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NAB LITTLE CREEK
5090.3a

FINAL REMEDIAL ACTION WORK PLAN AND SAMPLING AND ANALYSIS PLAN SITE 11A
WITH TRANSMITTAL
7/23/2012
OSAGE OF VIRGINIA

July 23, 2012

Mr. Jeff Boylan
USEPA, Region 3
1650 Arch Street
Philadelphia, PA 19103

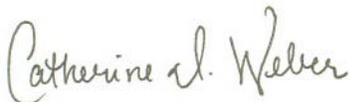
Re: *Final Site 11a Remedial Action Work Plan and Sampling and Analysis Plan*
Site 11a
Joint Expeditionary Base Little Creek-Fort Story
Virginia Beach, Virginia

Dear Mr. Boylan:

Enclosed please find two hard copies and two CD-ROMs of the *Final Site 11a Remedial Action Work Plan and Sampling and Analysis Plan* for the Site 11a Enhanced Reductive Dechlorination (ERD) Remedial Action. Also, the Responses to February 9, 2012 Virginia Department of Environmental Quality (VDEQ) comments dated April 30, 2012 on the Draft *Site 11a Remedial Action Work Plan and Sampling and Analysis Plan* have been included. This final submission incorporates the April 30, 2012 responses to comments.

If you have any questions please do not hesitate to contact me at my office at (757) 440-0400, on my cellular phone at (757) 619-4690, or by e-mail at cweber@osageva.com.

Yours sincerely,

A handwritten signature in cursive script that reads "Catherine I. Weber".

Catherine I. Weber
Sr. Project Manager

cc: Mr. David Cohn, Osage of Virginia
Mr. Paul Herman, VDEQ
Mr. Paul Landin, CH2MHill
Mr. Bryan Peed, NAVFAC

July 23, 2012

Mr. Paul Herman
Virginia Department of Environmental Quality
PO Box 1105
Richmond, VA 23218

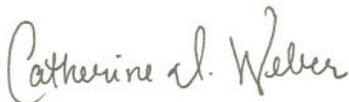
Re: *Final Site 11a Remedial Action Work Plan and Sampling and Analysis Plan*
Site 11a
Joint Expeditionary Base Little Creek-Fort Story
Virginia Beach, Virginia

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A handwritten signature in cursive script that reads "Catherine I. Weber".

Catherine I. Weber
Sr. Project Manager

cc: Mr. Jeff Boylan, USEPA Region 3
Mr. David Cohn, Osage of Virginia
Mr. Paul Landin, CH2MHill
Mr. Bryan Peed, NAVFAC

April 30, 2012

Mr. Paul Herman, P.E.
Virginia Department of Environmental Quality
P.O. Box 1105
Richmond, Virginia 23218

Re: Responses to February 9, 2012 letter from Paul E. Herman, P.E. of Virginia Department of Environmental Quality to Mr. Bryan Peed of NAVFAC Mid-Atlantic Regarding Draft Remedial Action Work Plan and Sampling and Analysis Plan Site 11a, Building 3033 Former Vehicle Repair Facility and Waste Oil Tank Joint Expeditionary Base Little Creek-Fort Story

Dear Mr. Herman:

We are in receipt of your comments on the Draft Remedial Action Work Plan and Sampling and Analysis Plan for Site 11a, Building 3033 Former Vehicle Repair Facility and Waste Oil Tank, located at the Joint Expeditionary Base Little Creek-Fort Story. We have proposed the below responses to address your comments, which will be incorporated into a final document that will include the baseline groundwater sampling results.

1. General Comment *The title of the subject document is confusing as the content focuses on the pre- and post injection sampling and analysis of groundwater and provides very little remedial design information. Perhaps the title should be revised to "Site 11a- Groundwater Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan) to Support the Remedial Design".*

Response: The design will be documented in the Final 100% Design Document. This Sampling and Analysis Plan is intended to serve as the Remedial Action Work Plan for the remediation. A separate document will be prepared for Long Term Monitoring following the remedy implementation.

2. General Comment: *Given that Site 11a came about as a result of investigations at Site 11, a figure showing the 2 sites should be included in the document.*

Response: This figure has been included.

