver	No information was available to suggest silver accumulates in any specific organ for fish or crab.	"Terhaar et al. (1977) studied bioconcentration (uptake from water) and bioaccumulation (uptake from food and water) of silver thiosulfate complexes in algae (Scenedesmus sp.), water flea (Daphnia magna), mussels (Ligumia sp. and Margaritifera sp.), and fathead minnow (Pimephales promelas) in 10-week exposures. Bioconcentration indices were 96-150 for algae, 12.2-26 for Daphnia, 5.9-8.5 for mussels, and 1.8-28 for fish. Bioaccumulation indices were 9-26 for Daphnia, 6.6-9.8 for mussels, and 4.0-6.2 for fish. These indices, which are based on measured wet weight concentrations in biota and nominal concentrations in water, indicate little potential for silver biomagnification (systematic increase in residue concentrations moving up a food chain) in the tested aquatic food chain."
Nickel	No information was available to suggest nickel accumulates in any specific organ for fish or crab.	"In the work of McGeer et al. (2003), BCFs for nickel in various aquatic organisms (e.g., algae, arthropods, mollusks, and fish) was assessed based on whole-body metal concentrations and exposure concentrations that were obtained from the literature. For exposure concentrations within the range of 5–50 µg/L nickel in water, mean BCF values of 106±53 (1 standard deviation [SD]) were obtained. When the authors also included data for exposure concentrations outside the range of 5–50 µg/L, a BCF value of 157±135 was obtained. The authors noted that the BCF values were inversely correlated with the exposure concentrations, where the highest BCF values were obtained at the lowest exposure concentrations. There was no evidence that nickel biomagnifies in aquatic food webs and, in fact, there is evidence to indicate that the nickel concentrations in organisms decrease with increasing trophic level (McGeer et al. 2003; Suedel et al. 1994)."

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Attachment 4

Table 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 6

Former NASD, Vieques, Puerto Rico

Scenario Timeframe: Current/Future
Receptor Population: Fish Consumer
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF		Cancer Risk	Intake/Exposure Concentration		RfD		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Water	Fish (Lagoon)	Surface Water Fish (Lagoon)	Ingestion	Thallium	1.4E+01	mg/kg-biota	4.4E-03	mg/kg/day	NA	NA	NA	1.3E-02	mg/kg/day	1.0E-05	mg/kg/day	1.3E+03
			Exp. Route Total								0.0E+00					1.3E+03
		Exposure Point Total									0.0E+00					1.3E+03
	Exposure Medium Total										0.0E+00					1.3E+03
Surface Water Total											0.0E+00					1.3E+03
Sediment	Fish (Lagoon)	Sediment Fish (Lagoon)	Ingestion	Cadmium	2.6E-01	mg/kg-biota	8.1E-05	mg/kg-day	NA	NA	NA	2.4E-04	mg/kg-day	1.0E-03	mg/kg-day	2.4E-01
				Chromium	4.0E-01	mg/kg-biota	1.3E-04	mg/kg-day	NA	NA	NA	3.7E-04	mg/kg-day	1.5E+00	mg/kg-day	2.5E-04
				Copper	1.7E+01	mg/kg-biota	5.5E-03	mg/kg-day	NA	NA	NA	1.6E-02	mg/kg-day	4.0E-02	mg/kg-day	4.0E-01
				Lead	2.4E+01	mg/kg-biota	7.8E-03	mg/kg-day	NA	NA	NA	2.3E-02	mg/kg-day	NA	NA	NA
				Nickel	4.8E+00	mg/kg-biota	1.5E-03	mg/kg-day	NA	NA	NA	4.4E-03	mg/kg-day	2.0E-02	mg/kg-day	2.2E-01
				Silver	7.4E-02	mg/kg-biota	2.3E-05	mg/kg-day	NA	NA	NA	6.8E-05	mg/kg-day	5.0E-03	mg/kg-day	1.4E-02
				Zinc	2.8E+02	mg/kg-biota	8.7E-02	mg/kg-day	NA	NA	NA	2.5E-01	mg/kg-day	3.0E-01	mg/kg-day	8.5E-01
				4,4'-DDD	5.4E-02	mg/kg-biota	1.7E-05	mg/kg-day	2.4E-01	1/(mg/kg-day)	4.1E-06	5.0E-05	mg/kg-day	NA	NA	NA
				4,4'-DDE	1.1E+00	mg/kg-biota	3.6E-04	mg/kg-day	3.4E-01	1/(mg/kg-day)	1.2E-04	1.0E-03	mg/kg-day	NA	NA	NA
				4,4'-DDT	2.1E-01	mg/kg-biota	6.5E-05	mg/kg-day	3.4E-01	1/(mg/kg-day)	2.2E-05	1.9E-04	mg/kg-day	5.0E-04	mg/kg-day	3.8E-01
				Aroclor-1254	5.2E+00	mg/kg-biota	1.6E-03	mg/kg-day	2.0E+00	1/(mg/kg-day)	3.3E-03	4.8E-03	mg/kg-day	2.0E-05	mg/kg-day	2.4E+02
				Tetrachloroethene	1.7E-03	mg/kg-biota	5.3E-07	mg/kg-day	5.4E-01	1/(mg/kg-day)	2.9E-07	1.5E-06	mg/kg-day	1.0E-02	mg/kg-day	1.5E-04
			Exp. Route Total								3.4E-03					2.4E+02
		Exposure Point Total									3.4E-03					2.4E+02
	Exposure Medium Total										3.4E-03					2.4E+02
Sediment Total											3.4E-03					2.4E+02
Receptor Total											3.4E-03					1.5E+03

NA = Not applicable.

Table 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 6

Former NASD, Vieques, Puerto Rico

Scenario Timeframe: Current/Future
Receptor Population: Fish Consumer
Receptor Age: Youth

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF		Cancer Risk	Intake/Exposure Concentration		RfD		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Water	Fish (Lagoon)	Surface Water Fish (Lagoon)	Ingestion	Thallium	1.4E+01	mg/kg-biota	3.3E-03	mg/kg/day	NA	NA	NA	2.3E-02	mg/kg/day	1.0E-05	mg/kg/day	2.3E+03
			Exp. Route Total								0.0E+00					2.3E+03
		Exposure Point Total									0.0E+00					2.3E+03
	Exposure Medium Total										0.0E+00					2.3E+03
Surface Water Total											0.0E+00					2.3E+03
Sediment	Fish (Lagoon)	Sediment Fish (Lagoon)	Ingestion	Cadmium	2.6E-01	mg/kg-biota	6.1E-05	mg/kg-day	NA	NA	NA	4.2E-04	mg/kg-day	1.0E-03	mg/kg-day	4.2E-01
				Chromium	4.0E-01	mg/kg-biota	9.4E-05	mg/kg-day	NA	NA	NA	6.6E-04	mg/kg-day	1.5E+00	mg/kg-day	4.4E-04
				Copper	1.7E+01	mg/kg-biota	4.1E-03	mg/kg-day	NA	NA	NA	2.9E-02	mg/kg-day	4.0E-02	mg/kg-day	7.2E-01
				Lead	2.4E+01	mg/kg-biota	5.8E-03	mg/kg-day	NA	NA	NA	4.1E-02	mg/kg-day	NA	NA	NA
				Nickel	4.8E+00	mg/kg-biota	1.1E-03	mg/kg-day	NA	NA	NA	7.9E-03	mg/kg-day	2.0E-02	mg/kg-day	4.0E-01
				Silver	7.4E-02	mg/kg-biota	1.7E-05	mg/kg-day	NA	NA	NA	1.2E-04	mg/kg-day	5.0E-03	mg/kg-day	2.4E-02
				Zinc	2.8E+02	mg/kg-biota	6.5E-02	mg/kg-day	NA	NA	NA	4.6E-01	mg/kg-day	3.0E-01	mg/kg-day	1.5E+00
				4,4'-DDD	5.4E-02	mg/kg-biota	1.3E-05	mg/kg-day	2.4E-01	1/(mg/kg-day)	3.1E-06	9.0E-05	mg/kg-day	NA	NA	NA
				4,4'-DDE	1.1E+00	mg/kg-biota	2.7E-04	mg/kg-day	3.4E-01	1/(mg/kg-day)	9.1E-05	1.9E-03	mg/kg-day	NA	NA	NA
				4,4'-DDT	2.1E-01	mg/kg-biota	4.9E-05	mg/kg-day	3.4E-01	1/(mg/kg-day)	1.7E-05	3.4E-04	mg/kg-day	5.0E-04	mg/kg-day	6.8E-01
				Aroclor-1254	5.2E+00	mg/kg-biota	1.2E-03	mg/kg-day	2.0E+00	1/(mg/kg-day)	2.4E-03	8.6E-03	mg/kg-day	2.0E-05	mg/kg-day	4.3E+02
				Tetrachloroethene	1.7E-03	mg/kg-biota	3.9E-07	mg/kg-day	5.4E-01	1/(mg/kg-day)	2.1E-07	2.8E-06	mg/kg-day	1.0E-02	mg/kg-day	2.8E-04
		Exposure Point Total									2.6E-03					4.3E+02
	Exposure Medium Total										2.6E-03					4.3E+02
Sediment Total											2.6E-03					4.3E+02
Receptor Total											2.6E-03					2.8E+03

NA = Not applicable.

