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FINAL REMEDIAL ACTION WORK PLAN GROUNDWATER MONITORING AND INSTITUTIONAL CONTROLS WITH CONTINGENCY PLANS AREA OF CONCERN E (AOC E) ATLANTIC FLEET WEAPONS TRAINING AREA FORMER NAVAL AMMUNITION SUPPORT DETACHMENT VIEGUES ISLAND PUERTO RICO

01/01/2015

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Final

Remedial Action Work Plan
Groundwater Monitoring and Institutional Controls with Contingency Plans
Area of Concern E

Atlantic Fleet Weapons Training Area – Vieques
Former Naval Ammunition Support Detachment
Vieques, Puerto Rico

Contract Task Order 013

January 2015

Prepared for

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Prepared by

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Executive Summary

This Work Plan presents the groundwater remedial action activities for Area of Concern (AOC) E, located at the former Naval Ammunition Support Detachment (NASD) in Vieques, Puerto Rico. The U.S. Department of the Navy (Navy) and Environmental Protection Agency (EPA) Region 2 jointly selected the remedial action for AOC E, with the concurrence of the Commonwealth of Puerto Rico Environmental Quality Board (PREQB). AOC E is the site of a former 500-gallon underground storage tank (UST) and former 500-gallon aboveground storage tank (AST) that stored used oil from vehicle maintenance activities.

This remedial action is intended to address residual persulfate from an in-situ chemical oxidation (ISCO) pilot study and the potential for "rebound" of contaminants of concern (COCs) above regulatory levels once the persulfate levels return to normal. The COCs identified at AOC E are benzene, 1,2-dichloroethane, 2-methylnaphthalene, methyl tert-butyl ether, naphthalene, and xylenes. The selected remedial action for AOC E is Long Term Monitoring (LTM) and Institutional Controls (ICs) with Contingency Plans, as documented in the Record of Decision (ROD) (Navy, 2014).

This Work Plan describes how the remedial action will be implemented in order to meet the following Remedial Action Objective (RAO) for AOC E:

- Prevent exposure to COCs in groundwater at concentrations above remedial goals (RGs).

The RGs are based on potential use of groundwater as a potable (drinking water) source and are, therefore, Federal Maximum Contaminant Levels, Puerto Rico Water Quality Standards, or risk-based, as applicable. The remedial action involves implementation of periodic (at least annually) groundwater monitoring to ensure persulfate concentrations decline followed by annual groundwater monitoring of COCs for a period of 3 years to ensure contaminant rebound above RGs does not occur. The remedial action also includes ICs to restrict potable groundwater use until the RAO is met. The Land Use Control (LUC) boundary encompassing AOC E (**Figure ES-1**) is identified in the April 30, 2001 Quitclaim deed between the Department of the Navy and the Municipality of Vieques. The LTM network consists of six monitoring wells: MW-03 located upgradient of the former UST; MW-01, MW-04, and MW-05 located at or immediately downgradient of the former UST; and MW-07 and MW-08 located further downgradient.

In accordance with the ROD, should residual persulfate levels not demonstrate an overall decline after three years, an ISCO injection using a hydrogen peroxide solution will be conducted to accelerate persulfate decline (Contingency Plan 1, CP-1). If COCs rebound above RGs after three successive annual monitoring events, an ISCO injection using persulfate will be conducted for wells in which rebound is observed (Contingency Plan 2, CP-2). If either of the contingency plans is necessary, a Remedial Action Work Plan Addendum will be prepared for regulatory review to provide the details of the solution(s) to be injected, including location(s) and schedule, as well as any modifications to the subsequent monitoring protocol.

Resumen Ejecutivo

Este Plan de Trabajo presenta las actividades de medidas de remediación para el agua subterránea en el Área de Preocupación (AOC por sus siglas en inglés) E, ubicada en el antiguo Destacamento de Apoyo de Municiones Navales (NASD por sus siglas en inglés) en Vieques, Puerto Rico. El Departamento de la Marina de los EE.UU. (Marina) y la Región 2 de la Agencia de Protección Ambiental de los EE.UU. (USEPA por sus siglas en inglés) seleccionaron conjuntamente la medida de remediación para AOC E, con la concurrencia de la Junta de Calidad Ambiental de Puerto Rico (JCA). En AOC E se ubicaba un antiguo tanque de almacenamiento soterrado (UST por sus siglas en inglés) de 500 galones y un antiguo tanque de almacenamiento por encima del nivel del suelo (AST por sus siglas en inglés) de 500 galones en los que se almacenaron aceite usado proveniente de actividades de mantenimiento de vehículos.

Esta medida de remediación tiene por objetivo tratar el persulfato residual de un estudio piloto de oxidación química *in-situ* (ISCO por sus siglas en inglés) y la posibilidad de un "rebote" de contaminantes de preocupación (COCs por sus siglas en inglés) por encima de los niveles reglamentarios una vez que los niveles de persulfato regresen a la normalidad. Los COCs identificados en AOC E son benzeno, 1,2-dicloroetano, 2-metilnaftaleno, éter metilbutílico terciario, naftaleno, y xilenos. La medida de remediación seleccionada para AOC E es Monitoreo a Largo Plazo (LTM por sus siglas en inglés) y Controles Institucionales (ICs por sus siglas en inglés) con Planes de Contingencia, tal y como se documenta en el Registro de Decisión (ROD por sus siglas en inglés) (Marina, 2014).

Este Plan de Trabajo describe cómo se implementará la medida de remediación para cumplir el siguiente Objetivo de Medida de Remediación (RAO por sus siglas en inglés) para AOC E:

Prevenir la exposición a COCs en el aguasubterránea en concentraciones superiores a los objetivos de remediación (RGs por sus siglas en inglés). Los RGs se basan en el uso potencial del agua subterránea como fuente de agua potable (agua para beber) y son, por lo tanto, Niveles Federales de Contaminantes Máximos, Estándares de Calidad del Agua de Puerto Rico, o están basados en riesgos, según resulte aplicable. La medida de remediación envuelve la implementación de monitoreo periódico (al menos anualmente) del agua subterránea para asegurarse de que disminuyan las concentraciones de persulfato, seguido de un monitoreo anual de COCs en el agua subterránea por un período de 3 años para asegurar que no se produzcan rebotes en los contaminantes por encima de los RGs. La medida de remediación incluye también ICs para restringir el uso del agua subterránea como agua potable hasta que se cumpla el RAO. El límite de Control de Uso de Terrenos (LUC por sus siglas en inglés) que abarca a AOC E (**Figura ES-1**) se identifica en la Escritura de Renuncia con fecha del 30 de abril de 2001 entre el Departamento de la Marina y la Municipalidad de Vieques. La red de LTM consta de seis pozos de monitoreo: MW-03 ubicado gradiente arriba del antiguo UST; MW-01, MW-04, y MW-05 ubicados en o inmediatamente gradiente abajo del antiguo UST; y MW-07 y MW-08 ubicados en un gradiente más abajo.

De acuerdo con el ROD, si los niveles residuales de persulfato no indican un descenso global después de tres años, se llevará a cabo una inyección de ISCO utilizando una solución de peróxido de hidrógeno para acelerar el descenso del persulfato (Plan de Contingencia 1, CP-1). Si los COCs rebotan por encima de los RGs después de tres eventos sucesivos de monitoreo anual, se llevará a cabo una inyección de ISCO utilizando persulfato para los pozos en los que se observe un rebote (Plan de Contingencia 2, CP-2). Si es necesario alguno de los planes de contingencia, se preparará un Apéndice al Plan de Trabajo de Medidas de Remediación para revisión regulatoria para proporcionar los detalles de la solución o las soluciones a ser inyectadas, incluyendo ubicación/ubicaciones y calendario de trabajo, así como cualquier modificación en el protocolo de monitoreo subsecuente.

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

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

(\\mnustrictgfs01\ctg$\projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Executive_Summary\Figure ES-1 - Conceptual Plan for LUC ImplementationV2.mxd12/2/2014

Legend
- Sign
- LTM Monitoring Well
- Fence
- AOC E Land Use Control Boundary

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Figure ES-1
Conceptual Plan for Land Use Controls
AOC E Remedial Action Work Plan
Atlantic Fleet Weapons Training Area - Vieques
Former Naval Ammunition Support Detachment
Vieques, Puerto Rico

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D Final Responses to Regulatory Comments

Acronyms and Abbreviations

AOC	Area of Concern
ARAR	Applicable or relevant and appropriate requirement
AST	aboveground storage tank
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CLEAN	Comprehensive Long-term Environmental Action—Navy
COC	contaminant of concern
CP	contingency plan
CTO	Contract Task Order
DBB	denitrification-based bioremediation
1,2-DCA	1,2 - dichloroethane
DoD	Department of Defense
DOI	Department of the Interior
EPA	Environmental Protection Agency
ERP	Environmental Restoration Program
FFA	Federal Facility Agreement
gpm	gallons per minute
HI	Hazard Index
ICs	Institutional Controls
IRACR	Interim Remedial Action Completion Report
ISCO	in-situ chemical oxidation
LTM	long-term monitoring
LUC	land use control
mg/L	milligrams per liter
MOV	Municipality of Vieques
MPE	Multiphase Extraction
MTBE	methyl tert butyl ether
MW	monitoring well
NASD	Naval Ammunition Support Detachment
NAVFAC	Naval Facilities Engineering Command, Atlantic
Navy	U.S. Department of the Navy
PA/SI	Preliminary Assessment/Site Investigation
PREQB	Puerto Rico Environmental Quality Board
RA	remedial action
RAB	Restoration Advisory Board
RAO	remedial action objective
RG	Remedial Goal
RI	Remedial Investigation
ROD	Record of Decision
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SWMU	Solid Waste Management Unit
USFWS	U.S. Fish and Wildlife Service
UST	underground storage tank

SECTION 1

Introduction

This Remedial Action (RA) Work Plan presents the groundwater remedial action activities for Area of Concern (AOC) E , located at the former Naval Ammunition Support Detachment (NASD) in Vieques, Puerto Rico (**Figures 1-1** and **1-2**). It was prepared under the Naval Facilities Engineering Command, Atlantic (NAVFAC), Comprehensive Long-term Environmental ActiRGon – Navy (CLEAN) 8012 Contract N62470-11-D-8012, Contract Task Order (CTO) 013, for submittal to NAVFAC, the Environmental Protection Agency (EPA) Region 2, the Commonwealth of Puerto Rico Environmental Quality Board (PREQB), and the U.S. Fish and Wildlife Service (USFWS). NAVFAC, EPA, PREQB, and USFWS work jointly as the Vieques Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Environmental Restoration Program (ERP) Technical Subcommittee.

Although recent groundwater data show that the in-situ chemical oxidation (ISCO) pilot study resulted in contaminants of concern (COCs) concentrations below regulatory standards, residual persulfate may continue to actively reduce contaminants that partition or diffuse from soil into groundwater. Therefore, the RA address residual persulfate and the potential for “rebound” of COCs above regulatory standard once the persulfate levels return to normal.

The U.S. Department of the Navy (Navy) and EPA jointly selected the RA for AOC E, with the concurrence of PREQB. The selected RA for AOC E is Long Term Monitoring (LTM) and Institutional Controls (ICs) with Contingency Plans, as documented in the Record of Decision (ROD) (Navy, 2014). The components of the RA include implementing groundwater LTM, physical barriers and ICs, groundwater treatment contingency plans (if necessary), and statutory Five-Year Reviews and reporting. This RA Work Plan describes the activities, reporting requirements, and schedule for implementing the RA to ensure the remedial action objective (RAO) contained within the ROD for AOC E is met.

1.1 Background

Vieques Island is part of the Commonwealth of Puerto Rico and located approximately 7 miles southeast of the eastern tip of the main island of Puerto Rico (**Figure 1-1**). The Navy purchased large portions of Vieques in the early 1940s to conduct activities related to military training. Operations within the former NASD consisted mainly of ammunition loading and storage, vehicle and facility maintenance, and some training.

The Navy ceased facility-wide operations on the former NASD in April 2001, in accordance with the January 30, 2000, Presidential Directive to the Secretary of Defense associated with the transfer of lands of the Navy-owned western portion of Vieques. The land transfer was completed on May 1, 2001, and the Navy has had no military presence since. Currently, the Navy’s involvement at the former NASD comprises the ERP activities.

AOC E is the site of a former 500-gallon underground storage tank (UST) and former 500-gallon aboveground storage tank (AST) that stored used oil from vehicle maintenance activities. The site is less than a tenth of an acre located within the main operation area of the former NASD, which is now part of the Municipality of Vieques (MOV) Public Works facility (**Figure 1-2**). The UST was used from about 1970 until its removal and replacement in 1996 by the AST, which was subsequently removed in 2001. Leaks from the former UST resulted in localized petroleum related groundwater contamination.

AOC E is located on U.S. property that was transferred to the MOV as part of a Quitclaim Deed that transferred the former NASD property to the MOV, U.S. Department of Interior (DOI), and the Puerto Rico Conservation Trust. Access to AOC E is restricted from the public.

1.2 Environmental History

Previous removals, environmental investigations, and pilot studies conducted at AOC E, beginning in 1996 comprise:

- **UST Removal (1996)** – The 500-gallon UST that stored used oil from vehicle maintenance activities and 110 cubic yards of contaminated soil adjacent to the UST were removed (Reliable Mechanical, Inc., 1997). The UST was replaced with a 500-gallon AST.
- **Site Characterization (1998)** - Site characterization included the collection of eight subsurface soil samples and the installation and sampling of three monitoring wells (MW-01 through MW-03) (CH2M HILL, 1999).
- **Expanded Preliminary Assessment/Site Investigation (Expanded PA/SI) (2000)** –Assessed impacts to site groundwater from releases from the former UST, which included the installation and sampling of three monitoring wells (MW-04, MW-05, and MW-06) and the sampling of two existing monitoring wells (CH2M HILL, 2000).
- **AST Removal (2001)** - The 500-gallon AST which replaced the former 500-gallon UST in 1996 was removed when Navy operations ceased in 2001. There were no documented releases from the AST.
- **Initial RI Sampling Event (2002 and 2003)** – Based on the recommendations of the Expanded PA/SI, an initial RI sampling event was conducted in 2002 and 2003. The RI field work consisted of drilling seven borings from which 20 soil samples were collected to assist in characterizing the horizontal and vertical extent of soil contamination. In addition, two monitoring wells were installed (MW-07 and MW-08) and sampled, additional groundwater samples were collected from four existing monitoring wells, and in-situ hydraulic conductivity tests were performed (CH2M HILL, 2004).
- **Multiphase Extraction (MPE) Pilot Study (2002)** – A MPE pilot study was conducted to provide quantitative performance, cost, and design information to help evaluate the effectiveness of this technology in mitigating the free phase hydrocarbon product accumulation. The MPE system recovered groundwater/product at an average rate of approximately 0.2 gallons per minute (gpm) over the study period. A total of approximately 11,000 gallons of emulsified free product and groundwater were recovered (CH2M HILL, 2004).
- **Supplemental RI (2004 and 2005)** – Supplemental data were collected including a round of groundwater samples from all eight monitoring wells in 2004 and surface soil samples from seven locations, subsurface soil samples from four locations, and groundwater samples from six monitoring wells in 2005 (CH2M HILL, 2008a).
- **Pilot Study (2010 and 2011)** – A groundwater ISCO pilot study was conducted in 2010 and 2011, which included baseline COC sampling, two rounds of persulfate ISCO injection, three rounds of residual persulfate field measurements in MW-01, MW-03, MW-04 and MW-05, and two rounds of groundwater sampling in January and May 2011 from wells MW-01 and MW-05 (and one sample collected from well MW-04 in May 2011) for benzene and naphthalene analysis. In addition an unsaturated soil denitrification-based bioremediation (DBB) pilot study was conducted in 2010 and 2011, which included baseline sampling, injecting calcium nitrate, and collecting post-injection soil samples (CH2M HILL, 2008b; CH2M HILL, 2010a; and CH2M HILL, 2011).

Because of the presence of residual persulfate levels in groundwater, a Focused Feasibility Study was conducted to evaluate groundwater remedial alternatives at AOC E (CH2M HILL, 2012). In 2014, a ROD for AOC E was signed in which the Navy and EPA jointly selected the remedy for the site, with concurrence of PREQB (Navy, 2014).

1.3 Nature and Extent of Contamination

Six COCs were identified for AOC E groundwater: 1,2-dichloroethane (1,2-DCA), benzene, methyl tert butyl ether (MTBE), xylenes, 2-methylnaphthalene, and naphthalene. Groundwater contamination occurs within a localized area around three monitoring wells (MW-01, MW-04, and MW-05) (**Figure 1-3**). During the ISCO pilot study, concentrations of COCs measured declined to non-detect levels. However, elevated levels of persulfate persisted (**Table 1-1**).

1.4 Remedial Action Objective

The RAO developed for AOC E (Navy, 2014) is to:

- Prevent exposure to COCs in groundwater at concentrations above Remedial Goals (RGs).

1.5 Summary of Selected Remedy

The RA involves the implementation of periodic (at least annually) groundwater monitoring to ensure persulfate concentrations decline and annual groundwater monitoring of COCs for a period of 3 years after persulfate levels decline to ensure contaminant rebound does not occur, and ICs to restrict potable groundwater use until the RAO is met. Should residual persulfate levels not demonstrate an overall decline after three successive annual monitoring events, an ISCO injection using a hydrogen peroxide solution will be conducted to accelerate persulfate decline (Contingency Plan 1, CP-1). If COCs rebound above acceptable levels and unacceptable concentrations persist after three successive annual monitoring events, an ISCO injection using persulfate will be conducted for wells in which rebound is observed (Contingency Plan 2, CP-2).

1.6 Work Plan Organization

This RA Work Plan is organized as follows:

- Section 1 – Introduction
- Section 2 – Land Use Control Plan
- Section 3 – Groundwater Long-Term Monitoring
- Section 4 – Reporting Requirements
- Section 5 – Project Schedule
- Section 6 – References

Tables and figures are provided at the end of each section.

Table 1-1

AOC E Persulfate Concentrations

AOC E Remedial Action Workplan

Atlantic Fleet Weapons Training Area - Vieques, Former Naval Ammunition Support Detachment

Vieques, Puerto Rico

Well number	1/27/2011	5/18/2011	12/07-12/10/2011	5/24-5/27/2013
Concentration (mg/L)				
MW-1	5,000	4,200	504	0
MW-3	35,000	21,000	10,750	4,375
MW-4	15,000	21,000	4,200	700
MW-5	7,000	7,000	5,040	0

R:\USNAVFACENGCOM405450\VIEQUES\MAPFILES\AOC_E_REMEDIAL_ACTION_IMPLEMENTATION_WORK_PLAN\FIGURE 1-1 - REGIONAL LOCATION MAP.MXD CELEFTHERIADIS 5/12/2014 8:37:18 AM

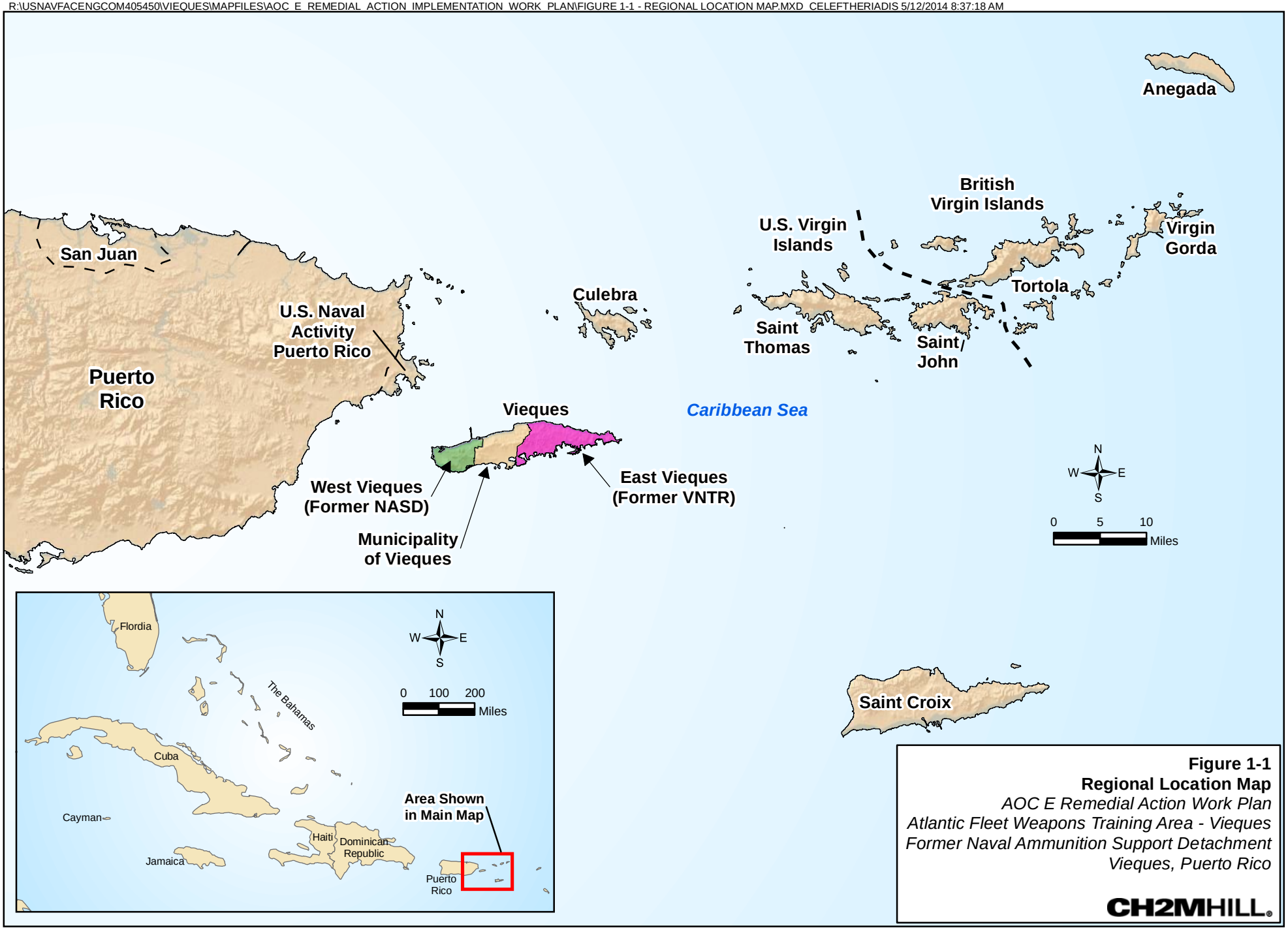

Figure 1-1
Regional Location Map
AOC E Remedial Action Work Plan
Atlantic Fleet Weapons Training Area - Vieques
Former Naval Ammunition Support Detachment
Vieques, Puerto Rico

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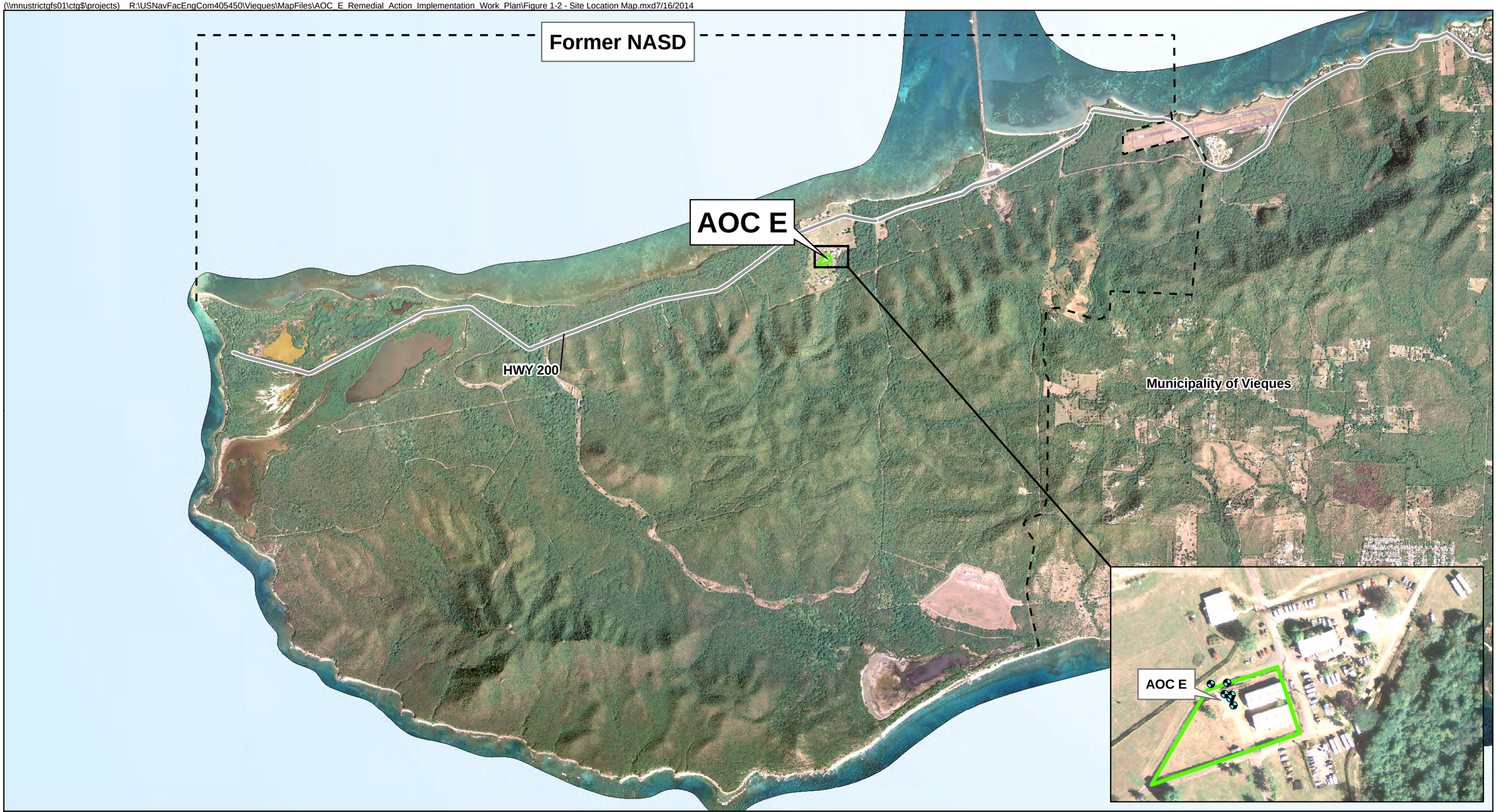
(\\mnustrictgfs01\ctg$\projects) R:\USNavFacEngCom405450\Vieques\MapFiles\AOC_E_Remedial_Action_Implementation_Work_Plan\Figure 1-2 - Site Location Map.mxd7/16/2014



Legend

- LTM Monitoring Well
- Road
- AOC E Land Use Control Boundary

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Figure 1-2
AOC E Site Location Map
AOC E Remedial Action Work Plan
Atlantic Fleet Weapons Training Area - Vieques
Former Naval Ammunition Support Detachment
Vieques, Puerto Rico

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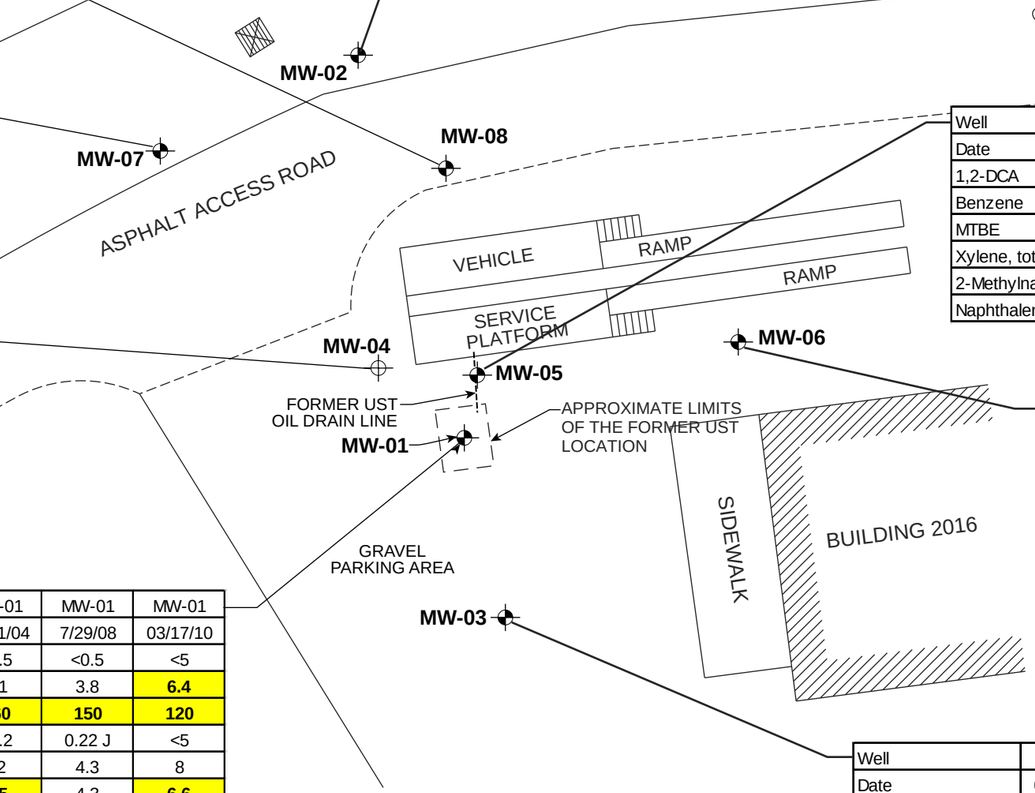
Well	MW-08	MW-08	MW-08
Date	09/08/03	08/26/04	7/27/08
1,2-DCA	<0.5	<0.5	<0.5
Benzene	<0.5	<0.5	<0.5
MTBE	<0.5	<0.5	<0.5
Xylene, total	<2	<2	<0.5
2-Methylnaphthalene	<5.2	<5.2	<0.098
Naphthalene	<5.2	<5.2	<0.098

Well	MW-02	MW-02	MW-02	MW-02	MW-02
Date	09/11/98	04/05/00	05/21/02	08/26/04	7/27/08
1,2-DCA	NA	<1	<1	<0.5	<0.5
Benzene	<5	<1	<1	<0.5	<0.5
MTBE	NA	NA	NA	<0.5	<0.5
Xylene, total	<15	<1	<1	<2	<0.5
2-Methylnaphthalene	NA	<5	<5.4	<5.3	<0.093
Naphthalene	NA	<5	<5.4	<5.3	<0.093

Well	MW-07	MW-07	MW-07
Date	05/24/02	08/26/04	7/27/08
1,2-DCA	<1	<0.5	<0.5
Benzene	<1	<0.5	<0.5
MTBE	NA	<0.5	<0.5
Xylene, total	<1	<2	<0.5
2-Methylnaphthalene	<5.8	<5	<0.11
Naphthalene	<5.8	<5	<0.11

Well	MW-05	MW-05	MW-05	MW-05	MW-05
Date	05/01/00	08/30/04	08/30/04	7/29/08	03/17/10
1,2-DCA	**32**	**7.2**	**6.4**	<0.5	<5
Benzene	**6**	0.81 J	1.2 J	**16**	4.5 J
MTBE	NA	**1,180**	**1,220**	**560**	**520**
Xylene, total	20	1 J	1.8 J	2.5	<5
2-Methylnaphthalene	14	<5.1	<5.2	16 J	5.8
Naphthalene	**15**	<5.1	<5.2	**35 J**	**13**

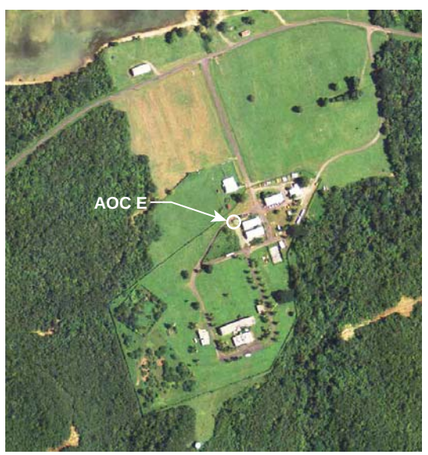
Well	MW-04	MW-04	MW-04	MW-04	MW-04
Date	04/27/00	05/21/02	08/30/04	7/28/08	03/17/10
1,2-DCA	<1	4.6	0.59	<0.5	<5
Benzene	2	0.72 J	0.21 J	<0.5	<5
MTBE	NA	NA	**234**	110	**130**
Xylene, total	0.9 J	<1	<2	<0.5	<5
2-Methylnaphthalene	<5	<5.4	<5.1	0.05 J	<1
Naphthalene	<5	<5.4	<5.1	<0.093	<1



Well	MW-06	MW-06	MW-06	MW-06
Date	04/27/00	05/20/02	08/25/04	7/28/08
1,2-DCA	<1	<1	<0.5	<0.5
Benzene	<1	<1	<0.5	<0.5
MTBE	NA	NA	<0.5	0.11 J
Xylene, total	<1	<1	<2	<0.5
2-Methylnaphthalene	<6	<5.4	<5.3	0.035 J
Naphthalene	<6	<5.4	<5.3	0.1

Well	MW-01	MW-01	MW-01	MW-01
Date	09/11/98	09/01/04	7/29/08	03/17/10
1,2-DCA	NA	<0.5	<0.5	<5
Benzene	**17**	4.1	3.8	**6.4**
MTBE	NA	**260**	**150**	**120**
Xylene, total	<15	26.2	0.22 J	<5
2-Methylnaphthalene	NA	12	4.3	8
Naphthalene	NA	**9.5**	4.3	**6.6**

Well	MW-03	MW-03	MW-03	MW-03	MW-03	MW-03
Date	09/11/98	04/05/00	05/21/02	08/25/04	7/27/08	03/16/10
1,2-DCA	NA	<1	<1	<0.5	<0.5	<5
Benzene	<5	<1	<1	<0.5	<0.5	<5
MTBE	NA	NA	NA	<0.5	<0.5	<5
Xylene, total	<15	<1	<1	<2	<0.5	<5
2-Methylnaphthalene	NA	<5	<5.6	<5.3	<0.095	<1
Naphthalene	NA	<5	<5.6	<5.3	<0.095	<1



2004 Aerial Photograph

COCs	PRG (ug/L)
1,2-DCA	3.8
Benzene	5
MTBE	120
Xylene, total	10,000
2-Methylnaphthalene	27
Naphthalene	6.1

Notes:
NA - Not analyzed
< - Non-detected results (below detection limit)
J - Estimated results
All concentrations in ug/L
Bolded and hihglighted results exceed PRGs
1,2-Dichloroethane - 1,2-DCA
Methyl-tert-butyl ether - MTBE

North 0 20 40 Scale in Feet

Figure 1-3
Groundwater COC Concentrations
(Prior to Pilot Study)
AOC E Remedial Action Work Plan
Atlantic Fleet Weapons Training Area - Vieques
Former Naval Ammunition Support Detachment
Vieques, Puerto Rico

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SECTION 2

Land Use Control Plan

The Land Use Control (LUC) plan satisfies the ROD requirement for LUCs and for implementation, operation, maintenance, and enforcement of the LUCs component of the RA. The Navy will be responsible for performing all short- and long-term implementation actions at AOC E as per *The Principles and Procedures for Specifying, Monitoring and Enforcement of Land Use Controls and Other Post-ROD Actions* (EPA, 2003), the Federal Facility Agreement (FFA), the ROD, and applicable Navy directives. Although the Navy may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, the Navy shall retain ultimate responsibility for remedy integrity and will continue to maintain responsibility for implementing, monitoring, and enforcing LUCs. Future land use at AOC E is anticipated to be vehicle maintenance activities by MOV.

2.1 Land Use Control Objective

LUCs will be implemented to prevent unauthorized and uncontrolled groundwater use within the LUC boundary at AOC E until the RAO is met. The LUC is a legal mechanism that restricts the use of or limits access to prevent or reduce risks to human health.

2.2 Implementation and Maintenance

Figure 2-1 illustrates the LUCs. Implementation and maintenance details are listed below.

- The LUC boundary encompassing AOC E, as shown in **Figure 2-1**, is identified in the April 30, 2001 Quitclaim deed between the Department of the Navy and the Municipality of Vieques. Potable use of groundwater within this boundary will be prevented until the RAO is met.
- Bi-lingual (Spanish and English) signs prohibiting trespassing will be installed along the fence, including on the gate, at the approximate locations shown in **Figure 2-1**. **Appendix A** contains a schematic drawing of the sign. The actual signs produced may vary slightly in terms of dimensions and format, but will convey the information shown in the schematic drawing.
- During each groundwater monitoring event, the fence (including gate and lock) along and within the LUC boundary, the associated signs, and the LTM wells will be inspected. Repairs/replacement will be made as necessary to ensure structural integrity. In addition, the area will be inspected for signs of trespassing. As needed, vegetation along and within the LUC boundary will be cut to facilitate sign/fence inspection and groundwater sampling. Additional inspections will be conducted if unusual events occur that may threaten the integrity of the LUCs (e.g., hurricanes). An inspection form (**Appendix B**) will be filled out during each inspection.
- The Navy shall notify EPA and PREQB as soon as practicable, but within 1 week, of the discovery of activity at AOC E inconsistent with the LUC objective stated above, and the corrective action that has or will be implemented, including the anticipated timeframe.
- The Navy shall certify during each monitoring event that the LUCs remain properly implemented and any deficiencies or inconsistent uses have been addressed. The LUCs shall be maintained until the RAO is met. The Navy shall not modify or terminate LUCs, implement actions, or modify land use without approval from both EPA and PREQB. The Navy shall seek prior concurrence before any anticipated action that may disrupt the effectiveness of the LUCs or any action that may alter or negate the needs of LUCs.