3. Executive Summary: *For the second group of numbered items, please revise Item #1 as follows, "Installation of five new groundwater monitoring wells and advancement of two soil borings."*

Response: Item #1 has been revised as suggested.

4. Worksheet #6: Please include the worksheet number and title in the header of each page of the worksheet.

Response: The worksheets have been revised as suggested.

5. Worksheet #8: Why isn't HAZWOPER training a requirement for technicians working at a CERCLA site? Isn't the site safety officer required to have 40 hour HAZWOPER training and 8 hour annual renewal certifications?

Response: This training requirement has been added to the Worksheet. Yes, the site safety officer is required to have 40 hour HAZWOPER training and 8 hour annual renewal certifications.

6. Worksheet #9: Did Shaun Whitworth and Cathy Weber contribute to the project scoping session? If not, please remove them from the table. If they had a role, what was it? In the "Comments" portion, the opening sentence is confusing. Please edit.

Response: Shaun Whitworth and Cathy Weber have been removed. The first sentence in the comments will be revised to "The Final ROD and the Final 90% Design for the Site 11a provided the basis for the remedial action at Site 11a (NAVFAC, 2011 and CH2MHILL, 2011b).

7. Worksheet #10: Please consider revising the opening sentence of the 1st paragraph as follows, "The JEB Little Creek-Fort Story (formerly known as Naval Amphibious Base (NAB) Little Creek), located in Virginia Beach, VA, began operations as a permanent base in 1946 and currently covers approximately 2,215 acres."

Response: This has been revised as suggested.

The last sentence of the 1st paragraph states Site 11a is in "the eastern portion of the base" while the 2nd paragraph of the Executive Summary and the 1st paragraph of Worksheet #10, Site 11 Background states it is in "the central portion". Use one or the other consistently throughout the document.

Response: The terminology has been revised to consistently refer to the site's location as "the central portion".

The 3rd paragraph of "Background" describes how SWMU 60 was closed with no further action under CERCLA via a desktop audit. Please include in the text the parties who conducted the desktop audit.

Response: This desktop audit was developed by the environmental staff at NAB Little Creek in 2000. The text will be revised to "...via a desktop audit performed by the Naval Amphibious Base Little Creek. (NAB Little Creek, 2000)." The reference has been added to the document as follows:

NAB Little Creek. 2000. SWMU/IR Summary for Naval Amphibious Base, Little Creek. June.

Under "Previous Investigations" please note the RI concluded there was no risk to ecological receptors from exposure to any site media (soil, sediment, surface water and groundwater).

Response: This statement has been added.

In the 2nd paragraph under "Nature and Extent of Contamination" please revise the 2nd half of the opening sentence as follows, ", while PCE is primarily concentrated in the source area and extends slightly south."

Response: This has been revised as suggested.

Please delete the end of the 3rd sentence after the last comma and the entire 4th sentence and add a reference to the figure (suggested in Comment #1) depicting both sites.

Response: This has been revised as suggested.

8. Worksheet #11, "Who will use the data?": *Please consider revising the 1st sentence as follows, "The groundwater data will be used by Osage and the Tier I Partnering Team to evaluate the remedy effectiveness by assessing groundwater quality at the perimeter and source areas to verify plume containment and source area concentration reduction."*

Response: This has been revised as suggested.

"What are the PALS?" In the sentence following the bulleted list of PALS please replace the term "breakdown products" with "hazardous byproducts".

Response: This has been revised to be consistent with the Record of Decision (ROD) for the site as follows:

PALs have been established for constituents with concentrations contributing to unacceptable risks and hazards from exposure to shallow groundwater within Site 11a. The cleanup levels were developed from the preliminary remediation goals, which were established in the FS as the MCLs after consideration of the total risks/hazards associated with their use. Cleanup levels (i.e., PALs) for the Site 11a COCs are as follows:

PCE: 5 µg/L

TCE: 5 µg/L

The Navy acknowledges the Commonwealth of Virginia's and USEPA's expectation to return groundwaters to their beneficial uses wherever practicable. Therefore, although not identified as site-specific COCs requiring action, the degradation of PCE and TCE may result in temporary increases to the concentrations of daughter products cis-1,2-DCE and vinyl chloride (VC) above their respective MCLs. RAOs cannot be met if these constituents are above their MCLs. As a result, cis-1,2-DCE and VC will be monitored during remedy implementation to ensure concentrations remain below their respective MCLs. The daughter product MCLs are as follows:

cis-1,2-DCE: 70 µg/L
VC: 2 µg/L

In the next paragraph, please consider the following revision to the opening sentence, "Additionally, the ERD process may mobilize certain metals, particularly arsenic. Therefore, dissolved arsenic will be monitored during remedy implementation with a goal of returning concentrations to the baseline condition or the MCL (10 ug/L) whichever is higher."