Table 7.3.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 6

Former NASD, Vieques, Puerto Rico

Scenario Timeframe: Current/Future
Receptor Population: Fish Consumer
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF		Cancer Risk	Intake/Exposure Concentration		RfD		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Water	Fish (Lagoon)	Surface Water Fish (Lagoon)	Ingestion	Thallium	1.4E+01	mg/kg-biota	2.6E-03	mg/kg/day	NA	NA	NA	3.0E-02	mg/kg/day	1.0E-05	mg/kg/day	3.0E+03
			Exp. Route Total								0.0E+00					3.0E+03
		Exposure Point Total									0.0E+00					3.0E+03
	Exposure Medium Total										0.0E+00					3.0E+03
Surface Water Total											0.0E+00					3.0E+03
Sediment	Fish (Lagoon)	Sediment Fish (Lagoon)	Ingestion	Cadmium	2.6E-01	mg/kg-biota	4.8E-05	mg/kg-day	NA	NA	NA	5.5E-04	mg/kg-day	1.0E-03	mg/kg-day	5.5E-01
				Chromium	4.0E-01	mg/kg-biota	7.4E-05	mg/kg-day	NA	NA	NA	8.6E-04	mg/kg-day	1.5E+00	mg/kg-day	5.7E-04
				Copper	1.7E+01	mg/kg-biota	3.2E-03	mg/kg-day	NA	NA	NA	3.8E-02	mg/kg-day	4.0E-02	mg/kg-day	9.4E-01
				Lead	2.4E+01	mg/kg-biota	4.5E-03	mg/kg-day	NA	NA	NA	5.3E-02	mg/kg-day	NA	NA	NA
				Nickel	4.8E+00	mg/kg-biota	8.9E-04	mg/kg-day	NA	NA	NA	1.0E-02	mg/kg-day	2.0E-02	mg/kg-day	5.2E-01
				Silver	7.4E-02	mg/kg-biota	1.4E-05	mg/kg-day	NA	NA	NA	1.6E-04	mg/kg-day	5.0E-03	mg/kg-day	3.2E-02
				Zinc	2.8E+02	mg/kg-biota	5.1E-02	mg/kg-day	NA	NA	NA	6.0E-01	mg/kg-day	3.0E-01	mg/kg-day	2.0E+00
				4,4'-DDD	5.4E-02	mg/kg-biota	1.0E-05	mg/kg-day	2.4E-01	1/(mg/kg-day)	2.4E-06	1.2E-04	mg/kg-day	NA	NA	NA
				4,4'-DDE	1.1E+00	mg/kg-biota	2.1E-04	mg/kg-day	3.4E-01	1/(mg/kg-day)	7.1E-05	2.4E-03	mg/kg-day	NA	NA	NA
				4,4'-DDT	2.1E-01	mg/kg-biota	3.8E-05	mg/kg-day	3.4E-01	1/(mg/kg-day)	1.3E-05	4.5E-04	mg/kg-day	5.0E-04	mg/kg-day	8.9E-01
				Aroclor-1254	5.2E+00	mg/kg-biota	9.6E-04	mg/kg-day	2.0E+00	1/(mg/kg-day)	1.9E-03	1.1E-02	mg/kg-day	2.0E-05	mg/kg-day	5.6E+02
				Tetrachloroethene	1.7E-03	mg/kg-biota	3.1E-07	mg/kg-day	5.4E-01	1/(mg/kg-day)	1.7E-07	3.6E-06	mg/kg-day	1.0E-02	mg/kg-day	3.6E-04
			Exp. Route Total								2.0E-03					5.6E+02
		Exposure Point Total									2.0E-03					5.6E+02
	Exposure Medium Total										2.0E-03					5.6E+02
Sediment Total											2.0E-03					5.6E+02
Receptor Total											2.0E-03					3.6E+03

NA = Not applicable.

Table 7.4.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 6

Former NASD, Vieques, Puerto Rico

Scenario Timeframe: Current/Future
Receptor Population: Crab Consumer
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF		Cancer Risk	Intake/Exposure Concentration		RfD		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Water	Crab (Lagoon)	Surface Water Crab (Lagoon)	Ingestion	Thallium	1.4E+01	mg/kg-biota	4.4E-03	mg/kg/day	NA	NA	NA	1.3E-02	mg/kg/day	1.0E-05	mg/kg/day	1.3E+03
			Exp. Route Total								0.0E+00					1.3E+03
		Exposure Point Total									0.0E+00					1.3E+03
	Exposure Medium Total										0.0E+00					1.3E+03
Surface Water Total											0.0E+00					1.3E+03
Sediment	Crab (Lagoon)	Sediment Crab (Lagoon)	Ingestion	Cadmium	2.6E-01	mg/kg-biota	8.1E-05	mg/kg-day	NA	NA	NA	2.4E-04	mg/kg-day	1.0E-03	mg/kg-day	2.4E-01
				Chromium	4.0E-01	mg/kg-biota	1.3E-04	mg/kg-day	NA	NA	NA	3.7E-04	mg/kg-day	1.5E+00	mg/kg-day	2.5E-04
				Copper	1.7E+01	mg/kg-biota	5.5E-03	mg/kg-day	NA	NA	NA	1.6E-02	mg/kg-day	4.0E-02	mg/kg-day	4.0E-01
				Lead	2.4E+01	mg/kg-biota	7.8E-03	mg/kg-day	NA	NA	NA	2.3E-02	mg/kg-day	NA	NA	NA
				Nickel	4.8E+00	mg/kg-biota	1.5E-03	mg/kg-day	NA	NA	NA	4.4E-03	mg/kg-day	2.0E-02	mg/kg-day	2.2E-01
				Silver	7.4E-02	mg/kg-biota	2.3E-05	mg/kg-day	NA	NA	NA	6.8E-05	mg/kg-day	5.0E-03	mg/kg-day	1.4E-02
				Zinc	2.8E+02	mg/kg-biota	8.7E-02	mg/kg-day	NA	NA	NA	2.5E-01	mg/kg-day	3.0E-01	mg/kg-day	8.5E-01
				4,4'-DDD	8.0E-02	mg/kg-biota	2.5E-05	mg/kg-day	2.4E-01	1/(mg/kg-day)	6.1E-06	7.4E-05	mg/kg-day	NA	NA	NA
				4,4'-DDE	1.4E+00	mg/kg-biota	4.3E-04	mg/kg-day	3.4E-01	1/(mg/kg-day)	1.5E-04	1.3E-03	mg/kg-day	NA	NA	NA
				4,4'-DDT	3.2E-03	mg/kg-biota	1.0E-06	mg/kg-day	3.4E-01	1/(mg/kg-day)	3.4E-07	2.9E-06	mg/kg-day	5.0E-04	mg/kg-day	5.9E-03
				Aroclor-1254	5.4E-01	mg/kg-biota	1.7E-04	mg/kg-day	2.0E+00	1/(mg/kg-day)	3.4E-04	5.0E-04	mg/kg-day	2.0E-05	mg/kg-day	2.5E+01
				Tetrachloroethene	1.3E-03	mg/kg-biota	4.0E-07	mg/kg-day	5.4E-01	1/(mg/kg-day)	2.2E-07	1.2E-06	mg/kg-day	1.0E-02	mg/kg-day	1.2E-04
			Exp. Route Total								4.9E-04					2.7E+01
		Exposure Point Total									4.9E-04					2.7E+01
	Exposure Medium Total										4.9E-04					2.7E+01
Sediment Total											4.9E-04					2.7E+01
Receptor Total											4.9E-04					1.3E+03

NA = Not applicable.