(\\mnustrictgfs01\ctg$\projects) R:\USNavFacEngCom405450\Vieques\MapFiles\AOC_E_Remedial_Action_Implementation_Work_Plan\Figure 2-1 - Conceptual Plan for LUC ImplementationV2.mxd7/9/2014

Legend
- Sign
- LTM Monitoring Well
- Fence
- AOC E Land Use Control Boundary

N
W E
S

0 25 50
Feet

Figure 2-1
Conceptual Plan for Land Use Controls
AOC E Remedial Action Work Plan
Atlantic Fleet Weapons Training Area - Vieques
Former Naval Ammunition Support Detachment
Vieques, Puerto Rico

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SECTION 3

Groundwater Long-Term Monitoring

This section describes the groundwater LTM approach, performance criteria, contingency plans to address residual persulfate and COC rebound, and LTM well abandonment once the RAO is met. The overall decision process for groundwater LTM and implementation of the contingency plans (if necessary) at AOC E is shown in **Figure 3-1**.

3.1 LTM Approach and Contingency Plans

Groundwater LTM will be conducted in accordance with the AOC E LTM Sampling and Analysis Plan (SAP), provided in **Appendix C**. The monitoring well network consists of the following six monitoring wells (**Figure 2-1** and **Table 3-1**):

- Upgradient Area – MW-03 - to monitor potential non-site-related contamination; historically has not contained contamination.
- Contamination Area – MW-01, MW-04, and MW-05 - located at or immediately downgradient of the former UST; each monitoring well historically contained contamination.
- Downgradient Area –MW-07 and MW-08 - will act as sentinel monitoring wells; historically have not contained contamination.

The initial monitoring will be field measurements of persulfate concentrations in the six monitoring wells. If persulfate concentrations in groundwater samples are non-detect or, with concurrence by the Vieques Technical Subcommittee, close to non-detect, the groundwater samples will be collected for laboratory analysis of the COCs (MTBE, benzene, 1,2-DCA, total xylenes, naphthalene, and 2-methylnaphthalene).

If persulfate concentrations in groundwater samples are sufficiently above non-detect (based on concurrence by the Vieques Technical Subcommittee) in at least one well for 3 consecutive years, then CP-1 is implemented, in which hydrogen peroxide will be injected to stimulate persulfate degradation and persulfate monitoring will continue the following year. If LTM data from 3 consecutive groundwater sampling events indicate there is an exceedance(s) of a RG, (as shown in **Table 3-2**), then CP-2 is implemented, which includes injection of hydrogen peroxide activated sodium persulfate to stimulate COC degradation. Since the specific configuration and mixture ratios of chemicals to be injected is dependent on the observed site conditions, if either of the contingency plans is necessary, an RA Work Plan Addendum will be prepared for regulatory review to provide the details of the solution(s) to be injected, including location(s) and schedule, as well as any modifications to the subsequent monitoring protocol.

Once LTM data from 3 consecutive groundwater sampling events indicate COC concentrations in groundwater are below RGs in all wells, then the RAO will have been achieved. At that time, an Interim Remedial Action Completion Report (IRACR) will be prepared and the land use controls will be terminated.

Figure 3-2 shows an example timeline for the LTM and contingency plans. It is noted that the schematic is only an example to help visualize the process; the actual timeline may differ from what is shown in Figure 3-2.

3.2 Monitoring Well Abandonment

Once the RAO has been met, the monitoring wells at AOC E will be abandoned in accordance with Standard Operating Procedure (SOP) D-3 from the Vieques Master Standard Operating Procedures, Protocols, and Plans (CH2M HILL, 2010b). In general, each monitoring well flush mounted protective cover and ground surface seal would be removed and the monitoring well riser will be cut off approximately 30 inches below the ground surface and each monitoring well will be filled with bentonite-cement grout.

TABLE 3-1

Well Completion Details

AOC E Remedial Action Work Plan

Atlantic Fleet Weapons Training Area - Vieques, Former Naval Ammunition Support Detachmen

Vieques, Puerto Rico

Well ID	Date Installed	Elevation at Measuring Point (ft msl)	Well Depth (ft bgs)	Bottom of Screen (elev)	Screen Interval Elevation (ft amsl)	Depth to Bentonite (ft bgs)	Depth to Sand Pack (ft bgs)	Northing UTM NAD 83 (Meters)	Easting UTM NAD 83 (Meters)
MW-01	08/17/1998	43.93	50	-6.07	3.93 to (-6.07)	36	38	232797.52	2005684.767
MW-03	08/20/1998	44.06	50	-5.94	4.06 to (-5.94)	35	37	232799.796	2005679.684
MW-04	04/17/2000	43.6	51	-6.4	3.60 to (-6.40)	36	38	232793.297	2005687.006
MW-05	04/17/2000	44.32	50	-5.68	4.32 to (-5.68)	36	38	232798.483	2005687.31
MW-07	05/21/2002	43.41	50	-6.59	3.41 to (-6.59)	37	38	232778	2005704
MW-08	05/28/2002	43.04	50	-6.96	3.04 to (-6.96)	37	38	232792	2005698

TABLE 3-2

Remedial Goals for AOC E

AOC E Remedial Action Work Plan

Atlantic Fleet Weapons Training Area - Vieques, Former Naval Ammunition Support Detachment

Vieques, Puerto Rico

Chemicals of Concern	Remedial Goal	Basis
Benzene	5 µg/L	MCL
1,2-Dichloroethane	3.8 µg/L	PRWQS for Groundwater (SG); an ARAR that is lower than the MCL of 5 µg/L
2-Methylnaphthalene	27 µg/L	HI of 1; not a potential carcinogen
MTBE	120 µg/L	ELCR of $1X10^{-5}$ and HI of 0.02 (EPA, 2013)
Naphthalene	6.1 µg/L	HI of 1 and ELCR of $4X10^{-5}$ (EPA, 2013)
Total xylenes	10,000 µg/L	MCL

Notes:

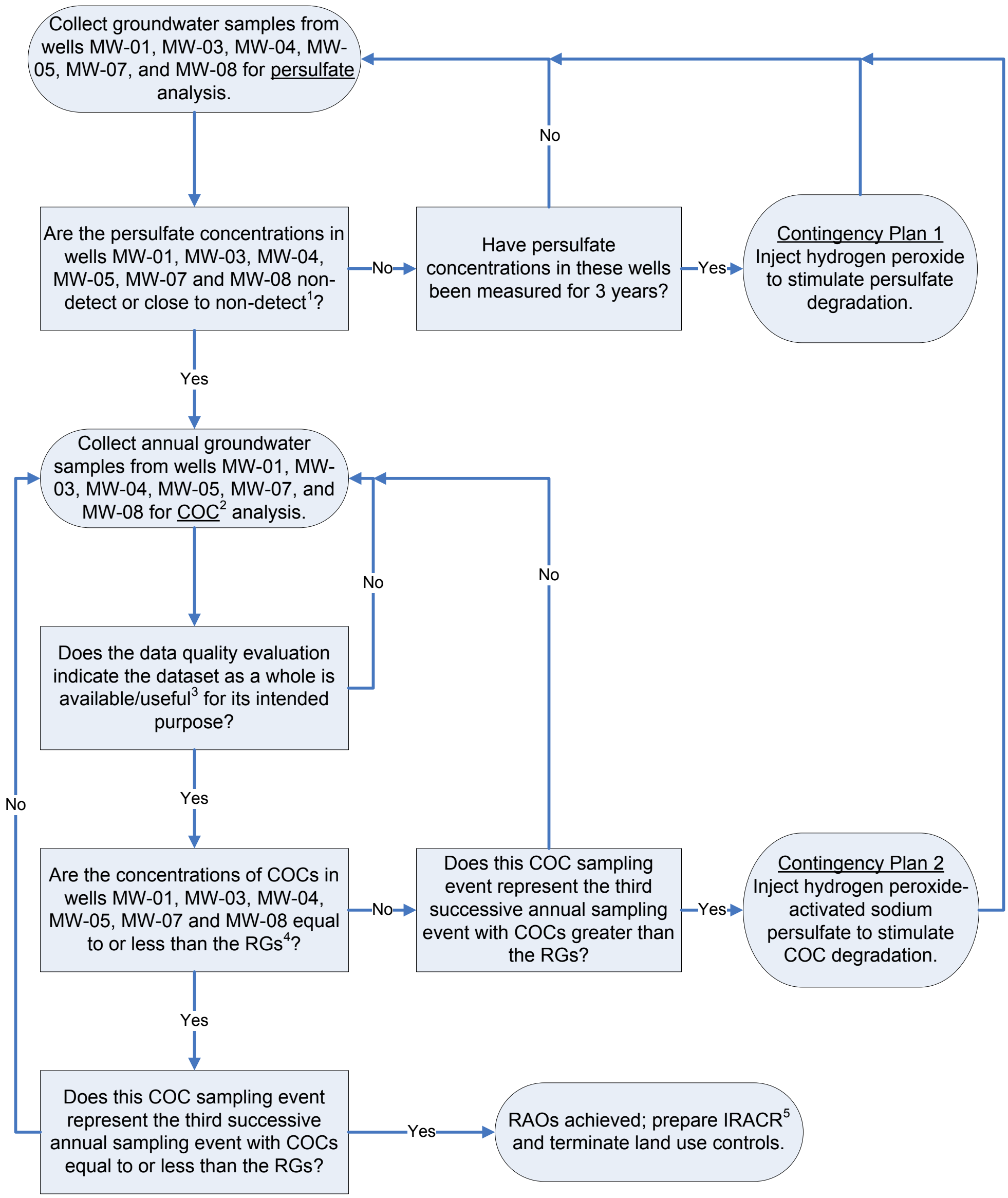
ELCR - excess lifetime cancer risk

HI - hazard index

MCL – Federal Maximum Contaminant Level (EPA, 2009)

PRWQS – Puerto Rico Water Quality Standards (March 2010; for groundwater – class SG)

RSL – EPA Regional Screening Level (EPA, 2013) for tap water; lowest of the cancer-based and non-cancer based levels (based on ELCR of 1x10-6 and HI of 1).



Notes:

The decision makers associated with this decision tree are the Navy, EPA, and PREQB (Vieques Technical Subcommittee).

[1] "Close to non-detect" is a subjective concentration determination that will be based on concurrence by the Vieques Technical Subcommittee

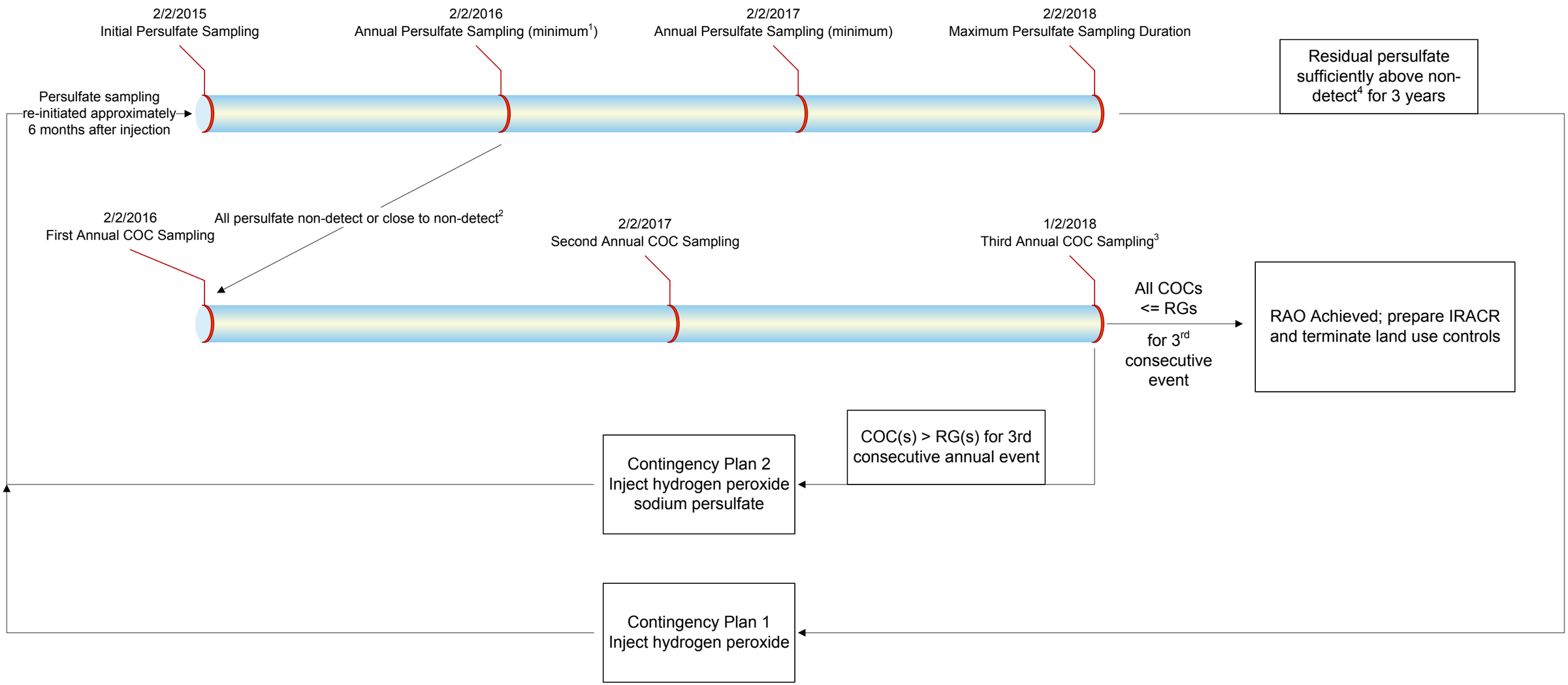
[2] Contaminants of Concern (COCs): 1,2-dichloroethane (1,2-DCA); benzene; methyl tert-butyl ether (MTBE); 2-methylnaphthalene; naphthalene; xylenes (total)

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

[4] Remediation Goals (RGs): 1,2-DCA (3.8 μg/L); benzene (5 μg/L); MTBE (120 μg/L); 2-methylnaphthalene (27 μg/L); naphthalene (6.1 μg/L); total xylenes (10,000 μg/L)

[5] IRACR = Interim Remedial Action Completion Report

Figure 3-1
Long-term Monitoring Decision Tree
AOC E Remedial Action Work Plan
Atlantic Fleet Weapons Training Area – Vieques
Former Naval Ammunition Support Detachment
Vieques, Puerto Rico



Notes:

The dates shown in the figure are for duration/frequency demonstration purposes only and may differ, as described in the footnotes below.

[1] Persulfate monitoring must be conducted as least annually, but may be conducted more frequently.

[2] First annual COC monitoring takes place whenever all persulfate concentrations are non-detect or close to non-detect[4], which may occur anytime on or after the initial persulfate sampling event.

[3] Annual COC monitoring continues until: (a) three consecutive events where all COCs are less than or equal to the RGs (RAO achieved) or (b) three consecutive events where one or more COCs are above the RGs (Contingency Plan 2 triggered).

[4] "Sufficiently above non-detect" and "close to non-detect" are subjective concentration determinations that will be based on concurrence by the Vieques Technical Subcommittee.

Figure 3-2
Example Remedial Action Timeline
AOC E Remedial Action Work Plan
Atlantic Fleet Weapons Training Area – Vieques
Former Naval Ammunition Support Detachment
Vieques, Puerto Rico

SECTION 4

Reporting

4.1 Interim Remedial Action Completion Report

Following the achievement of the RAO, an IRACR will be prepared to summarize the activities and results in general accordance with the applicable guidance documents:

- *Joint Guidance on Streamlined Site Closeout and NPL Deletion Process for DoD Facilities, August 2006* (DOD and EPA, 2006);
- *Guidance to Documenting Milestones Through the Site Closeout Process, March 2006* (Navy, 2006);
- *Close Out Procedures for National Priorities List Sites, Office of Superfund Remediation and Technology Innovation 9320.2-22, EPA, May, 2011* (EPA, 2011).

The report will document that the RAO has been achieved and provide the details of how it was achieved (i.e., LTM, contingency plans, if necessary, and LUCs).

4.2 Annual Implementation and Maintenance Inspection Logs and Status Report

Inspection checklists will be completed for each inspection and included in an annual RA Status Report. Each report will detail the inspection and monitoring activities that took place during the year (including any corrective actions taken), as well as a cumulative summary of the analytical results of groundwater monitoring.

4.3 Five-Year Review Report

The first Vieques statutory Five-Year Review period is anticipated to be initiated and completed in 2018, 5 years from the initiation of the SWMU 1 RA, which began in August 2013. The Five-Year Review report will generally follow the template included in the Appendix E of *Comprehensive Five-Year Review Guide (EPA 540-R-01-007)* (EPA, 2001 or most recent guidance, as applicable) unless an alternate format is concurred upon by the Navy and regulatory agencies. The Five-Year Review process consists of the following:

4.3.1 Technical Document Reviews

The Five-Year Review includes a review of site-specific documentation. At a minimum, the ROD is reviewed to familiarize the Five-Year Review personnel with the COCs, RAO, the selected remedy, RGs, and applicable or relevant and appropriate requirements (ARARs) the performance evaluation and protectiveness determination.

4.3.2 Site Inspection and Groundwater Data Reviews

Groundwater data, site inspections and any associated maintenance of fences, signage, and wells during the five-year review period will be reviewed and summarized in the Five Year Review Report.

4.3.3 Performance Evaluation and Protectiveness Determination

Groundwater data collected during the five-year period will be compared to the applicable performance criteria (i.e., persulfate detection level, RGs, as applicable). Additionally, a determination will be made of the protectiveness of the groundwater remedy and associated LUCs for human health, and this information provided in the Five-Year Review Report. Specifically, the conclusions of the Five-Year Review will include:

- Identification of issues, as applicable
- Evaluation (and potential recommendations) associated with the monitoring frequency

- Evaluation (and potential recommendations) associated with the suite of analyses
- Recommendations for modifications, as applicable
- A protectiveness statement

4.3.4 Community Involvement Activities

Community involvement and notifications specific to the AOC E remedial action will include:

- Notification to the Restoration Advisory Board (RAB) that the Five-Year Review process will be initiated and solicitation for any information or concerns from RAB members about the protectiveness of the remedy as part of the data gathering process.
- Notification to the RAB that the Five-Year Review process has been completed.
- Briefing to the RAB on the results of the Five-Year Review.
- Inclusion of the 5-Year Review report in the Administrative Record on the NAVFAC public website for the former Vieques Naval Installation (http://www.navfac.navy.mil/vieques).
- Inclusion of the Five-Year Review conclusions in informational fliers that distributed on Vieques and to the Vieques mailing list.

SECTION 5

Project Schedule

The general schedule for completing the RA activities outlined in this RA Work Plan is provided below. Each year, the RA schedule will be updated, as necessary, and documented in the fiscal year Site Management Plan schedule update, which will provide the specific month(s) of the year when the activities below will be performed.

- Initial persulfate monitoring: Within 3 months of ROD signature
- Subsequent persulfate monitoring: No less frequently than annually following initial persulfate monitoring unless and until persulfate concentrations in all wells are non-detect or, by concurrence of the Vieques Technical Subcommittee, close to non-detect
- Initial COC monitoring: During the monitoring event when persulfate concentrations in all wells are non-detect or, by concurrence of the Vieques Technical Subcommittee, close to non-detect
- Subsequent COC monitoring: Annually until COC concentrations in all wells are less than or equal to the RGs for three successive annual events
- Draft RA Work Plan Addendum (if necessary): Within 4 months of the following triggers:
  - Measured persulfate concentration(s) sufficiently above non-detect (based on concurrence by the Vieques Technical Subcommittee) for 3 years

    or
  - Measured COC concentration(s) above RG(s) for three successive annual monitoring events
- Final Five-Year Review Report: August 2018.

SECTION 6

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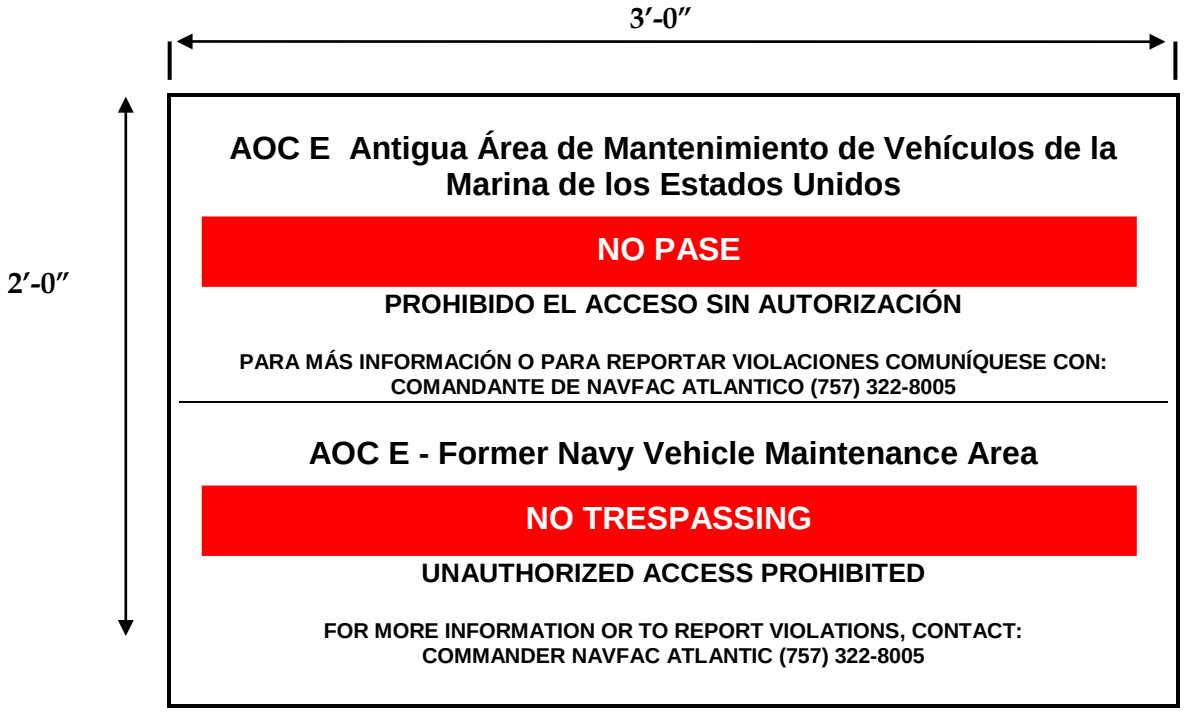
Appendix A
AOC E Land Use Control Sign Schematic Drawing

Land Use Control Sign Schematic Drawing

(size and format may vary)



Appendix B
AOC E Land Use Control Inspection Form

AOC E Land Use Control Inspection Form

DATE: _____ **WEATHER CONDITIONS:** _____ **INSPECTOR'S NAME:** _____

Item	Potential Problems	Observations	Acceptable ?		Recommended Remedial Action	Date of Completion
			Yes	No		
Signs, Fencing, and Gate	Deterioration of signs, fence, or gate; Personnel unable to read sign due to obstruction; Observed signs of trespassing (noting the location); lock damaged or missing, etc.					
Vegetation	Growth on fence, damaging fence, obscuring signage. Vegetation hiding wells.					
Well integrity	Flush mount seal leaking/missing. Flush mount bolts stripped/missing/holes broken. Expanding plug/lock missing/dammaged. Well obstructed. Flush mount obscured by dirt.					
Other Observations (including potential groundwater use)						

ADDITIONAL COMMENTS:

Appendix C
Area of Concern E
Remedial Action Groundwater Long-Term Monitoring Sampling and Analysis Plan

Final

Area of Concern E
Remedial Action Groundwater Long-Term Monitoring Sampling and Analysis Plan

Atlantic Fleet Weapons Training Area – Vieques
Former Naval Ammunition Support Detachment
Vieques, Puerto Rico

Contract Task Order 013

January 2015

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Atlantic Division

Under the

NAVFAC CLEAN 8012 Program
Contract N62470-11-D-8012

Prepared by

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Attachments

A Persulfate Test Kit Instructions
B Laboratory DoD ELAP Accreditation Letter

Acronyms and Abbreviations

AA	absorbic acid
AFWTA	Atlantic Fleet Weapons Training Area
AHA	activity hazard analysis
AM	Activity Manager
AOC	Area of Concern
AQM	Activity Quality Manager
AST	aboveground storage tanks
bgs	below ground surface
°C	degrees Celsius
CA	corrective action
CAS	Chemical Abstract Services
CCC	Calibration Check Compound
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Class SG	Groundwater as defined in the Puerto Rico Water Quality Standards
CLEAN	Comprehensive Long-term Environmental Action—Navy
COC	contaminant of concern
COD	coefficient of determination
CSM	Conceptual Site Model
CTO	Contract Task Order
DBB	denitrification-based bioremediation
DDT	dichlorodiphenyltrichloroethane
1,2-DCE	1,2-dichloroethane
DL	Detection Limit
DO	dissolved oxygen
DoD	United States Department of Defense
DOI	Department of the Interior
DQE	data quality evaluation
DQI	data quality indicator
DQO	data quality objective
DV	data validator
EB	equipment blank
e.g.	(exempli gratia) for example
EICP	extracted ion current profile
ELAP	Environmental Laboratory Accreditation Program
ELCR	excess lifetime cancer risk
EM	Environmental Manager
EPA	Environmental Protection Agency
EQB	Environmental Quality Board
ERP	Environmental Restoration Program
etc.	(et cetera)
FRC	Federal Records Center
ft	feet/foot
FTL	Field Team Leader

GC	gas chromatography
GC-MS	gas chromatography – mass spectrometry
gpm	gallons per minute
GW	groundwater
H&S	Health and Safety
HASP	Health and Safety Plan
HCl	hydrogen chloride
HHRA	Human Health Risk Assessment
HI	Hazard Index
ICAL	initial calibration
ICV	second source calibration verification
ID	identification
IDW	investigation-derived waste
i.e.	(id est) meaning “that is”
IR	Installation Restoration
IRACR	Interim Remedial Action Completion Report
IS	Internal Standards
ISCO	in-situ chemical oxidation
L	liter(s)
LCL	lower control limit
LCS	laboratory control sample
LIMS	Laboratory Information Management System
LOD	Limit of Detection
LOQ	Limit of Quantitation
LTM	Long-term Monitoring
µg/L	microgram(s) per liter
MCL	maximum contaminant level
MD	Maryland
mg/L	milligram(s) per liter
ml	milliliter(s)
MOV	Municipality of Vieques
MPC	Measurement Performance Criteria
MPE	Multiphase Extraction
MRP	Munitions Response Program
MS	matrix spike
MSD	matrix spike duplicate
MSOPPs	Master Standard Operating Procedures, Protocols, and Plans
MTBE	Methyl-tert-butyl ether
mV	millivolt(s)
MW	monitoring well
N/A	not applicable
NASD	Naval Ammunition Support Detachment
NAVFAC	Naval Facilities Engineering Command
Navy	Department of the Navy
NIRIS	Navy Installation Restoration Information System
NPL	National Priorities List
NTU	Nephelometric Turbidity Units
NY	New York

ORP	oxidation-reduction potential
OU	operable unit
PA	Preliminary Assessment
PAH	polycyclic aromatic hydrocarbon
PAL	project action limit
PC	Project Chemist
pdf	portable document format
PDM	Project Data Manager
pH	measure of acidity and alkalinity of a solution
PM	Project Manager
POC	Point of Contact
PPE	personal protective equipment
PQO	Project Quality Objectives
PREQB	Puerto Rico Environmental Quality Board
PRWQS	Puerto Rico Water Quality Standards
PT	Performance Testing
PTSP	Pre-Task Safety Plan
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
RAO	Remedial Action Objective
RF	response factor
RI	Remedial Investigation
RL	reporting limit
ROD	Record of Decision
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
SBO	Safe Behavior Observation
SI	Site Inspection
SIM	Selected Ion Monitoring
SOP	Standard Operating Procedure
SPCC	System Performance Check Compound
SSC	Site Safety Coordinator
STAC	Safety Task Analysis Card
SVOC	semivolatile organic compound
SWO	Safe Work Observation
TAT	turnaround time
TB	trip blank

TBD	to be determined
TRC	TRC Engineering Services, Inc.
U.S.	United States
UCL	upper confidence limit
UFP	Uniform Federal Policy
UST	Underground storage tanks
VNTR	Vieques Naval Training Range
VOA	volatile organic analysis
VOC	volatile organic compound
WCHEM	wet chemistry
YSI	Yellow Springs Instruments, Inc.

SAP Worksheet #1—Title and Approval Page

Final

Area of Concern E
Remedial Action Groundwater Long-Term Monitoring
Sampling and Analysis Plan

Atlantic Fleet Weapons Training Area – Vieques
Former Naval Ammunition Support Detachment
Vieques, Puerto Rico

January 2015

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

Prepared by:

CH2MHILL

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Prepared under:
Navy CLEAN 8012 Program
Contract N62470-11-D-8012
Contract Task Order – 013

QA Review Signature:

G. Brett Doerr Digitally signed by G. Brett Doerr DN: cn=G. Brett Doerr, o=CH2M HILL, ou, email=brett.doerr@ch2m.com, c=US Date: 2015.01.27 15:30:48 -05'00'

Brett Doerr
Activity Manager

Other Approval Signatures:

for

Kevin Cloe
NAVFAC – Remedial Project Manager

Denise Zeno
EPA Region 2 – Remedial Project Manager

Wilmarie Rivera
PREQB – Remedial Project Manager

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SAP Worksheet #2—Identifying Information

Site Name/Number: Area of Concern (AOC) E at the former Atlantic Fleet Weapons Training Area (AFWTA), Naval Ammunition Support Detachment (NASD), Vieques, Puerto Rico
Operable Unit (OU):
Contractor Name: CH2M HILL
Contract Number: N62470-08-D-1000
Contract Title: Navy Comprehensive Long-term Environmental Action— Navy (CLEAN) Program 1000
Work Assignment Number (optional): Contract Task Order (CTO) 083

1. **Sampling and Analysis Plan (SAP) Requirements:** This SAP was prepared in general accordance with the requirements of the Uniform Federal Policy (UFP) for Quality Assurance Project Plans (QAPPs) (Intergovernmental Data Quality Task Force, 2005) and United States (U.S.) Environmental Protection Agency (EPA) for QAPPs, EPA Quality Assurance (QA)/G-5, Quality Assurance Management Section (QAMS) (EPA, 2002).

2. **Regulatory program:** Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

3. **Type of SAP:** This SAP is a project-specific SAP for the Long-term Monitoring (LTM) of groundwater associated with the Remedial Action at AOC E.

4. **Dates of scoping sessions:**

Title	Date
Environmental Restoration Program (ERP)/Munitions Response Program (MRP) Subcommittee Meeting – Vieques Superfund Site	January 14-22, 2014

5. **Dates and titles of any SAP documents written for previous site work that are relevant to the current investigation:**

Title	Date
Record of Decision, Area of Concern E	September 2014
Focused Feasibility Study Report Area of Concern (AOC) E	November 2012
Master Standard Operating Procedures, Protocols, and Plans (MSOPPPs)	April 2010
In-Situ Remediation Pilot Studies (AOC E and AOC I Sites) Sampling and Analysis Plan	February 2010

SAP Worksheet #2—Identifying Information (continued)

6. Organizational partners (stakeholders) and connection with lead organization:

- EPA Region 2 – Federal regulatory stakeholder overseeing CERCLA Vieques ERP implemented by lead organization.
- Puerto Rico Environmental Quality Board (PREQB) – Commonwealth regulatory stakeholder overseeing CERCLA Vieques ERP implemented by lead organization.

7. Lead organization (see Worksheet #7 for detailed list of data users):

- U.S. Department of the Navy (Navy).

8. **Applicable SAP elements:** All required UFP-SAP elements are included in this UFP-SAP; therefore a crosswalk table is not necessary for this project.

SAP Worksheet #3—Distribution List

Name of SAP Recipients	Title/Project Role	Organization	Telephone Number (Optional)	E-mail Address or Mailing Address	D	DF	F
Kevin Cloe (or current personnel)	Vieques Remedial Project Manager (RPM)/Lead Agency Point of Contact (POC)	Navy	757-322-4736	kevin.cloe@navy.mil	A	CL	A
Daniel Hood (or current personnel)	Vieques RPM/No project-specific role	Navy	757-322-4630	daniel.r.hood@navy.mil	CL		CL
Madeline Rivera (or current personnel)	Vieques ERP Site Manager /On-island coordination	Navy	757-286-6457 (cell)	llamasmad@gmail.com	A		A
Julio Vazquez (or current personnel)	Vieques RPM/ Regulatory agency POC	EPA	212-637-4323	vazquez.julio@epa.gov	A		A
Jose Font (or current personnel)	Caribbean Environmental Protection Acting Division Director	EPA	787-977-5814	soderberg.carl@epa.gov	CL		CL
Sergio Lopez (or current personnel)	Quality control (QC) Specialist/Technical input and draft document review	EPA	732-321-6778	lopez.sergio@epa.gov	A		A
Michael Sivak (or current personnel)	Human Health Risk Assessment (HHRA) Lead/Technical input and draft document review	EPA	212-637-4310	sivak.michael@epa.gov	A		A
Diana Cutt (or current personnel)	Geology/Hydrogeology Lead/Technical input and draft document review	EPA	212-637-4311	cutt.diana@epa.gov	A		A
Laura Velez-Velez (or current personnel)	President/No project-specific role	PREQB	787-767-8056	lauravalez@jca.gobierno.pr	CL		CL
Wilmarie Rivera (or current personnel)	Vieques RPM/ Regulatory agency POC	PREQB	787-767-8181 (x6141) (work) 787-365-8573 (cell)	wilmarierivera@jca.gobierno.pr	A		A
Katarina Rutkowski (or current personnel)	Technical Support Consultant for Puerto Rico Environmental Quality Board (PREQB)/PREQB contractor primary POC	TRC Engineering Services, Inc. (TRC)	860-305-4339 (cell)	krutkowski@trcsolutions.com	A		E
Elizabeth Denly (or current personnel)	Senior QA Chemist	TRC	978-656-3577	edenly@trcsolutions.com	HC		

SAP Worksheet #3—Distribution List (continued)

Name of SAP Recipients	Title/Project Role	Organization	Telephone Number (Optional)	E-mail Address or Mailing Address	D	DF	F
Angela Carpenter (or current personnel)	Specials Projects Branch	EPA	212-637-4435	Carpenter.angela@epa.gov	CL		CL
Brett Doerr (or current personnel)	Contractor Activity Manager)/Program Quality Assurance Officer (QAO) - Navy contractor primary POC	CH2M HILL	757-671-6219	brett.doerr@ch2m.com	A		A
Barrie Selcoe (or current personnel)	Project Human Health Risk Assessor	CH2MHILL	281-721-8527	Barrie.selcoe@ch2m.com			E
John Swenfurth (or current personnel)	Project Manager (PM)	CH2M HILL	813-281-7762	John.Swenfurth@ch2m.com	A		A
To be determined (TBD)	Field Team Lead	CH2M HILL	TBD	TBD			A
Bill Hannah (or current personnel)	Senior Technical Consultant	CH2M HILL	757-671-6277	bill.hannah@ch2m.com	A		CD
Mike Zamboni (or current personnel)	Project Chemist (PC)	CH2M HILL	703-376-5301	Mike.zamboni@ch2m.com			CD
Bhavana Reddy (or current personnel)	Navy Installation Restoration Information System (NIRIS) Data Specialist	CH2M HILL	703-462-3784	bhavana.reddy@ch2m.com			CD
Colleen McNamara (or current personnel)	Not Applicable (N/A)	Restoration Advisory Board (RAB)	787-380-2545	lacolina@hughes.com		A	
Stacie D. Notine (or current personnel)	N/A	RAB	N/A	N/A		HC	
Jorge Fernandez Porto (or current personnel)	N/A	RAB	787-726-2839	jfporto@onelinkpr.net		CD	
Lirio Marquez D'Acunti (or current personnel)	N/A	RAB	787-726-2839	liriomarquez@gmail.com		n/a	

A = All DF = Draft Final CL = Cover Letter F = Final CD = Compact Disc HC = Hard Copy D = Draft E = Electronic (e.g., e-mail, website)

SAP Worksheet #4—Project Personnel Sign-Off Sheet

Name	Organization-Title-Role	Telephone Number	Signature/email receipt	Date SAP Read	SAP Section Reviewed
John Swenfurth (or current personnel)	CH2M HILL – PM	813-281-7762			
Barrie Selcoe (or current personnel)	CH2M HILL - Senior Human Health Risk Assessor	281-721-8527			
Brett Doerr (or current personnel)	CH2M HILL – AM/Activity Quality Manager (AQM)	757-671-6219			
Bill Hannah (or current personnel)	CH2M HILL – Senior Technical Consultant	757-671-6277			
Anita Dodson (or current personnel)	CH2M HILL – Program Chemist	757-671-6218			
Mike Zamboni (or current personnel)	CH2M HILL – Project Chemist (PC)	703-376-5301			
TBD	CH2M HILL – Field Team Lead	TBD			
Carl Woods (or current personnel)	CH2M HILL – Navy CLEAN Regional Health and Safety (H&S) Manager	513-889-5771			
Bhavana Reddy (or current personnel)	CH2M HILL – Navy Installation Restoration Information System (NIRIS) Data Specialist	703-462-3784			
Jennifer Obrin (or current personnel)	Katahdin Laboratories – PM	207-874-2400 X 17			
Laura Maschoff (or current personnel)	DataQual - data validator (DV)	314-330-1327			

Signed versions of Worksheet #4 will be kept on file at CH2M HILL along with other project documents.

