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FINAL TIER II UNIFORM FEDERAL POLICY SAMPLING AND ANALYSIS PLAN PRE-
REMEDIAL DESIGN GROUNDWATER MONITORING PLAN FOR OPERABLE UNIT 1 (OU 1)
MCAS CHERRY POINT NC
11/1/2013
CH2M HILL



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November 4, 2013

403379.MS.MS

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Subject: Final Tier II Uniform Federal Policy Sampling and Analysis Plan, Pre-Remedial Design
Groundwater Monitoring, Operable Unit 1, MCAS Cherry Point, North Carolina, Contract
No: N62470-11-D-8012, CTO-WE70.

Dear Mr. Revell:

CH2M HILL is pleased to submit the Final Tier II Uniform Federal Policy Sampling and Analysis Plan (UFP-SAP), Pre-Remedial Design Groundwater Monitoring, Marine Corps Air Station (MCAS) Cherry Point, North Carolina. This Tier II UFP-SAP has also been provided to NCDENR, EPA, and MCAS Cherry Point, and CH2M HILL, as indicated below. If you have any questions or comments, feel free to contact me at (919) 875-4311.

Sincerely,

CH2M HILL

A handwritten signature in black ink, appearing to read "Erin M. Twamley".

Erin M. Twamley, PG
Project Manager

Enclosures: Final Tier II Uniform Federal Policy Sampling and Analysis Plan, Pre-Remedial Design
Groundwater Monitoring, Operable Unit 1, MCAS Cherry Point, North Carolina (1 hard copy, 1 CD)

C: Mr. George Lane, NCDENR (2 CDs)
Mrs. Gena Townsned, EPA (2 CDs)
Mr. Will Potter, MCAS Cherry Point (1 hard copy, 1 CD)
Mr. Doug Bitterman, CH2M HILL (1 electronic copy)
Mr. Bill Hannah, CH2M HILL (1 electronic copy)

1 Title and Approval Page

Final

Tier II Uniform Federal Policy Sampling and Analysis Plan Pre-Remedial Design Groundwater Monitoring Operable Unit 1

Marine Corps Air Station
Cherry Point, North Carolina

Contract Task Order WE70

November 2013

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Mid-Atlantic

Under the

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

Prepared by:



Virginia Beach, Virginia



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Signature Page

Quality Assurance Approval:

NAVFAC Quality Assurance Officer / Date

Quality Assurance Review:

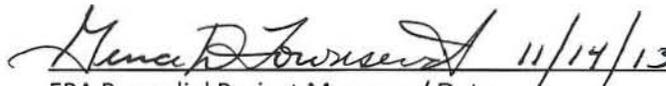


Doug Bitterman
CH2M HILL Activity Quality Manager / Date:

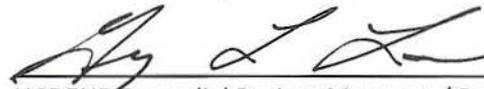
Other Approvals:



NAVFAC Remedial Project Manager / Date:



EPA Remedial Project Manager / Date:



NCDENR Remedial Project Manager / Date:

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Executive Summary

This Uniform Federal Policy Sampling and Analysis Plan (UFP-SAP) is prepared to support the pre-remedial design groundwater monitoring field activities at Operable Unit (OU) 1, located at Marine Corps Air Station (MCAS) Cherry Point, North Carolina (**Figures 1 and 2**). This UFP-SAP details various aspects of the field activities and serves as a guideline for the field activities and data assessment. It was developed in general accordance with two guidance documents: 1) U.S. Environmental Protection Agency (EPA), *EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5, QAMS* (EPA, 2002), and 2) *Uniform Federal Policy for Quality Assurance Project Plans* (Intergovernmental Data Quality Task Force, 2005).

This UFP-SAP was prepared under the Naval Facilities Engineering Command (NAVFAC) Atlantic, Comprehensive Long-term Environmental Action—Navy (CLEAN) 8012 Contract No. N62470-11-D-8012, Contract Task Order (CTO) WE70, for submittal to NAVFAC Mid-Atlantic, MCAS Cherry Point Environmental Affairs Department, EPA Region 4, and North Carolina Department of Environment and Natural Resources (NCDENR). The Department of the Navy (Navy), Environmental Affairs Department, EPA, and NCDENR work jointly as the MCAS Cherry Point Tier I Partnering Team.

OU1 is an industrial area of approximately 565 acres in the southwestern portion of MCAS Cherry Point. A large volatile organic compound (VOC) plume in groundwater has been identified across the majority of the southern portion of OU1, and has been designated the OU1 Central Groundwater Plume. The primary chemicals of concern in the OU1 Central Groundwater Plume are chlorinated VOCs that include trichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, vinyl chloride, 1,1-dichloroethane, and 1,1-dichloroethene. Other chemicals detected less frequently include tetrachloroethene, 1,1,1-trichloroethane, 1,1,2,2-tetrachloroethane, 1,2-dichloroethane, and chloroform.

The OU1 sites that contribute contamination to the OU1 Central Groundwater Plume are currently in the Proposed Plan stage, in which the preferred remedial alternative for the groundwater cleanup is identified. A comprehensive summary of historical activities and environmental investigations conducted at OU1, along with a Feasibility Study of potential remedial alternatives, are provided in the final Remedial Investigation report for OU1 (TetraTech NUS, 2002), OU1 Remedial Investigation Addendum (CH2M HILL, 2009), and OU1 Central Groundwater Plume Feasibility Study report (CH2M HILL, 2011).

The groundwater data collected as a part of this UFP-SAP will be used to support the remedial design of the final remedy for the OU1 Central Groundwater Plume. The last comprehensive sampling event at OU1 was conducted in 2009, and more recent data, plus some additional data from previously unsampled locations, are warranted. This data will be supplemented by data gathered during the OU1 Central Groundwater Plume biobarrier and zero-valent iron permeable reactive barrier pilot studies, which are currently on-going. The specific objectives of this groundwater monitoring will be to:

- Provide a current snapshot of the horizontal and vertical extent of the OU1 Central Groundwater Plume
- Better define the plume characteristics in the vicinity of Sandy Branch
- Provide a current assessment of conditions for natural attenuation

To achieve these objectives, the following field activities will be conducted:

- Site preparation, including vegetation clearance, silt fence construction, and utility location
- Drilling, installation, development, and surveying of seven¹ new groundwater monitoring wells

¹The final locations for the new monitoring wells may be altered based on the field conditions. Additional locations may be selected based on the analytical results.

- Collection of groundwater samples from 162 existing monitoring wells and 7 new monitoring wells
- Site restoration and investigation-derived waste management

Groundwater samples from all sampling locations will be analyzed for the site-specific chemicals of concern and select geochemical parameters (temperature, pH, dissolved oxygen, oxidation-reduction potential, specific conductance, turbidity, and ferrous iron). A select number of groundwater samples will also be analyzed for natural attenuation indicator parameters including methane, ethane, ethene, nitrate, nitrite, sulfate, and total organic carbon. A smaller subset of groundwater samples will be further analyzed for the natural attenuation indicator parameter sulfide and microbial analyses for *Dehalococcoides* (DHC) and DHC functional genes. The final locations for the new monitoring wells may be altered based on the field conditions. Additional locations may be selected based on the analytical results.

This UFP-SAP will help ensure that environmental data collected or compiled are scientifically sound, of known and documented quality, and suitable for the intended uses (environmental characterization and determination of the path forward). The laboratory information cited in this UFP-SAP is specific to EMAX, Inc. and Microbial Insights, Inc. If additional laboratory services are requested that require modification to the existing UFP-SAP, the revised sections will be submitted to the Navy and regulatory agencies for approval.

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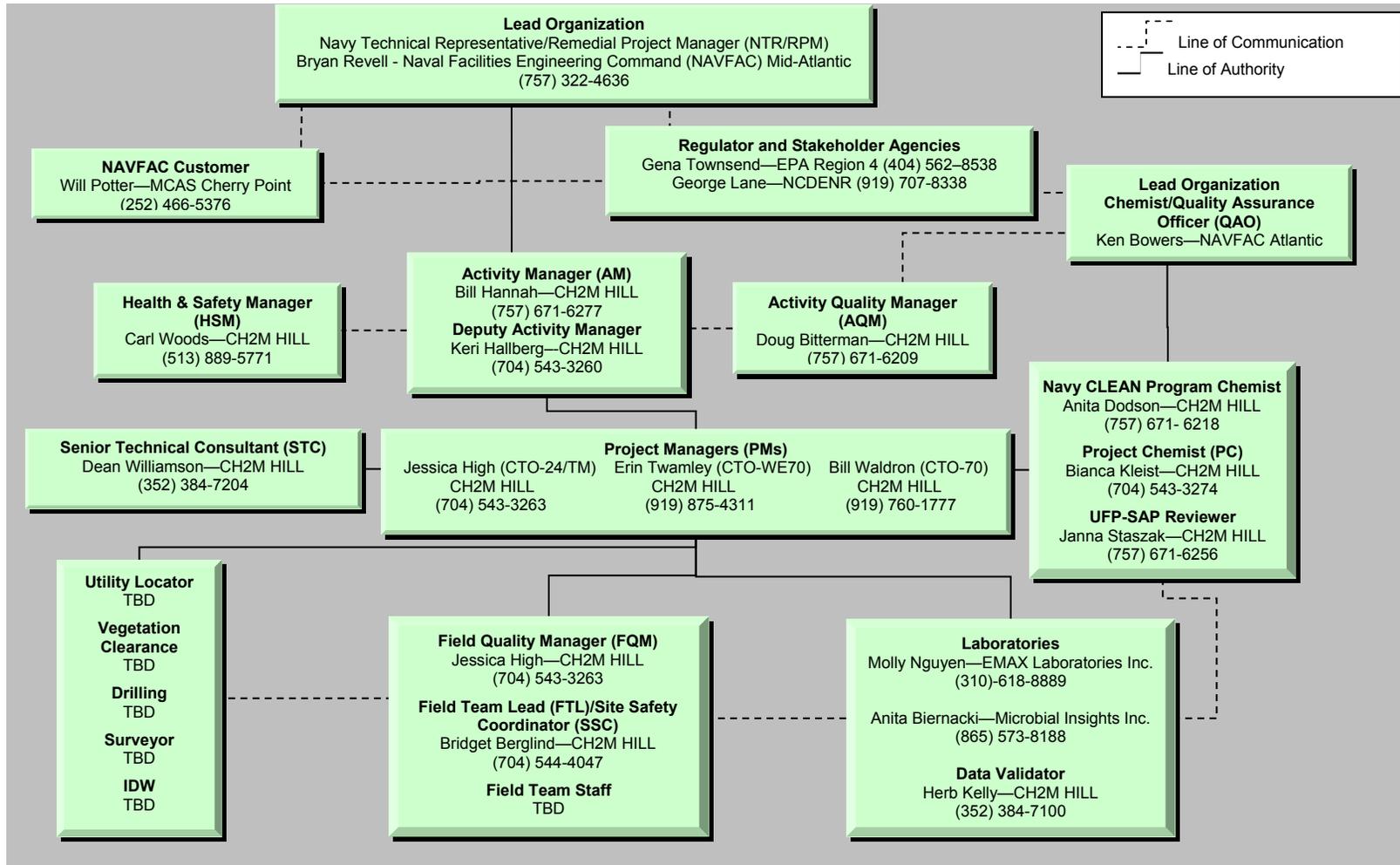
Acronyms and Abbreviations

°C	degrees Celsius
µg/L	micrograms per liter
AM	Activity Manager
AQM	Activity Quality Manager
bgs	below ground surface
CA	corrective action
CLEAN	Comprehensive Long-term Environmental Action—Navy
COC	chemical of concern
COPC	chemical of potential concern
CTO	Contract Task Order
DCA	dichloroethane
DCE	dichloroethene
DHC	<i>Dehalococcoides</i>
DL	detection limit
DO	dissolved oxygen
DoD	Department of Defense
DQI	data quality indicator
DRMO	Defense Reutilization and Marketing Office
DV	data validation
ELAP	Environmental Laboratory Accreditation Program
EPA	U.S. Environmental Protection Agency
FRCE	Fleet Readiness Center—East
FS	Feasibility Study
FTL	Field Team Lead
HDPE	high-density polyethylene
HSM	Health & Safety Manager
ICAL	initial calibration
IDW	investigation-derived waste
IWTP	Industrial Wastewater Treatment Plant
LCS	laboratory control sample
LOD	limit of detection
LOQ	limit of quantification
LUC	land use control
MCAS	Marine Corps Air Station
MCL	maximum contaminant level
mg/L	milligrams per liter
ml	milliliter(s)
MPC	measurement performance criteria
MS/MSD	matrix spike/matrix spike duplicate
NAIP	natural attenuation indicator parameter

Navy	Department of the Navy
NCDENR	North Carolina Department of Environment and Natural Resources
NIRIS	Navy Installation Restoration Information System
NTR	Navy Technical Representative
NC 2L	North Carolina 2L Groundwater Quality Standards
OU1	Operable Unit 1
ORP	oxidation-reduction potential
PAL	project action limits
PC	Project Chemist
PCA	tetrachloroethane
PCE	tetrachloroethene
PIL	project indicator limit
PM	Project Manager
POC	point of contact
PQL	project quantitation limit
PRB	permeable reactive barrier
QA	quality assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RI	Remedial Investigation
RPD	relative percent difference
RPM	Remedial Project Manager
SAP	Sampling and Analysis Plan
SOP	standard operating procedure
SSC	Site Safety Coordinator
STC	Senior Technical Consultant
TBD	to be determined
TCA	trichloroethane
TCE	trichloroethene
TM	Task Manager
TOC	total organic carbon
UFP	Uniform Federal Policy
VC	vinyl chloride
VOC	volatile organic compound
WQP	water quality parameter
ZVI	zero-valent iron

2 Project Organizational Chart

[\(Uniform Federal Policy-Quality Assurance Project Plans \[UFP-QAPP\] Manual Section 2.4.1 – Worksheet #5\)](#)



3 Communication Pathways

[\(UFP-QAPP Manual Section 2.4.2 – Worksheet #6\)](#)

The communication pathways for the Uniform Federal Policy - Sampling and Analysis Plan (UFP-SAP) are shown below.

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or E-mail	Procedure, Pathway, etc.
Communication with the Department of the Navy (Navy) (lead agency)	NTR/RPM	Bryan Revell	bryan.revell@navy.mil (757) 322-4636	Primary point of contact (POC) for Navy; can delegate communication to other internal or external POCs. RPM will notify the EPA and NCDENR via email or telephone within 24 hours of field changes affecting the scope or implementation of the design. Navy will have 30 days for UFP-SAP review. All sampling data will be presented and discussed during partnering meetings.
Communication with EPA Region 4	EPA Region 4 RPM	Gena Townsend	townsend.gena@epa.gov (404) 562-8538	Primary POC for EPA; can delegate communication to other internal or external POCs. Upon notification of field changes, EPA will have 24 hours to approve or comment on the field changes. All data results will be presented and discussed during partnering meetings.
Communication with NCDENR	NCDENR RPM	George Lane	george.lane@ncdenr.gov (919) 707-8338	Primary POC for NCDENR; can delegate communication to other internal or external POCs. Upon notification of field changes, NCDENR will have 24 hours to approve or comment on the field changes. All data results will be presented and discussed during partnering meetings.
Communication regarding overall project status and implementation and primary POC with Navy RPM, EPA, and NCDENR	CH2M HILL AM	Bill Hannah	bill.hannah@ch2m.com (757) 671-6277	Oversees project and will be informed of project status by the PM. If field changes occur, the AM will work with the Navy RPM to communicate field changes to the team via email within 24 hours. All data results will be communicated to the project team during the first partnering meeting following data receipt.
Communication regarding overall project status and implementation and backup POC with Navy RPM, EPA, and NCDENR	CH2M HILL Deputy AM	Keri Hallberg	keri.hallberg@ch2m.com (704) 543-3260	Oversees project and will be informed of project status by the PM. If field changes occur, the Deputy AM will provide backup to AM to work with the Navy RPM to communicate field changes to the team via email within 24 hours. All data results will be communicated to the project team during the first partnering meeting following data receipt.
Technical communications for project implementation, and data interpretation	CH2M HILL STC	Dean Williamson	dean.williamson@ch2m.com (352) 384-7204	Team members will contact the STC regarding questions/issues encountered in the field, input on data interpretation, etc., as needed. The STC will have 24 hours to respond to technical field questions as necessary. Additionally, the STC will review the data (as necessary) prior to partnering team discussion and reporting review.
Quality issues during project implementation and data interpretation	CH2M HILL AQM	Doug Bitterman	doug.bitterman@ch2m.com (757) 671-6209	Team members will contact the AQM regarding quality issues during project implementation. The AQM will report to the AM, the CH2M HILL Program Quality Manager, and the NAVFAC Atlantic QAO.

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or E-mail	Procedure, Pathway, etc.
Communications regarding project management and implementation of work related to Contract Task Order (CTO)-24	PM	Jessica High	jessica.high@ch2m.com (704) 543-3263	Responsible for forwarding all information and materials about the project to the Navy, AMs, and the STC as necessary. POC for field sampling team.
Communications regarding project management and implementation of work related to CTO-WE70	PM	Erin Twamley	erin.twamley@ch2m.com (919) 875-4311	Responsible for forwarding all information and materials about the project to the Navy, AMs, and the STC as necessary. POC for field sampling team.
Communications regarding project management and implementation of work related to CTO-70	PM	Bill Waldron	bill.waldron@ch2m.com (919) 760-1777	Responsible for forwarding all information and materials about the project to the Navy, AMs, and the STC as necessary. POC for field sampling team.
Assists with communications regarding project management and implementation	TM	Jessica High	jessica.high@ch2m.com (704) 543-3263	Assists PMs with communication with project team and the STC as necessary. Additional POC for field sampling team.
Health and Safety	SSC	Bridget Berglind	bridget.berglind@ch2m.com (704) 544-4047	Responsible for the adherence of team members to the site safety requirements described in the Health and Safety Plan. Will report health and safety incidents and near misses to the PM.
UFP-SAP changes in field	FQM	Jessica High	jessica.high@ch2m.com (704) 543-3263	Prepares documentation of deviations from the UFP-SAP in the field logbook and immediately notifies the PM. Deviations will be made only with approval from the PM.
UFP-SAP Field Changes/ Field Progress Reports	FTL	Bridget Berglind	bridget.berglind@ch2m.com (704) 544-4047	Prepares documentation of field activities and UFP-SAP deviations (made with the approval of the AM and/or QAO) in field logbooks; provides daily progress reports to the PM. The contractor PM or AM may notify the Navy RPM of any field data quality issues that could affect the data quality objectives or could negatively affect project schedule.
Data tracking from field collection to database upload	PC	Bianca Kleist	bianca.kleist@ch2m.com (704) 543-3274	Tracking data from sample collection through database upload.
Reporting Laboratory Data Quality Issues	Laboratory PM	Molly Nguyen (EMAX Labs Inc.) Anita Biernacki (Microbial Insights Inc.)	(310)-618-8889 (865) 573-8188	All quality assurance (QA)/quality control (QC) issues with project field samples will be reported within 1 day to the PC by the laboratory. Should analytical laboratory issues affect data usability by rendering a significant amount of rejectable or unusable data, such that the project completeness goal cannot be obtained, the PC will notify the project team, including the Navy RPM and Navy QAO.
Reporting Data Validation (DV) Issues	Data Validator	Herb Kelly	herb.kelly@ch2m.com (352) 384-7100	All DV issues regarding resubmissions from the laboratory will copy the CH2M HILL chemist on communications. The DV report will be due within 14 calendar days of data receipt.
Field and analytical corrective actions (CAs)	PC	Bianca Kleist	bianca.kleist@ch2m.com (704) 543-3274	CAs for field and analytical issues will be determined by the FTL and/or the PC and reported to the PM within 4 hours.

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or E-mail	Procedure, Pathway, etc.
Release of Analytical Data	PC	Bianca Kleist	bianca.kleist@ch2m.com (704) 543-3274	No analytical data can be released until validation of the data is completed and has been approved by the PC. The PC will review analytical results within 7 days of receipt for release to the project team.
Field CAs	FTL FQM/PM/TM PM PM	Bridget Berglind Jessica High Erin Twamley Bill Waldron	bridget.berglind@ch2m.com (704) 544-4047 jessica.high@ch2m.com (704) 543-3263 erin.twamley@ch2m.com (919) 875-4311 bill.waldron@ch2m.com (919) 760-1777	Field and analytical issues requiring CA will be determined by the FQM/TM and FTL or PM; the PM will ensure QAPP requirements are met by field staff.

Note: Stop Work Order: Any field member can immediately stop work if an unsafe condition, which is immediately threatening to human health, is observed. Ultimately, the FTL, PM, and AM can stop work for a period of time. NAVFAC Mid-Atlantic can stop work at any time.

4 Project Planning Session Participants Sheet

[\(UFP-QAPP Manual Section 2.5.1 – Worksheet #9\)](#)

4.1 September 2012 Team Discussion

Project Name: OU1 Additional Supplemental Investigation		Site Name: Operable Unit 1 (OU1)		
Projected Date(s) of Sampling: October 2013		Site Location: MCAS Cherry Point		
Project Manager: Jessica High, Erin Twamley, Bill Waldron				
Date of Session: September 10, 2012				
Scoping Session Purpose: Teleconference call; Review the Sandy Branch Feasibility Study (FS) alternatives				
Name	Title	Affiliation	Phone #	E-mail Address
Nicole Cowand	RPM	NAVFAC	757-322-4768	Nicole.Cowand@navy.mil
Keri Hallberg	Deputy AM	CH2M HILL	803-396-5452	Keri.hallberg@ch2m.com
Will Potter	RPM	Cherry Point	252-466-5376	William.r.potter@usmc.mil
Gena Townsend	RPM	EPA	404-562-8538	Townsend.gena@epa.gov
George Lane	RPM	NCDENR	919-707-8338	George.lane@ncdenr.gov
Bill Hannah	AM	CH2M HILL	757-671-6277	Bill.hannah@ch2m.com
Doug Bitterman	AAQM	CH2M HILL	757-671-6209	Doug.bitterman@ch2m.com
Erica DeLattre	AM	Rhea	724-316-6593	Erica@rhea.us

Comments/Decisions

The team reviewed the FS alternatives for OU1, in particular at Sandy Branch, based on the results of the OU1 permeable reactive barrier (PRB) pilot study. The team discussed how long the remedy for Zone 2 (downgradient portion) of the plume would be needed once the Zone 1 (near source) portion of the plume has been cut off. George asked if bioaugmentation is needed in Zone 2; Keri responded that bioaugmentation likely will be needed based on Zone 1 pilot study results.

George asked about land use controls (LUCs) and long-term monitoring (LTM); Bill responded that LUCs and LTM will be included in the final remedy and that LUCs would extend everywhere there is an exceedance of North Carolina Groundwater Quality Standards (NC 2L Standards).

The team concurred that zero-valent iron (ZVI) ferrox injection is the best alternative for Zone 2 in the area of Sandy Branch. Gena's biggest concern is to ensure that the remedy is distributed across the plume. She agreed that alternating well points for greater coverage and plume treatment is appropriate.

Bill added that the Navy is considering adding additional monitoring wells in the Sandy Branch area to help optimize the remedial design and discussed the purpose for these additional wells to provide adequate delineation of the plume in this area.

Action Items

None

Consensus Decisions

None

4.2 February 2013 Team Discussion

Project Name: OU1 Pre-Remedial Design Groundwater Monitoring		Site Name: Operable Unit 1		
Projected Date(s) of Sampling: October 2013		Site Location: MCAS Cherry Point		
Project Manager: Jessica High, Erin Twamley, Bill Waldron				
Date of Session: February 27, 2013				
Scoping Session Purpose: Present and discuss the overall objective of the OU1 Pre-Remedial Design Groundwater Monitoring				
Name	Title	Affiliation	Phone #	E-mail Address
Bryan Revell	RPM	NAVFAC	757-322-4636	Bryan.revell@navy.mil
Kirk Stevens	RPM	NAVFAC	757-322-4589	Kirk.a.stevens@navy.mil
Will Potter	RPM	Cherry Point	252-466-5376	William.r.potter@usmc.mil
Gena Townsend	RPM	EPA	404-562-8538	Townsend.gena@epa.gov
George Lane	RPM	NCDENR	919-707-8338	George.lane@ncdenr.gov
Bill Hannah	AM	CH2M HILL	757-671-6277	Bill.hannah@ch2m.com
Doug Bitterman	QAM	CH2M HILL	757-671-6209	Doug.bitterman@ch2m.com
Erin Twamley	Recorder/PM	CH2M HILL	919-760-1763	Erin.twamley@ch2m.com
Erica DeLattre	AM	Rhea	724-316-6593	Erica@rhea.us

Comments/Decisions

The Team discussed that the last full round of groundwater samples were collected at OU1 in 2009. The objective of the OU1 additional groundwater monitoring is to provide a snapshot of the Central Groundwater Plume at OU1 in preparation for the remedial design. Groundwater samples will be collected from 169 monitoring wells at OU1 and analyzed for chemicals of concern (COCs) outlined in the FS.

Action Items

None

Consensus Decisions

The Team was in agreement on the general approach.

5 Conceptual Site Model

[\(UFP-QAPP Manual Section 2.5.2 – Worksheet #10\)](#)

This section provides a summary of site background and key elements of the conceptual site model, followed by a narrative description of the problems to be addressed during the field activities in Section 6.

5.1 Background

Marine Corps Air Station Cherry Point

Marine Corps Air Station (MCAS) Cherry Point is a 13,164-acre military reservation adjacent to the city of Havelock in southeastern Craven County, North Carolina (**Figure 1**). MCAS Cherry Point was commissioned in 1942 and provides support facilities and services for the Second Marine Aircraft Wing, the Fleet Readiness Center—East (FRCE) (formerly Naval Aviation Depot), Combat Service Support Detachment 21 of the Second Marine Logistics Group, the Naval Air Maintenance Training Group Detachment, and the Defense Reutilization and Marketing Office (DRMO). MCAS Cherry Point maintains facilities for training and for supporting the Atlantic Fleet Marine Force aviation units and is designated as a primary aviation supply point.

MCAS Cherry Point is bounded by the Neuse River to the north, Hancock Creek to the east, and North Carolina Highway 101 to the south. The western boundary is an irregular property line located approximately 0.75 mile west of Slocum Creek.

In 1943, a massive aircraft assembly and repair facility (now FRCE) was added. Hazardous wastes have been generated through historical aircraft assembly and maintenance operations within FRCE since that time. These wastes have included plating wastes, organic solvents, paint removers and cleaners, oils and lubricants, waste petroleum, and polychlorinated biphenyls.

Operable Unit 1

OU1 is an industrial area of approximately 565 acres in the southwestern portion of MCAS Cherry Point (**Figures 2 and 3**). OU1 is bounded by C Street and Sandy Branch to the northwest, portions of the MCAS Cherry Point flightline and runway to the northeast and southeast, and East Prong Slocum Creek to the southwest.

The major features of OU1 are the FRCE, a former borrow pit/disposal area (Site 16), the Industrial Wastewater Treatment Plant (IWTP, Site 42), the DRMO (Site 17), and several support facilities. The Federal Facility Agreement identified 12 sites that were investigated as part of the OU1 Remedial Investigation (RI) completed in 2002. These sites are shown in **Figure 3** and listed as follows:

- Site 14 – Motor Transportation
- Site 15 – Ditch and Area Behind Fleet Readiness Center East
- Site 16 – Landfill at Sandy Branch
- Site 17 – DRMO Drainage Ditch
- Site 18 – Facilities Maintenance Compound
- Site 42 – IWTP
- Site 47 – Industrial Area Sewer System
- Site 51 – Building 137 Former Plating Shop
- Site 52 – Building 133 Former Plating Shop and Ditch
- Site 83 – Building 96 Former Pesticide Mixing Area
- Site 92 – Volatile Organic Compounds (VOCs) in Groundwater near the Stripper Barn
- Site 98 – VOCs in Groundwater near Building 4032

A Focused RI/FS report completed in 1996 identified a VOC plume at OU1. At that time, the plume had been delineated to include the majority of the southern portion of OU1, including an area beneath Building 133 within FRCE. This plume has subsequently been designated the OU1 Central Groundwater Plume and has been more fully delineated (discussed further in Section 5.1.2 below). Six of the 12 FFA sites listed above have been identified as contributing to VOC contamination within the OU1 Central Groundwater Plume. These sites are:

- Site 42 – IWTP
- Site 47 – Industrial Area Sewer System
- Site 51 – Building 137 Former Plating Shop
- Site 52 – Building 133 Former Plating Shop and Ditch
- Site 92 – VOCs in Groundwater near the Stripper Barn
- Site 98 – VOCs in Groundwater near Building 4032

5.2 Historical Site Investigations

A comprehensive summary of historical activities and environmental investigations conducted at OU1 is provided in the *Remedial Investigation (RI) for Operable Unit 1* (Tetra Tech NUS, 2002), the *OU1 Remedial Investigation Addendum* (RI Addendum) (CH2M HILL, 2009), and the *OU1 Central Groundwater Plume Feasibility Study* (FS) (CH2M HILL, 2011). Information for the on-going OU1 Central Groundwater Plume biobarrier and ZVI PRB pilot studies is included in the *OU1 Central Groundwater Plume In-Situ Enhanced Bioremediation Pilot Study Implementation Report* (CH2M HILL, 2012a) and the *OU1 Central Groundwater Plume Zero-Valent Iron Permeable Reactive Barrier Pilot Study Implementation Plan* (CH2M HILL, 2012b).

5.3 Site Description

OU1 generally consists of paved or concrete surfaces with buildings throughout the area. The ground surface is relatively flat, ranging in elevation from 18 to 24 feet above mean sea level, except within the western portion of OU1 adjacent to East Prong Slocum Creek, where the ground surface elevation drops to 2 feet above mean sea level.

Surface water bodies present within OU1 include East Prong Slocum Creek and its tributaries School House Branch and Sandy Branch (**Figure 3**). School House Branch flows along the southeastern boundary of OU1. Two tributaries of Sandy Branch are within the western portion of OU1 and flow to Sandy Branch along the western boundary of OU1. East Prong Slocum Creek is brackish, is larger than its two tributaries, and occurs along the southwestern boundary of OU1. From East Prong Slocum Creek, surface water flows into Slocum Creek and eventually the Neuse River. East Prong Slocum Creek, School House Branch, and Sandy Branch have been classified by NCDENR as Class C fresh water bodies.

The hydrogeologic framework to a depth of approximately 500 feet beneath OU1 consists of nine hydrostratigraphic units: five aquifers and four confining units. From shallowest (youngest) to deepest (oldest), the aquifers with associated confining units are the surficial, Yorktown, Pungo River, upper Castle Hayne, and lower Castle Hayne aquifers. A simplified conceptual site model of OU1 showing the pertinent hydrostratigraphic units is presented on **Figure 4**.

The locations of hydrogeologic cross sections through OU1 are shown in **Figure 5**, with the conceptual cross-sections A-A', B-B', and C-C' shown in **Figures 6** through **8**.

The surficial aquifer is the first encountered groundwater beneath OU1 (depth of approximately 4 to 21 feet below ground surface [bgs]) and is unconfined. The saturated thickness of the surficial aquifer ranges from approximately 30 to 45 feet beneath OU1, and is controlled by the fine-grained Yorktown confining unit (generally sandy silt) at the base of the aquifer. The Yorktown aquifer occurs beneath the Yorktown confining unit and is generally a confined to semi-confined aquifer. The saturated thickness is approximately 40 feet and is controlled by the Yorktown confining unit at the top and the Pungo River confining unit at its base, where present.

Groundwater contamination at OU1 has only been identified in the surficial aquifer and not observed in the Yorktown, Pungo River, upper Castle Hayne, or lower Castle Hayne aquifers. Each aquifer is separated by a confining unit except where the units are absent or discontinuous.

A regional, Pleistocene-age paleochannel eroded the Yorktown and Pungo River confining units and deposited younger sediments in the southwestern portion of OU1 (**Figures 6 and 7**). As a result, the uppermost aquifers may be in direct hydraulic communication within the paleochannel where the confining units are absent. Groundwater levels northeast of the paleochannel boundary (outside the paleochannel) show a discontinuity across the Yorktown confining unit (which acts as an aquitard) and a downward vertical gradient from the surficial aquifer to the Yorktown aquifer. Groundwater levels southwest of the paleochannel boundary (within the paleochannel) generally show similar groundwater levels between the surficial and Yorktown aquifers and an upward vertical gradient from the Yorktown aquifer to the surficial aquifer.

Groundwater flows generally westward in the surficial aquifer toward East Prong Slocum Creek and Sandy Branch at an average horizontal hydraulic gradient of approximately 0.003 foot per foot. The average linear horizontal groundwater velocity in the surficial aquifer is estimated at approximately 0.1 to 0.2 foot per day. The 2009 groundwater elevation maps are provided as **Figures 9 and 10**.

Nature and Extent of Contamination

The most prevalent VOCs detected above regulatory standards within the Central Groundwater Plume (in order based on the greatest frequency of exceedances) are trichloroethene (TCE), vinyl chloride (VC), 1,2-dichloroethene (DCE), 1,1-dichloroethane (DCA), and 1,1-DCE. These chemicals generally exceed the regulatory standards at a frequency of greater than 10 percent in monitoring wells. Other VOCs related to chlorinated solvents detected above regulatory standards, but less frequently, included tetrachloroethene (PCE), 1,1,1-trichloroethane (TCA), 1,1,2,2-tetrachloroethane (PCA), and 1,2-DCA.

Although the Central Groundwater Plume has not been sampled since 2009, three distinct plumes of TCE and its degradation products have been consistently observed within OU1 (**Figures 11 through 16**). VOC isoconcentration contours are also shown on the cross-sections A-A', B-B', and C-C', shown in **Figures 6 through 8**. The most elevated TCE concentrations (**Figures 11 and 12**) occur beneath Building 133, at concentrations that may be indicative of the presence of dense non-aqueous phase liquid (maximum concentration of 62,000 micrograms per liter ($\mu\text{g/L}$)). Beneath Building 133, TCE generally occurs only within the upper portion of the surficial aquifer (upper surficial aquifer) and was not observed in the lower portion of the surficial aquifer (lower surficial aquifer). TCE extends from the upper surficial aquifer into the lower surficial aquifer at locations downgradient of Building 133, and the plume extends from the western portion of the building more than 3,000 feet to East Prong Slocum Creek and Sandy Branch. TCE was not observed on the western side of these water bodies because the plume is believed to discharge to them, creating a hydraulic barrier.

Another distinct TCE plume occurs within the upper surficial aquifer beneath Building 137 and extends a few hundred feet in the southwestern direction beneath the building. The plume extends from the upper surficial aquifer to the lower surficial aquifer downgradient of Building 137 and mixes with the plume originating from beneath the IWTP.

A third TCE groundwater plume within the upper surficial aquifer occurs near the IWTP. The TCE plume from this area migrates within the upper and lower surficial aquifers beneath Tributary #2 to Sandy Branch and also joins the larger plume that extends from Building 133.

Detections of 1,2-DCE (**Figures 13 and 14**) and VC (**Figures 15 and 16**) generally occur in the monitoring wells where exceedances of the NC 2L Standards for TCE were recorded. The most elevated concentration of cis-1,2-DCE (maximum concentration of 4,200 $\mu\text{g/L}$) was detected within the lower surficial aquifer just downgradient of Building 133. The most elevated concentration of VC (maximum concentration of 650 $\mu\text{g/L}$) was also detected in the lower surficial aquifer, downgradient of Building 133. Similar to TCE, 1,2-DCE and VC contamination extends

from the upper surficial aquifer beneath Building 133 to the lower surficial aquifer downgradient of the building, and farther to Sandy Branch and East Prong Slocum Creek.

Concentrations of 1,1-DCE generally exceed the NC 2L Standards in a small area within the upper surficial aquifer beneath Building 137, within the lower surficial aquifer downgradient of Building 137 and upgradient of the IWTP, and within the upper surficial aquifer beneath the IWTP. Concentrations of 1,1,1-TCA were detected above the NC 2L Standards at only one monitoring well completed within the upper surficial aquifer at Building 137.

Receptors

As depicted on **Figure 4**, potential current receptors are industrial workers and construction workers. In the future, potential receptors could also include hypothetical residential receptors.

The updated human health risk assessment presented in the OU1 RI Addendum (CH2M HILL, 2009) concluded that potable use of the surficial aquifer groundwater by future residents may result in unacceptable risk. The noncarcinogenic hazard to both a child and adult resident and carcinogenic risk to the lifetime resident using the surficial aquifer groundwater as a potable water supply exceeded EPA acceptable levels for both reasonable maximum exposure and central tendency exposure point evaluations. These hazards and risks were primarily associated with chlorinated VOCs (PCE, TCE, and VC contributing the greatest risk and hazard), with additional contributions from benzene and arsenic.

The updated human health risk assessment also concluded that exposure to surficial aquifer groundwater by a construction worker would result in a hazard index of 1.7. However, no individual constituents or target organs had hazard indices above EPA's target level of 1.0. The carcinogenic risk to a future construction worker from exposure to surficial aquifer groundwater was within EPA's target risk range. As a result, there were no calculated hazards or risks to a future construction worker above EPA's target levels. Potential risks to industrial workers related to vapor intrusion are currently under evaluation.

A complete discussion of the technical details of the CSM is included in Volume 2 of the RI (Tetra Tech NUS, 2002). The site COCs identified during the risk assessments were finalized in the OU1 Central Groundwater Plume FS (CH2M HILL, 2011), and are listed below.

- 1,1,1 TCA
- 1,1,2,2 PCA
- 1,1,2 TCA
- 1,1 DCA
- 1,1 DCE
- 1,2 DCA
- 1,2 DCE (total)
- Chloroform
- cis-1,2-DCE
- PCE
- trans-1,2-DCE
- TCE
- VC

6 Data Quality Objectives/Systematic Planning Process Statements

[\(UFP-QAPP Manual Section 2.6.1 – Worksheet #11\)](#)

6.1 Problem Statement

The groundwater data collected as a part of this UFP-SAP will be used to support the remedial design of the final remedy for the OU1 Central Groundwater Plume. The last comprehensive sampling event at OU1 was conducted in 2009, and more recent data, plus some additional data from previously unsampled locations, are warranted. Additionally, the concentrations of COCs and the extent of the plume within the vicinity of Sandy Branch is currently unknown.

6.2 Project Quality Objectives listed in the form of if/then qualitative and quantitative statements.

Table 6-1 below lists the site-specific COCs and their respective screening criteria the data collected will be compared against to ascertain the lateral and vertical extent of the COC plumes. **Table 6-2** below describes the PIL data being collected to illustrate the process of defining the natural attenuation performance-monitoring objectives.

If the COC and PIL data results of the OU1 pre-remedial design groundwater monitoring event indicate that the current understanding of the lateral and vertical extent of the OU1 Central Groundwater Plume has changed since the last comprehensive sampling event in 2009, then the Navy, EPA, and NCDENR will use the site-specific details for optimization of the remedial design.

If monitoring wells determined to be necessary to providing adequate plume determination are determined to be damaged or cannot be found, then the Navy, EPA, and NCDENR will assess whether the missing or damaged wells need to be replaced to complete assessment of the OU1 Central Groundwater Plume.

6.3 Environmental Questions to be Answered

The purpose of the additional groundwater investigation is to provide a current snapshot of the extent of the OU1 Central Groundwater Plume and to better refine the northern lobe plume characteristics in the vicinity of Sandy Branch. The final locations for the new Sandy Branch monitoring wells may be altered based on the field conditions encountered and additional locations may be selected based on the analytical results. Additionally, data will be collected to update the assessment of conditions within the OU1 Central Groundwater Plume for natural attenuation. The following are the specific environmental questions to be answered by the investigation.

What are the current COC concentrations?

Groundwater samples will be collected throughout OU1 to better define the extent of the OU1 Central Groundwater Plume in specific areas, including the northern lobe of the plume in the vicinity of Sandy Branch, which had previously been undefined, and to provide a current assessment of conditions for natural attenuation. The samples will be analyzed for the following VOCs, which were identified as COCs during the FS:

- 1,1-DCA
- 1,1-DCE
- 1,1,1-TCA
- 1,1,2-TCA
- 1,1,2,2-PCA
- 1,2-DCA

- 1,2-DCE (total)
- Chloroform
- cis-1,2-DCE
- trans-1,2-DCE
- PCE
- TCE
- VC

What is the extent of COC impacts in groundwater within the vicinity of Sandy Branch ?

Seven new monitoring wells are proposed for installation to refine the northern lobe of the OU1 Central Groundwater Plume in the vicinity of Sandy Branch (see Section 8.1.3 for well location rationale). One of these will be screened in the upper surficial aquifer, and the remaining six will be screened in the lower surficial aquifer. These seven new well locations were selected for localized spatial understanding in the area where the remedy would be implemented. Additional locations may be selected based on the analytical results if the seven wells are not adequate to refine the northern lobe of the plume.

6.4 What are the Project Action Limits?

Project action limits (PALs) are media-specific standards and criteria chosen for evaluation to help provide a conservative assessment of site conditions and determine if action is needed to address concentrations of chemicals present at the site, and if so, what remedial alternative(s) are potentially appropriate. The PALs are the preliminary remediation goals developed in the FS, which are the lower of chemicals the NC 2L Standards and federal maximum contaminant levels (MCLs). **Table 6-1** lists the COCs for the OU1 Central Groundwater Plume identified in the FS and the screening criteria data will be compared against.

TABLE 6-1
 OU1 Central Groundwater Plume Site-specific COCs

COC (µg/L)	Screening Criteria		Maximum Detection	
	NC 2L Standards	MCL	Maximum Concentration	Location
1,1,1-TCA	200	200	49,000	47GW07
1,1,2,2-PCA	0.2	--	6	16GW02
1,1,2-TCA	--	5	39	52GW08
1,1-DCA	6	--	8,800	47GW07
1,1-DCE	7	7	2,900	47GW07
1,2-DCA	0.4	5	14	47GW07
1,2-DCE (total)	--	70	16,000	42GW05
Chloroform	70	80	40	52GW14
cis-1,2-DCE	70	70	33,000	52GW08
PCE	0.7	5	71	52GW53
trans-1,2-DCE	100	100	1,100	MW73
TCE	3	5	62,000	52GW53
VC	0.03	2	8,000	42GW05

In addition to PALs, project indicator limits (PILs) for groundwater were established to better determine the extent to which natural attenuation is occurring at the site. In order for geochemical parameter data to be meaningful, more than one round of data is typically necessary. Therefore, it is anticipated that the most thorough evaluation will be of the results for the existing wells that were also sampled during the 2009 additional groundwater investigation. PILs will be evaluated as a whole because no individual parameter represents a definitive summary of site conditions. The parameters, their associated PILs, and explanations for inclusion are shown in **Table 6-2**.

TABLE 6-2
 Project Indicator Levels

Parameter	PIL	Justification
DHC and functional genes	>10 ³ cells per milliliter (ml)	A result of >10 ³ cells per ml is indicative of conditions optimal for reductive dechlorination; however, the presence (detection) of lower concentrations of DHC can indicate conditions favorable for slower rates of natural attenuation or conditions favorable for enhanced reductive dechlorination. Very low concentrations or non-detect levels may indicate that the site would benefit from bioaugmentation.
pH	6 - 8.5	A pH value ranging from 6 to 8.5 is ideal for supporting microbial populations needed for natural attenuation.
Methane	> 0.5 milligrams per liter (mg/L)	Elevated methane levels are expected to be present under highly reducing conditions as a byproduct of degradation by methanogenic bacteria and are a positive indicator that reductive dechlorination of VOCs can occur.
Ethane	Baseline value to later determine increasing trend	Ethane data will be collected if a natural attenuation or enhanced biological remedy is later needed for the site. Enhanced biological treatment methods that reduce aquifer conditions are generally expected to result in increasing concentrations of ethane.
Ethene	Baseline value to later determine increasing trend	Ethene data will be collected if a natural attenuation or enhanced biological remedy is later needed for the site. Enhanced biological treatment methods that reduce aquifer conditions are generally expected to result in increasing concentrations of ethene.
Ferrous Iron	> 1 mg/L	Elevated concentrations indicate the activity of iron-reducing bacteria and are a positive indication that reductive dechlorination of VOCs may be occurring.
Sulfate	> 20 mg/L	If sulfur compounds are present in the aquifer at levels above 20 mg/L, this may lead to sulfate reduction and the production of sulfide. Sulfide in turn may react with ferrous iron, forming iron sulfide, which has been shown to have abiotic dechlorination properties. Although higher concentrations of sulfate may consume organic substrate, the presence of sulfate in general is considered neutral to favorable for reductive dechlorination.
Sulfide	> 1 mg/L	If sulfur compounds are present in the aquifer, higher concentrations of sulfide are more favorable to reductive dechlorination. Therefore, ideal conditions will maintain higher sulfide levels.
Total Organic Carbon (TOC)	> 20 mg/L	TOC is an indicator of the total amount of organic matter available to microbial communities to use as a carbon source in the degradation of VOCs. Increasing TOC concentrations are a positive indicator of natural attenuation potential.
Nitrate	Baseline value to later determine decreasing trend	Nitrate data will be collected if a natural attenuation or enhanced biological remedy is later needed for the site. Enhanced biological treatment methods that reduce aquifer conditions are generally expected to result in decreasing concentrations of nitrate.
Nitrite	Baseline value to later determine increasing trend	Nitrite data will be collected if a natural attenuation or enhanced biological remedy is later needed for the site. Enhanced biological treatment methods that reduce aquifer conditions are generally expected to result in increasing concentrations of nitrite.

6.5 What will the data be used for?

The data will be used to answer the environmental questions previously defined above. In general, data collected will be used to optimize the remedial design for the OU1 Central Groundwater Plume.

6.6 What types of data are needed and how much data is needed

Section 8 and **Table 8-1** contains detailed information on the types of data needed for this project, including proposed sample locations and sampling rationale. Groundwater samples will need to be collected from 162 existing and 7 new monitoring wells across OU1 to be analyzed for the site-specific COCs. The groundwater sampling locations are shown on **Figures 11** through **16**. A select number of groundwater samples will also be analyzed for the PILs, also indicated on **Figures 11** through **16**. All groundwater samples will be submitted for laboratory analysis to offsite laboratories (EMAX Labs, Inc. and Microbial Insights, Inc.). **Table 11-1** details the laboratory analytical protocol. Sampling techniques are described in **Table 9-2**.