Table 7.5.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 6

Former NASD, Vieques, Puerto Rico

Scenario Timeframe: Current/Future
Receptor Population: Crab Consumer
Receptor Age: Youth

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF		Cancer Risk	Intake/Exposure Concentration		RfD		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Water	Crab (Lagoon)	Surface Water Crab (Lagoon)	Ingestion	Thallium	1.4E+01	mg/kg-biota	3.3E-03	mg/kg/day	NA	NA	NA	2.3E-02	mg/kg/day	1.0E-05	mg/kg/day	2.3E+03
			Exp. Route Total								0.0E+00					2.3E+03
		Exposure Point Total									0.0E+00					2.3E+03
	Exposure Medium Total										0.0E+00					2.3E+03
Surface Water Total											0.0E+00					2.3E+03
Sediment	Crab (Lagoon)	Sediment Crab (Lagoon)	Ingestion	Cadmium	2.6E-01	mg/kg-biota	6.1E-05	mg/kg-day	NA	NA	NA	4.2E-04	mg/kg-day	1.0E-03	mg/kg-day	4.2E-01
				Chromium	4.0E-01	mg/kg-biota	9.4E-05	mg/kg-day	NA	NA	NA	6.6E-04	mg/kg-day	1.5E+00	mg/kg-day	4.4E-04
				Copper	1.7E+01	mg/kg-biota	4.1E-03	mg/kg-day	NA	NA	NA	2.9E-02	mg/kg-day	4.0E-02	mg/kg-day	7.2E-01
				Lead	2.4E+01	mg/kg-biota	5.8E-03	mg/kg-day	NA	NA	NA	4.1E-02	mg/kg-day	NA	NA	NA
				Nickel	4.8E+00	mg/kg-biota	1.1E-03	mg/kg-day	NA	NA	NA	7.9E-03	mg/kg-day	2.0E-02	mg/kg-day	4.0E-01
				Silver	7.4E-02	mg/kg-biota	1.7E-05	mg/kg-day	NA	NA	NA	1.2E-04	mg/kg-day	5.0E-03	mg/kg-day	2.4E-02
				Zinc	2.8E+02	mg/kg-biota	6.5E-02	mg/kg-day	NA	NA	NA	4.6E-01	mg/kg-day	3.0E-01	mg/kg-day	1.5E+00
				4,4'-DDD	8.0E-02	mg/kg-biota	1.9E-05	mg/kg-day	2.4E-01	1/(mg/kg-day)	4.6E-06	1.3E-04	mg/kg-day	NA	NA	NA
				4,4'-DDE	1.4E+00	mg/kg-biota	3.2E-04	mg/kg-day	3.4E-01	1/(mg/kg-day)	1.1E-04	2.3E-03	mg/kg-day	NA	NA	NA
				4,4'-DDT	3.2E-03	mg/kg-biota	7.5E-07	mg/kg-day	3.4E-01	1/(mg/kg-day)	2.6E-07	5.3E-06	mg/kg-day	5.0E-04	mg/kg-day	1.1E-02
				Aroclor-1254	5.4E-01	mg/kg-biota	1.3E-04	mg/kg-day	2.0E+00	1/(mg/kg-day)	2.5E-04	8.9E-04	mg/kg-day	2.0E-05	mg/kg-day	4.4E+01
				Tetrachloroethene	1.3E-03	mg/kg-biota	3.0E-07	mg/kg-day	5.4E-01	1/(mg/kg-day)	1.6E-07	2.1E-06	mg/kg-day	1.0E-02	mg/kg-day	2.1E-04
		Exposure Point Total									3.7E-04					4.8E+01
	Exposure Medium Total										3.7E-04					4.8E+01
Sediment Total											3.7E-04					4.8E+01
Receptor Total											3.7E-04					2.4E+03

NA = Not applicable.

Table 7.6.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 6

Former NASD, Vieques, Puerto Rico

Scenario Timeframe: Current/Future
Receptor Population: Crab Consumer
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF		Cancer Risk	Intake/Exposure Concentration		RfD		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Water	Crab (Lagoon)	Surface Water Crab (Lagoon)	Ingestion	Thallium	1.4E+01	mg/kg-biota	2.6E-03	mg/kg/day	NA	NA	NA	3.0E-02	mg/kg/day	1.0E-05	mg/kg/day	3.0E+03
			Exp. Route Total								0.0E+00					3.0E+03
		Exposure Point Total									0.0E+00					3.0E+03
	Exposure Medium Total										0.0E+00					3.0E+03
Surface Water Total											0.0E+00					3.0E+03
Sediment	Crab (Lagoon)	Sediment Crab (Lagoon)	Ingestion	Cadmium	2.6E-01	mg/kg-biota	4.8E-05	mg/kg-day	NA	NA	NA	5.5E-04	mg/kg-day	1.0E-03	mg/kg-day	5.5E-01
				Chromium	4.0E-01	mg/kg-biota	7.4E-05	mg/kg-day	NA	NA	NA	8.6E-04	mg/kg-day	1.5E+00	mg/kg-day	5.7E-04
				Copper	1.7E+01	mg/kg-biota	3.2E-03	mg/kg-day	NA	NA	NA	3.8E-02	mg/kg-day	4.0E-02	mg/kg-day	9.4E-01
				Lead	2.4E+01	mg/kg-biota	4.5E-03	mg/kg-day	NA	NA	NA	5.3E-02	mg/kg-day	NA	NA	NA
				Nickel	4.8E+00	mg/kg-biota	8.9E-04	mg/kg-day	NA	NA	NA	1.0E-02	mg/kg-day	2.0E-02	mg/kg-day	5.2E-01
				Silver	7.4E-02	mg/kg-biota	1.4E-05	mg/kg-day	NA	NA	NA	1.6E-04	mg/kg-day	5.0E-03	mg/kg-day	3.2E-02
				Zinc	2.8E+02	mg/kg-biota	5.1E-02	mg/kg-day	NA	NA	NA	6.0E-01	mg/kg-day	3.0E-01	mg/kg-day	2.0E+00
				4,4'-DDD	8.0E-02	mg/kg-biota	1.5E-05	mg/kg-day	2.4E-01	1/(mg/kg-day)	3.6E-06	1.7E-04	mg/kg-day	NA	NA	NA
				4,4'-DDE	1.4E+00	mg/kg-biota	2.5E-04	mg/kg-day	3.4E-01	1/(mg/kg-day)	8.6E-05	2.9E-03	mg/kg-day	NA	NA	NA
				4,4'-DDT	3.2E-03	mg/kg-biota	5.9E-07	mg/kg-day	3.4E-01	1/(mg/kg-day)	2.0E-07	6.9E-06	mg/kg-day	5.0E-04	mg/kg-day	1.4E-02
				Aroclor-1254	5.4E-01	mg/kg-biota	1.0E-04	mg/kg-day	2.0E+00	1/(mg/kg-day)	2.0E-04	1.2E-03	mg/kg-day	2.0E-05	mg/kg-day	5.8E+01
				Tetrachloroethene	1.3E-03	mg/kg-biota	2.4E-07	mg/kg-day	5.4E-01	1/(mg/kg-day)	1.3E-07	2.7E-06	mg/kg-day	1.0E-02	mg/kg-day	2.7E-04
			Exp. Route Total								2.9E-04					6.2E+01
		Exposure Point Total									2.9E-04					6.2E+01
	Exposure Medium Total										2.9E-04					6.2E+01
Sediment Total											2.9E-04					6.2E+01
Receptor Total											2.9E-04					3.1E+03

NA = Not applicable.

Attachment 5

Attachment 5
Fish and Crab Risk Estimates for 4,4'-DDE
SWMU 6
Former NASD, Vieques, Puerto Rico

Fish							Crab				
Chemical	**Sediment EPC (mg/kg-sediment)**	**BSAF Value (1)**	**Fish Species (1)**	**Tissue Concentration (mg/kg-biota)**	**HQ (Child)(3)**	**ELCR (Adult)(3)**	**BSAF Value (2)**	**Crab Species (2)**	**Tissue Concentration (mg/kg-biota)**	**HQ (Child)(3)**	**ELCR (Adult)(3)**
4,4'-DDE	5.9E-02	2.0E+01	Largemouth Bass (Micropterus salmoides)	7.1E-01	--	1.2E-04	1.0E+01	Burrowing Crab	3.5E-01	--	4.6E-05
	5.9E-02	1.0E+01	Largemouth Bass (Micropterus salmoides)	3.6E-01	--	6.3E-05	3.2E+01	Burrowing Crab	1.1E+00	--	1.5E-04
	5.9E-02	3.5E+01	Cunner (Tautogolabrus adspersus)	1.2E+00	--	2.1E-04	1.8E+01	Burrowing Crab	6.4E-01	--	8.4E-05
	5.9E-02	8.4E+00	Cunner (Tautogolabrus adspersus)	3.0E-01	--	5.1E-05	6.7E+00	Burrowing Crab	2.4E-01	--	3.1E-05
	5.9E-02	4.2E+00	Bluegill (Lepomis macrochirus)	1.5E-01	--	2.5E-05	--	--	--	--	--

(1) Fish BSAF values were acquired from EPA 2008 and are based on whole body tissue BSAFs.
(2) Crab BSAF values were acquired from USACE, 2009 and are based on whole body tissue BSAFs.
(3) Risk estimates were performed to provide a range of values to assist in the decision making process. The most conservative cancer and noncancer risk estimates are based on the adult and child respectively.