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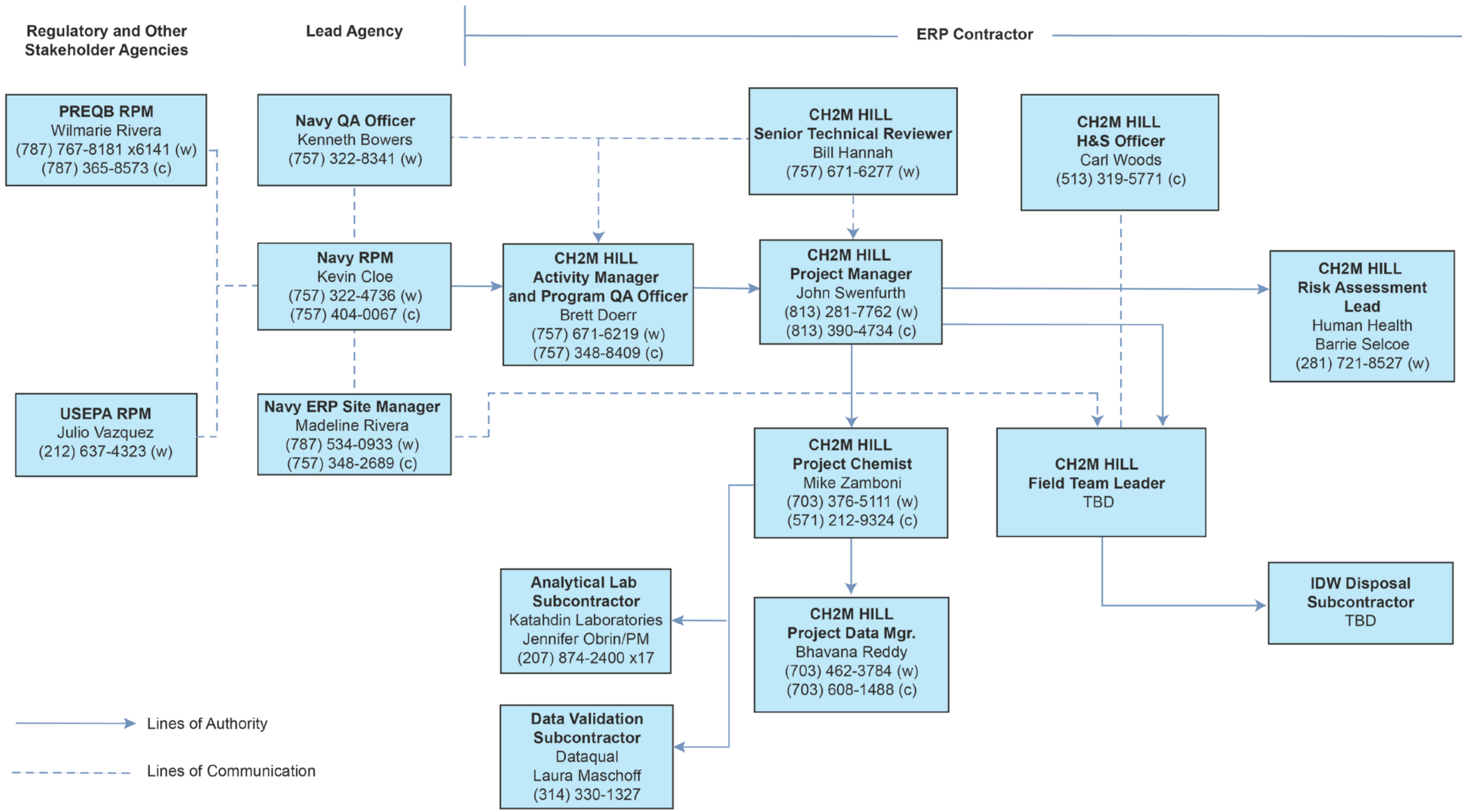
SAP Worksheet #5—Project Organizational Chart (note that staff within organizational chart may change over time)



Worksheet #5
AOC E Groundwater LTM Sampling and Analysis Plan
Atlantic Fleet Weapons Training Area - Vieques
Former Naval Ammunition Support Detachment
Vieques, Puerto Rico

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SAP Worksheet #6—Communication Pathways

Communication Drivers	Responsible Affiliation	Name	Phone Number	Procedure
Communication to/from Navy (e.g., submission of SAP for review; receipt of regulatory comments, etc.)	Navy RPM	Kevin Cloe (or current personnel)	757-322-4736	Primary POC for Navy (via e-mail, telephone, hardcopy, or in-person, as warranted); can delegate communication to other internal or external POCs. Stop work notices to regulators, notifying regulators of significant SAP changes or deviations (i.e., prevent meeting SAP objectives) and corrective actions by phone or e-mail within 2 weeks of notification of Navy RPM.
Communication to/from EPA (e.g., receipt of SAP for review; submission of EPA comments)	EPA RPM	Julio Vazquez (or current personnel)	212-637-4323	Primary POC for EPA (via e-mail, telephone, hardcopy, or in-person, as warranted); can delegate communication to other internal or external POCs.
Communication to/from Navy	Navy - ERP Site Manager	Madeline Rivera (or current personnel)	757-348-2689 (cell)	On-Island POC for Navy (via e-mail, telephone, hardcopy, or in-person, as warranted); can delegate communication to other internal or external POCs.
Communication to/from PREQB (e.g., receipt of SAP for review; submission of PREQB comments)	PREQB RPM	Wilmarie Rivera (or current personnel)	787-767-8181 (x6141)	Primary POC for PREQB (via e-mail, telephone, hardcopy, or in-person, as warranted); can delegate communication to other internal or external POCs.
Navy QA/QC input	Navy QAO	Kenneth Bowers (or current personnel)	757-322-8341	Provides review comments to Navy contractor on pre-draft SAP via e-mail through Kevin Cloe. Provides overall Navy guidance via direct communication with Navy contractor QAO, as warranted.
Communication to/from Navy contractor (e.g., submission of SAP for review; receipt of regulatory comments, updates on project progress, communication of stakeholder expectations, etc.)	CH2M HILL AM/AQM	Brett Doerr (or current personnel)	757-671-6219	Primary POC for Navy contractor (via e-mail, telephone, hardcopy, or in-person, as warranted); can delegate communication to other contractor staff, as appropriate. Stop work notices to Navy RPM, notifying Navy RPM of significant SAP changes or deviations (i.e., prevent meeting SAP objectives) and corrective actions.
Project administration and logistics	CH2M HILL PM	John Swenfurth (or current personnel)	813-281-7762	Direct communication (via e-mail, telephone, hardcopy, or in-person, as warranted) to/from Navy contractor project staff to ensure appropriate project implementation.
H&S expectations and procedures	CH2M HILL H&S Officer	Carl Woods (or current personnel)	513-889-5771	Review of Health and Safety Plan (HASP). Direct communication (via e-mail, telephone, hardcopy, or in-person, will be notified within 24 hours of incident) to/from Navy contractor project staff to ensure implementation of appropriate H&S procedures.
Implementation of sampling activities; SAP changes in the field	CH2M HILL Field Team Lead (FTL)	TBD	TBD	Documentation of deviations from work plan made in field logbooks and rationale for deviations, made within 24 hours of deviation; assistance in material procurement and delivery; injection oversight and implementation; deviations made only with approval from contractor PM and/or environmental manager (EM). Notifying CH2MHILL EM/AQM of significant SAP changes or deviations (i.e., prevent meeting SAP objectives) and corrective actions.
Daily Field Progress Reports	CH2M HILL FTL	TBD	TBD	FTL will call to contractor PMs daily

SAP Worksheet #6—Communication Pathways (continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number	Procedure
Ensure staff H&S in the field	CH2M HILL Site Safety Coordinator (SSC)	TBD	TBD	Daily safety tailgates; daily observations; real-time discussions of observations and changes to be implemented with field staff.
QC on Laboratory Data	CH2M HILL Program Chemist	Anita Dodson (or current personnel)	757-671-6218	Provides program-level chemistry support, program-level review of UFP-SAP, and senior review of analytical data
QC on Laboratory Data, release of analytical data for upload to database, Data tracking from collection through upload to database	CH2M HILL PC	Michael Zamboni (or current personnel)	703-376-5301	See Worksheets 24, 25, and 28 for analytical corrective actions (CAs); Upon review of validated data to ensure adherence to project requirements, PC communicates via e-mail to Project Data Manager (PDM) that data are ready for release (i.e., upload to database). Will track data from sample collection through upload to database, ensuring QAPP requirements are met by laboratory and field staff. Tracking involves receipt of electronic and hardcopy data from laboratory and DV. Communicates with CH2M HILL laboratory PM, and DV PM, as warranted, to ensure adherence to project analysis and validation requirements. Should there be laboratory QA/QC issues that prevents the achievement of project objectives, completeness goals, or delays project schedule, the PC will communicate this information to the Navy RPM and Navy QAO Also coordinates data upload with contractor database manager.
Uploading project data and maintaining the database to ensure data are stored properly and can be retrieved by the PDM.	CH2M HILL Database Manager	Bhavana Reddy (or current personnel)	703-462-3784	Once contractor chemist ensures data are appropriate for upload to database, PDM submits data electronically to contractor database manager, who uploads data to NIRIS.
Reporting Lab Data Quality Issues	Laboratory PM (Katahdin)	Jennifer Obrin (or current personnel)	207-874-2400 x17	All QA/QC issues with project field samples will be reported by the lab to the PDM, PC, and Contractor QAO via e-mail within 2 business days.
Technical Support and Reporting	CH2M HILL Senior Technologist	Bill Hannah (or current personnel)	757-671-6277	Data evaluation, analysis, and reporting
Technical Support	CH2M HILL Senior Human Health Risk Assessor	Barrie Selcoe (or current personnel)	281- 246-4322	Data evaluation, analysis, and interpretation
Validated data	DV PM	Laura Maschoff (or current personnel)	314-330-1327	DV provides data validation reports (electronic and hardcopy) that provide the data qualifiers and associated explanations.

SAP Worksheet #7—Personnel Responsibilities Table

Name	Title	Organizational Affiliation	Responsibilities
Kevin Cloe (or current personnel)	Vieques RPM	Navy	ERP activities implemented under this SAP
Kenneth Bowers (or current personnel)	QAO	Navy	Navy review of SAP and QA input
Madeline Rivera (or current personnel)	Vieques ERP Site Manager	Navy	On-island Navy liaison; provides logistical support for implementation of ERP activities under this SAP
Brett Doerr (or current personnel)	AM	CH2M HILL	Responsible for ERP at Vieques; primary Navy contractor POC; assists in data evaluation and interpretation; reviews report
John Swenfurth (or current personnel)	PM	CH2M HILL	Project administration; coordinates staffing; monitors project performance; directs and oversees project staff
Bill Hannah (or current personnel)	Senior Technologist	CH2M HILL	Technical support related to data collection and analysis
Barrie Selcoe (or current personnel)	Senior Human Health Risk Assessor	CH2M HILL	As the Human Health technical lead, provides technical support related to human health considerations
Anita Dodson (or current personnel)	Program Chemist	CH2M HILL	Provides program level review and support of the SAP
Mike Zamboni (or current personnel)	PC	CH2M HILL	Establishes laboratory scope of work; ensures selected laboratory can meet project-required analytical protocol; primary communications with laboratory and DV; performs data quality evaluation (DQE) to determine availability of analytical data. Manages sample tracking; coordinates assimilation of data from field collection through analysis, validation, and upload to environmental database; performs data queries for data evaluation and report writing
Carl Woods (or current personnel)	H&S Officer	CH2M HILL	Responsible for overall Navy CLEAN program H&S performance; reviews project-specific HASP; interacts with SSC to ensure project-specific safety of field personnel
TBD	FTL	CH2M HILL	Supervises sampling and coordinates field activities; ensures onsite compliance with work plan Responsible for maintaining daily communication with contractor and PMs
TBD	SSC	CH2M HILL	Oversees and ensures safety of onsite personnel; responsible for use and completion of all field work related H&S paperwork
TBD	Field Team Member	CH2M HILL	Assist FTL/SSC with implementation of field tasks
Bhavana Reddy (or current personnel)	Database Manager	CH2M HILL	Uploads validated data to environmental database
Jennifer Obrin (or current personnel)	Laboratory PM	Katahdin Laboratory	Responsible for laboratory QA program and review of QC data
Laura Maschoff (or current personnel)	PM and DV	DataQual Data Validator	Responsible for validating analytical data in accordance with project-specific UFP-SAP
TBD	TBD	Investigation-derived Waste (IDW) Subcontractor	Responsible for transport and disposal of IDW deemed necessary for offsite disposal

Staff may be removed (if unnecessary to project execution) and other staff may be added or substituted, as necessary and available.

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SAP Worksheet #8—Special Personnel Training Requirements Table

There are no special personnel training requirements for this project.

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SAP Worksheet #9-1—Project Scoping Session Participants Sheet

Project Name: Groundwater Remedial Action Long-term Monitoring, AOC E, Former NASD				
Projected Date(s) of Sampling: TBD			**Site Name:** AOC E	
PM: John Swenfurth			**Site Location:** Former NASD, Vieques, Puerto Rico	
Dates of Session: January 14-16, 2014, New York, NY. **Scoping Session Purpose:** AOC E Groundwater LTM SAP Scoping Session.				
Name	**Title/Role**	**Affiliation**	**Phone #**	**E-mail Address**
Kevin Cloe	Naval Facilities Engineering Command (NAVFAC) RPM	Navy	757-322-4736	kevin.cloe@navy.mil
Dan Waddill	NAVFAC Vieques Coordinator	Navy	757-322-4630	dan.waddill@navy.mil
Brett Doerr	Activity Manager (CLEAN contractor to Navy)	CH2M HILL	757-671-6219	brett.doerr@ch2m.com
Bill Hannah	CLEAN contractor to Navy	CH2M HILL	757-671-6277	bill.hannah@ch2m.com
Angela Carpenter	EPA Special Projects Branch	EPA	212-637-4435	Carpenter.angela@epa.gov
Daniel Rodriguez	EPA RPM	EPA	787-741-5201	Rodriguez.daniel@epamail.gov
Julio Vazquez	EPA RPM	EPA	212-637-4323	Vazquez.julio@epa.gov
Nicole Goers (by phone)	Technical support contractor to EPA	Tech Law	312-345-8926	ngoers@techlawinc.com
Wilmarie Rivera	PREQB RPM	PREQB	787-767-8181 x 6141	wilmarierivera@jca.gobierno.pr
Katarina Rutkowski	Technical support contractor to PREQB	TRC	860-298-6202	krutkowski@trcsolutions.com
Jeff Hansen	Technical support contractor to PREQB	TRC	207-620-3883	jhansen@trcsolutions.com

SAP Worksheet #9-1—Project Scoping Session Participants Sheet (continued)

Discussion Objective

Discuss seed file for AOC E Post-Record of Decision (ROD) long-term groundwater monitoring, and associated decision tree.

Key Discussion Points

Brett Doerr/CH2M HILL walked the team through the Post-ROD long-term groundwater monitoring SAP seed file. He presented the proposed decision tree and figure showing the proposed monitoring wells to sample and LUCs for AOC E. Kevin Cloe/Navy added that the Navy may create a land use control boundary that is smaller than the current site boundary so that the area south (i.e., upgradient) of the area of contamination can be utilized by the municipality, including the southern warehouse. Danny Rodriguez/EPA added that the municipality would also like access to the ramp. Kevin responded that that area of the site will remain restricted until the remedial action goals are met.

The team discussed the number of wells to be monitored and the frequency of the sampling event. The team discussed the possibility of using dissolved oxygen (DO) to help determine when baseline (pre-injection) levels are met prior to commencing sampling the monitoring wells. Jeff/TRC responded that EQB may comment on using DO as a trigger with persulfate analysis. Jeff/TRC asked what happens if there is an upward trend in contaminants of concern (COCs) but they remain below RGs, if in that case monitoring may be required beyond 3 years. Dan Waddill/Navy responded that 3 years seems sufficient since at these low level concentrations, what appear to be trends is likely the innate groundwater heterogeneity.

Consensus Decisions

The team agreed to abandon MW-02, MW-06; LTM will be conducted on MW-01, MW-03, MW-04, MW-05, MW-07 and MW-08.

SAP Worksheet #10—Conceptual Site Model

This worksheet provides a summary of the site background and key elements of the Conceptual Site Model (CSM). Detailed information of the site characteristics can be found in the Remedial Investigation (RI) Report for AOC E (CH2M HILL, 2008a).

Site Background

AOC E is located at the former NASD in Vieques, Puerto Rico and occupies less than about a tenth of an acre. **Figure 1** shows the location of the former NASD. **Figure 2** shows the site location map. AOC E is the site of a former 500-gallon underground storage tank (UST) associated with a former vehicle maintenance operation within the main operational area (i.e., Public Works) of the former NASD. The UST was in service between about 1970 and 1996, during which time it was used to store used oil generated from vehicle maintenance activities that took place at the vehicle maintenance and transportation shop (Building 2016). Specifically, oil removed from vehicles on the vehicle maintenance platform adjacent to Building 2016 was drained to the UST via an underground pipe between the platform and the UST (**Figure 3**). In 1996, the UST was removed and replaced with a 500-gallon aboveground storage tank (AST) that, in turn, was removed in 2001.

The Navy ceased facility-wide operations on the former NASD on April 30, 2001, when the land was transferred to the Department of the Interior (DOI), the Municipality of Vieques (MOV), and Conservation Trust. AOC E is located on U.S. property that was transferred to the MOV as part of a Quitclaim Deed that transferred the former NASD property to the MOV, U.S. Department of Interior (DOI), and the Puerto Rico Conservation Trust. The site is within the current MOV Public Works facility and restricted from the public.

Investigation History

On March 15, 2005, Vieques was placed on the National Priorities List (NPL) that required all subsequent environmental restoration activities for Navy Installation Restoration (IR) sites (including AOC E) to be conducted under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) procedures.

A chronological list of previous investigations and remedial activities as well as milestone dates at AOC E is summarized below:

- **UST Removal (1996)** – The 500-gallon UST that stored used oil from vehicle maintenance activities and 110 cubic yards of contaminated soil adjacent to the UST were removed (Reliable Mechanical, Inc., 1997). The UST was replaced with a 500-gallon AST.
- **Site Characterization (1998)** - Site characterization included the collection of eight subsurface soil samples and the installation and sampling of three monitoring wells (MW-01 through MW-03) (CH2M HILL, 1999).
- **Expanded Preliminary Assessment/Site Investigation (Expanded PA/SI) (2000)** –Assessed impacts to site groundwater from releases from the former UST, which included the installation and sampling of three monitoring wells (MW-04, MW-05, and MW-06) and the sampling of two existing monitoring wells (CH2M HILL, 2000).
- **AST Removal (2001)** - The 500-gallon AST which replaced the former 500-gallon UST in 1996 was removed when Navy operations ceased in 2001. There were no documented releases from the AST.
- **Initial RI (2002 and 2003)** – Based on the recommendations of the Expanded PA/SI, an initial RI sampling event was conducted in 2002 and 2003. The RI field work consisted of drilling seven borings from which 20 samples were collected to assist in characterizing the horizontal and vertical extent of soil contamination. In addition, two monitoring wells were installed (MW-07 and MW-08) and sampled, additional groundwater samples were collected from four existing monitoring wells, and in-situ hydraulic conductivity tests were performed (CH2M HILL, 2004).

SAP Worksheet #10—Conceptual Site Model (continued)

- **Multiphase Extraction (MPE) Pilot Study (2002)** – A MPE pilot study was conducted to provide quantitative performance, cost, and design information to help evaluate the effectiveness of this technology in mitigating the free phase hydrocarbon product accumulation. The MPE system recovered groundwater at an average rate of approximately 0.2 gallons per minute (gpm) over the study period. A total of approximately 11,000 gallons of emulsified free product and groundwater were recovered (CH2M HILL, 2004).
- **Supplemental RI (2004 and 2005)** – Supplemental data were collected including another round of groundwater samples from all eight monitoring wells in 2004 and surface soil samples from seven locations, subsurface soil samples from four locations, and groundwater samples from six of the monitoring wells in 2005 (CH2M HILL, 2008a).
- **Pilot Study (2010 and 2011)** – A groundwater in-situ chemical oxidation (ISCO) pilot study was conducted in 2010 and 2011, which included baseline sampling, two rounds of persulfate ISCO injection and three rounds of residual persulfate field measurements in MW-01, MW-03, MW-04 and MW-05. Also two rounds of groundwater sampling in January and May 2011 from wells MW-01 and MW-05 (and one sample collected from well MW-04 in May 2011) for benzene and naphthalene analysis. In addition an unsaturated soil denitrification-based bioremediation (DBB) pilot study was conducted in 2010 and 2011, which included baseline sampling, injecting calcium nitrate, and collecting post-injection soil samples (CH2M HILL, 2008b; CH2M HILL, 2010a; and CH2M HILL, 2011).

Conceptual Site Model

Figure 3 presents a generalized conceptual site model of AOC E. Pertinent elements of the CSM are discussed below.

Physical Characteristics

AOC E is approximately 43 feet (ft) above mean sea level and relatively flat. No surface water bodies are located at or immediately adjacent to AOC E. The site is covered primarily with grass, weeds, and scrub brush, and the grounds adjacent to AOC E are maintained by MOV Public Works personnel. The buildings onsite are not occupied and the site is fenced to discourage trespassing. Because it is developed and periodically maintained, the site has no significant ecological habitat.

The soil at the site comprises sandy clay with interspersed silty/clayey sand from ground surface to a depth of approximately 35 feet below ground surface (bgs) in the vicinity of the former UST. Beneath these deposits lies a clay-rich saprolite weathered in place from the underlying granodiorite bedrock. The sandy clay and silty/clayey sand layers are generally above the water table, though the lowest sections are submerged at the site's highest recorded water levels. The top of the saprolite varies in elevation from approximately 28 feet bgs to below 50 feet bgs (**Figure 4**) (CH2M HILL, 2008a).

Depth to groundwater typically ranges from approximately 28 to 43 feet bgs, with seasonal (or drought-induced) fluctuations up to approximately 15 feet. Groundwater is usually encountered in the saprolite, but sometimes in the lowest portion of the unconsolidated, sandy deposits directly above the saprolite. Groundwater flow is to the north-northwest toward the Vieques Passage at a velocity of approximately 1 ft/year (**Figure 5**) (CH2M HILL, 2008a).

Nature and Extent of Contamination and Transport Pathways

Based on the historical activities and extent of contamination identified during the RI and related investigations, the release mechanism at the site was from subsurface leaks from the former UST and associated piping. Therefore, the primary route of contaminant migration was likely vertical leaching through soil to groundwater and subsequent transport with groundwater flow in the saprolite. Because the saprolite consists of relatively "tight" clay and the hydraulic gradient across the site is low, the rate of contaminant transport is likely very low, as evinced by the general absence of groundwater contamination within 10s of feet downgradient of the former source.

SAP Worksheet #10—Conceptual Site Model (continued)

Groundwater contamination at AOC E is defined by six COCs: 1,2-dichloroethane (1,2-DCA), benzene, methyl tert butyl ether (MTBE), xylenes, 2-methylnaphthalene, and naphthalene. Groundwater contamination occurs within a small area and is localized to three monitoring wells (MW-01, MW-04, and MW-05) (**Figure 6**); petroleum free product had been observed at these monitoring wells, but was removed during the MPE and ISCO pilot studies.

Groundwater contamination at AOC E is localized and has historically only been observed in three monitoring wells (MW-01, MW-04, and MW-05) (**Figure 6**). During the ISCO pilot study, concentrations of COCs measured declined to non-detect levels. Although recent groundwater data show that the ISCO pilot study resulted in COC concentrations below regulatory standards, residual persulfate may continue to actively reduce contaminants that partition or diffuse from soil into groundwater.

Summary of Site Risks

The only unacceptable human health risk identified based on exposure scenarios at AOC E was for a hypothetical resident exposed to groundwater. The human health risk assessment identified 1,2-DCA, 2-methylnaphthalene, MTBE, naphthalene, and xylenes as COCs. Benzene was subsequently added as a COC because its concentration in groundwater exceeded the federal maximum contaminant level (MCL).

No unacceptable risks to potential ecological receptors were identified (CH2MHILL, 2008a).

Future Land Use

The former NASD occupied approximately 8,000 acres, most of which are undeveloped. Military operations ceased on the former NASD in April 2001 and the land containing AOC E was transferred to the MOV. The site is currently fenced and vacant except for periodic (approximately once per year) maintenance of site vegetation. In addition, there is no continuous or daily human occupancy of the buildings located immediately adjacent to AOC E (i.e., buildings 2015 and 2016). The site is also located a significant distance from any of the established conservation zones and wildlife landing and nesting areas; therefore ecological habitat in the area is insignificant. Groundwater beneath AOC E is classified by the Commonwealth of Puerto Rico as SG, where groundwater may be intended for use as a source of drinking water supply, agricultural use, and/or flows into waters that support ecological communities of exceptional ecological value. No archaeological or cultural resources are located within AOC E. The land occupied by AOC E is reportedly planned for use by the MOV for industrial purposes once CERCLA related activities are completed.

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

General Problems to Address

Although recent groundwater data show that the pilot study resulted in measured COC concentrations below regulatory standards, residual persulfate may continue to actively reduce contaminants that partition or diffuse from soil into groundwater. Therefore, a remedial action is needed to ensure COC levels remain at acceptable levels once persulfate levels decline and that groundwater within the site boundaries is not used as a potable source during that time. Specifically, the RAO is to prevent exposure to COCs in groundwater at concentrations above remedial goals (RGs).

The selected remedial action involves the implementation of annual (at a minimum) groundwater monitoring to ensure persulfate concentrations decline, continued annual groundwater monitoring of COCs for a period of 3 years after persulfate levels decline to ensure contaminant rebound does not occur, and ICs to restrict potable groundwater use until the RAO is met. Should residual persulfate levels not demonstrate an overall decline after three successive annual monitoring events, an ISCO injection using a hydrogen peroxide solution will be conducted to accelerate persulfate decline. If COCs rebound above acceptable levels and unacceptable concentrations (i.e., above Project Action Limits [PALs]) persist after three successive annual monitoring events, an ISCO injection using persulfate will be conducted for wells in which rebound is observed. The overall decision process for groundwater LTM and implementation of contingency plans (if necessary) at AOC E are shown in **Figure 7**.

Environmental Questions to be Answered by the LTM SAP:

To address the problem statement, the following environmental questions will be answered via implementation of this SAP:

1. **Have persulfate concentrations in groundwater sufficiently attenuated?**

   Persulfate concentrations will be field measured in groundwater from six monitoring wells (**Figure 8**; see Worksheet #17 for well selection rationale). If persulfate concentrations are non-detect or, with concurrence by the Vieques Technical Subcommittee, close to non-detect in all six wells within 3 years, persulfate has sufficiently attenuated and groundwater sampling for COCs can commence. If persulfate concentrations are sufficiently above non-detect (based on concurrence by the Vieques Technical Subcommittee) in any of the six wells after 3 years of persulfate monitoring, ISCO injections of catalyzed hydrogen peroxide will be used to reduce the persulfate concentrations (Contingency Plan 1) and persulfate monitoring will continue as described above. Prior to implementing Contingency Plan 1, a work plan will be submitted to the regulatory agencies that provides the details of the planned injection (i.e., ISCO mixture concentrations, quantities, and locations), which will be based on observations made during the persulfate monitoring.

2. **Are COCs in groundwater above acceptable levels?**

   Once persulfate concentrations have sufficiently attenuated (either naturally or via Contingency Plan 1), annual groundwater samples will be collected for 3 years from the six monitoring wells for laboratory analysis of the six COCs listed under “Summary of Site Risks.” They are: volatile organic compound (VOCs) MTBE, benzene, 1,2-dichloroethane, and total xylenes via SW-846 8260C and semivolatile organic compound (SVOCs) naphthalene and 2-methylnaphthalene via SW846 8270D. Analytical results will be compared to the remediation goals. If after 3 years of annual groundwater monitoring, COCs in groundwater remain at or below remediation goals, then the RAO has been met, and land use controls will be terminated and an Interim Remedial Action Completion Report (IRACR) will be prepared. Otherwise, hydrogen peroxide-activated

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

sodium persulfate will be injected (Contingency Plan 2) and persulfate and subsequent COC monitoring will begin again as described above. Prior to implementing Contingency Plan 2, a work plan will be submitted to the regulatory agencies that provides the details of the planned injection (i.e., sodium persulfate mixture concentrations, quantities, and locations), which will be based on observations made during the COC monitoring.

Project Quality Objectives/Systematic Planning Process Statements

1. **For what and by whom will the data be used?**

   The Navy, EPA, and PREQB will use the data collected during the LTM at AOC E to assess the performance of the selected remedy and determine when the RAO has been met and whether Contingency Plans 1 and/or 2 are warranted.

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

   The PALs are the performance criteria necessary to meet the RAO. The PALs for groundwater are shown in **Table 1** and Worksheet #15.

TABLE 1
Project Action Limits for AOC E

Chemicals of Concern	Project Action Limit	Basis
Benzene	5 microgram(s) per liter (L) (µg/L)	MCL
1,2-Dichloroethane	3.8 µg/L	Puerto Rico Water Quality Standards (PRWQS) for Groundwater (SG)
2-Methylnaphthalene	27 µg/L	HI of 1
MTBE	120 µg/L	ELCR of $1X10^{-5}$ and HI of 0.02
Naphthalene	6.1 µg/L	HI of 1 and ELCR of $4X10^{-5}$
Total xylenes	10,000 µg/L	MCL

Notes:
ELCR – excess lifetime cancer risk
HI – hazard index
MCL – Federal Maximum Contaminant Level (EPA, 2009)
PRWQS – Puerto Rico Water Quality Standards (March 2010; for groundwater – class SG)
RSL – EPA Regional Screening Level (EPA, 2013) for tap water; lowest of the cancer-based and non-cancer based levels (based on ELCR of $1x10^{-6}$ and HI of 1).

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

   Field measurements of persulfate in groundwater are needed to determine when the persulfate has been sufficiently attenuated or Contingency Plan 1 is warranted. Following persulfate attenuation, off-site laboratory analysis of COCs is necessary to determine when the RAO is met or whether Contingency Plan 2 is warranted.

   Persulfate monitoring will be conducted in the field, as documented in Worksheet #14. Groundwater samples will be submitted to an offsite laboratory for analysis (Katahdin Analytical Services, Inc. of Scarborough, Maine). Worksheets #10, #15, and #18 define the matrices, analytical groups, and, where applicable, specific target analytes for the AOC E.

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

Field parameters including water level, dissolved oxygen [DO], oxidation-reduction potential [ORP], pH, temperature, specific conductivity, and turbidity also will be collected during LTM. Based on their use, the field parameters do not have PALs. Temporal water level, temperature, turbidity, pH, and specific conductivity readings relative to each other are only used as purging stabilization indicators. DO and ORP help assess the groundwater's redox conditions and will help determine when groundwater conditions have returned to pre-injection conditions; however, these data will be subordinate to the persulfate levels when determining when to begin sampling for COCs (i.e., when persulfate levels decline to non-detect or, with concurrence by the Vieques Technical Subcommittee, close to non-detect) since there may be influences on the redox conditions not attributable to persulfate consumption.

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

The data will be of the quantity and quality necessary to provide technically sound and defensible assessments of when the RAO is met and whether additional groundwater treatment is warranted. Laboratory methods will meet CERCLA, EPA 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) for field and laboratory QC samples in Worksheet #28. These MPC are consistent with the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) as applicable and laboratory in-house limits where the QSM does not apply.

As evidenced by Worksheet #15-1, and 15-2, laboratory Limit of Detections (LODs) are all below the PALs for a given constituent.

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

To determine when to initiate sampling for COCs or if Contingency Plan 1 is warranted, one groundwater sample from each of the six monitoring wells (MW-01, MW03, MW-04, MW-5, MW-7, and MW-8) will be collected and field analyzed for persulfate no less often than annually until the persulfate concentrations in all wells decline to non-detect or, with concurrence by the Vieques Technical Subcommittee, close to non-detect or 3 years elapse, whichever occurs first. More frequent measurements may be collected at the Navy's discretion. Additional persulfate monitoring will be conducted as above if Contingency Plan 1 is implemented.

To determine when the RAO is achieved or if Contingency Plan 2 is warranted, once persulfate concentrations in all six wells decline to non-detect or, with concurrence by the Vieques Technical Subcommittee, close to non-detect, one groundwater sample from the six wells will be collected annually for at least three annual monitoring events for COC analysis. Additional COC monitoring will be conducted as above if Contingency Plan 2 is implemented.

Worksheet #18 contains the number of samples per matrix per analytical group for AOC E. Worksheet #15 contains the particular analytes, PALs, and quantitation limits (QLs).

6. Where, when, and how should the data be collected/generated?

The first persulfate sampling event is anticipated to begin in late 2014 or early 2015, upon signature of the ROD. Sampling thereafter will be in accordance with the timeline described above and the decision framework for AOC E (**Figure 7**). Details on the how data will be collected are summarized in Worksheet #14, in accordance with SOPs.

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

7. Who will collect and generate the data? How will the data be reported?

CH2M HILL field staff will conduct field measurements and collect and prepare the samples for shipment. Laboratory analysis will be performed by Katahdin Analytical Services Inc. of Scarborough, Maine. Field measurements of persulfate (and the other field-measured parameters) and validated COC data will be compiled after each event and provided electronically (e.g., e-mailed) to the regulatory agencies, together with recommendations based on the data trends and the ROD requirements. Once the RAO is met, all LTM data will be compiled in the IRACR, which will be provided to the regulatory agencies.

8. 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.

9. List the PQOs in the form of if/then qualitative and quantitative statements

The following PQOs are defined by the decision framework established in **Figure 7**:

- If persulfate concentrations in groundwater samples are sufficiently above non-detect (based on concurrence by the Vieques Technical Subcommittee) in at least one well for 3 consecutive years, then hydrogen peroxide will be injected to stimulate persulfate degradation (Contingency Plan 1) and persulfate monitoring will be reinitiated. As noted previously, prior to implementing Contingency Plan 1, a work plan will be submitted to the regulatory agencies that provides the details of the planned injection (i.e., ISCO mixture concentrations, quantities, and locations), which will be based on observations made during the persulfate monitoring.
- If persulfate concentrations in groundwater samples are non-detect or, with concurrence by the Vieques Technical Subcommittee, close to non-detect in all wells sampled within 3 years, then annual groundwater samples will be collected for 3 years for laboratory analysis of COCs.
- If the COC data are usable/available for the intended purpose, they will be used to assess COC trends and potential achievement of the RAO. Otherwise, the well(s) for which the data are not useful/available will be resampled.
- If COC concentration(s) after 3 years of annual groundwater monitoring exceed(s) a PAL(s), then hydrogen peroxide activated sodium persulfate will be injected to stimulate COC degradation (Contingency Plan 2) and persulfate/COC monitoring will be reinitiated as described above. As noted previously, prior to implementing Contingency Plan 2, a work plan will be submitted to the regulatory agencies that provides the details of the planned injection (i.e., sodium persulfate mixture concentrations, quantities, and locations), which will be based on observations made during the COC monitoring.
- If COC concentrations after 3 years of annual groundwater monitoring are at or below PALs in all sampled wells, then the RAO has been achieved and an IRACR will be prepared and the land use controls will be terminated.

In addition to the above, the following PQO is provided for potential modifications to the LTM protocol:

- If the LTM data indicate a modification(s) to the monitoring protocol is warranted (i.e., additional or reduced data are warranted [e.g., additional or fewer constituents of interest, additional or fewer monitoring points, increased or decreased frequency, etc.]), the modification(s) will be added to the LTM via addenda to this SAP or other mechanism that constitutes formal concurrence among the agencies. Because of the multitude of variables that would be considered in making these determinations, it is not feasible to list all possible conditions that would warrant a modified monitoring protocol. However, the

rationale upon which those recommendations will be provided and concurred upon prior to implementation.

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SAP Worksheet #12—Field QC Samples Table

UFP-QAPP Manual Section 2.6.2

In accordance with regulator request on past SAPs, all field QC sample information is within Worksheet #28 and Worksheet #12 is not applicable.

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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.

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
Groundwater	CH2MHILL. Focused Feasibility Study Report Area of Concern (AOC) E, Former Naval Ammunition Support Detachment Vieques, Puerto Rico November 2012.	Pre- and post-injection (pilot study) groundwater analytical results.	As basis for determining wells to be sampled as part of LTM. As an aid in determining mixture ratios for Contingency Plans 1 and 2.	Measurements made during post-ROD monitoring may supersede data used in mixture ratio/quantity information assumed in Focused Feasibility Study.

Note:

See Worksheet 10 for discussion of historical documents pertaining to the site, the data from which will be used for historical perspective for the site and not for making decisions for the project; decisions regarding LTM will be primarily based on the data collected during the LTM.

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SAP Worksheet #14—Summary of Project Tasks

The technical approach for the proposed field activities at AOC E is detailed below. The *Master Standard Operating Procedures, Protocols, and Plans* (CH2M HILL, 2010b) address the protocols and SOPs to be used for the LTM. The sample design rationale is discussed in Worksheet #17.