The water quality parameters (WQPs) to be measured using field tests during the groundwater monitoring event will include:

- Temperature
- pH
- Dissolved oxygen (DO)
- Oxidation-reduction potential (ORP)
- Specific conductance (SC)
- Turbidity
- Ferrous iron

6.7 Are there any special data quality needs, field or laboratory, in order to support environmental decisions?

The offsite laboratory analytical data will be of the quantity and quality necessary to provide technically sound and defensible assessments with respect to the aforementioned project objectives. QC sample requirements are detailed in **Table 9-3**. For action decisions, the laboratory will follow the measurement performance criteria (MPC) in **Tables 7-1** through **7-3** for field QC samples and **Tables 12-1** through **12-6** for laboratory QC samples. These MPC are consistent with the DoD QSM as applicable and with laboratory in-house limits where the QSM does not apply.

To reach lower limits, the laboratory will report concentrations between the LOQ and detection limit (DL) as estimated. These results will have a J qualifier applied to them to indicate they are quantitative estimates.

Except for geochemical and geotechnical data, data will be validated by CH2M HILL using the procedures listed in **Table 13-1**. A full Level IV equivalent data package and QC sampling are required for these data. A Level IV equivalent data package includes a case narrative, all field sample results, QC forms, and raw data.

6.8 How will data be collected and generated? How will the data be reported?

CH2M HILL personnel will oversee the installation of the new monitoring wells. They will also collect the groundwater samples from the newly installed and existing monitoring wells, as outlined above. The sample locations are shown on **Figures 11** through **16**. Data will be collected and generated in accordance with the standard operating procedures (SOPs) contained in this UFP-SAP. The fieldwork is tentatively scheduled to begin in fall 2013. The samples will be shipped by overnight courier to EMAX Labs, Inc. and Microbial Insights, Inc., which are under subcontract to CH2M HILL for analysis.

Once generated, analytical data collected during the sampling event will be submitted to Herb Kelly of CH2M HILL for validation against analytical methodology requirements and MPC presented in this UFP-SAP.

CH2M HILL will receive validated data and upload it into a centralized electronic database used for Navy projects (Navy Installation Restoration Information System) by the project team(s).

The specific results will be reported in the OU1 pre-remedial design groundwater monitoring report and used in support of the remedial design for OU1.

6.9 How will the data be archived?

Data will be archived according to procedures dictated via the Navy Comprehensive Long-term Environmental Action—Navy (CLEAN) program/contract. All data will be uploaded into a centralized database developed and maintained by CH2M HILL and used for Navy projects and will also be loaded into the Navy Installation Restoration Information System (NIRIS). At the end of the project, paper copies of archived laboratory data and validation reports will be archived by Iron Mountain.

6.10 Who will use the data?

The data will be used by the Navy, its contractors, and the other stakeholder agencies to refine the current understanding of the OU1 Central Groundwater Plume in support of the future remedial design. If appropriate, the information will be used to evaluate actions to be taken to provide adequate protection of human health and the environment. Engineers and scientists will evaluate the data for decision making and a chemist will evaluate laboratory data quality. Once published in the Administrative Record, the data will be available to the public.

6.11 How will the Data Usability be Documented?

The following is a summary of the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:

- Non-detected constituents will be evaluated to ensure that project required quantitation limits in **Tables 10-1** through **10-3** were achieved. If project quantitation limits were achieved and the verification and validation steps yielded acceptable data, then the data are considered usable.
- The Data Validator is the only party who may apply qualifiers to the data. Minor QC exceedances will result in “estimated” data, represented by J, J+, 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.
- For duplicate sample results, the most conservative value will be used for project decisions.
- Analytical data will be checked to ensure the values and any qualifiers are appropriately transferred to the electronic database. These checks include comparison of hardcopy data and qualifiers to the electronic data deliverable. Once the data have been uploaded into the electronic database, another check will be performed to ensure all results were loaded accurately.
- Field and laboratory precision will be compared as relative percent difference (RPD) between the two results.
- Deviations from the UFP-SAP will be reviewed to assess whether CA is warranted and to assess impacts on achievement of project objectives.

The evaluative procedures used to assess overall measurement error associated with the project are:

- To assess whether a sufficient quantity of acceptable data are available for decision making, the data will be reconciled with MPC following validation and review of data quality indicators (DQIs).

- If significant biases are detected with laboratory QA/QC samples, they will be evaluated to assess their impact on decision making. Low biases will be described in greater detail as they represent a possible inability to detect compounds that may be present.

If significant deviations are noted between lab and field precision, the cause will be further evaluated to assess the impact on decision making.

The documentation that will be generated during the usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies, include:

- Data tables will be produced to reflect detected and non-detected constituents and geochemical parameters. Data qualifiers will be reflected in the tables and discussed in the additional OU1 site investigation report.
- A DV report will be provided as an appendix to the site investigation report.
- If needed, a technical memorandum will be produced that will identify any data usability limitations and make recommendations for CA.

The personnel responsible for performing the usability assessment are:

- The CH2M HILL PM, PC, and other team members as necessary.

7 Field Quality Control Samples

[\(UFP-QAPP Manual Section 2.6.2 – Worksheet #12\)](#)

Field QC samples will be collected to assist in evaluating whether the results reported from the field effort meet the precision, accuracy, and representativeness requirements for this project. Presented in **Tables 7-1 through 7-3** are details about the frequency at which each QC sample will be collected, what constitutes acceptable field QC results, and what aspect of data quality is indicated by the outcome of each QC sample.

Table 7-1
 Measurement Performance Criteria Table – Field QC Samples

Matrix: Groundwater
 Analytical Group: VOCs (select)

QC Sample	Analytical Group	Frequency	DQIs	MPC
Field Duplicate	VOC	One per 10 normal field samples	Precision	%RPD ≤ 20%
Equipment Blank		One per week of sampling	Bias/Contamination	No target analytes detected > ½ the LOQ
Trip Blank		One per cooler containing VOCs	Bias/Contamination	
Temperature Blank		One per cooler	Representativeness	0–6 degrees Celsius (°C)

Table 7-2
 Measurement Performance Criteria Table – Field QC Samples

Matrix: Groundwater
 Analytical Group: Wet Chemistry – Methane, Ethane, Ethene; Nitrate, Nitrite, Sulfate; Sulfide; TOC

QC Sample	Analytical Group	Frequency	DQIs	MPC
Temperature Blank	Wet Chemistry - Methane, Ethane, Ethene; Nitrate, Nitrite, Sulfate; Sulfide; TOC	One per cooler	Representativeness	0–6°C

Table 7-3
 Measurement Performance Criteria Table – Field QC Samples

Matrix: Groundwater
 Analytical Group: Microbial - DHC, BAV1 R-Dase, TCE R-Dase, and VC R-Dase

QC Sample	Analytical Group	Frequency	DQIs	MPC
Temperature Blank	Microbial – DHC, BAV1 R-Dase, TCE R-Dase, and VC R-Dase	One per cooler	Representativeness	0–6°C

8 Sampling Design and Rationale

[\(UFP-QAPP Manual Section 3.1.1 - Worksheet #17\)](#)

8.1 General Approach

The general sampling approach was developed to achieve the following specific objectives:

- Provide a current snapshot of the horizontal and vertical extent of the OU1 Central Groundwater Plume
- Better define the plume characteristics in the vicinity of Sandy Branch
- Provide a current assessment of conditions for natural attenuation

To achieve these objectives, the following field activities will be conducted:

- Site preparation, including vegetation clearance, silt fence construction, and utility location
- Drilling, installation, development, and surveying of seven new groundwater monitoring wells
- Collection of groundwater samples from 162 existing monitoring wells and 7 new monitoring wells
- Site restoration and investigation-derived waste management

8.2 Sample Matrices

Sample matrices are limited to samples of groundwater from the target monitoring wells.

8.3 Analytical Groups

Groundwater analytical groups include site-specific COCs (**Table 6-1**) and natural attenuation indicator parameters (NAIPs) including methane, ethane, ethene, nitrate, nitrite, sulfate, sulfide, TOC, DHC and functional genes, and ferrous iron. Results will be used to evaluate the current status of groundwater contamination at OU1.

Reference Areas, Sample Numbers, and Locations

Groundwater samples will be collected from a total of 169 wells located at the OU1 Central Groundwater Plume. The number of wells sampled for each parameter is listed below as well as in **Table 8.1**. Of the more than 200 wells at OU1, 162 existing and 7 new monitoring wells were selected for the OU1 pre-remedial design groundwater monitoring event, as this data will be supplemented by data that will be collected from 27 monitoring wells during the OU1 Central Groundwater Plume biobarrier and the ZVI PRB pilot studies (CH2M HILL 2012a; CH2M HILL 2012b). When combined, these data sets were deemed to be sufficient to assess current conditions of the COC plumes across OU1 and to achieve thorough spatial delineation of the COC plumes in the Sandy Branch area (**Figures 11** through **16**). Additional locations may be selected based on the analytical results if data gaps are identified.

To summarize the sampling activities:

- 169 total wells (162 existing and 7² new monitoring wells) to be sampled and analyzed for VOCs, WQPs, and ferrous iron. The rationale for the 7 new monitoring wells in the Sandy Branch area is discussed in the next section.
- 48 of the collected samples will also be analyzed for methane, ethane, ethene, nitrate, nitrite, sulfate, and TOC.

² The final locations for the new monitoring wells may be altered based on the field conditions. Additional locations may be selected based on the analytical results.

- 20 wells to be sampled for sulfide, DHC, and DHC functional genes

All proposed groundwater sample locations are shown in **Figure 17**. The final locations of the monitoring wells may be altered based on the field conditions. Additional locations may be selected based on the analytical results.

The sampling rationale for the new monitoring well locations and locations where specific analytical parameters are to be collected is discussed below.

Rationale for New Sandy Branch Monitoring Wells

Locations for the new Sandy Branch groundwater monitoring wells are shown on **Figure 17**. The new well locations are also identified on the plume maps (**Figures 11 through 16**). The rationale for each well location is as follows:

- 52GW82—Upper Surficial Aquifer Monitoring Well—evaluate downgradient plume migration from Building 133. Screened from the water table downward within the upper surficial aquifer.
- 52GW83—Lower Surficial Aquifer Monitoring Well— evaluate downgradient plume migration from Building 133. Screened from the top of the Yorktown confining unit upward, covering the deepest part of the aquifer within the core of the plume.
- 52GW84—Lower Surficial Aquifer Monitoring Well—refine the southern boundary of the northern plume prior to discharge to Sandy Branch. Screened from the top of the Yorktown confining unit upward, covering the deepest part of the aquifer on the southern edge of northern lobe of the plume.
- 52GW85—Lower Surficial Aquifer Monitoring Well—better define the width of the plume prior to its discharge to Sandy Branch. Screened from the top of the Yorktown confining unit upward, covering the deepest part of the aquifer within the core of the northern lobe of the plume.
- 52GW86—Lower Surficial Aquifer Monitoring Well—refine the northern boundary of the northern plume in the area of Sandy Branch Tributary #1. Screened from the top of the Yorktown confining unit upward, covering the deepest part of the aquifer on the northern edge of the northern lobe of the plume.
- 52GW87—Lower Surficial Aquifer Monitoring Well—refine the northern boundary of the northern plume prior to discharge to Sandy Branch. Screened from the top of the Yorktown confining unit upward, covering the deepest part of the aquifer at the leading edge on the northern side of the northern lobe of the plume.
- 52GW88—Lower Surficial Aquifer Monitoring Well—refine the extent of the northern plume adjacent to Sandy Branch. Screened from the top of the Yorktown confining unit upward, covering the deepest part of the aquifer at the leading edge of the northern lobe of the plume.

Sampling Rationale

It was determined that of the more than 200 monitoring wells within OU1, 169 groundwater data are needed from 162 existing and 7 new monitoring wells for the adequate delineation of the horizontal and vertical extent of the OU1 Central Groundwater Plume for site-specific COCs and to update the assessment of conditions for natural attenuation. All of these samples will be analyzed for the following:

- VOCs (select COC list)
- Ferrous Iron (via field test)
- pH (via field test)
- ORP (via field test)
- DO (via field test)
- Specific conductance (via field test)
- Turbidity (via field test)

A subset of these wells will also be analyzed for the select suite of NAIPs listed below. The wells in this subset were chosen to assess the conditions for natural attenuation across the site, with an emphasis on locations near the source area and upgradient of East Prong Slocum Creek and Sandy Branch.

- Methane
- Ethane
- Ethene
- Nitrate
- Nitrite
- Sulfate
- TOC

A smaller subset of the groundwater samples across the OU1 Central Groundwater Plume will also be analyzed for the additional NAIPs listed below, to assess the site for sulfate reducing conditions and the health of the DHC population across the site, with an emphasis on locations near the source area and upgradient of East Prong Slocum Creek and Sandy Branch.

- Sulfide
- DHC and DHC functional genes

Table 8-1 indicates the total number of samples to be collected for each analyte. Complete sample details and which locations will be collected for each analyte is included in Section 9.

Sampling Frequency

The samples will be collected once during a 2-week field event in fall 2013.

TABLE 8-1
 Samples to be Collected

Matrix	Depth of Samples	Analysis	Method	Preliminary Number of Samples	Rationale	Sampling Strategy
Groundwater from 7 new monitoring wells and 162 existing wells	Middle of well screen	VOCs: 1,1 DCA 1,1 DCE 1,1,1 TCA 1,1,2 TCA 1,1,2,2 PCA 1,2 DCA 1,2-DCE (total) Chloroform Cis-1,2-DCE Trans-1,2-DCE PCE TCE VC	SW-846 Method 8260B	169	Assess current site-wide conditions and complete COC delineation in the vicinity of Sandy Branch	See Figures 11 and 12 for sampling locations.
		WQPs: DO ORP pH Specific Conductance Turbidity	YSI-556 or equivalent water quality meter	169	Natural Attenuation	
		Ferrous Iron	HACH Field Kit	169	Natural Attenuation	
		Methane, Ethane, Ethene	RSK-175	48	Natural Attenuation	
		Nitrate, Nitrite, Sulfate	SW846 300.0	48	Natural Attenuation	
		TOC	SW846 9060/ SM 5310	48	Natural Attenuation	
		Sulfide	SM4500-S2	20	Natural Attenuation	
		DHC and Functional Genes	qPCR	20	Natural Attenuation	

9 Field Project Implementation

9.1 Field Project Tasks

[\(UFP-QAPP Manual Section 2.8.1 – Worksheet #14\)](#)

9.1.1 Vegetation Clearance

Vegetation clearing will be conducted as needed for installation of the seven new monitoring wells. Based on reconnaissance conducted in June 2013, only minimal vegetation clearance will likely be required. It is possible that some vegetation clearance will be required for personnel and equipment to safely avoid one large dead tree that is directly en-route to the new 52GW85 groundwater monitoring well location. Additionally, access to the new 52GW86 groundwater monitoring well location without crossing any creeks will require personnel and equipment to circumvent Building 4630 outside of the fenced area, which also borders the riparian zone along Sandy Branch Tributary #2 (**Figure 17**). With the exception of a few tight spots where the drill rig will need to turn corners, only minimal vegetation clearance is anticipated.

9.1.2 Utility Clearance

Before drilling activities begin for monitoring well installation, all buried utilities in the vicinity of the new wells will be identified by a subcontracted utility locator for avoidance during drilling.

9.1.3 Silt Fencing

Prior to installation of new monitoring wells 52GW85, 52GW86, and 52GW87, a silt fence will be constructed between the work areas and the creek to ensure that no impacts from drilling in the work area will affect the Sandy Branch Tributary (**Figure 17**).

Silt fence will be a woven geotextile produced by the manufacturer specifically for this use. The fabric will have a minimum height of 3 ft. Filter fabric may be fastened in place by stake or other accepted means. Posts will be placed a maximum of 6 ft apart. The bottom of the fabric will be entrenched in the ground at least 4 inches.

9.1.4 Monitoring Well Installation

The monitoring well to be installed within the upper surficial aquifer will be screened from roughly 10 to 25 feet bgs, while the lower surficial wells will be screened from roughly 40 to 50 feet bgs. All well borings will be advanced using a small, track-mounted, rotasonic drill. Final well depths may be modified by the field geologist to adjust for field conditions. Continuous soil cores will be collected for lithologic characterization and field screened for VOCs using a photoionization detector as the borehole is advanced. Precise well construction depths will be determined in the field following a review of the soil cores. The well construction details are shown in **Table 9-1**.

TABLE 9-1
Well Construction Details

Monitoring Well ID	Aquifer Zone	Total Well Depth (ft bgs)	Screen Length (ft)	Screen Interval (ft bgs)
52GW82	Upper Surficial	25	15	10 – 25
52GW83	Lower Surficial	50	10	40 – 50
52GW84	Lower Surficial	50	10	40 – 50
52GW85	Lower Surficial	50	10	40 – 50
52GW86	Lower Surficial	50	10	40 – 50
52GW87	Lower Surficial	50	10	40 – 50
52GW88	Lower Surficial	50	10	40 – 50

9.1.5 Installation Procedures

Monitoring Well Construction Procedures

Upon completion of the borehole to the desired depth, approximately 1 foot of sand filter pack will be placed on the bottom of the borehole by the tremie method. Wells will be constructed using a 10-foot section (15-foot section for 52GW82) of 2-inch-inner-diameter, 0.010-inch factory slotted Schedule 40 polyvinyl chloride screen with a bottom cap. The screens will be connected to a threaded, flush-jointed, Schedule 40 polyvinyl chloride riser.

The annular space around the well screens will be filled with a well-graded, fine to medium silica sand filter pack consisting of a thoroughly washed, round, durable, siliceous, material containing less than 5 percent silt or clay. During placement of the filter pack, the well casing will be suspended above the bottom of the borehole. The casing will remain suspended until placement of the filter pack is completed. The top of the casing will have a temporary cap during installation of the annulus materials. The sand filter pack will extend to approximately 2 feet above the top of the screened interval. The filter pack will be installed in approximately 2-foot lifts to prevent bridging. The casing will be moved upward as the annulus is filled. The depth to the top of the sand filter pack will be measured periodically using a weighted measuring tape.

Sodium bentonite pellets will be placed above the sand pack to form a seal that is between 2 to 5 feet thick. The depth to the top of the bentonite seal will be measured periodically using a weighted measuring tape.

After hydration of the bentonite (at least 1 hour), the remaining borehole annular space will be completed with a cement-bentonite grout slurry using a side-discharge tremie method. The grout slurry will extend from the top of the bentonite seal to approximately 1 foot bgs.

Five of the monitoring wells (52GW84, 52GW85, 52GW86, 52GW87, and 52GW88) will be completed approximately 3 feet above ground surface with a lockable, steel protective stickup cover and 2-foot x 2-foot x 4-inch concrete pad. Four painted bollards (3.5 feet tall and 4 inches in diameter) will be placed at each corner of the concrete pad, and each will be painted bright yellow. Sand will be placed in the annular space between the riser and protective cover. Well identification tags will be attached to the outside of the steel protective cover. An expansion plug and lock will be added to each monitoring well.

The remaining two wells, 52GW82 and 52GW83, are to be installed in a parking lot and will therefore require flush mount well completion with 8-inch-diameter covers. A lockable, weathertight cover will be installed over each well that can be easily removed to allow ready access to the monitoring well. The covers will be positioned over the monitoring well casings in such a manner that when installation is complete, the monitoring well covers are mounted flush and level with the surrounding terrain.

All drilling and well installation activities will be conducted by a North Carolina-licensed well driller, in accordance with the well construction standards provided in the North Carolina Administrative Code 15A Subchapter 2C Section 0100, under the supervision of a CH2M HILL engineer or hydrogeologist.

Well Development

Development pumping and surging will not start until the last pumped grout in the well has had at least 24 hours to cure. Each well will be developed by using a surge block and over-pumping. Well development will be considered complete when visible sediment is removed or 1 hour of active development has been completed, whichever is sooner. Field parameters (specific conductance, temperature, pH, DO, ORP, and turbidity) will be measured during development.

9.1.6 Surveying

Land surveying will be conducted in accordance with Section 3.3 of the Master Project Plans (CH2M HILL, 2005). The surveying will be conducted after the installation of the seven new monitoring wells. Both top of casing and ground surface elevation will be surveyed at each well.

9.1.7 Sampling Tasks

- Groundwater Level Measurements:
 - Before purging, the depth to groundwater will be measured in each site monitoring well. Groundwater depths will be measured with a water level indicator to the nearest 0.01 foot, as specified in SOP-008. The downhole instruments will be decontaminated after use in each well, in accordance with SOP-013 (**Appendix A**).
- Collection of groundwater samples:
 - Refer to SOPs 004 (Low Flow Purging/ Sampling techniques), 009 (Blank Prep), 010 (Chain of Custody), and 011 (Shipping Samples) for specific implementation guidelines and details.
 - Groundwater samples will be collected from monitoring wells using a submersible or peristaltic pump. Monitoring wells will be purged in accordance with SOP-004 (**Appendix A**) low-flow sampling protocol. A list of all parameters to be analyzed is included in **Table 9-3**.
 - All groundwater samples will be collected from monitoring wells by placing the pump intake at the middle of the well screen interval. WQPs (specific conductance, pH, turbidity, temperature, DO, and ORP) will be measured and recorded (approximately every 5 minutes) before sampling using a multi-parameter water quality meter (such as Horiba U-22), calibrated at a minimum on a daily basis and as subsequently warranted. Sampling will begin when WQPs have stabilized for three consecutive readings and a minimum of one well volume has been purged. Depth to water, WQPs, total well depth measurements, and field kit testing results for nitrate and sulfate will be recorded on groundwater sampling data sheets.
- Decontamination
 - Refer to SOPs 013 and 014 (Decontamination Procedures) for specific implementation guidelines and details.
 - All non-disposable sampling equipment will be decontaminated before use and immediately after each use in accordance with applicable SOPs referenced in **Table 9-2**. The water level indicator will be cleaned with deionized water between each measurement.
- Investigation-derived Waste Handling
 - Refer to SOP 015 (Investigation-derived Waste [IDW] Handling) for specific implementation guidelines and details. Wastes generated during the investigation of potentially contaminated sites are classified as IDW and will be managed to protect human health and the environment, as well as to meet legal requirements. IDW is expected to consist of soil cuttings and drilling fluids from well installation, purge water from groundwater sampling, and disposable equipment items. Soil cuttings that are generated during this groundwater sampling event will be stored in containers for subsequent disposal. Soil cuttings will be transported to a storage location (TBD) located within OU1. Purge, development, and decontamination water will be discharged to the IWTP, located near the center of OU1, north of A Street. The FTL will be responsible for the documentation, containerization, and offsite staging. IDW will be stored in approved, appropriately-sized tanks, drums, or roll-off boxes. The containers will be labeled in accordance with the Master Field Sampling Plan either with a preprinted label or paint pen.
- Analyses and Testing Tasks
 - The analytical laboratory will process and prepare samples for analyses and will analyze all samples for various groups of parameters in accordance with **Table 9-3**.
- Surveying
 - All newly installed monitoring wells will be surveyed in accordance with Navy CLEAN SOPs.

9.1.8 Quality Control Tasks

- Implement SOPs for field and laboratory activities. QC samples are described in the Sample Details Table.

9.2 Field SOPs Reference Table

[\(UFP-QAPP Manual Section 3.1.2 – Worksheet #21\)](#)

Applicable SOPs for project tasks are listed in Table 9-1 and the SOPs are included as **Appendix A**.

TABLE 9-2
 Field SOPs Reference Table

SOP Reference Number	Title/Author	Revision Date or Version Number	Location of SOP (if not included in the UFP-SAP)	Any planned deviation from SOP	Comments
SOP-001	Preparing Field Logbooks, CH2M HILL	Revised 08/2012		No	
SOP-002	Locating and Clearing Underground Utilities, CH2M HILL	Revised 08/2012		No	
SOP-003	General Guidance for Monitoring Well Installation, CH2M HILL	Revised 08/2012		No	
SOP-004	Low-Flow Groundwater Sampling from Monitoring Wells – EPA Region IV, CH2M HILL	Revised 08/2012		No	
SOP-005	VOC Sampling—Water, CH2M HILL	Revised 08/2012		No	
SOP-006	Bio-Flo – DNA Sampling Protocol, Microbial Insights	Downloaded 5/10/2013			
SOP-007	Field Measurement of pH, Specific Conductance, Turbidity, DO, ORP, and Temperature Using a Water Quality Parameter Meter with Flow-through Cell, CH2M HILL	Revised 08/2012		No	
SOP-008	Water Level Measurement, CH2M HILL	Revised 08/2012		No	
SOP-009	Equipment Blank and Field Blank Preparation, CH2M HILL	Revised 08/2012		No	
SOP-010	Chain-of-Custody, CH2M HILL	Revised 08/2012		No	
SOP-011	Packaging and Shipping Procedures for Low-Concentration Samples, CH2M HILL	Revised 08/2012		No	
SOP-012	Multi RAE Photoionization Detector, CH2M HILL	Revised 03/2010		No	
SOP-013	Decontamination of Personnel and Equipment, CH2M HILL	Revised 08/2012		No	
SOP-014	Decontamination of Drilling Rigs and Equipment, CH2M HILL	Revised 08/2012		No	
SOP-015	Disposal of Waste Fluids and Solids, CH2M HILL	Revised 08/2012		No	

Notes:

9.3 Field Project Implementation (Field Project Instructions)

[UFP-QAPP Manual Sections 3.1.1 and 3.5.2.3 – Worksheets #18, 19, 20 and 30](#)

Groundwater samples will be collected and analyzed as outlined in **Table 9-3** below.

TABLE 9-3
 Sample Details Table

CTO-WE70 OU1 Pre-Remedial Design Groundwater Monitoring						Analysis Group	VOCs	DHC & functional genes	Sulfide	Methane, Ethane, Ethene	Nitrate, Nitrite Sulfate	TOC	Ferrous Iron
EMAX Laboratories, Inc. 1835 W 205 th St. Torrance, CA 90501 Molly Nguyen 310-618-8889 Microbial Insights, Inc. 2340 Stock Creek Blvd. Rockford, TN 37853 Anita Biernacki 865-573-8188						Preparation and Analytical Method	SW846 8260B	qPCR	SM4500-S2	RSK-175	SW846 300.0	SW-846 9060	Hach Field Kit
						Analytical Laboratory/ Analytical SOP Reference ²	EMAX Labs, Inc. / EMAX-8260	Microbial Insights, Inc. / DNA-qPCR	EMAX Labs, Inc. / EMAX-4500-S2D	EMAX Labs, Inc. / EMAX-RSK175	EMAX Labs, Inc. / EMAX-300.0	EMAX Labs, Inc. / EMAX-9060	--
						Data Package Turnaround Time	28 calendar days	28 calendar days	28 calendar days	28 calendar days	28 calendar days	28 calendar days	--
						Container Type/ Volume required (if different than container volume)	3 – 40ml volatile organic analyte vials	1 – BioFlo filter	1 – 250ml high-density polyethylene (HDPE)	3– 40ml volatile organic analyte vials	1 – 250ml HDPE	1 – 250ml HDPE	--
						Preservative	HCl to pH <2; Cool to ≤ 6°C; no headspace	cool to < 6°C	ZnAc + NaOH, cool to <6°C	HCl, cool to <6°C	cool to <6°C	HCl, cool to <6°C	--
						Holding Time (Preparation/ Analysis) ³	14 days	24 hours	7 days	14 days	Nitrate/Nitrite: 48 hours Sulfate: 28 days	28 days	--
						Site	Matrix	Station ID	Sample ID	Coordinates (optional)		Depth/ Sampling Interval (ft bgs)	
				X	Y								
14	Groundwater	14GW18	14GW18-MMDDYY	423939.33	2630554.86	16 - 26	X						X
14	Groundwater	14GW35	14GW35-MMDDYY	423815.77	2630068.67	8 - 18	X						X
14	Groundwater	14GW39†	14GW39-MMDDYY	423979.55	2630425.68	45 - 50	X						X
14	Groundwater	14GW49†	14GW49-MMDDYY	424023.73	2629862.56	5 - 15	X						X
14	Groundwater	14GW51	14GW51-MMDDYY	423690.96	2630214.48	45 - 50	X			X		X	X
14	Groundwater	14GW53	14GW53-MMDDYY	424015.05	2629877.07	33 - 43	X						X
16	Groundwater	16GW01	16GW01-MMDDYY	421658.00	2628029.38	10 - 25	X						X
16	Groundwater	16GW02	16GW02-MMDDYY	421591.03	2627027.59	10 - 25	X			X		X	X
16	Groundwater	16GW03	16GW03-MMDDYY	421811.48	2627015.08	10 - 25	X			X		X	X
16	Groundwater	16GW04	16GW04-MMDDYY	421896.03	2627111.70	10 - 25	X	X	X	X	X	X	X
16	Groundwater	16GW05	16GW05-MMDDYY	420746.35	2628194.40	15 - 25	X						X
16	Groundwater	16GW06	16GW06-MMDDYY	422641.09	2628057.67	15 - 25	X						X
16	Groundwater	16GW08	16GW08-MMDDYY	421664.59	2628767.55	17 - 27	X						X
16	Groundwater	16GW09	16GW09-MMDDYY	420666.09	2628485.25	16 - 26	X						X
16	Groundwater	16GW10	16GW10-MMDDYY	422475.12	2628395.41	10 - 25	X						X
16	Groundwater	16GW16	16GW16-MMDDYY	421308.29	2627987.51	10 - 25	X	X	X	X	X	X	X
16	Groundwater	16GW21	16GW21-MMDDYY	422687.93	2629113.12	3 - 13	X			X		X	X
16	Groundwater	16GW30	16GW30-MMDDYY	422105.50	2627628.74	45 - 55	X						X
16	Groundwater	16GW31	16GW31-MMDDYY	422102.14	2627641.36	11 - 21	X						X
16	Groundwater	16GW32	16GW32-MMDDYY	421929.40	2627695.89	44 - 54	X						X
16	Groundwater	16GW33	16GW33-MMDDYY	421929.26	2627683.50	9 - 19	X						X
16	Groundwater	16GW36	16GW36-MMDDYY	422686.96	2627957.82	32 - 42	X	X	X	X	X	X	X
16	Groundwater	16GW37	16GW37-MMDDYY	422695.80	2627959.36	5 - 15	X	X	X	X	X	X	X
16	Groundwater	16GW40	16GW40-MMDDYY	421666.62	2627021.13	15 - 25	X	X	X	X	X	X	X
16	Groundwater	16GW41	16GW41-MMDDYY	421671.40	2627021.35	35 - 45	X			X		X	X
16	Groundwater	16GW42	16GW42-MMDDYY	421862.20	2627124.05	35 - 45	X	X	X	X	X	X	X
16	Groundwater	16GW49	16GW49-MMDDYY	420939.06	2628045.21	20 - 30	X						X

TABLE 9-3
 Sample Details Table

CTO-WE70 OU1 Pre-Remedial Design Groundwater Monitoring						Analysis Group	VOCs	DHC & functional genes	Sulfide	Methane, Ethane, Ethene	Nitrate, Nitrite Sulfate	TOC	Ferrous Iron
EMAX Laboratories, Inc. 1835 W 205 th St. Torrance, CA 90501 Molly Nguyen 310-618-8889 Microbial Insights, Inc. 2340 Stock Creek Blvd. Rockford, TN 37853 Anita Biernacki 865-573-8188						Preparation and Analytical Method	SW846 8260B	qPCR	SM4500-S2	RSK-175	SW846 300.0	SW-846 9060	Hach Field Kit
						Analytical Laboratory/ Analytical SOP Reference ²	EMAX Labs, Inc. / EMAX-8260	Microbial Insights, Inc. / DNA-qPCR	EMAX Labs, Inc. / EMAX-4500-S2D	EMAX Labs, Inc. / EMAX-RSK175	EMAX Labs, Inc. / EMAX-300.0	EMAX Labs, Inc. / EMAX-9060	--
						Data Package Turnaround Time	28 calendar days	28 calendar days	28 calendar days	28 calendar days	28 calendar days	28 calendar days	--
						Container Type/ Volume required (if different than container volume)	3 – 40ml volatile organic analyte vials	1 – BioFlo filter	1 – 250ml high-density polyethylene (HDPE)	3– 40ml volatile organic analyte vials	1 – 250ml HDPE	1 – 250ml HDPE	--
						Preservative	HCl to pH <2; Cool to ≤ 6°C; no headspace	cool to < 6°C	ZnAc + NaOH, cool to <6°C	HCl , cool to <6°C	cool to <6°C	HCl, cool to <6°C	--
						Holding Time (Preparation/ Analysis) ³	14 days	24 hours	7 days	14 days	Nitrate/Nitrite: 48 hours Sulfate: 28 days	28 days	--
						Site	Matrix	Station ID	Sample ID	Coordinates (optional)		Depth/ Sampling Interval (ft bgs)	
				X	Y								
16	Groundwater	16GW50	16GW50-MMDDYY	421730.74	2628050.21	40 - 50	X	X	X	X	X	X	X
16	Groundwater	16GW51	16GW51-MMDDYY	421454.56	2628102.14	40 - 50	X						X
16	Groundwater	16GW52	16GW52-MMDDYY	421217.68	2628603.83	35 - 45	X						X
16	Groundwater	MW12	GW12-MMDDYY	421213.13	2627480.98	3 - 13	X						X
16	Groundwater	MW18	GW18-MMDDYY	422117.57	2628557.96	3 - 18	X						X
16	Groundwater	MW28	GW28-MMDDYY	421996.43	2627855.20	12 - 24	X						X
16	Groundwater	MW40	GW40-MMDDYY	422339.42	2627449.46	2 - 12	X						X
16	Groundwater	MW41	GW41-MMDDYY	422346.89	2627453.98	31 - 41	X						X
16	Groundwater	MW42	GW42-MMDDYY	422081.01	2626983.94	2 - 12	X						X
16	Groundwater	MW43	GW43-MMDDYY	422078.70	2626991.12	32.5 - 42.5	X						X
16	Groundwater	MW44	GW44-MMDDYY	421756.09	2626587.80	2 - 12	X						X
16	Groundwater	MW45	GW45-MMDDYY	421784.63	2626579.83	35 - 45	X						X
16	Groundwater	MW48	GW48-MMDDYY	421217.30	2627500.19	32 - 42	X						X
16	Groundwater	MW50	GW50-MMDDYY	421068.44	2627943.05	3 - 13	X						X
16	Groundwater	MW51	GW51-MMDDYY	421055.84	2627967.35	31 - 41	X						X
16	Groundwater	MW55	GW55-MMDDYY	422476.15	2628404.30	42 - 52	X						X
16	Groundwater	S3W3	S3W3-MMDDYY	421992.40	2627847.13	38 - 48	X	X	X	X	X	X	X
16	Groundwater	51EX18	51EX18-MMDDYY	422071.01	2628642.30	30 - 50	X						X
16	Groundwater	51EX19	51EX19-MMDDYY	421974.36	2628635.07	30 - 50	X	X	X	X	X	X	X
42	Groundwater	42GW05	42GW05-MMDDYY	423300.16	2630052.03	1 - 11	X			X	X	X	X
42	Groundwater	42GW08	42GW08-MMDDYY	423191.87	2629823.83	3 - 15	X						X
42	Groundwater	42GW15	42GW15-MMDDYY	423027.68	2628937.61	36 - 46	X	X	X	X	X	X	X
42	Groundwater	42GW16	42GW16-MMDDYY	423793.86	2629092.31	20 - 30	X						X
42	Groundwater	42GW17	42GW17-MMDDYY	423793.86	2629092.31	37 - 47	X						X
42	Groundwater	42GW18	42GW18-MMDDYY	423793.86	2629092.31	13 - 23	X						X
42	Groundwater	42GW19	42GW19-MMDDYY	423793.86	2629092.31	31 - 41	X						X
42	Groundwater	42GW20	42GW20-MMDDYY	423793.86	2629092.31	15 - 25	X						X
42	Groundwater	42GW21	42GW21-MMDDYY	423793.86	2629092.31	31 - 41	X						X
42	Groundwater	42GW22	42GW22-MMDDYY	423793.86	2629092.31	20 - 30	X			X	X	X	X
42	Groundwater	42GW23	42GW23-MMDDYY	423793.86	2629092.31	40 - 50	X						X
42	Groundwater	GW75	GW75-MMDDYY	423037.57	2628949.64	20 - 30	X			X	X	X	X

TABLE 9-3
 Sample Details Table

CTO-WE70 OU1 Pre-Remedial Design Groundwater Monitoring						Analysis Group	VOCs	DHC & functional genes	Sulfide	Methane, Ethane, Ethene	Nitrate, Nitrite Sulfate	TOC	Ferrous Iron
EMAX Laboratories, Inc. 1835 W 205 th St. Torrance, CA 90501 Molly Nguyen 310-618-8889 Microbial Insights, Inc. 2340 Stock Creek Blvd. Rockford, TN 37853 Anita Biernacki 865-573-8188						Preparation and Analytical Method	SW846 8260B	qPCR	SM4500-S2	RSK-175	SW846 300.0	SW-846 9060	Hach Field Kit
						Analytical Laboratory/ Analytical SOP Reference ²	EMAX Labs, Inc. / EMAX-8260	Microbial Insights, Inc. / DNA-qPCR	EMAX Labs, Inc. / EMAX-4500-S2D	EMAX Labs, Inc. / EMAX-RSK175	EMAX Labs, Inc. / EMAX-300.0	EMAX Labs, Inc. / EMAX-9060	--
						Data Package Turnaround Time	28 calendar days	28 calendar days	28 calendar days	28 calendar days	28 calendar days	28 calendar days	--
						Container Type/ Volume required (if different than container volume)	3 – 40ml volatile organic analyte vials	1 – BioFlo filter	1 – 250ml high-density polyethylene (HDPE)	3– 40ml volatile organic analyte vials	1 – 250ml HDPE	1 – 250ml HDPE	--
						Preservative	HCl to pH <2; Cool to ≤ 6°C; no headspace	cool to < 6°C	ZnAc + NaOH, cool to <6°C	HCl, cool to <6°C	cool to <6°C	HCl, cool to <6°C	--
						Holding Time (Preparation/ Analysis) ³	14 days	24 hours	7 days	14 days	Nitrate/Nitrite: 48 hours Sulfate: 28 days	28 days	--
						Site	Matrix	Station ID	Sample ID	Coordinates (optional)		Depth/ Sampling Interval (ft bgs)	
		X	Y										
42	Groundwater	GW76	GW76-MMDDYY	423303.69	2629413.45	20 - 30	X			X	X	X	X
42	Groundwater	MW01	GW01-MMDDYY	423315.86	2630056.89	25.9 - 35.9	X						X
42	Groundwater	MW37	GW37-MMDDYY	423184.79	2629189.44	2 - 12	X						X
42	Groundwater	MW38	GW38-MMDDYY	422866.19	2627967.89	3 - 13	X						X
42	Groundwater	MW39	GW39-MMDDYY	422872.40	2627968.67	25 - 35	X			X	X	X	X
42	Groundwater	MW58	GW58-MMDDYY	423456.12	2629903.57	3 - 13	X						X
42	Groundwater	MW59	GW59-MMDDYY	423476.80	2629903.53	32 - 42	X			X	X	X	X
42	Groundwater	MW64	GW64-MMDDYY	423075.25	2629470.45	35 - 45	X						X
42	Groundwater	51EX10	51EX10-MMDDYY	423316.41	2629815.94	18 - 38	X						X
42	Groundwater	51EX11	51EX11-MMDDYY	423279.73	2630045.87	18 - 38	X						X
42	Groundwater	N2GW15	N2GW15-MMDDYY	422702.10	2629655.16	20 - 30	X			X	X	X	X
42	Groundwater	N2GW27	N2GW27-MMDDYY	423169.21	2630088.89	5 - 15	X						X
42	Groundwater	N2GW28	N2GW28-MMDDYY	423078.37	2630001.80	5 - 15	X						X
42	Groundwater	N2GW44	N2GW44-MMDDYY	422838.83	2629575.61	30.5 - 35.5	X	X	X	X	X	X	X
47	Groundwater	47GW05	47GW05-MMDDYY	424005.62	2631304.66	9 - 19	X						X
47	Groundwater	47GW06	47GW06-MMDDYY	424002.76	2631307.33	39 - 49	X						X
47	Groundwater	47GW07	47GW07-MMDDYY	423876.25	2631308.22	7 - 17	X	X	X	X	X	X	X
47	Groundwater	47GW08	47GW08-MMDDYY	423871.78	2631303.96	38 - 48	X						X
47	Groundwater	47GW09	47GW09-MMDDYY	423985.14	2631419.55	14.5 - 24.5	X						X
47	Groundwater	47GW10	47GW10-MMDDYY	423990.34	2631414.47	37.5 - 47.5	X						X
47	Groundwater	47GW11	47GW11-MMDDYY	423809.04	2631244.38	40 - 50	X	X	X	X	X	X	X
47	Groundwater	47GW12	47GW12-MMDDYY	423722.42	2631163.43	7 - 17	X						X
47	Groundwater	47GW17	47GW17-MMDDYY	423895.29	2631280.33	9 - 19	X			X	X	X	X
47	Groundwater	47GW18	47GW18-MMDDYY	423876.50	2631352.76	8 - 18	X						X
47	Groundwater	47GW19	47GW19-MMDDYY	423849.43	2631301.52	8 - 18	X			X	X	X	X
47	Groundwater	47GW25	47GW25-MMDDYY	423733.89	2630537.08	33 - 43	X						X
47	Groundwater	MW20	GW20-MMDDYY	424034.59	2631032.34	5 - 20	X						X
47	Groundwater	MW21	GW21-MMDDYY	424032.19	2631030.12	39 - 49	X						X
47	Groundwater	MW23	GW23-MMDDYY	423976.11	2630979.45	38 - 48	X			X	X	X	X
52	Groundwater	51EX12	51EX12-MMDDYY	422792.68	2629859.37	30 - 50	X			X	X	X	X
52	Groundwater	51EX13	51EX13-MMDDYY	422589.57	2629716.54	30 - 50	X						X

TABLE 9-3
 Sample Details Table

CTO-WE70 OU1 Pre-Remedial Design Groundwater Monitoring						Analysis Group	VOCs	DHC & functional genes	Sulfide	Methane, Ethane, Ethene	Nitrate, Nitrite Sulfate	TOC	Ferrous Iron
EMAX Laboratories, Inc. 1835 W 205 th St. Torrance, CA 90501 Molly Nguyen 310-618-8889 Microbial Insights, Inc. 2340 Stock Creek Blvd. Rockford, TN 37853 Anita Biernacki 865-573-8188						Preparation and Analytical Method	SW846 8260B	qPCR	SM4500-S2	RSK-175	SW846 300.0	SW-846 9060	Hach Field Kit
						Analytical Laboratory/ Analytical SOP Reference ²	EMAX Labs, Inc. / EMAX-8260	Microbial Insights, Inc. / DNA-qPCR	EMAX Labs, Inc. / EMAX-4500-S2D	EMAX Labs, Inc. / EMAX-RSK175	EMAX Labs, Inc. / EMAX-300.0	EMAX Labs, Inc. / EMAX-9060	--
						Data Package Turnaround Time	28 calendar days	28 calendar days	28 calendar days	28 calendar days	28 calendar days	28 calendar days	--
						Container Type/ Volume required (if different than container volume)	3 – 40ml volatile organic analyte vials	1 – BioFlo filter	1 – 250ml high-density polyethylene (HDPE)	3– 40ml volatile organic analyte vials	1 – 250ml HDPE	1 – 250ml HDPE	--
						Preservative	HCl to pH <2; Cool to ≤ 6°C; no headspace	cool to < 6°C	ZnAc + NaOH, cool to <6°C	HCl, cool to <6°C	cool to <6°C	HCl, cool to <6°C	--
						Holding Time (Preparation/ Analysis) ³	14 days	24 hours	7 days	14 days	Nitrate/Nitrite: 48 hours Sulfate: 28 days	28 days	--
						Site	Matrix	Station ID	Sample ID	Coordinates (optional)		Depth/ Sampling Interval (ft bgs)	
				X	Y								
52	Groundwater	51EX16	51EX16-MMDDYY	422378.35	2629436.26	30 - 50	X						X
52	Groundwater	51EX17	51EX17-MMDDYY	422292.65	2629352.82	30 - 50	X						X
52	Groundwater	52GW01	52GW01-MMDDYY	422711.55	2630328.53	5 - 15	X						X
52	Groundwater	52GW07	52GW07-MMDDYY	422734.95	2630395.82	10 - 20	X						X
52	Groundwater	52GW08	52GW08-MMDDYY	422754.67	2630336.14	8 - 18	X			X	X	X	X
52	Groundwater	52GW15	52GW15-MMDDYY	422935.66	2630137.38	43 - 53	X						X
52	Groundwater	52GW16	52GW16-MMDDYY	422859.06	2629978.52	40 - 50	X						X
52	Groundwater	52GW17	52GW17-MMDDYY	422855.49	2629982.25	20 - 30	X			X	X	X	X
52	Groundwater	52GW18	52GW18-MMDDYY	422794.12	2629748.11	45 - 55	X	X	X	X	X	X	X
52	Groundwater	52GW19	52GW19-MMDDYY	422698.74	2629653.74	44 - 54	X						X
52	Groundwater	52GW20	52GW20-MMDDYY	422779.94	2629863.19	42 - 52	X						X
52	Groundwater	52GW21	52GW21-MMDDYY	422698.32	2629751.02	43 - 53	X			X	X	X	X
52	Groundwater	52GW22	52GW22-MMDDYY	422716.00	2629860.05	40 - 50	X						X
52	Groundwater	52GW23	52GW23-MMDDYY	422596.79	2629755.50	43 - 53	X						X
52	Groundwater	52GW24	52GW24-MMDDYY	422739.04	2629945.23	42 - 52	X						X
52	Groundwater	52GW25	52GW25-MMDDYY	422690.71	2629896.68	41 - 51	X						X
52	Groundwater	52GW26	52GW26-MMDDYY	422538.62	2629730.91	40 - 50	X						X
52	Groundwater	52GW27	52GW27-MMDDYY	422875.27	2630184.09	40 - 50	X						X
52	Groundwater	52GW28	52GW28-MMDDYY	422880.34	2630188.63	20 - 30	X			X	X	X	X
52	Groundwater	52GW29	52GW29-MMDDYY	422777.74	2630087.85	43 - 53	X						X
52	Groundwater	52GW30	52GW30-MMDDYY	422499.02	2629813.73	40 - 50	X						X
52	Groundwater	52GW31	52GW31-MMDDYY	422494.86	2629816.42	20 - 30	X			X	X	X	X
52	Groundwater	52GW32	52GW32-MMDDYY	422886.09	2630303.78	40 - 50	X						X
52	Groundwater	52GW33	52GW33-MMDDYY	422889.09	2630306.55	20 - 30	X						X
52	Groundwater	52GW34	52GW34-MMDDYY	422779.58	2630225.99	40 - 50	X	X	X	X	X	X	X
52	Groundwater	52GW35	52GW35-MMDDYY	422782.65	2630222.85	20 - 30	X			X	X	X	X
52	Groundwater	52GW36	52GW36-MMDDYY	422647.99	2630090.03	40 - 50	X						X
52	Groundwater	52GW37	52GW37-MMDDYY	422645.32	2630093.07	20 - 30	X			X	X	X	X
52	Groundwater	52GW38	52GW38-MMDDYY	422935.68	2630466.57	40 - 50	X						X
52	Groundwater	52GW39	52GW39-MMDDYY	422930.38	2630470.63	20 - 30	X						X
52	Groundwater	52GW40	52GW40-MMDDYY	422836.43	2630404.71	38.5 - 48.5	X						X