The following equations were used to calculate Tissue Concentrations
Fish/Crab EPC (mg/kg-biota [ww]) = Sed EPC (mg/kg-sed [dw]) x lipid normalized BSAF (kg-OC [dw]/kg-lipid [dw]) x (%lipid / %OC) x 0.25 (kg-biota [dw]/kg-biota [ww]).
Fish/Crab EPCs were calculated assuming 2.1% organic carbon (site-specific) in sediment and 5% lipid for fish (EPA, 2000), 3.8% lipid for crab (USACE, 2009), and 75% moisture in fish/crab (EPA, 1993).

EPC - Exposure Point Concentration, BSAF - biota-sediment accumulation factor, HQ - Hazard Quotient, ELCR - Excess Lifetime Cancer Risk, OC - organic carbon, dw - dry weight basis, ww -wet weight basis

EPA, 1993. Wildlife exposure factors handbook. Volume I of II. EPA/600/R-93/187a
EPA, 2000. Bioaccumulation testing and interpretation for the purpose of sediment quality assessment - status and needs. EPA/823/R-00/001.

EPA, 2008. Biota-Sediment Accumulation Factor Data Set, Version 1.0. Prepared for the U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Mid-Continent Ecology Division (MED), Duluth, Minnesota. Prepared Computer Sciences Corporation Duluth, Minnesota Contract 68 W-02 032, Task 5003 and 5004. January 2008. http://www.epa.gov/med/Prods_Pubs/bsaf.htm
United States Army Corps of Engineers (USACE), 2009. BSAF Database. Available online: http://el.erdc.usace.army.mil/bsafnew/bsaf.html

Attachment E
Final Response to EPA and PREQB Comments

Responses to EPA Comments on Fish/Crab Tech Memo (11/21/11)

Table 1: Please provide the references for the ATSDR documents from which the information and citations are taken.

Navy Response: Table 1 was updated and the appropriate references added (see revised Table 1 attached).

Table 1
Organ Accumulation of SWMU 6 Fish and Crab COPCs
SWMU 6
Former NASD, Vieques, Puerto Rico

Contaminant	Primary Organ of Accumulation	Excerpted Text from ATSDR
Aroclor-1254	Hepatopancreas	"The highest levels of PCBs occurred in hepatopancreas samples from crustaceans, which are typically not consumed."
Tetrachloroethene	Crab specific information was not available. Liver and other tissues in fish.	Levels of 1-41 ppb (wet weight) in liver tissue, and up to 11 ppb (wet weight) in other tissue, were found in various species of fish collected off the coast of Great Britain near several organochlorine plants (Pearson and McConnell 1975)."
Cadmium	Hepatopancreas and Muscle	"Cadmium is accumulated mainly in the hepatopancreas (digestive gland) of the crab, and cadmium levels as high as 30–50 ppm have been detected in this edible part of the animal."
Chromium	Information was not available to suggest chromium accumulates in any specific organ.	"It is generally believed that chromium does not bioconcentrate in fish (EPA 1980, 1984a; Fishbein 1981; Schmidt and Andren 1984) and there is no indication of biomagnification of chromium along the aquatic food chain (Cary 1982)." "Based on this information, chromium is not expected to biomagnify in the aquatic food chain."
Copper	Crab specific information was not available. Sampling activities in fish are primarily concerned with accumulation of copper in the muscle, liver, and tissues of fish.	In bluefin tuna caught in the northwest Atlantic off Newfoundland, the mean copper concentration in muscle tissue has been measured at 1.0 ppm (dry weight) (Hellou et al. 1992a). In cod caught off the coast of Newfoundland, mean copper concentrations of <1.2–1.5 µg/g (dry weight) in muscle and 5– 10 ppm (dry weight) in liver have been determined (Hellou et al. 1992b). Respective mean and median copper concentrations of 127 samples of finfish from Chesapeake Bay and its tributaries were 1.66 and 0.36 ppm in 1978, and 1.85 and 0.61 ppm in 1979 (Eisenberg and Topping 1986). In striped bass taken from Turkey Point in the bay, copper levels were below the detection limit of the study (<0.1 µg/g) in muscle, but were higher in liver tissue ranging from 0.86 to 23.5 µg/g. In gonad tissue obtained from tissue from a different site on the bay, there was also an increase in the mean copper concentration in this tissue (4.25 µg/g) as compared to muscle (0.76 µg/g). The copper content of muscle tissue of several species of fish collected from metal-contaminated lakes near Sudbury, Ontario, ranged from 0.5 to 1.4 ppm (dry weight). No major pattern in variation was evident among species or among the study lakes (Bradley and Morris 1986). The copper concentration in the livers, however, ranged from 5 to 185 ppm (dry weight) and differed significantly among species and among lakes. Unlike muscle tissue, liver tissue is a good indicator of copper availability, although the data indicate that there are other factor(s) that influence the availability and bioaccumulation of copper in these fish.
Lead	Crab specific information was not available. Blood and tissues in fish.	"Exposure of a fresh-water fish to several sublethal concentrations of lead for a period of 30 days showed significant accumulation of lead in the blood and tissues." "Lead is toxic to all aquatic biota, and organisms higher up in the food chain may experience lead poisoning as a result of eating lead-contaminated food."
Zinc	Hepatopancreas and muscle	"Zinc bioconcentrates moderately in aquatic organisms; bioconcentration is higher in crustaceans and bivalve species than in fish." "Blue crabs (Callinectes sapidus) from the Quinnipac and Connecticut Rivers (Connecticut), which are mostly harvested for personal consumption, contained zinc in muscle and heltopancreas tissues at concentrations of 31–33 and 27–28 mg/kg wet weight, respectively (Jop et al.1997)."
DDT, DDE, DDD	Fatty Tissues	DDT, DDE, and DDD are highly lipid soluble, as reflected by their log octanol-water partition coefficients (log Kow) of 6.91, 6.51, and 6.02, respectively for the p,p'- isomers and 6.79, 6.00, and 5.87, respectively, for the o,p'- isomers (Howard and Meylan 1997). This lipophilic property, combined with an extremely long half-life is responsible for its high bioconcentration in aquatic organisms (i.e., levels in organisms exceed those levels occurring in the surrounding water). Organisms also feed on other animals at lower trophic levels. The result is a progressive biomagnification of DDT in organisms at the top of the food chain. Biomagnification is the cumulative increase in the concentration of a persistent contaminant in successively higher trophic levels of the food chain (i.e., from algae to zooplankton to fish to birds).
Silver	No information was available to suggest silver accumulates in any specific organ for fish or crab.	"Terhaar et al. (1977) studied bioconcentration (uptake from water) and bioaccumulation (uptake from food and water) of silver thiosulfate complexes in algae (Scenedesmus sp.), water flea (Daphnia magna), mussels (Ligumia sp. and Margaritifera sp.), and fathead minnow (Pimephales promelas) in 10-week exposures. Bioconcentration indices were 96-150 for algae, 12.2-26 for Daphnia, 5.9-8.5 for mussels, and 1.8-28 for fish. Bioaccumulation indices were 9-26 for Daphnia, 6.6-9.8 for mussels, and 4.0-6.2 for fish. These indices, which are based on measured wet weight concentrations in biota and nominal concentrations in water, indicate little potential for silver biomagnification (systematic increase in residue concentrations moving up a food chain) in the tested aquatic food chain."
Nickel	No information was available to suggest nickel accumulates in any specific organ for fish or crab.	"In the work of McGeer et al. (2003), BCFs for nickel in various aquatic organisms (e.g., algae, arthropods, mollusks, and fish) was assessed based on whole-body metal concentrations and exposure concentrations that were obtained from the literature. For exposure concentrations within the range of 5–50 µg/L nickel in water, mean BCF values of 106±53 (1 standard deviation [SD]) were obtained. When the authors also included data for exposure concentrations outside the range of 5–50 µg/L, a BCF value of 157±135 was obtained. The authors noted that the BCF values were inversely correlated with the exposure concentrations, where the highest BCF values were obtained at the lowest exposure concentrations. There was no evidence that nickel biomagnifies in aquatic food webs and, in fact, there is evidence to indicate that the nickel concentrations in organisms decrease with increasing trophic level

Table 1
Organ Accumulation of SWMU 6 Fish and Crab COPCs
SWMU 6
Former NASD, Vieques, Puerto Rico