In general, work will be performed in Level D personal protective equipment (PPE), which includes safety glasses, safety-toed boots, and appropriate gloves. Optional PPE includes the use of Tyvek® coveralls (or comparable). Upgrades to higher levels of PPE are discussed in the *Accident Prevention Plan and Site Safety and Health Plan, Environmental Restoration Program, Former Vieques Naval Training Range (VNTR) and Former Naval Ammunition Support Detachment (NASD) Vieques, Puerto Rico* (CH2M HILL, 2013). Sampling activities are expected to be performed during normal working hours, except under specific arrangement for after-hours or weekend activities.

Mobilization

Mobilization for the field effort includes scheduling support staff, as well as 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 mobilization, EPA and PREQB will be notified to allow for appropriate oversight and coordination. Additionally, CH2M HILL has/will procure the following subcontractors to support investigation activities:

- Analytical laboratory
- Data validation
- Investigation Derived Waste (IDW) disposal contractor

Groundwater Sampling

The groundwater monitoring events will include the sampling of six monitoring wells. Prior to purging, the field team will measure and record the depth to water in the log book. Purging and sampling will be done either using a submersible pump. Purging will continue until water quality parameters are stabilized for three consecutive readings. Water quality parameters will be obtained using a Yellow Springs Instruments (YSI) multi-meter, or comparable, water quality meter and flow-through cell. Groundwater samples will be collected following SOP B-1, Groundwater Sampling Procedure Low Stress (Low Flow) Purging and Sampling (CH2M HILL, 2010).

Groundwater samples will be collected by placing the sample tubing intake in about the middle of the screened interval. For off-site analyses, samples will be collected in laboratory-prepared sample bottles and packed on ice. Quality assurance/quality control (QA/QC) samples will be collected in accordance with Worksheet #20.

Persulfate monitoring will be conducted in accordance with **Attachment A** using the CHEMetrics field kit. For persulfate concentrations above 70 mg/L (the upper range of the CHEMetrics kit), a field dilution will be performed to bring the persulfate within range of the CHEMetrics kit.

Sample Shipment

All samples for off-site analysis will be shipped in accordance with the Master SOP H-9, “Packaging and Shipping Procedures for Low-Concentration Samples.”

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

Documentation

Pertinent field observations will be recorded in a field notebook in accordance with applicable SOPs referenced on Worksheet #21.

Equipment Decontamination

All non-disposable sampling equipment will be decontaminated before sampling activities at each location in accordance with applicable SOPs referenced in Worksheet #21. Disposable equipment and personal protective equipment (PPE) that comes in contact with environmental media at the site will be decontaminated in accordance with SOP E-1 and disposed of with normal trash.

Investigation-Derived Waste Management

Other than PPE (discussed under "Equipment Decontamination" above), no solid investigation-derived waste (IDW) will be generated. The only liquid IDW anticipated is relatively small amounts of purge water generated during low-glow sampling and decontamination fluids. If practical, the liquid IDW will be allowed to evaporate; otherwise, it will be containerized, characterized, and disposed of in general accordance with the Master Waste Management Plan of the Master Protocols (CH2M HILL, 2010).

Quality Control

In reference to the field tasks, all field work will be overseen by the FTL, or his/her delegate, who is responsible for the QC of the sampling task.

Sample Analysis

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

Data Management

The Project chemist, Michael Zamboni (or other qualified personnel), is responsible for data tracking and storage. In addition a third party DV will receive all analytical data from the laboratory and the data will be validated prior to its use by the Navy. All validated analytical data will be loaded into the NIRIS database.

Procedures for Recording and Correcting Data

Field data will be recorded in field logbooks.

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

Data Validation: Worksheets #35 and #36.

Data Usability Assessment: Worksheet #37.

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

Matrix: GW
Analytical Group: VOC
Units: µg/L (unless otherwise specified)

Analyte	Chemical Abstract Services (CAS) No.	Project Action Limits		PQL Goal[2]	Laboratory-Specific Reporting Limits			Laboratory-Specific Accuracy and Precision Limits[3]		
		Remediation Goal	Basis		LOQ	LOD	DL	Lower Control Unit (LCL) (%)	Upper Confidence Level (UCL) (%)	Relative Percent Difference (RPD) (%)
Methyl-tert-butyl ether (MTBE)	1634-04-4	120	RSL[1]	60	1.0	0.50	0.36	65	125	30
Benzene	71-43-2	5	MCL	2.5	1.0	0.50	0.26	80	120	30
1,2-Dichloroethane	107-06-2	3.8	PRWQS	1.9	1.0	0.50	0.20	70	130	30
Xylene, total	1330-20-7	10000	MCL	5000	3.0	1.5	0.25	80	120	30
1,2-Dichloroethane-d_4 (surr)	--	--	--	--	--	--	--	*70*	*120*	--
4-Bromofluorobenzene (surr)	--	--	--	--	--	--	--	*75*	*120*	--
Dibromofluoromethane (surr)	--	--	--	--	--	--	--	*85*	*115*	--
Toluene-d_8 (surr)	--	--	--	--	--	--	--	*85*	*120*	--

Notes:
1. ELCR of 1E-5 and HI of 0.02 (EPA, 2013a)
2. The PQL goal is one half of the remediation goal.
3. Accuracy/Precision limits are per DoD QSM v. 4.2.

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

Matrix: GW
Analytical Group: SVOC
Units: µg/L (unless otherwise specified)

Analyte	CAS No.	Project Action Limits		PQL Goal[3]	Laboratory-Specific Reporting Limits			Laboratory-Specific Accuracy and Precision Limits[4]		
		Remediation Goal	Basis		LOQ	LOD	DL	LCL (%)	UCL (%)	RPD (%)
Naphthalene	91-20-3	6.1	RSL[1]	3.05	0.20	0.10	0.064	40	100	30
2-Methylnaphthalene	91-57-6	27	RSL[2]	13.5	0.20	0.10	0.077	45	105	30
2-Methylnaphthalene-d_{10} (surr)	--	--	--	--	--	--	--	*43*	*92*	--
Fluorene-d_{10} (surr)	--	--	--	--	--	--	--	*29*	*101*	--
Pyrene-d_{10} (surr)	--	--	--	--	--	--	--	*53*	*166*	--

Notes:
1. ELCR of 4E-5 and HI of 1 (EPA, 2013a)
2. HI of 1; not a potential carcinogen (EPA, 2013a)
3. The PQL goal is one half of the remediation goal.
4. Accuracy/Precision limits are per DoD QSM v. 4.2.

Light green shading indicates statistical laboratory limits because QSM does not specify.

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SAP Worksheet #16—Project Schedule / Timeline

The AOC E groundwater LTM will be implemented upon signature of the ROD, which is anticipated by September 2014. The sampling schedule will be in accordance with that described in Worksheet #11.

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SAP Worksheet #17—Sampling Design and Rationale

The selected remedy for AOC E involves the implementation of groundwater monitoring to ensure persulfate concentrations decline and that COCs do not rebound. The expected outcome is that residual persulfate levels decline and COCs in groundwater remain at or below PALs. To achieve the expected outcome, the following is the rationale for the groundwater monitoring:

- Groundwater samples will be collected from six monitoring wells (MW-01, MW-03, MW-04, MW-05, MW-07, and MW-08 (**Figure 8**). MW-03 is located upgradient of the site and will be used to monitor potential non-site-related contamination. MW-01 is located at the former UST, MW-05 is located at the former underground pipe between the maintenance rack and the UST, and MW-04 is located immediately downgradient; each of these monitoring wells historically contained groundwater contamination and represent the area of contamination. MW-07 and MW-08 will be monitored as downgradient sentinel wells; these wells have not historically shown contamination.
- Persulfate and COC monitoring (parameters, frequency, and duration) is dictated by the ROD and displayed in **Figure 7**. Other field measurements are to assist in evaluating purge stabilization prior to sampling.

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

Sampling Station / Sample Identification (ID) Per Sampling Event	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples Per Sampling Event	Sampling SOP Reference
VWAEMW01 / VWAE-MW01-MMYY VWAEMW01 / VWAE-MW01P-MMYY	GW	40 to 50	Select VOCs (MTBE, benzene, 1,2-dichloroethane, total xylenes), select SVOCs (naphthalene, 2-methylnaphthalene)	2	See Worksheet #21
VWAEMW03 / VWAE-MW03-MMYY VWAEMW03 / VWAE-MW03-MMYY-MS VWAEMW03 / VWAE-MW03-MMYY-SD	GW	40 to 50		3 (MS/MSD)	
VWAEMW04 / VWAE-MW04-MMYY	GW	40 to 50		1	
VWAEMW05 / VWAE-MW05-MMYY	GW	40 to 50		1	
VWAEMW07 / VWAE-MW07-MMYY	GW	40 to 50		1	
VWAEMW08 / VWAE-MW08-MMYY	GW	40 to 50		1	
VWAE-QC / VWAE-EB-MMDDYY	QC - EB	N/A	Select VOCs select SVOCs	Reference Worksheet #20	
VWAE-QC / VWAE-TB-MMDDYY	QC - TB	N/A	Select VOCs		

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SAP Worksheet #19-1—Field Sampling Requirements Table

UFP-QAPP Manual Section 3.1.1

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference	Containers	Sample Volume	Preservation Requirements	Maximum Holding Time (Preparation, Analysis)
GW	VOC	SW-846 8260C / CA-202	3 X 40 milliliter(s) (Ml) Vial	40mL (per vial)	4:1 to 40:1 molar ratio of AA[3,4] to persulfate; < 6 degrees Celsius (°C) but not frozen	7 days[1,2]
	SVOC	SW-846 3520, 8270D_SIM / CA-502, CA-213	2 X 1L Amber	1000mL	< 6°C but not frozen	7 days, 40 days

Notes:

1. Because VOCs vials preserved with ascorbic acid are considered "improperly-preserved" (not hydrogen chloride (HCl) to pH < 2), the holding time is shortened from 14 days to 7 days. If persulfate is not present at the site, typical vials (containing HCl to pH < 2) will be used and the holding time will be 14 days.
2. Samples are typically shipped on the day of collection. For this project, ascorbic acid-preserved VOCs fractions should be shipped on the day of collection and received the morning after.
3. Usually, VOCs vials are preserved with ascorbic acid (not HCl) when any site well exceeds 500mg/L of persulfate. For this project, samples are not planned for collection until persulfate is absent. Ascorbic acid preservation is shown in the event that the Vieques Technical Subcommittee agrees that samples should be collected when persulfate is still present.
4. The laboratory provides pre-preserved VOCs vials containing ascorbic acid. Vials each contain 0.83mg, 8.29, 82.9mg ascorbic acid.
   a. Persulfate is measured after purging (when the well has stabilized) and just before collecting the sample.
   b. Vials containing 0.83mg ascorbic acid are good for well water containing 0.7-7mg/L persulfate. 0.7mg/L is the lowest standard on the CHEMetrics K-7870 test kit. Well water which is nondetect or less than 0.7mg/L for persulfate can also use these vials.
   c. Vials containing 8.29mg ascorbic acid are good for well water containing 7-70mg/L persulfate.
   d. Vials containing 82.9mg ascorbic acid are good for well water containing 70-700mg/L persulfate.
   e. if the supply of vials containing a specific ascorbic acid mass is exhausted and another set is needed, then the sample may be preserved using the vials with the next higher mass of ascorbic acid.
   f. Ascorbic acid vials are not used if persulfate is no longer present at the site.

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SAP Worksheet #20—Field Quality Control Sample Summary Table

UFP-QAPP Manual Section 3.1.1

Matrix	Analysis Group	No. of Sampling Locations	No. of Field Duplicates	No. of MS/MSD Pairs	No. of Field Blanks	No. of Equipment Blanks[1]	No. of VOA Trip Blanks[2]	No. of PT Samples	Total No. of Samples to Lab
Quantities below reflect one round of sampling (six wells).									
GW	VOC	6	1	1	0	3	3	--	15
	SVOC	6	1	1	0	3	--	--	12

Notes:

1. For the purpose of completing this worksheet, is assumed that decontaminated equipment (submersible pump) is used (one equipment rinseate blank is needed per day). It is further assumed that two wells can be sampled per day.
2. It is assumed that there will be three shipments containing VOCs (one per day for three days).

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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
SOP B-1	Groundwater Sampling Procedure Low Stress (Low Flow) Purging and Sampling Reviewed 3/2014, no changes necessary	CH2M HILL	Adjustable pump, water quality meter, water level indicator, purge buckets, tubing and other disposables	N	
SOP C-1	Calibration and measurement with Field Instruments Reviewed 3/2014, no changes necessary	CH2M HILL	Multi-parameter water quality monitoring instrument	N	
SOP E-1	Decontamination of Personnel and Equipment Reviewed 3/2014, no changes necessary	CH2M HILL	Decon equipment and solutions	N	
SOP H-1	Preparing Field Log Books Reviewed 3/2014, no changes necessary	CH2M HILL	Log book	N	
SOP H-2	Water Level Measurements Reviewed 3/2014, no changes necessary	CH2M HILL	Water level meter	N	
SOP H-4	Chain-of-Custody Reviewed 3/2014, no changes necessary	CH2M HILL	SOP, tape, custody seals, electronic chain-of-custody forms	N	
SOP H-5	Packaging and Shipping Procedures for Samples Not Considered Dangerous Goods Reviewed 3/2014, no changes necessary	CH2M HILL	Packing materials, ice, shipping labels, etc.	N	
SOP H-6	Equipment Blank Reviewed 3/2014, no changes necessary	CH2M HILL	Sample containers	N	
Master Waste Management Plan	Master Waste Management Plan, U.S. Naval Ammunition Support Detachment, (NASD) and Former Vieques Naval Training Range (VNTR) Vieques Island, Puerto Rico Reviewed 3/2014, no changes necessary	CH2M HILL	Drums, sample containers, tools, PPE, etc.	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	CA	Resp. Person	SOP Reference
YSI pH probe	Calibrate probe using YSI Auto-Calibration Standard Solution			Daily, before use and if unstable readings due to instrument malfunction are suspected	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 and if unstable readings due to instrument malfunction are suspected	±3%	Clean probe with deionized water and calibrate again. Do not use this instrument if unable to calibrate properly.	FTL	SOP C-1
YSI Turbidity Meter	Calibrate probe using Hach-Calibration Standard			Daily, before use and if unstable readings due to instrument malfunction are suspected	0.1 to 10 Nephelometric Turbidity Units (NTU) standard - ±10%; 11 to 40 NTU standard - ±8%; 41 to 100 NTU standard - ±6.5%; >100 NTU standard - ±5%	Clean probe with deionized water and calibrate again. Do not use this instrument if unable to calibrate properly.	FTL	SOP C-1
YSI DO 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 and if unstable readings due to instrument malfunction are suspected	±0.3 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 and if unstable readings due to instrument malfunction are suspected	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
ORP	Calibrate using ORP standard solution	Check batteries and have a replacement set on hand	Visual inspection	Daily, before use and if unstable readings due to instrument malfunction are suspected	±10 millivolts (mV) of the theoretical redox standard value at that temperature	Clean probe with deionized water and calibrate again. Do not use this instrument if unable to calibrate properly	FTL	SOP C-1

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SAP Worksheet #23—Analytical SOP References Table

UFP-QAPP Manual Section 3.2.1

Lab SOP Number	Title, Revision Date[1], and/or Number	Date Last Revisited if not Revised[1]	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis[2]	Variance to QSM	Modified for Project Work?
CA-202	Analysis of volatile organic analysis (VOAs) by Purge and trap GC/MS, SW-846 Method 8260; April, 2013; Rev. 14	--	Definitive	GW / VOC	GC-MS	Katahdin	None	N
CA-213	Analysis of Semivolatile Organic Compounds by SW-846 Method 8270 Modified for Selected Ion Monitoring (SIM); March, 2013; Rev. 11	--	Definitive	GW / SVOC	GC-MS	Katahdin	None	N
CA-502	Preparation of Aqueous Samples for Extractable Semivolatile Analysis; May, 2013; Rev. 8	--	Definitive	GW / SVOC	N/A	Katahdin	None	N
SD-902	Sample Receipt and Internal Control; August, 2013; Rev. 10	--	--	N/A	N/A	Katahdin	None	N
SD-903	Sample Disposal; June, 2013; Rev. 5	--	--	N/A	N/A	Katahdin	None	N

Notes:

1. Worksheet #23 is intended as a 'snapshot' of laboratory SOPs as it pertains to revision and revisitation dates. This worksheet was prepared 1/20/14.
2. Katahdin Analytical Services, Inc. possesses DoD ELAP accreditation for the applicable analytical methods. Their accreditation through L-A-B is good through 2/1/16 **(Attachment B)**.

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SAP Worksheet #24—Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference
GC-MS (for VOC)	Tuning	Prior to ICAL and at the beginning of each 12-hour period.	Refer to SW-846 8260C for specific ion criteria.	Retune instrument and verify. Rerun affected samples. Flagging criteria are not appropriate. Problem must be corrected. No samples may be accepted without a valid tune.	Analyst	CA-202
	Minimum five-point initial calibration (ICAL) for all analytes	ICAL prior to sample analysis.	1. Average response factor (RF) for SPCCs: VOCs ≥ 0.30 for Chlorobenzene and 1,1,2,2-Tetrachloroethane; ≥ 0.1 for Chloromethane, Bromoform, and 1,1-Dichloroethane. 2. RSD for RFs for CCCs: VOCs ≤ 30% and one option below: Option 1: RSD for each analyte ≤ 15%; Option 2: Linear least-squares regression r ≥ 0.995; Option 3: Non-linear regression - coefficient of determination (COD) r^2 ≥ 0.99 (six points shall be used for second order, seven points shall be used for third order).	Correct problem then repeat ICAL. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until ICAL has passed. Calibration may not be forced through the origin.		
	Second source calibration verification (ICV)	Once after each ICAL.	All project analytes within ±20% of true value.	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until calibration has been verified.		
	Retention time window position establishment for each analyte and surrogate	Once per ICAL	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	N/A		
	Evaluation of relative retention times (RRT)	With each sample.	RRT of each target analyte within ±0.06 RRT units.	Correct problem, then rerun ICAL. Flagging criteria are not appropriate. Refer to DoD QSM v. 4.2 Table F-4 for more information.		
	Continuing calibration verification (CCV)	Daily before sample analysis and every 12 hours of analysis time.	1. Average response factor (RF) for SPCCs: VOCs ≥ 0.30 for Chlorobenzene and 1,1,2,2-Tetrachloroethane; ≥ 0.1 for Chloromethane, Bromoform, and 1,1-Dichloroethane. 2. %Difference/Drift for all target compounds and surrogates: VOCs ≤ 20%D (Note: D = difference when using RFs or drift when using least squares regression or non-linear calibration).	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since last acceptable CCV. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since last acceptable CCV. Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.		

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

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference
GC-MS (for SIM PAHs)	Tuning	Prior to ICAL and at the beginning of each 12-hour period.	Refer to SW-846 8270D for specific ion criteria.	Retune instrument and verify. Rerun affected samples. Flagging criteria are not appropriate. Problem must be corrected. No samples may be accepted without a valid tune.	Analyst	CA-213
	Minimum five-point initial calibration (ICAL) for all analytes	ICAL prior to sample analysis.	1. Average response factor (RF) for SPCCs: SVOCs ≥ 0.050. 2. RSD for RFs for CCCs: SVOCs ≤ 30% and one option below: Option 1: RSD for each analyte ≤ 15%; Option 2: Linear least-squares regression r ≥ 0.995; Option 3: Non-linear regression - coefficient of determination (COD) r^2 ≥ 0.99 (six points shall be used for second order, seven points shall be used for third order).	Correct problem then repeat ICAL. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until ICAL has passed. Calibration may not be forced through the origin.		
	Second source calibration verification (ICV)	Once after each ICAL.	All project analytes within ±20% of true value.	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until calibration has been verified.		
	Retention time window position establishment for each analyte and surrogate	Once per ICAL	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	N/A		
	Evaluation of relative retention times (RRT)	With each sample.	RRT of each target analyte within ±0.06 RRT units.	Correct problem, then rerun ICAL. Flagging criteria are not appropriate. Refer to DoD QSM v. 4.2 Table F-4 for more information.		
	Continuing calibration verification (CCV)	Daily before sample analysis and every 12 hours of analysis time.	1. Average response factor (RF) for SPCCs: SVOCs ≥ 0.050. 2. %Difference/Drift for all target compounds and surrogates: SVOCs ≤ 20%D (Note: D = difference when using RFs or drift when using least squares regression or non-linear calibration).	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since last acceptable CCV. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since last acceptable CCV. Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.		

Notes:

1. DoD QSM v. 4.2 is the basis for specifications for VOCs and SVOCs.

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

UFP-QAPP Manual Section 3.2.3

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
GC-MS (for VOCs)	Check pressure and gas supply daily. Bake out trap and column. Manual tune if BFB not in criteria. Change septa as needed. Cut column as needed. Change trap as needed. Perform other maintenance specified in lab Equipment Maintenance SOP.	VOCs	Ion source, injector liner, column, column flow, purge lines, purge flow, and trap.	Prior to ICAL and/or as necessary.	Acceptable calibration or CCV.	Correct the problem and repeat calibration or CCV.	Analyst	CA-202
GC-MS (for SIM PAHs)	Check pressure and gas supply daily. Manual tune if DFTPP not in criteria. Change septa as needed. Change liner as needed. Cut column as needed. Perform other maintenance specified in lab Equipment Maintenance SOP.	SIM PAHs	Ion source, injector liner, column, and column flow.	Prior to ICAL and/or as necessary.	Acceptable calibration or CCV.	Correct the problem and repeat calibration or CCV.	Analyst	CA-213

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SAP Worksheet #26—Sample Handling System

(UFP-QAPP Manual Appendix A)

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection: Field Team Leader (TBD)/CH2M HILL. Sample Packaging: Sample Processor or Field Team Member (TBD)/CH2M HILL. Coordination of Shipment: Sample Processor or Field Team Member (TBD)/CH2M HILL. Type of Shipment/Carrier: Overnight/FedEx.
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt: Sample Receipt Personnel/Katahdin. Sample Custody and Storage: Sample Receipt Personnel/Katahdin. Sample Preparation: Extractions Personnel/Katahdin. Sample Determinative Analysis: Analyst/Katahdin
SAMPLE ARCHIVING
Field Sample Storage: 45 days from sample collection. Sample Extract/Digestate Storage: Extracts may be disposed of 90 days after extraction. Biological Sample Storage (No. of days from sample collection): N/A
SAMPLE DISPOSAL
Sample Disposal: Environmental Health and Safety Officer/Katahdin. Field Sample Disposal: Samples may be disposed of 45 days after analysis.

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SAP Worksheet #27—Sample Custody Requirements

(UFP-QAPP Manual Section 3.3.3)

Sample Labeling

Sample labels will include, at a minimum, client name, site, sample ID, date/time collected, analysis group or method, preservative, and sampler's initials. Labels will be taped to the jar to ensure that they do not separate. The following exceptions apply:

Aqueous VOCs: The laboratory may request that labels not be taped onto the 40mL VOA vials if the tape interferes with the laboratory's robotic auto-sampler. In this instance, indelible ink must be used on a waterproof label.

Field Sample Custody Procedures

Samples will be collected by field team members under the supervision of the field team leader. As samples are collected, they will be placed into containers and labeled, as outlined above. Samples will be cushioned with packaging material and placed into coolers containing enough ice to keep the samples at less than 6°C (but not frozen) until they are received by the laboratory. The chain of custody (COC) will also be placed into the cooler. Coolers will be shipped to the laboratory via FedEx, with the airbill number indicated on the COC to relinquish custody. Upon delivery, the laboratory will log in each cooler and report the status of the samples.

Laboratory Sample Custody Procedures

Please refer to laboratory SOPs SD-902 and SD-903.

Sample Identification Procedures

Upon opening the cooler, the receiving clerk signs the COC and then takes the temperature using the temperature blank. If absent, a sampler container or infrared thermometer is used. The sample containers in the cooler are unpacked and checked against the COC and any discrepancies or breakage is recorded. Next, if any water samples require preservative, the clerk will check the pH values to see if they are in the acceptable pH range. The clerk will deliver the COC (and any other paperwork; e.g. temperature or pH QA notice) to the project manager for Laboratory Information Management System (LIMS) entry and client contact (if needed).

The field logbook will identify the sample ID with the location, depth, date/time collected, and the parameters required. The laboratory will assign each field sample a laboratory sample ID based on information in the chain of custody. The laboratory will send sample logins to project chemist to check that sample IDs date/time collected, and scheduled analyses.

Chain-of-Custody Procedures

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

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SAP Worksheet #28-1—Laboratory QC Samples Table[1]

UFP-QAPP Manual Section 3.4

Matrix: GW
Analytical Group: VOC

QC Sample	Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicates	One per 10 normal field samples	%RPD < 25% for aqueous matrices	Assess groundwater heterogeneity. Qualify as per Worksheet #36.	PM/FTL, Data Validator	Precision	%RPD < 25% for aqueous matrices
Matrix Spike/Matrix Spike Duplicate	One per 20 normal field samples	See below.	See below. Qualify as per Worksheet #36.	Analyst, Data Validator	Accuracy/Precision	See below.
Equipment Rinseate Blank	One per day for decontaminated equipment. One per event for disposable equipment.	Same as method blank (see below)	Assess equipment decontamination procedures. Qualify as per Worksheet #36.	PM/FTL, Data Validator	Contamination	Same as method blank (see below).
Trip Blanks	One per cooler containing VOCs	Same as method blank (see below)	Assess storage and transport conditions. Qualify as per Worksheet #36.	PM/FTL, Data Validator	Contamination	Same as method blank (see below).
Temperature Blank	One per cooler	≤ 6°C but not frozen	Notify project chemist. Assess sample packaging and shipment procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PM/FTL, Data Validator	Representativeness	≤ 6°C but not frozen
Internal Standards Verification	Every field sample, standard, and QC sample.	Retention time ±30 seconds from retention time of the midpoint standard in the ICAL; extracted ion current profile (EICP) area within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory. If corrective action fails in field samples, apply Q-flag to analytes associated with the non-compliant internal standards (IS). Flagging criteria are not appropriate for failed standards. Sample results are not acceptable without a valid IS verification.	Analyst	Accuracy	Retention time ±30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.
Method Blank	One per preparatory batch.	No analytes detected > 1/2 reporting limit (RL) and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v. 4.2).	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.2. If required, re-prepare and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch. Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst	Contamination	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v. 4.2).
Laboratory Control Sample (LCS) containing all analytes to be reported, including surrogates	One per preparatory batch.	Refer to Worksheet #15-1.	Correct problem then re-prep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch. Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst	Accuracy	Refer to Worksheet #15-1.
Matrix Spike (MS)	One per preparatory batch per matrix	Same as for LCS	Examine the project-specific data quality objectives (DQOs). Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy	Same as for LCS
Matrix Spike Duplicate (MSD) or Laboratory Replicate	One per preparatory batch per matrix	Same as for LCS.	Same as MS.	Analyst	Accuracy / Precision	Same as for LCS.
Surrogate Spike	All field and QC samples	Refer to Worksheet #15-1.	For QC and field samples, correct problem then re-prep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteria are not met.	Analyst	Accuracy	Refer to Worksheet #15-1.

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

UFP-QAPP Manual Section 3.4

Matrix: GW
Analytical Group: VOC

QC Sample	Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible	Data Quality Indicator (DQI)	Measurement Performance Criteria
Results reported between DL and LOQ	--	Apply J-flag to all results between DL and LOQ. Nondetect results are reported as U-Values at the LOD.	--	Analyst	Accuracy	--

Notes:

1. Specifications on this table are as per DoD QSM v. 4.2.

SAP Worksheet #28-2—Laboratory QC Samples Table[1]

UFP-QAPP Manual Section 3.4

Matrix: GW
Analytical Group: SVOC

QC Sample	Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible	DQI	Measurement Performance Criteria
Field Duplicates	One per 10 normal field samples	%RPD < 25% for aqueous matrices	Assess groundwater heterogeneity. Qualify as per Worksheet #36.	PM/FTL, Data Validator	Precision	%RPD < 25% for aqueous matrices
Matrix Spike/Matrix Spike Duplicate	One per 20 normal field samples	See below.	See below. Qualify as per Worksheet #36.	Analyst, Data Validator	Accuracy/Precision	See below.
Equipment Rinseate Blank	One per day for decontaminated equipment. One per event for disposable equipment.	Same as method blank (see below)	Assess equipment decontamination procedures. Qualify as per Worksheet #36.	PM/FTL, Data Validator	Contamination	Same as method blank (see below).
Temperature Blank	One per cooler	≤ 6°C but not frozen	Notify project chemist. Assess sample packaging and shipment procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PM/FTL, Data Validator	Representativeness	≤ 6°C but not frozen
Breakdown Check	At the beginning of each 12-hour period, prior to analysis of samples	Degradation ≤20% for dichlorodiphenyltrichloroethane (DDT). Benzidine and Pentachlorophenol should be present at their normal responses, and should not exceed a tailing factor of 2.	Correct problem then repeat breakdown check. Flagging criteria are not appropriate. No samples shall be run until degradation <20%.	Analyst	Accuracy	Degradation ≤20% for DDT. Benzidine and Pentachlorophenol should be present at their normal responses, and should not exceed a tailing factor of 2.
Internal Standards Verification	Every field sample, standard, and QC sample.	Retention time ±30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory. If corrective action fails in field samples, apply Q-flag to analytes associated with the non-compliant IS. Flagging criteria are not appropriate for failed standards. Sample results are not acceptable without a valid IS verification.	Analyst	Accuracy	Retention time ±30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v. 4.2).	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.1. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch. Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst	Contamination	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v. 4.2).
Laboratory Control Sample (LCS) containing all analytes to be reported, including surrogates	One per preparatory batch.	Refer to Worksheet #15-2.	Correct problem then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch. Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst	Accuracy	Refer to Worksheet #15-2.
Matrix Spike (MS)	One per preparatory batch per matrix	Same as for LCS	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy	Same as for LCS

SAP Worksheet #28-2—Laboratory QC Samples Table[1] (continued)

UFP-QAPP Manual Section 3.4

Matrix: GW
Analytical Group: SVOC

QC Sample	Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible	DQI	Measurement Performance Criteria
Matrix Spike Duplicate (MSD) or Laboratory Replicate	One per preparatory batch per matrix	Same as for LCS.	Same as MS.	Analyst	Accuracy / Precision	Same as for LCS.
Surrogate Spike	All field and QC samples	Refer to Worksheet #15-2.	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteria are not met.	Analyst	Accuracy	Refer to Worksheet #15-2.
Results reported between DL and LOQ	--	Apply J-flag to all results between DL and LOQ. Nondetect results are reported as U-Values at the LOD.	--	Analyst	Accuracy	--

Notes:

1. Specifications on this table are as per DoD QSM v. 4.2.

SAP Worksheet #29—Project Documents and Records Table

Document	Where Maintained
Field Notes	Electronic portable document format (.pdf) copies in the project file. Hardcopy (bound Field Notebook) in the project file. Archived at project closeout*.
Chain-of-Custody Records	Electronic .pdf copies in the project file. Hardcopy in the project file. Archived at project closeout.
Air Bills	Hardcopy in the project file. Archived at project closeout.
Telephone Logs	Hardcopy in the project file. Archived at project closeout.
CA Forms	Electronic .pdf copies in the project file. Hardcopy in the project file. Archived at project closeout.
Pre-Task Safety Plan Forms or Safety Task Analysis Cards	Recorded in Field Notebook. Hardcopy in the project file. Archived at project closeout.
Safe Behavior Observation Forms	Recorded in Field Notebook. Hardcopy in the project file. Archived at project closeout.
Signed HASP and associated Activity Hazard Analysis (AHA) Forms	Recorded in Field Notebook. Hardcopy in the project file. Archived at project closeout.
Water quality field parameters collected during groundwater sampling	Recorded in Field Notebook. Stored in NIRIS.
Various field measurements	Recorded in Field Notebook.
All field equipment calibration information	Recorded in Field Notebook.
Pertinent telephone conversations	Recorded in Field Notebook.
Field equipment maintenance records	Inspected by FTL. Not maintained.
Sample Receipt, Custody, and Tracking Records	Electronic .pdf copies in the project file. Hardcopy in the full data package.
Equipment Calibration Logs	Hardcopy in the full data package[1]. Archived at project closeout.
Sample Prep Logs	Hardcopy in the full data package[1]. Archived at project closeout.
Run Logs	Hardcopy in the full data package[1]. Archived at project closeout.
Reported Field Sample Results	Electronic .pdf copies in the project file. Hardcopy in the full data package[1]. Archived at project closeout.
Reported Results for Standards, QC Checks, and QC Samples	Hardcopy in the full data package[1]. Archived at project closeout.

SAP Worksheet #29—Project Documents and Records Table (continued)

Document	Where Maintained
Instrument Printouts (raw data) for Field Samples, Standards, QC Checks, and QC Samples	Hardcopy in the full data package[1]. Archived at project closeout.
Sample Disposal Records	Maintained by the laboratory.
Extraction/Clean-up Records	Hardcopy in the full data package[1].
Raw Data	Hardcopy in the full data package[1]. Archived at project closeout.
Field Sampling Audit Checklists	Hardcopy in the project file. Archived at project closeout.
Fixed Laboratory Audit Checklists	If completed, hardcopy in the project file. Archived at project closeout.
Data Validation Reports	Electronic .pdf copies in the project file. Hardcopy stored with the data package. Archived at project closeout.
Monitoring Event Summaries	Electronic (e-mails) submitted to regulatory agencies; data ultimately compiled in IRACR.
IRACR	Electronic .pdf copies in the project file. Hardcopy (bound notebook) in the project file and administrative record. Archived at project closeout.

* After completion of the project, project documents required to be maintained will be stored at the Federal Records Center (FRC) in Suitland, MD:

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

[1] CH2M HILL requires a “Level 4” package.

SAP Worksheet #30—Analytical Services Table

UFP-QAPP Manual Section 3.5.2.3

Matrix	Analysis Group	No. of Sampling Locations	Analytical and Preparation Method / SOP Reference	Data Package Turnaround Time[1]	Laboratory	Backup Laboratory[2]
GW	VOC	6	SW-846 8260C / CA-202	Standard 28 Calendar-day TAT	Katahdin Analytical Services, Inc. 600 Technology Way Scarborough, Maine 04074 (207) 874-2400 POC: Jennifer Obrin	TBD
	SVOC	6	SW-846 3520, 8270D_SIM / CA-502, CA-213			

Notes:

1. Data Package Turnaround time is from time of sample receipt (of final sample) to laboratory reporting. Subsequent data validation is conducted using a standard 14 calendar-day TAT.
2. A backup laboratory may be considered due to instrument malfunction or capacity issues. A backup laboratory must be DoD ELAP accredited via the specified analysis method.