TABLE 9-3
 Sample Details Table

CTO-WE70 OU1 Pre-Remedial Design Groundwater Monitoring						Analysis Group	VOCs	DHC & functional genes	Sulfide	Methane, Ethane, Ethene	Nitrate, Nitrite Sulfate	TOC	Ferrous Iron						
EMAX Laboratories, Inc. 1835 W 205 th St. Torrance, CA 90501 Molly Nguyen 310-618-8889						Microbial Insights, Inc. 2340 Stock Creek Blvd. Rockford, TN 37853 Anita Biernacki 865-573-8188						Preparation and Analytical Method	SW846 8260B	qPCR	SM4500-S2	RSK-175	SW846 300.0	SW-846 9060	Hach Field Kit
												Analytical Laboratory/ Analytical SOP Reference ²	EMAX Labs, Inc. / EMAX-8260	Microbial Insights, Inc. / DNA-qPCR	EMAX Labs, Inc. / EMAX-4500-S2D	EMAX Labs, Inc. / EMAX-RSK175	EMAX Labs, Inc. / EMAX-300.0	EMAX Labs, Inc. / EMAX-9060	--
												Data Package Turnaround Time	28 calendar days	28 calendar days	28 calendar days	28 calendar days	28 calendar days	28 calendar days	--
												Container Type/ Volume required (if different than container volume)	3 – 40ml volatile organic analyte vials	1 – BioFlo filter	1 – 250ml high-density polyethylene (HDPE)	3– 40ml volatile organic analyte vials	1 – 250ml HDPE	1 – 250ml HDPE	--
												Preservative	HCl to pH <2; Cool to ≤ 6°C; no headspace	cool to < 6°C	ZnAc + NaOH, cool to <6°C	HCl , cool to <6°C	cool to <6°C	HCl, cool to <6°C	--
												Holding Time (Preparation/ Analysis) ³	14 days	24 hours	7 days	14 days	Nitrate/Nitrite: 48 hours Sulfate: 28 days	28 days	--
												Site	Matrix	Station ID	Sample ID	Coordinates (optional)		Depth/ Sampling Interval (ft bgs)	
				X	Y														
52	Groundwater	52GW41	52GW41-MMDDYY	422834.24	2630407.26	20 - 30	X						X						
52	Groundwater	52GW43	52GW43-MMDDYY	422699.77	2630227.17	45.5 - 55.5	X						X						
52	Groundwater	52GW44	52GW44-MMDDYY	422696.89	2630230.16	20 - 30	X						X						
52	Groundwater	52GW46	52GW46-MMDDYY	422568.66	2630098.11	20 - 30	X	X	X	X	X	X	X						
52	Groundwater	52GW47	52GW47-MMDDYY	422487.50	2630070.12	44 - 54	X						X						
52	Groundwater	52GW48	52GW48-MMDDYY	422491.05	2630066.33	20 - 30	X						X						
52	Groundwater	52GW49	52GW49-MMDDYY	422406.19	2630063.43	42 - 52	X						X						
52	Groundwater	52GW50	52GW50-MMDDYY	422789.38	2630441.25	39.5 - 49.5	X						X						
52	Groundwater	52GW51	52GW51-MMDDYY	422791.63	2630443.99	20 - 30	X						X						
52	Groundwater	52GW52	52GW52-MMDDYY	422529.76	2630236.28	44 - 54	X			X	X	X	X						
52	Groundwater	52GW53	52GW53-MMDDYY	422526.60	2630239.62	20 - 30	X	X	X	X	X	X	X						
52	Groundwater	52GW55	52GW55-MMDDYY	422765.94	2630511.48	40 - 50	X						X						
52	Groundwater	52GW57	52GW57-MMDDYY	422746.18	2630471.37	40 - 50	X						X						
52	Groundwater	52GW58	52GW58-MMDDYY	422742.53	2630475.33	20 - 30	X	X	X	X	X	X	X						
52	Groundwater	52GW59	52GW59-MMDDYY	422646.93	2630413.13	40 - 50	X						X						
52	Groundwater	52GW60	52GW60-MMDDYY	422649.92	2630416.07	20 - 30	X						X						
52	Groundwater	52GW61	52GW61-MMDDYY	422484.02	2630281.35	45 - 55	X						X						
52	Groundwater	52GW62	52GW62-MMDDYY	422479.21	2630285.98	20.5 - 30.5	X			X	X	X	X						
52	Groundwater	52GW63	52GW63-MMDDYY	422372.58	2630289.83	40 - 50	X						X						
52	Groundwater	52GW64	52GW64-MMDDYY	422376.15	2630292.98	20 - 30	X			X	X	X	X						
52	Groundwater	52GW65	52GW65-MMDDYY	422302.87	2630222.78	38 - 48	X						X						
52	Groundwater	52GW67	52GW67-MMDDYY	422156.55	2630119.91	40 - 50	X						X						
52	Groundwater	52GW68	52GW68-MMDDYY	422154.27	2630122.01	20 - 30	X						X						
52	Groundwater	52GW70	52GW70-MMDDYY	422748.10	2630544.96	20 - 30	X						X						
52	Groundwater	52GW71	52GW71-MMDDYY	422691.87	2630594.38	36 - 46	X						X						
52	Groundwater	52GW72	52GW72-MMDDYY	422696.53	2630600.36	20 - 30	X						X						
52	Groundwater	52GW73	52GW73-MMDDYY	422600.98	2630509.97	39 - 49	X						X						
52	Groundwater	52GW74	52GW74-MMDDYY	422596.85	2630506.81	20 - 30	X						X						
52	Groundwater	52GW76	52GW76-MMDDYY	422410.49	2629803.15	20 - 30	X						X						
52	Groundwater	52GW82	52GW82-MMDDYY	422335.52	2628543.73	10 - 25	X	X	X	X	X	X	X						
52	Groundwater	52GW83	52GW83-MMDDYY	422335.52	2628543.73	40 - 50	X	X	X	X	X	X	X						

TABLE 9-3
 Sample Details Table

CTO-WE70 OU1 Pre-Remedial Design Groundwater Monitoring						Analysis Group	VOCs	DHC & functional genes	Sulfide	Methane, Ethane, Ethene	Nitrate, Nitrite Sulfate	TOC	Ferrous Iron						
EMAX Laboratories, Inc. 1835 W 205 th St. Torrance, CA 90501 Molly Nguyen 310-618-8889						Microbial Insights, Inc. 2340 Stock Creek Blvd. Rockford, TN 37853 Anita Biernacki 865-573-8188						Preparation and Analytical Method	SW846 8260B	qPCR	SM4500-S2	RSK-175	SW846 300.0	SW-846 9060	Hach Field Kit
												Analytical Laboratory/ Analytical SOP Reference ²	EMAX Labs, Inc. / EMAX-8260	Microbial Insights, Inc. / DNA-qPCR	EMAX Labs, Inc. / EMAX-4500-S2D	EMAX Labs, Inc. / EMAX-RSK175	EMAX Labs, Inc. / EMAX-300.0	EMAX Labs, Inc. / EMAX-9060	--
												Data Package Turnaround Time	28 calendar days	28 calendar days	28 calendar days	28 calendar days	28 calendar days	28 calendar days	--
												Container Type/ Volume required (if different than container volume)	3 – 40ml volatile organic analyte vials	1 – BioFlo filter	1 – 250ml high-density polyethylene (HDPE)	3– 40ml volatile organic analyte vials	1 – 250ml HDPE	1 – 250ml HDPE	--
												Preservative	HCl to pH <2; Cool to ≤ 6°C; no headspace	cool to < 6°C	ZnAc + NaOH, cool to <6°C	HCl, cool to <6°C	cool to <6°C	HCl, cool to <6°C	--
												Holding Time (Preparation/ Analysis) ³	14 days	24 hours	7 days	14 days	Nitrate/Nitrite: 48 hours Sulfate: 28 days	28 days	--
												Site	Matrix	Station ID	Sample ID	Coordinates (optional)		Depth/ Sampling Interval (ft bgs)	
				X	Y														
52	Groundwater	52GW84	52GW84-MMDDYY	422681.16	2628566.94	40 – 50	X						X						
52	Groundwater	52GW85	52GW85-MMDDYY	422857.94	2628447.72	40 – 50	X						X						
52	Groundwater	52GW86	52GW86-MMDDYY	423005.08	2628620.28	40 – 50	X						X						
52	Groundwater	52GW87	52GW87-MMDDYY	422871.97	2628203.99	40 – 50	X						X						
52	Groundwater	52GW88	52GW88-MMDDYY	422611.25	2628062.29	40 – 50	X						X						
52	Groundwater	MW73	GW73-MMDDYY	422428.68	2630433.01	5 - 15	X						X						
52	Groundwater	N2GW07	N2GW07-MMDDYY	422783.14	2629837.70	20 - 30	X			X	X	X	X						
52	Groundwater	N2GW17	N2GW17-MMDDYY	422735.24	2629937.86	13 - 23	X			X	X	X	X						
52	Groundwater	N2GW18	N2GW18-MMDDYY	422736.87	2629940.88	7.5 - 17.5	X						X						
52	Groundwater	N2GW25	N2GW25-MMDDYY	422958.70	2630243.70	5 - 15	X						X						
52	Groundwater	N2GW29	N2GW29-MMDDYY	422779.30	2630090.00	5 - 15	X						X						
52	Groundwater	N2GW36	N2GW36-MMDDYY	422940.80	2630132.86	5 - 15	X						X						
52	Groundwater	N2GW41	N2GW41-MMDDYY	422979.90	2630264.60	45 - 50	X						X						
52	Groundwater	N4GW07	N4GW07-MMDDYY	422429.83	2630057.83	8 - 18	X						X						
52	Groundwater	N4GW09	N4GW09-MMDDYY	422424.08	2630052.60	45 - 50	X						X						
52	Groundwater	N4GW14	N4GW14-MMDDYY	422234.69	2630197.89	5 - 15	X						X						
52	Groundwater	N4GW75	N4GW75-MMDDYY	422517.63	2629950.21	NA	X						X						
52	Groundwater	N5GW03	N5GW03-MMDDYY	422320.39	2630173.62	10 - 20	X						X						
Field QC Samples ¹																			
	Field Duplicate	16GW04	16GW04P-MMDDYY			10 - 25	X												
	Field Duplicate	16GW10	16GW10P-MMDDYY			10 - 25	X												
	Field Duplicate	16GW16	16GW16P-MMDDYY			10 - 25	X												
	Field Duplicate	16GW32	16GW32P-MMDDYY			44 - 54	X												
	Field Duplicate	16GW36	16GW36P-MMDDYY			32 - 42	X												
	Field Duplicate	16GW37	16GW37P-MMDDYY			5 - 15	X												
	Field Duplicate	16GW50	16GW50P-MMDDYY				X												
	Field Duplicate	42GW15	42GW15P-MMDDYY			36 - 46	X												
	Field Duplicate	42GW16	42GW16P-MMDDYY				X												
	Field Duplicate	GW76	GW76P-MMDDYY			20 - 30	X												
	Field Duplicate	47GW07	47GW07P-MMDDYY			7 - 17	X												
	Field Duplicate	47GW11	47GW11P-MMDDYY			40 - 50	X												

TABLE 9-3
 Sample Details Table

CTO-WE70 OU1 Pre-Remedial Design Groundwater Monitoring						Analysis Group	VOCs	DHC & functional genes	Sulfide	Methane, Ethane, Ethene	Nitrate, Nitrite Sulfate	TOC	Ferrous Iron
EMAX Laboratories, Inc. 1835 W 205 th St. Torrance, CA 90501 Molly Nguyen 310-618-8889 Microbial Insights, Inc. 2340 Stock Creek Blvd. Rockford, TN 37853 Anita Biernacki 865-573-8188						Preparation and Analytical Method	SW846 8260B	qPCR	SM4500-S2	RSK-175	SW846 300.0	SW-846 9060	Hach Field Kit
						Analytical Laboratory/ Analytical SOP Reference ²	EMAX Labs, Inc. / EMAX-8260	Microbial Insights, Inc. / DNA-qPCR	EMAX Labs, Inc. / EMAX-4500-S2D	EMAX Labs, Inc. / EMAX-RSK175	EMAX Labs, Inc. / EMAX-300.0	EMAX Labs, Inc. / EMAX-9060	--
						Data Package Turnaround Time	28 calendar days	28 calendar days	28 calendar days	28 calendar days	28 calendar days	28 calendar days	--
						Container Type/ Volume required (if different than container volume)	3 – 40ml volatile organic analyte vials	1 – BioFlo filter	1 – 250ml high-density polyethylene (HDPE)	3– 40ml volatile organic analyte vials	1 – 250ml HDPE	1 – 250ml HDPE	--
						Preservative	HCl to pH <2; Cool to ≤ 6°C; no headspace	cool to < 6°C	ZnAc + NaOH, cool to <6°C	HCl, cool to <6°C	cool to <6°C	HCl, cool to <6°C	--
						Holding Time (Preparation/ Analysis) ³	14 days	24 hours	7 days	14 days	Nitrate/Nitrite: 48 hours Sulfate: 28 days	28 days	--
						Site	Matrix	Station ID	Sample ID	Coordinates (optional) X Y		Depth/ Sampling Interval (ft bgs)	
	Field Duplicate	52GW18	52GW18P-MMDDYY			45 - 55	X						
	Field Duplicate	52GW46	52GW46P-MMDDYY			20 - 30	X						
	Field Duplicate	52GW57	52GW57P-MMDDYY			40 - 50	X						
	Field Duplicate	52GW58	52GW58P-MMDDYY			20 - 30	X						
	Field Duplicate	52GW83	52GW83P-MMDDYY			41 - 51	X						
	Matrix Spike	16GW02	16GW02-MMDDYY-MS			10 - 25	X						
	Matrix Spike Duplicate	16GW02	16GW02-MMDDYY-SD			10 - 25	X						
	Matrix Spike	16GW06	16GW06-MMDDYY-MS			15 - 25	X						
	Matrix Spike Duplicate	16GW06	16GW06-MMDDYY-SD			15 - 25	X						
	Matrix Spike	16GW41	16GW41-MMDDYY-MS			35 - 45	X						
	Matrix Spike Duplicate	16GW41	16GW41-MMDDYY-SD			35 - 45	X						
	Matrix Spike	MW58	GW58-MMDDYY-MS			3 - 13	X						
	Matrix Spike Duplicate	MW58	GW58-MMDDYY-SD			3 - 13	X						
	Matrix Spike	47GW09	47GW09-MMDDYY-MS			14.5 - 24.5	X						
	Matrix Spike Duplicate	47GW09	47GW09-MMDDYY-SD			14.5 - 24.5	X						
	Matrix Spike	47GW10	47GW10-MMDDYY-MS			37.5 - 47.5	X						
	Matrix Spike Duplicate	47GW10	47GW10-MMDDYY-SD			37.5 - 47.5	X						
	Matrix Spike	52GW24	52GW24-MMDDYY-MS			42 - 52	X						
	Matrix Spike Duplicate	52GW24	52GW24-MMDDYY-SD			42 - 52	X						
	Matrix Spike	52GW60	52GW60-MMDDYY-MS			20 - 30	X						
	Matrix Spike Duplicate	52GW60	52GW60-MMDDYY-SD			20 - 30	X						
	Matrix Spike	52GW88	52GW88-MMDDYY-MS			35 - 45	X						
	Matrix Spike Duplicate	52GW88	52GW88-MMDDYY-SD			35 - 45	X						
	Equipment Blank	EB	EB01-MMDDYY			NA	X						
	Equipment Blank	EB	EB02-MMDDYY			NA	X						
	Trip Blank	TB	TB01-MMDDYY			NA	X						
	Trip Blank	TB	TB02-MMDDYY			NA	X						
	Trip Blank	TB	TB03-MMDDYY			NA	X						
Total Number of Samples to the Laboratory							209	20	20	48	48	48	169

† Sample location not found during 2009 additional groundwater investigation.

TABLE 9-3
 Sample Details Table

CTO-WE70 OU1 Pre-Remedial Design Groundwater Monitoring					Analysis Group	VOCs	DHC & functional genes	Sulfide	Methane, Ethane, Ethene	Nitrate, Nitrite Sulfate	TOC	Ferrous Iron
EMAX Laboratories, Inc. 1835 W 205 th St. Torrance, CA 90501 Molly Nguyen 310-618-8889 Microbial Insights, Inc. 2340 Stock Creek Blvd. Rockford, TN 37853 Anita Biernacki 865-573-8188					Preparation and Analytical Method	SW846 8260B	qPCR	SM4500-S2	RSK-175	SW846 300.0	SW-846 9060	Hach Field Kit
					Analytical Laboratory/ Analytical SOP Reference ²	EMAX Labs, Inc. / EMAX-8260	Microbial Insights, Inc. / DNA-qPCR	EMAX Labs, Inc. / EMAX-4500-S2D	EMAX Labs, Inc. / EMAX-RSK175	EMAX Labs, Inc. / EMAX-300.0	EMAX Labs, Inc. / EMAX-9060	--
					Data Package Turnaround Time	28 calendar days	28 calendar days	28 calendar days	28 calendar days	28 calendar days	28 calendar days	--
					Container Type/ Volume required (if different than container volume)	3 – 40ml volatile organic analyte vials	1 – BioFlo filter	1 – 250ml high-density polyethylene (HDPE)	3– 40ml volatile organic analyte vials	1 – 250ml HDPE	1 – 250ml HDPE	--
					Preservative	HCl to pH <2; Cool to ≤ 6°C; no headspace	cool to < 6°C	ZnAc + NaOH, cool to <6°C	HCl, cool to <6°C	cool to <6°C	HCl, cool to <6°C	--
					Holding Time (Preparation/ Analysis) ³	14 days	24 hours	7 days	14 days	Nitrate/Nitrite: 48 hours Sulfate: 28 days	28 days	--
					Site	Matrix	Station ID	Sample ID	Coordinates (optional) X Y	Depth/ Sampling Interval (ft bgs)		

‡Sample will be analyzed for site-specific select VOCs under a different CTO. Sample associated with an on-going pilot study.

¹ Include field QC samples (per site and media) including field duplicates, matrix spike/matrix spike duplicates (MS/MSDs), trip blanks, equipment blanks, and field blanks. Field QC counts may change depending upon duration of field event.

² List laboratory addresses and contacts in the upper left hand corner of table. If samples will be shipped to multiple laboratories then specify as well. If backup laboratory has been identified, specify in upper left-hand corner.

³ Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted.

Frequency of QA/QC sample collection:

Field Duplicate- One per 10 field samples

MS/MSD- One pair per 20 field samples (including field QC samples)

Trip Blank- One per cooler to the laboratory containing volatiles

Equipment Blank- One per week of sampling

10 Reference Limits and Evaluation Tables

[\(UFP-QAPP Manual Section 2.8.1 – Worksheet # 15\)](#)

Samples will be collected and analyzed for the analytical groups and methods detailed in **Table 9-3, Sample Details Table**. The PALs and laboratory reporting limits for each analyte from these samples are provided in *Reference Limits and Evaluation Tables* (**Tables 10-1 through 10-4**).

According to North Carolina regulations (15A North Carolina Administrative Code 02L.0202 (b)(1)), when the regulatory standard for a particular constituent is less than the laboratory's limit of quantitation (LOQ) a concentration at or above the limit constitutes a violation of the standard. The laboratory for this project is operating under DoD (Department of Defense) Quality Systems Manual (QSM), version 4.2 criteria, so when this situation occurs, any detection at or above the LOQ constitutes a violation of the standard.

If the laboratory limit of detection (LOD) for a specific constituent is greater than the corresponding PAL, any detection of this constituent above a corresponding 95 percent background UTL will be considered potentially site-related. In those cases where this specific constituent is not detected above the LOD, the analyte will be considered not present.

If the LOD for a specific constituent is greater than the corresponding PAL, any detection of this constituent above a corresponding 95 percent background UTL will be considered potentially site-related.

TABLE 10-1

Reference Limits and Evaluation Table

Matrix: Groundwater

Analytical Group: VOCs (select)

Analyte	CAS No.	PAL ¹ (µg/L)	PAL Reference ²	Project Quantitation Limit Goal ³ (µg/L)	Laboratory-specific Limits (µg/L)			LCS, MS/MSD %R and RPD Limits ⁴ (%)		
					LOQs	LODs	DLs	LCL	UCL	RPD
1,1,1-Trichloroethane	71-55-6	200	MCL, NC2L	66.7	1	0.2	0.10	65	130	30
1,1,2,2-Tetrachloroethane	79-34-5	0.2	NC2L	0.1	1	0.2	0.11	65	130	
1,1,2-Trichloroethane	79-00-5	5.0	MCL	1.7	1	0.2	0.10	75	125	
1,1-Dichloroethane	75-34-3	6.0	NC2L	2.0	1	0.2	0.10	70	135	
1,1-Dichloroethene	75-35-4	7.0	MCL, NC2L	2.3	1	0.2	0.10	70	130	
1,2-Dichloroethane	107-06-2	0.4	NC2L	0.1	1	0.2	0.10	70	130	
1,2-Dichloroethene (total)	540-59-0	70	MCL	23.3	1	0.2	0.10	70	130	
Chloroform	67-66-3	70	NC2L	23.3	1	0.2	0.10	65	135	30
Cis-1,2-Dichloroethene	156-59-2	70	MCL, NC2L	23.3	1	0.2	0.10	70	125	
Tetrachloroethene	127-18-4	0.7	NC2L	0.2	1	0.2	0.15	45	150	
Trans-1,2-Dichloroethene	156-60-5	100	MCL, NC2L	33.3	1	0.2	0.10	60	140	
Trichloroethene	79-01-6	3.0	NC2L	1.0	1	0.2	0.10	70	125	
Vinyl Chloride	75-01-4	0.03 ⁵	NC2L	0.01	1	0.2	0.12	50	145	

Notes:

- 1 The PAL for each analyte is the lower of the criteria shown. Refer to **Section 6.4** for a detailed discussion on PALs.
- 2 MCL values are taken from the drinking water MCLs. NC2L values are from the NC 2L Standards (April 2013).
- 3 Project quantitation limit (PQL) goals are three times less than the minimum applicable PALs.
- 4 DoD QSM v.4.2 is the basis for laboratory control sample (LCS) and MS/MSD limits. Bolded values represent in-house limits when DoD QSM v4.2 limits do not exist.
- 5 Shading indicates that the LOD for the specific constituent is greater than the corresponding PAL. Please see **Section 10** for detailed discussion on how the data will be used in this circumstance.

TABLE 10-2

Reference Limits and Evaluation Table

Matrix: Groundwater

Analytical Group: Wet Chemistry

Analyte	CAS No.	PQL Goal (µg/L) ²	Laboratory-specific Limits (µg/L)			LCS, MS/MSD %R and RPD Limits ³ (%)		
			LOQs	LODs	DLs	LCL	UCL	RPD
Ethane	74-84-0	0.64	2	0.64	0.32	60	140	30
Ethene	74-85-1	0.6	2	0.6	0.3	60	140	
Methane	74-82-8	0.34	2	0.34	0.17	60	140	
Nitrate	14797-55-8	50	100	50	25	LCS: 80 MS: 75	LCS: 120 MS: 125	20
Nitrite	14797-65-0	50	100	50	25			
Sulfate	14808-79-8	250	500	250	130	80	120	30
Sulfide	18496-25-8	20	100	20	10			
TOC	TOC ¹	500	1000	500	250			

[1 Contractor-generated CAS number](#)

[2 PQL goals for the parameters listed above are equal to the laboratory LODs.](#)

[3 Bolded values represent in-house limits when DoD QSM v4.2 limits do not exist.](#)

[4 See Table 6-1 for a discussion on how analytical results for the parameters above will be used.](#)

TABLE 10-3

Reference Limits and Evaluation Table

Matrix: Groundwater

Analytical Group: Microbials – DHC and DHC Functional Genes

Analyte	CAS No. ¹	Laboratory-specific Limits (cells/mL)		
		LOQs	LODs	DLs
<i>Dehalococcoides</i>	DHC	500	100	100
BAV1 R-Dase	BAV1 R-Dase	500	100	100
TCE R-Dase	TCE R-Dase	500	100	100
VC R-Dase	VC R-Dase	500	100	100

[1 Contractor-generated CAS numbers](#)

[2 See Table 6-1 for a discussion on how analytical results for the parameters above will be used.](#)

11 Analytical SOP References Table

[\(UFP-QAPP Manual Section 3.2.1 – Worksheet #23\)](#)

Information contained in the laboratory SOPs will be used for the handling and analysis of the samples; the SOPs are listed in **Table 11-1**.

Table 11-1

Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and Number	Date Last Reviewed (or revised)	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to QSM	Modified for Project Work? (Y/N)
EMAX-8260	VOLATILE ORGANIC COMPOUNDS BY GC/MS Revision 9 Date 1/14/2013	1/14/2013	Definitive	Groundwater / VOCs	GCMS	EMAX	N
EMAX-RSK175	DISSOLVED GASES Revision 2 Date 9/1/2010	6/13/2013	Definitive	Groundwater / Wet Chemistry (Methane Ethane Ethene)	GC FID	EMAX	N
EMAX-300.0	ION CHROMATOGRAPHY ANALYSIS Revision 9 Date 10/3/2012	10/3/2012	Definitive	Groundwater / Wet Chemistry (Nitrate, Nitrite, and Sulfate)	IC	EMAX	N
EMAX-4500-S2D	SULFIDE (COLORIMETRY) Revision 2 Date 8/27/2012	4/29/2013	Definitive	Groundwater / Wet Chemistry (Sulfide)	NA	EMAX	N
EMAX-9060	TOTAL ORGANIC CARBON Revision 3 Date 11/7/2011	12/28/2012	Definitive	Groundwater / Wet Chemistry (TOC)	TOC	EMAX	N
EMAX-5030	PURGE & TRAP Revision 3 Date 3/25/2013	3/25/2013	Definitive	Groundwater / VOCs (Prep Method)	Preparation	EMAX	N
EMAX-SM01	SAMPLE MANAGEMENT Revision 6 Date 5/1/2012	5/28/2013	N/A	N/A	N/A	EMAX	N
EMAX-SM02	SAMPLE RECEIVING Revision 7 Date 6/18/2012	6/28/2013	N/A	N/A	N/A	EMAX	N
EMAX-SM03	WASTE DISPOSAL Revision 5 Date 1/23/2012	1/28/2013	N/A	N/A	N/A	EMAX	N
MI-SAMREC	Sample Receiving, Revision 1.1, 01/02/2013	01/02/2013	N/A	N/A	N/A	Microbial Insights	N
SOP-Waste Disposal	Waste Disposal, Revision 1.0, 01/02/2013	01/02/2013	N/A	N/A	N/A	Microbial Insights	N
DNA-EXT	Extraction of DNA from Environmental Samples, Revision 1.0, 01/02/2013	01/02/2013	Definitive	Groundwater / Microbial (Prep Method)	Preparation	Microbial Insights	N
DNA-qPCR	Quantitative Polymerase Chain Reaction (qPCR), Revision 1.0, 01/02/2013	01/02/2013	Definitive	Groundwater / Microbial	ABI 7300	Microbial Insights	N
SOP-ABI 7300	Exporting Results from the ABI 7300 Instrument, Revision 1.0, 01/02/2013	01/02/2013	Definitive	Groundwater / Microbial	ABI 7300	Microbial Insights	N

Lab SOP Number	Title, Revision Date, and Number	Date Last Reviewed (or revised)	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to QSM	Modified for Project Work? (Y/N)
SOP - Calculating qPCR	Calculating qPCR Results, Revision 1.0, 01/02/2013	01/02/2013	Definitive	Groundwater / Microbial	Calculation	Microbial Insights	N

Note:

DoD Environmental Laboratory Accreditation Program (ELAP) certification is required for this work. A copy of the current DoD ELAP letter is included in **Appendix B**.

12 Laboratory QC Samples Table

[\(UFP-QAPP Manual Section 3.4 – Worksheet #28\)](#)

Laboratories analyzing samples in support of this work will perform laboratory QC samples at the frequency required by the DoD QSM 4.2. Details regarding each laboratory QC sample are provided in **Tables 12-1** through **12-6**.

TABLE 12-1

Laboratory QC Samples Table

Matrix: Groundwater

Analytical Group: VOCs

Analytical Method/ SOP Reference: SW-846 8260B / EMAX-8260

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	MPC
Method Blank	One per preparation batch	No analytes detected > ½LOQ and 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). For common laboratory contaminants, no analytes detected > LOQ. Blank result must not otherwise affect sample results.	Determine cause of contamination and re-prep and reanalyze method blank and all samples processed with the non-conforming method blank.	EMAX Chemist	Contamination	No analytes detected > ½LOQ and 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). For common laboratory contaminants, no analytes detected > LOQ. Blank result must not otherwise affect sample results.
LCS	One per preparation batch	Refer to Table 10-1.	Re-prep and reanalyze LCS and all samples processed with the non-conforming LCS.		Accuracy/Bias	Refer to Table 10-1.
MS/MSD	Project Designated (1 per 20 project samples of similar matrix)	Refer to Table 10-1.	If result is indicative of matrix interference, discuss in case narrative. Otherwise check for possible source of error, and extract / reanalyze the sample.		Accuracy/Bias/Precision	Refer to Table 10-1.

Matrix: Groundwater

Analytical Group: VOCs

Analytical Method/ SOP Reference: SW-846 8260B / EMAX-8260

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	MPC
Surrogates	Every analytical sample	1,2-Dichloroethane-d4: 70-120%R 4-Bromofluorobenzene: 75-120%R Dibromofluoromethane: 85-115%R Toluene-d8: 85-120%R	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.		Accuracy/Bias	1,2-Dichloroethane-d4: 70-120%R 4-Bromofluorobenzene: 75-120%R Dibromofluoromethane: 85-115%R Toluene-d8: 85-120%R
Internal Standards (IS)	Every analytical sample	Retention time \pm 30 seconds from retention time of the midpoint standard in the initial calibration (ICAL); extracted ion current profile area within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions. Re-analysis of samples analyzed while system was malfunctioning is required.		Accuracy/Bias	Retention time \pm 30 seconds from retention time of the midpoint standard in the ICAL; extracted ion current profile area within -50% to +100% of ICAL midpoint standard.

TABLE 12-2
 Laboratory QC Samples Table

Matrix: Groundwater

Analytical Group: Wet Chemistry –
 Methane, Ethane, and Ethene

Analytical Method/ SOP Reference: SW-
 RSK-175 / EMAX-RSK175

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	MPC
Method Blank	One per preparation batch	No analytes detected > ½LOQ. For common laboratory contaminants, no analytes detected > LOQ. Blank result must not otherwise affect sample results.	Determine cause of contamination and re-prepare and reanalyze method blank and all samples processed with the non-conforming method blank.	Analyst	Contamination	No analytes detected > ½LOQ. For common laboratory contaminants, no analytes detected > LOQ. Blank result must not otherwise affect sample results.
LCS	One per preparation batch	Refer to Table 10-2	Re-prepare and reanalyze LCS and all samples processed with the non-conforming LCS.	Analyst	Accuracy/Bias	Refer to Table 10-2
MS/MSD	Project Designated sample in matrix QC. In general 1:20 project samples.	Refer to Table 10-2	If result is indicative of matrix interference, discuss in case narrative. Otherwise check for possible source of error, and extract / reanalyze the sample.	Analyst	Accuracy/Bias/Precision	Refer to Table 10-2

TABLE 12-3

Laboratory QC Samples Table

Matrix: Groundwater

Analytical Group: Wet Chemistry – Nitrate, Nitrite, and Sulfate

Analytical Method/ SOP Reference: EPA 300.0 / EMAX-300.0

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	MPC
Method Blank	One per preparation batch	No analytes detected > ½LOQ. For common laboratory contaminants, no analytes detected > LOQ. Blank result must not otherwise affect sample results.	Determine cause of contamination and re-prepare and reanalyze method blank and all samples processed with the non-conforming method blank.	Analyst	Contamination	No analytes detected > ½LOQ. For common laboratory contaminants, no analytes detected > LOQ. Blank result must not otherwise affect sample results.
LCS	One per preparation batch	Refer to Table 10-2	Re-prepare and reanalyze LCS and all samples processed with the non-conforming LCS.	Analyst	Accuracy/Bias	Refer to Table 10-2
MS/MSD	Project Designated sample in matrix QC. In general 1:20 project samples.	Refer to Table 10-2	If result is indicative of matrix interference, discuss in case narrative. Otherwise check for possible source of error, and extract / reanalyze the sample.	Analyst	Accuracy/Bias/Precision	Refer to Table 10-2

TABLE 12-4

Laboratory QC Samples Table

Matrix: Groundwater

Analytical Group: Wet Chemistry – Total Organic Carbon

Analytical Method/ SOP Reference: EPA 300.0 / EMAX-300.0

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	MPC
Method Blank	One per preparation batch	No analytes detected > ½LOQ. For common laboratory contaminants, no analytes detected > LOQ. Blank result must not otherwise affect sample results.	Determine cause of contamination and re-prepare and reanalyze method blank and all samples processed with the non-conforming method blank.	Analyst	Contamination	No analytes detected > ½LOQ. For common laboratory contaminants, no analytes detected > LOQ. Blank result must not otherwise affect sample results.
LCS	One per preparation batch	Refer to Table 10-2	Re-prepare and reanalyze LCS and all samples processed with the non-conforming LCS.	Analyst	Accuracy/Bias	Refer to Table 10-2
MS/MSD	Project Designated sample in matrix QC. In general 1:20 project samples.	Refer to Table 10-2	If result is indicative of matrix interference, discuss in case narrative. Otherwise check for possible source of error, and extract / reanalyze the sample.	Analyst	Accuracy/Bias/Precision	Refer to Table 10-2

TABLE 12-5

Laboratory QC Samples Table

Matrix: Groundwater

Analytical Group: Wet Chemistry – Sulfide

Analytical Method/ SOP Reference:
 SM4500 S2D / EMAX-4500-S2D

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	MPC
Method Blank	One per preparation batch	No analytes detected >= LOQ.	Determine cause of contamination and re-prepare and reanalyze method blank and all samples processed with the non-conforming method blank.	Analyst	Contamination	No analytes detected >= LOQ.
LCS	One per preparation batch	Refer to Table 10-2	Re-prepare and reanalyze LCS and all samples processed with the non-conforming LCS.	Analyst	Accuracy/Bias	Refer to Table 10-2
MS/MSD	Project Designated sample in matrix QC. In general 1:20 project samples.	Refer to Table 10-2	If result is indicative of matrix interference, discuss in case narrative. Otherwise check for possible source of error, and extract / reanalyze the sample.	Analyst	Accuracy/Bias/Precision	Refer to Table 10-2

TABLE 12-6

Laboratory QC Samples Table

Matrix: Groundwater

Analytical Group: Microbial - DHC, BAV1
 R-Dase, TCE R-Dase, and VC R-Dase

Analytical Method/ SOP Reference: qPCR
 / DNA-qPCR

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	MPC
Laboratory (sample) Duplicate	All field samples	N/A	Rerun assay; if still not within 2 Ct units, flag J (estimate)	Lab Manager	N/A	CT value within 2 units of other duplicate
Field duplicate	At client's request & with sample submission		Rerun assay; if still not within 4 Ct units, flag J (estimate)	Lab Manager		CT value within 4 units of other sample (duplicate)
Assay Negative Control (Blank)	1 per analytical assay plate		Rerun assay; may have to reoptimize assay			values for positive samples are set above any fluorescence for the negative control
DNA extraction negative control	1 per analytical batch		Rerun assay or re-extract samples if problem persists			CT < or = Assay Negative Control
Positive Control	1 per analytical assay plate		Rerun assay / check reagents			Calculated concentration within +/-20% of same concentration on standard curve

13 Data Verification and Validation (Steps I and IIa/IIb) Process Table

[\(UFP-QAPP Manual Section 5.2.1, UFP-QAPP Manual Section 5.2.2, Figure 37 UFP-QAPP Manual, Table 9 UFP-QAPP Manual – Worksheets #34, 35, 36\)](#)

Data will be collected and reviewed for quality and completeness as detailed in **Table 13-1**, the *Data Verification and Validation (Steps I and IIa/IIb) Process Table* as follows.

TABLE 13-1

Data Verification and Validation (Steps I and IIa/IIb)¹ Process Table

Data Review Input	Description	Responsible for Verification ¹ and Validation ² (name, organization)	Internal/ External ³
Target Compound List and Target Analyte List	Ensure the laboratory reported all analytes from each analysis group.	PC/CH2M HILL	External
Reporting Limits	Ensure the laboratory met the PQLs. If they were not met, the reason will be determined and documented.	PC/CH2M HILL	External
Field SOPs	Ensure that all field SOPs were followed.	PC/CH2M HILL	Internal
Laboratory SOPs	Ensure that approved analytical laboratory SOPs were followed.	FTL/CH2M HILL	Internal
Raw Data	10 percent review of raw data to confirm laboratory calculations	Respective Laboratory QAO	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.	Data Validator /CH2M HILL	Internal
Documentation of Method QC Results	Establish that all required QC samples were run.	FTL/CH2M HILL	External
Documentation of Field QC Sample Results	Establish that all required QC samples were run.	PC/CH2M HILL	Internal
DoD ELAP Evaluation	Ensure that each laboratory is DoD ELAP-certified for the analyses they are to perform. Ensure evaluation timeframe does not expire.	PC/CH2M HILL	External

Data Review Input	Description	Responsible for Verification ¹ and Validation ² (name, organization)	Internal/ External ³
Analytical data for VOCs (select) in groundwater	Analytical methods and laboratory SOPs as presented in this UFP-SAP will be used to evaluate compliance against QA/QC criteria. Should adherence to QA/QC criteria yield deficiencies, data may be qualified. The data qualifiers used are those presented in <i>Region 4 Modifications to the National Functional Guidelines for Organic Data Review</i> (EPA, 1994) and in <i>Region 4 Modifications to the Laboratory Data Validation Guidelines for Inorganic Data Review</i> (EPA, 1993). National Functional Guidelines will not be used for data validation; however, the specific qualifiers listed therein may be applied to data should non-conformances against the QA/QC criteria as presented in this UFP-SAP be identified	Data Validator /CH2M HILL	External
Analytical data for wet chemistry and microbial analysis results in groundwater	Wet chemistry (Methane, Ethane, Ethene; Nitrate, Nitrite, Sulfate; Sulfide; TOC) and microbial data (DHC, BAV1 R-Dase, TCE R-Dase, and VC R-Dase) will not undergo third-party validation, but are subject to all other previously detailed data review.	N/A	N/A

¹ Verification (Step I) is a completeness check that is performed before the data review process continues to determine whether the required information (complete data package) is available for further review. Validation (Step IIa) is a review that the data generated are in compliance with analytical methods, procedures, and contracts. Validation (Step IIb) is a comparison of generated data against MPC in the UFP-SAP (both sampling and analytical).

² Should CH2M HILL find discrepancies during the verification or validation procedures above, an email documenting the issue will be circulated to the internal project team, and a Corrections to File Memo will be prepared identifying the issues and the corrective action needed. This Memo will be sent to the laboratory, or applicable party, and maintained in the project file.

³ Internal or external is in relation to the data generator.

14 References

- CH2M HILL. 2005. *Master Project Plans, Marine Corps Air Station, Cherry Point, North Carolina*.
- CH2M HILL. 2009. *Final OU1 Remedial Investigation Addendum, Marine Corps Air Station, Cherry Point, North Carolina*. April.
- CH2M HILL. 2011. *Operable Unit 1 Central Groundwater Plume Feasibility Study, Marine Corps Air Station, Cherry Point, North Carolina*. August.
- CH2M HILL. 2012a. *OU1 Central Groundwater Plume In-Situ Enhanced Bioremediation Pilot Study Implementation Report, Marine Corps Air Station, Cherry Point, North Carolina*. January.
- CH2M HILL. 2012b. *OU1 Central Groundwater Plume Zero-Valent Iron Permeable Reactive Barrier Pilot Study Implementation Plan, Marine Corps Air Station, Cherry Point, North Carolina*. May.
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- EPA. 1994. *Modifications to the National Functional Guidelines for Organic Data Review*.
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- Intergovernmental Data Quality Task Force. 2005. *EPA, Uniform Federal Policy for Quality Assurance Project Plans*.
- TetraTech NUS, Inc. 2002. *Final Remedial Investigation Report for Operable Unit 1 (OU 1)*. Marine Corps Air Station, Cherry Point, North Carolina. November.