Contaminant	Primary Organ of Accumulation	Excerpted Text from ATSDR

References:
Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological profile for Polychlorinated Biphenyls (PCBs). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.
Agency for Toxic Substances and Disease Registry (ATSDR). 1997. Toxicological profile for Tetrachloroethylene (PERC). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.
Agency for Toxic Substances and Disease Registry (ATSDR). 2008. Toxicological profile for Cadmium (Draft for Public Comment). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.
Agency for Toxic Substances and Disease Registry (ATSDR). 2008. Toxicological profile for Chromium (Draft for Public Comment). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.
Agency for Toxic Substances and Disease Registry (ATSDR). 2004. Toxicological profile for Copper. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Se
Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological profile for Lead. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Servi
Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological profile for Zinc. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Servi
Agency for Toxic Substances and Disease Registry (ATSDR). 2002. Toxicological profile for DDT, DDE, DDD. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.
Agency for Toxic Substances and Disease Registry (ATSDR). 1990. Toxicological profile for silver. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Serv
Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological profile for Nickel. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Ser

Responses to PREQB Comments on Draft SWMU 6 SAP Addendum (10/11/11) and Fish/Crab Tech Memo (11/21/11)

Fish/Crab Tech Memo

1 Page 2, Identification of Whole Body Bioaccumulation Factors: Please provide additional detail on the basis for the specific BSAFs selected.

Navy Response: Tables presenting the derivation of Whole Body BSAF values are attached to these response as Tables A and B1 to B5.

PREQB Evaluation of Response: The identification of fish sediment BSAFs are presented in Table A for inorganic contaminants of concern and in Tables B1 through B5 for organic contaminants of concern (i.e., DDT and its derivatives and PCBs). The inorganic BSAFs were generally derived by averaging the BSAFs reported for carnivorous, herbivorous and omnivorous fish within areas of "medium" contamination. Although the "medium" level of contamination may be appropriate for this site, the Navy may wish to consider selecting the maximum reported value (in "medium" contamination) for the three fish foraging guilds presented for the inorganic contaminants of concern. This would provide adequate conservatism for all fish foraging guilds potentially present at SWMU 6. The maximum BSAF available for organic contaminants was generally selected so, in order to maintain consistency, it would be reasonable to select the maximum value for inorganic contaminants as well.

Table B1 presents the rationale for selection of the BSAFs for organic contaminants of concern. Although the values selected appear to be appropriately conservative, the Navy may wish to consider revising the selection process to make it more transparent. The selection process indicates that geographical relevance (i.e., present at Vieques) of the test species is the first criterion while the second criterion is that the test species must be a gamefish (i.e., consumed by people). Using 4,4-DDE as an example, the cunner BSAF was rejected as this species does not occur at Vieques and the largemouth bass BSAF was selected. However, the largemouth bass also does not occur at Vieques. Actually, none of the test fish species selected for any of the organic contaminants occurs at Vieques so this first selection criterion does not appear useful and could be deleted. The second criterion (fish is consumed by people) can be satisfied by both of the selected fish test species (largemouth bass and bluegill) as well as the cunner. Please consider using the cunner BSAF value for 4,4-DDE as this would represent the maximum BSAF available for a gamefish and would be consistent with the selection process for the remaining organic contaminants of concern.

Navy Response: On January 12, 2012, a conference call was held with PREQB, TRC, and CH2MHILL. This comment was discussed and PREQB indicated that the intent of the comment was for the BSAF selection process for inorganics and organics to be consistent and transparent; PREQB agreed that average BSAFs for commonly-consumed fish could be used for organics, consistent with the average BSAFs used for inorganics. Subsequently, average BSAFs for organics (DDD, DDE, DDT, and PCBs) were calculated for saltwater fish species that are commonly consumed by humans. The average BSAFs are presented in revised Tables B1 through B5 (attached) and will be used in the HHRA.

Please note that during final review of the BSAFs for copper, it was discovered that BSAFs for mussels (Elliptio Complanata) were inadvertently used rather than BSAFs for fish or crustaceans. Since no copper BSAFs are available for fish, the BSAF for crustaceans (0.14) will be used in the HHRA; see revised Table A (attached).

Page 2, Risk Estimates and Identification of Analytes for Fish/Crab Samples: It is PREQB's preference that the fish ingestion rate of 7 meals per week be used in calculating risk estimates, especially for screening purposes, rather than the less conservative value of 2 meals per week as the preferred value is the value listed in the Master HHRA SOP and is based on a study conducted in Humacao, PR.

Navy Response: The 2 meals per week ingestion scenario is a more realistic exposure scenario for SWMU 6 than the subsistence scenario. Since one of the primary objectives of the biota sampling is to more realistically evaluate potential risks due to fish and crab consumption at SWMU 6, the 2 meals per week ingestion rate will be used, as described in the SAP Addendum (10/11/11).

PREQB Evaluation of Response: The evaluation of 2 meals per week as the exposure frequency for the purpose of quantifying risks appears reasonable as a site-specific modification to the Master SOP; however, at the screening stage when identifying chemicals of potential concern for laboratory analysis of tissue samples, PREQB prefers a more protective approach of using the number of meals per week identified in the Puerto Rico study. It would be helpful if the chemicals excluded by reducing the EF to 2 days per week were provided as a means of determining the impact of using the reduced value on the risk assessment. However, PREQB will defer to EPA on this issue.

Navy Response: The purpose of collecting biota samples from SMWU 6 is to assess a reasonable maximum exposure (RME) scenario for the Feasibility Study phase of the project, not a maximum exposure scenario. On January 12, 2012, a conference call was held with PREQB, TRC, and CH2MHILL. This comment was discussed and PREQB agreed that the site-specific biota ingestion frequency of 2 meals per week is appropriate for the HHRA.

Draft SAP Addendum

Navy Note: Please note that in addition to incorporating the responses below, the following revisions will also be made based on the Fish/Crab Tech Memo and associated discussions at the October 2011 Technical Subcommittee Meeting:

1. The number of samples has been revised to reflect discussions held among the human health risk assessors at the October 2011 meeting. There will be four site fish, four site crab, four background fish, and four background crab (plus QA/QC).
2. Due to the decrease in the total number of samples, all field samples will be analyzed for PCBCONG (versus half of them as stated in the Draft Addendum).
3. Analysis of methyl mercury will be removed.
4. Based on the full body analysis discussed at the October 2011 meeting, the processing techniques for fish and crab will be revised. Crabs will be "whole body." Fish will be "whole body, no guts."

SAP Worksheets

1. Worksheet 11 and Worksheet 15:
   a. The LOD for thallium (0.002 mg/kg) is above the screening level (0.00046 mg/kg). Since this is a potential risk-driver, please clarify whether lower detection limits are possible.

      Navy Response: The current thallium LOD of 0.0020 mg/kg is already from an extremely low (i.e. "ultra-trace") concentration range. For comparison, this is already 1250X lower than typical analysis via ICP-AES (CRQL from ILM05 = 2.5mg/kg), 250X lower than typical analysis via ICP-MS (CRQL from ILM06 = 0.5mg/kg), and 3X lower than the next-best (laboratory-specific) we found (LOD from PEL via SW-846 7841 = 0.060 mg/kg). Lower detection limits are not possible at Brooks Rand. In addition, please keep in mind that Brooks Rand is an experienced tissue laboratory with DoD ELAP accreditation for these analyses.

   b. The preparation and analytical SOPs that will be used were not provided in this SAP. It would be helpful to obtain copies of these for review since the selected laboratory (Brooks Rand) has not been used before on this program.

Navy Response: All analytical SOPs listed on Worksheet #23 (with the exception of that for methyl mercury) are provided as part of these responses to comments.

2. Worksheet 11:

   a. Page 41: Please clarify how the screening levels for crab and fish tissue were calculated, as fish ingestion RSLs are not included on the published table.

      Navy Response: The exposure factors, formulas, and toxicity values used in the derivation of fish and crab screening levels for the revised analytes are presented on Tables 1-3 (attached) and in the two attached figures.

   b. **Page 42:** The text states that percent lipids and percent solids will be field measurements. Please revise to reflect that these measurements will be performed in the laboratory.

      Navy Response: The requested change will be made.

3. Worksheet 12-1 (metals in tissue):

   a. The designation of field duplicates should be changed to laboratory replicates. It is not really possible to collect true biota field duplicates. Therefore, the procedure of the laboratory splitting the sample after homogenization represents a laboratory replicate and not a field duplicate.