Response: This has been revised as suggested.

"List the PQO's...", in the last bullet please insert the terms "cleanup goals" and "PALS" as they pertain to COCs.

While the comment is a little unclear and clarification would be welcome, the suggested revision for this is:

“If after six months of groundwater monitoring following remedy implementation, groundwater results indicate that the substrate is reducing COC concentrations in groundwater, a long-term groundwater monitoring program may be initiated to monitor natural attenuation until groundwater COC concentrations are reduced to the **clean up goals**.”

9. Worksheet #14: *In the 2nd bullet, "Groundwater Monitoring Well installation", please refer to "Appendix B" rather than "Attachment B".*

Response: This has been revised as suggested.

For "Groundwater Monitoring Well Development" please indicate in the text the SOP will be followed.

Response: This has been revised as suggested.

In the 2nd paragraph under "EVO Injection" please consider revising the 1st sentence similar to, "As shown in the process flow diagram in Figure 5, flow meters will be used to monitor the volume of SRS leaving the SRS storage tank to be mixed with water from the fire hydrant prior to the mixture being injected into the wells."

Response: This has been revised as suggested.

In the 1st sentence of the 3rd paragraph, please insert the word "delivery" prior to each word "interval".

Response: This has been revised as suggested.

In the 2nd sentence of the 4th paragraph, please replace the word "per" with the phrase "as specified in".

Response: This has been revised as suggested.

In the 3rd sentence of the 4th paragraph, please replace the word "manifolding" with the phrase "simultaneous distribution" and delete "at a time" from the end of the sentence.

Response: This has been revised as suggested.

In the last sentence of the 5th paragraph, please insert the word "pressure" prior to the word "test".

Response: This has been revised as suggested.

In the sentence under "Injection Point Abandonment" please revise to reflect Virginia preference for using 100% bentonite grout when abandoning boreholes.

Response: This has been revised as suggested.

In the 1st paragraph under "Waste Management Plan" please note "groundwater purge water" will include well development water and pre-sampling purge water and note storage of IDW will comply with applicable Virginia Waste Management Regulations.

Response: This has been revised as suggested.

Under "Water Level Elevation Survey" please note the survey will follow established SOPS.

Response: This has been revised as suggested.

10. Worksheet #21: *Please include an SOP for the collection of field data. In the portion of the field data SOP that discusses dissolved oxygen, please include a dissolved oxygen solubility table and provide instructions for field technicians to follow should instruments provide super-saturated dissolved oxygen readings.*

Response: This SOP has been added and includes a chart for dissolved oxygen solubility and provides instructions as suggested.

11. Appendix B, SOP 2, Setup and Purging: *The 8th bullet should reference the SOP requested in Comment #9.*

Response: This comment is assumed to be referring to the SOP that was requested in Comment #10, not #9. If that is incorrect, please provide clarification for this comment.
Regarding "Additional Remark #1, what instructions should the field technician follow if a well goes dry during purging and doesn't recover after several hours?"

Response: If the well goes dry during purging and doesn't recover after several hours, the sampler should attempt to collect the sample on the following day or as soon as practicable. The

collection of a “complete sample” is measured as the ability to collect the required volume for a particular analyte, not the entire suite of analytes needed. Therefore, as long as a complete sample can be collected from each trip back to a monitoring well, there is no limit on the number of trips that can be made to facilitate successful collection of the entire suite of analytes needed. If a complete sample (e.g., all the volume of sample bottle(s) required for an analytical scan) cannot be collected in a single trip back, the well may be considered not viable and require either rehabilitation or replacement. To facilitate the collection of a complete sample from a well with poor recovery alternative sample methods (i.e. passive diffusion bags [PDBs]) can be considered, as well as a reduction in the volume of groundwater required by the laboratory.