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Figures



- Legend**
- Cities
 - Rivers and Streams
 - Military Installation
 - County Boundary

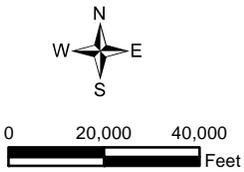
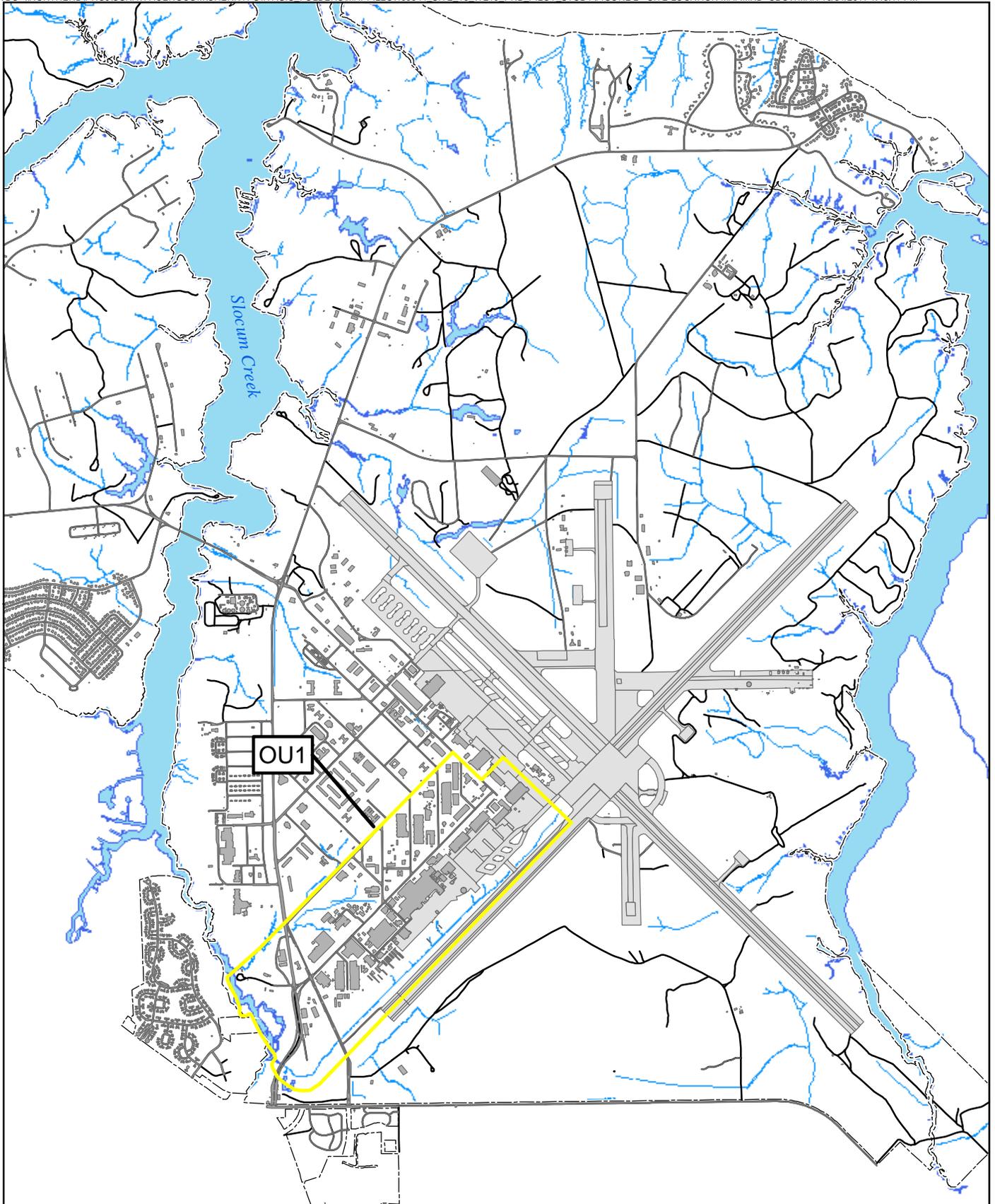


Figure 1
Base Location Map
Marine Corps Air Station Cherry Point
Cherry Point, North Carolina



Legend

-  OU Boundary
-  Surface Water
-  Base Boundary
-  Buildings
-  Runway
-  Road

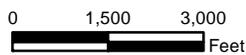


Figure 2
OU1 Location Map
Marine Corps Air Station Cherry Point
Cherry Point, North Carolina



- Legend**
- Surface Water
 - Industrial Area Sewer System
 - Site Boundary
 - OU1 Boundary
 - Existing Buildings
- IWTP - Industrial Wastewater Treatment Plant

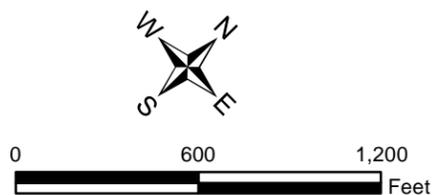


Figure 3
OU1 Sites Location Map
Marine Corps Air Station Cherry Point
Cherry Point, North Carolina

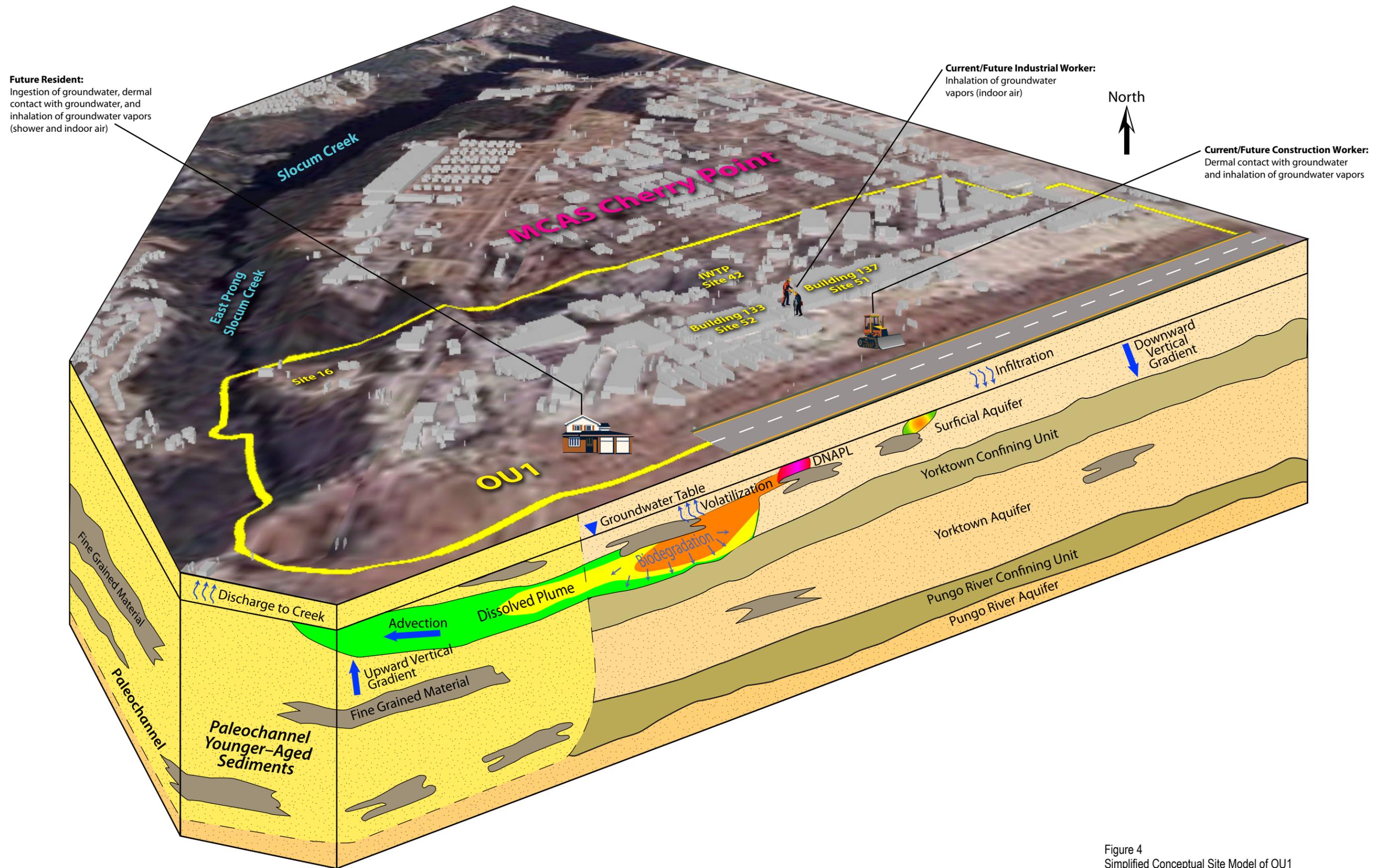
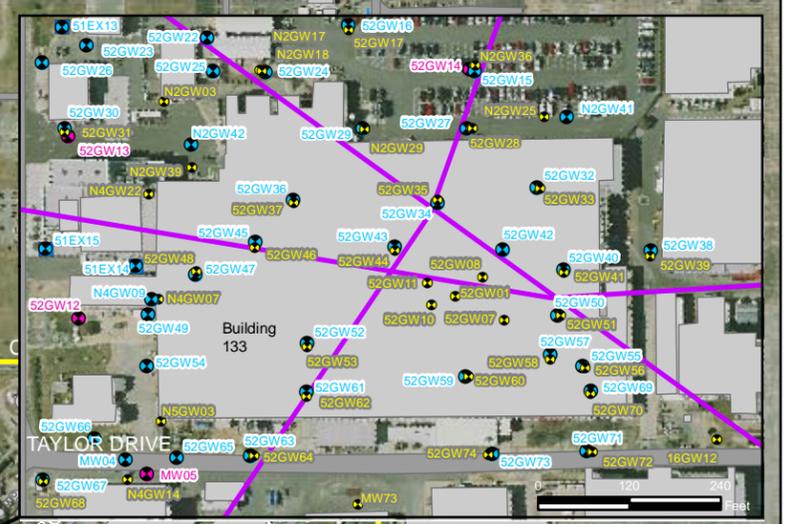
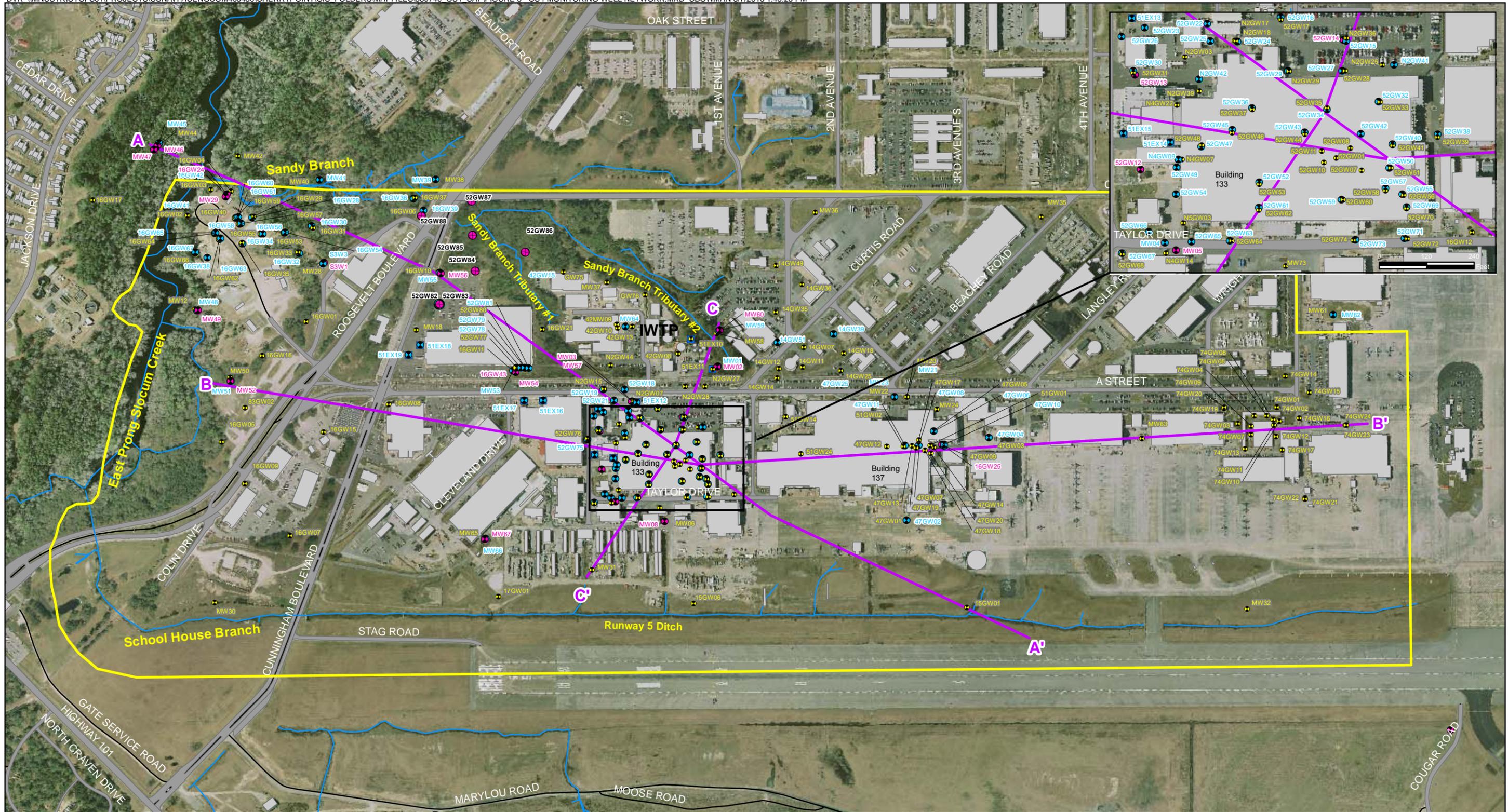


Figure 4
Simplified Conceptual Site Model of OU1
Marine Corps Air Station Cherry Point
Cherry Point, North Carolina



- Legend**
- Proposed New Well - Upper Aquifer
 - Proposed New Well - Lower Aquifer
 - Extraction Well
 - Upper Surficial Monitoring Well
 - Lower Surficial Monitoring Well
 - Yorktown Monitoring Well
 - Cross Section Transects
 - Surface Water
 - OU1 Boundary
 - Existing Buildings

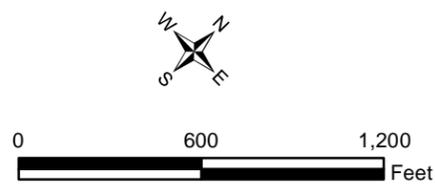
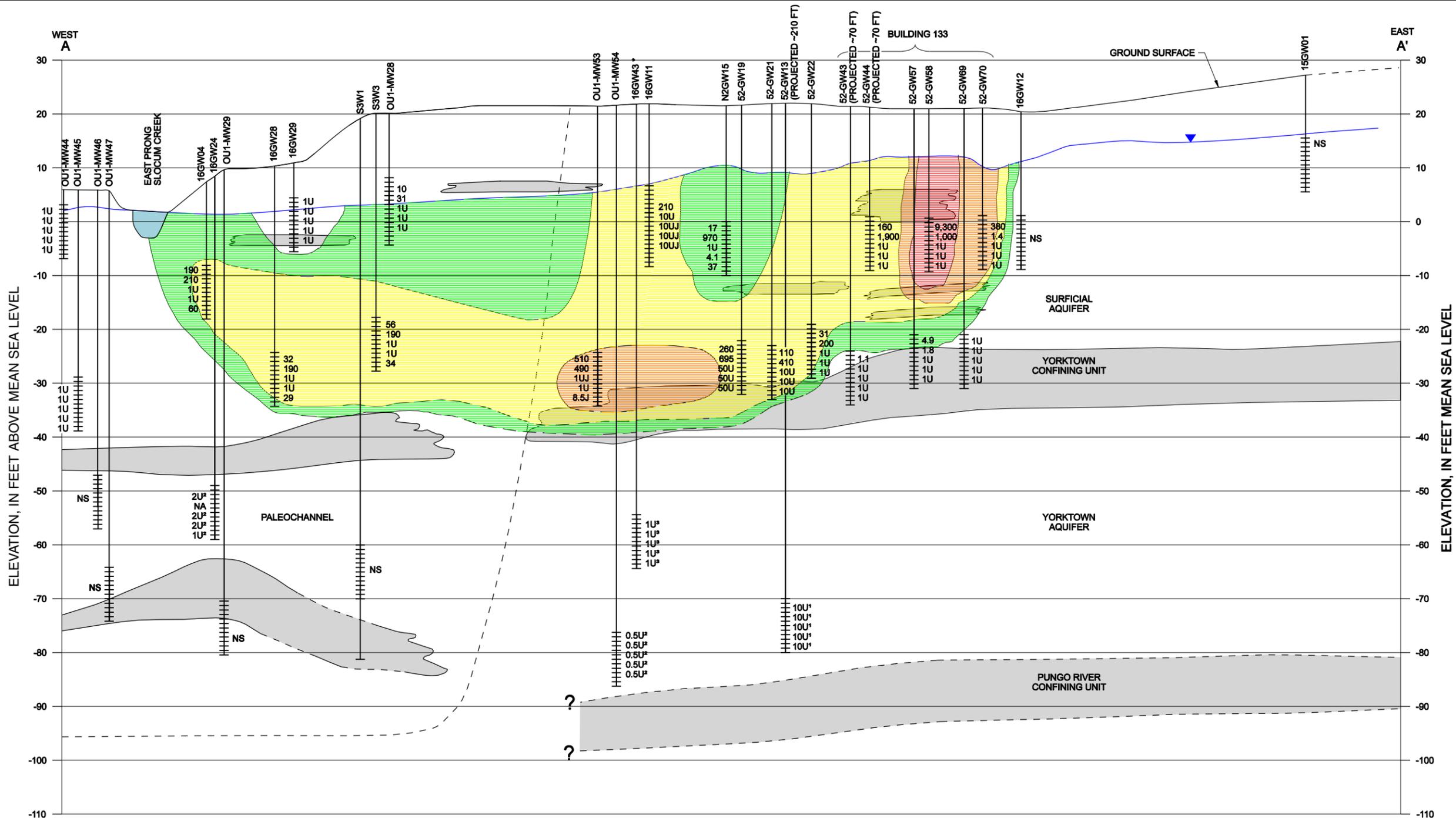


Figure 5
 OU1 Monitoring Well Network and
 Location of Hydrogeologic Cross-Sections
 Marine Corps Air Station Cherry Point
 Cherry Point, North Carolina

IWTP - Industrial Wastewater Treatment Plant



LEGEND

- WELL SCREEN INTERVAL
 - LINE OF APPROXIMATELY EQUAL TCE ISOCONCENTRATION IN ug/L
 - PREDOMINANTLY COARSE-GRAINED MATERIAL
 - PREDOMINANTLY FINE-GRAINED MATERIAL
- TCE ISOCONCENTRATION CONTOURS**
- 3 - 30 ug/L
 - 30 - 300 ug/L
 - 300 - 3,000 ug/L
 - 3,000 - 11,000 ug/L
 - >11,000 ug/L

NOTES:

- ALL ANALYTICAL DATA ARE FROM THE SPRING 2009 SAMPLING EVENT UNLESS OTHERWISE NOTED.
- 1. ANALYTICAL DATA ARE FROM APRIL AND MAY 2006 SAMPLING EVENT.
- 2. ANALYTICAL DATA ARE FROM EITHER THE MARCH OR MAY 2005 SAMPLING EVENT.
- 3. ANALYTICAL DATA ARE FROM THE AUGUST 2008 SAMPLING EVENT
- ? - PUNGO RIVER CONFINING UNIT NOT DELINEATED IN THE WESTERN PORTION OF THE SITE.

CONCENTRATIONS ARE PRESENTED IN THE FOLLOWING ORDER:

- TRICHLOROETHENE (TCE)
 - 1,2 - DICHLOROETHENE (1,2 - DCE)
 - 1,1,1 - TRICHLOROETHANE (1,1,1 - TCA)
 - 1,1 - DICHLOROETHENE (1,1 - DCE)
 - VINYL CHLORIDE
- ALL CONCENTRATIONS ARE IN ug/L
- NA = NOT ANALYZED
 - ug/L = MICROGRAMS PER LITER
 - NS = NOT SAMPLED
 - J = ESTIMATED VALUE
 - NC2L FOR TCE = 3 ug/L

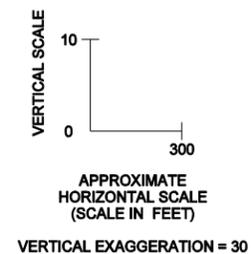
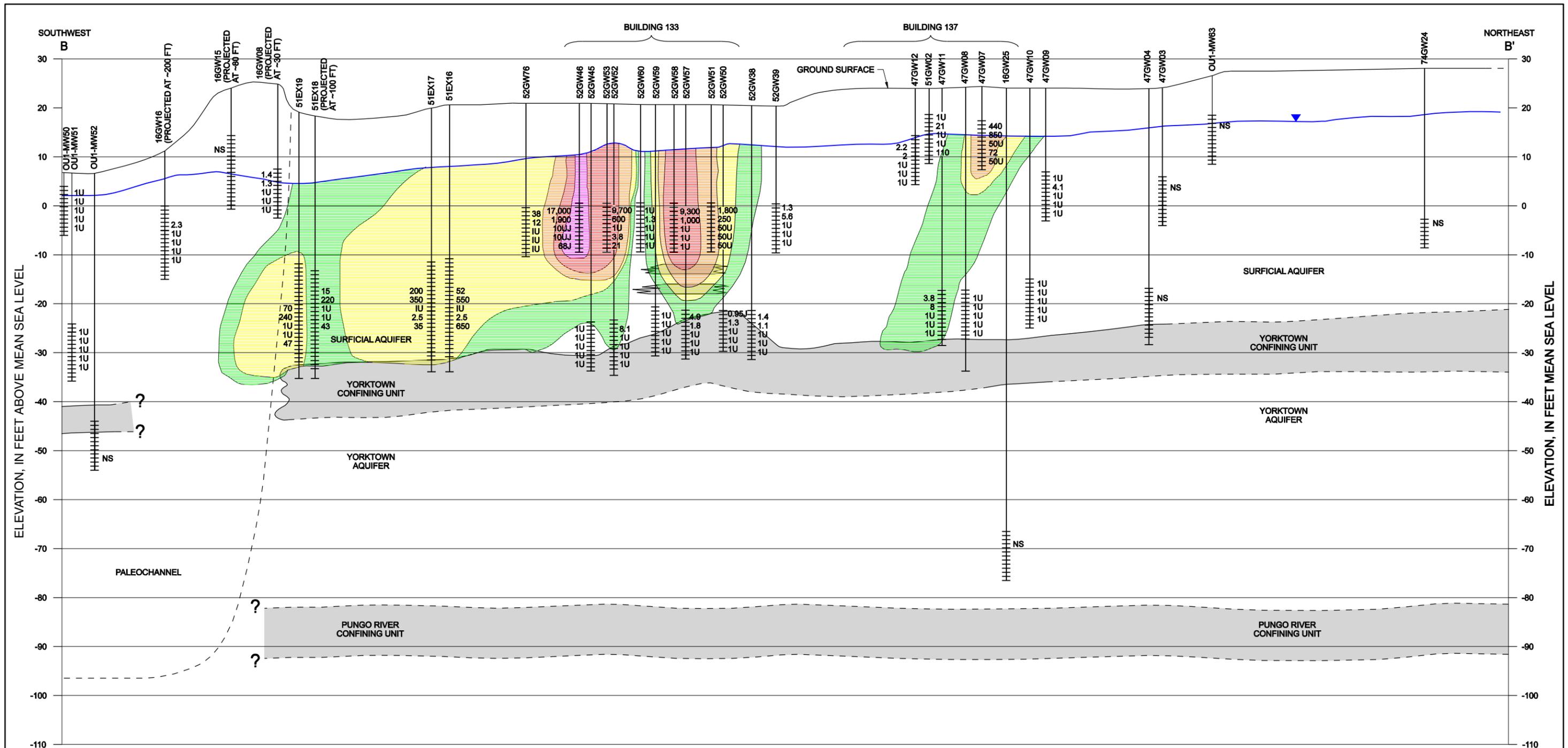


Figure 6
VOC Isoconcentrations
Cross Section A-A'
Marine Corps Air Station Cherry Point
Cherry Point, NC



LEGEND

- WELL SCREEN INTERVAL
 - LINE OF APPROXIMATELY EQUAL TCE ISOCONCENTRATION IN ug/L
 - PREDOMINANTLY COARSE-GRAINED MATERIAL
 - PREDOMINANTLY FINE-GRAINED MATERIAL
- TCE ISOCONCENTRATION CONTOURS**
- 3 - 30 µg/L
 - 30 - 300 µg/L
 - 300 - 3,000 µg/L
 - 3,000 - 11,000 µg/L
 - >11,000 µg/L

NOTES:

- ALL ANALYTICAL DATA ARE FROM THE SPRING 2009 SAMPLING EVENT UNLESS OTHERWISE NOTED.
1. ANALYTICAL DATA ARE FROM MAY 2005 SAMPLING EVENT.
 2. ANALYTICAL DATA ARE FROM NOVEMBER 2005 SAMPLING EVENT.
 3. ANALYTICAL DATA ARE FROM THE MARCH 2000 SAMPLING EVENT
- ? - PUNGO RIVER CONFINING UNIT NOT DELINEATED IN THE WESTERN PORTION OF THE SITE.
- CONCENTRATIONS ARE PRESENTED IN THE FOLLOWING ORDER:**
- TRICHLOROETHENE (TCE)
 1,2 - DICHLOROETHENE (1,2 - DCE)
 1,1,1 - TRICHLOROETHANE (1,1,1 - TCA)
 1,1 - DICHLOROETHENE (1,1 - DCE)
 VINYL CHLORIDE
- ALL CONCENTRATIONS ARE IN ug/L
- NA = NOT ANALYZED
 ug/L = MICROGRAMS PER LITER
 NS = NOT SAMPLED
 J = ESTIMATED VALUE
 NC2L FOR TCE = 3 ug/L

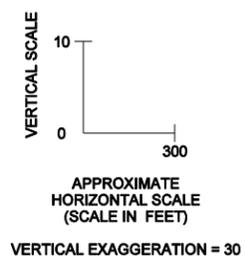


Figure 7
 VOC Isoconcentrations
 Cross Section B-B'
 Marine Corps Air Station Cherry Point
 Cherry Point, NC



- Legend**
- Extraction Well
 - Monitoring Well
 - Groundwater Elevation Contour (ft msl)
 - Surface Water
 - ▭ Operable Unit (OU) Boundary
 - ▭ Existing Buildings
 - ▭ Paved

Notes:
 1. ft msl - feet (relative to) mean sea level
 2. NU - Not used in contouring

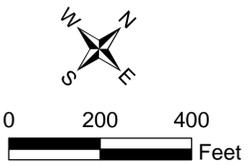


Figure 9
 2009 Groundwater Elevation Map
 Upper Surficial Aquifer
 Marine Corps Air Station Cherry Point
 Cherry Point, North Carolina



- Legend**
- Proposed Monitoring Well - VOCs and Full NAIPs
 - Monitoring Well - VOCs Only
 - Monitoring Well - VOCs and Full NAIPs
 - Monitoring Well - VOCs and Select NAIPs
 - Monitoring Well - Not Included in Sampling Plan
 - Surface Water
 - OU1 Boundary
 - Existing Buildings
 - 3 - 30 µg/L
 - 30 - 300 µg/L
 - 300 - 3,000 µg/L
 - 3,000 - 11,000 µg/L
 - > 11,000 µg/L

Notes:
 NAIPs - Natural Attenuation Indicator Parameters
 NC2L - North Carolina Groundwater Standard
 NC2L = 3 µg/L (Jan 2010)
 NU = Not Used
 Concentrations are from the Spring 2009 sampling event
 µg/L = micrograms per liter
 U - analyte not detected above detection limit
 J - concentration is estimated
 Newly installed wells not sampled in Spring 2009,
 not used for contouring
 *Well not located during 2009 Additional Groundwater Investigation sampling event



Figure 11
 TCE Isoconcentrations and Proposed
 Sampling Locations Map
 Upper Surficial Aquifer
 Marine Corps Air Station Cherry Point
 Cherry Point, North Carolina

IWTW - Industrial Wastewater Treatment Plant



- Legend**
- Proposed Monitoring Well - VOCs and Full NAIPs
 - Proposed Monitoring Well - VOCs
 - Monitoring Well - VOCs Only
 - Monitoring Well - VOCs and Full NAIPs
 - Monitoring Well - VOCs and Select NAIPs
 - Monitoring Well - Not Included in Sampling Plan
 - Surface Water
 - OU1 Boundary
 - Existing Buildings
 - 3 - 30 µg/L
 - 30 - 300 µg/L
 - 300 - 3,000 µg/L

Notes:
 NAIPs - Natural Attenuation Indicator Parameters
 NC2L - North Carolina Groundwater Standard
 NC2L = 3 µg/L (Jan 2010)
 NU = Not Used
 Concentrations are from the Spring 2009 sampling event
 µg/L = micrograms per liter
 U - analyte not detected above detection limit
 J - concentration is estimated
 Newly installed wells not sampled in Spring 2009, not used for contouring

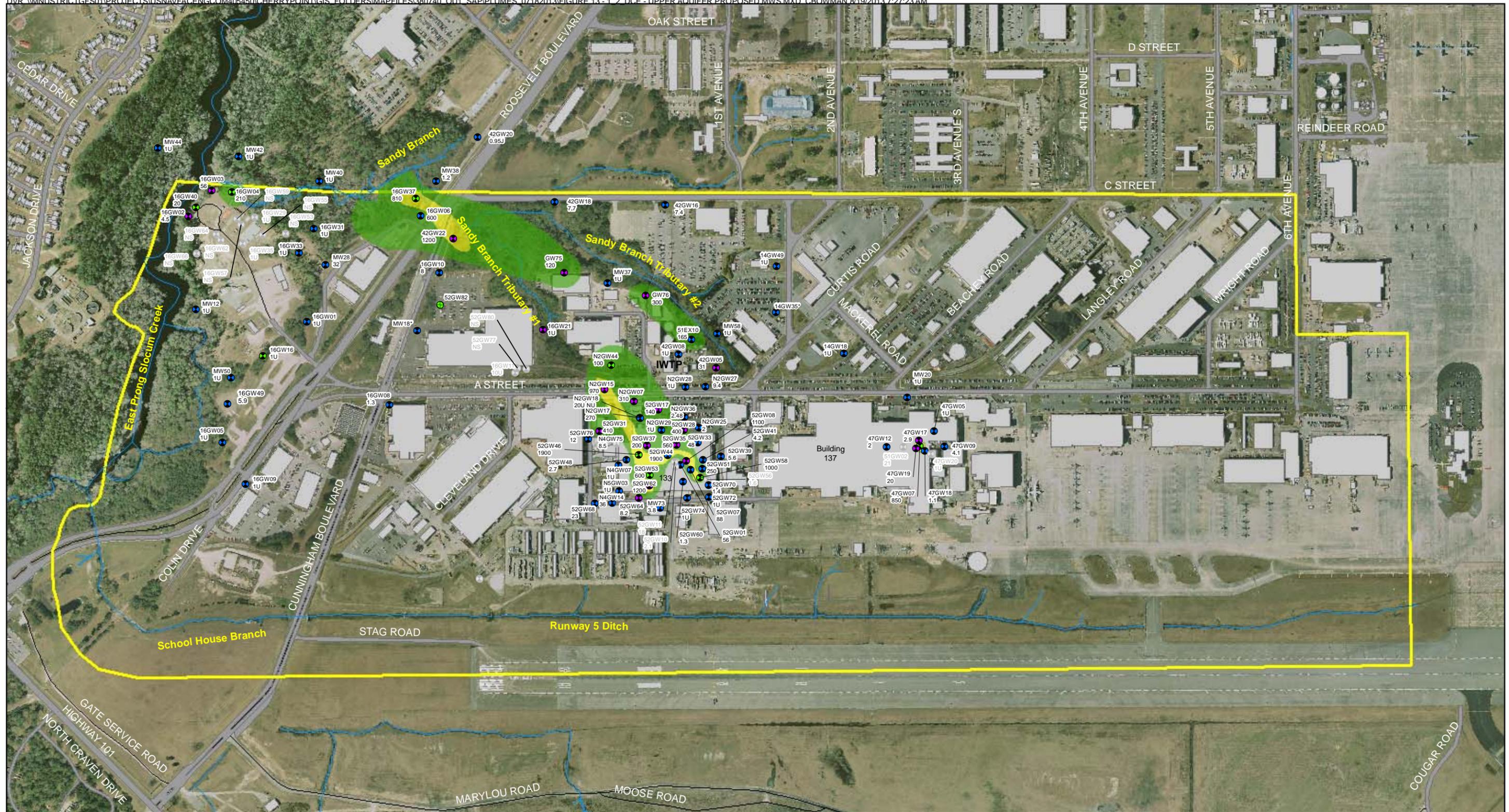
*Well not located during 2009 Additional Groundwater Investigation sampling event
 **To be inspected carefully, observed to be potentially compromised during 2009 Additional Groundwater Investigation sampling event



Figure 12
 TCE Isoconcentrations and Proposed Sampling Locations Map
 Lower Surficial Aquifer
 Marine Corps Air Station Cherry Point
 Cherry Point, North Carolina

IWTP - Industrial Wastewater Treatment Plant





Notes:
 NAIPs - Natural Attenuation Indicator Parameters
 NC2L - North Carolina Groundwater Standard
 NC2L = 70 µg/L (Jan 2010)
 NU = Not Used
 Concentrations are from the Spring 2009 sampling event
 µg/L = micrograms per liter
 U - analyte not detected above detection limit
 J - concentration is estimated
 Newly installed wells not sampled in Spring 2009,
 not used for contouring
 *Well not located during 2009 Additional Groundwater Investigation sampling event

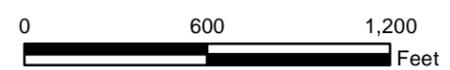


Figure 13
 1,2 DCE Isoconcentrations and Proposed
 Sampling Locations Map
 Upper Surficial Aquifer
 Marine Corps Air Station Cherry Point
 Cherry Point, North Carolina

IWTP - Industrial Wastewater Treatment Plant



- Legend**
- Proposed Monitoring Well - VOCs and Full NAIPs
 - Proposed Monitoring Well - VOCs
 - Monitoring Well - VOCs Only
 - Monitoring Well - VOCs and Full NAIPs
 - Monitoring Well - VOCs and Select NAIPs
 - Monitoring Well - Not Included in Sampling Plan
 - Surface Water
 - OU1 Boundary
 - Existing Buildings
 - 70 - 700 µg/L
 - 700 - 7,000 µg/L

Notes:
 NAIPs - Natural Attenuation Indicator Parameters
 NC2L - North Carolina Groundwater Standard
 NC2L = 70 µg/L (Jan 2010)
 NU = Not Used
 Concentrations are from the Spring 2009 sampling event
 µg/L = micrograms per liter
 U - analyte not detected above detection limit
 J - concentration is estimated
 Newly installed wells not sampled in Spring 2009,
 not used for contouring

*Well not located during 2009 Additional Groundwater Investigation sampling event
 **To be inspected carefully, observed to be potentially compromised during 2009 Additional Groundwater Investigation sampling event



Figure 14
 1,2 DCE Isoconcentrations and Proposed Sampling Locations Map
 Lower Surficial Aquifer
 Marine Corps Air Station Cherry Point
 Cherry Point, North Carolina

IWTP - Industrial Wastewater Treatment Plant



- Legend**
- Proposed Monitoring Well - VOCs and Full NAIPs
 - Monitoring Well - VOCs Only
 - Monitoring Well - VOCs and Full NAIPs
 - Monitoring Well - VOCs and Select NAIPs
 - Monitoring Well - Not Included in Sampling Plan
 - Surface Water
 - OU1 Boundary
 - Existing Buildings
 - 0.03 - 30 µg/L
 - 30 - 300 µg/L
 - 300 - 3,000 µg/L

Notes:
 NAIPs - Natural Attenuation Indicator Parameters
 NC2L - North Carolina Groundwater Standard
 NC2L = 0.03 µg/L (Jan 2010)
 NU = Not Used
 Concentrations are from the Spring 2009 sampling event
 µg/L = micrograms per liter
 U - analyte not detected above detection limit
 J - concentration is estimated
 Newly installed wells not sampled in Spring 2009,
 not used for contouring
 *Well not located during 2009 Additional Groundwater Investigation sampling event

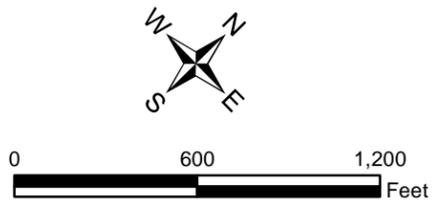


Figure 15
 VC Isoconcentrations and Proposed
 Sampling Locations Map
 Upper Surficial Aquifer
 Marine Corps Air Station Cherry Point
 Cherry Point, North Carolina

IWTP - Industrial Wastewater Treatment Plant



- Legend**
- Proposed Monitoring Well - VOCs and Full NAIPs
 - Proposed Monitoring Well - VOCs
 - Monitoring Well - VOCs Only
 - Monitoring Well - VOCs and Full NAIPs
 - Monitoring Well - VOCs and Select NAIPs
 - Monitoring Well - Not Included in Sampling Plan
 - Surface Water
 - OU1 Boundary
 - Existing Buildings
 - 0.03 - 30 µg/L
 - 30 - 300 µg/L
 - 300 - 3,000 µg/L

Notes:
 NAIPs - Natural Attenuation Indicator Parameters
 NC2L - North Carolina Groundwater Standard
 NC2L = 0.03 µg/L (Jan 2010)
 NU = Not Used
 Concentrations are from the Spring 2009 sampling event
 µg/L = micrograms per liter
 U - analyte not detected above detection limit
 J - concentration is estimated
 Newly installed wells not sampled in Spring 2009, not used for contouring

*Well not located during 2009 Additional Groundwater Investigation sampling event
 **To be inspected carefully, observed to be potentially compromised during 2009 Additional Groundwater Investigation sampling event

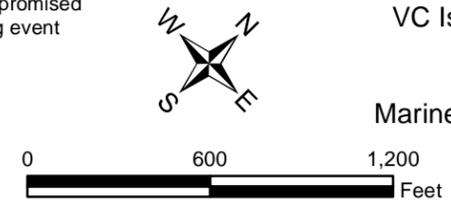


Figure 16
 VC Isoconcentrations and Proposed Sampling Locations Map
 Lower Surficial Aquifer
 Marine Corps Air Station Cherry Point
 Cherry Point, North Carolina

IWTP - Industrial Wastewater Treatment Plant



- Legend**
- Proposed New Well - Upper Aquifer
 - Proposed New Well - Lower Aquifer
 - Surface Water
 - OU1 Boundary
 - Existing Buildings
 - Wetlands
 - Proposed Silt Fence Installation
 - Proposed Pathway for Vegetation Clearance

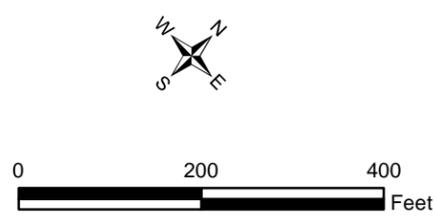


Figure 17
Proposed Sandy Branch Drilling Locations
Marine Corps Air Station Cherry Point
Cherry Point, North Carolina

Appendix A
Field Standard Operating Procedures

Preparing Field Log Books

I. Purpose

This SOP provides general guidelines for entering field data into log books during site investigation and remediation activities.

II. Scope

This is a general description of data requirements and format for field log books. Log books are needed to properly document all field activities in support of data evaluation and possible legal activities.

III. Equipment and Materials

- Log book
- Indelible pen

IV. Procedures and Guidelines

Properly completed field log books are a requirement for much of the work we perform under the Navy CLEAN contract. Log books are legal documents and, as such, must be prepared following specific procedures and must contain required information to ensure their integrity and legitimacy. This SOP describes the basic requirements for field log book entries.

A. PROCEDURES FOR COMPLETING FIELD LOG BOOKS

1. Field notes commonly are kept in bound, hard-cover logbooks used by surveyors and produced, for example, by Peninsular Publishing Company and SESCO, Inc. Pages should be water-resistant and notes should be taken only with water-proof, non-erasable permanent ink, such as that provided in Sanford Sharpie® permanent markers.
2. On the inside cover of the log book the following information should be included:
 - Company name and address
 - Log-holders name if log book was assigned specifically to that person
 - Activity or location

- Project name
 - Project manager's name
 - Phone numbers of the company, supervisors, emergency response, etc.
3. All lines of all pages should be used to prevent later additions of text, which could later be questioned. Any line not used should be marked through with a line and initialed and dated. Any pages not used should be marked through with a line, the author's initials, the date, and the note "Intentionally Left Blank."
 4. If errors are made in the log book, cross a single line through the error and enter the correct information. All corrections shall be initialed and dated by the personnel performing the correction. If possible, all corrections should be made by the individual who made the error.
 5. Daily entries will be made chronologically.
 6. Information will be recorded directly in the field log book during the work activity. Information will not be written on a separate sheet and then later transcribed into the log book.
 7. Each page of the log book will have the date of the work and the note takers initials.
 8. The final page of each day's notes will include the note-takers signature as well as the date.
 9. Only information relevant to the subject project will be added to the log book.
 10. The field notes will be copied and the copies sent to the Project Manager or designee in a timely manner (at least by the end of each week of work being performed).

B. INFORMATION TO BE INCLUDED IN FIELD LOG BOOKS

1. Entries into the log book should be as detailed and descriptive as possible so that a particular situation can be recalled without reliance on the collector's memory. Entries must be legible and complete.
2. General project information will be recorded at the beginning of each field project. This will include the project title, the project number, and project staff.
3. Scope: Describe the general scope of work to be performed each day.
4. Weather: Record the weather conditions and any significant changes in the weather during the day.
5. Tail Gate Safety Meetings: Record time and location of meeting, who was present, topics discussed, issues/problems/concerns identified,

and corrective actions or adjustments made to address concerns/problems, and other pertinent information.

6. Standard Health and Safety Procedures: Record level of personal protection being used (e.g., level D PPE), record air monitoring data on a regular basis and note where data were recording (e.g., reading in borehole, reading in breathing zone, etc). Also record other required health and safety procedures as specified in the project specific health and safety plan.
7. Instrument Calibration; Record calibration information for each piece of health and safety and field equipment.
8. Personnel: Record names of all personnel present during field activities and list their roles and their affiliation. Record when personnel and visitors enter and leave a project site and their level of personal protection.
9. Communications: Record communications with project manager, subcontractors, regulators, facility personnel, and others that impact performance of the project.
10. Time: Keep a running time log explaining field activities as they occur chronologically throughout the day.
11. Deviations from the Work Plan: Record any deviations from the work plan and document why these were required and any communications authorizing these deviations.
12. Health and Safety Incidents: Record any health and safety incidents and immediately report any incidents to the Project Manager.
13. Subcontractor Information: Record name of company, record names and roles of subcontractor personnel, list type of equipment being used and general scope of work. List times of starting and stopping work and quantities of consumable equipment used if it is to be billed to the project.
14. Problems and Corrective Actions: Clearly describe any problems encountered during the field work and the corrective actions taken to address these problems.
15. Technical and Project Information: Describe the details of the work being performed. The technical information recorded will vary significantly between projects. The project work plan will describe the specific activities to be performed and may also list requirements for note taking. Discuss note-taking expectations with the Project Manager prior to beginning the field work.
16. Any conditions that might adversely affect the work or any data obtained (e.g., nearby construction that might have introduced excessive amounts of dust into the air).

17. Sampling Information; Specific information that will be relevant to most sampling jobs includes the following:
- Description of the general sampling area – site name, buildings and streets in the area, etc.
 - Station/Location identifier
 - Description of the sample location – estimate location in comparison to two fixed points – draw a diagram in the field log book indicating sample location relative to these fixed points – include distances in feet.
 - Sample matrix and type
 - Sample date and time
 - Sample identifier
 - Draw a box around the sample ID so that it stands out in the field notes
 - Information on how the sample was collected – distinguish between “grab,” “composite,” and “discrete” samples
 - Number and type of sample containers collected
 - Record of any field measurements taken (i.e. pH, turbidity, dissolved oxygen, and temperature, and conductivity)
 - Parameters to be analyzed for, if appropriate
 - Descriptions of soil samples and drilling cuttings can be entered in depth sequence, along with PID readings and other observations. Include any unusual appearances of the samples.

C. SUGGESTED FORMAT FOR RECORDING FIELD DATA

1. Use the left side border to record times and the remainder of the page to record information (see attached example).
2. Use tables to record sampling information and field data from multiple samples.
3. Sketch sampling locations and other pertinent information.
4. Sketch well construction diagrams.

V. Attachments

Example field notes.

Locating and Clearing Underground Utilities

I. Purpose

The purpose of this SOP is to provide general guidelines and specific procedures that must be followed on Navy CLEAN projects for locating underground utilities and clearing dig locations in order to maximize our ability to avoid hitting underground utilities and to minimize liabilities to CH2M HILL and its subcontractors and health and safety risks to our project staff.

This SOP shall be used by Activity Managers and Project Managers to, in-turn, develop Activity-specific and project-specific utility location procedures. The activity and project-specific procedures will become part of work plans and project instructions and will be used to prepare scopes of work (SOWs) for the procurement of utility location subcontractors to meet the needs of individual projects.

This SOP also identifies the types of utility locating services that are available from subcontractors and the various tools that are used to locate utilities, and discusses when each type of service and tool may or may not be applicable.

II. Scope

Depending on the Navy/Marine Activity we typically find ourselves in one of two scenarios:

Scenario 1

The Activity provides utility locating (or dig clearance) services through the public works department or similar organization, or has a contract with an outside utility clearance service. Some of these services are provided in the form of dig permits which are required before you can dig or drill. In other cases no official permit is required and the process is somewhat vague.

Scenario 2

The Activity does not get involved in any utility locating processes aside from possibly providing the most recent utility maps, and relies on CH2M HILL to clear the dig locations.

Table 1 provides an up to date summary of which scenarios apply to the various primary Activities served under the Navy CLEAN program.

Scenario 1 is preferred because under this scenario the Navy tends to assume the responsibility if the location is improperly cleared, a utility is struck, and property damage results. However, our experience has been that the clearance services provided

by the Navy do not meet the standards that we consider to be adequate, in that they often simply rely on available base maps to mark utilities and do not verify locations using field geophysics. And if they do use locating tools, they do not provide adequate documentation or marking to confirm that a location has been cleared. So while the Navy's process may protect us from liability for property damage, it does not adequately protect our staff and subcontractors from health risks nor does it compensate us for down time, should a utility be hit.

Therefore, regardless of what services the Navy provides, in most cases we still need to supplement this effort with clearance services from our own third party utility location subcontractor following the procedures and guideline outlined in Section IV of this SOP. The cost implications of providing this service will range from \$500 to several \$1,000 depending on the size of the project.

The scope of services that we ask our subcontractors to provide can involve utility marking/mapping or the clearing of individual dig locations. In the former we ask our subs to mark all utilities within a "site" and often ask them to prepare a map based on their work. In the later, we ask them to clear (identify if there are any utilities within) a certain radius of a proposed dig/drill location.

The appropriate requested scope of services for a project will depend on the project. Clearing individual boreholes is often less expensive and allows the sub to concentrate their efforts on a limited area. However if the scope of the investigation is fluid (all borehole locations are not predetermined) it may be best to mark and map an entire site or keep the subcontractor on call.

Clearance of individual dig locations should be done to a minimum 20 foot radius around the location.

An example SOW for a utility subcontractor procurement is provided in Attachment A.

III. Services and Equipment

This section provides a general description of the services available to help us locate subsurface utilities and describes the types of equipment that these services may (or may not) use to perform their work. It identifies the capabilities of each type of equipment to help the PM specify what they should require from our utility location subs.

Services

The services that are available to us for identifying and marking underground utilities are:

- The local public/private utility-run service such as Miss Utility
- Utility location subcontractors (hired by us)

Attachment B provides a detailed description of each type of organization. It also provides contact numbers and web sites for the various Miss-Utility-type organizations in the areas where we do work for the Navy and contacts and services provided by several subcontractors that we have used or spoken to in the past.

Equipment

Attachment C provides a summary of the various types of equipment used for subsurface utility location. It describes the capabilities and limitations of each in order to help the PM determine if the equipment being used by a subcontractor is adequate.

It is important to make the potential subcontractors aware of the possible types of utilities (and utility materials) that are at the site, and to have them explain in their bid what types of equipment they will use to locate utilities / clear dig locations, and what the limitations of these equipment are.

A list of in-house experts that can be used to help you evaluate bids or answer questions you may have is provided in **Appendix C**.

IV. Procedures and Guidelines

This section presents specific procedures to be followed for the utility location work to be conducted by CH2M HILL and our subcontractors. In addition, a PM will have to follow the procedures required by the Activity to obtain their approvals, clearances and dig permits where necessary. These “dig permit” requirements vary by Activity and must be added to the project-specific SOP, or project instructions. It is preferable that the Activity perform their clearance processes before we follow up with our clearance work.

Activity Notification and Dig Permit Procedures

Identify Activity-specific permit and/or procedural requirements for excavation and drilling activities. Contact the Base Civil Engineer and obtain the appropriate form to begin the clearance process.

Activity Specific: To be provided by Activity or Project Manager

CH2M HILL Utility Clearance Procedures

Do not begin subsurface construction activities (e.g., trenching, excavation, drilling, etc.) until a check for underground utilities and similar obstructions has been conducted by CH2M HILL as a follow-up to the services provided by the Navy. The use of as-built drawings and utility company searches must be supplemented with a geophysical or other survey by a qualified, independent survey contractor (subcontracted to CH2M HILL) to identify additional and undiscovered buried utilities.

Examples of the type of geophysical technologies include (these are further described in Attachment C):

- **Ground Penetrating Radar (GPR)**, which can detect pipes, including gas pipes, tanks, conduits, cables etc, both metallic and non-metallic at depths up to 30 feet depending on equipment. Sensitivity for both minimum object size and maximum depth detectable depends on equipment selected, soil conditions, etc.
- **Radio Frequency (RF)**, involves inducing an RF signal in the pipe or cable and using a receiver to trace it. Some electric and telephone lines emit RF naturally and can be

detected without an induced signal. This method requires knowing where the conductive utility can be accessed to induce RF field if necessary.

- **Dual RF**, a modified version of RF detection using multiple frequencies to enhance sensitivity but with similar limitations to RF
- **Ferromagnetic Detectors**, are metal detectors that will detect ferrous and non-ferrous utilities. Sensitivity is limited, e.g. a 100 mm iron disk to a depth of about one meter or a 25 mm steel paper clip to a depth of about 20 cm.
- **Electronic markers**, are emerging technologies that impart a unique electronic signature to materials such as polyethylene pipe to facilitate location and tracing after installation. Promising for future installations but not of help for most existing utilities already in place.