      Navy Response: It is agreed that true biota field duplicates cannot be collected. However, these QC samples are probably closer to field duplicates than to laboratory replicates and may cause confusion with true laboratory replicates, which are also required. The exception to the norm ("Field duplicates are not blind to the laboratory.") is described at the bottom of Worksheet #12-1. Please keep in mind that this comment is only discussing the title of a QC sample. The title does not change how they will be collected (designated), analyzed, or evaluated.

   b. The methods cited on the worksheet are 1638M and 1630M. In order to understand the modifications, the laboratory SOPs for these procedures must be provided for review.

      Navy Response: Please refer to the response to Comment 1b, above.

      PREQB Evaluation of Response: In Appendix A (page 49 of 49) of Brooks Rand's ICP/MS SOP (BR-0060), there is a table showing the modifications to EPA method 1638M. The table states that Section 13.8 of the method will be modified to allow blank subtraction, as per standard industry practices. It is PREQB's understanding that it is not standard industry practice to perform blank subtraction; rather, the laboratory reports the results of the samples and blanks and if data need to be qualified due to blank contamination, this is determined during data validation. Please address.

      Navy Response: Worksheet #23 will be updated as follows: LAB SOP BR-0060 will be marked as "Y[6]" under "Modified for Project Work?" Footnote 6 will be defined as "Blank subtraction will not be allowed for analysis of metals via BR-0060."

      PREQB Evaluation of Response, continued: Also, in reviewing this SOP that the Navy provided with their Responses to Comments, page 46 of the SOP states that DOD work is only reported down to the LOQ. Worksheet 15 states that the laboratory will report results down to the LODs. Please clarify.

      Navy Response: The statement in the SOP is confusing and has been scheduled by Brooks Rand for elimination from the SOP when BR-0060 is next revised. Brooks Rand's default reporting is LOQ/LOD/DL and matches the typical reporting requirements for DoD QSM v. 4 projects. Specifically, results between the DL and LOQ will be reported, qualified as applicable, and nondetect results will be reported as U-Values at the LOD.

4. Worksheet 12-2 (PCB congeners in tissue): The designation of field duplicates should be changed to laboratory replicates. It is not really possible to collect true biota field duplicates. Therefore, the procedure of the laboratory splitting the sample after homogenization represents a laboratory replicate and not a field duplicate.

   Navy Response: Please refer to the response to Comment 3a, above. In addition, these QC samples are very similar to field duplicates for PCBCONG. Brooks Rand will homogenize the sample and then split it into field duplicates. The field duplicates will be shipped to TestAmerica-West Sacramento. These are then blind to the laboratory performing the analysis. This process is described at the bottom of Worksheet #12-2.

5. Worksheet 14, page 50: Please include the procedure for decontamination of the blending/grinding equipment for fish and crab samples as well as the requirement for the preparation and analysis of equipment blanks after decontamination.

   Navy Response: The procedure for decontamination is discussed in the analytical laboratory SOPs which are provided as part of the response to Comment 1b above. For equipment blanks, please refer to the response to Comment 9, below (a change is not necessary for Worksheet #14).

6. Worksheet 17: Please verify the sample identifications for the fish and crab samples on this worksheet and Worksheet 18 (they appear to be inconsistent).

   Navy Response: Worksheets #17 and #18 will be updated to reflect the new sampling protocol (four site fish, four site crab, four background fish, four background crab). The discrepancy between "F001" and "FS01" and between "C001" and "CRB01" will be corrected.

7. Worksheet 18: This is the first instance where it is noted that PCB congener analysis will be performed on one-half of the samples. Please include rationale for this in Worksheet 14.

   Navy Response: Please see the Navy Note near the top of these responses. The comment is no longer applicable because all field samples will be analyzed for PCBCONG.

8. Worksheet 23:

   a. Please provide all laboratory SOPs referenced on this worksheet. In addition, please clarify if Test America will be performing additional cleanup procedures for the PCB congener analysis.

      Navy Response: Please refer to the response to Comment 1b, above. Then, please refer to Section 11.10 of WS-IDP-0013 for details on cleanup procedures.

   b. There is a potential for some uncertainty and representativeness issues by having each laboratory separately process and homogenize the samples. Please consider having one laboratory process and homogenize all samples and provide aliquots of the homogenate to the other laboratory for analysis. Otherwise, the laboratories' procedures for processing and homogenization must be provided for review.

      Navy Response: Each laboratory is not separately processing and homogenizing samples. One laboratory (Brooks Rand) will process and homogenize all samples and provide aliquots of the homogenate to the other laboratory for analysis. Please refer to Worksheet #26 which says "Note that all samples will be shipped to BRL who will forward PCBCONG fraction to TA." Also, please note that on Worksheet #23, sample homogenization (BR-0106) and processing (BR-0304) will be performed by Brooks Rand.

9. Worksheet 28: Please add equipment blanks for each analysis to ensure no contamination is present on the grinding/homogenizing equipment after decontamination and between samples.

   Navy Response: To avoid confusion, these will be referred to as 'homogenization blanks' and are described in Section 6.2 of BR-0106. The following worksheets will be updated to include homogenization blanks: Worksheet #12-1, #12-2, #20, and #28. Due to their significant cost, homogenization blanks will be collected and analyzed (for METAL and PCBCONG) at a frequency of one per sub-matrix (one for fish and one for crab).

Table A - Selection of Whole Body Metal BSAFs
SWMU 6
Former NASD, Vieques, Puerto Rico

Chemical	Saltwater or Freshwater Species	Species	Sediment Contamination	BSAF	Values Used	Comment/Summary
Cadmium	Saltwater	Carnivore	high	0.043		Cadmium BSAF derived using the average of three fish species based on medium sediment contamination
	Saltwater	Carnivore	medium	0.22	0.22	
	Saltwater	Carnivore	low	2		
	Saltwater	Herbivore	high	0.32		
	Saltwater	Herbivore	medium	0.11	0.11	
	Saltwater	Herbivore	low	2		
	Saltwater	Omnivore	high	0.15		
	Saltwater	Omnivore	medium	0.22	0.22	
	Saltwater	Omnivore	low	2		
			Average	--	0.18	
Chromium	Freshwater	Fish (perca flavescens)		0.043	0.043	Chromium BSAF selected is the only fish BSAF available.
Copper	Saltwater	Crustacean (cancer magister)		0.14	0.14	Copper BSAF selected is the only BSAF available for crustaceans; fish BSAF is not available.
Lead	Saltwater	Carnivore	high	0.028		Lead BSAF derived using the average of three fish species based on medium sediment contamination
	Saltwater	Carnivore	medium	0.13	0.13	
	Saltwater	Carnivore	low	0.33		
	Saltwater	Herbivore	high	0.11		
	Saltwater	Herbivore	medium	0.093	0.093	
	Saltwater	Herbivore	low	0.16		
	Saltwater	Omnivore	high	0.076		
	Saltwater	Omnivore	medium	0.26	0.26	
	Saltwater	Omnivore	low	0.43		
			Average	--	0.16	
Zinc	Saltwater	Carnivore	High	0.13		Zinc BSAF derived using the average of three fish species based on medium sediment contamination
	Saltwater	Carnivore	Medium	1.2	1.2	
	Saltwater	Carnivore	Low	3.7		
	Saltwater	Herbivore	High	0.24		
	Saltwater	Herbivore	Medium	1.3	1.3	
	Saltwater	Herbivore	Low	4.6		
	Saltwater	Omnivore	High	0.17		
	Saltwater	Omnivore	Medium	1.3	1.3	
	Saltwater	Omnivore	Low	5		
			Average	--	1.3	

Note:
All values acquired from WDE 1995 and are based on whole body values.
BSAF basis is dry weight

Reference:
Washington Department of Ecology (WDE). 1995. Bioaccumulation Factor Approach Analysis for Metals and Polar Organic Compounds. October 1995.

Table B1 - Selection of Fish Whole Body BSAF Values
SWMU 6
Former NASD, Vieques, Puerto Rico

Parameter	Available Saltwater Species	Average Value
4,4-DDD	cunner	0.255
4,4-DDE	spot, cunner	14.44
4,4-DDT	cunner	0.232
Aroclor-1254	Atlantic croaker, spotted seatrout, sand seatrout, spot, black drum, red drum, anchovy, cunner, alewife	4.56

Selection Process: The average fish BSAF value was calculated based on BSAFs for whole-body values for saltwater species that are commonly consumed.

Reference

EPA, 2008. Biota-Sediment Accumulation Factor Data Set, Version 1.0. Prepared for the U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Mid-Continent Ecology Division (MED), Duluth, Minnesota. Prepared Computer Sciences Corporation Duluth, Minnesota Contract 68 W-02 032, Task 5003 and 5004. January 2008. http://www.epa.gov/med/Prods_Pubs/bsaf.htm

Table B2 - Selection of 4,4-DDD Whole Body BSAF Values
SWMU 6
Former NASD, Vieques, Puerto Rico

Superfund Site	Organism Common Name	Fresh or Saltwater Species	Commonly Consumed (Yes or No)	Biota Tissue Supplemental	BSAF
Naval Education & Training Center, Old Fire Fighting Training Area	cunner	Saltwater	Yes	single or multiple organisms	0.254800903

Average	0.254800903

Notes:
BSAF values presented are whole-body values. Biota age class was not reported.