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SAP Worksheet #31—Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (title and organizational affiliation)	Person(s) Responsible for Responding to Assessment Findings (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing CAs (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (title and organizational affiliation)
Field Performance Audit	One during sampling activities	Internal	CH2M HILL	TBD Field Auditor CH2M HILL	Project Field Team CH2M HILL	John Swenfurth (or current personnel) PM CH2M HILL	Brett Doerr (or current personnel) AM CH2M HILL
Pre-Task Safety Plan or Safety Task Analysis Card	One per day during field activities	Internal	CH2M HILL	TBD Field Auditor CH2M HILL	Project Field Team CH2M HILL	Howard Gordon (or current personnel) H&S Officer CH2M HILL	Howard Gordon (or current personnel) H&S Officer CH2M HILL
Safe Behavior Observation Form	One per week during field activities	Internal	CH2M HILL	TBD Field Auditor CH2M HILL	Project Field Team CH2M HILL	Howard Gordon (or current personnel) H&S Officer CH2M HILL	Howard Gordon (or current personnel) H&S Officer CH2M HILL

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SAP Worksheet #32—Assessment Findings and Corrective Action Responses

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

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SAP Worksheet #32-1—Laboratory Corrective Action Form

Person initiating CA _____ **Date** _____

Description of problem and when identified: _____

_____

_____

_____

_____

Cause of problem, if known or suspected: _____

_____

_____

_____

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

_____

_____

_____

_____

_____

_____

_____

CA implemented by: _____ **Date:** _____

CA initially approved by: _____ **Date:** _____

Follow-up date: _____

Final CA approved by: _____ **Date:** _____

Information copies to:

Anita Dodson, CH2M HILL Navy CLEAN Program Chemist

_____

_____

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SAP Worksheet #32-2—Field Performance Audit Checklist

Project Responsibilities

Project No.: **Date:**

Project Location: **Signature:**

Team Members

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

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

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

Sample Collection

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

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

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

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

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

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

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

Yes No 7) Are photographs taken and documented?
Comments

Document Control

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

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

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

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

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

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

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

SAP Worksheet #32-3—Safe Behavior Observation Form

Safe Behavior Observation Form		
☐ Federal or ☐ Commercial Sector (check one)		☐Construction or ☐Consulting (check one)
Project Number:	Client/Program:	
Project Name:	Observer:	Date:
Position/Title of worker observed:	Background Information/ comments:	
Task/Observation Observed:		

- ❖ Identify and reinforce safe work practices/behaviors
- ❖ Identify and improve on at-risk practices/acts
- ❖ Identify and improve on practices, conditions, controls, and compliance that eliminate or reduce hazards
- ❖ Proactive PM support facilitates eliminating/reducing hazards (do you have what you need?)
- ❖ Positive, corrective, cooperative, collaborative feedback/recommendations

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

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SAP Worksheet #33—QA Management Reports Table

Type of Report	Frequency (Daily, Weekly, Monthly, Quarterly, Annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliations)
Field Audit Report	One during sampling activities	Submitted with report in which data are analyzed and presented	PM: John Swenfurth/CH2M HILL (or current personnel)	Regional Health, Safety, Environment, and Quality Manager: Carl Woods/CH2M HILL (or current personnel) Included in project files.
Data Validation Reports	Once, after analysis by laboratory, for all laboratory analytical data except wet chemistry (WCHEM) and MICRO analyses.	Submitted by the DV within 14 calendar-days of notification to begin)	PM: TBD	PC: Michael Zamboni/CH2M HILL (or current personnel) PM: John Swenfurth/CH2M HILL (or current personnel)
Data Usability Assessments (DQE)	Once, as an appendix to the report in which data are analyzed and presented.	Along with the project report.	PC: Michael Zamboni/CH2M HILL (or current personnel)	Vieques RPM: Julio Vasquez/EPA and Vieques RPM Wilmarie Rivera/PREQB (or current personnel)

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SAP Worksheet #34-36—Data Verification and Validation Process Table

Data Review Input	Description	Responsible for Verification	Step I / IIa / IIb[1]	Int. / Ext
Field Notebooks	Field notebooks will be reviewed internally and placed into the project file for archival at project closeout.	Field Team Leader/CH2M HILL (TBD)	Step I	Internal
Chains of Custody and Shipping Forms	Chain-of-custody forms and shipping documentation will be reviewed internally upon their completion and verified against the packed sample coolers they represent. The shipper's signature on the chain-of-custody will be initialed by the reviewer, a copy of the chain-of-custody retained in the site file, and the original and remaining copies taped inside the cooler for shipment.	Field Team Leader/CH2M HILL (TBD) Michael Zamboni/CH2M HILL (Project Chemist)	Step I	Internal / External
Sample Condition Upon Receipt	Any discrepancies, missing, or broken containers will be communicated to the project data manager in the form of laboratory logins.	Michael Zamboni/CH2M HILL (Project Chemist)	Step I	External
Documentation of Laboratory Method Deviations	Laboratory Method Deviations will be discussed and approved by the project chemist. Documentation will be incorporated into the case narrative which becomes part of the final hardcopy data package.	Michael Zamboni/CH2M HILL (Project Chemist)	Step I	External
Electronic Data Deliverables	Electronic Data Deliverables will be compared against hardcopy laboratory results (10% check).	Michael Zamboni/CH2M HILL (Project Chemist)	Step I	External
Case Narrative	Case narratives will be reviewed by the data validator during the data validation process. This is verification that they were generated and applicable to the data packages.	Data Validator/TBD	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.	Leslie Dimond/Katahdin (Laboratory QAO)	Step I	Internal
Laboratory Data	The data will be verified for completeness by the project chemist.	Michael Zamboni/CH2M HILL (Project Chemist)	Step I	External
Audit Reports	Upon report completion, a copy of all audit reports will be placed in the site file. If CAs are required, a copy of the documented CA taken will be attached to the appropriate audit report in the QA site file. Periodically, and at the completion of site work, site file audit reports and CA forms will be reviewed internally to ensure that all appropriate CAs have been taken and that CA reports are attached. If CAs have not been taken, the site manager will be notified to ensure action is taken.	John Swenfurth/CH2M HILL (Project Manager) Michael Zamboni/CH2M HILL (Project Chemist)	Step I	Internal / External
Corrective Action Reports	CA reports will be reviewed by the project chemist or PM and placed into the project file for archival at project closeout.	John Swenfurth/CH2M HILL (Project Manager) Michael Zamboni/CH2M HILL (Project Chemist)	Step I	External
Laboratory Methods	Ensure the laboratory analyzed samples using the correct methods.	Michael Zamboni/CH2M HILL (Project Chemist)	Step IIa	External
Target Compound List	Ensure the laboratory reported all analytes from each analysis group as per Worksheet 15.	Michael Zamboni/CH2M HILL (Project Chemist)	Step IIa	External
Reporting Limits	Ensure the laboratory met the project-designated reporting limits as per Worksheet 15. If reporting limits were not met, the reason will be determined and documented.	Michael Zamboni/CH2M HILL (Project Chemist)	Step IIb	External
Laboratory SOPs	Ensure that approved analytical laboratory SOPs were followed.	Data Validator/TBD	Step IIa	External
Sample Chronology	Holding times from collection to extraction or analysis and from extraction to analysis will be considered by the data validator during the data validation process.	Data Validator/TBD	Step IIa / IIb	External
Raw Data[2]	From each analytical suite containing definitive data, a 10 percent review of chromatograms and raw data will be performed to confirm laboratory calculations. For a recalculated result the data validator attempts to re-create the reported numerical value. Samples selected for this review will be at the discretion of the validator. The laboratory is asked for clarification if a discrepancy is identified which cannot reasonably be attributed to rounding.	Data Validator/TBD	Step IIa	External
Onsite Screening	All non-analytical field data will be reviewed against UFP-SAP requirements for completeness and accuracy based on the field calibration records.	Field Team Leader/CH2M HILL (TBD)	Step IIb	Internal
Documentation of Method QC Results	Establish that all required QC samples were run and met limits.	Data Validator/TBD	Step IIa	External

SAP Worksheet #34-36—Data Verification and Validation Process Table (continued)

Data Review Input	Description	Responsible for Verification	Step I / IIa / IIb[1]	Int. / Ext
Documentation of Field QC Sample Results	Establish that all required QAPP QC samples were run and met limits.	Michael Zamboni/CH2M HILL (Project Chemist) Data Validator/TBD	Step IIb	External
Data Validation (for VOC)	Analytical methods and laboratory SOPs, as presented in this UFP-SAP, will be used to evaluate compliance against QA/QC criteria, which includes but is not limited to, holding time, sample preservation, blanks (field and method), field duplicates, lab duplicates, detection limits, surrogate recoveries, LCS/LCSD, MS/MSD, internal standard recovery, initial calibration criteria, and continuing calibration criteria. QA/QC criteria for field QC samples are presented in Worksheet #28. QA/QC criteria for calibrations are presented in Worksheet #24. QA/QC criteria for laboratory QC samples are presented in Worksheet #28. Reporting limits and laboratory specific limits are presented in Worksheet #15. Data may be qualified if QA/QC exceedances have occurred. Data qualifiers will be those presented in "Low/Medium Volatile Data Validation" (SOP HW-33 Rev. 3; EPA Region II; EPA, March, 2013b). Guidance from "USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review" (EPA; June, 2008) may also be applicable.	Data Validator/TBD	Step IIa and IIb	External
Data Validation (for SVOC)	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 #28. QA/QC criteria for calibrations are presented in Worksheet #24. QA/QC criteria for laboratory QC samples are presented in Worksheet #28. Reporting limits and laboratory specific limits are presented in Worksheet #15. Data may be qualified if QA/QC exceedances have occurred. Data qualifiers will be those presented in "Semivolatile Data Validation" (SOP HW-35 Rev. 2; EPA Region II; EPA, March, 2013b). Guidance from "USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review" (EPA; June, 2008) may also be applicable.	Data Validator/TBD	Step IIa and IIb	External

Notes:

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

SAP Worksheet #37—Usability Assessment

Data usability evaluation comprises critical assessment of the data with respect to the project objective. Given that the primary objective of the LTM is to ensure the RAO is met, the comprehensive datasets from the off-site analytical laboratory, as validated, will be reviewed to determine if it is adequate for making the project-specific determinations.

Some specific examples of data availability and usability protocol are:

- The third-party DV is the only party that may apply qualifiers to the data. Minor QC exceedances will result in "estimated" data, represented by J, NJ, and UJ qualifiers. Major QC exceedances will result in "rejected" data, represented by R-qualifiers. The effect on availability and usability of rejected results will be evaluated.
- The use of "estimated" data will be discussed in the report. "Estimated" data are generally considered usable for all purposes. For results reported between the DL and LOQ the laboratory will apply J-flags.
- While all non-rejected data are available for use to the project team, non-detect (and attributable to blank contamination) results may not be useful if the LOD is greater than the associated PAL. In these cases, the project team will determine whether or not the laboratory would likely have detected the contaminant if present at or above the PAL (i.e., evaluation of the PAL versus the DL).
- Ten percent of hardcopy analytical data will be checked against the electronic data to identify discrepancies. This check will be performed manually. The check will verify results and qualifiers. This process is intended to identify discrepancies between the hardcopy and electronic data. If any discrepancies are identified during the ten percent verification, the laboratory will be contacted, the discrepancies will be communicated, and the laboratory will resolve the discrepancies.
- If significant deviation is evident between parent samples and their field or laboratory duplicate, the cause will be investigated. The possibility of a switched sample will be examined. Field duplicates are expected to exhibit greater deviation than laboratory duplicates. Field duplicate and laboratory duplicate reproducibility is outlined in Worksheets 12 and 28.
- Significant biases may be evident based on LCS, MS/MSD, and spiked surrogate exceedances. The third-party DV will consider QC exceedances and biases when applying qualifiers to data. The project team will consider the direction of bias when determining the usability of qualified data compared to PALs. Low biases are expected to occur more frequently than high biases. In the case of rejected non-detect data, low biases represent the inability of the laboratory to detect contaminants that may or may not be present at the site. The project team will act conservatively and understand that it is not known whether or not these compounds are present below, at, or above the PAL. High biases indicate that a result may be lower than it is reported. When high-biased data are greater than a PAL, the project team will examine the proximity of the result to the PAL to determine whether additional data are needed or if the result should simply be considered a PAL exceedance.
- After completion of the data validation, the distribution of applied data validation qualifiers will be examined to determine if there are patterns that negatively affect the usability of data. This information will be compiled into a DQE, which will be presented as an appendix to the project report.
- Data usability is not decided upon by any one individual or entity. The project team, as a whole, will decide upon the usability of the data.

SAP Worksheet #37—Usability Assessment (continued)

- Deviations from the SAP sampling and analytical protocols will be reviewed to ascertain whether or not they are significant enough to negatively affect the usability of data.
- Precision is accessed via percent difference or relative percent difference. Percent difference is typically used when one value is considered theoretically correct and relative percent difference is typically used when both values are experimental. Percent difference is calculated by taking the absolute value of the difference divided by the theoretical value. This is also expressed as

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

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

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

  where X1 and X2 are both measured values. Percent difference and relative percent difference often have upper control limits for precision.

  - Accuracy is accessed via percent recovery. This is calculated by taking the measured value divided by the theoretical value. This is also expressed as

    $$(X_2 / X_1) * 100$$

    where X1 is the theoretical value and X2 is the experimental value, both positive numbers because they are 'amounts' or concentrations. Percent recovery can be negative, such as for MS and MSD recovery, if X2 is calculated by subtracting a parent concentration from an experimental recovery. Percent recovery often has upper and lower control limits for accuracy.

  - Completeness is calculated by taking the number of available results divided by the total number of results. This is also expressed as

    $$(X_2 / X_1) * 100$$

    where X2 is the number of distinct results deemed "available for use" (not rejected) and X1 is the total number of distinct results (not excluded). Completeness is calculated for the entire data set, for each matrix, and for each combination of matrix and analysis group. If patterns of rejection are evident in the data set, completeness may also be calculated for select combinations of matrix, analysis group, and analyte or other combinations as applicable for the data quality evaluation. Completeness has a lower control limit (completeness goal) and cannot exceed 100%.

Notes:

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

References

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Figures

R:\USNAVFACENGCOM405450\VIEQUES\MAPFILES\AOC_E_GROUNDWATER_LTM_SAP\FIGURE 1 - REGIONAL LOCATION MAP.MXD CELEFTHERIADIS 2/20/2014 7:14:07 AM

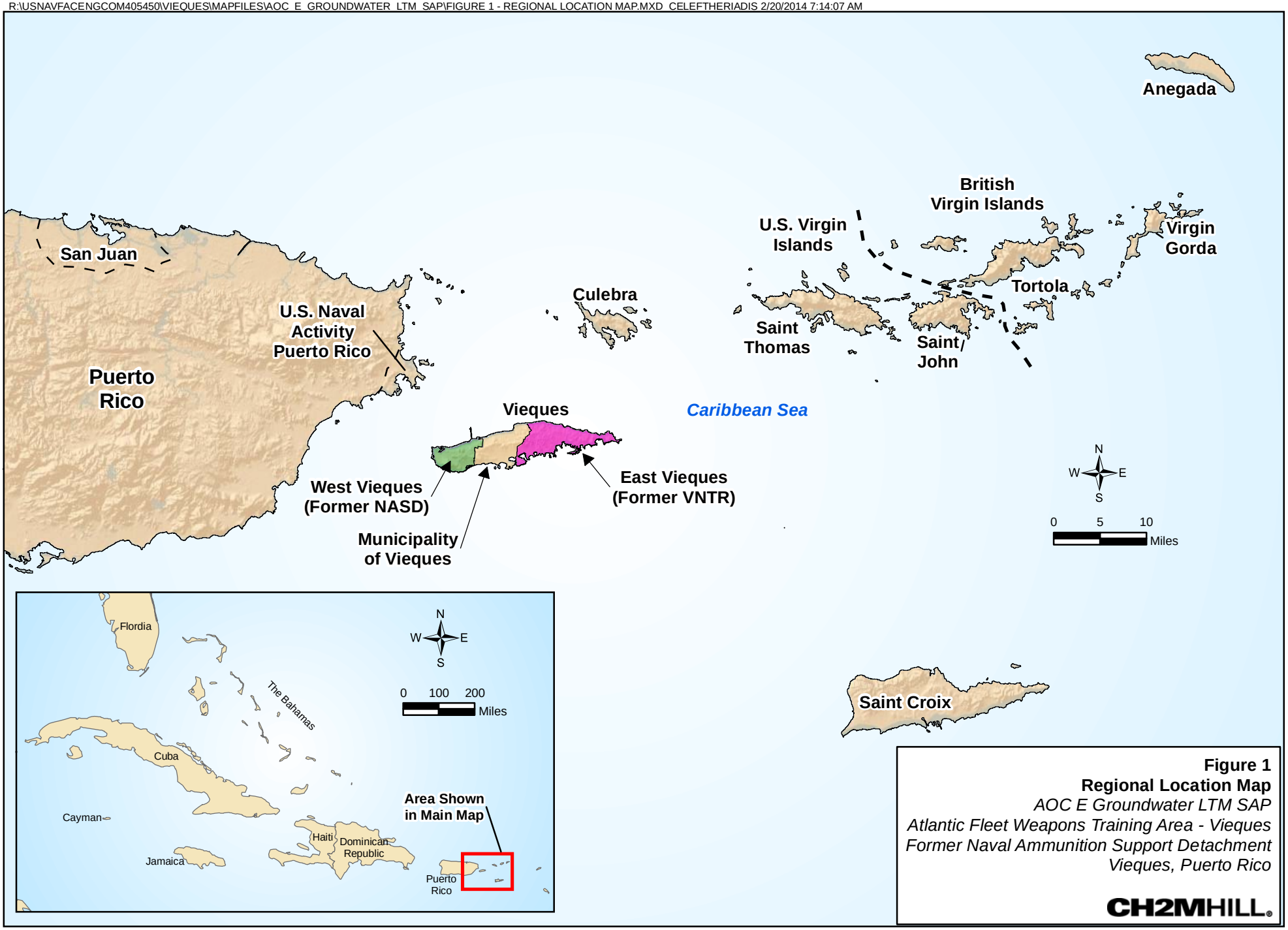
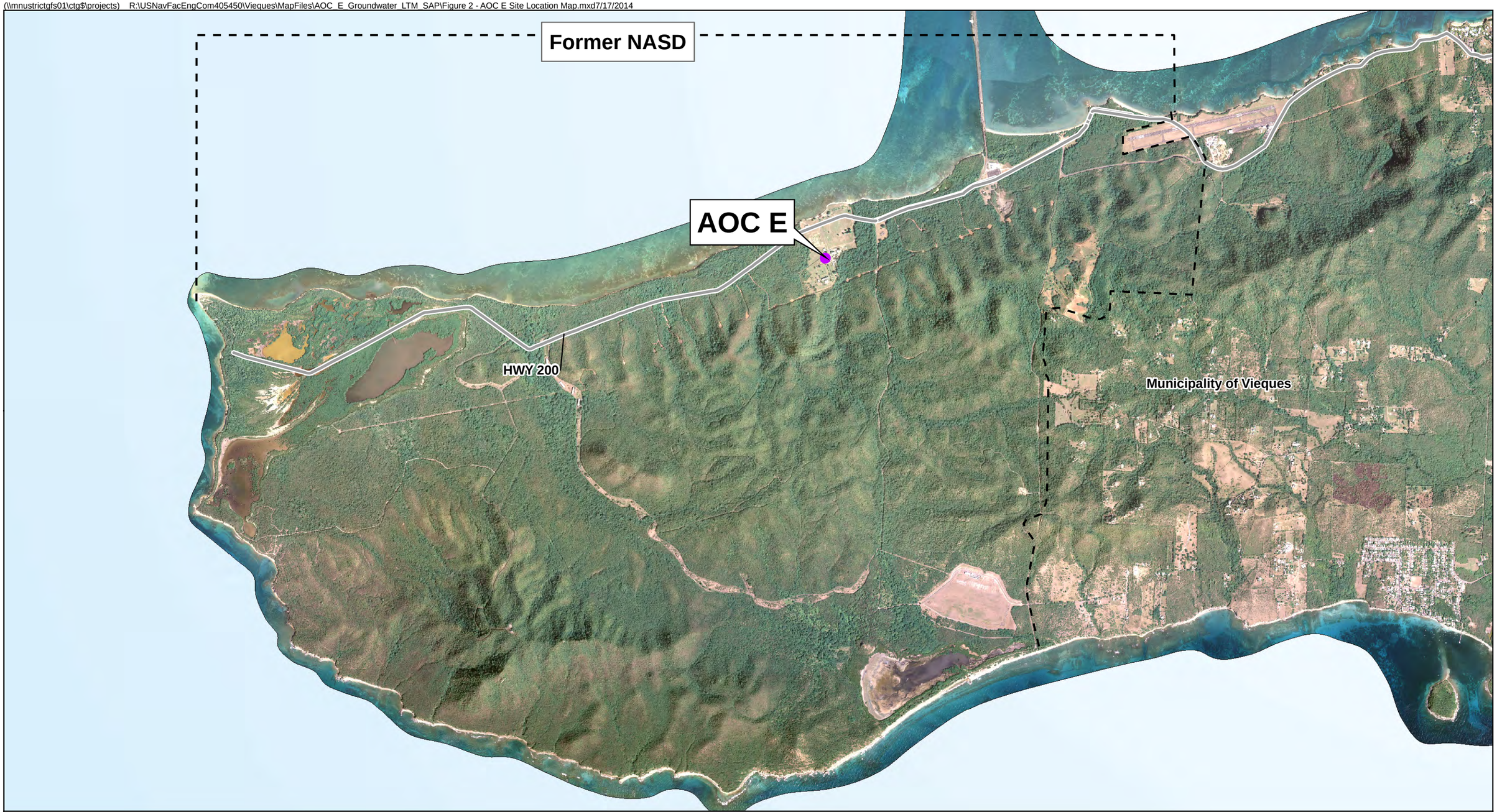


Figure 1
Regional Location Map
AOC E Groundwater LTM SAP
Atlantic Fleet Weapons Training Area - Vieques
Former Naval Ammunition Support Detachment
Vieques, Puerto Rico

CH2MHILL®

(\\mnustrictgfs01\ctg$\projects) R:\USNavFacEngCom405450\Vieques\MapFiles\AOC_E_Groundwater_LTM_SAP\Figure 2 - AOC E Site Location Map.mxd7/17/2014



Legend

Road

AOC E

N
W E
S

0 2,500 5,000
Feet

Figure 2
AOC E Site Location Map
AOC E Groundwater LTM SAP
Atlantic Fleet Weapons Training Area - Vieques
Former Naval Ammunition Support Detachment
Vieques, Puerto Rico

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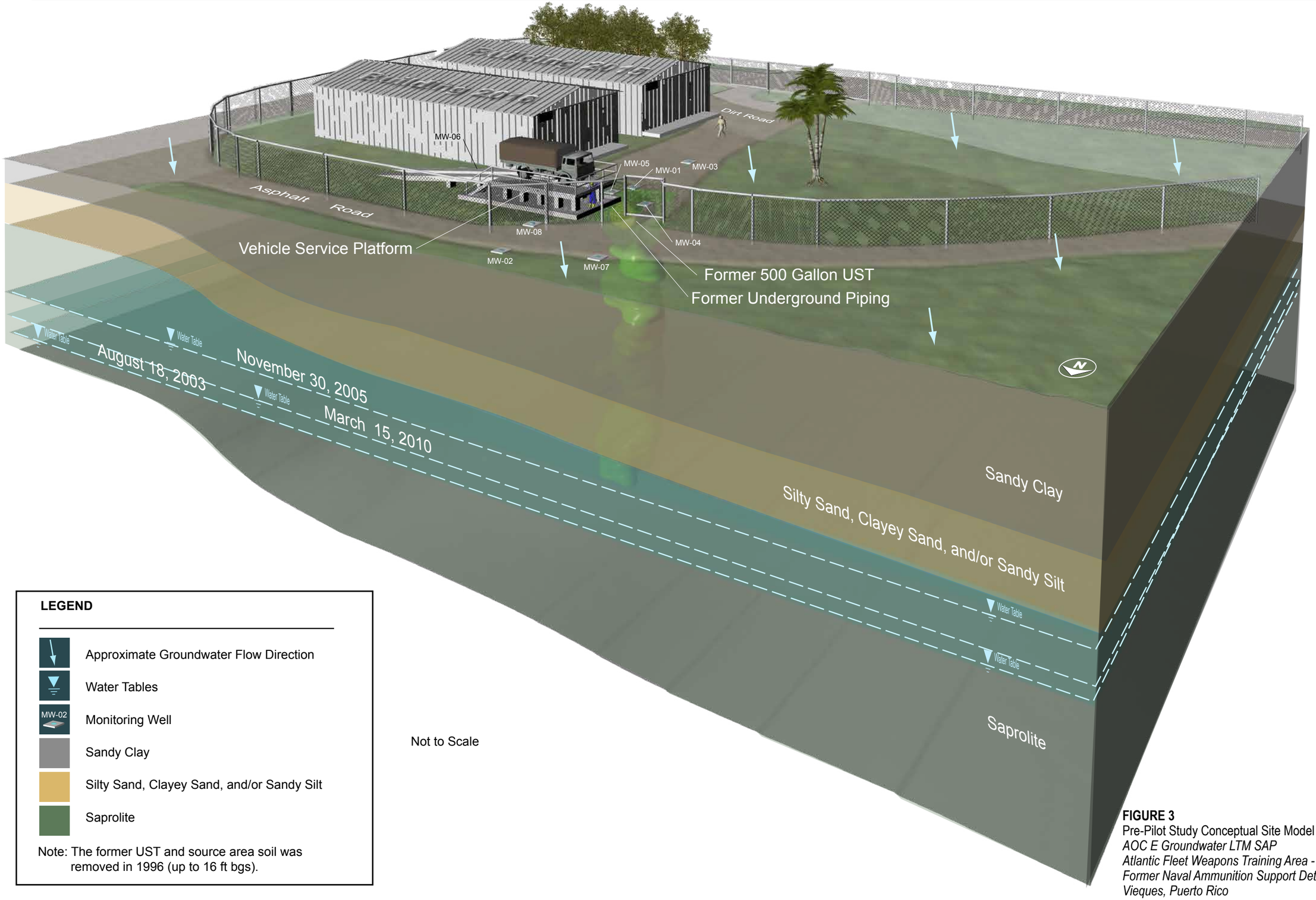


LEGEND

- Approximate Groundwater Flow Direction
- Water Tables
- MW-02 Monitoring Well
- Sandy Clay
- Silty Sand, Clayey Sand, and/or Sandy Silt
- Saprolite

Note: The former UST and source area soil was removed in 1996 (up to 16 ft bgs).

FIGURE 3
Pre-Pilot Study Conceptual Site Model
AOC E Groundwater LTM SAP
Atlantic Fleet Weapons Training Area - Vieques
Former Naval Ammunition Support Detachment
Vieques, Puerto Rico

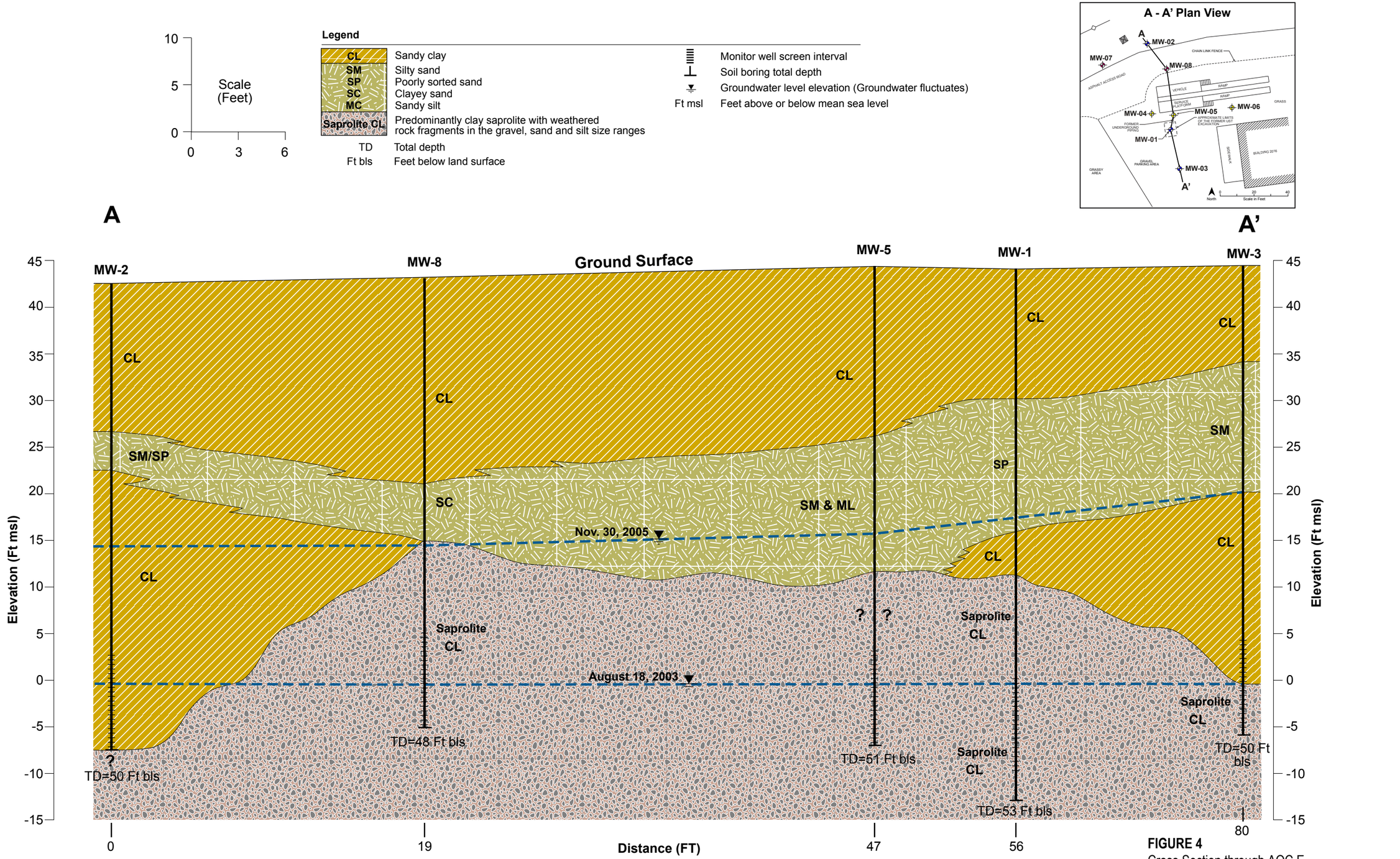
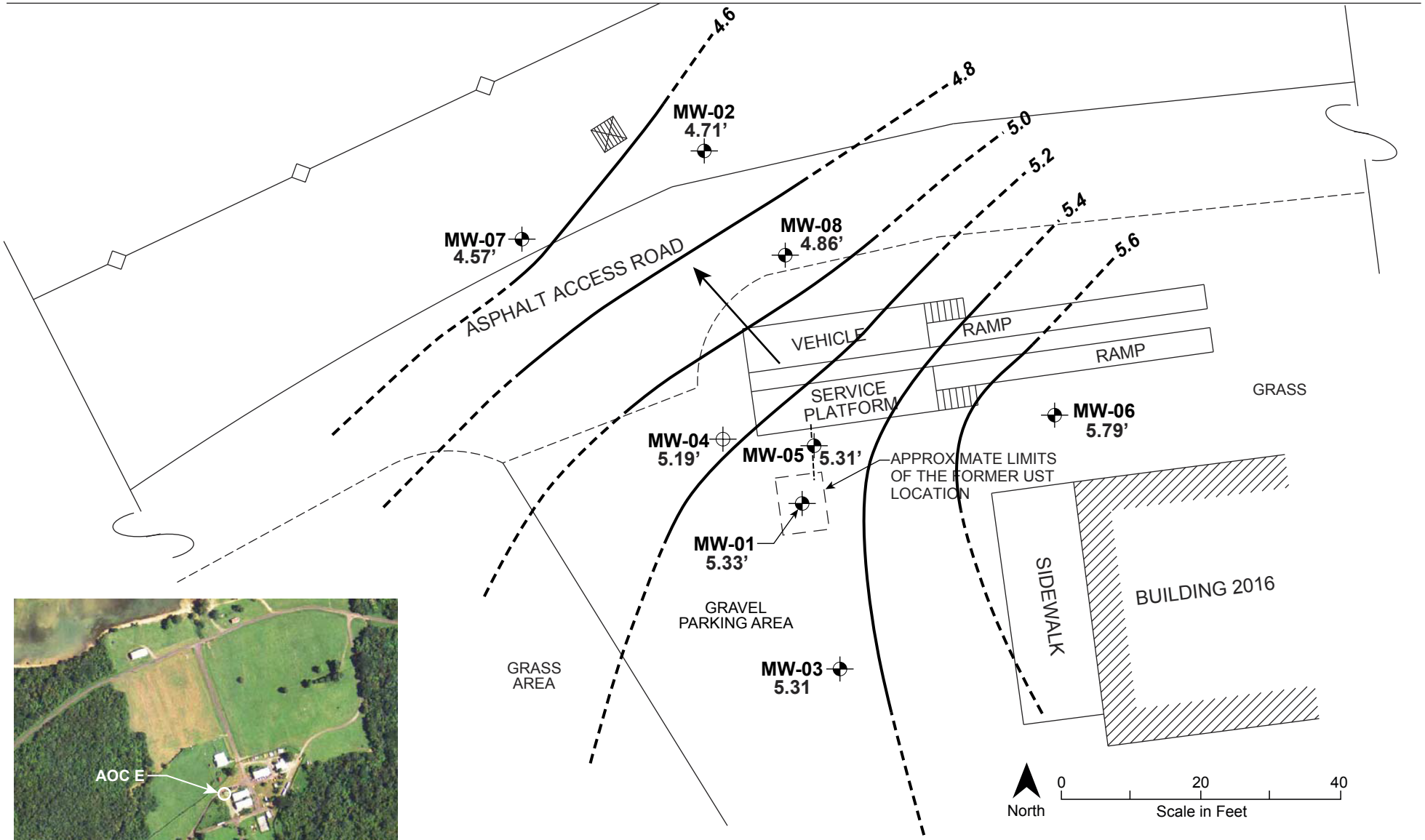


FIGURE 4
Cross Section through AOC E
AOC E Groundwater LTM SAP
Atlantic Fleet Weapons Training Area - Vieques
Former Naval Ammunition Support Detachment
Vieques, Puerto Rico

CH2MHILL



2004 Aerial Photograph

LEGEND

Estimated Direction of Groundwater Flow

5.19' Water Level, feet above mean sea level

Estimated Groundwater Contour
(March 15, 2010)
Dashed where inferred

FIGURE 5
Potentiometric Map March 15, 2010
AOC E Groundwater LTM SAP
Atlantic Fleet Weapons Training Area - Vieques
Former Naval Ammunition Support Detachment
Vieques, Puerto Rico

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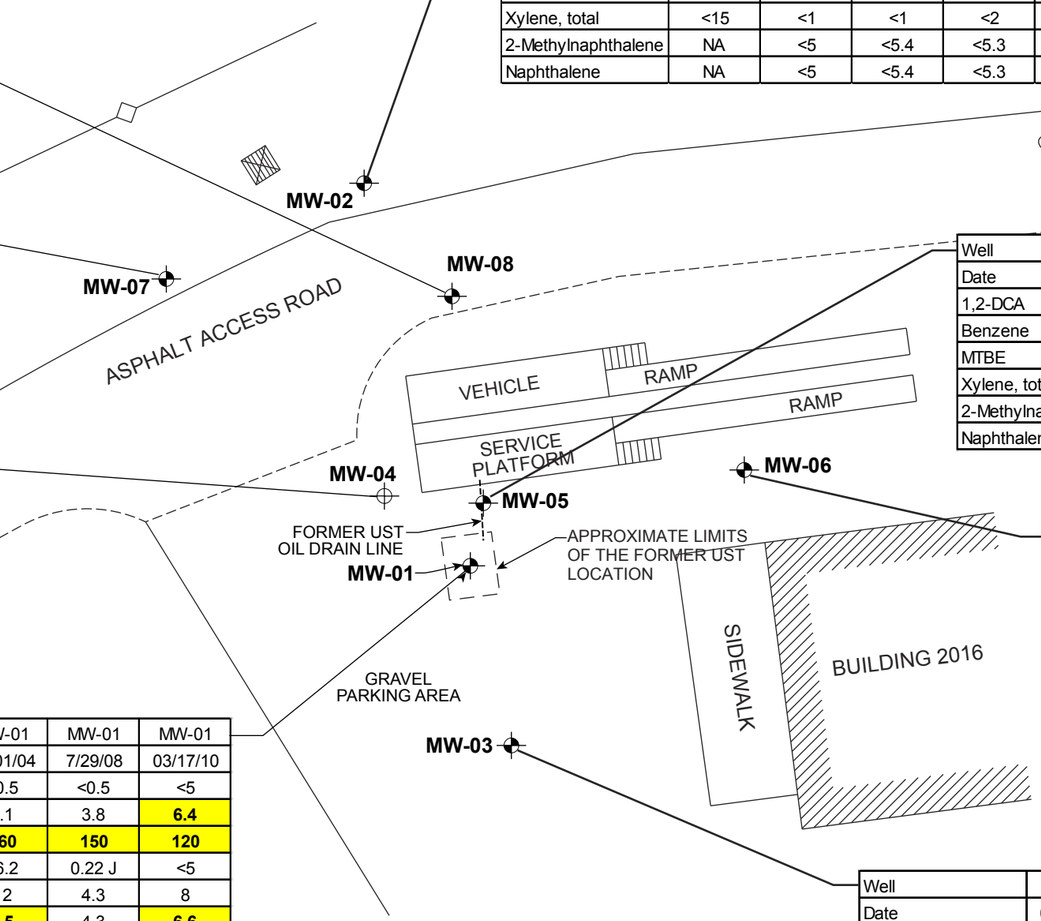
Well	MW-08	MW-08	MW-08
Date	09/08/03	08/26/04	7/27/08
1,2-DCA	<0.5	<0.5	<0.5
Benzene	<0.5	<0.5	<0.5
MTBE	<0.5	<0.5	<0.5
Xylene, total	<2	<2	<0.5
2-Methylnaphthalene	<5.2	<5.2	<0.098
Naphthalene	<5.2	<5.2	<0.098

Well	MW-02	MW-02	MW-02	MW-02	MW-02
Date	09/11/98	04/05/00	05/21/02	08/26/04	7/27/08
1,2-DCA	NA	<1	<1	<0.5	<0.5
Benzene	<5	<1	<1	<0.5	<0.5
MTBE	NA	NA	NA	<0.5	<0.5
Xylene, total	<15	<1	<1	<2	<0.5
2-Methylnaphthalene	NA	<5	<5.4	<5.3	<0.093
Naphthalene	NA	<5	<5.4	<5.3	<0.093

Well	MW-07	MW-07	MW-07
Date	05/24/02	08/26/04	7/27/08
1,2-DCA	<1	<0.5	<0.5
Benzene	<1	<0.5	<0.5
MTBE	NA	<0.5	<0.5
Xylene, total	<1	<2	<0.5
2-Methylnaphthalene	<5.8	<5	<0.11
Naphthalene	<5.8	<5	<0.11

Well	MW-05	MW-05	MW-05	MW-05	MW-05
Date	05/01/00	08/30/04	08/30/04	7/29/08	03/17/10
1,2-DCA	**32**	**7.2**	**6.4**	<0.5	<5
Benzene	**6**	0.81 J	1.2 J	**16**	4.5 J
MTBE	NA	**1,180**	**1,220**	**560**	**520**
Xylene, total	20	1 J	1.8 J	2.5	<5
2-Methylnaphthalene	14	<5.1	<5.2	16 J	5.8
Naphthalene	**15**	<5.1	<5.2	**35 J**	**13**