The following procedures shall be used to identify and mark underground utilities during subsurface construction activities on the project:

- Contact utility companies or the state/regional utility protection service (such as Miss Utility) at least two (2) working days prior to intrusive activities to advise of the proposed work, and ask them to establish the location of the utility underground installations prior to the start of actual excavation: this is a law. These services will only mark the location of public-utility-owned lines and not Navy-owned utilities. In many cases there will not be any public-utility-owned lines on the Activity. There may also be Base-access issues to overcome.
- Procure and schedule the independent survey.
- The survey contractor shall determine the most appropriate geophysical technique or combinations of techniques to identify the buried utilities on the project site, based on the survey contractor's experience and expertise, types of utilities anticipated to be present and specific site conditions. *The types of utilities must be provided to the bidding subcontractors in the SOW and procedures to be used must be specified by the bidder in their bid. It is extremely helpful to provide the sub with utility maps, with the caveat that all utilities are not necessarily depicted.*
- The survey subcontractor shall employ the same geophysical techniques used to identify the buried utilities, to survey the proposed path of subsurface investigation/construction work to confirm no buried utilities are present.
- Obtain utility clearances for subsurface work on both public and private property.
- Clearances provided by both the "Miss Utility" service and the CH2M HILL-subcontracted service are to be in writing, signed by the party conducting the clearance. The Miss Utility service will have standard notification forms/letters which typically simply state that they have been to the site and have done their work. The CH2M HILL subcontractor shall be required to fill out the form provided in Attachment D (this can be modified for a particular project) indicating that each dig/drill location has been addressed. *This documentation requirement (with a copy of the form) needs to be provided in the subcontractor SOW.*

- Marking shall be done using the color coding presented in Attachment E. The type of material used for marking must be approved by the Activity prior to marking. Some base commanders have particular issues with persistent spray paint on their sidewalks and streets. *Any particular marking requirements need to be provided in the subcontractor SOW.*
- Protect and preserve the markings of approximate locations of facilities until the markings are no longer required for safe and proper excavations. If the markings of utility locations are destroyed or removed before excavation commences or is completed, the Project Manager must notify the utility company or utility protection service to inform them that the markings have been destroyed.
- Perform a field check prior to drilling/digging (preferably while the utility location sub is still at the site) to see if field utility markings coincide with locations on utility maps. Look for fire hydrants, valves, manholes, light poles, lighted signs, etc to see if they coincide with utilities identified by the subcontractor.
- Underground utility locations must be physically verified (or dig locations must be physically cleared) by hand digging using wood or fiberglass-handled tools, air knifing, or by some other acceptable means approved by CH2M HILL, when the dig location (e.g. mechanical drilling, excavating) is expected to be within 5 feet of a marked underground system. Hand clearance shall be done to a depth of four feet unless a utility cross-section is available that indicates the utility is at a greater depth. In that event, the hand clearance shall proceed until the documented depth of the utility is reached.
- Conduct a site briefing for employees at the start of the intrusive work regarding the hazards associated with working near the utilities and the means by which the operation will maintain a safe working environment. Detail the method used to isolate the utility and the hazards presented by breaching the isolation.
- Monitor for signs of utilities during advancement of intrusive work (e.g., sudden change in advancement of auger or split spoon during drilling or change in color, texture or density during excavation that could indicate the ground has been previously disturbed).

IV. Attachments

- A- Example SOW for Utility Location Subcontractor Procurement
- B - Services Available for Identifying and Marking Underground Utilities
- C - Equipment Used for Identifying Underground Utilities
- D - Utility Clearance Documentation Form
- E - Utility Marking Color Codes

Attachment A – Example SOW for Subcontracting Underground Utilities Locating Services

CTO-XXX

Scope of Work

Subsurface Utility Locating

Site XX

Navy Activity

City, State

A licensed and insured utility locator will be subcontracted to identify and mark out subsurface utilities for an environmental investigation/remediation project at Site XX of <<insert name of base, city, and state>>. The subcontractor will need to be available beginning at <<insert time>> on <<insert date>>. It is estimated that the work can be completed within XX days.

Proposed Scope of Work

The subcontractor will identify and mark all subsurface utilities (CHOOSE 1) that lie within a radius of 20 feet of each of XX sampling locations at Site XX shown on the attached Figure 1; (OR) that lie within the bounds of Site XX as delineated on the attached Figure 1. (If multiple sites are to be cleared, provide maps of each site with sample locations or clearance boundaries clearly delineated and a scale provided.)

Utilities will be identified using all reasonably available as-built drawings, electronic locating devices, and any other means necessary to maintain the safety of drilling and sampling personnel and the protection of the base infrastructure. The location of utilities identified from as-built drawings or other maps must be verified in the field prior to marking.

Base utility drawings for the Site(s) (CHOOSE 1) can be found at <<insert specific department and address or phone number on the base>> and should be reviewed by the subcontractor and referenced as part of the utility locating. (OR), will be provided to the subcontractor by CH2M HILL upon the award of the subcontract. (OR), are not available. Utility drawings shall not be considered definitive and must be field verified.

Field verification will include detection using nonintrusive subsurface detection equipment (magnetometers, GPR, etc) as well as opening manhole covers to verify pipe directions. As part of the bid, the Subcontractor shall provide a list of the various subsurface investigation tools they propose to have available and use at the site and what the limitations are of each tool.

A CH2M HILL representative shall be present to coordinate utility clearance activities and identify points and features to be cleared.

Field Marking and Documentation

All utilities located within **(CHOOSE 1) a 20-ft radius of the XX proposed soil boring locations (OR) within the boundary of the site(s)** as identified on the attached figure(s) will be marked using **paint (some Bases such as the WNY may have restrictions on the use of permanent paint)** and/or pin flags color coded to indicate electricity, gas, water, steam, telephone, TV cable, fiber optic, sewer, etc. The color coding shall match the industry standard as described on the attached form. In addition, the **Buried Utility Location Tracking Form** (attached) will be completed by the Subcontractor based upon what is identified in the field during the utility locating and submitted back to CH2M HILL (field staff or project manager) within 24 hours of completing the utility locating activities.

(OPTIONAL) The subcontractor shall also provide a map (or hand sketch) of the identified utilities to the Engineer within XX days of field demobilization. The map shall include coordinates or ties from fixed surface features to each identified subsurface utility.

Bid Sheet/Payment Units

The subcontractor will bid on a time and materials basis for time spent on site and researching utility maps. Mobilization (including daily travel to the site) should be bid as a lump sum, as well as the preparation of the AHA **and any required mapping**. The per diem line item should be used if the field crew will require overnight accommodations at the project site.

Health and Safety Requirements

The utility locating subcontractor is to provide and assume responsibility for an adequate corporate Health and Safety Plan for onsite personnel. Standard personal safety equipment including: hard hat, safety glasses, steel-toed boots, gloves are recommended for all project activities. Specific health and safety requirements will be established by the Subcontractor for each project. The health and safety requirements will be subject to the review of CH2M HILL.

The subcontractor shall also prepare and provide to the Engineer, at least 48 hours prior to mobilization, an acceptable Activity Hazard Analysis (AHA) using the attached AHA form or similar.

It is also required that all subcontractor personnel who will be on site attend the daily 15-minute health and safety tailgate meeting at the start of each day in the field.

Subcontractor personnel showing indications of being under the influence of alcohol or illegal drugs will be sent off the job site and their employers will be notified. Subcontractor personnel under the influence of prescription or over-the-counter medication that may impair their ability to operate equipment will not be permitted to do so. It is expected that the subcontractor will assign them other work and provide a capable replacement (if necessary) to operate the equipment to continue work.

Security

The work will be performed on US Navy property. CH2M HILL will identify the Subcontractor personnel who will perform the work to the appropriate Navy facility point-of-contact, and will identify the Navy point-of-contact to the Subcontractor crew. The Subcontractor bears final responsibility for coordinating access of his personnel onto Navy property to perform required work. This responsibility includes arranging logistics and providing to CH2M HILL, in advance or at time of entry as specified, any required identification information for the Subcontractor personnel. Specifically, the following information should be submitted with the bid package for all personnel that will perform the work in question (this information is required to obtain a base pass):

- Name
- Birth Place
- Birth Date
- Social Security Number
- Drivers License State and Number
- Citizenship

Please be advised that no weapons, alcohol, or drugs will be permitted on the Navy facility at any time. If any such items are found, they will be confiscated, and the Subcontractor will be dismissed.

Quality Assurance

The Subcontractor will be licensed and insured to operate in the State of <<state>> and will comply with all applicable federal, state, county and local laws and regulations. The subcontractor will maintain, calibrate, and operate all electronic locating instruments in accordance with the manufacturer's recommendations. Additionally, the Subcontractor shall make all reasonable efforts to review as-built engineering drawings maintained by Base personnel, and shall notify the CH2M HILL Project Manager in writing (email is acceptable) whenever such documentation was not available or could not be reviewed.

Subcontractor Standby Time

At certain periods during the utility locating activities, the Subcontractor's personnel may be asked to stop work and standby when work may normally occur. During such times, the Subcontractor will cease activities until directed by the CH2M HILL representative to resume operations. Subcontractor standby time also will include potential delays caused by the CH2M HILL representative not arriving at the site by the agreed-upon meeting time for start of the work day. Standby will be paid to the

Subcontractor at the hourly rate specified in the Subcontractor's Bid Form attached to these specifications.

Cumulative Subcontractor standby will be accrued in increments no shorter than 15 minutes (i.e., an individual standby episode of less than 15 minutes is not chargeable).

During periods for which standby time is paid, the surveying equipment will not be demobilized and the team will remain at the site. At the conclusion of each day, the daily logs for the Subcontractor and CH2M HILL representative will indicate the amount of standby time incurred by the Subcontractor, if any. Payment will be made only for standby time recorded on CH2M HILL's daily logs.

Down Time

Should equipment furnished by the Subcontractor malfunction, preventing the effective and efficient prosecution of the work, or inclement weather conditions prevent safe and effective work from occurring, down time will be indicated in the Subcontractor's and CH2M Hill representative's daily logs. No payment will be made for down time.

Schedule

It is anticipated that the subsurface utility locating activities will occur on <<insert date>>. It is estimated that the above scope will be completed within XXX days.

Attachment B - Services Available for Identifying and Marking Underground Utilities

The services that are available to us for identifying and marking underground utilities are:

- The Activity's PWC (or similar organization)
- The local public/private utility -run service such as Miss Utility
- Utility location subcontractors (hired by CH2M HILL)

Each are discussed below.

Navy Public Works Department

A Public Works Department (PWD) is usually present at each Activity. The PWD is responsible for maintaining the public works at the base including management of utilities. In many cases, the PWD has a written permit process in place to identify and mark-out the locations of Navy-owned utilities [Note: The PWD is usually NOT responsible for the locations/mark-outs of non-Navy owned, public utilities (e.g., Washington Gas, Virginia Power, municipal water and sewer, etc.). Therefore, it is likely that we will have to contact other organizations besides the PWD in order to identify non-Navy owned, public utilities].

At some Activities, there may not be a PWD, the PWD may not have a written permit process in place, or the PWD may not take responsibility for utility locating and mark-outs. In these cases, the PWD should still be contacted since it is likely that they will have the best understanding of the utility locations at the Activity (i.e., engineering drawings, institutional knowledge, etc.). Subsequently, the PWD should be brought into a cooperative arrangement (if possible) with the other services employed in utility locating and mark-out in order to have the most comprehensive assessment performed.

At all Activities we should have a contact (name and phone number), and preferably an established relationship, with PWD, either directly or through the NAVFAC Atlantic, Midlant, or Washington NTR or Activity Environmental Office that we can work with and contact in the event of problems.

Miss Utility or "One Call" Services for Public Utility Mark-outs

Miss Utility or "One Call" service centers are information exchange centers for excavators, contractors and property owners planning any kind of excavation or digging. The "One Call" center notifies participating public utilities of the upcoming excavation work so they can locate and mark their underground utilities in advance to prevent possible damage to underground utility lines, injury, property damage and service outages. In some instances, such with southeastern Virginia bases, the Navy has entered into agreement with Ms. Utilities and is part of the response process for Miss

Utilities. Generally, a minimum of 48 hours is required for the public utility mark-outs to be performed. The "One Call" services are free to the public. Note that the "One Call" centers only coordinate with participating public utilities. There may be some public utilities that do NOT participate in the "One Call" center which may need to be contacted separately. For example, in Washington, DC, the Miss Utility "One Call" center does not locate and mark public sewer and water lines. Therefore, the municipal water and sewer authority must be contacted separately to have the sewer and water lines marked out. The AM should contact the appropriate one-call center to determine their scope of services.

For the Mid-Atlantic region, the following "One Call" service centers are available.

Name	Phone	Website	Comments
Miss Utility of DELMARVA	800-257-7777	www.missutility.net	Public utility mark-outs in Delaware, Maryland, Washington, DC, and Northern Virginia
Miss Utility of Southern Virginia (One Call)	800-552-7001	not available	Public utility mark-outs in Southern Virginia
Miss Utility of Virginia	800-257-7777 800-552-7007	www.missutilityofvirginia.com	General information on public utility mark-outs in Virginia, with links to Miss Utility of DELMARVA and Miss Utility of Southern Virginia (One Call)
Miss Utility of West Virginia, Inc	800-245-4848	none	Call to determine what utilities they work with in West Virginia
North Carolina One Call Center	800-632-4949	www.ncocc.org/ncocc/default.htm	Public Utility Markouts in North Carolina

Private Subcontractors

- Utility-locating support is required at some level for most all CH2M HILL field projects in "clearing" proposed subsurface boring locations on the project site. Utility location and sample clearance can include a comprehensive effort of GIS map interpretation, professional land surveying, field locating, and geophysical surveying. Since we can usually provide our own GIS-related services for projects and our professional land surveying services are normally procured separately, utility-locating subcontractors will normally only be required for some level of geophysical surveying support in the field. This level of geophysical surveying support can range widely from a simple electromagnetic (EM) survey over a known utility line, to a blind geophysical effort, including a ground-penetrating radar (GPR) survey and/or a comprehensive EM survey to delineate and characterize all unknown subsurface anomalies.

The level of service required from the subcontractor will vary depending on the nature of the site. At sites where utility locations are well defined on the maps and recent construction is limited, CH2M HILL may be confident with a limited effort from a traditional utility-locating subcontractor providing a simple EM survey. At

sites where utility locations are not well defined, where recent constructions may have altered utility locations, or the nature of the site makes utility location difficult, CH2M HILL will require the services of a comprehensive geophysical surveying subcontractor, with a wide range of GPR and EM services available for use on an "as-needed" basis. Typical costs for geophysical surveying subcontractors will range from approximately \$200 per day for a simple EM effort (usually one crew member and one instrument) to approximately \$1,500 per day for a comprehensive geophysical surveying effort (usually a two-person crew and multiple instruments). Comprehensive geophysical surveying efforts may also include field data interpretation (and subsequent report preparation) and non-destructive excavation to field-verify utility depths and locations.

The following table provides a list of recommended geophysical surveying support subcontractors that can be used for utility-locating services:

Company Name and Address	Contact Name and Phone Number	Equipment ¹					Other Services ²		
		1	2	3	4	5	A	B	C
US Radar, Inc.* PO Box 319 Matawan, NJ 07747	Ron LaBarca 732-566-2035			4					
Utilities Search, Inc.*	Jim Davis 703-369-5758	4				4	4	4	4
So Deep, Inc.* 8397 Euclid Avenue Manassas Park, VA 20111	703-361-6005	4					4	4	4
Accurate Locating, Inc. 1327 Ashton Rd., Suite 101 Hanover, MD 21076	Ken Shipley 410-850-0280	4	4						
NAEVA Geophysics, Inc. P.O. Box 7325 Charlottesville, VA 22906	Alan Mazurowski 434-978-3187	4	4	4	4	4	4	4	4
Earth Resources Technology, Inc. 8106 Stayton Rd. Jessup, MD 20794	Peter Li 240-554-0161	4	4	4	4	4	4	4	
Geophex, Ltd 605 Mercury Street Raleigh, NC 27603	I. J. Won 919-839-8515	4	4	4	4	4	4	4	4

Notes:

*Companies denoted with an asterisk have demonstrated reluctance to assume responsibility for damage to underground utilities or an inability to accommodate the insurance requirements that CH2M HILL requests for this type of work at many Navy sites.

¹Equipment types are:

1. Simple electromagnetic instruments, usually hand-held
2. Other, more innovative, electromagnetic instruments, including larger instruments for more area coverage
3. Ground-penetrating radar systems of all kinds
4. Audio-frequency detectors of all kinds
5. Radio-frequency detectors of all kinds

²Other services include:

- A. Data interpretation and/or report preparation to provide a permanent record of the geophysical survey results and a professional interpretation of the findings, including expected accuracy and precision.
- B. Non-destructive excavation to field-verify the depths, locations, and types of subsurface utilities.
- C. Concrete/asphalt coring and pavement/surface restoration.

Attachment C – Equipment Used for Identifying Underground Utilities

This attachment provides a summary of the various types of equipment used for subsurface utility location. It describes the capabilities and limitations of each in order to help the AM and PM determine if the equipment being proposed by a subcontractor or Navy is adequate. A list of in-house experts that can be used to answer questions you may have is provided below.

CH2M HILL In-house Utility Location Experts

Tamir Klaff/WDC

Home Office Phone – 703-669-9611

Electromagnetic Induction (EMI) Methods

EMI instruments, in general, induce an electromagnetic field into the ground (the primary field) and then record the response (the secondary field), if any. Lateral changes in subsurface conductivity, such as caused by the presence of buried metal or by significant soil variations, cause changes in the secondary field recorded by the instrument and thus enable detection and mapping of the subsurface features. It should be noted that EMI only works for electrically conductive materials--plastic or PVC pipes are generally not detected with EMI. Water and gas lines are commonly plastic, although most new lines include a copper "locator" strip on the top of the PVC to allow for detection with EMI.

EMI technology encompasses a wide range of instruments, each with inherent strengths and weaknesses for particular applications. One major division of EMI is between "time-domain" and "frequency-domain" instruments that differ in the aspect of the secondary field they detect. Another difference in EMI instruments is the operating frequency they use to transmit the primary field. Audio- and radio-frequencies are often used for utility detection, although other frequencies are also used. Consideration of the type of utility expected, surface features that could interfere with detection, and the "congestion" of utilities in an area, should be made when choosing a particular EMI instrument for a particular site.

One common EMI tool used for utility location is a handheld unit that can be used to quickly scan an area for utilities and allows for marking locations in "real time". This method is most commonly used by "dig-safe" contractors marking out known utilities prior to excavation. It should be noted that this method works best when a signal (the primary field) can be placed directly onto the line (i.e., by clamping or otherwise connecting to the end of the line visible at the surface, or for larger utilities such as sewers, by running a transmitter through the utility). These types of tools also have a limited capability to scan an area for unknown utilities. Usually this requires having enough area to separate a hand held transmitter at least a hundred feet from the

receiver. Whether hunting for unknown, or confirming known, utilities, this method will only detect continuous lengths of metallic conductors.

In addition to the handheld EMI units, larger, more powerful EMI tools are available that provide more comprehensive detection and mapping of subsurface features. Generally, data with these methods are collected on a regular grid in the investigation area, and are then analyzed to locate linear anomalies that can be interpreted as utilities. These methods will usually detect *all* subsurface metal (above a minimum size), including pieces of abandoned utilities. In addition, in some situations, backfill can be detected against native soils giving information on trenching and possible utility location. Drawbacks to these methods are that the secondary signals from utilities are often swamped (i.e., undetectable) close to buildings and other cultural features, and that the subsurface at heavily built-up sites may be too complicated to confidently interpret completely.

Hand-held metal detectors (treasure-finders) are usually based on EMI technology. They can be used to locate shallow buried metal associated with utilities (e.g., junctions, manholes, metallic locators). Advantages of these tools is the ease of use and real-time marking of anomalies. Drawbacks include limited depths of investigations and no data storage capacity.

Ground Penetrating Radar (GPR)

GPR systems transmit radio and microwave frequency (e.g., 80 megaHertz to 1,000 megaHertz) waves into the ground and then record reflections of those waves coming back to the surface. Reflections of the radar waves typically occur at lithologic changes, subsurface discontinuities, and subsurface structures. Plastic and PVC pipes can sometimes be detected in GPR data, especially if they are shallow, large, and full of a contrasting material such as air in a wet soil, or water in a dry soil. GPR data are usually collected in regular patterns over an area and then analyzed for linear anomalies that can be interpreted as utilities. GPR is usually very accurate in x-y location of utilities, and can be calibrated at a site to give very accurate depth information as well. A significant drawback to GPR is that depth of investigation is highly dependant on background soil conductivity, and it will not work on all sites. It is not uncommon to get only 1-2 feet of penetration with the signal in damp, clayey environments. Another drawback to GPR is that sites containing significant fill material (e.g., concrete rubble, scrap metal, garbage) will result in complicated anomalies that are difficult or impossible to interpret.

Magnetic Field Methods

Magnetic field methods rely on detecting changes to the earth's magnetic field caused by ferrous metal objects. This method is usually more sensitive to magnetic metal (i.e., deeper detection) than EMI methods. A drawback to this method is it is more susceptible to being swamped by surface features such as fences and cars. In addition, procedures must usually be implemented that account for natural variations in the earth's background field as it changes throughout the day. One common use of the method is to measure and analyze the gradient of the magnetic field, which eliminates most of the drawbacks to the method. It should be noted this method only detects

ferrous metal, primarily iron and steel for utility location applications. Some utility detector combine magnetic and EMI methods into a single hand-held unit.

Optical Methods

Down the hole cameras may be useful in visually reviewing a pipe for empty conduits and/or vaults.

Attachment D – Utility Clearance Documentation Form

Attachment E – Utility Marking Color Codes

The following is the standard color code used by industry to mark various types of utilities and other features at a construction site.

White – Proposed excavations and borings

Pink – Temporary survey markings

Red – Electrical power lines, cables, conduits and lighting cables

Yellow – Gas, oil, steam, petroleum or gaseous materials

Orange – Communication, alarm or signal lines, cables, or conduits

Blue – Potable water

Purple – Reclaimed water, irrigation and slurry lines

Green – Sewer and storm drain lines

PMS 219

PMS 1795*

PMS 108

PMS 144*

13.5 parts process
2.5 parts reflex

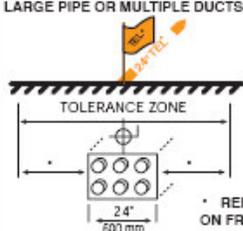
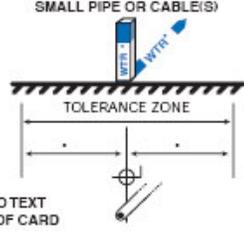
PMS 253

PMS 3415

ADWA **UNIFORM COLOR CODE**

	WHITE - Proposed Excavation
	PINK - Temporary Survey Markings
	RED - Electric Power Lines, Cables, Conduit and Lighting Cables
	YELLOW - Gas, Oil, Steam, Petroleum or Gaseous Materials
	ORANGE - Communication, Alarm or Signal Lines, Cables or Conduit
	BLUE - Potable Water
	PURPLE - Reclaimed Water, Irrigation and Slurry Lines
	GREEN - Sewers and Drain Lines

TYPICAL MARKING

LARGE PIPE OR MULTIPLE DUCTS	SMALL PIPE OR CABLE(S)
	
* REFER TO TEXT ON FRONT OF CARD	

Customize with your center's phone and address information

GUIDELINES FOR UNIFORM TEMPORARY MARKING OF UNDERGROUND FACILITIES

This marking guide provides for universal use and understanding of the temporary marking of subsurface facilities to prevent accidents and damage or service interruption by contractors, excavators, utility companies, municipalities or any others working on or near underground facilities.

ONE-CALL SYSTEMS

The One-Call damage prevention system shall be contacted prior to excavation.

PROPOSED EXCAVATION

Use white marks to show the location, route or boundary of proposed excavation. Surface marks on roadways do not exceed 1.5" by 18" (40 mm by 450 mm). The facility color and facility owner identity may be added to white flags or stakes.

USE OF TEMPORARY MARKING

Use color-coded surface marks (i.e., paint or chalk) to indicate the location or route of active and out-of-service buried lines. To increase visibility, color coded vertical markers (i.e., stakes or flags) should supplement surface marks. Marks and markers indicate the name, initials or logo of the company that owns or operates the line, and width of the facility if it is greater than 2" (50 mm). Marks placed by other than line owner/operator or its agent indicate the identity of the designating firm. Multiple lines in joint trench are marked in tandem. If the surface over the buried line is to be removed, supplementary offset markings are used. Offset markings are on a uniform alignment and clearly indicate the actual facility is a specific distance away.

TOLERANCE ZONE

Any excavation within the tolerance zone is performed with non-powered hand tools or non-invasive method until the marked facility is exposed. The width of the tolerance zone may be specified in law or code. If not, a tolerance zone including the width of the facility plus 18" (450 mm) measured horizontally from each side of the facility is recommended.

ADOPT UNIFORM COLOR CODE

The American Public Works Association encourages public agencies, utilities, contractors, other associations, manufacturers and all others involved in excavation to adopt the APWA Uniform Color Code, using ANSI standard Z535.1 Safety Colors for temporary marking and facility identification.

Rev. 4/09

General Guidance for Monitoring Well Installation

I. Purpose

To provide site personnel with a review of the well installation procedures that will be performed. These procedures are to be considered general guidelines only and are in no way intended to supplement or replace the contractual specifications in the driller's subcontract.

II. Scope

Monitoring well installations are planned for shallow and/or deep unconsolidated aquifers and/or for bedrock aquifers. The SOPs *Installation of Shallow Monitoring Wells*, *Installation of Surface-Cased Monitoring Wells*, *Installation of Bedrock Monitoring Wells*, and *Installation of Monitoring Wells Using Sonic Drilling* provide more specifics.

III. Equipment and Materials

1. Drilling rig (hollow stem auger, sonic, air hammer, air rotary, or mud rotary)
2. Well-construction materials (i.e., surface casing, screens, riser, casing, caps, bottom plugs, centering guides, sand, bentonite, grout, and surface-finish materials)
3. Development equipment

IV. Procedures and Guidelines

1. Wells will be installed in accordance with standard EPA procedures. Note that USEPA Region III requires any well penetrating a confining layer to be double-cased.
2. The threaded connections will be water-tight.
3. Well screens generally will be constructed of 10-slot or 20-slot Schedule 40 PVC and will be 5 to 10 feet in length depending on saturated thickness of unconsolidated sediments. The exact slot size and length will be determined by the field team supervisor. Stainless steel may be required under certain contaminant conditions.
4. Stick-up wells will be surrounded by four concrete-filled guard posts at least 2 inches in diameter.

5. A record of the finished well construction will be compiled.
6. All soils and liquids generated during well installations will be drummed for proper disposal.

Monitoring Well Installation

- 2" monitoring wells in unconsolidated materials will be installed in at least 6-inch-diameter boreholes to accommodate well completion materials in designated locations.
- All monitoring wells penetrating a confining layer will be surface-cased from the ground surface to approximately 5 feet into the confining layer. Exceptions to this may be allowed under certain circumstances (e.g., evidence of significant natural gaps in the confining layer).
- Monitoring wells in unconsolidated materials will be constructed of 2-inch-diameter, factory manufactured, flush-jointed, Schedule 40 PVC (or stainless steel) screen with threaded bottom plug and riser.
- Screens will be filter packed with a properly sized and graded, thoroughly washed, sound, durable, well-rounded basalt or siliceous sand. When using hollow-stem augers, the filter pack will be installed by slowly pouring the sand into the annular space while simultaneously raising the augers and using a weighted tape to sound for the sand surface. For rotary-drilled wells, the height of the sand pack also will be sounded with a weighted tape.
- The primary filter sand pack (typically Morie #00 or DSI #1 for a 10-slot screen) will extend from 1 to 2 feet below the base to 2 feet above the top of the screen; filter pack will be allowed to settle before final measurement is taken. For wells deeper than 30 feet, the filter pack will be placed using a tremie pipe and flowing water.
- A secondary filter sand pack (typically a fine sand seal) 1-foot thick may be placed above the primary sand pack.
- Annular well seals will consist of 2 feet of pelletized, chip, or granular bentonite clay placed above the filter pack. If necessary the pellets will be hydrated using potable water. For wells installed using hollow-stem augers, the bentonite will be poured into the annular space while slowly raising the augers and sounding for the top of the bentonite with a weighted tape. A high-solids bentonite slurry using powdered bentonite introduced with a side-discharging tremie pipe will be used for the bentonite seals in wells greater than 30 feet deep. For rotary-drilled wells, the height of the well seal also will be sounded with a weighted tape. High-solids slurries will have solids content of at least 20 percent.
- The top of the annular seal will be measured after the bentonite seal has been allowed to hydrate and before the grout is applied. The seal will be allowed to hydrate for at least 30 minutes before work in the well continues.

- The annular space above the bentonite seal will be filled to grade with a bentonite-cement slurry grout mixture.
- The grout mixture consists of 6 to 8 gallons of water per 94-pound bag of Portland cement; 3 to 6 pounds of bentonite added per bag of cement to reduce shrinkage.
- The grout mix will be carefully applied to avoid disturbing the bentonite seal; the method of grout placement must force grout from the top of the bentonite seal to ground surface.
- After allowing the grout to settle and set up overnight, additional grout will be added to maintain grade.
- A protective steel casing equipped with keyed alike locking caps will be grouted in place for each new well; the casing will extend at least 2 feet above grade and 3 feet below grade, and will be painted a bright color.

Well Development

- New monitoring wells will be developed after the well has been completely installed and the grout has hardened (at least 24 hours)
- The well will be developed by surging and pumping.
- Equipment placed in the well will be decontaminated before use.
- If information is available, begin developing in the least-contaminated well first.
- Development will include surging the well by either abruptly stopping flow and allowing water in the well column to fall back into the well or through the use of a surge block that is slightly smaller in diameter than the well casing inner diameter.
- Pipes and pumps must not be fitted with foot valves or other devices that might inhibit the return flow of water to the well.
- Surging should continue throughout the development process.
- The air-lift method may be used to pump materials out of the well. The air compressor will be fitted with filters to remove all oil and the air lift hose used will be made of inert materials.
- Well development will continue until the water produced is free of turbidity, sand, and silt. A Horiba-U22 meter, YSI meter with separate Hanna turbidity meter, or equivalent should be used to determine when the turbidity is low and parameters have stabilized.
- Development water will be considered hazardous and placed in sealed 55-gallon U.S. DOT approved steel drums. CH2M HILL will label and date the drums as pending analysis, and transport the drums to a designated site for storage.

V. Attachments

None.

VI. Key Check and Items

- Ensure that all equipment is properly decontaminated as needed.
- Only new, sealed materials (e.g., screens, risers, and sand) will be used in constructing the well.
- Care shall be taken when making downhole measurements to ensure that proper heights of sand, seal, and grout are achieved.

Low-Flow Groundwater Sampling from Monitoring Wells – EPA Region IV

I. Purpose and Scope

This SOP presents general guidelines for the collection of groundwater samples from monitoring wells using low-flow purging and sampling procedures. Operations manuals should be consulted for specific calibration and operating procedures.

II. Equipment and Materials

- Adjustable-rate positive-displacement pump, submersible pump, or peristaltic pump
- Horiba® U-22 or equivalent water quality meters to monitor pH, specific conductance, turbidity, dissolved oxygen, oxidation-reduction potential (ORP), and temperature
- Flow-through cell with inlet/outlet ports for purged groundwater and watertight ports for each probe
- Generator or alternate power source depending on pump type
- Water-level indicator
- Disposable Teflon, Teflon-lined polyethylene tubing or polyethylene tubing for metals and other inorganics
- Plastic sheeting
- Well-construction information
- Calibrated container and stopwatch to determine flow rate
- Sample containers
- In-line disposable 0.45µm filters (QED® FF8100 or equivalent)
- Shipping supplies (labels, coolers, and ice)
- Field book

III. Procedures and Guidelines

A. Setup and Purging

1. Obtain information on well location, diameter(s), depth, and screen interval(s), and the method for disposal of purged water.
2. Calibrate instruments according to manufacturer's instructions.
3. The well number, site, date, and condition are recorded in the field logbook.

4. Plastic sheeting is placed on the ground, and the well is unlocked and opened. All decontaminated equipment to be used in sampling will be placed only on the plastic sheeting until after the sampling has been completed. To avoid cross-contamination, do not let any downhole equipment touch the ground.
5. All sampling equipment and any other equipment to be placed in the well is cleaned and decontaminated before sampling in accordance with SOP *Decontamination of Personnel and Equipment*.
6. Water level measurements are collected in accordance with the *Water Level Measurements SOP*. **Do not measure the depth to the bottom of the well at this time**; this reduces the possibility that any accumulated sediment in the well will be disturbed. Obtain depth to bottom information from well construction log.
7. Attach and secure the tubing to the low-flow pump. Lower the pump slowly into the well and set it at approximately the middle of the screen. Place the pump intake in the middle of the saturated screen length and should be at least two feet above the bottom of the well to avoid mobilization of any sediment present in the bottom.
8. Insert the measurement probes into the flow-through cell. The purged groundwater is directed through the cell, allowing measurements to be collected before the water contacts the atmosphere.
9. If using a generator, locate it 30 feet downwind from the well to avoid exhaust fumes contaminating the samples.
10. Start purging the well at 0.2 to 0.5 liters per minute. Avoid surging. Purging rates for more transmissive formations could be started at 0.5-liter to 1 liter per minute. The initial field parameters of pH, specific conductance, dissolved oxygen, ORP, turbidity, and temperature of water are measured and recorded in the field logbook.
11. The water level should be monitored during purging, and, ideally, the purge rate should equal the well recharge rate so that there is little or no drawdown in the well (i.e., less than 0.3-foot). The water level should stabilize for the specific purge rate. Record adjustments in the purge rate and changes in depth to water in the logbook. Purge rates should, if needed, be decreased to the minimum capabilities of the pump (0.1- to 0.2-liter per minute) to avoid affecting well drawdown. If the water level is drawn down by more than 0.3 feet, purging should be conducted in accordance with SOP *Groundwater Sampling from Monitoring Wells*.
12. During purging, the field parameters are measured frequently (every 5 minutes) until the parameters have stabilized. Field parameters are considered stable when measurements meet the following criteria:
 - pH: within 0.1 pH units

- Specific conductance: within 10 percent
- Turbidity: <10 NTU or within 10 percent
- Temperature: constant

B. Sample Collection

Once purging is complete the well is ready to sample. The elapsed time between completion of purging and collection of the groundwater sample should be minimized. Typically, the sample is collected immediately after the well has been purged, but this is also dependent on well recovery.

Samples will be placed in sample containers that have been cleaned to laboratory standards and are preserved in accordance with the analytical method. The containers are typically pre-preserved, if required.

VOC samples are normally collected first and directly into pre-preserved sample containers (see Special Conditions for Sampling with Peristaltic Pumps).

The steps to be followed for sample collection are as follows:

1. The cap is removed from the sample bottle, and the bottle is tilted slightly.
2. The sample is slowly poured from the bailer or discharged from the pump so that it runs down the inside of the sample bottle with a minimum of splashing. The pumping rate should be reduced to approximately 100 ml per minute when sampling VOCs.
3. Inorganics, including metals, may be collected and preserved in the filtered form as well as the unfiltered form. Disposable in-line filters (0.45 micron filter), connected to the end of the sample tubing,, are typically used for field filtration. Samples are field filtered as the water is being placed into the sample container. If a bailer is used, filtration may be driven by a peristaltic pump.
4. Adequate space is left in the bottle to allow for expansion, except for VOC vials, which are filled to the top with a positive meniscus.
5. The bottle is capped and clearly labeled.
6. Samples are placed in appropriate containers and, if necessary, packed with ice in coolers as soon as practical.
7. Nondedicated equipment is cleaned and decontaminated in accordance with the *Decontamination of Personnel and Equipment* SOP.

The following information, at a minimum, will be recorded in the log book:

1. Sample identification (site name, location, and project number; sample name/number and location; sample type and matrix; time and date; sampler's identity)

2. Sample source and source description
3. Field observations and measurements (appearance, volatile screening, field chemistry, sampling method), volume of water purged prior to sampling, number of well volumes purged, and field parameter measurements
4. Sample disposition (preservative; laboratory name, date and time sent; laboratory sample number, chain-of-custody number, sample bottle lot number)
5. Additional remarks

Special Conditions for Sampling with Peristaltic Pumps

It is not acceptable to collect samples for organic compounds analyses through the flexible tubing used in the pump head. When collecting samples for organic compound analyses it is necessary to use a vacuum container, placed between the pump and the well for sample collection.

The following step-by-step procedures describe the process of sampling with a peristaltic pump and vacuum jug (see note following these procedures for collection of VOC samples):

1. Disconnect the purge tubing from the pump. Make sure the tubing is securely attached to the protective casing or other secure object.
2. Insert the tubing into one of the ferrule nut fittings of a Teflon® vacuum container transfer cap assembly.
3. Place a suitable length of Teflon® tubing between the remaining transfer cap assembly ferrule nut fitting and the vacuum side of the flexible tubing in the peristaltic pump head. Securely hand-tighten both fittings.
4. Turn the pump on. Water should begin to collect in the transfer container (typically a 1-liter “Boston round” glass sample container) within a few minutes. If water does not begin to flow into the container within several minutes, check the transfer cap fittings and make sure the assembly is tightly attached to the container. It may be necessary to tighten the ferrule nuts with a wrench or pliers to achieve a vacuum in the system, particularly when approaching the maximum head difference between the pump and water table (limit of suction).
5. When the transfer container is nearly full, turn off the pump, remove the transfer cap assembly, and pour the sample into the appropriate containers.
6. If additional sample volume is needed, replace the transfer cap assembly, turn the pump on, and collect additional volume.

NOTE: Samples for volatile organic compound analyses cannot be collected using the vacuum jug method. If samples for VOC analyses are required,

they must be collected with a bailer or by other approved methods, such as the “soda straw” method. The “soda straw” method involves allowing the tubing to fill, by either lowering it into the water column (A) or by filling it via suction applied by the pump head (B). If method (A) is used, the tubing is removed from the well after filling and the captured sample is allowed to drain into the sample vial. If method (B) is used, after running the pump and filling the tubing with sample, the pump speed is reduced and the direction reversed to push the sample out of the tubing into the vials. Avoid completely emptying the tubing when filling the sample vials when using method (B) to prevent introducing water that was in contact with the flexible pump head tubing. Either method is repeated, as necessary, until all vials are filled.

Samples for some constituents, primarily inorganic analytes such as metals and cyanide, may be collected directly from the peristaltic pump head tubing. This method is acceptable under the following conditions:

- The pump head tubing must be changed between sampling locations;
- An equipment rinsate blank must be collected by pumping de-ionized water through a piece of the tubing.

C. Additional remarks

1. If the well goes dry during purging, wait until it recovers sufficiently to remove the required volumes to sample all parameters. It may be necessary to return periodically to the well but a particular sample (e.g., large amber bottles for semivolatile analysis) should be filled at one time rather than over the course of two or more visits to the well.
2. Disposable tubing is disposed of with PPE and other site trash.

IV. Attachments

White paper on reasons and rationale for low-flow sampling.

V. Key Checks and Preventative Maintenance

- The drawdown in the well should be minimized as much as possible (preferably no more than 0.5-foot to 1 foot) so that natural groundwater-flow conditions are maintained as closely as possible.
- The highest purging rate should not exceed 1 liter per minute. This is to keep the drawdown minimized.

- Stirring up of sediment in the well should be avoided so that turbidity containing adsorbed chemicals is not suspended in the well and taken in by the pump.
- Overheating of the pump should be avoided to minimize the potential for losing VOCs through volatilization.
- Keep the working space clean with plastic sheeting and good housekeeping.
- Maintain field equipment in accordance with the manufacturer's recommendations. This will include, but is not limited to:
 - Inspect sampling pump regularly and replace as warranted
 - Inspect quick-connects regularly and replace as warranted
 - Verify battery charge, calibration, and proper working order of field measurement equipment prior to initial mobilization and daily during field efforts

Attachment to the SOP on Low-Flow Sampling Groundwater Sampling from Monitoring Wells

White Paper on Low-Flow Sampling

EPA recommends low-flow sampling as a means of collecting groundwater samples in a way that minimizes the disturbance to the natural groundwater flow system and minimizes the introduction of contamination into the samples from extraneous sources. The following are details about these issues.

When a pump removes groundwater from the well at the same rate that groundwater enters the well through the screen, the natural groundwater-flow system around the well experiences a minimum of disturbance. Some disturbance is bound to occur because you are causing groundwater to flow to the well in a radial fashion that otherwise would have flowed past it. However, the resulting low-flow sample provides the most-representative indication we can get of groundwater quality in the immediate vicinity of the well.

Normally, when a well is pumped at an excessive rate that drops the water level in the well below the water level in the aquifer, the water cascades down the inside of the well screen when it enters the well. The turbulence from this cascading causes gases such as oxygen and carbon dioxide to mix with the water in concentrations that are not representative of the native groundwater and are higher than expected. This causes geochemical changes in the nature of the water that can change the concentrations of some analytes, particularly metals, in the groundwater sample, not mention it's effect on the dissolved oxygen levels that then will be measured in the flow-through cell. Such turbulence also may cause lower-than-expected concentrations of volatile organic compounds due to volatilization.

For wells in which the water level is above the top of the screen, the water up in the riser is out of the natural circulation of the groundwater and, therefore, can become stagnant. This stagnant water is no longer representative of natural groundwater quality because its pH, dissolved-oxygen content, and other geochemical characteristics change as it contacts the air in the riser. If we minimize the drawdown in the well when we pump, then we minimize the amount of this stagnant water that is brought down into the well screen and potentially into the pump. As a result, a more-representative sample is obtained.

Typically, wells contain some sediment in the bottom of the well, either as a residue from development that has settled out of the water column or that has sifted through the sand pack and screen since the well was installed. This sediment commonly has adsorbed on it such analytes as metals, SVOCs, and dioxins that normally would not be dissolved in the groundwater. If these sediments are picked up in the groundwater when the well is disturbed by excessive pumping, they can:

- Make filtering the samples for metals analysis more difficult
- Add unreasonably to the measured concentration of SVOCs and other organic compounds

The SOP for low-flow sampling has been modified recently and should be consulted for additional information about low-flow sampling and ways of dealing with wells in which the water level cannot be maintained at a constant level.

VOC Sampling-Water

I. Purpose

To provide general guidelines for sampling aqueous volatile organic compounds.

II. Scope

Standard techniques for collecting representative samples are summarized. Site-specific details are discussed in the Field Sampling Plan.

III. Equipment and Materials

- Sample vials pre-preserved at laboratory with hydrochloric acid (HCl)
- Surgical or latex gloves

IV. Procedures and Guidelines

1. Sample VOCs before sampling other analyte groups.
2. When sampling for VOCs, especially residential wells, evaluate the area around the sampling point for possible sources of air contamination by VOCs. Products that may give off VOCs and possibly contaminate a sample include perfumes and cosmetics, skin applied pharmaceuticals, automotive products (gasoline, starting fluid, windshield deicers, carburetor cleaners, etc.) and household paint products (paint strippers, thinners, turpentine, etc.).
3. Keep the caps off the sample vials for as short a time as possible.
4. Wear clean latex or surgical gloves.
5. Fill the sample vial immediately, allowing the water stream to strike the inner wall of the vial to minimize formation of air bubbles. **DO NOT RINSE THE SAMPLE VIALS BEFORE FILLING.**

6. Fill the sample vial with a minimum of turbulence, until the water forms a positive meniscus at the brim.
7. Replace the cap by gently setting it on the water meniscus. Tighten firmly, but DO NOT OVERTIGHTEN.
8. Invert the vial and tap it lightly. If you see air bubbles in the sample, do not add more sample. Use another vial to collect another sample. Repeat if necessary until you obtain a proper sample.

V. Attachments

None.

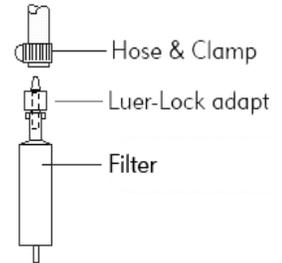
VI. Key Checks and Items

- Check for possible sources of contamination.
- Fill slowly, with as little turbulence as possible.
- Check for air bubbles.

bio-flo

SAMPLING INSTRUCTIONS

1. Purge the well.
2. Prepare the pump (Peristaltic preferred, Grundfos, or air bladder) as normal. Use the clamp provided to ensure a leak-proof connection.
3. Remove the filter from the Falcon tube.
4. Attach the inlet of the filter with a 1/4" - 5/16" inner diameter (I.D.) tubing using the clamp to secure.
5. Place the filter within a receiving container so that the amount of water filtered can be measured accurately.
6. The amount of water filtered will vary depending upon the turbidity of the water. We recommend filtering 1-2 L.
7. Record the volume of water that passed through the filter, and then submit the filter for analysis. The water may then be discarded. Please cap the filter on both ends. The thinner end should be closed with the red rubber cap and the thicker end should be closed with the clear luer plug.



Note: If the filter clogs before 1L has been filtered, record how much water was passed through the first filter, and then collect an additional filter, also recording the volume of water that went through the second filter. In this case, both filters are then submitted for testing. For each location there should be **no more than 2 filters** used and there is no need to filter more than 2L of water.

Hold time for this analysis is 24-48 hours.

To Submit Sample:

1. Place the filter in the Falcon tube provided.
2. Affix the label to the Falcon tube and note the amount of water that passed through the filter, the well location, sampling date, and the analyses requested.

SHIPPING INSTRUCTIONS

Packaging Samples:

1. Samples should be shipped in a cooler with ice or blue ice for next day delivery. If regular ice is used, the ice should be double bagged.
2. A chain of custody form must be included with each shipment of samples. Access our chain of custody at www.microbe.com

Shipment for Weekday Delivery:

Samples for weekday delivery should be shipped to:

Sample Custodian
Microbial Insights, Inc.
2340 Stock Creek Blvd.
Rockford, TN 37853-3044
(865) 573-8188

Shipment for Saturday Delivery:

Coolers to be delivered on Saturday must be sent to our **FedEx Drop Location**. To ensure proper handling the following steps must be taken:

1. FedEx shipping label should be marked under (6) Special Handling, check Hold Saturday.
2. The cooler must be taped with FedEx SATURDAY tape.
3. The shipping label must be filled out with the Drop Location address below. Our laboratory name must be on the address label.
4. You **MUST notify by email** customerservice@microbe.com with the tracking number of the package on Friday (prior to 4pm Eastern Time) to arrange for Saturday pickup. Please make sure you write "Saturday Delivery" in the subject line of the message. **Without proper labeling and the tracking number, there is no guarantee that the samples will be collected.**

Samples for **Saturday delivery** should be shipped to:

Microbial Insights, Inc.
FedEx Drop Location
10601 Murdock Road
Knoxville, TN 37932
(865) 617-4782 (cell)

Note: Samples received for Saturday Delivery will be frozen immediately upon receipt by Microbial Insights staff to minimize changes in the microbial community.