Table B3 - Selection of 4,4-DDE Whole Body BSAF Values
SWMU 6
Former NASD, Vieques, Puerto Rico

Superfund Site	Organism Common Name	Fresh or Saltwater Species	Commonly Consumed (Yes or No)	Biota Tissue Supplemental	BSAF
Calcasieu Estuary	spot	Saltwater	Yes	single or multiple organisms	0.111415924
Naval Education & Training Center, Derecktor Shipyard	cunner	Saltwater	Yes	composite	8.432787618
Naval Education & Training Center, McAllister Point Landfill	cunner	Saltwater	Yes	composite	34.77241596

Average	14.43887317

Notes:
BSAF values presented are whole-body values. Biota age class was not reported.

Table B4 - Selection of 4,4-DDT Whole Body BSAF Values

SWMU 6

Former NASD, Vieques, Puerto Rico

Superfund Site	Organism Common Name	Fresh or Saltwater Species	Commonly Consumed (Yes or No)	Biota Tissue Supplemental	BSAF
Naval Education & Training Center, Old Fire Fighting Training Area	cunner	Saltwater	Yes	single or multiple organisms	0.231977393
				Average	0.231977393

Notes:

BSAF values presented are whole-body values. Biota age class was not reported.

Table B5 - Selection of Aroclor-1254 Whole Body BSAF Values

SWMU 6

Former NASD, Vieques, Puerto Rico

Superfund Site	Organism Common Name	Fresh or Saltwater Species	Commonly Consumed (Yes or No)	Biota Tissue Supplemental	Biota Age Class	BSAF
Calcasieu Estuary	Atlantic croaker	Saltwater	Yes	composite| single or multiple organisms	NR	3.780278331
Calcasieu Estuary	spotted seatrout	Saltwater	Yes	composite| composite| single or multiple organisms	NR	4.423274886
Calcasieu Estuary	red drum	Saltwater	Yes	single or multiple organisms	NR	8.421994343
Calcasieu Estuary	sand seatrout	Saltwater	Yes	single or multiple organisms	NR	6.041238245
Calcasieu Estuary	spot	Saltwater	Yes	composite	NR	1.032014099
Calcasieu Estuary	spotted seatrout	Saltwater	Yes	single or multiple organisms	NR	3.133280346
Calcasieu Estuary	red drum	Saltwater	Yes	single or multiple organisms	NR	0.878280239
Calcasieu Estuary	spot	Saltwater	Yes	single or multiple organisms	NR	3.358468334
Calcasieu Estuary	spotted seatrout	Saltwater	Yes	single or multiple organisms	NR	0.866147847
Calcasieu Estuary	black drum	Saltwater	Yes	single or multiple organisms	NR	9.198622855
Calcasieu Estuary	anchovy	Saltwater	Yes	single or multiple organisms	NR	2.319290195
Calcasieu Estuary	spot	Saltwater	Yes	single or multiple organisms	NR	1.331968136
Calcasieu Estuary	spot	Saltwater	Yes	composite	NR	0.703699845
Naval Education & Training Center, Derecktor Shipyard	cunner	Saltwater	Yes	composite	NR	5.305713582
Green Bay	alewife	Saltwater	Yes	composite	adult	0.607849238
Green Bay	alewife	Saltwater	Yes	composite	adult	7.46721296
Green Bay	alewife	Saltwater	Yes	composite	adult	2.153721006
Green Bay	alewife	Saltwater	Yes	composite	YOY	1.64264063
Green Bay	alewife	Saltwater	Yes	composite	adult	1.572379224
Green Bay	alewife	Saltwater	Yes	composite	YOY	0.897669682
Green Bay	alewife	Saltwater	Yes	composite	adult	1.972944293
Naval Education & Training Center, McAllister Point Landfill	cunner	Saltwater	Yes	composite	NR	33.30356695

Average	4.564193421

Notes:

BSAF values presented are whole-body values for Total PCBs.

NR = not reported; YOY = young of year

Table 1
Exposure Assumptions for PAL Calculations (For Fish/Crab Ingestion)
SWMU 6
Former NASD, Vieques, Puerto Rico

Contaminant	CAS No.	Toxicity				Adult Fish Ingestion Cancer SL (mg/kg)	Child Fish Ingestion Non-Cancer SL (mg/kg)
Analyte		SFO $(mg/kg\text{-}day)^{-1}$	key	RfD_o (mg/kg-day)	key		
Thallium (Soluble Salts)	7440-28-0			1.0E-05	X		4.6E-04
Zinc and Compounds	7440-66-6			3.0E-01	I		1.4E+01
~Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189)	39635-31-9	3.9E+00	E	3.3E-05	E	8.1E-04	1.5E-03
~Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167)	52663-72-6	3.9E+00	E	3.3E-05	E	8.1E-04	1.5E-03
~Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157)	69782-90-7	3.9E+00	E	3.3E-05	E	8.1E-04	1.5E-03
~Hexachlorobiphenyl, 2,3,3',4,4',5- (PCB 156)	38380-08-4	3.9E+00	E	3.3E-05	E	8.1E-04	1.5E-03
~Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169)	32774-16-6	3.9E+03	E	3.3E-08	E	8.1E-07	1.5E-06
~Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123)	65510-44-3	3.9E+00	E	3.3E-05	E	8.1E-04	1.5E-03
~Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118)	31508-00-6	3.9E+00	E	3.3E-05	E	8.1E-04	1.5E-03
~Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105)	32598-14-4	3.9E+00	E	3.3E-05	E	8.1E-04	1.5E-03
~Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114)	74472-37-0	3.9E+00	E	3.3E-05	E	8.1E-04	1.5E-03
~Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126)	57465-28-8	1.3E+04	E	1.0E-08	E	2.4E-07	4.6E-07
~Polychlorinated Biphenyls (high risk)	1336-36-3	2.0E+00	I			1.6E-03	
~Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77)	32598-13-3	1.3E+01	E	1.0E-05	E	2.4E-04	4.6E-04
~Tetrachlorobiphenyl, 3,4,4',5- (PCB 81)	70362-50-4	3.9E+01	E	3.3E-06	E	8.1E-05	1.5E-04

Equations
Calculation of Non-Cancer Fish Ingestion Screening Level (mg/kg)
$(THQ \times BW_c \times ED_c \times AT \times RfD_o) / (IR_c \times EF \times ED \times CF\ (0.001))$
Calculation of Carcinogenic Fish Ingestion Screening Level (mg/kg)
$(TR \times BW_a \times LT \times AT) / (SF_o \times IR_a \times EF \times ED \times CF\ (0.001))$

Exposure Factors	
Target cancer risk (TR) - unitless	0.000001
Target hazard quotient = 1 (THQ) - unitless	0.1
Adult Exposure Factors	
Averaging time (AT) - days	365
Exposure frequency (EF) - days	104
Exposure duration (ED) - years	24
Life Time (LT)	70
Body weight - adult (BW_a) - kg	70
Fish consumption rate (IR_a) - g/day	227
Child Exposure Factors	
Averaging time (AT) - days	365
Exposure frequency (EF) - days	104
Exposure duration (ED) - years	6
Body weight - adult (BW_c) - kg	15
Fish consumption rate (IR_c) - g/day	114

Notes:
I = Integrated Risk Information System
X = PPRTV Appendix
E = Environmental Criteria and Assessment Office

Fish Ingestion screening levels calculated using June 2011 Regional Screening Levels (RSL) toxicity values and Vieques-specific exposure factors.

Table 2
Selection of Lead PAL (For Fish/Crab Ingestion)
SWMU 6
Former NASD, Vieques, Puerto Rico

Analyte	Child Ingestion SL (1)	Adult Ingestion SL (2)
Lead	0.472	1.036

All concentrations expressed in mg/kg-biota.
SL = Screening Level
IEUBK = Integrated Exposure Uptake Biokinetic Model
ALM = Adult Lead Methodology

(1) Child screening level calculated using IEUBK model to meet 1994 OSWER Directive of no more than 5% of children exceeding 10 ug/dL blood lead. See IEUBK output Figures 1 and 2.

(2) Adult screening level calculated using the ALM model to meet the 1994 OSWER Directive of no more than 5% of children (fetuses of exposed women) exceeding 10 ug/dL blood lead. See Table 3 for ALM inputs.