12. Appendix B, SOP #4, Procedures and Guidelines: *Please include instruction for the management of unused soil extracted from the borehole (IDW).*

Response: Instructions have been added.

13. Appendix B, SOP #6, Procedures and Guidelines: Drilling Method *Include instructions for the disposal of drill cuttings as IDW.*

Response: Instructions have been added.

Monitoring Well Installation- Please note grout to be used must be 100% bentonite.

Response: Noted.

14. Appendix C: *Where is the ELAP Certificate of Accreditation for Microseeps, Inc.?*

Response: To Osage’s knowledge, there are not any DOD ELAP certified laboratories that perform dissolved H₂ analysis. Hence, an ELAP certificate is not applicable for these analyses. A footnote has been added with this information to explain the absence of a DOD ELAP certificate.

15. Appendix D, Site 11a Remedial Design Technical Specification, Section 1.3.2: *Please verify the treatment area calculation and subsequent calculations. According to the injection plan, there are 46 injection points each with a 10' radius of influence which yields a treatment area of $14,451 \text{ ft}^2 = 46[\pi(10^2)]$.*

Response: This information is from the 90% Design Document. This comment has been communicated to the author of that document. The comment is noted.

16. Appendix D, Site 11 a Remedial Design Technical Specification, Part 1, Section 1.4: *Please specify where and how the post-injection radius of influence measurements will be taken.*

Response: This information has been added.

17. Appendix D, Site 11a Remedial Design Technical Specification, Part 1, Section 1.5: *The 1st submittal listed under SD-01 Pre-construction Submittals is the Remedial Action Work Plan for ERD. The inclusion of the term Remedial Action Work Plan in the title of the document that*

is the subject of this review is confusing. Perhaps the title of the document under review requires revision as suggested in Comment# 1 above.

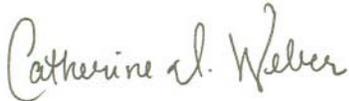
Response: Please see the response to Comment #1.

18. Appendix D, Site 11a Remedial Design Technical Specification, Part I, Section 3.2: *In the last paragraph please specify "granular 100% bentonite slurry".*

Response: This has been specified as suggested.

If you have any questions please do not hesitate to contact me at my office at (757) 440-0400, on my cellular phone at (757) 619-4690, or by e-mail at cweber@osageva.com.

Yours sincerely,



Catherine I. Weber
Sr. Project Manager

cc: Mr. Jeffrey M. Boylan, USEPA
Mr. David Cohn, Osage of Virginia
Ms. Cecilia Landin, CH2MHILL
Mr. Paul Landin, CH2MHILL
Mr. Bryan Peed, NAVFAC

SAP Worksheet #1 -- Title and Approval Page

FINAL

**Site 11a Remedial Action Work Plan and
Sampling and Analysis Plan
(Field Sampling Plan and Quality Assurance Project Plan)
Joint Expeditionary Base Little Creek-Fort Story
Virginia Beach, Virginia**

Prepared for:

Department of the Navy
Naval Facilities Engineering Command
Mid-Atlantic Division
9742 Maryland Avenue
Norfolk, VA 23511

Prepared under:

Contract No. N40085-11-D-0066
CTO No. 0002

July 2012

Prepared by:

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2618 Colley Avenue, Norfolk, Virginia
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Osage of Virginia – Project Manager

Shaun Whitworth
Osage of Virginia – Program Manager

Approval Signatures:

Jonathan Tucker
NAVFAC Atlantic – Chemist / Quality Assurance Officer

Other Approval Signatures:

Bryan Peed
NAVFAC Mid-Atlantic – Remedial Project Manager

Jeff Boylan
USEPA Region 3 – Remedial Project Manager

Paul Herman, P.E.
VDEQ – Remedial Project Manager

EXECUTIVE SUMMARY

Osage of Virginia, Inc. (Osage) has prepared this Sampling and Analysis Plan (SAP) and Remedial Action Work Plan to support the Selected Remedy for Site 11a at the Joint Expeditionary Base (JEB) Little Creek-Fort Story, Virginia Beach, Virginia. Osage was contracted by the United States Navy (Navy), Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic Division to implement the Selected Remedy in accordance with the Final Record of Decision (ROD) for Site 11a: Building 3033 Former Vehicle Repair Facility and Waste Oil Tank (NAVFAC, 2011). The Selected Remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