Field Measurement of pH, Specific Conductance, Turbidity, Dissolved Oxygen, ORP, and Temperature Using a Water Quality Meter with Flow-Through Cell

I. Purpose and Scope

The purpose of this procedure is to provide a general guideline for using a water quality meter for field measurements of pH, specific conductance, turbidity, dissolved oxygen, oxidation-reduction potential (ORP), and temperature of aqueous samples. The operator's manual should be consulted for detailed operating procedures.

II. Equipment and Materials

- Water Quality Monitoring System with flow-through cell (Horiba, YSI, In-Situ, Ion Science, etc)
- Auto-Calibration Standard Solution (provided by rental company)
- Distilled water in squirt bottle

III. Procedures and Guidelines

A. General Parameters and Specifications:

Note: the general parameters listed below may not be available for every type of meter used. Please refer to the specific meter's manual to determine meter's range of measurement and accuracy.

<u>Parameter</u>	<u>Range of measurement</u>	<u>Accuracy</u>
pH	0 to 14 pH units	+/- 0.1 pH units
Specific conductance	0 to 9.99 S/m	+/- 3 % full scale
Turbidity	0 to 800 NTU	+/- 5 % full scale
Dissolved oxygen	0 to 19.99 mg/l	+/- 0.2 mg/l
Temperature	0 to 55 °C	+/- 1.0 °C
ORP	-999 to +999 mV	+/- 15 mV
Salinity	0 to 4 %	+/- 0.3 %

B. Calibration:

Prior to each day's use, clean the probe and flow-through cell using deionized water and calibrate using the Standard Solution. Refer to the specific instrumentation manual for the proper calibration methods.

C. Sample Measurement:

The water quality probes are inserted into a flow-through cell. The purged groundwater is directed through the cell by connecting the pump discharge tubing to the bottom port on the flow through cell, allowing measurements to be collected before the water contacts the atmosphere.

As water passes through the flow-through the flow cell, press MEAS to obtain readings or the readings are displayed on the meter for each parameter (dependent on the type of meter used). Record the water quality parameter data in a field notebook. Once the parameters have stabilized (see *Low-Flow Groundwater Sampling from Monitoring Wells – EPA Region I and III* or *Low-Flow Groundwater Sampling from Monitoring Wells – EPA Region IV* depending on project site location), remove the tubing from the bottom port of the flow-through cell. Never collect a groundwater sample for laboratory analysis from the flow-through cell. Rinse the flow-through cell between wells to remove any sediment buildup within the cell.

IV. Key Checks and Preventive Maintenance

- Calibrate meter
- Clean probe with deionized water when done
- Refer to operations manual for recommended maintenance and troubleshooting
- Check batteries, and have a replacement set on hand
- Due to the importance of obtaining these parameters, the field team should have a spare unit readily available in case of an equipment malfunction.

Water-Level Measurements

I. Purpose and Scope

The purpose of this procedure is to provide a guideline for the measurement of the depth to groundwater in piezometers and monitoring wells, even where a second phase of floating liquid (e.g., gasoline) is encountered, and on staff gages in surface-water bodies. This SOP includes guidelines for discrete measurements of static water levels and does not cover the use of continuously recording loggers (see SOP *Use of Data Loggers and Pressure Transducers*).

II. Equipment and Materials

- Electronic water-level meter (Solinst® or equivalent) with a minimum 100-foot tape; the tape should have graduations in increments of 0.01 feet or less
- Interface probe (Solinst® Model 122 Interface Meter or equivalent)

III. Procedures and Guidelines

Verify that the unit is turned on and functioning properly. Slowly lower the probe on its cable into the piezometer or well until the probe just contacts the water surface; the unit will respond with a tone or light signal. Note the depth from a reference point indicated on the piezometer or well riser. Typically this is the top of the PVC casing. If no reference is clearly visible, measure the depth to water from the northern edge of the PVC casing. If access to the top of the PVC casing is difficult, sight across the top of the locking casing adjacent to the measuring point, recording the position of the cable when the probe is at the water surface.

Measure the distance from this point to the closest interval marker on the tape, and record the water level reading in the logbook. Water levels will be measured to the nearest 0.01-foot. Also when specified in the project plans, measure and record the depth of the piezometer or well. The depth of the piezometer or well may be measured using the water-level probe with the instrument turned off.

Free product light or dense nonaqueous phase liquid may be present in the piezometer or well. If the presence of free product is suspected, the thickness of the product should be determined using appropriate equipment (e.g., Solinst® Model 122 Interface Meter). The depth to water also is determined with this equipment and the water-level meter should not be used in the piezometer or well as long as product is present. Typically, a constant sound is emitted from the device when free product is encountered and an alternating on/off beep sound is emitted when water is encountered.

The apparent elevation of the water level in the well or piezometer is determined by measuring both the apparent depth to water and the thickness of free product. The corrected water-level elevation is calculated by the following equation:

$$WL_c = WL_a + (\text{Free-product thickness} \times 0.80)$$

Where WL_c = Corrected water-level elevation

WL_a = Apparent water-level elevation

0.80 = Typical value for the density of petroleum hydrocarbon products.

If free product is detected on the surface of the water in the piezometer or well, the value of sampling should be reconsidered because of the potential for contaminating the sampling equipment.

Staff gages may be installed in some surface-water bodies. These facilities typically are constructed by attaching a calibrated, marked staff gage to a wood or metal post, driving the post into the bottom of the surface-water body, and surveying the elevation of the top of the post to a resolution or 0.01-foot. The elevation of the water in the surface-water body then can be determined by reading off the distance the water level is from the top of the post. A shield or other protection may be needed to calm the fluctuations in water level if the gage is installed at a location exposed to wind or wave.

IV. Attachments

None.

V. Key Checks

- Before each use, verify that the battery is charged by pressing the test button on the water-level meter.
- Verify that the unit is operating correctly by testing the probe in distilled or de-ionized water. Leave the unit turned off when not in use.

Equipment Blank and Field Blank Preparation

I. Purpose

To prepare blanks to determine whether decontamination procedures are adequate and whether any cross-contamination is occurring during sampling due to contaminated air and dust.

II. Scope

The general protocols for preparing the blanks are outlined. The actual equipment to be rinsed will depend on the requirements of the specific sampling procedure.

III. Equipment and Materials

- Blank liquid (use ASTM Type II or lab grade water)
- Millipore™ deionized water
- Sample bottles as appropriate
- Gloves
- Preservatives as appropriate

IV. Procedures and Guidelines

- A. Decontaminate all sampling equipment that has come in contact with sample according to SOP *Decontamination of Personnel and Equipment*.
- B. To collect an equipment blank for volatile analysis from the surfaces of sampling equipment other than pumps, pour blank water over one piece of equipment and into two 40-ml vials until there is a positive meniscus, then seal the vials. Note the sample number and associated piece of equipment in the field notebook as well as the type and lot number of the water used.

For non-volatiles analyses, one aliquot is to be used for equipment. For example, if a pan and trowel are used, place trowel in pan and pour blank fluid in pan such that pan and trowel surfaces which contacted the sample are contacted by the blank fluid. Pour blank fluid from pan into appropriate sample bottles.

Do not let the blank fluid come in contact with any equipment that has not been decontaminated.

- C. When collecting an equipment blank from a pump, run an extra gallon of deionized water through the pump while collecting the pump outflow into appropriate containers. Make sure the flow rate is low when sampling VOCs. If a Grundfos Redi-Flo2 pump with disposable tubing is used, remove the disposable tubing after sampling but before decon. When decon is complete, put a 3- to 5-foot segment of new tubing onto the pump to collect the equipment blank.
- D. To collect a field blank, slowly pour ASTM Type II or lab grade water directly into sample containers.
- E. Document and ship samples in accordance with the procedures for other samples.
- F. Collect next field sample.

V. Attachments

None.

VI. Key Checks and Items

- Wear gloves.
- Do not use any non-decontaminated equipment to prepare blank.
- Use ASTM-Type II or lab grade water.

Chain-of-Custody

I Purpose

The purpose of this SOP is to provide information on chain-of-custody procedures to be used under the CLEAN Program.

II Scope

This procedure describes the steps necessary for transferring samples through the use of Chain-of-Custody Records. A Chain-of-Custody Record is required, without exception, for the tracking and recording of samples collected for on-site or off-site analysis (chemical or geotechnical) during program activities (except wellhead samples taken for measurement of field parameters). Use of the Chain-of-Custody Record Form creates an accurate written record that can be used to trace the possession and handling of the sample from the moment of its collection through analysis. This procedure identifies the necessary custody records and describes their completion. This procedure does not take precedence over region specific or site-specific requirements for chain-of-custody.

III Definitions

Chain-of-Custody Record Form - A Chain-of-Custody Record Form is a printed two-part form that accompanies a sample or group of samples as custody of the sample(s) is transferred from one custodian to another custodian. One copy of the form must be retained in the project file.

Custodian - The person responsible for the custody of samples at a particular time, until custody is transferred to another person (and so documented), who then becomes custodian. A sample is under one's custody if:

- It is in one's actual possession.
- It is in one's view, after being in one's physical possession.
- It was in one's physical possession and then he/she locked it up to prevent tampering.
- It is in a designated and identified secure area.

Sample - A sample is physical evidence collected from a facility or the environment, which is representative of conditions at the point and time that it was collected.

IV. Procedures

The term “chain-of-custody” refers to procedures which ensure that evidence presented in a court of law is valid. The chain-of-custody procedures track the evidence from the time and place it is first obtained to the courtroom, as well as providing security for the evidence as it is moved and/or passed from the custody of one individual to another.

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

Sample Identification

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

Information which shall be recorded in the field logbook, when in-situ measurements or samples for laboratory analysis are collected, includes:

- Field Sampler(s),
- Contract Task Order (CTO) Number,
- Project Sample Number,
- Sample location or sampling station number,
- Date and time of sample collection and/or measurement,
- Field observations,
- Equipment used to collect samples and measurements, and
- Calibration data for equipment used

Measurements and observations shall be recorded using waterproof ink.

Sample Label

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

- Project - CTO Number.
- Station Location - The unique sample number identifying this sample.
- Date - A six-digit number indicating the day, month, and year of sample collection (e.g., 08/21/12).

- Time - A four-digit number indicating the 24-hour time of collection (for example: 0954 is 9:54 a.m., and 1629 is 4:29 p.m.).
- Medium - Water, soil, sediment, sludge, waste, etc.
- Sample Type - Grab or composite.
- Preservation - Type and quantity of preservation added.
- Analysis - VOA, BNAs, PCBs, pesticides, metals, cyanide, other.
- Sampled By - Printed name of the sampler.
- Remarks - Any pertinent additional information.

Using only the work assignment number of the sample label maintains the anonymity of sites. This may be necessary, even to the extent of preventing the laboratory performing the analysis from knowing the identity of the site (e.g., if the laboratory is part of an organization that has performed previous work on the site). The field team should always follow the sample ID system prepared by the project EIS and reviewed by the Project Manager.

Chain-of-Custody Procedures

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

Field Custody Procedures

- Samples are collected as described in the site Sampling and Analysis Plan. Care must be taken to record precisely the sample location and to ensure that the sample number on the label matches the Chain-of-Custody Record exactly.
- A Chain-of-Custody Record will be prepared for each individual cooler shipped and will include *only* the samples contained within that particular cooler. The Chain-of-Custody Record for that cooler will then be sealed in a zip-log bag and placed in the cooler prior to sealing. This ensures that the laboratory properly attributes trip blanks with the correct cooler and allows for easier tracking should a cooler become lost during transit.
- The person undertaking the actual sampling in the field is responsible for the care and custody of the samples collected until they are properly transferred or dispatched.
- When photographs are taken of the sampling as part of the documentation procedure, the name of the photographer, date, time, site location, and site description are entered sequentially in the site logbook as photos are taken. Once downloaded to the server or developed, the electronic files or photographic prints shall be serially numbered, corresponding to the logbook descriptions; photographic prints will be stored in the project files. To identify

sample locations in photographs, an easily read sign with the appropriate sample location number should be included.

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

Transfer of Custody and Shipment

Samples are accompanied by a Chain-of-Custody Record Form. **A Chain-of-Custody Record Form must be completed for each cooler and should include only the samples contained within that cooler.** A Chain-of-Custody Record Form example is shown in Attachment B. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the Record. This Record documents sample custody transfer from the sampler, often through another person, to the analyst in the laboratory. The Chain-of-Custody Record is filled out as given below:

- Enter header information (CTO number, samplers, and project name).
- Enter sample specific information (sample number, media, sample analysis required and analytical method grab or composite, number and type of sample containers, and date/time sample was collected).
- Sign, date, and enter the time under “Relinquished by” entry.
- Have the person receiving the sample sign the “Received by” entry. If shipping samples by a common carrier, print the carrier to be used in this space (i.e., Federal Express).
- If a carrier is used, enter the airbill number under “Remarks,” in the bottom right corner;
- Place the original (top, signed copy) of the Chain-of-Custody Record Form in a plastic zipper-type bag or other appropriate sample-shipping package. Retain the copy with field records.
- Sign and date the custody seal, a 1-inch by 3-inch white paper label with black lettering and an adhesive backing. Attachment C is an example of a custody seal. The custody seal is part of the chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field. Custody seals shall be provided by the analytical laboratory.
- Place the seal across the shipping container opening (front and back) so that it would be broken if the container were to be opened.
- Complete other carrier-required shipping papers.

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

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

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

V Quality Assurance Records

Once samples have been packaged and shipped, the Chain-of-Custody copy and airbill receipt become part of the quality assurance record.

VI Attachments

- A. Sample Label
- B. Chain of Custody Form
- C. Custody Seal

VII References

USEPA. *User's Guide to the Contract Laboratory Program*. Office of Emergency and Remedial Response, Washington, D.C. (EPA/540/P-91/002), January 1991.

Packaging and Shipping Procedures for Low-Concentration Samples

I. Purpose and Scope

The purpose of this guideline is to describe the packaging and shipping of low-concentration samples of various media to a laboratory for analysis.

II. Scope

The guideline only discusses the packaging and shipping of samples that are anticipated to have low concentrations of chemical constituents. Whether or not samples should be classified as low-concentration or otherwise will depend upon the site history, observation of the samples in the field, odor, and photoionization-detector readings.

If the site is known to have produced high-concentration samples in the past or the sampler suspects that high concentrations of contaminants might be present in the samples, then the sampler should conservatively assume that the samples cannot be classified as low-concentration. Samples that are anticipated to have medium to high concentrations of constituents should be packaged and shipped accordingly.

If warranted, procedures for dangerous-goods shipping may be implemented. Dangerous goods and hazardous materials pose an unreasonable risk to health, safety, or property during transportation without special handling. As a result only employees who are trained under CH2M HILL Dangerous Goods Shipping course may ship or transport dangerous goods. Employees should utilize the HAZMAT ShipRight tool on the Virtual Office and/or contact a designated CH2M HILL HazMat advisor with questions.

III. Equipment and Materials

- Coolers
- Clear tape
- "This Side Up" labels
- "Fragile" labels
- Vermiculite
- Ziplock bags or bubble wrap
- Ice
- Chain-of-Custody form (completed)
- Custody seals

IV. Procedures and Guidelines

Low-Concentration Samples

- A. Prepare coolers for shipment:
 - Tape drains shut.
 - Affix "This Side Up" labels on all four sides and "Fragile" labels on at least two sides of each cooler.
 - Place mailing label with laboratory address on top of coolers.
 - Fill bottom of coolers with about 3 inches of vermiculite or absorbent pads.
- B. Arrange decontaminated sample containers in groups by sample number. Consolidate VOC samples into one cooler to minimize the need for trip blanks.
- C. Affix appropriate adhesive sample labels to each container. Protect with clear label protection tape.
- D. Seal each sample bottle within a separate ziplock plastic bag or bubble wrap, if available. Tape the bag around bottle. Sample label should be visible through the bag.
- E. Arrange sample bottles in coolers so that they do not touch.
- F. If ice is required to preserve the samples, cubes should be repackaged in zip-lock bags and placed on and around the containers.
- G. Fill remaining spaces with vermiculite or absorbent pads.
- H. Complete and sign chain-of-custody form (or obtain signature) and indicate the time and date it was relinquished to Federal Express or the courier.
- J. Close lid and latch.
- K. Carefully peel custody seals from backings and place intact over lid openings (right front and left back). Cover seals with clear protection tape.
- L. Tape cooler shut on both ends, making several complete revolutions with strapping tape. Cover custody seals with tape to avoid seals being able to be peeled from the cooler.
- M. Relinquish to Federal Express or to a courier arranged with the laboratory. Place airbill receipt inside the mailing envelope and send to the sample documentation coordinator along with the other documentation.

Medium- and High-Concentration Samples:

Medium- and high-concentration samples are packaged using the same techniques used to package low-concentration samples, with potential additional restrictions. If applicable, the sample handler must refer to instructions associated with the shipping of dangerous goods for the necessary procedures for shipping by Federal Express or other overnight carrier. If warranted, procedures for dangerous-goods shipping may be implemented. Dangerous goods and hazardous materials pose an unreasonable risk to health, safety, or property during transportation without special handling. As a result only employees who are trained under CH2M HILL Dangerous Goods Shipping course may ship or transport dangerous goods. Employees should utilize the HAZMAT ShipRight tool on the Virtual Office and/or contact a designated CH2M HILL HazMat advisor with questions.

V. Attachments

None.

VI. Key Checks and Items

- Be sure laboratory address is correct on the mailing label
- Pack sample bottles carefully, with adequate vermiculite or other packaging and without allowing bottles to touch
- Be sure there is adequate ice
- Include chain-of-custody form
- Include custody seals

Multi RAE Photoionization Detector (PID)

I. Purpose

The purpose of this SOP is to provide general reference information for using the Multi RAE PID in the field. Calibration and operation, along with field maintenance, will be included in this SOP.

II. Scope

This procedure provides information on the field operation and general maintenance of the Multi RAE PID. Review of the information contained herein will ensure that this type of field monitoring equipment will be properly utilized. Review of the owner's instruction manuals is a necessity for more detailed descriptions.

III. Definitions

Carbon Monoxide Sensor (CO) - Expresses the Carbon Monoxide concentration in ppm.

Volatile Organic Compound (VOC) - Expresses the VOC concentration in ppm

Lower Explosive Limit (LEL) - Combustible gas is expressed as a percent of the lower explosive limit.

Hydrogen Sulfide Sensor (H₂S) - Expresses the Hydrogen Sulfide concentration in ppm.

Oxygen Sensor (OXY) - Expresses the Oxygen concentration as a percentage.

ppm - parts per million: parts of vapor or gas per million parts of air by volume.

IV. Responsibilities

Project Manager - The Project Manager is responsible for ensuring that project-specific plans are in accordance with these procedures, where applicable, or that other approved procedures are developed. The Project Manager is responsible for selecting qualified individuals for the monitoring activities.

Health and Safety Coordinator - The Health and Safety Coordinator is responsible for developing a site-specific Health and Safety Plan (HASP) which specifies air monitoring requirements.

Field Team Leader - It is the responsibility of the Field Team Leader to implement these procedures in the field, and to ensure that the field team performing air monitoring activities have been briefed and trained to execute these procedures before the start of site operations.

Safety Coordinator-Hazard Worker (SC-HW)- The SC-HW is responsible for ensuring that the specified air monitoring equipment is on site, calibrated, and used correctly by the field personnel. The SC-HW will coordinate these activities with the Field Team Leader if the SC-HW is not the Field Team Leader as well.

Field team - It is the responsibility of the field team to follow these procedures or to follow documented project-specific procedures as directed by the Field Team Leader/ Safety Coordinator-Hazard Worker. The field personnel are responsible for documenting all air monitoring results in the field logbook during each field investigation.

V. Procedures

The Multi RAE utilizes the principle of detecting sensors. The PID operates on the principle that most organic compounds and some inorganic compounds are ionized when they are bombarded by high-energy ultraviolet light. These compounds absorb the energy of the light, which excites the molecules and results in a loss of electron and the formation of a positively charged ion. The number of ions formed and the ion current produced is directly proportional to mass and concentration. The amount of energy required to displace an electron is called ionization potential (IP). The air sample is drawn into a UV lamp using a pump or a fan. The energy of the lamp determines whether a particular chemical will be ionized. Each chemical compound has a unique ionizing potential. When the UV light energy is greater than the ionization potential of the chemical, ionization will occur. When the sample is ionized, the electrical signal is displayed on an analog or digital output. Although the output does not distinguish between chemicals, it does detect an increase in the ion current. If only one chemical is present in the air, it is possible to use PIDs quantitatively. Chemical structure and lamp intensity affects the sensitivity of the instrument to a given contaminant. All PID readings are relative to the calibration gas, usually isobutylene. It is important to calibrate the PID in the same temperature and elevation that the equipment will be used, and to determine the background concentrations in the field before taking measurements. For environments where background readings are high, factory zero calibration gas should be used.

The following subsections will discuss Multi RAE calibration, operation, and maintenance. These sections, however, do not take the place of the instruction manual.

A. Calibration

For Multi RAE configured with O₂, LEL, H₂S, CO, sensors and a 10.6eV PID Lamp.

Start up Instrument

- Press **Mode** button

- Observe displays:

On!.....

Multi RAE
Version X.XX

Model Number
SN XXXX

Date Time
Temp

Checking Sensor
Ids....

VOC Installed

CO Installed

H₂S Installed

OXY Installed

LEL Installed

H₂S VOC CO
LEL OXY

Alarm Limits=

XX XX.X XX
XX High XX.X

XX XX.X XX
XX Low XX.X

XX XX.X XX
STEL

XX XX.X XX
TWA

Battery = X.XV
Shut off at 4.2V

User Mode=

Alarm Mode=

Datalog Time Left

Datalog Mode

Datalog Period

Unit ready in.....
10 Seconds

- The pump will start, the seconds will count down to zero, and the instrument will be ready for use

Calibration Check and Adjustment

Allow instrument to warm up for 15 minutes.

- Depress the [N/-] key first, then while depressing the [N/-], depress the [Mode] key also and depress both keys for 5 seconds.

- Display will read:

Calibrate
Monitor?

- Press the [Y/+] key

- Display will read:

Fresh Air
Calibration?

- If "Zero Air" is necessary, attach the calibration adapter over the inlet port of the Multi RAE Monitor and connect the other end of the tube to the gas regulator (HAZCO loaner regulator LREG.5, RAE Systems P/N 008-3011 or suitable .5 LPM regulator) on the Zero Air bottle (HAZCO P/N SGZA, RAE P/N 600-0024). If no Zero Air is available, perform the Fresh Air Calibration in an area free of any detectable vapor.

- Press the [Y/+] key

- Display will read:

Zero....
In progress...

CO Zeroed!
Reading = X

VOC Zeroed!
Reading = X

LEL Zeroed!
Reading = X

OXY Zeroed!
Reading = X

Zero Cal done!
H₂S Zeroed!
Reading = X

In each of the above screens, "X" is equal to the reading of the sensor before it was zeroed.

- Display will then read:

Multiple Sensor
Calibration?

- Press the [Y/+] key
- The display shows all of the pre-selected sensors and the "OK?" question:

CO H₂S
LEL OK? OXY

- Apply calibration gas - use either HAZCO Services Part Number R-SGRAE4 or Rae Systems Part Number 008-3002 - using a .5 LPM regulator and direct tubing.
- Press the [Y/+] key. Display will read:

Apply Mixed gas

Calibration
In progress ...

- The display will count down showing the number of remaining seconds:

CO cal'ed
Reading=50

H₂S cal'ed
Reading=25

LEL cal'ed
Reading=50

OXY cal'ed
Reading=20.9

Calibration done
Turn off gas!

- Display will read:

Single Sensor
Calibration?

- Press the [Y/+].
- Display will read:

CO VOC H₂S
LEL pick? OXY

- Attach 100 ppm Isobutylene (HAZCO P/N r-SGISO or Rae P/N 600-0002) using a 1.0 LPM regulator (HAZCO P/N LR10HS or Rae P/N 008-3021). Open regulator.
- Press the [Mode] key once, the V of VOC will be highlighted.
- Press the [Y/+]. The display will read:

Apply VOC Gas

Calibration
In progress...

- The display will count down showing the number of remaining seconds:, then display:

VOC cal'd
Reading=100

Calibration done
Turn off gas!

Single Sensor
Calibration?

- Press [Mode] key twice to return to main screen.
- **CALIBRATION IS COMPLETE!**

B. Operation

Due to the Multi RAE having many functions in terms of operation, it is recommended that you follow the operational procedures as outlined in the instruction manual from pages 9 to 14.

C. Site Maintenance

After each use, the meter should be recharged and the outside of the instruments should be wiped clean with a soft cloth.

D. Scheduled Maintenance

Function

Frequency

Check alarm and settings

Monthly/before each use

Clean screens and gaskets around sensors	Monthly
Replace sensors	Biannually or when calibration is unsuccessful

VI. Quality Assurance Records

Quality assurance records will be maintained for each air monitoring event. The following information shall be recorded in the field logbook.

- Identification - Site name, date, location, CTO number, activity monitored, (surface water sampling, soil sampling, etc), serial number, time, resulting concentration, comments and identity of air monitoring personnel.
- Field observations - Appearance of sampled media (if definable).
- Additional remarks (e.g, Multi RAE had wide range fluctuations during air monitoring activities.)

VII. References

Multi RAE Plus Multiple Gas Monitor User Manual, RAE Systems, Revision B1, November 2003.

Decontamination of Personnel and Equipment

I. Purpose

To provide general guidelines for the decontamination of personnel, sampling equipment, and monitoring equipment used in potentially contaminated environments.

II. Scope

This is a general description of decontamination procedures.

III. Equipment and Materials

- Demonstrated analyte-free, deionized (“DI”) water (specifically, ASTM Type II water or lab-grade DI water)
- Potable water; must be from a municipal water supplier, otherwise an analysis must be run for appropriate volatile and semivolatile organic compounds and inorganic chemicals (e.g., Target Compound List and Target Analyte List chemicals)
- 2.5% (W/W) Liquinox[®] (or Alconox[®]) and water solution
- Concentrated (V/V) pesticide grade isopropanol (DO NOT USE ACETONE)
- Large plastic pails or tubs for Liquinox[®] and water, scrub brushes, squirt bottles for Liquinox[®] solution, methanol and water, plastic bags and sheets
- DOT approved 55-gallon drum for disposal of waste
- Personal Protective Equipment as specified by the Health and Safety Plan
- Decontamination pad and steam cleaner/high pressure cleaner for large equipment

IV. Procedures and Guidelines

A. PERSONNEL DECONTAMINATION

To be performed after completion of tasks whenever potential for contamination exists, and upon leaving the exclusion zone.

1. Wash boots in Liquinox[®] solution, then rinse with water. If disposable latex booties are worn over boots in the work area, rinse with Liquinox[®] solution, remove, and discard into DOT-approved 55-gallon drum.
2. Wash outer gloves in Liquinox[®] solution, rinse, remove, and discard into DOT-approved 55-gallon drum.
3. Remove disposable coveralls (“Tyveks”) and discard into DOT-approved 55-gallon drum.
4. Remove respirator (if worn).
5. Remove inner gloves and discard.
6. At the end of the work day, shower entire body, including hair, either at the work site or at home.
7. Sanitize respirator if worn.

B. SAMPLING EQUIPMENT DECONTAMINATION – GROUNDWATER SAMPLING PUMPS

Sampling pumps are decontaminated after each use as follows.

1. Don phthalate-free gloves.
2. Spread plastic on the ground to keep equipment from touching the ground
3. Turn off pump after sampling. Remove pump from well and remove and dispose of tubing. Place pump in decontamination tube.
4. Turn pump back on and pump 1 gallon of Liquinox[®] solution through the sampling pump.
5. Rinse with 1 gallon of 10% isopropanol solution pumped through the pump. (DO NOT USE ACETONE).
6. Rinse with 1 gallon of tap water.
7. Rinse with 1 gallon of deionized water.
8. Keep decontaminated pump in decontamination tube or remove and wrap in aluminum foil or clean plastic sheeting.
9. Collect all rinsate and dispose of in a DOT-approved 55-gallon drum.
10. Decontamination materials (e.g., plastic sheeting, tubing, etc.) that have come in contact with used decontamination fluids or sampling equipment will be disposed of in either DOT-approved 55-gallon drums or with solid waste in garbage bags, dependent on Facility/project requirements.

C. SAMPLING EQUIPMENT DECONTAMINATION – OTHER EQUIPMENT

Reusable sampling equipment is decontaminated after each use as follows.

1. Don phthalate-free gloves.
2. Before entering the potentially contaminated zone, wrap soil contact points in aluminum foil (shiny side out).
3. Rinse and scrub with potable water.
4. Wash all equipment surfaces that contacted the potentially contaminated soil/water with Liquinox[®] solution.
5. Rinse with potable water.
6. Rinse with distilled or potable water and isopropanol solution (DO NOT USE ACETONE).
7. Air dry.
8. Rinse with deionized water.
9. Completely air dry and wrap exposed areas with aluminum foil (shiny side out) for transport and handling if equipment will not be used immediately.
10. Collect all rinsate and dispose of in a DOT-approved 55-gallon drum.
11. Decontamination materials (e.g., plastic sheeting, tubing, etc.) that have come in contact with used decontamination fluids or sampling equipment will be disposed of in DOT-approved 55-gallon drums or with solid waste in garbage bags, dependent on Facility/project requirements.

D. HEALTH AND SAFETY MONITORING EQUIPMENT DECONTAMINATION

1. Before use, wrap soil contact points in plastic to reduce need for subsequent cleaning.
2. Wipe all surfaces that had possible contact with contaminated materials with a paper towel wet with Liquinox[®] solution, then a towel wet with methanol solution, and finally three times with a towel wet with distilled water. Dispose of all used paper towels in a DOT-approved 55-gallon drum or with solid waste in garbage bags, dependent on Facility/project requirements.

E. SAMPLE CONTAINER DECONTAMINATION

The outsides of sample bottles or containers filled in the field may need to be decontaminated before being packed for shipment or handled by personnel without hand protection. The procedure is:

1. Wipe container with a paper towel dampened with Liquinox[®] solution or immerse in the solution AFTER THE CONTAINERS HAVE BEEN SEALED. Repeat the above steps using potable water.
2. Dispose of all used paper towels in a DOT-approved 55-gallon drum or with solid waste in garbage bags, dependent on Facility/project requirements.

F. HEAVY EQUIPMENT AND TOOLS

Heavy equipment such as drilling rigs, drilling rods/tools, and the backhoe will be decontaminated upon arrival at the site and between locations as follows:

1. Set up a decontamination pad in area designated by the Facility
2. Steam clean heavy equipment until no visible signs of dirt are observed. This may require wire or stiff brushes to dislodge dirt from some areas.

V. Attachments

None.

VI. Key Checks and Items

- Clean with solutions of Liquinox[®], methanol, and distilled water.
- Do not use acetone for decontamination.
- Drum all contaminated rinsate and materials.
- Decontaminate filled sample bottles before relinquishing them to anyone.

Decontamination of Drilling Rigs and Equipment

I. Purpose and Scope

The purpose of this guideline is to provide methods for the decontamination of drilling rigs, downhole drilling tools, and water-level measurement equipment. Personnel decontamination procedures are not addressed in this SOP; refer to the site safety plan and SOP *Decontamination of Personnel and Equipment*. Sample bottles will not be field decontaminated; instead they will be purchased with certification of laboratory sterilization.

II. Equipment and Materials

- Portable steam cleaner and related equipment
- Potable water
- Phosphate-free detergent such as Liquinox[®]
- Buckets
- Brushes
- Isopropanol, pesticide grade
- Personal Protective Equipment as specified by the Health and Safety Plan
- ASTM-Type II grade water or Lab Grade DI Water
- Aluminum foil

III. Procedures and Guidelines

A. Drilling Rigs and Monitoring Well Materials

Before the onset of drilling, after each borehole, before drilling through permanent isolation casing, and before leaving the site, heavy equipment and machinery will be decontaminated by steam cleaning at a designated area. The steam-cleaning area will be designed to contain decontamination wastes and waste waters and can be an HDPE-lined, bermed pad. A pumping system will be used to convey decontaminated water from the pad to drums.

Surface casings may be steam cleaned in the field if they are exposed to contamination at the site prior to use.

B. Downhole Drilling Tools

Downhole tools will be steam cleaned before the onset of drilling, prior to drilling through permanent isolation casing, between boreholes, and prior to leaving the site. This will include, but is not limited to, rods, split spoons or similar samplers, coring equipment, augers, and casing.

Before the use of a sampling device such as a split-spoon sampler for the collection of a soil sample for physical characterization, the sampler shall be cleaned by scrubbing with a detergent solution followed by a potable water rinse.

Before the use of a sampling device such as a split-spoon sampler for the collection of a soil sample for chemical analysis, the sampler shall be decontaminated following the procedures outlined in the following subsection.

C. Field Analytical Equipment

1. Water Level Indicators

Water level indicators that consist of a probe that comes into contact with the groundwater must be decontaminated using the following steps:

- a. Rinse with tap water
- b. Rinse with de-ionized water
- c. Solvent rinse with isopropanol
- d. Rinse with de-ionized water

2. Probes

Probes, for example, pH or specific ion electrodes, geophysical probes, or thermometers that would come in direct contact with the sample, will be decontaminated using the procedures specified above unless manufacturer's instructions indicate otherwise. For probes that make no direct contact, for example, OVM equipment, the probe will be wiped with clean paper-towels or cloth wetted with isopropanol.

IV. Attachments

None.

V. Key Checks and Preventative Maintenance

- The effectiveness of field cleaning procedures may be monitored by rinsing decontaminated equipment with organic-free water and submitting the rinse water in standard sample containers for analysis.

Disposal of Waste Fluids and Solids

I. Purpose and Scope

This SOP describes the procedures used to dispose of hazardous fluid and solid materials generated as a result of the site operations. This SOP does not provide guidance on the details of Department of Transportation regulations pertaining to the transport of hazardous wastes; the appropriate Code of Federal Regulations (49 CFR 171 through 177) should be referenced. Also, the site investigation-derived waste management plan should be consulted for additional information and should take precedence over this SOP.

II. Equipment and Materials

A. Fluids

- DOT-approved 55-gallon steel drums or Baker® Tanks
- Tools for securing drum lids
- Funnel for transferring liquid into drum
- Labels
- Paint Pens
- Marking pen for appropriate labels
- Seals for 55-gallon steel drums

B. Solids

- DOT-approved 55-gallon steel drums or rolloffs
- Tools for securing drum lids
- Paint Pens
- Plastic sheets
- Labels
- Marking pen for appropriate labels

III. Procedures and Guidelines

A. Methodology

Clean, empty drums or rolloffs or Baker® Tanks will be brought to the site by the drilling subcontractor for soil and groundwater collection and storage. The empty drums will be located at the field staging area and moved to drilling locations as required. The drums will be filled with the drilling and well installation wastes, capped, sealed, and moved to the onsite drum storage area by the drilling subcontractor. The full drums will separate types of wastes by media. The drums will

be labeled as they are filled in the field and labels indicating that the contents are pending analysis affixed.

The drum contents will be sampled to determine the disposal requirements of the drilling wastes. The drum sampling will be accomplished through the collection and submittal of composite samples, one sample per 10 drums (check with disposal facility to determine sample frequency) containing the same media. Similar compositing will be performed in each rolloff to obtain a representative sample. The compositing of the sample will be accomplished by collecting a specific volume of the material in each drum into a large sample container. When samples from each of the drums being sampled in a single compositing are collected, the sample will be submitted for TCLP, ignitability, corrosivity, and reactivity analysis. The analysis will be used to determine if drilling wastes are covered by land disposal restrictions.

If rolloffs are used, compositing and sampling of soil will comply with applicable state and federal regulations.

B. Labels

Drums and other containers used for storing wastes from drilling operations will be labeled when accumulation in the container begins. Labels will include the following minimum information:

- Container number
- Container contents
- Origin (source area including individuals wells, piezometers, and soil borings)
- Date that accumulation began
- Date that accumulation ended
- Generator Contact Information
- When laboratory results are received, drum labels will be completed or revised to indicate the hazardous waste constituents in compliance with Title 40 of the Code of Federal Regulations, Part 262, Subpart C if the results indicate hazardous waste or labeled as non-hazardous if applicable.

C. Fluids

Drilling fluids generated during soil boring and groundwater discharged during development and purging of the monitoring wells will be collected in 55-gallon, closed-top drums. When a drum is filled, the bung will be secured tightly. Fluids may also be transferred to Baker® Tanks after being temporarily contained in drums to minimize the amount of drums used.

When development and purging is completed, the water will be tested for appropriate hazardous waste constituents. Compositing and sampling of fluids will comply with applicable state and federal regulations.

D. Solids

The soil cuttings from well and boring drilling will constitute a large portion of the solids to be disposed of.

The solid waste stream also will include plastic sheeting used for decontamination pads, Tyveks, disposable sampling materials, and any other disposable material used during the field operations that appears to be contaminated. These materials will be placed in designated drums.

E. Storage and Disposal

The wastes generated at the site at individual locations will be transported to the drum storage area by the drilling services subcontractor. Drums should be stored on pallets on plastic sheeting with a short berm wall (hay bales or 2 x 4 planks or equivalent) to capture small spills.

Waste solid materials that contain hazardous constituents will be disposed of at an offsite location in a manner consistent with applicable solid waste, hazardous waste, and water quality regulations. Transport and disposal will be performed by a commercial firm under subcontract.

The liquid wastes meeting acceptable levels of discharge contamination may be disposed of through the sanitary sewer system at the site. However, prior to disposal to the sanitary sewer system, approval and contract arrangements will be made with the appropriate authorities. Wastes exceeding acceptable levels for disposal through the sanitary sewer system will be disposed of through contract with a commercial transport and disposal firm.

IV. Attachments

None.

V. Key Checks and Preventative Maintenance

- Check that representative samples of the containerized materials are obtained.
- Be sure that all state and federal regulations are considered when classifying waste for disposal.

Appendix B
Laboratory DoD ELAP Certifications

Scope of Accreditation For EMAX Laboratories, Inc.

1835 W 205th Street
Torrance, CA 90501
Kenette Pimentel
310-618-8889

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 **EMAX Laboratories, Inc.** to perform the following tests:

Accreditation granted through: **January 10, 2014**

Testing - Environmental

Non-Potable Water		
Technology	Method	Analyte
GC	AK101	GRO
GC	AK102	DRO
GC	AK103	RRO
GFAA	CA 939M	Organo Lead
Platinum Electrode	EPA 120.1	Specific Conductance
Titrimetric	EPA 130.2	Hardness
Electrode	EPA 150.1	pH
Gravimetric	EPA 160.1	TDS
Gravimetric	EPA 160.2	TSS
Gravimetric	EPA 160.3	Total Residue
Turbidimetric	EPA 180.1	Turbidity
ICP	EPA 200.7	Aluminum
ICP	EPA 200.7	Antimony
ICP	EPA 200.7	Arsenic
ICP	EPA 200.7	Barium
ICP	EPA 200.7	Beryllium
ICP	EPA 200.7	Boron
ICP	EPA 200.7	Cadmium
ICP	EPA 200.7	Calcium
ICP	EPA 200.7	Chromium
ICP	EPA 200.7	Cobalt
ICP	EPA 200.7	Copper
ICP	EPA 200.7	Iron

Non-Potable Water		
Technology	Method	Analyte
ICP	EPA 200.7	Lead
ICP	EPA 200.7	Magnesium
ICP	EPA 200.7	Manganese
ICP	EPA 200.7	Molybdenum
ICP	EPA 200.7	Nickel
ICP	EPA 200.7	Potassium
ICP	EPA 200.7	Selenium
ICP	EPA 200.7	Silver
ICP	EPA 200.7	Sodium
ICP	EPA 200.7	Strontium
ICP	EPA 200.7	Thallium
ICP	EPA 200.7	Tin
ICP	EPA 200.7	Titanium
ICP	EPA 200.7	Vanadium
ICP	EPA 200.7	Zinc
ICP-MS	EPA 200.8	Aluminum
ICP-MS	EPA 200.8	Antimony
ICP-MS	EPA 200.8	Arsenic
ICP-MS	EPA 200.8	Barium
ICP-MS	EPA 200.8	Beryllium
ICP-MS	EPA 200.8	Boron
ICP-MS	EPA 200.8	Cadmium
ICP-MS	EPA 200.8	Calcium
ICP-MS	EPA 200.8	Chromium
ICP-MS	EPA 200.8	Cobalt
ICP-MS	EPA 200.8	Copper
ICP-MS	EPA 200.8	Iron
ICP-MS	EPA 200.8	Lead
ICP-MS	EPA 200.8	Lithium
ICP-MS	EPA 200.8	Magnesium
ICP-MS	EPA 200.8	Manganese
ICP-MS	EPA 200.8	Molybdenum
ICP-MS	EPA 200.8	Nickel
ICP-MS	EPA 200.8	Potassium
ICP-MS	EPA 200.8	Selenium
ICP-MS	EPA 200.8	Silver
ICP-MS	EPA 200.8	Sodium
ICP-MS	EPA 200.8	Strontium
ICP-MS	EPA 200.8	Thallium
ICP-MS	EPA 200.8	Tin
ICP-MS	EPA 200.8	Titanium
ICP-MS	EPA 200.8	Uranium
ICP-MS	EPA 200.8	Vanadium

Non-Potable Water		
Technology	Method	Analyte
ICP-MS	EPA 200.8	Zinc
IC	EPA 218.6	Hexavalent Chromium
COLD VAPOR	EPA 245.1	Mercury
IC	EPA 300.0	Fluoride
IC	EPA 300.0	Chloride
IC	EPA 300.0	Nitrite
IC	EPA 300.0	Bromide
IC	EPA 300.0	Nitrate
IC	EPA 300.0	Phosphate
IC	EPA 300.0	Sulfate
IC	EPA 300.0	Bromate
IC	EPA 300M	Lactate
IC	EPA 300M	Acetate
IC	EPA 300M	Propionate
IC	EPA 300M	Butyrate
IC	EPA 300M	Pyruvate
IC	EPA 310.1	Alkalinity
IC	EPA 314.0	Perchlorate
Titrimetric	EPA 330.3	Total Residual Chlorine
Spectrometric	EPA 352.1	Nitrate-N
Spectrometric	EPA 353.3	Nitrate-N
Spectrometric	EPA 354.1	Nitrite-N
Spectrometric	EPA 365.2	Ortho-phosphate
Spectrometric	EPA 335.2	Cyanide
Spectrometric	EPA 350.2	Ammonia
Spectrometric	EPA 351.3	TKN
Spectrometric	EPA 365.2	Phosphorus
Spectrometric	EPA 370.1	Silica
Titrimetric	EPA 376.1	Sulfide
Spectrometric	EPA 376.2	Sulfide
Electrode	EPA 405.1	BOD
Spectrometric	EPA 410.4	COD
Combustion-IR	EPA 415.1	TOC
Spectrometric	EPA 420.1	Phenols
Spectrometric	EPA 425.1	MBAS
GC	EPA 504.1	DBCP
GC	EPA 504.1	EDB
GC	EPA 608	Aldrin
GC	EPA 608	alpha-BHC
GC	EPA 608	beta-BHC
GC	EPA 608	delta-BHC
GC	EPA 608	gamma-BHC (Lindane)
GC	EPA 608	DDD (4,4)



Non-Potable Water		
Technology	Method	Analyte
GC	EPA 608	DDE (4,4)
GC	EPA 608	DDT (4,4)
GC	EPA 608	Dieldrin
GC	EPA 608	Endosulfan I
GC	EPA 608	Endosulfan II
GC	EPA 608	Endosulfan sulfate
GC	EPA 608	Endrin
GC	EPA 608	Endrin Aldehyde
GC	EPA 608	Heptachlor
GC	EPA 608	Heptachlor epoxide
GC	EPA 608	Methoxychlor
GC	EPA 608	alpha-Chlordane
GC	EPA 608	gamma-Chlordane
GC	EPA 608	Endrin Ketone
GC	EPA 608	Toxaphene
GC	EPA 608	Technical Chlordane
GC	EPA 608	cis-Nonachlor
GC	EPA 608	DDD (2,4)
GC	EPA 608	DDE (2,4)
GC	EPA 608	DDT (2,4)
GC	EPA 608	Mirex
GC	EPA 608	Oxychlordane
GC	EPA 608	trans-Nonachlor
GC	EPA 608	PCB1016
GC	EPA 608	PCB1221
GC	EPA 608	PCB1232
GC	EPA 608	PCB1242
GC	EPA 608	PCB1248
GC	EPA 608	PCB1254
GC	EPA 608	PCB1260
GC	EPA 608	PCB1262
GC	EPA 608	PCB1268
GC-MS	EPA 624	Acrolein
GC-MS	EPA 624	Acrylonitrile
GC-MS	EPA 624	Benzene
GC-MS	EPA 624	Bromodichloromethane
GC-MS	EPA 624	Bromoform
GC-MS	EPA 624	Bromomethane
GC-MS	EPA 624	Carbon tetrachloride
GC-MS	EPA 624	Chlorobenzene
GC-MS	EPA 624	2-Chloroethyl vinyl ether
GC-MS	EPA 624	Chloroethane
GC-MS	EPA 624	Chloroform