USEPA. 2002. Blood Lead Concentrations of U.S. Adult Females: Summary Statistics from Phases 1 and 2 of the National Health and Nutrition Evaluation Survey (NHANES III). Final. Technical Review Workgroup for Lead. March.

USEPA. 2003. Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposure to Lead in Soil. Office of Solid Waste and Emergency Response. OSWER 9285.7-54. January.

USEPA. 2009. Update of the Adult Lead Methodology's Default Baseline Blood Lead Concentration and Geometric Standard Deviation Parameter. OSWER Dir #9200.2-82. 2009.

Table 3
Adult Lead SL Calculation Using ALM Model
SWMU 6
Former NASD, Vieques, Puerto Rico

Calculations of Blood Lead Concentrations (PbBs)

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee
Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004
PbF	Lead concentration in fish (average)	ug/g or ppm	1.036
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	ug/dL	1.0
IR_F	**Fish ingestion rate (8 oz./day)**	g/day	227
IR_{S+D}	Total ingestion rate of outdoor soil and indoor dust	g/day	--
W_S	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--
K_{SD}	Mass fraction of soil in dust	--	--
AF	**Absorption fraction (assumed same as soil and dust)**	--	0.12
EF_F	**Exposure frequency (2 days/week or 365 days/year)**	days/yr	**104.29**
AT_F	Averaging time	days/yr	365
PbB_{adult}	**PbB of adult fish consumer, geometric mean**	**ug/dL**	**4.2**
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses of adult fish consumers	ug/dL	10.0
PbB_t	Target PbB level of concern (e.g., 10 ug/dL)	ug/dL	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**5.000%**

[1] Equation 1 does not apportion exposure between soil and dust ingestion (excludes W_S, K_{SD}).
When $IR_S = IR_{S+D}$ and $W_S = 1.0$, the equations yield the same $PbB_{fetal,0.95}$.

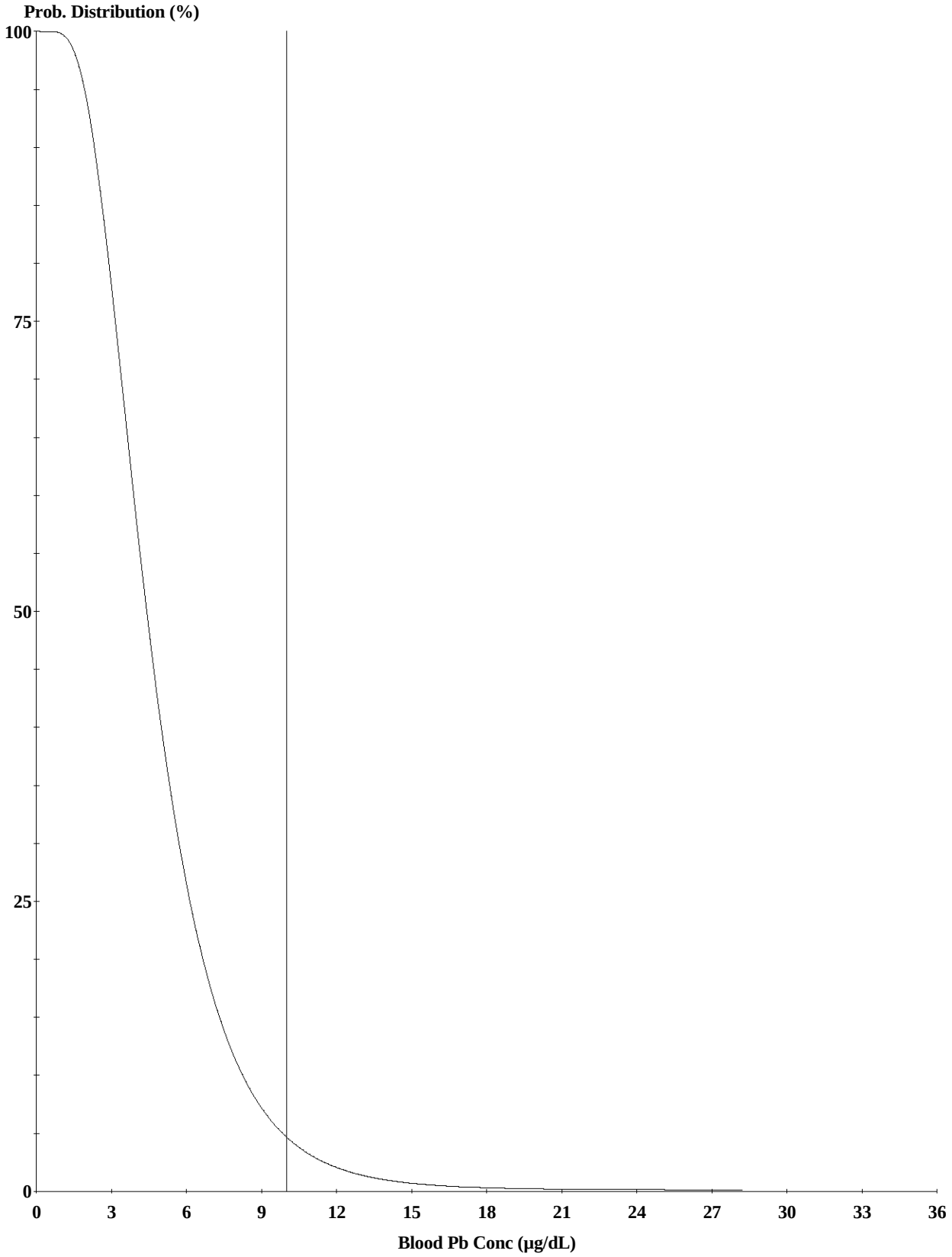
***Equation 1, based on Eq. 1, 2 in USEPA (1996).**

PbB_{adult} =	$(PbF*BKSF*IR_F*AF*EF_F/AT_F) + PbB_0$
$PbB_{fetal, 0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

Note:
(1) Recommended baseline blood lead concentration (µg/dL) and GSD estimates of U.S. women, 17–45 years of age, between NHANES III and 1999–2004 NHANES data were used according to the EPA June 2009 Update.

EPA. 2009. Update of the adult lead methodology's default baseline blood lead concentration and geometric standard deviation para
OSWER 9200.2-82. June 2009.

Source: U.S. EPA (1996). Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil



Cutoff = 10.000 µg/dl
Geo Mean = 4.616
GSD = 1.600
% Above = 4.999

Age Range = 0 to 84 months

Run Mode = Research

LEAD MODEL FOR WINDOWS Version 1.1

==========
Model Version: 1.1 Build9
User Name:
Date:
Site Name:
Operable Unit:
Run Mode: Research
==========

****** Air ******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m^3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (µg Pb/m^3)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100
4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

****** Diet ******

Age	Diet Intake(µg/day)
.5-1	7.226
1-2	15.804
2-3	19.951
3-4	21.176
4-5	22.403
5-6	24.192
6-7	27.726

Alternative Dietary Values
Home grown fruits concentration: 0.000 µg/g
Home grown vegetables concentration: 0.000 µg/g
Fish from fishing concentration: 0.472 µg/g
Game animals from hunting concentration: 0.000 µg/g
Home grown fruits factor: 0.000 % of all fruits
Home grown vegetables factor: 0.000 % of all vegetables
Fish from fishing factor: 100.000 %of all meat
Game animals from hunting factor: 0.000 % of all meat

****** Drinking Water ******

Water Consumption:

Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 4.000 µg Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 101.000 µg/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (µg Pb/g)	House Dust (µg Pb/g)
.5-1	130.000	101.000
1-2	130.000	101.000
2-3	130.000	101.000
3-4	130.000	101.000
4-5	130.000	101.000
5-6	130.000	101.000
6-7	130.000	101.000

****** Alternate Intake ******

Age	Alternate (µg Pb/day)
.5-1	0.000
1-2	0.000
2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 1.000 µg Pb/dL

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (µg/day)	Diet (µg/day)	Alternate (µg/day)	Water (µg/day)
.5-1	0.021	3.357	0.000	0.372
1-2	0.034	7.097	0.000	0.898
2-3	0.062	8.975	0.000	0.936
3-4	0.067	9.630	0.000	0.964
4-5	0.067	10.339	0.000	1.015
5-6	0.093	11.231	0.000	1.077
6-7	0.093	12.864	0.000	1.095

Year	Soil+Dust (µg/day)	Total (µg/day)	Blood (µg/dL)
.5-1	2.702	6.452	3.5
1-2	4.149	12.178	4.9
2-3	4.155	14.128	5.1
3-4	4.201	14.862	5.1
4-5	3.158	14.579	4.9
5-6	2.859	15.260	4.6
6-7	2.699	16.751	4.6