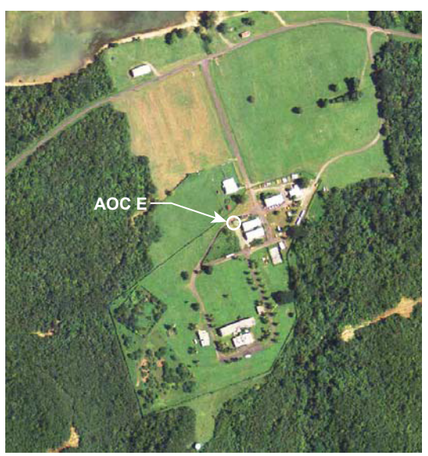
Well	MW-04	MW-04	MW-04	MW-04	MW-04
Date	04/27/00	05/21/02	08/30/04	7/28/08	03/17/10
1,2-DCA	<1	4.6	0.59	<0.5	<5
Benzene	2	0.72 J	0.21 J	<0.5	<5
MTBE	NA	NA	**234**	110	**130**
Xylene, total	0.9 J	<1	<2	<0.5	<5
2-Methylnaphthalene	<5	<5.4	<5.1	0.05 J	<1
Naphthalene	<5	<5.4	<5.1	<0.093	<1



Well	MW-06	MW-06	MW-06	MW-06
Date	04/27/00	05/20/02	08/25/04	7/28/08
1,2-DCA	<1	<1	<0.5	<0.5
Benzene	<1	<1	<0.5	<0.5
MTBE	NA	NA	<0.5	0.11 J
Xylene, total	<1	<1	<2	<0.5
2-Methylnaphthalene	<6	<5.4	<5.3	0.035 J
Naphthalene	<6	<5.4	<5.3	0.1

Well	MW-01	MW-01	MW-01	MW-01
Date	09/11/98	09/01/04	7/29/08	03/17/10
1,2-DCA	NA	<0.5	<0.5	<5
Benzene	**17**	4.1	3.8	**6.4**
MTBE	NA	**260**	**150**	**120**
Xylene, total	<15	26.2	0.22 J	<5
2-Methylnaphthalene	NA	12	4.3	8
Naphthalene	NA	**9.5**	4.3	**6.6**

Well	MW-03	MW-03	MW-03	MW-03	MW-03	MW-03
Date	09/11/98	04/05/00	05/21/02	08/25/04	7/27/08	03/16/10
1,2-DCA	NA	<1	<1	<0.5	<0.5	<5
Benzene	<5	<1	<1	<0.5	<0.5	<5
MTBE	NA	NA	NA	<0.5	<0.5	<5
Xylene, total	<15	<1	<1	<2	<0.5	<5
2-Methylnaphthalene	NA	<5	<5.6	<5.3	<0.095	<1
Naphthalene	NA	<5	<5.6	<5.3	<0.095	<1



2004 Aerial Photograph

COCs	PRG (ug/L)
1,2-DCA	3.8
Benzene	5
MTBE	120
Xylene, total	10,000
2-Methylnaphthalene	27
Naphthalene	6.1

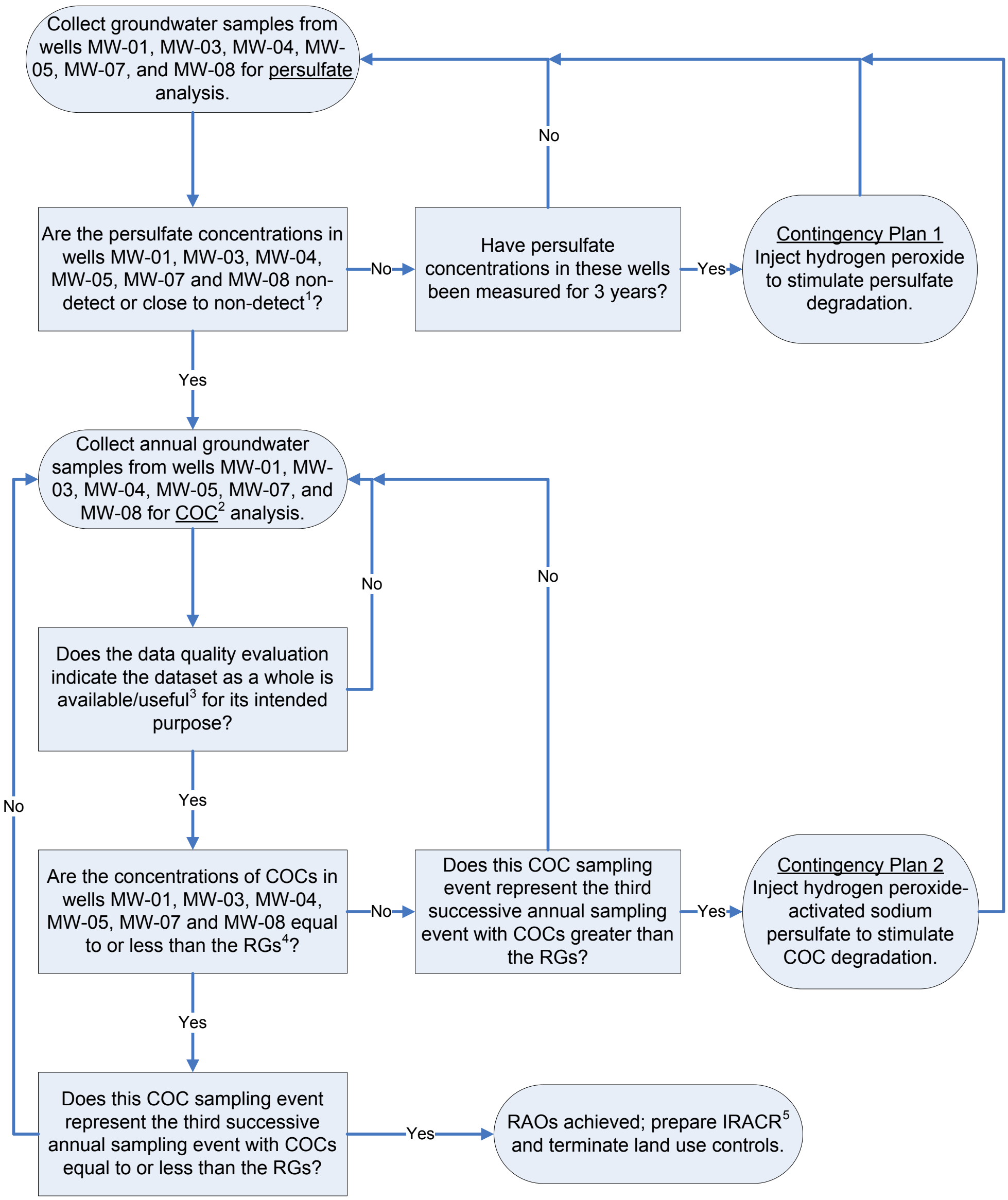
Notes:
NA - Not analyzed
< - Non-detected results (below detection limit)
J - Estimated results
All concentrations in ug/L
Bolded and hihglighted results exceed PRGs
1,2-Dichloroethane - 1,2-DCA
Methyl-tert-butyl ether - MTBE

North
0 20 40
Scale in Feet

FIGURE 6
Groundwater COC Concentrations (Prior to Pilot Study)
AOC E Groundwater LTM SAP
Atlantic Fleet Weapons Training Area - Vieques
Former Naval Ammunition Support Detachment
Vieques, Puerto Rico

CH2MHILL

ES092211083434TPA F6-GW COC Concentrations-rev4.ai



Notes:

The decision makers associated with this decision tree are the Navy, EPA, and PREQB (Vieques Technical Subcommittee).

[1] "Close to non-detect" is a subjective concentration determination that will be based on concurrence by the Vieques Technical Subcommittee

[2] Contaminants of Concern (COCs): 1,2-dichloroethane (1,2-DCA); benzene; methyl tert-butyl ether (MTBE); 2-methylnaphthalene; naphthalene; xylenes (total)

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

[4] Remediation Goals (RGs): 1,2-DCA (3.8 μg/L); benzene (5 μg/L); MTBE (120 μg/L); 2-methylnaphthalene (27 μg/L); naphthalene (6.1 μg/L); total xylenes (10,000 μg/L)

[5] IRACR = Interim Remedial Action Completion Report

Figure 7
Long-term Monitoring Decision Tree
AOC E Groundwater LTM SAP
Atlantic Fleet Weapons Training Area – Vieques
Former Naval Ammunition Support Detachment
Vieques, Puerto Rico

R:\USNAVFACENGCOM405450\VIEQUES\MAPFILES\AOC_E_GROUNDWATER_LTM_SAP\FIGURE 8 - AOC E LAND USE CONTROL BOUNDARY AND WELLS FOR LONG TERM MONITORING.MXD FCAIN 7/10/2014 4:14:00 AM

Legend

- Monitoring Well Proposed to be Monitored
- Monitoring Well Proposed to be Abandoned
- Fence
- AOC E Land Use Control Boundary

N
W E
S

0 25 50 Feet

2007 Aerial Imagery

Figure 8
AOC E Land Use Control Boundary and Wells for Long-Term Monitoring
AOC E Groundwater LTM SAP
Atlantic Fleet Weapons Training Area - Vieques
Former Naval Ammunition Support Detachment
Vieques, Puerto Rico

CH2MHILL

Attachment A
Persulfate Test Kit Instructions

Sodium Persulfate CHEMets®
0 - 7 & 7 - 70 ppm

Safety Information

Read MSDS before performing this test procedure. Wear safety glasses.

Test Procedure

1. Fill the sample cup to the 25 mL mark with the sample (fig 1).
2. Place the CHEMet ampoule in the sample cup. Snap the tip by pressing the ampoule against the side of the cup. The ampoule will fill leaving a small bubble to facilitate mixing (fig 2).
3. Mix the contents of the ampoule by inverting it several times, allowing the bubble to travel from end to end each time. Wipe all liquid from the exterior of the ampoule. Test results should be obtained **within one minute** after snapping the ampoule tip.
4. Use the appropriate comparator to determine the level of sodium persulfate in the sample. If the color of the CHEMet ampoule is between two color standards, a concentration estimate can be made.
   a. Place the CHEMet ampoule, flat end downward into the center tube of the low range comparator. Direct the top of the comparator up toward a source of bright light while viewing from the bottom. Rotate the comparator until the color standard below the CHEMet ampoule shows the closest match (fig 3).

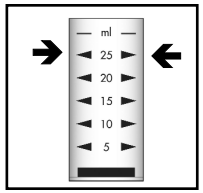


Figure 1

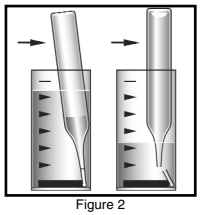


Figure 2

Figure 3

   b. Hold the high range comparator in a nearly horizontal position while standing directly beneath a bright source of light. Place the CHEMet ampoule between the color standards moving it from left to right along the comparator until the best color match is found (fig 4).

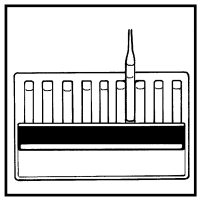


Figure 4

Test Method

The Sodium Persulfate CHEMets®[1] test method employs the ferric thiocyanate chemistry.[2] In an acidic solution, sodium persulfate oxidizes ferrous iron. The resulting ferric iron reacts with ammonium thiocyanate to form ferric thiocyanate, a red-orange colored complex, in direct proportion to the sodium persulfate concentration.

Various oxidizing agents such as hydrogen peroxide, ozone, ferric ions and cupric ions will produce high test results.

1. CHEMets is a registered trademark of CHEMetrics, Inc. U.S. Patent No. 3,634,038
2. D. F. Boltz and J. A. Howell, eds., Colorimetric Determination of Nonmetals, 2nd ed., Vol. 8, p. 304 (1978)

Reorder Information	Cat. No.
***Test Kit**, complete*	*K-7870*
***Refill**, 30 CHEMet ampoules*	*R-7870*
***Sample Cup**, 25 mL, package of six*	*A-0013*
***Comparator**, 0-7 ppm*	*C-7807*
***Comparator**, 7-70 ppm*	*C-7870*

CHEMetrics
Water Analysis Systems

CHEMetrics, Inc., 4295 Catlett Road, Calverton, VA 20138-0214 U.S.A.
Phone: (800) 356-3072; Fax: (540) 788-4856; E-Mail: orders@chemetrics.com
www.chemetrics.com
June 06, Rev. 3

Attachment B
Laboratory DoD ELAP Accreditation Letter

LABORATORY ACCREDITATION BUREAU®

Certificate of Accreditation

ISO/IEC 17025:2005 **Certificate Number L2223**

Katahdin Analytical Services, Inc.

600 Technology Way
Scarborough ME 04074

has met the requirements set forth in L-A-B's policies and procedures, all requirements of ISO/IEC 17025:2005 "General Requirements for the competence of Testing and Calibration Laboratories" and the U.S. Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP).*

The accredited lab has demonstrated technical competence to a defined "Scope of Accreditation" and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

Accreditation valid through: February 1, 2016

R. Douglas Leonard, Jr., President, COO
Laboratory Accreditation Bureau
Presented the 1st of February 2013

*See the laboratory's Scope of Accreditation for details of accredited parameters
**Laboratory Accreditation Bureau is found to be in compliance with ISO/IEC 17011:2004 and recognized by ILAC (International Laboratory Accreditation Cooperation) and NACLA (National Cooperation for Laboratory Accreditation).

LABORATORY ACCREDITATION BUREAU

Certificate # L2223

Scope of Accreditation
For
Katahdin Analytical Services, Inc.

600 Technology Way
Scarborough, ME 04074
Leslie Dimond
207-874-2400

In recognition of a successful assessment to ISO/IEC 17025:2005 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 v4.2) based on the National Environmental Laboratory Accreditation Conference Chapter 5 Quality Systems Standard (NELAC Voted Revision June 5, 2003), accreditation is granted to Katahdin Analytical Services to perform the following tests:

Accreditation granted through: February 1, 2016

Testing - Environmental

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8081B	2, 4`-DDD
GC/ECD	EPA 8081B	2, 4`-DDE
GC/ECD	EPA 8081B	2, 4`-DDT
GC/ECD	EPA 608; EPA 8081B	4, 4`-DDD
GC/ECD	EPA 608; EPA 8081B	4, 4`-DDE
GC/ECD	EPA 608; EPA 8081B	4, 4`-DDT
GC/ECD	EPA 608; EPA 8081B	Aldrin
GC/ECD	EPA 608; EPA 8081B	alpha-BHC (alpha-Hexachlorocyclohexane)
GC/ECD	EPA 8081B	Alpha-Chlordane
GC/ECD	EPA 608; EPA 8081B	beta-BHC (beta-Hexachlorocyclohexane)
GC/ECD	EPA 8081B	Cis-Nonaclor
GC/ECD	EPA 608; EPA 8081B	Chlordane (tech.)
GC/ECD	EPA 608; EPA 8081B	delta-BHC
GC/ECD	EPA 608; EPA 8081B	Dieldrin
GC/ECD	EPA 608; EPA 8081B	Endosulfan I
GC/ECD	EPA 608; EPA 8081B	Endosulfan II

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/ECD	EPA 608; EPA 8081B	Endosulfan sulfate
GC/ECD	EPA 608; EPA 8081B	Endrin
GC/ECD	EPA 608; EPA 8081B	Endrin aldehyde
GC/ECD	EPA 8081B	Endrin Ketone
GC/ECD	EPA 8081B	gamma-BHC (Lindane gamma-Hexachlorocyclohexane)
GC/ECD	EPA 8081B	gamma-Chlordane
GC/ECD	EPA 608; EPA 8081B	Heptachlor
GC/ECD	EPA 608; EPA 8081B	Heptachlor epoxide
GC/ECD	EPA 8081B	Hexachlorobenzene
GC/ECD	EPA 8081B	Methoxychlor
GC/ECD	EPA 8081B	Mirex
GC/ECD	EPA 8081B	Oxychlordane
GC/ECD	EPA 608; EPA 8081B	Toxaphene (Chlorinated camphene)
GC/ECD	EPA 8081B	trans-Nonachlor
GC/ECD	EPA 608; EPA 8082A	Aroclor-1016 (PCB-1016)
GC/ECD	EPA 608; EPA 8082A	Aroclor-1221 (PCB-1221)
GC/ECD	EPA 608; EPA 8082A	Aroclor-1232 (PCB-1232)
GC/ECD	EPA 608; EPA 8082A	Aroclor-1242 (PCB-1242)
GC/ECD	EPA 608; EPA 8082A	Aroclor-1248 (PCB-1248)
GC/ECD	EPA 608; EPA 8082A	Aroclor-1254 (PCB-1254)
GC/ECD	EPA 608; EPA 8082A	Aroclor-1260 (PCB-1260)
GC/ECD	EPA 8082A MOD	Aroclor-1262 (PCB-1262)
GC/ECD	EPA 8082A MOD	Aroclor-1268 (PCB-1268)
GC/ECD	EPA 8082A	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)
GC/ECD	EPA 8082A	2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ 195)
GC/ECD	EPA 8082A	2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)
GC/ECD	EPA 8082A	2,2',3,3',4,4'-Hexachlorobiphenyl (BZ 128)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 5, 5'-Heptachlorobiphenyl (BZ 180)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 5', 6-Heptachlorobiphenyl (BZ 183)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 5-Hexachlorobiphenyl (BZ 138)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 6, 6'-Heptachlorobiphenyl (BZ 184)

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8082A	2, 2', 3, 4', 5, 5', 6-Heptachlorobiphenyl (BZ 187)
GC/ECD	EPA 8082A	2, 2', 3, 4, 5'-Pentachlorobiphenyl (BZ 87)
GC/ECD	EPA 8082A	2, 2', 3, 5'-Tetrachlorobiphenyl (BZ 44)
GC/ECD	EPA 8082A	2, 2', 4, 4', 5, 5'-Hexachlorobiphenyl (BZ 153)
GC/ECD	EPA 8082A	2, 2', 4, 5, 5'-Pentachlorobiphenyl (BZ 101)
GC/ECD	EPA 8082A	2, 2', 4, 5-Tetrachlorobiphenyl (BZ 48)
GC/ECD	EPA 8082A	2, 2', 4, 5’-Tetrachlorobiphenyl (BZ 49)
GC/ECD	EPA 8082A	2, 2', 5, 5'-Tetrachlorobiphenyl (BZ 52)
GC/ECD	EPA 8082A	2, 2', 5-Trichlorobiphenyl (BZ 18)
GC/ECD	EPA 8082A	2, 3, 3', 4, 4', 5-Hexachlorobiphenyl (BZ 156)
GC/ECD	EPA 8082A	2, 3, 3', 4, 4', 5'-Hexachlorobiphenyl (BZ 157)
GC/ECD	EPA 8082A	2, 3, 3', 4, 4'-Pentachlorobiphenyl (BZ 105)
GC/ECD	EPA 8082A	2, 3, 3’, 4, 4’, 5, 5’-Heptachlorobiphenyl (BZ 189)
GC/ECD	EPA 8082A	2, 3', 4, 4', 5, 5'-Hexachlorobiphenyl (BZ 167)
GC/ECD	EPA 8082A	2, 3', 4, 4', 5-Pentachlorobiphenyl (BZ 118)
GC/ECD	EPA 8082A	2, 3', 4, 4',5’-Pentachlorobiphenyl (BZ 123)
GC/ECD	EPA 8082A	2, 3', 4, 4'-Tetrachlorobiphenyl (BZ 66)
GC/ECD	EPA 8082A	2, 3, 4, 4’, 5-Pentachlorobiphenyl (BZ 114)
GC/ECD	EPA 8082A	2, 4, 4'-Trichlorobiphenyl (BZ 28)
GC/ECD	EPA 8082A	2, 4'-Dichlorobiphenyl (BZ 8)
GC/ECD	EPA 8082A	3, 3', 4, 4', 5, 5'-Hexachlorobiphenyl (BZ 169)
GC/ECD	EPA 8082A	3, 3', 4, 4', 5-Pentachlorobiphenyl (BZ 126)
GC/ECD	EPA 8082A	3, 3', 4, 4'-Tetrachlorobiphenyl (BZ 77)
GC/ECD	EPA 8082A	3, 4, 4’, 5-Tetrachlorobiphenyl (BZ 81)
GC/ECD	EPA 8082A	Decachlorobiphenyl (BZ 209)
GC/ECD	EPA 8151A	2, 4, 5-T
GC/ECD	EPA 8151A	2, 4-D
GC/ECD	EPA 8151A	2, 4-DB
GC/ECD	EPA 8151A	Dalapon
GC/ECD	EPA 8151A	Dicamba
GC/ECD	EPA 8151A	Dichloroprop

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8151A	Dinoseb
GC/ECD	EPA 8151A	MCPA
GC/ECD	EPA 8151A	MCPP
GC/ECD	EPA 8151A	Pentachlorophenol
GC/ECD	EPA 8151A	Silvex (2, 4, 5-TP)
GC/FID	EPA 8015C/D MOD	Diesel range organics (DRO)
GC/FID	EPA 8015C/D MOD	Total Petroleum Hydrocarbon (TPH)
GC/FID	EPA 8015C/D MOD	Gasoline range organics (GRO)
GC/FID/PID	MA DEP VPH	Volatile Organic Hydrocarbons
GC/FID	MA DEP EPH	Extractable Petroleum Hydrocarbons
GC/FID	CT ETPH	Total Petroleum Hydrocarbons
GC/FID	TNRCC Method 1005	Total Petroleum Hydrocarbons
GC/FID	FL-PRO	Petroleum Range Organics
GC/ECD	EPA 8011; EPA 504	1, 2-Dibromoethane (EDB)
GC/ECD	EPA 8011; EPA 504	1, 2-Dibromo-3-chloropropane
GC/FID	RSK-175	Methane Ethane Ethene
GC/MS	EPA 8260B/C; EPA 524.2	1, 1, 1, 2-Tetrachloroethane
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	1, 1, 1-Trichloroethane
GC/MS	EPA 624; 8260B/C; EPA 524.2	1, 1, 2, 2-Tetrachloroethane
GC/MS	EPA 8260B/C	1,1,2-Trichloro-1,2,2-trifluoroethane
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	1, 1, 2-Trichloroethane
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	1, 1-Dichloroethane
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	1, 1-Dichloroethene
GC/MS	EPA 8260B/C; EPA 524.2	1, 1-Dichloropropene
GC/MS	EPA 8260B/C; EPA 524.2	1, 2, 3-Trichlorobenzene
GC/MS	EPA 8260B/C; EPA 524.2	1, 2, 3-Trichloropropane
GC/MS	EPA 8260B/C	1,2,3-Trimethylbenzene
GC/MS	EPA 8260B/C; EPA 524.2	1, 2, 4-Trichlorobenzene
GC/MS	EPA 8260B/C; EPA 524.2	1, 2, 4-Trimethylbenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/C; EPA 524.2	1, 2-Dibromo-3-chloropropane
GC/MS	EPA 8260B/C; EPA 524.2	1, 2-Dibromoethane (EDB)
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	1, 2-Dichlorobenzene
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	1, 2-Dichloroethane
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	1, 2-Dichloropropane
GC/MS	EPA 8260B/C	1,3,5-Trichlorobenzene
GC/MS	EPA 8260B/C; EPA 524.2	1, 3, 5-Trimethylbenzene
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	1, 3-Dichlorobenzene
GC/MS	EPA 8260B/C; EPA 524.2	1, 3-Dichloropropane
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	1, 4-Dichlorobenzene
GC/MS	EPA 8260B/C	1, 4-Dioxane
GC/MS	EPA 8260B/C	1-Chlorohexane
GC/MS	EPA 8260B/C; EPA 524.2	2, 2-Dichloropropane
GC/MS	EPA 8260B/C; EPA 524.2	2-Butanone
GC/MS	EPA 624; EPA 8260B/C	2-Chloroethyl vinyl ether
GC/MS	EPA 8260B/C; EPA 524.2	2-Chlorotoluene
GC/MS	EPA 8260B/C; EPA 524.2	2-Hexanone
GC/MS	EPA 8260B/C; EPA 524.2	4-Chlorotoluene
GC/MS	EPA 8260B/C; EPA 524.2	4-Methyl-2-pentanone
GC/MS	EPA 8260B/C; EPA 524.2	Acetone
GC/MS	EPA 8260B/C	Acetonitrile
GC/MS	EPA 624; EPA 8260B/C	Acrolein
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	Acrylonitrile
GC/MS	EPA 8260B/C; EPA 524.2	Allyl chloride
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	Benzene
GC/MS	EPA 8260B/C	Benzyl chloride
GC/MS	EPA 8260B/C; EPA 524.2	Bromobenzene
GC/MS	EPA 8260B/C; EPA 524.2	Bromochloromethane

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	Bromodichloromethane
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	Bromoform
GC/MS	EPA 8260B/C; EPA 524.2	Carbon disulfide
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	Carbon tetrachloride
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	Chlorobenzene
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	Chloroethane
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	Chloroform
GC/MS	EPA 8260B/C	Chloroprene
GC/MS	EPA 8260B/C; EPA 524.2	cis-1, 2-Dichloroethene
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	cis-1, 3-Dichloropropene
GC/MS	EPA 8260B/C	Cis-1,4-Dichloro-2-butene
GC/MS	EPA 8260B/C	Cyclohexane
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	Dibromochloromethane
GC/MS	EPA 8260B/C; EPA 524.2	Dibromomethane
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	Dichlorodifluoromethane
GC/MS	EPA 8260B/C; EPA 524.2	Diethyl ether
GC/MS	EPA 8260B/C	Di-isopropylether
GC/MS	EPA 8260B/C; EPA 524.2	Ethyl methacrylate
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	Ethylbenzene
GC/MS	EPA 8260B/C	Ethyl-t-butylether
GC/MS	EPA 8260B/C; EPA 524.2	Hexachlorobutadiene
GC/MS	EPA 8260B/C	Iodomethane
GC/MS	EPA 8260B/C	Isobutyl alcohol
GC/MS	EPA 8260B/C	Isopropyl alcohol
GC/MS	EPA 8260B/C; EPA 524.2	Isopropyl benzene
GC/MS	EPA 8260B/C; EPA 524.2	m p-xylenes
GC/MS	EPA 8260B/C	Methyl acetate

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/C; EPA 524.2	Methacrylonitrile
GC/MS	EPA 624 / 8260B,C	Methyl bromide (Bromomethane)
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	Methyl chloride (Chloromethane)
GC/MS	EPA 8260B/C; EPA 524.2	Methyl methacrylate
GC/MS	EPA 8260B/C; EPA 524.2	Methyl tert-butyl ether
GC/MS	EPA 8260B/C	Methylcyclohexane
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	Methylene chloride
GC/MS	EPA 8260B/C; EPA 524.2	Naphthalene
GC/MS	EPA 8260B/C; EPA 524.2	n-Butylbenzene
GC/MS	EPA 8260B/C; EPA 524.2	n-Propylbenzene
GC/MS	EPA 8260B/C; EPA 524.2	o-Xylene
GC/MS	EPA 8260B/C	Pentachloroethane
GC/MS	EPA 8260B/C; EPA 524.2	p-Isopropyltoluene
GC/MS	EPA 8260B/C; EPA 524.2	Propionitrile
GC/MS	EPA 8260B/C; EPA 524.2	sec-butylbenzene
GC/MS	EPA 8260B/C; EPA 524.2	Styrene
GC/MS	EPA 8260B/C	t-Amylmethylether
GC/MS	EPA 8260B/C; EPA 524.2	tert-Butyl alcohol
GC/MS	EPA 8260B/C	tert-Butylbenzene
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	Tetrachloroethene (Perchloroethylene)
GC/MS	EPA 8260B/C; EPA 524.2	Tetrahydrofuran
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	Toluene
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	trans-1, 2-Dichloroethylene
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	trans-1, 3-Dichloropropylene
GC/MS	EPA 8260B/C; EPA 524.2	trans-1, 4-Dichloro-2-butuene
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	Trichloroethene (Trichloroethylene)
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	Trichlorofluoromethane
GC/MS	EPA 8260B/C	Vinyl acetate

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 624; EPA 8260B/C; EPA 524.2	Vinyl chloride
GC/MS	EPA 624 / 8260B,C	Xylene
GC/MS	EPA 8260B/C SIM	1,1,1,2-Tetrachloroethane
GC/MS	8260B, C SIM	1,1,1-Trichloroethane
GC/MS	EPA 8260B/C SIM	1,1,2,2-Tetrachloroethane
GC/MS	EPA 8260B/C SIM	1, 1, 2-Trichloroethane
GC/MS	EPA 8260B/C SIM	1,2,3-Trichloropropane
GC/MS	EPA 8260B/C SIM	1,1-Dichloroethane
GC/MS	EPA 8260B/C SIM	1,1-Dichloroethene
GC/MS	EPA 8260B/C SIM	1,2,4-Trichlorobenzene
GC/MS	EPA 8260B/C SIM	1,2,4-Trimethylbenzene
GC/MS	EPA 8260B/C SIM	1,2-Dibromo-3-chloropropane
GC/MS	EPA 8260B/C SIM	1,2-Dibromoethane
GC/MS	EPA 8260B/C SIM	1,2-Dichlorobenzene
GC/MS	EPA 8260B/C SIM	1,2-Dichloroethane
GC/MS	EPA 8260B/C SIM	1,2-Dichloropropane
GC/MS	EPA 8260B/C SIM	1,3-Dichlorobenzene
GC/MS	EPA 8260B/C SIM	1,3-Dichloropropane
GC/MS	EPA 8260B/C SIM	1,4-Dichlorobenzene
GC/MS	EPA 8260B/C SIM	2-Hexanone
GC/MS	EPA 8260B/C SIM	4-Methyl-2-pentanone
GC/MS	EPA 8260B/C SIM	Benzene
GC/MS	EPA 8260B/C SIM	Bromodichloromethane
GC/MS	EPA 8260B/C SIM	Carbon Tetrachloride
GC/MS	EPA 8260B/C SIM	Chloroform
GC/MS	EPA 8260B/C SIM	Chloromethane
GC/MS	EPA 8260B/C SIM	cis-1,2-Dichloroethene
GC/MS	EPA 8260B/C SIM	cis-1,3-Dichloropropene
GC/MS	EPA 8260B/C SIM	Dibromochloromethane
GC/MS	EPA 8260B/C SIM	Ethylbenzene
GC/MS	EPA 8260B/C SIM	Isopropylbenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/C SIM	Hexachlorobutadiene
GC/MS	EPA 8260B/C SIM	Methylcyclohexane
GC/MS	EPA 8260B/C SIM	m,p-Xylene
GC/MS	EPA 8260B/C SIM	o-Xylene
GC/MS	EPA 8260B/C SIM	Tetrachloroethene
GC/MS	EPA 8260B/C SIM	trans-1,2-Dichloroethene
GC/MS	EPA 8260B/C SIM	Trans-1,3-Dichloropropene
GC/MS	EPA 8260B/C SIM	Trichloroethene
GC/MS	EPA 8260B/C SIM	Trichlorofluoromethane
GC/MS	EPA 8260B/C SIM	Vinyl Chloride
GC/MS	EPA 8260B/C SIM	Xylenes (total)
GC/MS	EPA 8270C/D	1, 2, 4, 5-Tetrachlorobenzene
GC/MS	EPA 625; EPA 8270C/D	1, 2, 4-Trichlorobenzene
GC/MS	EPA 625; EPA 8270C/D	1, 2-Dichlorobenzene
GC/MS	EPA 8270C/D	1, 2-Diphenylhydrazine
GC/MS	EPA 8270C/D	1, 3, 5-Trinitrobenzene
GC/MS	EPA 625; EPA 8270C/D	1, 3-Dichlorobenzene
GC/MS	EPA 8270C/D	1, 3-Dinitrobenzene
GC/MS	EPA 625; EPA 8270C/D	1, 4-Dichlorobenzene
GC/MS	EPA 8270C/D	1, 4-Dioxane
GC/MS	EPA 8270C/D	1, 4-Naphthoquinone
GC/MS	EPA 8270C/D	1, 4-Phenylenediamine
GC/MS	EPA 8270C/D	1-Chloronaphthalene
GC/MS	EPA 8270C/D	1-Methylnaphthalene
GC/MS	EPA 8270C/D	1-Naphthylamine
GC/MS	EPA 8270C/D	2, 3, 4, 6-Tetrachlorophenol
GC/MS	EPA 8270C/D	2, 4, 5-Trochlorophenol
GC/MS	EPA 625; EPA 8270C/D	2, 4, 6-Trichlorophenol
GC/MS	EPA 625; EPA 8270C/D	2, 4-Dichlorophenol
GC/MS	EPA 625; EPA 8270C/D	2, 4-Dimethylphenol
GC/MS	EPA 625; EPA 8270C/D	2, 4-Dinitrophenol

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 625; EPA 8270C/D	2, 4-Dinitrotoluene (2, 4-DNT)
GC/MS	EPA 8270C/D	2, 6-Dichlorophenol
GC/MS	EPA 625; EPA 8270C/D	2, 6-Dinitrotoluene (2, 6-DNT)
GC/MS	EPA 8270C/D	2-Acetylaminofluorene
GC/MS	EPA 625; EPA 8270C/D	2-Chloronaphthalene
GC/MS	EPA 625; EPA 8270C/D	2-Chlorophenol
GC/MS	EPA 625; EPA 8270C/D	2-Methyl-4 6-dinitrophenol
GC/MS	EPA 8270C/D	2-Methylnaphthalene
GC/MS	EPA 8270C/D	2-Methylphenol
GC/MS	EPA 8270C/D	2-Naphthylamine
GC/MS	EPA 8270C/D	2-Nitroaniline
GC/MS	EPA 625; EPA 8270C/D	2-Nitrophenol
GC/MS	EPA 8270C/D	2-Picoline
GC/MS	EPA 8270C/D	3-Methylcholanthrene
GC/MS	EPA 8270C/D	3-Nitroaniline
GC/MS	EPA 8270C/D	4-Aminobiphenyl
GC/MS	EPA 625; EPA 8270C/D	4-Bromophenyl phenyl ether
GC/MS	EPA 625; EPA 8270C/D	4-Chloro-3-methylphenol
GC/MS	EPA 8270C/D	4-Chloroaniline
GC/MS	EPA 625; EPA 8270C/D	4-Chlorophenyl phenylether
GC/MS	EPA 8270C/D	4-Dimethyl aminoazobenzene
GC/MS	EPA 8270C/D	3, 4-Methylphenol
GC/MS	EPA 8270C/D	4-Nitroaniline
GC/MS	EPA 625; EPA 8270C/D	4-Nitrophenol
GC/MS	EPA 8270C/D	4-Nitroquinoline-1-oxide
GC/MS	EPA 8270C/D	5-Nitro-o-toluidine
GC/MS	EPA 8270C/D	7, 12-Dimethylbenz(a)anthracene
GC/MS	EPA 8270C/D	a a-Dimethylphenethylamine
GC/MS	EPA 625; EPA 8270C/D	Acenaphthene
GC/MS	EPA 625; EPA 8270C/D	Acenaphthylene
GC/MS	EPA 8270C/D	Acetophenone

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/D	Aniline
GC/MS	EPA 625; EPA 8270C/D	Anthracene
GC/MS	EPA 8270C/D	Aramite
GC/MS	EPA 8270C/D	Atrazine
GC/MS	EPA 8270C/D	Azobenzene
GC/MS	EPA 8270C/D	Benzaldehyde
GC/MS	EPA 625; EPA 8270C/D	Benzidine
GC/MS	EPA 625; EPA 8270C/D	Benzo(a)anthracene
GC/MS	EPA 625; EPA 8270C/D	Benzo(a)pyrene
GC/MS	EPA 625; EPA 8270C/D	Benzo(b)fluoranthene
GC/MS	EPA 625; EPA 8270C/D	Benzo(g h i)perylene
GC/MS	EPA 625; EPA 8270C/D	Benzo(k)fluoranthene
GC/MS	EPA 8270C/D	Benzoic Acid
GC/MS	EPA 8270C/D	Benzyl alcohol
GC/MS	EPA 8270C/D	1,1-Biphenyl
GC/MS	EPA 625; EPA 8270C/D	bis(2-Chloroethoxy)methane
GC/MS	EPA 625; EPA 8270C/D	bis(2-Chloroethyl) ether
GC/MS	EPA 625; EPA 8270C/D	bis(2-Chloroisopropyl) ether (2, 2`-Oxybis(1-chloropropane)
GC/MS	EPA 625; EPA 8270C/D	bis(2-Ethylhexyl)adipate
GC/MS	EPA 625; EPA 8270C/D	bis(2-Ethylhexyl) phthalate (DEHP)
GC/MS	EPA 625; EPA 8270C/D	Butyl benzyl phthalate
GC/MS	EPA 8270C/D	Caprolactam
GC/MS	EPA 8270C/D	Carbazole
GC/MS	EPA 8270C/D	Chlorobenzilate
GC/MS	EPA 625; EPA 8270C/D	Chrysene
GC/MS	EPA 8270C/D	Diallate
GC/MS	EPA 8270C/D	Dibenzo(a,j)acridine
GC/MS	EPA 625; EPA 8270C/D	Dibenz(a h)anthracene
GC/MS	EPA 8270C/D	Dibenzofuran
GC/MS	EPA 8270C/D	Diethyladipate
GC/MS	EPA 625; EPA 8270C/D	Diethyl phthalate