Non-Potable Water		
Technology	Method	Analyte
GC-MS	EPA 624	Chloromethane
GC-MS	EPA 624	Dibromochloromethane
GC-MS	EPA 624	1,1-Dichloroethane
GC-MS	EPA 624	1,2-Dichloroethane
GC-MS	EPA 624	1,2-Dichlorobenzene
GC-MS	EPA 624	1,3-Dichlorobenzene
GC-MS	EPA 624	1,4-Dichlorobenzene
GC-MS	EPA 624	Dichlorodifluoromethane
GC-MS	EPA 624	1,1-Dichloroethene
GC-MS	EPA 624	cis-1,2-Dichloroethene
GC-MS	EPA 624	trans-1,2-Dichloroethene
GC-MS	EPA 624	1,2-Dichloropropane
GC-MS	EPA 624	cis-1,3-Dichloropropene
GC-MS	EPA 624	trans-1,3-Dichloropropene
GC-MS	EPA 624	Ethylbenzene
GC-MS	EPA 624	Methylene Chloride
GC-MS	EPA 624	tert-Butyl methyl ether
GC-MS	EPA 624	Styrene
GC-MS	EPA 624	1,1,2,2-Tetrachloroethane
GC-MS	EPA 624	Tetrachloroethene
GC-MS	EPA 624	Toluene
GC-MS	EPA 624	1,1,1-Trichloroethane
GC-MS	EPA 624	1,1,2-Trichloroethane
GC-MS	EPA 624	1,2,4-Trichlorobenzene
GC-MS	EPA 624	Trichloroethene
GC-MS	EPA 624	Trichlorofluoromethane
GC-MS	EPA 624	1,1,2-Trichloro 1,2,2-trifluoroethane
GC-MS	EPA 624	Vinyl Chloride
GC-MS	EPA 624	m-Xylene & p-xylene
GC-MS	EPA 624	o-Xylene
GC-MS	EPA 625	Acenaphthene
GC-MS	EPA 625	Acenaphthylene
GC-MS	EPA 625	Aniline
GC-MS	EPA 625	Anthracene
GC-MS	EPA 625	Azobenzene
GC-MS	EPA 625	Benzidine
GC-MS	EPA 625	Benzo(a)anthracene
GC-MS	EPA 625	benzo(a)pyrene
GC-MS	EPA 625	Benzo(b)fluoranthene
GC-MS	EPA 625	Benzo(e)pyrene
GC-MS	EPA 625	Benzo(g,h,i)perylene
GC-MS	EPA 625	Benzo(k)fluoranthene
GC-MS	EPA 625	Benzoic Acid

Non-Potable Water		
Technology	Method	Analyte
GC-MS	EPA 625	Benzyl Alcohol
GC-MS	EPA 625	Biphenyl
GC-MS	EPA 625	bis(2-chloroethoxy)methane
GC-MS	EPA 625	bis(2-chloroethyl)ether
GC-MS	EPA 625	bis(2-chloroisopropyl)ether
GC-MS	EPA 625	bis(2-Ethylhexyl)adipate
GC-MS	EPA 625	bis(2-Ethylhexyl)phthalate
GC-MS	EPA 625	4-Bromophenyl-phenylether
GC-MS	EPA 625	Butylbenzylphthalate
GC-MS	EPA 625	Carbazole
GC-MS	EPA 625	4-Chloro-3-methylphenol
GC-MS	EPA 625	4-Chloroaniline
GC-MS	EPA 625	2-Chloronaphthalene
GC-MS	EPA 625	2-Chlorophenol
GC-MS	EPA 625	4-Chlorophenyl-phenylether
GC-MS	EPA 625	Chrysene
GC-MS	EPA 625	Dibenzo(a,h)anthracene
GC-MS	EPA 625	Dibenzofuran
GC-MS	EPA 625	1,2-Dichlorobenzene
GC-MS	EPA 625	1,3-Dichlorobenzene
GC-MS	EPA 625	1,4-Dichlorobenzene
GC-MS	EPA 625	3,3'-Dichlorobenzidine
GC-MS	EPA 625	2,4-Dichlorophenol
GC-MS	EPA 625	Diethylphthalate
GC-MS	EPA 625	2,6-Dimethylnaphthalene
GC-MS	EPA 625	2,4-Dimethylphenol
GC-MS	EPA 625	Dimethylphthalate
GC-MS	EPA 625	Di-n-butylphthalate
GC-MS	EPA 625	4,6-Dinitro-2-methylphenol
GC-MS	EPA 625	2,4-Dinitrophenol
GC-MS	EPA 625	2,4-Dinitrotoluene
GC-MS	EPA 625	2-6-Dinitrotoluene
GC-MS	EPA 625	Di-n-octylphthalate
GC-MS	EPA 625	1,2-Diphenylhydrazine
GC-MS	EPA 625	Fluoranthene
GC-MS	EPA 625	Fluorene
GC-MS	EPA 625	Hexachlorobenzene
GC-MS	EPA 625	Hexachlorobutadiene
GC-MS	EPA 625	Hexachlorocyclopentadiene
GC-MS	EPA 625	Hexachloroethane
GC-MS	EPA 625	Indeno(1,2,3-cd)pyrene
GC-MS	EPA 625	Isophorone
GC-MS	EPA 625	1-Methylnaphthalene

Non-Potable Water		
Technology	Method	Analyte
GC-MS	EPA 625	2-Methylnaphthalene
GC-MS	EPA 625	1-Methylphenanthrene
GC-MS	EPA 625	2-Methylphenol
GC-MS	EPA 625	4-Methylphenol
GC-MS	EPA 625	Naphthalene
GC-MS	EPA 625	2-Nitroaniline
GC-MS	EPA 625	3-Nitroaniline
GC-MS	EPA 625	4-Nitroaniline
GC-MS	EPA 625	Nitrobenzene
GC-MS	EPA 625	2-Nitrophenol
GC-MS	EPA 625	4-Nitrophenol
GC-MS	EPA 625	n-Nitrosodimethylamine
GC-MS	EPA 625	n-Nitroso-di-n-propylamine
GC-MS	EPA 625	n-Nitrosodiphenylamine
GC-MS	EPA 625	Pentachlorophenol
GC-MS	EPA 625	Perylene
GC-MS	EPA 625	Phenanthrene
GC-MS	EPA 625	Phenol
GC-MS	EPA 625	Pyrene
GC-MS	EPA 625	Pyridine
GC-MS	EPA 625	2,3,4,6-Tetrachlorophenol
GC-MS	EPA 625	1,2,4-Trichlorobenzene
GC-MS	EPA 625	2,3,4-Trichlorophenol
GC-MS	EPA 625	2,3,5-Trichlorophenol
GC-MS	EPA 625	2,4,5-Trichlorophenol
GC-MS	EPA 625	2,4,6-Trichlorophenol
GC-MS	EPA 625	2,3,5-Trimethylnaphthalene
Gravimetric	EPA 1664A	Oil & Grease
Pensky-Martens	EPA 1010	Ignitability
ICP	EPA 6010B / 6010C	Aluminum
ICP	EPA 6010B / 6010C	Antimony
ICP	EPA 6010B / 6010C	Arsenic
ICP	EPA 6010B / 6010C	Barium
ICP	EPA 6010B / 6010C	Beryllium
ICP	EPA 6010B / 6010C	Boron
ICP	EPA 6010B / 6010C	Cadmium
ICP	EPA 6010B / 6010C	Calcium
ICP	EPA 6010B / 6010C	Chromium
ICP	EPA 6010B / 6010C	Cobalt
ICP	EPA 6010B / 6010C	Copper
ICP	EPA 6010B / 6010C	Iron
ICP	EPA 6010B / 6010C	Lead
ICP	EPA 6010B / 6010C	Magnesium

Non-Potable Water		
Technology	Method	Analyte
ICP	EPA 6010B / 6010C	Manganese
ICP	EPA 6010B / 6010C	Molybdenum
ICP	EPA 6010B / 6010C	Nickel
ICP	EPA 6010B / 6010C	Potassium
ICP	EPA 6010B / 6010C	Selenium
ICP	EPA 6010B / 6010C	Silver
ICP	EPA 6010B / 6010C	Sodium
ICP	EPA 6010B / 6010C	Strontium
ICP	EPA 6010B / 6010C	Thallium
ICP	EPA 6010B / 6010C	Tin
ICP	EPA 6010B / 6010C	Titanium
ICP	EPA 6010B / 6010C	Vanadium
ICP	EPA 6010B / 6010C	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	Uranium
ICP-MS	EPA 6020A	Vanadium
ICP-MS	EPA 6020A	Zinc
HPLC-MS	EPA 6850	Perchlorate
Spectrometric	EPA 7196A	Hex. Chromium

Non-Potable Water		
Technology	Method	Analyte
IC	EPA 7199	Hex. Chromium
Cold-Vapor	EPA 7470A / 7471A /7471B	Mercury
GC	EPA 8015B / 8015C	Gasoline
GC	EPA 8015B / 8015C	Diesel
GC	EPA 8015B / 8015C	Motor Oil
GC	EPA 8015B / 8015C	Diethylene Glycol
GC	EPA 8015B / 8015C	Ethanol
GC	EPA 8015B / 8015C	Ethylene Glycol
GC	EPA 8015B / 8015C	Isopropanol
GC	EPA 8015B / 8015C	JP4
GC	EPA 8015B / 8015C	Methanol
GC	EPA 8015B / 8015C	Propylene Glycol
GC	EPA 8015B / 8015C	JP5
GC	EPA 8081A / 8081B	Aldrin
GC	EPA 8081A / 8081B	alpha-BHC
GC	EPA 8081A / 8081B	beta-BHC
GC	EPA 8081A / 8081B	delta-BHC
GC	EPA 8081A / 8081B	gamma-BHC (Lindane)
GC	EPA 8081A / 8081B	DDD (4,4)
GC	EPA 8081A / 8081B	DDE (4,4)
GC	EPA 8081A / 8081B	DDT (4,4)
GC	EPA 8081A / 8081B	Dieldrin
GC	EPA 8081A / 8081B	Endosulfan I
GC	EPA 8081A / 8081B	Endosulfan II
GC	EPA 8081A / 8081B	Endosulfan sulfate
GC	EPA 8081A / 8081B	Endrin
GC	EPA 8081A / 8081B	Endrin Aldehyde
GC	EPA 8081A / 8081B	Heptachlor
GC	EPA 8081A / 8081B	Heptachlor epoxide
GC	EPA 8081A / 8081B	Methoxychlor
GC	EPA 8081A / 8081B	alpha-Chlordane
GC	EPA 8081A / 8081B	gamma-Chlordane
GC	EPA 8081A / 8081B	Endrin Ketone
GC	EPA 8081A / 8081B	Toxaphene
GC	EPA 8081A / 8081B	Technical Chlordane
GC	EPA 8081A / 8081B	cis-Nonachlor
GC	EPA 8081A / 8081B	DDD (2,4)
GC	EPA 8081A / 8081B	DDE (2,4)
GC	EPA 8081A / 8081B	DDT (2,4)
GC	EPA 8081A / 8081B	Mirex
GC	EPA 8081A / 8081B	Oxychlordane
GC	EPA 8081A / 8081B	trans-Nonachlor
GC	EPA 8082 / 8082A	PCB1016

Non-Potable Water		
Technology	Method	Analyte
GC	EPA 8082 / 8082A	PCB1221
GC	EPA 8082 / 8082A	PCB1232
GC	EPA 8082 / 8082A	PCB1242
GC	EPA 8082 / 8082A	PCB1248
GC	EPA 8082 / 8082A	PCB1254
GC	EPA 8082 / 8082A	PCB1260
GC	EPA 8082 / 8082A	PCB1262
GC	EPA 8082 / 8082A	PCB1268
GC	EPA 8082 / 8082A	PCB 8
GC	EPA 8082 / 8082A	PCB 18
GC	EPA 8082 / 8082A	PCB 28
GC	EPA 8082 / 8082A	PCB 44
GC	EPA 8082 / 8082A	PCB 52
GC	EPA 8082 / 8082A	PCB 66
GC	EPA 8082 / 8082A	PCB 77
GC	EPA 8082 / 8082A	PCB 81
GC	EPA 8082 / 8082A	PCB 101
GC	EPA 8082 / 8082A	PCB 105
GC	EPA 8082 / 8082A	PCB 114
GC	EPA 8082 / 8082A	PCB 118
GC	EPA 8082 / 8082A	PCB 123
GC	EPA 8082 / 8082A	PCB 126
GC	EPA 8082 / 8082A	PCB 128
GC	EPA 8082 / 8082A	PCB 138
GC	EPA 8082 / 8082A	PCB 153
GC	EPA 8082 / 8082A	PCB 156
GC	EPA 8082 / 8082A	PCB 157
GC	EPA 8082 / 8082A	PCB 167
GC	EPA 8082 / 8082A	PCB 169
GC	EPA 8082 / 8082A	PCB 170
GC	EPA 8082 / 8082A	PCB 180
GC	EPA 8082 / 8082A	PCB 187
GC	EPA 8082 / 8082A	PCB 189
GC	EPA 8082 / 8082A	PCB 195
GC	EPA 8082 / 8082A	PCB 206
GC	EPA 8082 / 8082A	PCB 209
GC	EPA 8082 / 8082A	PCB 110
GC	EPA 8141A / 8141B	Azinphos-methyl
GC	EPA 8141A / 8141B	Bolstar
GC	EPA 8141A / 8141B	Chlorpyrifos
GC	EPA 8141A / 8141B	Coumaphos
GC	EPA 8141A / 8141B	Demeton
GC	EPA 8141A / 8141B	Diazinon

Non-Potable Water		
Technology	Method	Analyte
GC	EPA 8141A / 8141B	Dichlorvos
GC	EPA 8141A / 8141B	Disulfoton
GC	EPA 8141A / 8141B	Ethoprop
GC	EPA 8141A / 8141B	Fensulfothion
GC	EPA 8141A / 8141B	Fenthion
GC	EPA 8141A / 8141B	Merphos
GC	EPA 8141A / 8141B	Mevinphos
GC	EPA 8141A / 8141B	Naled
GC	EPA 8141A / 8141B	Methyl Parathion
GC	EPA 8141A / 8141B	Phorate
GC	EPA 8141A / 8141B	Ronnel
GC	EPA 8141A / 8141B	Stirophos
GC	EPA 8141A / 8141B	Tokuthion
GC	EPA 8141A / 8141B	Trichloronate
GC	EPA 8141A / 8141B	Dimethoate
GC	EPA 8141A / 8141B	EPN
GC	EPA 8141A / 8141B	Famphur
GC	EPA 8141A / 8141B	Malathion
GC	EPA 8141A / 8141B	Ethyl Parathion
GC	EPA 8141A / 8141B	O,O,O-Triethylphosphorothioate
GC	EPA 8141A / 8141B	Sulfotepp
GC	EPA 8141A / 8141B	Thionazin
GC	EPA 8141A / 8141B	Tributyl Phosphate
GC	EPA 8151A	Acifluorfen
GC	EPA 8151A	Bentazon
GC	EPA 8151A	Chloramben
GC	EPA 8151A	2,4-D
GC	EPA 8151A	2,4-DB
GC	EPA 8151A	Dacthal
GC	EPA 8151A	Dalapon
GC	EPA 8151A	Dicamba
GC	EPA 8151A	3,5 Dichlorobenzoic
GC	EPA 8151A	Dichlorprop
GC	EPA 8151A	Dinoseb
GC	EPA 8151A	MCPA
GC	EPA 8151A	MCPP
GC	EPA 8151A	4-Nitrophenol
GC	EPA 8151A	Pentachlorophenol
GC	EPA 8151A	Picloram
GC	EPA 8151A	Silvex
GC	EPA 8151A	2,4,5-T
GC-MS	EPA 8260B / 8260C	Acetone
GC-MS	EPA 8260B / 8260C	Acrolein

Non-Potable Water		
Technology	Method	Analyte
GC-MS	EPA 8260B / 8260C	Acrylonitrile
GC-MS	EPA 8260B / 8260C	Benzene
GC-MS	EPA 8260B / 8260C	Bromobenzene
GC-MS	EPA 8260B / 8260C	Bromochloromethane
GC-MS	EPA 8260B / 8260C	Bromodichloromethane
GC-MS	EPA 8260B / 8260C	Bromoform
GC-MS	EPA 8260B / 8260C	Bromomethane
GC-MS	EPA 8260B / 8260C	tert-Butyl alcohol
GC-MS	EPA 8260B / 8260C	2-Butanone (MEK)
GC-MS	EPA 8260B / 8260C	n-Butylbenzene
GC-MS	EPA 8260B / 8260C	sec-Butylbenzene
GC-MS	EPA 8260B / 8260C	tert-Butylbenzene
GC-MS	EPA 8260B / 8260C	Carbon disulfide
GC-MS	EPA 8260B / 8260C	Carbon tetrachloride
GC-MS	EPA 8260B / 8260C	Chlorobenzene
GC-MS	EPA 8260B / 8260C	2-Chloroethyl vinyl ether
GC-MS	EPA 8260B / 8260C	Chloroethane
GC-MS	EPA 8260B / 8260C	Chloroform
GC-MS	EPA 8260B / 8260C	1-Chlorohexane
GC-MS	EPA 8260B / 8260C	Chloromethane
GC-MS	EPA 8260B / 8260C	2-Chlorotoluene
GC-MS	EPA 8260B / 8260C	4-Chlorotoluene
GC-MS	EPA 8260B / 8260C	Isopropyl ether (DIPE)
GC-MS	EPA 8260B / 8260C	Dibromochloromethane
GC-MS	EPA 8260B / 8260C	1,2-Dibromo-3-chloropropane
GC-MS	EPA 8260B / 8260C	1,2-Dibromoethane
GC-MS	EPA 8260B / 8260C	Dibromomethane
GC-MS	EPA 8260B / 8260C	1,1-Dichloroethane
GC-MS	EPA 8260B / 8260C	1,2-Dichloroethane
GC-MS	EPA 8260B / 8260C	1,2-Dichlorobenzene
GC-MS	EPA 8260B / 8260C	1,3-Dichlorobenzene
GC-MS	EPA 8260B / 8260C	trans-1,4-Dichloro-2-Butene
GC-MS	EPA 8260B / 8260C	1,4-Dichlorobenzene
GC-MS	EPA 8260B / 8260C	Dichlorodifluoromethane
GC-MS	EPA 8260B / 8260C	1,1-Dichloroethene
GC-MS	EPA 8260B / 8260C	cis-1,2-Dichloroethene
GC-MS	EPA 8260B / 8260C	trans-1,2-Dichloroethene
GC-MS	EPA 8260B / 8260C	Dichlorofluoromethane
GC-MS	EPA 8260B / 8260C	1,1-Dichloropropene
GC-MS	EPA 8260B / 8260C	1,2-Dichloropropane
GC-MS	EPA 8260B / 8260C	1,3-Dichloropropane
GC-MS	EPA 8260B / 8260C	2,2-Dichloropropane
GC-MS	EPA 8260B / 8260C	cis-1,3-Dichloropropene

Non-Potable Water		
Technology	Method	Analyte
GC-MS	EPA 8260B / 8260C	trans-1,3-Dichloropropene
GC-MS	EPA 8260B / 8260C	tert-Butyl ethyl ether (ETBE)
GC-MS	EPA 8260B / 8260C	Ethyl Methacrylate
GC-MS	EPA 8260B / 8260C	Ethylbenzene
GC-MS	EPA 8260B / 8260C	2-Hexanone (MBK)
GC-MS	EPA 8260B / 8260C	Hexachlorobutadiene
GC-MS	EPA 8260B / 8260C	Iodomethane
GC-MS	EPA 8260B / 8260C	Isopropylbenzene
GC-MS	EPA 8260B / 8260C	p-Isopropyltoluene
GC-MS	EPA 8260B / 8260C	Methylene Chloride
GC-MS	EPA 8260B / 8260C	4-Methyl-2-pentanone (MIBK)
GC-MS	EPA 8260B / 8260C	tert-Butyl methyl ether
GC-MS	EPA 8260B / 8260C	Naphthalene
GC-MS	EPA 8260B / 8260C	n-Propylbenzene
GC-MS	EPA 8260B / 8260C	Styrene
GC-MS	EPA 8260B / 8260C	tert-Amyl methyl ether (TAME)
GC-MS	EPA 8260B / 8260C	1,1,1,2-Tetrachloroethane
GC-MS	EPA 8260B / 8260C	1,1,2,2-Tetrachloroethane
GC-MS	EPA 8260B / 8260C	Tetrachloroethene
GC-MS	EPA 8260B / 8260C	Toluene
GC-MS	EPA 8260B / 8260C	1,1,1-Trichloroethane
GC-MS	EPA 8260B / 8260C	1,1,2-Trichloroethane
GC-MS	EPA 8260B / 8260C	1,2,3-Trichlorobenzene
GC-MS	EPA 8260B / 8260C	1,2,4-Trichlorobenzene
GC-MS	EPA 8260B / 8260C	Trichloroethene
GC-MS	EPA 8260B / 8260C	Trichlorofluoromethane
GC-MS	EPA 8260B / 8260C	1,2,3-Trichloropropane
GC-MS	EPA 8260B / 8260C	1,1,2-Trichloro-1,2,2-trifluoroethane
GC-MS	EPA 8260B / 8260C	1,2,4-Trimethylbenzene
GC-MS	EPA 8260B / 8260C	1,3,5-Trimethylbenzene
GC-MS	EPA 8260B / 8260C	Vinyl Acetate
GC-MS	EPA 8260B / 8260C	Vinyl Chloride
GC-MS	EPA 8260B / 8260C	m-Xylene & p-xylene
GC-MS	EPA 8260B / 8260C	o-Xylene
GC-MS	EPA 8260B / 8260C	2-Butanol
GC-MS	EPA 8260B / 8260C	Cyclohexane
GC-MS	EPA 8260B / 8260C	1,4-Dioxane
GC-MS	EPA 8260B / 8260C	2-Chloro-1,1,1-trifluoroethane
GC-MS	EPA 8260B / 8260C	Chlorotrifluoroethylene
GC-MS	EPA 8260B / 8260C	cis-1,4-Dichloro-2-butene
GC-MS	EPA 8260B / 8260C	Ethanol
GC-MS	EPA 8260B / 8260C	Ethyl Methacrylate
GC-MS	EPA 8260B / 8260C	Isobutyl Alcohol

Non-Potable Water		
Technology	Method	Analyte
GC-MS	EPA 8260B / 8260C	Methacrylonitrile
GC-MS	EPA 8260B / 8260C	Methyl Methacrylate
GC-MS	EPA 8260B / 8260C	Pentachloroethane
GC-MS	EPA 8260B / 8260C	Propionitrile
GC-MS	EPA 8260B / 8260C	Sec-Propyl alcohol
GC-MS	EPA 8260B / 8260C	Tetrahydrofuran
GC-MS	EPA 8260B / 8260C	trans-1,4-Dichloro-2-butene
GC-MS	EPA 8260B / 8260C SIM	Benzene
GC-MS	EPA 8260B / 8260C SIM	Carbon tetrachloride
GC-MS	EPA 8260B / 8260C SIM	Chloroform
GC-MS	EPA 8260B / 8260C SIM	Chloromethane
GC-MS	EPA 8260B / 8260C SIM	1,2-Dibromo-3-chloropropane
GC-MS	EPA 8260B / 8260C SIM	1,2-Dibromoethane
GC-MS	EPA 8260B / 8260C SIM	1,2-Dichloroethane
GC-MS	EPA 8260B / 8260C SIM	1,1-Dichloroethene
GC-MS	EPA 8260B / 8260C SIM	cis-1,2-Dichloroethene
GC-MS	EPA 8260B / 8260C SIM	trans-1,2-Dichloroethene
GC-MS	EPA 8260B / 8260C SIM	1,1,2,2-Tetrachloroethane
GC-MS	EPA 8260B / 8260C SIM	Tetrachloroethene
GC-MS	EPA 8260B / 8260C SIM	1,1,1-Trichloroethane
GC-MS	EPA 8260B / 8260C SIM	1,1,2-Trichloroethane
GC-MS	EPA 8260B / 8260C SIM	Trichloroethene
GC-MS	EPA 8260B / 8260C SIM	1,2,3-Trichloropropane
GC-MS	EPA 8260B / 8260C SIM	Vinyl Chloride
GC-MS	EPA 8260B / 8260C SIM	1,4-Dioxane
GC-MS	EPA 8270C / 8270D	Acenaphthene
GC-MS	EPA 8270C / 8270D	Acenaphthylene
GC-MS	EPA 8270C / 8270D	Aniline
GC-MS	EPA 8270C / 8270D	Anthracene
GC-MS	EPA 8270C / 8270D	Azobenzene
GC-MS	EPA 8270C / 8270D	Benzidine
GC-MS	EPA 8270C / 8270D	Benzo(a)anthracene
GC-MS	EPA 8270C / 8270D	benzo(a)pyrene
GC-MS	EPA 8270C / 8270D	Benzo(b)fluoranthene
GC-MS	EPA 8270C / 8270D	Benzo(e)pyrene
GC-MS	EPA 8270C / 8270D	Benzo(g,h,i)perylene
GC-MS	EPA 8270C / 8270D	Benzo(k)fluoranthene
GC-MS	EPA 8270C / 8270D	Benzoic Acid
GC-MS	EPA 8270C / 8270D	Benzyl Alcohol
GC-MS	EPA 8270C / 8270D	Biphenyl
GC-MS	EPA 8270C / 8270D	bis(2-chloroethoxy)methane
GC-MS	EPA 8270C / 8270D	bis(2-chloroethyl)ether
GC-MS	EPA 8270C / 8270D	bis(2-chloroisopropyl)ether

Non-Potable Water		
Technology	Method	Analyte
GC-MS	EPA 8270C / 8270D	bis(2-Ethylhexyl)adipate
GC-MS	EPA 8270C / 8270D	bis(2-Ethylhexyl)phthalate
GC-MS	EPA 8270C / 8270D	4-Bromophenyl-phenylether
GC-MS	EPA 8270C / 8270D	Butylbenzylphthalate
GC-MS	EPA 8270C / 8270D	Carbazole
GC-MS	EPA 8270C / 8270D	4-Chloro-3-methylphenol
GC-MS	EPA 8270C / 8270D	4-Chloroaniline
GC-MS	EPA 8270C / 8270D	2-Chloronaphthalene
GC-MS	EPA 8270C / 8270D	2-Chlorophenol
GC-MS	EPA 8270C / 8270D	4-Chlorophenyl-phenylether
GC-MS	EPA 8270C / 8270D	Chrysene
GC-MS	EPA 8270C / 8270D	Dibenzo(a,h)anthracene
GC-MS	EPA 8270C / 8270D	Dibenzofuran
GC-MS	EPA 8270C / 8270D	1,2-Dichlorobenzene
GC-MS	EPA 8270C / 8270D	1,3-Dichlorobenzene
GC-MS	EPA 8270C / 8270D	1,4-Dichlorobenzene
GC-MS	EPA 8270C / 8270D	3,3'-Dichlorobenzidine
GC-MS	EPA 8270C / 8270D	2,4-Dichlorophenol
GC-MS	EPA 8270C / 8270D	Diethylphthalate
GC-MS	EPA 8270C / 8270D	2,6-Dimethylnaphthalene
GC-MS	EPA 8270C / 8270D	2,4-Dimethylphenol
GC-MS	EPA 8270C / 8270D	Dimethylphthalate
GC-MS	EPA 8270C / 8270D	Di-n-butylphthalate
GC-MS	EPA 8270C / 8270D	4,6-Dinitro-2-methylphenol
GC-MS	EPA 8270C / 8270D	2,4-Dinitrophenol
GC-MS	EPA 8270C / 8270D	2,4-Dinitrotoluene
GC-MS	EPA 8270C / 8270D	2-6-Dinitrotoluene
GC-MS	EPA 8270C / 8270D	Di-n-octylphthalate
GC-MS	EPA 8270C / 8270D	Fluoranthene
GC-MS	EPA 8270C / 8270D	Fluorene
GC-MS	EPA 8270C / 8270D	Hexachlorobenzene
GC-MS	EPA 8270C / 8270D	Hexachlorobutadiene
GC-MS	EPA 8270C / 8270D	Hexachlorocyclopentadiene
GC-MS	EPA 8270C / 8270D	Hexachloroethane
GC-MS	EPA 8270C / 8270D	Indeno(1,2,3-cd)pyrene
GC-MS	EPA 8270C / 8270D	Isophorone
GC-MS	EPA 8270C / 8270D	1-Methylnaphthalene
GC-MS	EPA 8270C / 8270D	2-Methylnaphthalene
GC-MS	EPA 8270C / 8270D	1-Methylphenanthrene
GC-MS	EPA 8270C / 8270D	2-Methylphenol
GC-MS	EPA 8270C / 8270D	4-Methylphenol
GC-MS	EPA 8270C / 8270D	Naphthalene
GC-MS	EPA 8270C / 8270D	2-Nitroaniline

Non-Potable Water		
Technology	Method	Analyte
GC-MS	EPA 8270C / 8270D	3-Nitroaniline
GC-MS	EPA 8270C / 8270D	4-Nitroaniline
GC-MS	EPA 8270C / 8270D	Nitrobenzene
GC-MS	EPA 8270C / 8270D	2-Nitrophenol
GC-MS	EPA 8270C / 8270D	4-Nitrophenol
GC-MS	EPA 8270C / 8270D	n-Nitrosodimethylamine
GC-MS	EPA 8270C / 8270D	n-Nitroso-di-n-propylamine
GC-MS	EPA 8270C / 8270D	n-Nitrosodiphenylamine
GC-MS	EPA 8270C / 8270D	Pentachlorophenol
GC-MS	EPA 8270C / 8270D	Perylene
GC-MS	EPA 8270C / 8270D	Phenanthrene
GC-MS	EPA 8270C / 8270D	Phenol
GC-MS	EPA 8270C / 8270D	Pyrene
GC-MS	EPA 8270C / 8270D	Pyridine
GC-MS	EPA 8270C / 8270D	2,3,4,6-Tetrachlorophenol
GC-MS	EPA 8270C / 8270D	1,2,4-Trichlorobenzene
GC-MS	EPA 8270C / 8270D	2,3,4-Trichlorophenol
GC-MS	EPA 8270C / 8270D	2,3,5-Trichlorophenol
GC-MS	EPA 8270C / 8270D	2,4,5-Trichlorophenol
GC-MS	EPA 8270C / 8270D	2,4,6-Trichlorophenol
GC-MS	EPA 8270C / 8270D	2,3,5-Trimethylnaphthalene
GC-MS	EPA 8270C / 8270D	1,2,4,5-Tetrachlorobenzene
GC-MS	EPA 8270C / 8270D	1,3,5-Trinitrobenzene
GC-MS	EPA 8270C / 8270D	1,3-Dinitrobenzene
GC-MS	EPA 8270C / 8270D	1,4-Dioxane
GC-MS	EPA 8270C / 8270D	1,4-Naphthoquinone
GC-MS	EPA 8270C / 8270D	1-Chloronaphthalene
GC-MS	EPA 8270C / 8270D	1-Naphthylamine
GC-MS	EPA 8270C / 8270D	2,6-Dichlorophenol
GC-MS	EPA 8270C / 8270D	2-acetylaminofluorene
GC-MS	EPA 8270C / 8270D	2-Naphthylamine
GC-MS	EPA 8270C / 8270D	2-Picoline
GC-MS	EPA 8270C / 8270D	3,3-Dimethylbenzidine
GC-MS	EPA 8270C / 8270D	3,4-Dimethylphenol
GC-MS	EPA 8270C / 8270D	3,5-Dimethylphenol
GC-MS	EPA 8270C / 8270D	3,5-Dimethylphenol
GC-MS	EPA 8270C / 8270D	3-Methylcholanthrene
GC-MS	EPA 8270C / 8270D	4-Aminobiphenyl
GC-MS	EPA 8270C / 8270D	4-Nitroquinoline-N-oxide
GC-MS	EPA 8270C / 8270D	5-Nitro-o-toluidine
GC-MS	EPA 8270C / 8270D	7,12-Dimethylben(a)anthracene
GC-MS	EPA 8270C / 8270D	a,a-dimethylphenethylamine
GC-MS	EPA 8270C / 8270D	Acetophenone

Non-Potable Water		
Technology	Method	Analyte
GC-MS	EPA 8270C / 8270D	Aramite
GC-MS	EPA 8270C / 8270D	Atrazine
GC-MS	EPA 8270C / 8270D	Biphenyl
GC-MS	EPA 8270C / 8270D	Chlorobenzilate
GC-MS	EPA 8270C / 8270D	Diallate
GC-MS	EPA 8270C / 8270D	Dibenzo(a,j)acridine
GC-MS	EPA 8270C / 8270D	Dimethoate
GC-MS	EPA 8270C / 8270D	Dinoseb
GC-MS	EPA 8270C / 8270D	Diphenyl ether
GC-MS	EPA 8270C / 8270D	Disulfoton
GC-MS	EPA 8270C / 8270D	Ethyl methacrylate
GC-MS	EPA 8270C / 8270D	Ethyl methanesulfonate
GC-MS	EPA 8270C / 8270D	Ethyl parathion
GC-MS	EPA 8270C / 8270D	Famphur
GC-MS	EPA 8270C / 8270D	Hexachlorophene
GC-MS	EPA 8270C / 8270D	Hexachloropropene
GC-MS	EPA 8270C / 8270D	Isodrin
GC-MS	EPA 8270C / 8270D	Isosafrole
GC-MS	EPA 8270C / 8270D	kepone
GC-MS	EPA 8270C / 8270D	Methapyrilene
GC-MS	EPA 8270C / 8270D	Methyl methanesulfonate
GC-MS	EPA 8270C / 8270D	Methyl parathion
GC-MS	EPA 8270C / 8270D	N-nitrosodiethylamine
GC-MS	EPA 8270C / 8270D	N-Nitrosodi-n-butylamine
GC-MS	EPA 8270C / 8270D	N-Nitrosomethylethylamine
GC-MS	EPA 8270C / 8270D	N-Nitrosomorpholine
GC-MS	EPA 8270C / 8270D	N-Nitrosopiperdine
GC-MS	EPA 8270C / 8270D	N-Nitrosopyrrolidine
GC-MS	EPA 8270C / 8270D	O,O,O-triethyl phosphorothi
GC-MS	EPA 8270C / 8270D	o-toluidine
GC-MS	EPA 8270C / 8270D	p-Dimethylaminoazobenze
GC-MS	EPA 8270C / 8270D	Pentachlorobenzene
GC-MS	EPA 8270C / 8270D	Pentachloroethane
GC-MS	EPA 8270C / 8270D	Pentachloronitrobenzene
GC-MS	EPA 8270C / 8270D	Phenacetin
GC-MS	EPA 8270C / 8270D	Phorate
GC-MS	EPA 8270C / 8270D	p-phenylenediamine
GC-MS	EPA 8270C / 8270D	Pronamide
GC-MS	EPA 8270C / 8270D	Safrole
GC-MS	EPA 8270C / 8270D	Sulfotepp
GC-MS	EPA 8270C / 8270D	Thionazin
GC-MS	EPA 8270C / 8270D SIM	Acenaphthene
GC-MS	EPA 8270C / 8270D SIM	Acenaphthylene

Non-Potable Water		
Technology	Method	Analyte
GC-MS	EPA 8270C / 8270D SIM	Anthracene
GC-MS	EPA 8270C / 8270D SIM	Azobenzene
GC-MS	EPA 8270C / 8270D SIM	Benzo(a)anthracene
GC-MS	EPA 8270C / 8270D SIM	benzo(a)pyrene
GC-MS	EPA 8270C / 8270D SIM	Benzo(b)fluoranthene
GC-MS	EPA 8270C / 8270D SIM	Benzo(e)pyrene
GC-MS	EPA 8270C / 8270D SIM	Benzo(g,h,i)perylene
GC-MS	EPA 8270C / 8270D SIM	Benzo(k)fluoranthene
GC-MS	EPA 8270C / 8270D SIM	Biphenyl
GC-MS	EPA 8270C / 8270D SIM	bis(2-chloroethyl)ether
GC-MS	EPA 8270C / 8270D SIM	bis(2-Ethylhexyl)phthalate
GC-MS	EPA 8270C / 8270D SIM	Carbazole
GC-MS	EPA 8270C / 8270D SIM	4-Chloro-3-methylphenol
GC-MS	EPA 8270C / 8270D SIM	2-Chlorophenol
GC-MS	EPA 8270C / 8270D SIM	Chrysene
GC-MS	EPA 8270C / 8270D SIM	Dibenzo(a,h)anthracene
GC-MS	EPA 8270C / 8270D SIM	2,4-Dichlorophenol
GC-MS	EPA 8270C / 8270D SIM	2,6-Dimethylnaphthalene
GC-MS	EPA 8270C / 8270D SIM	2,4-Dimethylphenol
GC-MS	EPA 8270C / 8270D SIM	Fluoranthene
GC-MS	EPA 8270C / 8270D SIM	Fluorene
GC-MS	EPA 8270C / 8270D SIM	Hexachlorobenzene
GC-MS	EPA 8270C / 8270D SIM	Indeno(1,2,3-cd)pyrene
GC-MS	EPA 8270C / 8270D SIM	1-Methylnaphthalene
GC-MS	EPA 8270C / 8270D SIM	2-Methylnaphthalene
GC-MS	EPA 8270C / 8270D SIM	1-Methylphenanthrene
GC-MS	EPA 8270C / 8270D SIM	Naphthalene
GC-MS	EPA 8270C / 8270D SIM	n-Nitrosodimethylamine
GC-MS	EPA 8270C / 8270D SIM	n-Nitroso-di-n-propylamine
GC-MS	EPA 8270C / 8270D SIM	Pentachlorophenol
GC-MS	EPA 8270C / 8270D SIM	Perylene
GC-MS	EPA 8270C / 8270D SIM	Phenanthrene
GC-MS	EPA 8270C / 8270D SIM	Phenol
GC-MS	EPA 8270C / 8270D SIM	Pyrene
GC-MS	EPA 8270C / 8270D SIM	2,4,5-Trichlorophenol
GC-MS	EPA 8270C / 8270D SIM	2,4,6-Trichlorophenol
GC-MS	EPA 8270C / 8270D SIM	2,3,5-Trimethylnaphthalene
GC-MS	EPA 8270C / 8270D SIM	1,4-Dioxane
GC-MS	EPA 8270C / 8270D SIM	Butylbenzylphthalate
GC-MS	EPA 8270C / 8270D SIM	Diethylphthalate
GC-MS	EPA 8270C / 8270D SIM	Dimethylphthalate
GC-MS	EPA 8270C / 8270D SIM	Di-n-butylphthalate
GC-MS	EPA 8270C / 8270D SIM	Di-n-octylphthalate

Non-Potable Water		
Technology	Method	Analyte
HPLC	EPA 8310	Acenaphthene
HPLC	EPA 8310	Acenaphthylene
HPLC	EPA 8310	Anthracene
HPLC	EPA 8310	Benzo(a)anthracene
HPLC	EPA 8310	Benzo(a)pyrene
HPLC	EPA 8310	Benzo(b)fluoranthene
HPLC	EPA 8310	Benzo(g,h,i)perylene
HPLC	EPA 8310	Benzo(k)fluoranthene
HPLC	EPA 8310	Chrysene
HPLC	EPA 8310	Dibenzo(a,h)anthracene
HPLC	EPA 8310	Fluoranthene
HPLC	EPA 8310	Fluorene
HPLC	EPA 8310	Indeno(1,2,3-cd)pyrene
HPLC	EPA 8310	1-Methylnaphthalene
HPLC	EPA 8310	2-Methylnaphthalene
HPLC	EPA 8310	Naphthalene
HPLC	EPA 8310	Phenanthrene
HPLC	EPA 8310	Pyrene
HPLC	EPA 8330A	HMX
HPLC	EPA 8330A	RDX
HPLC	EPA 8330A	1,3,5-TNB
HPLC	EPA 8330A	1,3-DNB
HPLC	EPA 8330A	Tetryl
HPLC	EPA 8330A	Nitrobenzene
HPLC	EPA 8330A	2,4,6-TNT
HPLC	EPA 8330A	4-AM-2,6-DNT
HPLC	EPA 8330A	2-AM-4,6-DNT
HPLC	EPA 8330A	2,6-DNT
HPLC	EPA 8330A	2,4-DNT
HPLC	EPA 8330A	2-Nitrotoluene
HPLC	EPA 8330A	4-Nitrotoluene
HPLC	EPA 8330A	3-Nitrotoluene
HPLC	EPA 8330A	3,5-Dinitroaniline
HPLC	EPA 8330A	2,4-Diamino-6-nitrotoluene
HPLC	EPA 8330A	2,6-Diamino-4-nitrotoluene
HPLC	EPA 8330A	3,5-Dinitroaniline
HPLC	EPA 8330A	Picric Acid
HPLC	EPA 8332	Nitroglycerine
HPLC	EPA 8332	PETN
Spectrometric	EPA 9014	Cyanide
Electrode	EPA 9040C	pH
Electrode	EPA 9045D	pH
IC	EPA 9056 / 9056A	Bromate

Non-Potable Water		
Technology	Method	Analyte
IC	EPA 9056 / 9056A	Bromide
IC	EPA 9056 / 9056A	Chloride
IC	EPA 9056 / 9056A	Fluoride
IC	EPA 9056 / 9056A	Nitrate
IC	EPA 9056 / 9056A	Nitrite
IC	EPA 9056 / 9056A	Phosphate
IC	EPA 9056 / 9056A	Sulfate
Combustion-IR	EPA 9060	TOC
Spectrometric	EPA 9065	Phenols
Gravimetric	EPA 9070	Oil & Grease
Gravimetric	EPA 9071B	Oil & Grease
GC	RSK175	Methane
GC	RSK175	Acetylene
GC	RSK175	Ethylene
GC	RSK175	Ethane
GC	RSK175	Propane
GC	RSK175	Carbon dioxide
Spectrometric	SM4500-NH3C	Ammonia
Spectrometric	SM4500-NH3F	Ammonia
Spectrometric	SM4500-NOrgC	TKN
Spectrometric	SM4500-PE	Phosphorus
Turbidimetric	SM 2130B	Turbidity
Titrimetric	SM 2320B	Alkalinity
Titrimetric	SM 2340C	Hardness
Platinum Electrode	SM 2510B	Specific Conductance
Gravimetric	SM 2540C	TDS
Gravimetric	SM 2540D	TSS
Gravimetric	SM 2540B	Total Residue
Combustion-IR	SM5310	TOC
Spectrometric	SM3500-FeD	Ferrous iron
Titrimetric	SM4500-Cl B	Total Residual Chlorine
Spectrometric	SM4500CNE	Cyanide
Spectrometric	SM4500-NO2B	Nitrite-N
Spectrometric	SM4500-NO3E	Nitrate-N
Spectrometric	SM4500PE	Ortho-phosphate
Spectrometric	SM4500-PE(PB5)	Phosphorus
Spectrometric	SM4500-S2D	Sulfide
Titrimetric	SM4500-S2F	Sulfide
Spectrometric	SM4500-SiO2C	Silica
Electrode	SM5210B	BOD
Spectrometric	SM5220B	COD
Combustion-IR	SM 5310B	TOC
Spectrometric	SM5540C	Surfactants (MBAS)

Non-Potable Water		
Technology	Method	Analyte
Distillation	EPA 9010C	Cyanide
MicroDistillation	QuickChem 10-204-00-1-X	Cyanide
ICP/ICP-MS	SM2340B	Hardness
Preparation	Method	Type
Purge & Trap	EPA 5030B	Volatiles Prep
Acid Digestion	EPA 3005A / EPA 3010A / EPA 200.8	Metals Prep
Continuous Liquid-Liquid	EPA 3520C	Organic Extraction
Separatory Funnel	EPA 3510B	Organic Extraction
Waste Dilution	EPA 3580A	Organic Extraction
TCLP	EPA 1311	Leaching
SPLP	EPA 1312	Leaching

Drinking Water		
Technology	Method	Analyte
Platinum Electrode	EPA 120.1	Specific Conductance
Electrode	EPA 150.1	pH
Gravimetric	EPA 160.1	TDS
Gravimetric	EPA 160.2	TSS
Gravimetric	EPA 160.3	Total Residue
ICP-MS	EPA 200.8	Aluminum
ICP-MS	EPA 200.8	Antimony
ICP-MS	EPA 200.8	Arsenic
ICP-MS	EPA 200.8	Barium
ICP-MS	EPA 200.8	Beryllium
ICP-MS	EPA 200.8	Boron
ICP-MS	EPA 200.8	Cadmium
ICP-MS	EPA 200.8	Calcium
ICP-MS	EPA 200.8	Chromium
ICP-MS	EPA 200.8	Cobalt
ICP-MS	EPA 200.8	Copper
ICP-MS	EPA 200.8	Iron
ICP-MS	EPA 200.8	Lithium
ICP-MS	EPA 200.8	Lead
ICP-MS	EPA 200.8	Magnesium
ICP-MS	EPA 200.8	Manganese
ICP-MS	EPA 200.8	Molybdenum
ICP-MS	EPA 200.8	Nickel
ICP-MS	EPA 200.8	Potassium
ICP-MS	EPA 200.8	Selenium

Drinking Water		
Technology	Method	Analyte
ICP-MS	EPA 200.8	Silver
ICP-MS	EPA 200.8	Sodium
ICP-MS	EPA 200.8	Strontium
ICP-MS	EPA 200.8	Thallium
ICP-MS	EPA 200.8	Tin
ICP-MS	EPA 200.8	Titanium
ICP-MS	EPA 200.8	Uranium
ICP-MS	EPA 200.8	Vanadium
ICP-MS	EPA 200.8	Zinc
IC	EPA 218.6	Hexavalent Chromium
Cold Vapor	EPA 245.1	Mercury
IC	EPA 300.0	Bromate
IC	EPA 300.0	Bromide
IC	EPA 300.0	Chloride
IC	EPA 300.0	Fluoride
IC	EPA 300.0	Nitrate
IC	EPA 300.0	Nitrite
IC	EPA 300.0	Phosphate
IC	EPA 300.0	Sulfate
IC	EPA 300M	Acetate
IC	EPA 300M	Butyrate
IC	EPA 300M	Lactate
IC	EPA 300M	Propionate
IC	EPA 300M	Pyruvate
IC	EPA314.0	Perchlorate
Spectrometric	EPA 335.2	Cyanide
Spectrometric	EPA 350.2	Ammonia
Spectrometric	EPA 351.3	TKN
Spectrometric	EPA 352.1	Nitrate-N
Spectrometric	EPA 353.3	Nitrate-N
Spectrometric	EPA 354.1	Nitrite-N
Spectrometric	EPA 365.2	Ortho-phosphate
Spectrometric	EPA 365.2	Phosphorus
Spectrometric	EPA 370.1	Silica
Titrimetric	EPA 376.2	Sulfide
Spectrometric	EPA 410.4	COD
Combustion-IR	EPA 415.1	TOC
Spectrometric	EPA 420.1	Phenols
GC	EPA 504.1	DBCP
GC	EPA 504.1	EDB
GC-MS	EPA 524.2	Acetone