Site 11a is a former vehicle repair facility and associated waste underground storage tank (UST) in the central portion of JEB Little Creek. Chlorinated volatile organic compounds (cVOCs) in groundwater were identified as the site chemicals of concern (COCs) and no further action is warranted for the other site media (soil and indoor air) as detailed in the Feasibility Study (CH2MHILL, 2011a). The Remedial Action Objectives (RAOs) for Site 11a, as stated in the ROD, are to:

1. Reduce concentrations of COCs in the source area and downgradient plume to cleanup levels (maximum contaminant levels [MCLs]) through treatment to the maximum extent practicable within a reasonable amount of time.
2. Prevent exposure to Site 11a groundwater and groundwater emissions in indoor air until concentrations of COCs have been reduced to levels that allow for unlimited use and unrestricted exposure (UU/UE).

Groundwater remediation will be accomplished through enhanced reductive dechlorination (ERD). Remedial action to address cVOCs in groundwater at Site 11a consists of the following tasks:

1. Installation of five new groundwater monitoring wells and advancement of two soil borings.
2. Baseline groundwater sampling.
3. Injection of electron donor substrate to stimulate (i.e., enhance) reductive dechlorination.
4. Post-injection performance monitoring (at months one, three, and six following injections).

Following post-injection performance monitoring, the need for continued groundwater monitoring will be assessed and annual groundwater monitoring could potentially be continued under a separate contract.

This SAP Work Plan was completed under contract number N40085-11-D-0045 Contract Task Order (CTO) 0002 in accordance with the Navy's Uniform Federal Policy (UFP) – SAP policy guidance to ensure that the environmental data collected are scientifically sound, of known and documented quality, and suitable for their intended use. The Navy UFP-SAP policy and document format complies with Quality Assurance Project Plan (QAPP) and Field Sampling Plan (FSP) guidance and requirements detailed in the NCP (§300.415.b.4.ii).

TestAmerica Laboratories, Inc. (TestAmerica) and Microseeps, Inc. will be used for laboratory analytical work for baseline performance monitoring and post-injection performance monitoring analyses. If additional laboratory services are requested requiring modification to the existing SAP, revised SAP worksheets will be submitted to the Navy and regulatory agencies for approval.

Work Plan Outline

This SAP Work Plan contains 37 worksheets in accordance with the Navy's UFP-SAP guidance and is consistent with United States Environmental Protection Agency (USEPA) QAPP guidance. Relevant tables are embedded within the worksheets. Figures are provided at the end of the document. The project Health and Safety Plan (HASP) is provided in Attachment A. Field standard operating procedures (SOPs) are provided in Attachment B. Attachment C contains the current TestAmerica Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP) Certificate. Attachment D contains existing groundwater monitoring well construction details and technical specifications and drawings for the ERD remedy.

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List of Attachments

Attachment A	Health and Safety Plan
Attachment B	Field Standard Operating Procedures
Attachment C	TestAmerica Department of Defense Environmental Laboratory Accreditation Program Certificate of Accreditation
Attachment D	Monitoring Well Construction Details and Technical Specifications

Acronyms and Abbreviations

A	analytical (for QC sample error assessment)
ACO	Administrative Contracting Officer
B.A.	Bachelor of Arts
BFB	bromofluorobenzene
bgs	below ground surface
B.S.	Bachelor of Science
°C	degrees Celsius
CA	corrective action
CAS	Chemical Abstract Services
CCB	continuing calibration blank
CCC	calibration check compound
CCV	continuing calibration verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CLC	common laboratory contaminant
CM	Construction Manager
COC	chemical of concern
CQA	construction quality assurance
CTO	Contract Task Order
cVOC	chlorinated volatile organic compound
%D	percent difference
DCE	cis-1,2-dichloroethene
DoD	Department of Defense
DOT	Department of Transportation
DO	dissolved oxygen
DPT	direct push technology
DL	detection limit
DQI	data quality indicator
DQO	data quality objective
EC	Electrical Conductivity
EDS	Environmental Data Services, Inc.
ELAP	Environmental Laboratory Accreditation Program
EMAC	Environmental Multiple Award Contract
ERD	enhanced reductive dechlorination
ERP	Environmental Restoration Program
eV	electronvolt
EVO	emulsified vegetable oil
FEAD	Facilities Engineering and Acquisition Division
FFA	Federal Facilities Agreement
ft	feet
g	gram
GC/MS	gas chromatogram / mass spectrometer