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/D	Dimethoate
GC/MS	EPA 625; EPA 8270C/D	Dimethyl phthalate
GC/MS	EPA 625; EPA 8270C/D	Di-n-butyl phthalate
GC/MS	EPA 625; EPA 8270C/D	Di-n-octyl phthalate
GC/MS	EPA 8270C/D	Dinoseb
GC/MS	EPA 8270C/D	Disulfoton
GC/MS	EPA 8270C/D	Ethyl methanesulfonate
GC/MS	EPA 8270C/D	Ethyl parathion
GC/MS	EPA 8270C/D	Ethyl methacrylate
GC/MS	EPA 8270C/D	Famfur
GC/MS	EPA 625; EPA 8270C/D	Fluoranthene
GC/MS	EPA 625; EPA 8270C/D	Fluorene
GC/MS	EPA 625; EPA 8270C/D	Hexachlorobenzene
GC/MS	EPA 625; EPA 8270C/D	Hexachlorobutadiene
GC/MS	EPA 625; EPA 8270C/D	Hexachlorocyclopentadiene
GC/MS	EPA 625; EPA 8270C/D	Hexachloroethane
GC/MS	EPA 8270C/D	Hexachlorophene
GC/MS	EPA 8270C/D	Hexachloropropene
GC/MS	EPA 625; EPA 8270C/D	Indeno(1, 2, 3-cd)pyrene
GC/MS	EPA 8270C/D	Isodrin
GC/MS	EPA 625; EPA 8270C/D	Isophorone
GC/MS	EPA 8270C/D	Isosafrole
GC/MS	EPA 8270C/D	Kepone
GC/MS	EPA 8270C/D	Methapyriline
GC/MS	EPA 8270C/D	Methy methanesulfonate
GC/MS	EPA 8270C/D	Methyl parathion
GC/MS	EPA 625; EPA 8270C/D	Naphthalene
GC/MS	EPA 625; EPA 8270C/D	Nitrobenzene
GC/MS	EPA 8270C/D	Nitroquinoline-1-oxide
GC/MS	EPA 8270C/D	n-Nitrosodiethylamine
GC/MS	EPA 625; EPA 8270C/D	n-Nitrosodimethylamine

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/D	n-Nitroso-di-n-butylamine
GC/MS	EPA 625; EPA 8270C/D	n-Nitrosodi-n-propylamine
GC/MS	EPA 625; EPA 8270C/D	n-Nitrosodiphenylamine
GC/MS	EPA 8270C/D	n-Nitrosomethylethylamine
GC/MS	EPA 8270C/D	n-Nitrosomorpholine
GC/MS	EPA 8270C/D	n-Nitrosopiperidine
GC/MS	EPA 8270C/D	n-Nitrosopyrrolidine
GC/MS	EPA 8270C/D	O,O,O-Triethyl phosphorothioate
GC/MS	EPA 8270C/D	o,o-Diethyl o-2pyrazinyl phosphorothioate
GC/MS	EPA 8270C/D	o-Toluidine
GC/MS	EPA 8270C/D	Pentachlorobenzene
GC/MS	EPA 8270C/D	Pentachloronitrobenzene
GC/MS	EPA 625; EPA 8270C/D	Pentachlorophenol
GC/MS	EPA 8270C/D	Phenacetin
GC/MS	EPA 625; EPA 8270C/D	Phenanthrene
GC/MS	EPA 625; EPA 8270C/D	Phenol
GC/MS	EPA 8270C/D	Phorate
GC/MS	EPA 8270C/D	Pronamide
GC/MS	EPA 625; EPA 8270C/D	Pyrene
GC/MS	EPA 8270C/D	Pyridine
GC/MS	EPA 8270C/D	Safrole
GC/MS	EPA 8270C/D	Sulfotepp
GC/MS	EPA 8270C/D	Thionazin
GC/MS	EPA 625; EPA 8270C/D	3, 3’-Dichlorobenzidine
GC/MS	EPA 8270C/D	3, 3’-Dimethylbenzidine
GC/MS	EPA 8270C/D SIM	1,1'-Biphenyl
GC/MS	EPA 8270C/D SIM	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 8270C/D SIM	1,4-Dioxane
GC/MS	EPA 8270C/D SIM	1-Methylnaphthalene
GC/MS	EPA 8270C/D SIM	2,2'-Oxybis(1-chloropropane
GC/MS	EPA 8270C/D SIM	2,3,4,6-Tetrachlorophenol

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/D SIM	2,4,5-Trichlorophenol
GC/MS	EPA 8270C/D SIM	2,4,6-Trichlorophenol
GC/MS	EPA 8270C/D SIM	2,4-Dichlorophenol
GC/MS	EPA 8270C/D SIM	2,4-Dimethylphenol
GC/MS	EPA 8270C/D SIM	2,4-Dinitrophenol
GC/MS	EPA 8270C/D SIM	2,4-Dinitrotoluene
GC/MS	EPA 8270C/D SIM	2,6-Dinitrotoluene
GC/MS	EPA 8270C/D SIM	2-Chloronaphthalene
GC/MS	EPA 8270C/D SIM	2-Chlorophenol
GC/MS	EPA 8270C/D SIM	2-Methylnaphthalene
GC/MS	EPA 8270C/D SIM	2-Methylphenol
GC/MS	EPA 8270C/D SIM	2-Nitroaniline
GC/MS	EPA 8270C/D SIM	2-Nitrophenol
GC/MS	EPA 8270C/D SIM	3&4-Methylphenol
GC/MS	EPA 8270C/D SIM	3,3'-Dichlorobenzidine
GC/MS	EPA 8270C/D SIM	3-Nitroaniline
GC/MS	EPA 8270C/D SIM	4,6-Dinitro-2-methylphenol
GC/MS	EPA 8270C/D SIM	4-Bromophenyl-phenylether
GC/MS	EPA 8270C/D SIM	4-Chloro-3-methylphenol
GC/MS	EPA 8270C/D SIM	4-Chloroaniline
GC/MS	EPA 8270C/D SIM	4-Chlorophenyl-phenylether
GC/MS	EPA 8270C/D SIM	4-Nitroaniline
GC/MS	EPA 8270C/D SIM	4-Nitrophenol
GC/MS	EPA 8270C/D SIM	Acenaphthene
GC/MS	EPA 8270C/D SIM	Acenaphthylene
GC/MS	EPA 8270C/D SIM	Acetophenone
GC/MS	EPA 8270C/D SIM	Anthracene
GC/MS	EPA 8270C/D SIM	Atrazine
GC/MS	EPA 8270C/D SIM	Benzaldehyde
GC/MS	EPA 8270C/D SIM	Benzo(a)anthracene
GC/MS	EPA 8270C/D SIM	Benzo(a)pyrene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/D SIM	Benzo(b)fluoranthene
GC/MS	EPA 8270C/D SIM	Benzo(g,h,i)perylene
GC/MS	EPA 8270C/D SIM	Benzo(k)fluoranthene
GC/MS	EPA 8270C/D SIM	Bis(2-chloroethoxy)methane
GC/MS	EPA 8270C/D SIM	Bis(2-chloroethyl)ether
GC/MS	EPA 8270C/D SIM	Bis(2-ethylhexyl)phthalate
GC/MS	EPA 8270C/D SIM	Butylbenzylphthalate
GC/MS	EPA 8270C/D SIM	Caprolactam
GC/MS	EPA 8270C/D SIM	Carbazole
GC/MS	EPA 8270C/D SIM	Chrysene
GC/MS	EPA 8270C/D SIM	Dibenzo(a,h)anthracene
GC/MS	EPA 8270C/D SIM	Dibenzofuran
GC/MS	EPA 8270C/D SIM	Diethylphthalate
GC/MS	EPA 8270C/D SIM	Dimethyl phthalate
GC/MS	EPA 8270C/D SIM	Di-n-butylphthalate
GC/MS	EPA 8270C/D SIM	Di-n-octylphthalate
GC/MS	EPA 8270C/D SIM	Fluoranthene
GC/MS	EPA 8270C/D SIM	Fluorene
GC/MS	EPA 8270C/D SIM	Hexachlorobenzene
GC/MS	EPA 8270C/D SIM	Hexachlorobutadiene
GC/MS	EPA 8270C/D SIM	Hexachlorocyclopentadiene
GC/MS	EPA 8270C/D SIM	Hexachloroethane
GC/MS	EPA 8270C/D SIM	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 8270C/D SIM	Isophorone
GC/MS	EPA 8270C/D SIM	Naphthalene
GC/MS	EPA 8270C/D SIM	Nitrobenzene
GC/MS	EPA 8270C/D SIM	n-Nitroso-di-n-propylamine
GC/MS	EPA 8270C/D SIM	n-Nitrosodiphenylamine
GC/MS	EPA 8270C/D SIM	Pentachlorophenol
GC/MS	EPA 8270C/D SIM	Phenanthrene
GC/MS	EPA 8270C/D SIM	Phenol

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/D SIM	Pyrene
HPLC/UV	EPA 8330A/B	1, 3, 5-Trinitrobenzene
HPLC/UV	EPA 8330A/B	1, 3-Dinitrobenzene
HPLC/UV	EPA 8330A/B	2, 4, 6-Trinitrotoluene
HPLC/UV	EPA 8330A/B	2, 4-Dinitrotoluene
HPLC/UV	EPA 8330A/B	2, 6-Dinitrotoluene
HPLC/UV	EPA 8330A/B	2-Amino-4, 6 -Dinitrotoluene
HPLC/UV	EPA 8330A/B	2-Nitrotoluene
HPLC/UV	EPA 8330A/B	3-Nitrotoluene
HPLC/UV	EPA 8330A/B	3,5-Dinitroaniline
HPLC/UV	EPA 8330A/B	4-Amino-2, 6-Dinitrotoluene
HPLC/UV	EPA 8330A/B	4-Nitrotoluene
HPLC/UV	EPA 8330A/B	Ethylene glycol dinitrate (EGDN)
HPLC/UV	EPA 8330A/B	Hexahydro-1, 3, 5-trinitro-1, 3, 5-triazine (RDX)
HPLC/UV	EPA 8330A/B	Nitrobenzene
HPLC/UV	EPA 8330A MOD	Nitroglycerin
HPLC/UV	EPA 8330B	Nitroglycerin
HPLC/UV	EPA 8330A/B	Octahydro-1, 3, 5, 7-tetrazocine (HMX)
HPLC/UV	EPA 8330A/B	Pentaerythritol Tetranitrate (PETN)
HPLC/UV	EPA 8330A/B	Tetryl
CVAA	EPA 245.1; EPA 7470A	Mercury
CVAF	EPA 1631E	Low Level Mercury
ICP/AES	EPA 200.7; EPA 6010B/C	Aluminum
ICP/AES	EPA 200.7; EPA 6010B/C	Antimony
ICP/AES	EPA 200.7; EPA 6010B/C	Arsenic
ICP/AES	EPA 200.7; EPA 6010B/C	Barium
ICP/AES	EPA 200.7; EPA 6010B/C	Beryllium
ICP/AES	EPA 200.7; EPA 6010B/C	Boron
ICP/AES	EPA 200.7; EPA 6010B/C	Cadmium
ICP/AES	EPA 200.7; EPA 6010B/C	Calcium
ICP/AES	EPA 200.7; EPA 6010B/C	Chromium

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP/AES	EPA 200.7; EPA 6010B/C	Cobalt
ICP/AES	EPA 200.7; EPA 6010B/C	Copper
ICP/AES	EPA 200.7; EPA 6010B/C	Iron
ICP/AES	EPA 200.7; EPA 6010B/C	Lead
ICP/AES	EPA 200.7; EPA 6010B/C	Magnesium
ICP/AES	EPA 200.7; EPA 6010B/C	Manganese
ICP/AES	EPA 200.7; EPA 6010B/C	Molybdenum
ICP/AES	EPA 200.7; EPA 6010B/C	Nickel
ICP/AES	EPA 200.7; EPA 6010B/C	Potassium
ICP/AES	EPA 200.7; EPA 6010B/C	Selenium
ICP/AES	EPA 200.7; EPA 6010B/C	Silicon
ICP/AES	EPA 200.7; EPA 6010B/C	Silver
ICP/AES	EPA 200.7; EPA 6010B/C	Sodium
ICP/AES	EPA 6010B/C	Strontium
ICP/AES	EPA 200.7; EPA 6010B/C	Thallium
ICP/AES	EPA 200.7; EPA 6010B/C	Tin
ICP/AES	EPA 200.7; EPA 6010B/C	Titanium
ICP/AES	EPA 200.7; EPA 6010B/C	Vanadium
ICP/AES	EPA 200.7; EPA 6010B/C	Zinc
ICP/MS	EPA 200.8; EPA 6020A	Aluminum
ICP/MS	EPA 200.8; EPA 6020A	Antimony
ICP/MS	EPA 200.8; EPA 6020A	Arsenic
ICP/MS	EPA 200.8; EPA 6020A	Barium
ICP/MS	EPA 200.8; EPA 6020A	Beryllium
ICP/MS	EPA 200.8; EPA 6020A	Boron
ICP/MS	EPA 200.8; EPA 6020A	Cadmium
ICP/MS	EPA 200.8; EPA 6020A	Calcium
ICP/MS	EPA 200.8; EPA 6020A	Chromium
ICP/MS	EPA 200.8; EPA 6020A	Cobalt
ICP/MS	EPA 200.8; EPA 6020A	Copper
ICP/MS	EPA 200.8; EPA 6020A	Iron

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP/MS	EPA 200.8; EPA 6020A	Lead
ICP/MS	EPA 200.8; EPA 6020A	Magnesium
ICP/MS	EPA 200.8; EPA 6020A	Manganese
ICP/MS	EPA 200.8; EPA 6020A	Molybdenum
ICP/MS	EPA 200.8; EPA 6020A	Nickel
ICP/MS	EPA 200.8; EPA 6020A	Potassium
ICP/MS	EPA 200.8; EPA 6020A	Selenium
ICP/MS	EPA 200.8; EPA 6020A	Silicon
ICP/MS	EPA 200.8; EPA 6020A	Silver
ICP/MS	EPA 200.8; EPA 6020A	Sodium
ICP/MS	EPA 6020A	Strontium
ICP/MS	EPA 200.8; EPA 6020A	Thallium
ICP/MS	EPA 200.8; EPA 6020A	Tin
ICP/MS	EPA 200.8; EPA 6020A	Titanium
ICP/MS	EPA 200.8; EPA 6020A	Tungsten
ICP/MS	EPA 200.8	Uranium
ICP/MS	EPA 200.8; EPA 6020A	Vanadium
ICP/MS	EPA 200.8; EPA 6020A	Zinc
IC	EPA 300.0; EPA 9056A	Bromide
IC	EPA 300.0; EPA 9056A	Chloride
IC	EPA 300.0; EPA 9056A	Fluoride
IC	EPA 300.0; EPA 9056A	Nitrate as N
IC	EPA 300.0; EPA 9056A	Nitrite as N
IC	EPA 300.0; EPA 9056A	Nitrate + Nitrite
IC	EPA 300.0; EPA 9056A	Orthophosphate as P
IC	EPA 300.0; EPA 9056A	Sulfate
IC	SOP CA-776	Lactic Acid
IC	SOP CA-776	Acetic Acid
IC	SOP CA-776	Propionic Acid
IC	SOP CA-776	Formic Acid
IC	SOP CA-776	Butyric Acid

Non-Potable Water		
Technology	**Method**	**Analyte**
IC	SOP CA-776	Pyruvic Acid
IC	SOP CA-776	i-Pentanoic Acid
IC	SOP CA-776	Pentanoic Acid
IC	SOP CA-776	i-Hexanoic Acid
IC	SOP CA-776	Hexanoic Acid
Titration	EPA 310.1; SM 2320B	Alkalinity
Caculation	SM 2340B	Hardness
Gravimetric	EPA 1664A; EPA 9070A	Oil and Grease, Oil and Grease with SGT
Gravimetric	SM 2540B/C/D	Solids
ISE	EPA 120.1; SM 2510B	Conductivity
ISE	SM 2520B	Practical Salinity
ISE	SM 4500F- C	Fluoride
ISE	SM 4500H+ B	pH
ISE	SM 5210B	TBOD / CBOD
Physical	EPA 1010A	Ignitability
Physical	EPA 9040C	pH
Titration	SM 2340C	Hardness
Titration	SM 4500SO_3 B	Sulfite
Titration	EPA 9034; SM 4500S^{2-} F	Sulfide
Titration	EPA SW-846 Chapter 7.3.4	Reactive Sulfide
IR	EPA 9060A; SM 5310B	Total organic carbon
Turbidimetric	EPA 180.1; SM 2130B	Turbidity
Turbidimetric	EPA 9038; ASTM 516-02	Sulfate
UV/VIS	EPA 335.4; EPA 9012B; SM 4500-CN G	Amenable cyanide
UV/VIS	EPA 350.1; SM 4500NH3 H	Ammonia as N
UV/VIS	SM 3500Fe D	Ferrous Iron
UV/VIS	EPA 351.2	Kjeldahl nitrogen - total
UV/VIS	EPA 353.2; SM 4500NO3 F	Nitrate + Nitrite
UV/VIS	EPA 353.2; SM 4500NO3 F	Nitrate as N
UV/VIS	EPA 353.2; SM 4500NO3 F	Nitrite as N
UV/VIS	EPA 365.2; SM 4500P E	Orthophosphate as P

Non-Potable Water		
Technology	**Method**	**Analyte**
UV/VIS	EPA 365.4	Phosphorus total
UV/VIS	EPA 821/R-91-100	AVS-SEM
UV/VIS	EPA 410.4	COD
UV/VIS	EPA 420.1; EPA 9065	Total Phenolics
UV/VIS	SM 4500Cl G	Total Residual Chlorine
UV/VIS	SM 5540C	MBAS
UV/VIS	EPA 7196A; SM 3500-Cr D	Chromium VI
UV/VIS	EPA 9012B; EPA 335.4	Total Cyanide
UV/VIS	EPA 9251; SM 4500Cl E	Chloride
UV/VIS	EPA SW-846 Chapter 7.3.4	Reactive Cyanide

Preparation	Method	Type
Cleanup Methods	EPA 3640A	Gel Permeation Clean-up
Cleanup Methods	EPA 3630C	Silica Gel
Cleanup Methods	EPA 3660B	Sulfur Clean-Up
Cleanup Methods	EPA 3665A	Sulfuric Acid Clean-Up
Organic Preparation	EPA 3510C	Separatory Funnel Extraction
Organic Preparation	EPA 3520C	Continuous Liquid-Liquid Extraction
Inorganic Preparation	EPA 3010A	Hotblock
Volatile Organic Preparation	EPA 5030C	Purge and Trap

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8081B	2,4`-DDD
GC/ECD	EPA 8081B	2,4`-DDE
GC/ECD	EPA 8081B	2,4`-DDT
GC/ECD	EPA 8081B	4, 4`-DDD
GC/ECD	EPA 8081B	4, 4`-DDE
GC/ECD	EPA 8081B	4, 4`-DDT
GC/ECD	EPA 8081B	Aldrin

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8081B	alpha-BHC (alpha-Hexachlorocyclohexane)
GC/ECD	EPA 8081B	Alpha-Chlordane
GC/ECD	EPA 8081B	beta-BHC (beta-Hexachlorocyclohexane)
GC/ECD	EPA 608; EPA 8081B	Chlordane (tech.)
GC/ECD	EPA 8081B	Cis-Nonachlor
GC/ECD	EPA 8081B	delta-BHC
GC/ECD	EPA 8081B	Dieldrin
GC/ECD	EPA 8081B	Endosulfan I
GC/ECD	EPA 8081B	Endosulfan II
GC/ECD	EPA 8081B	Endosulfan sulfate
GC/ECD	EPA 8081B	Endrin
GC/ECD	EPA 8081B	Endrin aldehyde
GC/ECD	EPA 8081B	Endrin Ketone
GC/ECD	EPA 8081B	gamma-BHC (Lindane gamma-Hexachlorocyclohexane)
GC/ECD	EPA 8081B	gamma-Chlordane
GC/ECD	EPA 8081B	Heptachlor
GC/ECD	EPA 8081B	Heptachlor epoxide
GC/ECD	EPA 8081B	Hexachlorobenzene
GC/ECD	EPA 8081B	Methoxychlor
GC/ECD	EPA 8081B	Mirex
GC/ECD	EPA 8081B	Oxychlordane
GC/ECD	EPA 8081B	Toxaphene (Chlorinated camphene)
GC/ECD	EPA 8081B	Trans-Nonachlor
GC/ECD	EPA 8082A	Aroclor-1016 (PCB-1016)
GC/ECD	EPA 8082A	Aroclor-1221 (PCB-1221)
GC/ECD	EPA 8082A	Aroclor-1232 (PCB-1232)
GC/ECD	EPA 8082A	Aroclor-1242 (PCB-1242)
GC/ECD	EPA 8082A	Aroclor-1248 (PCB-1248)
GC/ECD	EPA 8082A	Aroclor-1254 (PCB-1254)
GC/ECD	EPA 8082A	Aroclor-1260 (PCB-1260)
GC/ECD	EPA 8082A MOD	Aroclor-1262 (PCB-1262)

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8082A MOD	Aroclor-1268 (PCB-1268)
GC/ECD	EPA 8082A	2, 2', 3, 3', 4, 4', 5, 5', 6-Nonachlorobiphenyl (BZ 206)
GC/ECD	EPA 8082A	2, 2', 3, 3', 4, 4', 5, 6-Octachlorobiphenyl (BZ 195)
GC/ECD	EPA 8082A	2, 2', 3, 3', 4, 4', 5-Heptachlorobiphenyl (BZ 170)
GC/ECD	EPA 8082A	2, 2', 3, 3', 4, 4'-Hexachlorobiphenyl (BZ 128)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 5, 5'-Heptachlorobiphenyl (BZ 180)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 5', 6-Heptachlorobiphenyl (BZ 183)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 5-Hexachlorobiphenyl (BZ 138)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 6, 6'-Heptachlorobiphenyl (BZ 184)
GC/ECD	EPA 8082A	2, 2', 3, 4', 5, 5', 6-Heptachlorobiphenyl (BZ 187)
GC/ECD	EPA 8082A	2, 2', 3, 4, 5'-Pentachlorobiphenyl (BZ 87)
GC/ECD	EPA 8082A	2, 2', 3, 5'-Tetrachlorobiphenyl (BZ 44)
GC/ECD	EPA 8082A	2, 2', 4, 4', 5, 5'-Hexachlorobiphenyl (BZ 153)
GC/ECD	EPA 8082A	2, 2', 4, 5, 5'-Pentachlorobiphenyl (BZ 101)
GC/ECD	EPA 8082A	2, 2', 4, 5-Tetrachlorobiphenyl (BZ 48)
GC/ECD	EPA 8082A	2, 2', 4, 5'-Tetrachlorobiphenyl (BZ 49)
GC/ECD	EPA 8082A	2, 2', 5, 5'-Tetrachlorobiphenyl (BZ 52)
GC/ECD	EPA 8082A	2, 2', 5-Trichlorobiphenyl (BZ 18)
GC/ECD	EPA 8082A	2, 3, 3', 4, 4', 5-Hexachlorobiphenyl (BZ 156)
GC/ECD	EPA 8082A	2, 3, 3', 4, 4', 5'-Hexachlorobiphenyl (BZ 157)
GC/ECD	EPA 8082A	2, 3, 3', 4, 4'-Pentachlorobiphenyl (BZ 105)
GC/ECD	EPA 8082A	2, 3, 3', 4, 4', 5, 5'-Heptachlorobiphenyl (BZ 189)
GC/ECD	EPA 8082A	2, 3', 4, 4', 5, 5'-Hexachlorobiphenyl (BZ 167)
GC/ECD	EPA 8082A	2, 3', 4, 4', 5-Pentachlorobiphenyl (BZ 118)
GC/ECD	EPA 8082A	2, 3', 4, 4',5'-Pentachlorobiphenyl (BZ 123)
GC/ECD	EPA 8082A	2, 3', 4, 4'-Tetrachlorobiphenyl (BZ 66)
GC/ECD	EPA 8082A	2, 3, 4, 4', 5-Pentachlorobiphenyl (BZ 114)
GC/ECD	EPA 8082A	2, 4, 4'-Trichlorobiphenyl (BZ 28)
GC/ECD	EPA 8082A	2, 4'-Dichlorobiphenyl (BZ 8)
GC/ECD	EPA 8082A	3, 3', 4, 4', 5, 5'-Hexachlorobiphenyl (BZ 169)
GC/ECD	EPA 8082A	3, 3', 4, 4', 5-Pentachlorobiphenyl (BZ 126)

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8082A	3, 3', 4, 4'-Tetrachlorobiphenyl (BZ 77)
GC/ECD	EPA 8082A	3, 4, 4’, 5-Tetrachlorobiphenyl (BZ 81)
GC/ECD	EPA 8082A	Decachlorobiphenyl (BZ 209)
GC/ECD	EPA 8151A	2, 4, 5-T
GC/ECD	EPA 8151A	2, 4-D
GC/ECD	EPA 8151A	2, 4-DB
GC/ECD	EPA 8151A	Dalapon
GC/ECD	EPA 8151A	Dicamba
GC/ECD	EPA 8151A	Dichloroprop
GC/ECD	EPA 8151A	Dinoseb
GC/ECD	EPA 8151A	MCPA
GC/ECD	EPA 8151A	MCPP
GC/ECD	EPA 8151A	Pentachlorophenol
GC/ECD	EPA 8151A	Silvex (2, 4, 5-TP)
GC/FID	EPA 8015C/D	Diesel range organics (DRO)
GC/FID	EPA 8015C/D	Total Petroleum Hydrocarbons (TPH)
GC/FID	EPA 8015C/D	Gasoline range organics (GRO)
GC/FID/PID	MA DEP VPH	Volatile Organic Hydrocarbons
GC/FID	MA DEP EPH	Extractable Petroleum Hydrocarbons
GC/FID	MA DEP EPH EPA 3546	Extractable Petroleum Hydrocarbons Microwave Extraction Preparation
GC/FID	CT-ETPH	Total Petroleum Hydrocarbons
GC/FID	TNRCC Method 1005	Total Petroleum Hydrocarbons
GC/FID	FL-PRO	Petroleum Range Organics
GC/ECD	EPA 8011	1, 2-Dibromoethane (EDB)
GC/ECD	EPA 8011	1, 2-Dibromo-3-chloropropane
GC/MS	EPA 8260B/C	1, 1, 1, 2-Tetrachloroethane
GC/MS	EPA 8260B/C	1,1,2-Trichloro-1,2,2-trifluoroethane
GC/MS	EPA 8260B/C	1, 1, 1-Trichloroethane
GC/MS	EPA 8260B/C	1, 1, 2, 2-Tetrachloroethane
GC/MS	EPA 8260B/C	1, 1, 2-Trichloroethane
GC/MS	EPA 8260B/C	1, 1-Dichloroethane

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/C	1, 1-Dichloroethylene
GC/MS	EPA 8260B/C	1, 1-Dichloropropene
GC/MS	EPA 8260B/C	1, 2, 3-Trichlorobenzene
GC/MS	EPA 8260B/C	1, 2, 3-Trichloropropane
GC/MS	EPA 8260B/C	1,2,3-Trimethylbenzene
GC/MS	EPA 8260B/C	1, 2, 4-Trichlorobenzene
GC/MS	EPA 8260B/C	1, 2, 4-Trimethylbenzene
GC/MS	EPA 8260B/C	1, 2-Dibromo-3-chloropropane
GC/MS	EPA 8260B/C	1, 2-Dibromoethane
GC/MS	EPA 8260B/C	1, 2-Dichlorobenzene
GC/MS	EPA 8260B/C	1, 2-Dichloroethane
GC/MS	EPA 8260B/C	1, 2-Dichloropropane
GC/MS	EPA 8260B/C	1,3,5-Trichlorobenzene
GC/MS	EPA 8260B/C	1, 3, 5-Trimethylbenzene
GC/MS	EPA 8260B/C	1, 3-Dichlorobenzene
GC/MS	EPA 8260B/C	1, 3-Dichloropropane
GC/MS	EPA 8260B/C	1, 4-Dichlorobenzene
GC/MS	EPA 8260B/C	1, 4-Dioxane
GC/MS	EPA 8260B/C	1-Chlorohexane
GC/MS	EPA 8260B/C	2, 2-Dichloropropane
GC/MS	EPA 8260B/C	2-Butanone
GC/MS	EPA 8260B/C	2-Chloroethyl vinyl ether
GC/MS	EPA 8260B/C	2-Chlorotoluene
GC/MS	EPA 8260B/C	2-Hexanone
GC/MS	EPA 8260B/C	4-Chlorotoluene
GC/MS	EPA 8260B/C	4-Methyl-2-pentanone
GC/MS	EPA 8260B/C	Acetone
GC/MS	EPA 8260B/C	Acetonitrile
GC/MS	EPA 8260B/C	Acrolein
GC/MS	EPA 8260B/C	Acrylonitrile
GC/MS	EPA 8260B/C	Allyl chloride

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/C	Benzene
GC/MS	EPA 8260B/C	Benzyl chloride
GC/MS	EPA 8260B/C	Bromobenzene
GC/MS	EPA 8260B/C	Bromochloromethane
GC/MS	EPA 8260B/C	Bromodichloromethane
GC/MS	EPA 8260B/C	Bromoform
GC/MS	EPA 8260B/C	Carbon disulfide
GC/MS	EPA 8260B/C	Carbon tetrachloride
GC/MS	EPA 8260B/C	Chlorobenzene
GC/MS	EPA 8260B/C	Chloroethane
GC/MS	EPA 8260B/C	Chloroform
GC/MS	EPA 8260B/C	Chloroprene
GC/MS	EPA 8260B/C	cis-1, 2-Dichloroethene
GC/MS	EPA 8260B/C	cis-1, 3-Dichloropropene
GC/MS	EPA 8260B/C	cis-1,3-Dichloro-2-butene
GC/MS	EPA 8260B/C	Cyclohexane
GC/MS	EPA 8260B/C	Dibromochloromethane
GC/MS	EPA 8260B/C	Dibromomethane
GC/MS	EPA 8260B/C	Dichlorodifluoromethane
GC/MS	EPA 8260B/C	Diethyl ether
GC/MS	EPA 8260B/C	Di-isopropylether
GC/MS	EPA 8260B/C	1,2-Dibromoethane (EDB)
GC/MS	EPA 8260B/C	Ethyl methacrylate
GC/MS	EPA 8260B/C	Ethylbenzene
GC/MS	EPA 8260B/C	Ethyl-t-butylether
GC/MS	EPA 8260B/C	Hexachlorobutadiene
GC/MS	EPA 8260B/C	Iodomethane
GC/MS	EPA 8260B/C	Isobutyl alcohol
GC/MS	EPA 8260B/C	Isopropyl alcohol
GC/MS	EPA 8260B/C	Isopropyl benzene
GC/MS	EPA 8260B/C	m p-xylenes

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B, C	Methyl acetate
GC/MS	EPA 8260B/C	Methacrylonitrile
GC/MS	EPA 8260B/C	Methyl bromide (Bromomethane)
GC/MS	EPA 8260B/C	Methyl chloride (Chloromethane)
GC/MS	EPA 8260B/C	Methyl methacrylate
GC/MS	EPA 8260B/C	Methyl tert-butyl ether
GC/MS	EPA 8260B/C	Methylcyclohexane
GC/MS	EPA 8260B/C	Methylene chloride
GC/MS	EPA 8260B/C	Naphthalene
GC/MS	EPA 8260B/C	n-Butylbenzene
GC/MS	EPA 8260B/C	n-proplybenzene
GC/MS	EPA 8260B/C	o-Xylene
GC/MS	EPA 8260B/C	pentachloroethane
GC/MS	EPA 8260B/C	p-Isopropyltoluene
GC/MS	EPA 8260B/C	Propionitrile
GC/MS	EPA 8260B/C	sec-butylbenzene
GC/MS	EPA 8260B/C	Styrene
GC/MS	EPA 8260B/C	t-Amylmethylether
GC/MS	EPA 8260B/C	tert-Butyl alcohol
GC/MS	EPA 8260B/C	tert-Butylbenzene
GC/MS	EPA 8260B/C	Tetrachloroethylene (Perchloroethylene)
GC/MS	EPA 8260B/C	Tetrahydrofuran
GC/MS	EPA 8260B/C	Toluene
GC/MS	EPA 8260B/C	trans-1, 2-Dichloroethylene
GC/MS	EPA 8260B/C	trans-1, 3-Dichloropropylene
GC/MS	EPA 8260B/C	Trans-1, 4-Dichloro-2-butuene
GC/MS	EPA 8260B/C	Trichloroethene (Trichloroethylene)
GC/MS	EPA 8260B/C	Trichlorofluoromethane
GC/MS	EPA 8260B/C	Vinyl acetate
GC/MS	EPA 8260B/C	Vinyl chloride
GC/MS	EPA 8260B/C	Xylene

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/C SIM	1,1,1,2-Tetrachloroethane
GC/MS	EPA 8260B/C SIM	1,1,1-Trichloroethane
GC/MS	EPA 8260B/C SIM	1,1,2,2-Tetrachloroethane
GC/MS	EPA 8260B/C SIM	1, 1, 2-Trichloroethane
GC/MS	EPA 8260B/C SIM	1,2,3-Trichloropropane
GC/MS	EPA 8260B/C SIM	1,1-Dichloroethane
GC/MS	EPA 8260B/C SIM	1,1-Dichloroethene
GC/MS	EPA 8260B/C SIM	1,2,4-Trichlorobenzene
GC/MS	EPA 8260B/C SIM	1,2,4-Trimethylbenzene
GC/MS	EPA 8260B/C SIM	1,2-Dibromo-3-chloropropane
GC/MS	EPA 8260B/C SIM	1,2-Dibromoethane
GC/MS	EPA 8260B/C SIM	1,2-Dichlorobenzene
GC/MS	EPA 8260B/C SIM	1,2-Dichloroethane
GC/MS	EPA 8260B/C SIM	1,2-Dichloropropane
GC/MS	EPA 8260B/C SIM	1,3-Dichlorobenzene
GC/MS	EPA 8260B/C SIM	1,3-Dichloropropane
GC/MS	EPA 8260B/C SIM	1,4-Dichlorobenzene
GC/MS	EPA 8260B/C SIM	2-Hexanone
GC/MS	EPA 8260B/C SIM	4-Methyl-2-pentanone
GC/MS	EPA 8260B/C SIM	Benzene
GC/MS	EPA 8260B/C SIM	Bromodichloromethane
GC/MS	EPA 8260B/C SIM	Carbon Tetrachloride
GC/MS	EPA 8260B/C SIM	Chloroform
GC/MS	EPA 8260B/C SIM	Chloromethane
GC/MS	EPA 8260B/C SIM	cis-1,2-Dichloroethene
GC/MS	EPA 8260B/C SIM	cis-1,3-Dichloropropene
GC/MS	EPA 8260B/C SIM	Dibromochloromethane
GC/MS	EPA 8260B/C SIM	Ethylbenzene
GC/MS	EPA 8260B/C SIM	Isopropylbenzene
GC/MS	EPA 8260B/C SIM	Hexachlorobutadiene
GC/MS	EPA 8260B/C SIM	Methylcyclohexane

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/C SIM	m,p-Xylene
GC/MS	EPA 8260B/C SIM	o-Xylene
GC/MS	EPA 8260B/C SIM	Tetrachloroethene
GC/MS	EPA 8260B/C SIM	trans-1,2-Dichloroethene
GC/MS	EPA 8260B/C SIM	Trans-1,3-Dichloropropene
GC/MS	EPA 8260B/C SIM	Trichloroethene
GC/MS	EPA 8260B/C SIM	Trichlorofluoromethane
GC/MS	EPA 8260B/C SIM	Vinyl Chloride
GC/MS	EPA 8260B/C SIM	Xylenes (total)
GC/MS	EPA 8270C/D	1, 2, 4, 5-Tetrachlorobenzene
GC/MS	EPA 8270C/D	1, 2, 4-Trichlorobenzene
GC/MS	EPA 8270C/D	1, 2-Dichlorobenzene
GC/MS	EPA 8270C/D	1, 2-Diphenylhydrazine
GC/MS	EPA 8270C/D	1, 3, 5-Trinitrobenzene
GC/MS	EPA 8270C/D	1, 3-Dichlorobenzene
GC/MS	EPA 8270C/D	1, 3-Dinitrobenzene
GC/MS	EPA 8270C/D	1, 4-Dichlorobenzene
GC/MS	EPA 8270C/D	1, 4-Dioxane
GC/MS	EPA 8270C/D	1, 4-Naphthoquinone
GC/MS	EPA 8270C/D	1, 4-Phenylenediamine
GC/MS	EPA 8270C/D	1,1-Biphenyl
GC/MS	EPA 8270C/D	1-Chloronaphthalene
GC/MS	EPA 8270C/D	1-Methylnaphthalene
GC/MS	EPA 8270C/D	1-Naphthylamine
GC/MS	EPA 8270C/D	2, 3, 4, 6-Tetrachlorophenol
GC/MS	EPA 8270C/D	2, 4, 5-Trochlorophenol
GC/MS	EPA 8270C/D	2, 4, 6-Trichlorophenol
GC/MS	EPA 8270C/D	2, 4-Dichlorophenol
GC/MS	EPA 8270C/D	2, 4-Dimethylphenol
GC/MS	EPA 8270C/D	2, 4-Dinitrophenol
GC/MS	EPA 8270C/D	2, 4-Dinitrotoluene (2 4-DNT)