Drinking Water		
Technology	Method	Analyte
GC-MS	EPA 524.2	Benzene
GC-MS	EPA 524.2	Bromobenzene
GC-MS	EPA 524.2	Bromochloromethane
GC-MS	EPA 524.2	Bromodichloromethane
GC-MS	EPA 524.2	Bromoform
GC-MS	EPA 524.2	Bromomethane
GC-MS	EPA 524.2	tert-Butyl alcohol
GC-MS	EPA 524.2	2-Butanone (MEK)
GC-MS	EPA 524.2	n-Butylbenzene
GC-MS	EPA 524.2	sec-Butylbenzene
GC-MS	EPA 524.2	tert-Butylbenzene
GC-MS	EPA 524.2	Carbon disulfide
GC-MS	EPA 524.2	Carbon tetrachloride
GC-MS	EPA 524.2	Chlorobenzene
GC-MS	EPA 524.2	Chloroethane
GC-MS	EPA 524.2	Chloroform
GC-MS	EPA 524.2	Chloromethane
GC-MS	EPA 524.2	2-Chlorotoluene
GC-MS	EPA 524.2	4-Chlorotoluene
GC-MS	EPA 524.2	Dibromochloromethane
GC-MS	EPA 524.2	1,2-Dibromo-3-chloropropane
GC-MS	EPA 524.2	1,2-Dibromoethane
GC-MS	EPA 524.2	Dibromomethane
GC-MS	EPA 524.2	1,1-Dichloroethane
GC-MS	EPA 524.2	1,2-Dichloroethane
GC-MS	EPA 524.2	1,2-Dichlorobenzene
GC-MS	EPA 524.2	1,3-Dichlorobenzene
GC-MS	EPA 524.2	1,4-Dichlorobenzene
GC-MS	EPA 524.2	Dichlorodifluoromethane
GC-MS	EPA 524.2	1,1-Dichloroethene
GC-MS	EPA 524.2	cis-1,2-Dichloroethene
GC-MS	EPA 524.2	trans-1,2-Dichloroethene
GC-MS	EPA 524.2	1,1-Dichloropropene
GC-MS	EPA 524.2	1,2-Dichloropropane
GC-MS	EPA 524.2	1,3-Dichloropropane
GC-MS	EPA 524.2	2,2-Dichloropropane
GC-MS	EPA 524.2	cis-1,3-Dichloropropene
GC-MS	EPA 524.2	trans-1,3-Dichloropropene
GC-MS	EPA 524.2	tert-Butyl ethyl ether (ETBE)
GC-MS	EPA 524.2	Ethylbenzene
GC-MS	EPA 524.2	2-Hexanone (MBK)

Drinking Water		
Technology	Method	Analyte
GC-MS	EPA 524.2	Hexachlorobutadiene
GC-MS	EPA 524.2	Isopropyl ether (DIPE)
GC-MS	EPA 524.2	Isopropylbenzene
GC-MS	EPA 524.2	p-Isopropyltoluene
GC-MS	EPA 524.2	Methylene Chloride
GC-MS	EPA 524.2	4-Methyl-2-pentanone (MIBK)
GC-MS	EPA 524.2	tert-Butyl methyl ether
GC-MS	EPA 524.2	Naphthalene
GC-MS	EPA 524.2	n-Propylbenzene
GC-MS	EPA 524.2	Styrene
GC-MS	EPA 524.2	tert-Amyl methyl ether (TAME)
GC-MS	EPA 524.2	1,1,1,2-Tetrachloroethane
GC-MS	EPA 524.2	1,1,2,2-Tetrachloroethane
GC-MS	EPA 524.2	Tetrachloroethene
GC-MS	EPA 524.2	Toluene
GC-MS	EPA 524.2	1,1,1-Trichloroethane
GC-MS	EPA 524.2	1,1,2-Trichloroethane
GC-MS	EPA 524.2	1,2,3-Trichlorobenzene
GC-MS	EPA 524.2	1,2,4-Trichlorobenzene
GC-MS	EPA 524.2	Trichloroethene
GC-MS	EPA 524.2	Trichlorofluoromethane
GC-MS	EPA 524.2	1,2,3-Trichloropropane
GC-MS	EPA 524.2	1,1,2-Trichloro 1,2,2-trifluoroethane
GC-MS	EPA 524.2	1,2,4-Trimethylbenzene
GC-MS	EPA 524.2	1,3,5-Trimethylbenzene
GC-MS	EPA 524.2	Vinyl Chloride
GC-MS	EPA 524.2	m-Xylene & p-xylene
GC-MS	EPA 524.2	o-Xylene
HPLC-MS	EPA 6850	Perchlorate
ICP/ICP-MS by Calculation	SM 2340B	Hardness
Titrimetric	SM 2340C	Hardness
Platinum Electrode	SM 2510B	Specific Conductance
Gravimetric	SM 2540B	Total Residue
Gravimetric	SM 2540C	TDS
Gravimetric	SM 2540D	TSS
Spectrometric	SM 3500-FeD	Ferrous Iron
Spectrometric	SM 4500-CNE	Cyanide
Spectrometric	SM 4500-NH3C	Ammonia
Spectrometric	SM 4500-NH3F	Ammonia
Spectrometric	SM 4500-NO2B	Nitrite-N
Spectrometric	SM 4500-NO3E	Nitrate-N



Drinking Water		
Technology	Method	Analyte
Spectrometric	SM 4500-NOrgC	TKN
Spectrometric	SM 4500-PE	Ortho-phosphate
Spectrometric	SM 4500-PE(PB5)	Phosphorus
Titrimetric	SM 4500-S2D	Sulfide
Spectrometric	SM 4500-SiO2C	Silica
Spectrometric	SM 5220B	COD
Combustion-IR	SM 5310B	TOC
Spectrometric	SM 5540C	Surfactants
MicroDistillation	QuickChem 10-204-00-1-X	Cyanide

Solid and Chemical Materials		
Technology	Method	Analyte
GC	AK101	GRO
GC	AK102	DRO
GC	AK103	RRO
GC	AZ8015	DRO (C10-C22)
GC	AZ8015	ORO (C22-C32)
GC	RSK175	Methane
GC	RSK175	Acetylene
GC	RSK175	Ethylene
GC	RSK175	Ethane
GC	RSK175	Propane
GC	RSK175	Carbon dioxide
Spectrometric	SM4500-NH3C	Ammonia
Spectrometric	SM4500-NH3F	Ammonia
Spectrometric	SM4500-NOrgC	TKN
Spectrometric	SM4500-PE(PB5)	Phosphorus
Titrimetric	Walkley Black	TOC
Electrode	EPA 9040C	pH
Electrode	EPA 9045D	pH
Spectrometric	EPA 9065	Phenols
Penskey-Martens	EPA 1010	Ignitability
ICP	EPA 6010B / 6010C	Aluminum
ICP	EPA 6010B / 6010C	Antimony
ICP	EPA 6010B / 6010C	Arsenic
ICP	EPA 6010B / 6010C	Barium
ICP	EPA 6010B / 6010C	Beryllium
ICP	EPA 6010B / 6010C	Boron
ICP	EPA 6010B / 6010C	Cadmium
ICP	EPA 6010B / 6010C	Calcium
ICP	EPA 6010B / 6010C	Chromium

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

Solid and Chemical Materials		
Technology	Method	Analyte
ICP-MS	EPA 6020A	Uranium
ICP-MS	EPA 6020A	Vanadium
ICP-MS	EPA 6020A	Zinc
HPLC-MS	EPA 6850	Perchlorate
Spectrometric	EPA 7196A	Hex. Chromium
IC	EPA 7199	Hex. Chromium
Cold-Vapor	EPA 7470A / 7471A / 7471B	Mercury
GC	EPA 8011	DBCP
GC	EPA 8011	EDB
GC	EPA 8015B / 8015C	Gasoline
GC	EPA 8015B / 8015C	Diesel
GC	EPA 8015B / 8015C	Motor Oil
GC	EPA 8015B / 8015C	JP5
GC	EPA 8015B / 8015C	Ethanol
GC	EPA 8015B / 8015C	Isopropanol
GC	EPA 8015B / 8015C	Diethylene Glycol
GC	EPA 8015B / 8015C	Ethylene Glycol
GC	EPA 8015B / 8015C	JP4
GC	EPA 8015B / 8015C	Methanol
GC	EPA 8015B / 8015C	Propylene Glycol
GC	EPA 8081A / 8081B	Aldrin
GC	EPA 8081A / 8081B	alpha-BHC
GC	EPA 8081A / 8081B	beta-BHC
GC	EPA 8081A / 8081B	delta-BHC
GC	EPA 8081A / 8081B	gamma-BHC (Lindane)
GC	EPA 8081A / 8081B	DDD (4,4)
GC	EPA 8081A / 8081B	DDE (4,4)
GC	EPA 8081A / 8081B	DDT (4,4)
GC	EPA 8081A / 8081B	Dieldrin
GC	EPA 8081A / 8081B	Endosulfan I
GC	EPA 8081A / 8081B	Endosulfan II
GC	EPA 8081A / 8081B	Endosulfan sulfate
GC	EPA 8081A / 8081B	Endrin
GC	EPA 8081A / 8081B	Endrin Aldehyde
GC	EPA 8081A / 8081B	Heptachlor
GC	EPA 8081A / 8081B	Heptachlor epoxide
GC	EPA 8081A / 8081B	Methoxychlor
GC	EPA 8081A / 8081B	alpha-Chlordane
GC	EPA 8081A / 8081B	gamma-Chlordane
GC	EPA 8081A / 8081B	Endrin Ketone
GC	EPA 8081A / 8081B	Toxaphene
GC	EPA 8081A / 8081B	Technical Chlordane

Solid and Chemical Materials		
Technology	Method	Analyte
GC	EPA 8081A / 8081B	cis-Nonachlor
GC	EPA 8081A / 8081B	DDD (2,4)
GC	EPA 8081A / 8081B	DDE (2,4)
GC	EPA 8081A / 8081B	DDT (2,4)
GC	EPA 8081A / 8081B	Mirex
GC	EPA 8081A / 8081B	Oxychlorthane
GC	EPA 8081A / 8081B	trans-Nonachlor
GC	EPA 8082 / 8082A	PCB1016
GC	EPA 8082 / 8082A	PCB1221
GC	EPA 8082 / 8082A	PCB1232
GC	EPA 8082 / 8082A	PCB1242
GC	EPA 8082 / 8082A	PCB1248
GC	EPA 8082 / 8082A	PCB1254
GC	EPA 8082 / 8082A	PCB1260
GC	EPA 8082 / 8082A	PCB1262
GC	EPA 8082 / 8082A	PCB1268
GC	EPA 8082 / 8082A	PCB 8
GC	EPA 8082 / 8082A	PCB 18
GC	EPA 8082 / 8082A	PCB 28
GC	EPA 8082 / 8082A	PCB 44
GC	EPA 8082 / 8082A	PCB 52
GC	EPA 8082 / 8082A	PCB 66
GC	EPA 8082 / 8082A	PCB 77
GC	EPA 8082 / 8082A	PCB 81
GC	EPA 8082 / 8082A	PCB 101
GC	EPA 8082 / 8082A	PCB 105
GC	EPA 8082 / 8082A	PCB 110
GC	EPA 8082 / 8082A	PCB 114
GC	EPA 8082 / 8082A	PCB 118
GC	EPA 8082 / 8082A	PCB 123
GC	EPA 8082 / 8082A	PCB 126
GC	EPA 8082 / 8082A	PCB 128
GC	EPA 8082 / 8082A	PCB 138
GC	EPA 8082 / 8082A	PCB 153
GC	EPA 8082 / 8082A	PCB 156
GC	EPA 8082 / 8082A	PCB 157
GC	EPA 8082 / 8082A	PCB 167
GC	EPA 8082 / 8082A	PCB 169
GC	EPA 8082 / 8082A	PCB 170
GC	EPA 8082 / 8082A	PCB 180
GC	EPA 8082 / 8082A	PCB 187
GC	EPA 8082 / 8082A	PCB 189
GC	EPA 8082 / 8082A	PCB 195

Solid and Chemical Materials		
Technology	Method	Analyte
GC	EPA 8082 / 8082A	PCB 206
GC	EPA 8082 / 8082A	PCB 209
GC	EPA 8141A / 8141B	Azinphos-methyl
GC	EPA 8141A / 8141B	Bolstar
GC	EPA 8141A / 8141B	Chlorpyrifos
GC	EPA 8141A / 8141B	Coumaphos
GC	EPA 8141A / 8141B	Demeton
GC	EPA 8141A / 8141B	Diazinon
GC	EPA 8141A / 8141B	Dichlorvos
GC	EPA 8141A / 8141B	Disulfoton
GC	EPA 8141A / 8141B	Ethoprop
GC	EPA 8141A / 8141B	Fensulfothion
GC	EPA 8141A / 8141B	Fenthion
GC	EPA 8141A / 8141B	Merphos
GC	EPA 8141A / 8141B	Mevinphos
GC	EPA 8141A / 8141B	Naled
GC	EPA 8141A / 8141B	Methyl Parathion
GC	EPA 8141A / 8141B	Phorate
GC	EPA 8141A / 8141B	Ronnel
GC	EPA 8141A / 8141B	Stirophos
GC	EPA 8141A / 8141B	Tokuthion
GC	EPA 8141A / 8141B	Trichloronate
GC	EPA 8141A / 8141B	Dimethoate
GC	EPA 8141A / 8141B	EPN
GC	EPA 8141A / 8141B	Famphur
GC	EPA 8141A / 8141B	Malathion
GC	EPA 8141A / 8141B	Ethyl Parathion
GC	EPA 8141A / 8141B	O,O,O-Triethylphosphorothioate
GC	EPA 8141A / 8141B	Sulfotepp
GC	EPA 8141A / 8141B	Thionazin
GC	EPA 8141A / 8141B	Tributyl Phosphate
GC-MS	EPA 8260B / 8260C	Acetone
GC-MS	EPA 8260B / 8260C	Acrolein
GC-MS	EPA 8260B / 8260C	Acrylonitrile
GC-MS	EPA 8260B / 8260C	Benzene
GC-MS	EPA 8260B / 8260C	Bromobenzene
GC-MS	EPA 8260B / 8260C	Bromochloromethane
GC-MS	EPA 8260B / 8260C	Bromodichloromethane
GC-MS	EPA 8260B / 8260C	Bromoform
GC-MS	EPA 8260B / 8260C	Bromomethane
GC-MS	EPA 8260B / 8260C	tert-Butyl alcohol
GC-MS	EPA 8260B / 8260C	2-Butanone (MEK)
GC-MS	EPA 8260B / 8260C	n-Butylbenzene

Solid and Chemical Materials		
Technology	Method	Analyte
GC-MS	EPA 8260B / 8260C	sec-Butylbenzene
GC-MS	EPA 8260B / 8260C	tert-Butylbenzene
GC-MS	EPA 8260B / 8260C	Carbon disulfide
GC-MS	EPA 8260B / 8260C	Carbon tetrachloride
GC-MS	EPA 8260B / 8260C	Chlorobenzene
GC-MS	EPA 8260B / 8260C	2-Chloroethyl vinyl ether
GC-MS	EPA 8260B / 8260C	Chloroethane
GC-MS	EPA 8260B / 8260C	Chloroform
GC-MS	EPA 8260B / 8260C	1-Chlorohexane
GC-MS	EPA 8260B / 8260C	Chloromethane
GC-MS	EPA 8260B / 8260C	2-Chlorotoluene
GC-MS	EPA 8260B / 8260C	4-Chlorotoluene
GC-MS	EPA 8260B / 8260C	Isopropyl ether (DIPE)
GC-MS	EPA 8260B / 8260C	Dibromochloromethane
GC-MS	EPA 8260B / 8260C	1,2-Dibromo-3-chloropropane
GC-MS	EPA 8260B / 8260C	1,2-Dibromoethane
GC-MS	EPA 8260B / 8260C	Dibromomethane
GC-MS	EPA 8260B / 8260C	1,1-Dichloroethane
GC-MS	EPA 8260B / 8260C	1,2-Dichloroethane
GC-MS	EPA 8260B / 8260C	1,2-Dichlorobenzene
GC-MS	EPA 8260B / 8260C	1,3-Dichlorobenzene
GC-MS	EPA 8260B / 8260C	trans-1,4-Dichloro-2-Butene
GC-MS	EPA 8260B / 8260C	1,4-Dichlorobenzene
GC-MS	EPA 8260B / 8260C	Dichlorodifluoromethane
GC-MS	EPA 8260B / 8260C	1,1-Dichloroethene
GC-MS	EPA 8260B / 8260C	cis-1,2-Dichloroethene
GC-MS	EPA 8260B / 8260C	trans-1,2-Dichloroethene
GC-MS	EPA 8260B / 8260C	Dichlorofluoromethane
GC-MS	EPA 8260B / 8260C	1,1-Dichloropropene
GC-MS	EPA 8260B / 8260C	1,2-Dichloropropane
GC-MS	EPA 8260B / 8260C	1,3-Dichloropropane
GC-MS	EPA 8260B / 8260C	2,2-Dichloropropane
GC-MS	EPA 8260B / 8260C	cis-1,3-Dichloropropene
GC-MS	EPA 8260B / 8260C	trans-1,3-Dichloropropene
GC-MS	EPA 8260B / 8260C	tert-Butyl ethyl ether (ETBE)
GC-MS	EPA 8260B / 8260C	Ethyl Methacrylate
GC-MS	EPA 8260B / 8260C	Ethylbenzene
GC-MS	EPA 8260B / 8260C	2-Hexanone (MBK)
GC-MS	EPA 8260B / 8260C	Hexachlorobutadiene
GC-MS	EPA 8260B / 8260C	Iodomethane
GC-MS	EPA 8260B / 8260C	Isopropylbenzene
GC-MS	EPA 8260B / 8260C	p-Isopropyltoluene
GC-MS	EPA 8260B / 8260C	Methylene Chloride

Solid and Chemical Materials		
Technology	Method	Analyte
GC-MS	EPA 8260B / 8260C	4-Methyl-2-pentanone (MIBK)
GC-MS	EPA 8260B / 8260C	tert-Butyl methyl ether
GC-MS	EPA 8260B / 8260C	Naphthalene
GC-MS	EPA 8260B / 8260C	n-Propylbenzene
GC-MS	EPA 8260B / 8260C	Styrene
GC-MS	EPA 8260B / 8260C	tert-Amyl methyl ether (TAME)
GC-MS	EPA 8260B / 8260C	1,1,1,2-Tetrachloroethane
GC-MS	EPA 8260B / 8260C	1,1,2,2-Tetrachloroethane
GC-MS	EPA 8260B / 8260C	Tetrachloroethene
GC-MS	EPA 8260B / 8260C	Toluene
GC-MS	EPA 8260B / 8260C	1,1,1-Trichloroethane
GC-MS	EPA 8260B / 8260C	1,1,2-Trichloroethane
GC-MS	EPA 8260B / 8260C	1,2,3-Trichlorobenzene
GC-MS	EPA 8260B / 8260C	1,2,4-Trichlorobenzene
GC-MS	EPA 8260B / 8260C	Trichloroethene
GC-MS	EPA 8260B / 8260C	Trichlorofluoromethane
GC-MS	EPA 8260B / 8260C	1,2,3-Trichloropropane
GC-MS	EPA 8260B / 8260C	1,1,2-Trichloro-1,2,2-trifluoroethane
GC-MS	EPA 8260B / 8260C	1,2,4-Trimethylbenzene
GC-MS	EPA 8260B / 8260C	1,3,5-Trimethylbenzene
GC-MS	EPA 8260B / 8260C	Vinyl Acetate
GC-MS	EPA 8260B / 8260C	Vinyl Chloride
GC-MS	EPA 8260B / 8260C	m-Xylene & p-xylene
GC-MS	EPA 8260B / 8260C	o-Xylene
GC-MS	EPA 8260B / 8260C	2-Butanol
GC-MS	EPA 8260B / 8260C	Cyclohexane
GC-MS	EPA 8260B / 8260C	1,4-Dioxane
GC-MS	EPA 8260B / 8260C	2-Chloro-1,1,1-trifluoroethane
GC-MS	EPA 8260B / 8260C	2-Chloro-1,1,1-trifluoroethane
GC-MS	EPA 8260B / 8260C	Chlorotrifluoroethylene
GC-MS	EPA 8260B / 8260C	cis-1,4-Dichloro-2-butene
GC-MS	EPA 8260B / 8260C	Ethanol
GC-MS	EPA 8260B / 8260C	Ethyl Methacrylate
GC-MS	EPA 8260B / 8260C	Isobutyl Alcohol
GC-MS	EPA 8260B / 8260C	Methacrylonitrile
GC-MS	EPA 8260B / 8260C	Methyl Methacrylate
GC-MS	EPA 8260B / 8260C	Pentachloroethane
GC-MS	EPA 8260B / 8260C	Propionitrile
GC-MS	EPA 8260B / 8260C	Sec-Propyl alcohol
GC-MS	EPA 8260B / 8260C	Tetrahydrofuran
GC-MS	EPA 8260B / 8260C	trans-1,4-Dichloro-2-butene
GC-MS	EPA 8260B / 8260C SIM	Benzene
GC-MS	EPA 8260B / 8260C SIM	Carbon tetrachloride

Solid and Chemical Materials		
Technology	Method	Analyte
GC-MS	EPA 8260B / 8260C SIM	Chloroform
GC-MS	EPA 8260B / 8260C SIM	Chloromethane
GC-MS	EPA 8260B / 8260C SIM	1,2-Dibromo-3-chloropropane
GC-MS	EPA 8260B / 8260C SIM	1,2-Dibromoethane
GC-MS	EPA 8260B / 8260C SIM	1,2-Dichloroethane
GC-MS	EPA 8260B / 8260C SIM	1,1-Dichloroethene
GC-MS	EPA 8260B / 8260C SIM	cis-1,2-Dichloroethene
GC-MS	EPA 8260B / 8260C SIM	trans-1,2-Dichloroethene
GC-MS	EPA 8260B / 8260C SIM	1,1,2,2-Tetrachloroethane
GC-MS	EPA 8260B / 8260C SIM	Tetrachloroethene
GC-MS	EPA 8260B / 8260C SIM	1,1,1-Trichloroethane
GC-MS	EPA 8260B / 8260C SIM	1,1,2-Trichloroethane
GC-MS	EPA 8260B / 8260C SIM	Trichloroethene
GC-MS	EPA 8260B / 8260C SIM	1,2,3-Trichloropropane
GC-MS	EPA 8260B / 8260C SIM	Vinyl Chloride
GC-MS	EPA 8260B / 8260C SIM	1,4-Dioxane
GC-MS	EPA 8270C / 8270D	Acenaphthene
GC-MS	EPA 8270C / 8270D	Acenaphthylene
GC-MS	EPA 8270C / 8270D	Aniline
GC-MS	EPA 8270C / 8270D	Anthracene
GC-MS	EPA 8270C / 8270D	Azobenzene
GC-MS	EPA 8270C / 8270D	Benzidine
GC-MS	EPA 8270C / 8270D	Benzo(a)anthracene
GC-MS	EPA 8270C / 8270D	benzo(a)pyrene
GC-MS	EPA 8270C / 8270D	Benzo(b)fluoranthene
GC-MS	EPA 8270C / 8270D	Benzo(e)pyrene
GC-MS	EPA 8270C / 8270D	Benzo(g,h,i)perylene
GC-MS	EPA 8270C / 8270D	Benzo(k)fluoranthene
GC-MS	EPA 8270C / 8270D	Benzoic Acid
GC-MS	EPA 8270C / 8270D	Benzyl Alcohol
GC-MS	EPA 8270C / 8270D	Biphenyl
GC-MS	EPA 8270C / 8270D	bis(2-chloroethoxy)methane
GC-MS	EPA 8270C / 8270D	bis(2-chloroethyl)ether
GC-MS	EPA 8270C / 8270D	bis(2-chloroisopropyl)ether
GC-MS	EPA 8270C / 8270D	bis(2-Ethylhexyl)adipate
GC-MS	EPA 8270C / 8270D	bis(2-Ethylhexyl)phthalate
GC-MS	EPA 8270C / 8270D	4-Bromophenyl-phenylether
GC-MS	EPA 8270C / 8270D	Butylbenzylphthalate
GC-MS	EPA 8270C / 8270D	Carbazole
GC-MS	EPA 8270C / 8270D	4-Chloro-3-methylphenol
GC-MS	EPA 8270C / 8270D	4-Chloroaniline
GC-MS	EPA 8270C / 8270D	2-Chloronaphthalene
GC-MS	EPA 8270C / 8270D	2-Chlorophenol

Solid and Chemical Materials		
Technology	Method	Analyte
GC-MS	EPA 8270C / 8270D	4-Chlorophenyl-phenylether
GC-MS	EPA 8270C / 8270D	Chrysene
GC-MS	EPA 8270C / 8270D	Dibenzo(a,h)anthracene
GC-MS	EPA 8270C / 8270D	Dibenzofuran
GC-MS	EPA 8270C / 8270D	1,2-Dichlorobenzene
GC-MS	EPA 8270C / 8270D	1,3-Dichlorobenzene
GC-MS	EPA 8270C / 8270D	1,4-Dichlorobenzene
GC-MS	EPA 8270C / 8270D	3,3'-Dichlorobenzidine
GC-MS	EPA 8270C / 8270D	2,4-Dichlorophenol
GC-MS	EPA 8270C / 8270D	Diethylphthalate
GC-MS	EPA 8270C / 8270D	2,6-Dimethylnaphthalene
GC-MS	EPA 8270C / 8270D	2,4-Dimethylphenol
GC-MS	EPA 8270C / 8270D	Dimethylphthalate
GC-MS	EPA 8270C / 8270D	Di-n-butylphthalate
GC-MS	EPA 8270C / 8270D	4,6-Dinitro-2-methylphenol
GC-MS	EPA 8270C / 8270D	2,4-Dinitrophenol
GC-MS	EPA 8270C / 8270D	2,4-Dinitrotoluene
GC-MS	EPA 8270C / 8270D	2-6-Dinitrotoluene
GC-MS	EPA 8270C / 8270D	Di-n-octylphthalate
GC-MS	EPA 8270C / 8270D	Fluoranthene
GC-MS	EPA 8270C / 8270D	Fluorene
GC-MS	EPA 8270C / 8270D	Hexachlorobenzene
GC-MS	EPA 8270C / 8270D	Hexachlorobutadiene
GC-MS	EPA 8270C / 8270D	Hexachlorocyclopentadiene
GC-MS	EPA 8270C / 8270D	Hexachloroethane
GC-MS	EPA 8270C / 8270D	Indeno(1,2,3-cd)pyrene
GC-MS	EPA 8270C / 8270D	Isophorone
GC-MS	EPA 8270C / 8270D	1-Methylnaphthalene
GC-MS	EPA 8270C / 8270D	2-Methylnaphthalene
GC-MS	EPA 8270C / 8270D	1-Methylphenanthrene
GC-MS	EPA 8270C / 8270D	2-Methylphenol
GC-MS	EPA 8270C / 8270D	4-Methylphenol
GC-MS	EPA 8270C / 8270D	Naphthalene
GC-MS	EPA 8270C / 8270D	2-Nitroaniline
GC-MS	EPA 8270C / 8270D	3-Nitroaniline
GC-MS	EPA 8270C / 8270D	4-Nitroaniline
GC-MS	EPA 8270C / 8270D	Nitrobenzene
GC-MS	EPA 8270C / 8270D	2-Nitrophenol
GC-MS	EPA 8270C / 8270D	4-Nitrophenol
GC-MS	EPA 8270C / 8270D	n-Nitrosodimethylamine
GC-MS	EPA 8270C / 8270D	n-Nitroso-di-n-propylamine
GC-MS	EPA 8270C / 8270D	n-Nitrosodiphenylamine
GC-MS	EPA 8270C / 8270D	Pentachlorophenol

Solid and Chemical Materials		
Technology	Method	Analyte
GC-MS	EPA 8270C / 8270D	Perylene
GC-MS	EPA 8270C / 8270D	Phenanthrene
GC-MS	EPA 8270C / 8270D	Phenol
GC-MS	EPA 8270C / 8270D	Pyrene
GC-MS	EPA 8270C / 8270D	Pyridine
GC-MS	EPA 8270C / 8270D	2,3,4,6-Tetrachlorophenol
GC-MS	EPA 8270C / 8270D	1,2,4-Trichlorobenzene
GC-MS	EPA 8270C / 8270D	2,3,4-Trichlorophenol
GC-MS	EPA 8270C / 8270D	2,3,5-Trichlorophenol
GC-MS	EPA 8270C / 8270D	2,4,5-Trichlorophenol
GC-MS	EPA 8270C / 8270D	2,4,6-Trichlorophenol
GC-MS	EPA 8270C / 8270D	2,3,5-Trimethylnaphthalene
GC-MS	EPA 8270C / 8270D	1,2,4,5-Tetrachlorobenzene
GC-MS	EPA 8270C / 8270D	1,3,5-Trinitrobenzene
GC-MS	EPA 8270C / 8270D	1,3-Dinitrobenzene
GC-MS	EPA 8270C / 8270D	1,4-Dioxane
GC-MS	EPA 8270C / 8270D	1,4-Naphthoquinone
GC-MS	EPA 8270C / 8270D	1-Chloronaphthalene
GC-MS	EPA 8270C / 8270D	1-Naphthylamine
GC-MS	EPA 8270C / 8270D	2,6-Dichlorophenol
GC-MS	EPA 8270C / 8270D	2-acetylaminofluorene
GC-MS	EPA 8270C / 8270D	2-Naphthylamine
GC-MS	EPA 8270C / 8270D	2-Picoline
GC-MS	EPA 8270C / 8270D	3,3-Dimethylbenzidine
GC-MS	EPA 8270C / 8270D	3,4-Dimethylphenol
GC-MS	EPA 8270C / 8270D	3,5-Dimethylphenol
GC-MS	EPA 8270C / 8270D	3,5-Dimethylphenol
GC-MS	EPA 8270C / 8270D	3-Methylcholanthrene
GC-MS	EPA 8270C / 8270D	4-Aminobiphenyl
GC-MS	EPA 8270C / 8270D	4-Nitroquinoline-N-oxide
GC-MS	EPA 8270C / 8270D	5-Nitro-o-toluidine
GC-MS	EPA 8270C / 8270D	7,12-Dimethylben(a)anthracene
GC-MS	EPA 8270C / 8270D	Acetophenone
GC-MS	EPA 8270C / 8270D	Aramite
GC-MS	EPA 8270C / 8270D	Atrazine
GC-MS	EPA 8270C / 8270D	Biphenyl
GC-MS	EPA 8270C / 8270D	Chlorobenzilate
GC-MS	EPA 8270C / 8270D	Diallate
GC-MS	EPA 8270C / 8270D	Dibenzo(a,j)acridine
GC-MS	EPA 8270C / 8270D	Dimethoate
GC-MS	EPA 8270C / 8270D	Dinoseb
GC-MS	EPA 8270C / 8270D	Diphenyl ether
GC-MS	EPA 8270C / 8270D	Disulfoton

Solid and Chemical Materials		
Technology	Method	Analyte
GC-MS	EPA 8270C / 8270D	Ethyl methacrylate
GC-MS	EPA 8270C / 8270D	Ethyl methanesulfonate
GC-MS	EPA 8270C / 8270D	Ethyl parathion
GC-MS	EPA 8270C / 8270D	Famphur
GC-MS	EPA 8270C / 8270D	Hexachlorophene
GC-MS	EPA 8270C / 8270D	Hexachloropropene
GC-MS	EPA 8270C / 8270D	Isodrin
GC-MS	EPA 8270C / 8270D	Isosafrole
GC-MS	EPA 8270C / 8270D	kepone
GC-MS	EPA 8270C / 8270D	Methapyrilene
GC-MS	EPA 8270C / 8270D	Methyl methanesulfonate
GC-MS	EPA 8270C / 8270D	Methyl parathion
GC-MS	EPA 8270C / 8270D	N-nitrosodiethylamine
GC-MS	EPA 8270C / 8270D	N-Nitrosodi-n-butylamine
GC-MS	EPA 8270C / 8270D	N-Nitrosomethylethylamine
GC-MS	EPA 8270C / 8270D	N-Nitrosomorpholine
GC-MS	EPA 8270C / 8270D	N-Nitrosopiperdine
GC-MS	EPA 8270C / 8270D	N-Nitrosopyrrolidine
GC-MS	EPA 8270C / 8270D	O,O,O-triethyl phosphorothi
GC-MS	EPA 8270C / 8270D	o-toluidine
GC-MS	EPA 8270C / 8270D	p-Dimethylaminoazobenze
GC-MS	EPA 8270C / 8270D	Pentachlorobenzene
GC-MS	EPA 8270C / 8270D	Pentachloroethane
GC-MS	EPA 8270C / 8270D	Pentachloronitrobenzene
GC-MS	EPA 8270C / 8270D	Phenacetin
GC-MS	EPA 8270C / 8270D	Phorate
GC-MS	EPA 8270C / 8270D	p-phenylenediamine
GC-MS	EPA 8270C / 8270D	Pronamide
GC-MS	EPA 8270C / 8270D	Safrole
GC-MS	EPA 8270C / 8270D	Sulfotepp
GC-MS	EPA 8270C / 8270D	Thionazin
GC-MS	EPA 8270C / 8270D SIM	Acenaphthene
GC-MS	EPA 8270C / 8270D SIM	Acenaphthylene
GC-MS	EPA 8270C / 8270D SIM	Anthracene
GC-MS	EPA 8270C / 8270D SIM	Azobenzene
GC-MS	EPA 8270C / 8270D SIM	Benzo(a)anthracene
GC-MS	EPA 8270C / 8270D SIM	benzo(a)pyrene
GC-MS	EPA 8270C / 8270D SIM	Benzo(b)fluoranthene
GC-MS	EPA 8270C / 8270D SIM	Benzo(e)pyrene
GC-MS	EPA 8270C / 8270D SIM	Benzo(g,h,i)perylene
GC-MS	EPA 8270C / 8270D SIM	Benzo(k)fluoranthene
GC-MS	EPA 8270C / 8270D SIM	Biphenyl
GC-MS	EPA 8270C / 8270D SIM	bis(2-chloroethyl)ether

Solid and Chemical Materials		
Technology	Method	Analyte
GC-MS	EPA 8270C / 8270D SIM	bis(2-Ethylhexyl)phthalate
GC-MS	EPA 8270C / 8270D SIM	Carbazole
GC-MS	EPA 8270C / 8270D SIM	4-Chloro-3-methylphenol
GC-MS	EPA 8270C / 8270D SIM	2-Chlorophenol
GC-MS	EPA 8270C / 8270D SIM	Chrysene
GC-MS	EPA 8270C / 8270D SIM	Dibenzo(a,h)anthracene
GC-MS	EPA 8270C / 8270D SIM	2,4-Dichlorophenol
GC-MS	EPA 8270C / 8270D SIM	2,6-Dimethylnaphthalene
GC-MS	EPA 8270C / 8270D SIM	2,4-Dimethylphenol
GC-MS	EPA 8270C / 8270D SIM	Fluoranthene
GC-MS	EPA 8270C / 8270D SIM	Fluorene
GC-MS	EPA 8270C / 8270D SIM	Hexachlorobenzene
GC-MS	EPA 8270C / 8270D SIM	Indeno(1,2,3-cd)pyrene
GC-MS	EPA 8270C / 8270D SIM	1-Methylnaphthalene
GC-MS	EPA 8270C / 8270D SIM	2-Methylnaphthalene
GC-MS	EPA 8270C / 8270D SIM	1-Methylphenanthrene
GC-MS	EPA 8270C / 8270D SIM	Naphthalene
GC-MS	EPA 8270C / 8270D SIM	n-Nitrosodimethylamine
GC-MS	EPA 8270C / 8270D SIM	n-Nitroso-di-n-propylamine
GC-MS	EPA 8270C / 8270D SIM	Pentachlorophenol
GC-MS	EPA 8270C / 8270D SIM	Perylene
GC-MS	EPA 8270C / 8270D SIM	Phenanthrene
GC-MS	EPA 8270C / 8270D SIM	Phenol
GC-MS	EPA 8270C / 8270D SIM	Pyrene
GC-MS	EPA 8270C / 8270D SIM	2,4,5-Trichlorophenol
GC-MS	EPA 8270C / 8270D SIM	2,4,6-Trichlorophenol
GC-MS	EPA 8270C / 8270D SIM	2,3,5-Trimethylnaphthalene
GC-MS	EPA 8270C / 8270D SIM	1,4-Dioxane
GC-MS	EPA 8270C / 8270D SIM	Butylbenzylphthalate
GC-MS	EPA 8270C / 8270D SIM	Diethylphthalate
GC-MS	EPA 8270C / 8270D SIM	Dimethylphthalate
GC-MS	EPA 8270C / 8270D SIM	Di-n-butylphthalate
GC-MS	EPA 8270C / 8270D SIM	Di-n-octylphthalate
HPLC	EPA 8310	Acenaphthene
HPLC	EPA 8310	Acenaphthylene
HPLC	EPA 8310	Anthracene
HPLC	EPA 8310	Benzo(a)anthracene
HPLC	EPA 8310	Benzo(a)pyrene
HPLC	EPA 8310	Benzo(b)fluoranthene
HPLC	EPA 8310	Benzo(g,h,i)perylene
HPLC	EPA 8310	Benzo(k)fluoranthene
HPLC	EPA 8310	Chrysene

Solid and Chemical Materials		
Technology	Method	Analyte
HPLC	EPA 8310	Dibenzo(a,h)anthracene
HPLC	EPA 8310	Fluoranthene
HPLC	EPA 8310	Fluorene
HPLC	EPA 8310	Indeno(1,2,3-cd)pyrene
HPLC	EPA 8310	1-Methylnaphthalene
HPLC	EPA 8310	2-Methylnaphthalene
HPLC	EPA 8310	Naphthalene
HPLC	EPA 8310	Phenanthrene
HPLC	EPA 8310	Pyrene
HPLC	EPA 8330A	HMX
HPLC	EPA 8330A	RDX
HPLC	EPA 8330A	1,3,5-TNB
HPLC	EPA 8330A	1,3-DNB
HPLC	EPA 8330A	Tetryl
HPLC	EPA 8330A	Nitrobenzene
HPLC	EPA 8330A	2,4,6-TNT
HPLC	EPA 8330A	4-AM-2,6-DNT
HPLC	EPA 8330A	2-AM-4,6-DNT
HPLC	EPA 8330A	2,6-DNT
HPLC	EPA 8330A	2,4-DNT
HPLC	EPA 8330A	2-Nitrotoluene
HPLC	EPA 8330A	4-Nitrotoluene
HPLC	EPA 8330A	3-Nitrotoluene
HPLC	EPA 8330A	3,5-Dinitroaniline
HPLC	EPA 8330A	2,4-Diamino-6-nitrotoluene
HPLC	EPA 8330A	2,6-Diamino-4-nitrotoluene
HPLC	EPA 8330A	3,5-Dinitroaniline
HPLC	EPA 8330A	Picric Acid
HPLC	EPA 8332	Nitroglycerine
HPLC	EPA 8332	PETN
Combustion-IR	EPA 9060	TOC
IC	EPA9056/9056A	Bromate
IC	EPA9056/9056A	Bromide
IC	EPA9056/9056A	Chloride
IC	EPA9056/9056A	Fluoride
IC	EPA9056/9056A	Nitrate
IC	EPA9056/9056A	Nitrite
IC	EPA9056/9056A	Phosphate
IC	EPA9056/9056A	Sulfate
GC	EPA 8151A	Acifluorfen
GC	EPA 8151A	Bentazon

Solid and Chemical Materials		
Technology	Method	Analyte
GC	EPA 8151A	Chloramben
GC	EPA 8151A	2,4-D
GC	EPA 8151A	2,4-DB
GC	EPA 8151A	Dacthal
GC	EPA 8151A	Dalapon
GC	EPA 8151A	Dicamba
GC	EPA 8151A	3,5 Dichlorobenzoic
GC	EPA 8151A	Dichlorprop
GC	EPA 8151A	Dinoseb
GC	EPA 8151A	MCPA
GC	EPA 8151A	MCPP
GC	EPA 8151A	Pentachlorophenol
GC	EPA 8151A	Picloram
GC	EPA 8151A	Silvex
GC	EPA 8151A	2,4,5-T
Spectrometric	EPA 9014	Cyanide
GFAA	CA 939M	Organo Lead
Preparation	Method	Type
Purge & Trap	EPA 5030B / EPA 5035	Volatiles Prep
Acid Digestion	EPA 3010 / EPA 3050B	Metals Prep
Alkaline Digestion	EPA 3060A	Hexavalent Chrom
Soxhlet	EPA 3540C	Organic Extraction
Sonication	EPA 3520C / EPA 3550C	Organic Extraction
Waste Dilution	EPA 3580A	Organic Extraction
TCLP	EPA 1311	Leaching
SPLP	EPA 1312	Leaching
Florilic Clean-up	EPA 3520B	Extract Clean-Up
GPC Clean-up	EPA 3640A	Extract Clean-Up
Sulfur Clean-up	EPA 3660B	Extract Clean-Up
Acid/Permanganate Clean-up	EPA 3665A	Extract Clean-Up

Air and Emissions		
Technology	Method	Analyte
GC-MS	TO-15	1,1,1-trichloroethane
GC-MS	TO-15	1,1,2,2-tetrachloroethane
GC-MS	TO-15	1,1,2-Trichloro1,2,2-trifluoroethane
GC-MS	TO-15	1,1,2-trichloroethane
GC-MS	TO-15	1,1-dichloroethane

Air and Emissions		
Technology	Method	Analyte
GC-MS	TO-15	1,1-Dichloroethene
GC-MS	TO-15	1,2,4-trichlorobenzene
GC-MS	TO-15	1,2,4-trimethylbenzene
GC-MS	TO-15	1,2-dibromoethane
GC-MS	TO-15	1,2-dichlorobenzene
GC-MS	TO-15	1,2-dichloroethane
GC-MS	TO-15	1,2-dichloroethene
GC-MS	TO-15	1,2-dichloropropane
GC-MS	TO-15	1,3,5-trimethylbenzene
GC-MS	TO-15	1,3-Butadiene
GC-MS	TO-15	1,3-Butadiene, 1,1,2,3,4,Hexachloro
GC-MS	TO-15	1,3-dichlorobenzene
GC-MS	TO-15	1,4-dichlorobenzene
GC-MS	TO-15	1,4-Dioxane
GC-MS	TO-15	2,2,4-Trimethylpentane
GC-MS	TO-15	4-Ethyltoluene
GC-MS	TO-15	Acetone
GC-MS	TO-15	Acrylonitrile
GC-MS	TO-15	Allyl Chloride
GC-MS	TO-15	Benzene
GC-MS	TO-15	Benzyl Chloride
GC-MS	TO-15	Bromodichloromethane
GC-MS	TO-15	Bromoform
GC-MS	TO-15	Bromomethane
GC-MS	TO-15	Carbon Disulfide
GC-MS	TO-15	Carbon Tetrachloride
GC-MS	TO-15	Chlorobenzene
GC-MS	TO-15	Chloroethane
GC-MS	TO-15	Chloroethene
GC-MS	TO-15	Chloroform
GC-MS	TO-15	Chloromethane
GC-MS	TO-15	cis-1,3-Dichloropropene
GC-MS	TO-15	Cyclohexane
GC-MS	TO-15	Dibromochloromethane
GC-MS	TO-15	Dichlorodifluoromethane
GC-MS	TO-15	Dichlorotetrafluoroethane
GC-MS	TO-15	Ethyl Acetate



Air and Emissions		
Technology	Method	Analyte
GC-MS	TO-15	Ethylbenzene
GC-MS	TO-15	Isopropyl Alcohol
GC-MS	TO-15	m+p-Xylene
GC-MS	TO-15	Methyl butyl Ketone
GC-MS	TO-15	Methyl Ethyl Ketone
GC-MS	TO-15	Methyl Isobutyl Ketone
GC-MS	TO-15	Methyl Tert-Butyl Ether
GC-MS	TO-15	Methylene Chloride
GC-MS	TO-15	n-Heptane
GC-MS	TO-15	n-Hexane
GC-MS	TO-15	o-Xylene
GC-MS	TO-15	Styrene
GC-MS	TO-15	Tetrachloroethylene
GC-MS	TO-15	Tetrahydrofuran
GC-MS	TO-15	Toluene
GC-MS	TO-15	Trans-1,2-Dichloroethene
GC-MS	TO-15	trans-1,3-Dichloropropene
GC-MS	TO-15	Trichloroethylene
GC-MS	TO-15	Trichloromonofluoromethan
GC-MS	TO-15	Vinyl Acetate
GC-MS	TO-15	Vinyl Bromide

Notes:

- 1) This laboratory offers commercial testing service.

Approved by: 
 R. Douglas Leonard
 Chief Technical Officer

Date: March 21, 2013

Issued: 1/10/11
 Revised: 1/31/12

Revised: 1/18/11
 Revised: 1/3/13

Revised: 3/21/11
 Revised: 3/21/13

Revised: 3/24/11

Revised: 8/25/11

Attachment 1
Tier II Format Approval Letter

Subject: RE: Tier II SAP request

-----Original Message-----

From: Bowers, Kenneth A CIV NAVFAC LANT, EV [<mailto:kenneth.a.bowers@navy.mil>]
Sent: Wednesday, July 03, 2013 4:11 PM
To: Dodson, Anita/VBO
Subject: RE: Tier II SAP request

Anita,

I agree with your assessment - this site is a good candidate for Tier II SAP - LTM for groundwater.

Thanks,

Ken

-----Original Message-----

From: Anita.Dodson@CH2M.com [<mailto:Anita.Dodson@CH2M.com>]
Sent: Wednesday, July 03, 2013 10:23
To: Bowers, Kenneth A CIV NAVFAC LANT, EV
Cc: Anita.Dodson@CH2M.com
Subject: Tier II SAP request

Hi Ken,

We are seeking approval to prepare a Tier II SAP for MCAS Cherry Point. I believe this is a good candidate and have attached the questionnaire. Please look it over and let me know if you approve.

Thanks and have a great 4th of July J

Anita Dodson

Chemist

CH2M HILL
5701 Cleveland Street, Suite 200
Virginia Beach, VA, 23462
Direct: 757-671-6218
Fax: 757-497-6885