GME	Grand Mean Exception rule
gpm	gallons per minute
GPS	global positioning system
H&S	health and safety
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSA	hollow stem auger
ICAL	initial calibration
ICP	inductively coupled plasma
ICV	second source calibration verification
IDQTF	Intergovernmental Data Quality Task Force
IDW	investigative derived waste
IR	Installation Restoration
JEB	Joint Expeditionary Base
LCS	laboratory control sample
LCL	lower confidence limit
LIMS	laboratory information management system
LOD	limit of detection
LOQ	limit of quantitation
MCL	maximum contaminant level
MEE	methane, ethane, and ethene
µg/L	micrograms per liter
mg/L	milligrams per liter
mL	milliliter
MPC	measurement performance criteria
M.S.	Master of Science
MS/MSD	matrix spike/matrix spike duplicate
NAB	Naval Amphibious Base
NAVFAC	Naval Facilities Engineering Command
NIRIS	Naval Installation Restoration Information Solution
nM	nanomolar
NPL	National Priority List
NTR	Navy Technical Representative
ORP	oxidation-reduction potential
PAL	Project Action Limit
P.E.	Professional Engineer
PID	photoionization detector
PIL	project indicator level
POC	point of contact
PPE	personal protective equipment
PQOs	Project Quality Objectives

psi	pounds per square inch
PWC	Public Works Center
QA	quality assurance
QAM	Quality Assurance Manager
QAMS	Quality Assurance Management Section
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	quality control
QL	quantitation limit
%R	percent recovery
RAO	Remedial Action Objective
RI	Remedial Investigation
ROD	Record of Decision
ROI	radius of influence
RPD	Relative Percent Difference
RPM	Remedial Project Manager
RRF	Relative Response Factor
RSK	Robert S. Kerr Environmental Research Center in Ada, Oklahoma
S	sampling (for QC sample error assessment)
S&A	sampling and analytical (for QC sample error assessment)
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SOW	Scope of Work
SPCC	System Performance Check Compound (with respect to laboratory analysis)
SRS [®] -SD	Slow Release Substrate-Small Droplet
SW	Solid Waste
SWMU	solid waste management unit
TBD	to be determined
TCLP	toxicity characteristic leaching procedure
TOC	total organic carbon
UCL	upper confidence limit
UFP	Uniform Federal Policy
U.S.	United States
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VA	Virginia
VC	vinyl chloride
VDEQ	Virginia Department of Environmental Quality
VFA	volatile fatty acid
VOC	volatile organic compound

SAP Worksheet #2 – Sampling and Analysis Plan (SAP) Identifying Information

Site Name/Number: Joint Expeditionary Base (JEB) Little Creek-Fort Story Site 11a - Building 3033 Former Vehicle Repair Facility and Waste Oil Tank
Operable Unit: Not Applicable
Contractor Name: Osage of Virginia (Osage)
Contract Number: N40085-11-D-0045 Contract Task Order (CTO) 0002
Contract Title: Enhanced Reductive Dechlorination at Site 11A, JEB Little Creek

1. This SAP was prepared in accordance with the requirements of:
 - Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP) (United States Environmental Protection Agency [USEPA], 2005)
 - USEPA Guidance for Quality Assurance Project Plans (QAPPs)
 - USEPA QA/G-5, Quality Assurance Management Section (QAMS) (USEPA, 2002)
 - USEPA Guidance on Systematic Planning Using the Data Quality Objectives Process (USEPA, 2006)
2. **Identify regulatory program:** Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)
3. **This SAP is specific to:** The Site 11a Remedial Action.
4. **List dates of scoping sessions that were held:**