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/D	2, 6-Dichlorophenol
GC/MS	EPA 8270C/D	2, 6-Dinitrotoluene (2 6-DNT)
GC/MS	EPA 8270C/D	2-Acetylaminofluorene
GC/MS	EPA 8270C/D	2-Chloronaphthalene
GC/MS	EPA 8270C/D	2-Chlorophenol
GC/MS	EPA 8270C/D	2-Methyl-4, 6-dinitrophenol
GC/MS	EPA 8270C/D	2-Methylnaphthalene
GC/MS	EPA 8270C/D	2-Methylphenol
GC/MS	EPA 8270C/D	2-Naphthylamine
GC/MS	EPA 8270C/D	2-Nitroaniline
GC/MS	EPA 8270C/D	2-Nitrophenol
GC/MS	EPA 8270C/D	2-Picoline
GC/MS	EPA 8270C/D	3, 3`-Dichlorobenzidine
GC/MS	EPA 8270C/D	3, 3’-Dimethylbenzidine
GC/MS	EPA 8270C/D	3,4-Methylphenol
GC/MS	EPA 8270C/D	3-Methylcholanthrene
GC/MS	EPA 8270C/D	3-Nitroaniline
GC/MS	EPA 8270C/D	4-Aminobiphenyl
GC/MS	EPA 8270C/D	4-Bromophenyl phenyl ether
GC/MS	EPA 8270C/D	4-Chloro-3-methylphenol
GC/MS	EPA 8270C/D	4-Chloroaniline
GC/MS	EPA 8270C/D	4-Chlorophenyl phenylether
GC/MS	EPA 8270C/D	4-Dimethyl aminoazobenzene
GC/MS	EPA 8270C/D	4-Nitroaniline
GC/MS	EPA 8270C/D	4-Nitrophenol
GC/MS	EPA 8270C/D	4-Nitroquinoline-1-oxide
GC/MS	EPA 8270C/D	5-Nitro-o-toluidine
GC/MS	EPA 8270C/D	7,12-Dimethylbenz(a)anthracene
GC/MS	EPA 8270C/D	a a-Dimethylphenethylamine
GC/MS	EPA 8270C/D	Acenaphthene
GC/MS	EPA 8270C/D	Acenaphthylene

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/D	Acetophenone
GC/MS	EPA 8270C/D	Aniline
GC/MS	EPA 8270C/D	Anthracene
GC/MS	EPA 8270C/D	Aramite
GC/MS	EPA 8270C/D	Atrazine
GC/MS	EPA 8270C/D	Azobenzene
GC/MS	EPA 8270C/D	Benzaldehyde
GC/MS	EPA 8270C/D	Benzidine
GC/MS	EPA 8270C/D	Benzo(a)anthracene
GC/MS	EPA 8270C/D	Benzo(a)pyrene
GC/MS	EPA 8270C/D	Benzo(b)fluoranthene
GC/MS	EPA 8270C/D	Benzo(g h i)perylene
GC/MS	EPA 8270C/D	Benzo(k)fluoranthene
GC/MS	EPA 8270C/D	Benzoic Acid
GC/MS	EPA 8270C/D	Benzyl alcohol
GC/MS	EPA 8270C/D	bis(2-Chloroethoxy)methane
GC/MS	EPA 8270C/D	bis(2-Chloroethyl) ether
GC/MS	EPA 8270C/D	bis(2-Chloroisopropyl) ether (2, 2`-Oxybis(1-chloropropane))
GC/MS	EPA 8270C/D	bis(2-Ethylhexyl) phthalate (DEHP)
GC/MS	EPA 625; EPA 8270C/D	Bis(2-Ethylhexyl)adipate
GC/MS	EPA 8270C/D	Butyl benzyl phthalate
GC/MS	EPA 8270C/D	Caprolactam
GC/MS	EPA 8270C/D	Carbazole
GC/MS	EPA 8270C/D	Chlorobenzilate
GC/MS	EPA 8270C/D	Chrysene
GC/MS	EPA 8270C/D	Diallate
GC/MS	EPA 8270C/D	Dibenz(a h)anthracene
GC/MS	EPA 8270C/D	Dibenzo(a,j)acridine
GC/MS	EPA 8270C/D	Dibenzofuran
GC/MS	EPA 8270C/D	Diethyl phthalate
GC/MS	EPA 8270C/D	Diethyladipate

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/D	Dimethoate
GC/MS	EPA 8270C/D	Dimethyl phthalate
GC/MS	EPA 8270C/D	Di-n-butyl phthalate
GC/MS	EPA 8270C/D	Di-n-octyl phthalate
GC/MS	EPA 8270C/D	Dinoseb
GC/MS	EPA 8270C/D	Disulfoton
GC/MS	EPA 8270C/D	Ethyl methacrylate
GC/MS	EPA 8270C/D	Ethyl methanesulfonate
GC/MS	EPA 8270C/D	Ethyl parathion
GC/MS	EPA 8270C/D	Famfur
GC/MS	EPA 8270C/D	Fluoranthene
GC/MS	EPA 8270C/D	Fluorene
GC/MS	EPA 8270C/D	Hexachlorobenzene
GC/MS	EPA 8270C/D	Hexachlorobutadiene
GC/MS	EPA 8270C/D	Hexachlorocyclopentadiene
GC/MS	EPA 8270C/D	Hexachloroethane
GC/MS	EPA 8270C/D	Hexachlorophene
GC/MS	EPA 8270C/D	Hexachloropropene
GC/MS	EPA 8270C/D	Indeno(1, 2, 3-cd)pyrene
GC/MS	EPA 8270C/D	Isodrin
GC/MS	EPA 8270C/D	Isophorone
GC/MS	EPA 8270C/D	Isosafrole
GC/MS	EPA 8270C/D	Kepone
GC/MS	EPA 8270C/D	Methapyriline
GC/MS	EPA 8270C/D	Methyl methanesulfonate
GC/MS	EPA 8270C/D	Methyl parathion
GC/MS	EPA 8270C/D	Naphthalene
GC/MS	EPA 8270C/D	Nitrobenzene
GC/MS	EPA 8270C/D	n-Nitrosodiethylamine
GC/MS	EPA 8270C/D	n-Nitrosodimethylamine
GC/MS	EPA 8270C/D	n-Nitroso-di-n-butylamine

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/D	n-Nitrosodi-n-propylamine
GC/MS	EPA 8270C/D	n-Nitrosodiphenylamine
GC/MS	EPA 8270C/D	n-Nitrosomethylethylamine
GC/MS	EPA 8270C/D	n-Nitrosomorpholine
GC/MS	EPA 8270C/D	n-Nitrosopiperidine
GC/MS	EPA 8270C/D	n-Nitrosopyrrolidine
GC/MS	EPA 8270C/D	O, O, O-Triethyl phosphorothioate
GC/MS	EPA 8270C/D	o,o-Diethyl o-2-pyrazinyl phosphorothioate
GC/MS	EPA 8270C/D	o-Toluidine
GC/MS	EPA 8270C/D	Pentachlorobenzene
GC/MS	EPA 8270C/D	Pentachloronitrobenzene
GC/MS	EPA 8270C/D	Pentachlorophenol
GC/MS	EPA 8270C/D	Phenacetin
GC/MS	EPA 8270C/D	Phenanthrene
GC/MS	EPA 8270C/D	Phenol
GC/MS	EPA 8270C/D	Phorate
GC/MS	EPA 8270C/D	Pronamide
GC/MS	EPA 8270C/D	Pyrene
GC/MS	EPA 8270C/D	Pyridine
GC/MS	EPA 8270C/D	Safrole
GC/MS	EPA 8270C/D	Sulfotepp
GC/MS	EPA 8270C/D	Thionazin
GC/MS	EPA 8270C/D SIM	1,1'-Biphenyl
GC/MS	EPA 8270C/D SIM	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 8270C/D SIM	1,4-Dioxane
GC/MS	EPA 8270C/D SIM	1-Methylnaphthalene
GC/MS	EPA 8270C/D SIM	2,2'-Oxybis(1-chloropropane
GC/MS	EPA 8270C/D SIM	2,3,4,6-Tetrachlorophenol
GC/MS	EPA 8270C/D SIM	2,4,5-Trichlorophenol
GC/MS	EPA 8270C/D SIM	2,4,6-Trichlorophenol
GC/MS	EPA 8270C/D SIM	2,4-Dichlorophenol

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/D SIM	2,4-Dimethylphenol
GC/MS	EPA 8270C/D SIM	2,4-Dinitrophenol
GC/MS	EPA 8270C/D SIM	2,4-Dinitrotoluene
GC/MS	EPA 8270C/D SIM	2,6-Dinitrotoluene
GC/MS	EPA 8270C/D SIM	2-Chloronaphthalene
GC/MS	EPA 8270C/D SIM	2-Chlorophenol
GC/MS	EPA 8270C/D SIM	2-Methylnaphthalene
GC/MS	EPA 8270C/D SIM	2-Methylphenol
GC/MS	EPA 8270C/D SIM	2-Nitroaniline
GC/MS	EPA 8270C/D SIM	2-Nitrophenol
GC/MS	EPA 8270C/D SIM	3&4-Methylphenol
GC/MS	EPA 8270C/D SIM	3,3'-Dichlorobenzidine
GC/MS	EPA 8270C/D SIM	3-Nitroaniline
GC/MS	EPA 8270C/D SIM	4,6-Dinitro-2-methylphenol
GC/MS	EPA 8270C/D SIM	4-Bromophenyl-phenylether
GC/MS	EPA 8270C/D SIM	4-Chloro-3-methylphenol
GC/MS	EPA 8270C/D SIM	4-Chloroaniline
GC/MS	EPA 8270C/D SIM	4-Chlorophenyl-phenylether
GC/MS	EPA 8270C/D SIM	4-Nitroaniline
GC/MS	EPA 8270C/D SIM	4-Nitrophenol
GC/MS	EPA 8270C/D SIM	Acenaphthene
GC/MS	EPA 8270C/D SIM	Acenaphthylene
GC/MS	EPA 8270C/D SIM	Acetophenone
GC/MS	EPA 8270C/D SIM	Anthracene
GC/MS	EPA 8270C/D SIM	Atrazine
GC/MS	EPA 8270C/D SIM	Benzaldehyde
GC/MS	EPA 8270C/D SIM	Benzo(a)anthracene
GC/MS	EPA 8270C/D SIM	Benzo(a)pyrene
GC/MS	EPA 8270C/D SIM	Benzo(b)fluoranthene
GC/MS	EPA 8270C/D SIM	Benzo(g,h,i)perylene
GC/MS	EPA 8270C/D SIM	Benzo(k)fluoranthene

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/D SIM	Bis(2-chloroethoxy)methane
GC/MS	EPA 8270C/D SIM	Bis(2-chloroethyl)ether
GC/MS	EPA 8270C/D SIM	Bis(2-ethylhexyl)phthalate
GC/MS	EPA 8270C/D SIM	Butylbenzylphthalate
GC/MS	EPA 8270C/D SIM	Caprolactam
GC/MS	EPA 8270C/D SIM	Carbazole
GC/MS	EPA 8270C/D SIM	Chrysene
GC/MS	EPA 8270C/D SIM	Dibenzo(a,h)anthracene
GC/MS	EPA 8270C/D SIM	Dibenzofuran
GC/MS	EPA 8270C/D SIM	Diethylphthalate
GC/MS	EPA 8270C/D SIM	Dimethyl phthalate
GC/MS	EPA 8270C/D SIM	Di-n-butylphthalate
GC/MS	EPA 8270C/D SIM	Di-n-octylphthalate
GC/MS	EPA 8270C/D SIM	Fluoranthene
GC/MS	EPA 8270C/D SIM	Fluorene
GC/MS	EPA 8270C/D SIM	Hexachlorobenzene
GC/MS	EPA 8270C/D SIM	Hexachlorobutadiene
GC/MS	EPA 8270C/D SIM	Hexachlorocyclopentadiene
GC/MS	EPA 8270C/D SIM	Hexachloroethane
GC/MS	EPA 8270C/D SIM	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 8270C/D SIM	Isophorone
GC/MS	EPA 8270C/D SIM	Naphthalene
GC/MS	EPA 8270C/D SIM	Nitrobenzene
GC/MS	EPA 8270C/D SIM	n-Nitroso-di-n-propylamine
GC/MS	EPA 8270C/D SIM	n-Nitrosodiphenylamine
GC/MS	EPA 8270C/D SIM	Pentachlorophenol
GC/MS	EPA 8270C/D SIM	Phenanthrene
GC/MS	EPA 8270C/D SIM	Phenol
GC/MS	EPA 8270C/D SIM	Pyrene
HPLC/UV	EPA 8330A	1 ,3, 5-Trinitrobenzene
HPLC/UV	EPA 8330A	1, 3-Dinitrobenzene

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
HPLC/UV	EPA 8330A	2, 4, 6-Trinitrotoluene
HPLC/UV	EPA 8330A	2, 4-Dinitrotoluene
HPLC/UV	EPA 8330A	2, 6-Dinitrotoluene
HPLC/UV	EPA 8330A	2-Amino-4, 6-dinitrotoluene
HPLC/UV	EPA 8330A	2-Nitrotoluene
HPLC/UV	EPA 8330A	3-Nitrotoluene
HPLC/UV	EPA 8330A	3,5-Dinitroaniline
HPLC/UV	EPA 8330A	4-Amino-2,6-dinitrotoluene
HPLC/UV	EPA 8330A	4-Nitrotoluene
HPLC/UV	EPA 8330A	Ethylene glycol dinitrate (EGDN)
HPLC/UV	EPA 8330A	Hexahydr-1, 3, 5-trinitro-1, 3, 5-triazine (RDX)
HPLC/UV	EPA 8330A	Nitrobenzene
HPLC/UV	EPA 8330A MOD	Nitroglycerin
HPLC/UV	EPA 8330A	Octahydro-1, 3, 5, 7-tetrazocine (HMX)
HPLC/UV	EPA 8330A	Pentaerythritol Tetranitrate (PETN)
HPLC/UV	EPA 8330A	Tetryl
HPLC/UV	8330B (W/O Soil Grinding)	1, 3, 5-Trinitrobenzene
HPLC/UV	8330B (W/O Soil Grinding)	1, 3-Dinitrobenzene
HPLC/UV	8330B (W/O Soil Grinding)	2, 4, 6-Trinitrotoluene
HPLC/UV	8330B (W/O Soil Grinding)	2, 4-Dinitrotoluene
HPLC/UV	8330B (W/O Soil Grinding)	2, 6-Dinitrotoluene
HPLC/UV	8330B (W/O Soil Grinding)	2-Amino-4, 6 –Dinitrotoluene
HPLC/UV	8330B (W/O Soil Grinding)	2-Nitrotoluene
HPLC/UV	8330B (W/O Soil Grinding)	3-Nitrotoluene
HPLC/UV	8330B (W/O Soil Grinding)	3,5-Dinitroaniline
HPLC/UV	8330B (W/O Soil Grinding)	4-Amino-2,3-Dinitrotoluene
HPLC/UV	8330B (W/O Soil Grinding)	4-Nitrotoluene
HPLC/UV	8330B (W/O Soil Grinding)	Ethylene glycol dinitrate (EGDN)
HPLC/UV	8330B (W/O Soil Grinding)	Hexahydr-1, 3, 5-trinitro-1, 3, 5-triazine (RDX)
HPLC/UV	8330B (W/O Soil Grinding)	Nitrobenzene
HPLC/UV	8330B (W/O Soil Grinding)	Nitroglycerin

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
HPLC/UV	8330B (W/O Soil Grinding)	Octahydro-1, 3, 5, 7-tetrazocine (HMX)
HPLC/UV	8330B (W/O Soil Grinding)	Pentaerythritol Tetranitrate (PETN)
HPLC/UV	8330B (W/O Soil Grinding)	Tetryl
CVAA	EPA 7471B	Mercury
CVAF	EPA 1631E	Low Level Mercury
ICP/AES	EPA 6010B/C	Aluminum
ICP/AES	EPA 6010B/C	Antimony
ICP/AES	EPA 6010B/C	Arsenic
ICP/AES	EPA 6010B/C	Barium
ICP/AES	EPA 6010B/C	Beryllium
ICP/AES	EPA 6010B/C	Boron
ICP/AES	EPA 6010B/C	Cadmium
ICP/AES	EPA 6010B/C	Calcium
ICP/AES	EPA 6010B/C	Chromium
ICP/AES	EPA 6010B/C	Cobalt
ICP/AES	EPA 6010B/C	Copper
ICP/AES	EPA 6010B/C	Iron
ICP/AES	EPA 6010B/C	Lead
ICP/AES	EPA 6010B/C	Magnesium
ICP/AES	EPA 6010B/C	Manganese
ICP/AES	EPA 6010B/C	Molybdenum
ICP/AES	EPA 6010B/C	Nickel
ICP/AES	EPA 6010B/C	Potassium
ICP/AES	EPA 6010B/C	Selenium
ICP/AES	EPA 6010B/C	Silicon
ICP/AES	EPA 6010B/C	Silver
ICP/AES	EPA 6010B/C	Sodium
ICP/AES	EPA 6010B/C	Strontium
ICP/AES	EPA 6010B/C	Thallium
ICP/AES	EPA 6010B/C	Tin
ICP/AES	EPA 6010B/C	Titanium

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
ICP/AES	EPA 6010B/C	Vanadium
ICP/AES	EPA 6010B/C	Zinc
ICP/MS	EPA 6020A	Aluminum
ICP/MS	EPA 6020A	Antimony
ICP/MS	EPA 6020A	Arsenic
ICP/MS	EPA 6020A	Barium
ICP/MS	EPA 6020A	Beryllium
ICP/MS	EPA 6020A	Boron
ICP/MS	EPA 6020A	Cadmium
ICP/MS	EPA 6020A	Calcium
ICP/MS	EPA 6020A	Chromium
ICP/MS	EPA 6020A	Cobalt
ICP/MS	EPA 6020A	Copper
ICP/MS	EPA 6020A	Iron
ICP/MS	EPA 6020A	Lead
ICP/MS	EPA 6020A	Magnesium
ICP/MS	EPA 6020A	Manganese
ICP/MS	EPA 6020A	Molybdenum
ICP/MS	EPA 6020A	Nickel
ICP/MS	EPA 6020A	Potassium
ICP/MS	EPA 6020A	Selenium
ICP/MS	EPA 6020A	Silver
ICP/MS	EPA 6020A	Sodium
ICP/MS	EPA 6020A	Strontium
ICP/MS	EPA 6020A	Thallium
ICP/MS	EPA 6020A	Tin
ICP/MS	EPA 6020A	Titanium
ICP/MS	EPA 6020A	Tungsten
ICP/MS	EPA 6020A	Vanadium
ICP/MS	EPA 6020A	Zinc
IC	EPA 9056A	Chloride

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
IC	EPA 9056A	Fluoride
IC	EPA 9056A	Nitrate as N
IC	EPA 9056A	Nitrite as N
IC	EPA 9056A	Orthophosphate
IC	EPA 9056A	Sulfate
Gravimetric	EPA 9071A; EPA 9071B	Oil and Grease, Oil and Grease with SGT
Physical	EPA 1010A	Ignitability
Physical	EPA 9045D	pH
Titration	EPA SW-846 Chapter 7.3.4	Reactive Sulfide
Titration	Walkley-Black	Total Organic Carbon
IR	Lloyd Kahn	Total organic carbon
Turbidimetric	EPA 9038; ASTM 516-02	Sulfate
UV/VIS	EPA 350.1; SM 4500NH3 H	Ammonia as N
UV/VIS	EPA 9251; SM 4500Cl E	Chloride
UV/VIS	EPA SW-846 Chapter 7.3.4	Reactive Cyanide
UV/VIS	EPA 821/R-91-100	AVS-SEM
UV/VIS	SM 3500Fe D	Ferrous Iron
Cleanup Methods	EPA 3630C	Silica Gel
UV/VIS	EPA 7196	Chromium VI
UV/VIS	EPA 7196A	Chromium VI
UV/VIS	EPA 9012B	Total cyanide
Preparation	**Method**	**Type**
Preparation	EPA 1311	Toxicity Characteristic Leaching Procedure
Preparation	EPA 1312	Synthetic Precipitation Leaching Procedure
Cleanup Methods	EPA 3660B	Sulfur Clean-up
Cleanup Methods	EPA 3620C	Florsil Clean-up
Cleanup Methods	EPA 3630C	Silica Gel Clean-up
Cleanup Methods	EPA 3640A	GPC Clean-up
Organic Preparation	EPA 3540C	Soxhlet Extraction
Organic Preparation	EPA 3545A	Pressurized Fluid Extraction

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
Organic Preparation	EPA 3546	Microwave Extraction Preparation for EPA 8082A, 8081B and 8270C, D
Organic Preparation	EPA 3550C	Sonication
Inorganics Preparation	EPA 3050B	Hotblock
Inorganics Preparation	EPA 3060A	Alkaline Digestion
Volatile Organics Preparation	EPA 5035/5035A	Closed System Purge and Trap

Air		
Technology	**Method**	**Analyte**
GC/MS	EPA TO-15	Propene
GC/MS	EPA TO-15	1, 1, 1-Trichloroethane
GC/MS	EPA TO-15	1, 1, 2, 2-Tetrachloroethane
GC/MS	EPA TO-15	1, 1, 2-Trichloroethane
GC/MS	EPA TO-15	1, 1-Dichloroethane
GC/MS	EPA TO-15	1, 1-Dichloroethylene
GC/MS	EPA TO-15	1, 2, 4-Trichlorobenzene
GC/MS	EPA TO-15	1, 2, 4-Trimethylbenzene
GC/MS	EPA TO-15	1, 2-Dibromoethane (EDB)
GC/MS	EPA TO-15	1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon 114)
GC/MS	EPA TO-15	1, 2-Dichlorobenzene
GC/MS	EPA TO-15	1, 2-Dichloroethane
GC/MS	EPA TO-15	1, 2-Dichloroethenes (Total)
GC/MS	EPA TO-15	1, 2-Dichloropropane
GC/MS	EPA TO-15	1, 3, 5-Trimethylbenzene
GC/MS	EPA TO-15	1, 3-Butadiene
GC/MS	EPA TO-15	1, 3-Dichlorobenzene
GC/MS	EPA TO-15	1, 4-Dichlorobenzene
GC/MS	EPA TO-15	1,4-Difluorobenzene
GC/MS	EPA TO-15	1, 4-Dioxane
GC/MS	EPA TO-15	2-Butanone
GC/MS	EPA TO-15	2-Hexanone

Air		
Technology	**Method**	**Analyte**
GC/MS	EPA TO-15	2-Propanol
GC/MS	EPA TO-15	4-Ethyltoluene
GC/MS	EPA TO-15	4-Methyl-2-pentanone
GC/MS	EPA TO-15	Acetone
GC/MS	EPA TO-15	Acrolein
GC/MS	EPA TO-15	Benzene
GC/MS	EPA TO-15	Benzyl chloride
GC/MS	EPA TO-15	Bromochloromethane
GC/MS	EPA TO-15	Bromodichloromethane
GC/MS	EPA TO-15	Bromoform
GC/MS	EPA TO-15	Carbon disulfide
GC/MS	EPA TO-15	Carbon tetrachloride
GC/MS	EPA TO-15	Chlorobenzene
GC/MS	EPA TO-15	Chloroethane
GC/MS	EPA TO-15	Chloroform
GC/MS	EPA TO-15	Cis-1, 2-Dichloroethene
GC/MS	EPA TO-15	Cis-1, 3-Dichloropropene
GC/MS	EPA TO-15	Cyclohexane
GC/MS	EPA TO-15	Dibromochloromethane
GC/MS	EPA TO-15	Dichlorodifluoromethane (Freon 12)
GC/MS	EPA TO-15	Ethanol
GC/MS	EPA TO-15	Ethyl acetate
GC/MS	EPA TO-15	Ethylbenzene
GC/MS	EPA TO-15	Hexachlorobutadiene
GC/MS	EPA TO-15	Isopropyl alcohol
GC/MS	EPA TO-15	m, p-Xylene
GC/MS	EPA TO-15	Methyl bromide (Bromomethane)
GC/MS	EPA TO-15	Methyl chloride (Chloromethane)
GC/MS	EPA TO-15	Methyl methacrylate
GC/MS	EPA TO-15	Methyl tert-butyl ether
GC/MS	EPA TO-15	Methylene chloride

Air		
Technology	**Method**	**Analyte**
GC/MS	EPA TO-15	Naphthalene
GC/MS	EPA TO-15	n-Heptane
GC/MS	EPA TO-15	n-Hexane
GC/MS	EPA TO-15	o-Xylene
GC/MS	EPA TO-15	Styrene
GC/MS	EPA TO-15	Tetrachloroethylene (Perchloroethylene)
GC/MS	EPA TO-15	Tetrahydrofuran
GC/MS	EPA TO-15	Toluene
GC/MS	EPA TO-15	trans-1, 2-Dichloroethylene
GC/MS	EPA TO-15	trans-1, 3-Dichloropropylene
GC/MS	EPA TO-15	Trichloroethene (Trichloroethylene)
GC/MS	EPA TO-15	Trichlorofluoromethane (Freon 11)
GC/MS	EPA TO-15	1,1,2-Trichloro1,2,2-trifluoroethane (Freon 113)
GC/MS	EPA TO-15	Vinyl acetate
GC/MS	EPA TO-15	Vinyl chloride
GC/MS	EPA TO-15	Xylenes (Total)
GC/MS	MA DEP APH	Aliphatic C5-C8 range
GC/MS	MA DEP APH	Aliphatic C9-C12 range
GC/MS	MA DEP APH	Aromatic C9-C10 range
GC/MS	MA DEP APH	1,3-Butadiene
GC/MS	MA DEP APH	Benzene
GC/MS	MA DEP APH	Ethylbenzene
GC/MS	MA DEP APH	m+p-Xylene
GC/MS	MA DEP APH	Methyl tert-butyl ether
GC/MS	MA DEP APH	Naphthalene
GC/MS	MA DEP APH	o-Xylene
GC/MS	MA DEP APH	Toluene

Notes:

1) This laboratory offers commercial testing service.

Approved by: _____ Date: March 13, 2013

R. Douglas Leonard
Chief Technical Officer

Re-issued: 2/1/13 Revised: 3/13/13

Appendix D
Final Responses to Regulatory Comments

Final Responses to EPA Comments on the Draft Remedial Action Work Plan, Groundwater Monitoring and Institutional Controls with Contingency Plans, Area of Concern E

1. Sampling Procedures: The analytical method used to measure the persulfate concentrations in the groundwater should be changed to a more sensitive method with a detection limit of zero. Such test kits have been developed and are now available on the market (i.e., CHEMetrics: https://www.chemetrics.com/Persulfate). Once concentrations of persulfate are not detectable using a more sensitive analytical method, groundwater should be sampled for contaminants of concern. This approach would provide a more accurate determination that, in the absence of the oxidant, COCs have not rebounded. This would require that any mention of the 500 mg/L concentration in the workplan be changed to non-detect (with a detection limit of zero).

Please keep in mind that if COCs are sampled for in the presence of any concentrations of persulfate, the proposed sampling and analytical procedures need to conform with those in the attached issue paper authored by Scott Huling of ORD, et al, which includes the addition of ascorbic acid to the sample if the groundwater has ANY level of persulfate.

Navy Response: The test kit proposed in the work plan is the most sensitive available and is the one EPA cites in the comment (see SAP Worksheet #19-1 and SAP Attachment B). That method does not have a zero detection limit, nor does any analytical method. However, all text associated with persulfate monitoring with respect to triggering monitoring for COCs or Contingency Plan 1 has been revised to indicate the target persulfate level will be "close to non-detect" using the recommended test kit versus 500 mg/L, with concurrence among the Technical Subcommittee as to the path forward when the level is reached.

2. Section 4.3, Page 4-1: This section states that the first five-year review (FYR) for Vieques will be triggered off of the start of the RA on-site construction for AOC E and would be due in 2019. Please confirm that no other OU has an action that would trigger the site-wide FYR earlier. For example, the remedy for the Camp Garcia Landfill leaves hazardous material in place and the start of the RA on-site construction at that OU would also trigger an FYR, if initiated earlier.

Navy Response: The first sentence of Section 4.3 has been revised to read: "The first Vieques statutory Five-Year Review period is anticipated to be initiated and completed in 2018, 5 years from the initiation of the SWMU 1 RA, which began in August 2013."

3. Section 5, Page 5-1: This section states that the first FYR would be due five years after the first post-ROD monitoring event. Typically, a statutory FYR is triggered at the start of the RA on-site construction. If that activity is not part of the RA for AOC E, then the appropriate action should be identified as the trigger. Please confirm that this monitoring event is the appropriate action.

Navy Response: The last bullet in Section 5 has been revised to read: "Final Five-Year Review Report: August 2018"

Final Responses to PREQB Comments on the Draft Remedial Action Work Plan Groundwater Monitoring and Institutional Controls with Contingency Plans Area of Concern E, Atlantic Fleet Weapons Training Area – Vieques, Former Naval Ammunition Support Detachment, Vieques, Puerto Rico

GENERAL COMMENTS

1. It appears that certain acronyms referenced in the document were not included on the acronym list (e.g., ARARs, ICs, and RAB). In addition, the document cites several references that are not provided in the list of references. For example, none of the references cited in Section 1.2 of the Work Plan or on Table 3-2 appear on the List of References (Section 6.0). Similar findings were noted in the Long-Term Sampling and Analysis Plan provided as Appendix C. Please include the relevant information for all references and list all acronyms on the acronym list in the final document.

   Navy Response: The acronym list and references have been revised in both the Work Plan and the SAP.

PAGE-SPECIFIC COMMENTS

1. Page 3-1, Section 3.1. According to this Section, monitoring for contaminants of concern (COCs) will begin when persulfate concentrations in groundwater in all wells is less than 500 mg/L. At this persulfate concentration, the Navy has indicated that persulfate is not active (i.e., does not actively destroy contaminants) based upon studies performed by the vendor. However, quantitative studies have not been provided to support this conclusion. EPA's ISCO experts have stated that at concentrations around 500 mg/L, persulfate may continue to degrade organic compounds (EPA, 2012). Therefore, please provide the independent studies performed by the vendor to show that persulfate concentrations less than 500 mg/L will not continue to actively degrade VOCs. If it cannot be shown that persulfate concentrations below 500 mg/l are not reactive, at least one round (preferably all three rounds) of samples should be collected when persulfate concentrations are no longer detectable in groundwater to demonstrate that the attainment of remedial goals is permanent, allowing sufficient time for chemical equilibrium once the persulfate has been fully consumed. However, PREQB will defer to EPA.

   Navy Response: Please see the response to EPA Comment #1.

2. Page 3-1, Section 3.2: Please change reference for the SOPs to CH2M HILL 2010 instead of 2012, as per the References section.

   Navy Response: The reference has been changed as noted in the comment.

3. Table 3-2: Please add EPA, 2008 to the References section.

   Navy Response: The reference has been added to the References section.

Appendix C, Sampling and Analysis Plan:

1. Worksheets #5, 6 and 7, Pages 9, 11 and 13: Kenneth Bowers is listed as the Navy QA Officer but Judy Solomon is listed as the Navy QA Officer on Worksheet #1. Please be consistent throughout the document.

   Navy Response: Navy QA Officer listed on Worksheet #1 has been deleted.

2. Worksheet #5, Page 9: Rick Cavil is listed as the CH2M Hill Health & Safety Officer but Howard Gordon is listed as the CH2M Hill Health & Safety Officer on Worksheet #4. Please be consistent throughout the document.

   Navy Response: Revision made to show CH2M HILL Health & Safety Officer consistently throughout the document.

3. Worksheet 9-1. Please include Jeff Hansen's Phone Number – (207) 620-3883.

   Navy Response: Jeff Hansen's phone number has been added.

4. Worksheet #11:
   a. Please re-label the Contingency Plans as per the Work Plan. Please use Contingency Plan 1 instead of Contingency Plan 2a and Contingency Plan 2 instead of Contingency Plan 2b.

      Navy Response: The requested revision has been made.

   b. Item #5. In the first sentence, please clarify that one sample will be collected from each of the wells that are listed for field analysis of persulfate.

      Navy Response: The requested revision has been made.

   c. Item 9, fifth bullet. PREQB is concerned that if concentrations during annual sampling are below RGs but shows a consistent steadily increasing trend, rebound above the RGs is possible after monitoring has ceased. Therefore, as PREQB commented on the ROD, PREQB prefers that annual sampling be continued until it is demonstrated that concentrations are stable below the remediation goal. Note, PREQB recognizes that concentrations may fluctuate below the RG; however, should the three rounds of data show progressively increasing concentrations, additional monitoring is requested until concentrations cease to have an increasing trend and are below the RG. However, PREQB will defer to EPA on this issue.

      Navy Response: As stated in the ROD, action will only be taken if the concentrations of a COC(s) persist above the RG(s) for three consecutive events. At concentrations as low as the RGs and/or those observed prior to and during the pilot study, significant percent changes can be expected due to normal groundwater fluctuations and should not be interpreted as upward trends. For example, measured

benzene concentrations of 1, 2, and 4 ug/L over three consecutive events would not constitute an upward trend. For the purposes of evaluating groundwater conditions, recognizing instrument variability and innate groundwater heterogeneity, those concentrations are equivalent and, therefore, monitoring would cease because the remedial action objective would have been met. Please note that EPA concurred with the RAO being met when the COC concentrations over three consecutive events are less than or equal the RGs.

5. Worksheet #13: Please re-label the Contingency Plans as per the Work Plan. Please use Contingency Plan 1 instead of Contingency Plan 2a and Contingency Plan 2 instead of Contingency Plan 2b.

   Navy Response: The requested revision has been made.

6. Worksheet #14: Groundwater Sampling: The text states that sampling will be performed using a peristaltic or submersible pump. However, Worksheet #20 includes a note that it is assumed that a submersible pump will be used. Please use a submersible pump instead of a peristaltic pump due to the potential biases to VOCs with the use of a peristaltic pump. Please revise the text accordingly.

   Navy Response: Peristaltic pump has been removed from Worksheet #14. Groundwater sampling will be performed using a submersible pump.

7. Worksheet #15-2: The footnote for naphthalene states ELCR of 1E-5. However, Table 1 in Worksheet #11 states ELCR of 4E-5. Please revise Worksheet 15-2 for consistency.

   Navy Response: Footnote #1 on Worksheet #15-2 has been updated to "ELCR of 4E-5 and HI of 1 (EPA, 2013)" for consistency with Worksheet #11.

8. Worksheet 19-1. According to this table, preservation for SVOCs is listed as <6ºC but not freezing. However, EPA's Groundwater Issue entitled "Groundwater Sample Preservation at In-Situ Chemical Oxidation Sites – Recommended Guidelines" states that samples containing residual persulfate, which are to be analyzed for non-volatile contaminants (e.g., naphthalene and 2-methyl naphthalene) using GC-MS should also be preserved with ascorbic acid (EPA, 2012). Please clarify why ascorbic acid preservation is not being conducted for SVOCs.

   Navy Response: EPA's Groundwater Issue (EPA, 2012) states that "It is applicable for ground water samples containing volatile and non-volatile organic contaminants to be analyzed by gas chromatography (GC), or gas chromatography-mass spectroscopy (GC-MS), using either the purge and trap or headspace sample introduction methods, and high performance liquid chromatography (HPLC)." These two compounds Naphthalene and 2-Methylnaphthalene are analyzed as SVOCs (extractables, not purgeables). They are analyzed via GC-MS but the sample introduction method is 'direct injection.' "Purge and trap" and 'headspace' (and HPLC such as for Pentachlorophenol) do not apply; therefore, special preservation techniques are not suggested for SVOCs.

9. Worksheet#21: Please add SOP A-3 to this worksheet. SOP A-3 is listed as being used in Worksheet #22.

   Navy Response: SOP A-3 was incorrectly referenced in Worksheet #22. All occurrences of SOP A-3 in Worksheet #22 have been changed to SOP C-1, which is already listed in Worksheet #21.

10. Worksheet 22.
    a. Please confirm that the pH calibration will be a 2 or 3-point calibration.

       Navy Response: In general, a 2-point calibration will be done, but a 3-point calibration may be done, depending on the instrument used. This information is provided in SOP C-1, which is the reference SOP for the pH probe. As noted in the response to Page-specific Comment #9, the referenced SOP has been corrected in Worksheet #22.

    b. The calibration for DO is listed as using a YSI calibration standard. Please clarify if this standard is for 0 mg/L dissolved oxygen. Also please confirm that the dissolved oxygen probe will be calibrated to 100 percent saturation with compensation for barometric pressure.

       Navy Response: DO will be calibrated in accordance with SOP C-1. As noted in the response to Page-specific Comment #9, the referenced SOP has been corrected in Worksheet #22.

    c. Please clarify the acceptance criterion for dissolved oxygen. An acceptance criterion of +3.0 mg/L appears to be excessive.

       Navy Response: The acceptance criterion for dissolved oxygen has been revised to +/- 0.3 mg/L in accordance with SOP C-1.

    d. Please include daily drift checks for all field indicator parameters.

       Navy Response: For the purposes of purging the wells in order to determine when sampling can occur, calibrations daily and if unstable readings due to instrument malfunction are suspected are sufficient. All cells in the "Frequency" column have been revised to read "daily, before use and if unstable readings due to instrument malfunction are suspected."

    e. Please specify the calibration fluid for ORP as Zobell® solution, which is preferred for its stability and accuracy.

       Navy Response: The calibration solution used will be appropriate for the intended use.

11. Worksheet#24: Information for the VOC and SVOC analyses were provided twice in this worksheet. Please remove the first occurrence of these as the wrong SOPs are referenced in these occurrences.

    Navy Response: The requested revision has been made.

12. Worksheet #28: Worksheet #12 states that field QC samples will be included in Worksheet #28. However, field QC samples were not included. Please update Worksheet #28-1 to include equipment blanks, trip blanks and field duplicates. Please update Worksheet #28-2 to include equipment blanks and field duplicates.

    Navy Response: The requested information has been added: FDs, EBs, MS/MSDs, TBs, and temperature blanks for Worksheet #28-1 (GW VOCs) and FDs, EBs, MS/MSDs, and temperature blanks for Worksheet #28-2 (GW SVOCs).