<u>Scoping Session</u>	<u>Date</u>
The Final 90% Submittal Basis of Design for Site 11a (90% Design) that incorporated Virginia Department of Environmental Quality (VDEQ) and USEPA comments was used as the scope for this UFP-SAP Work Plan in lieu of a scoping session.	August 16, 2011

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

<u>Title</u>	<u>Date</u>
<u>CH2M HILL. 2007. Final Remedial Investigation Work Plan, Site 11a, Virginia Beach, Virginia (VA). September.</u>	<u>September 2007</u>

6. **List organizational partners (stakeholders) and connection with lead organization:**

VDEQ – regulatory stakeholder
USEPA Region 3 – regulatory stakeholder
Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic – lead organization
JEB Little Creek-Fort Story – site owner

SAP Worksheet #2 – Sampling and Analysis Plan (SAP) Identifying Information (continued)

7. Lead organization: NAVFAC Mid-Atlantic

8. If any required SAP elements or required information are not applicable to the project or are provided elsewhere, then note the omitted SAP elements and provide an explanation for their exclusion below:

Crosswalk table has been excluded; all required information is provided in this SAP.

SAP Worksheet #3 -- Distribution List

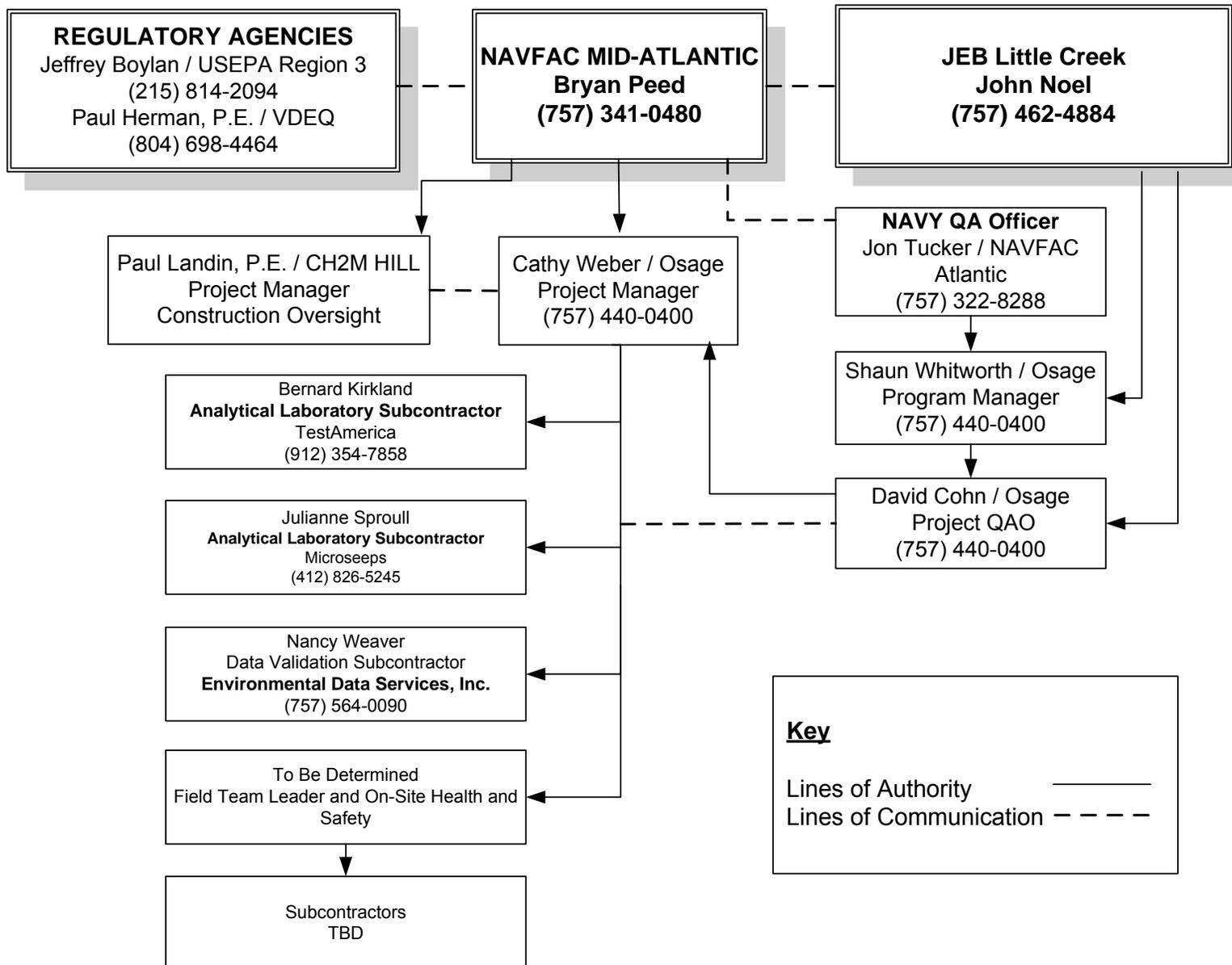
Name of SAP Recipients	Title/Role	Organization	Telephone Number	E-mail Address or Mailing Address
Bryan Peed	Navy Technical Representative (NTR)	NAVFAC Mid-Atlantic	(757) 341-0480	bryan.peed@navy.mil
John Noel	Construction Manager (CM); Administrative Contracting Officer (ACO)	JEB Little Creek-Fort Story Facilities Engineering and Acquisition Division (FEAD)	(757) 462-4884	john.w.noel@navy.mil
Jeffrey Boylan	Remedial Project Manager (RPM)	USEPA Region 3	(404) 562-8538	boylan.jeffrey@epamail.epa.gov
Paul Herman, P.E.	State RPM	VDEQ	(804) 698-4464	peherman@deq.virginia.gov
Paul Landin, P.E.	CH2M HILL Project Manager / Construction Quality Assurance (CQA)	CH2M HILL	(757) 671-6238	paul.landin@ch2m.com
To be determined (TBD)	Onsite CH2M HILL Field Quality Assurance Officer (QAO)		TBD	TBD
Shaun Whitworth	Program Manager	Osage	(757) 440-0400	swhitworth@osageva.com
Cathy Weber	Project Manager			cweber@osageva.com
David Cohn	QAO			dcohn@osageva.com
TBD	Field Team Leader		TBD	TBD
Bernard Kirkland	Laboratory Project Manager	TestAmerica Laboratories Inc. (TestAmerica) Savannah	(912) 354-7858	bernard.kirkland@testamericainc.com
Andrea Teal	Quality Assurance Manager (QAM)	TestAmerica Savannah	(912) 354-7858	andrea.teal@testamericainc.com
Sally Hoffman	Laboratory Project Manager	TestAmerica Buffalo	(716) 504-9839	sally.hoffman@testamericainc.com
Julianne Sproull	Laboratory Project Manager	Microseeps, Inc. (Microseeps)	(412) 826-5245	jsproull@microseeps.com
Nancy Weaver	Data Validation	Environmental Data Services, Inc. (EDS)	(757) 564-0900	nweaver@env-data.com

SAP Worksheet #4 -- Project Personnel Sign-Off Sheet

Name	Organization/Title/Role	Signature/email receipt	SAP Section Reviewed	Date SAP Read
Bryan Peed	NTR			
John Noel, RA	JEB Little Creek-Fort Story CM; ACO			
Paul Landin, P.E.	CH2M HILL / Project Manager / Construction Oversight			
Shaun Whitworth	Osage Program Manager			
Cathy Weber	Osage Project Manager			
David Cohn	Osage QAO			
Bernard Kirkland	TestAmerica Savannah Project Manager			
Andrea Teal	TestAmerica QAM			
Sally Hoffman	TestAmerica Buffalo Project Manager			
Julianne Sproull	Microseeps Project Manager			
Nancy Weaver	EDS Data Validator			

Note: The personnel sign-off sheet will be retained in the project file.

SAP Worksheet #5 -- Project Organizational Chart



SAP Worksheet #6 – Communication Pathways

Communication drivers would be approvals, notifications, or stop work issues. Sufficient notice will be given to allow for approval or planning for work to occur. Project contacts, phone numbers, and e-mail addresses are presented in Worksheet #3 and lines of communication are presented in Worksheet #5.

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure, Pathway, etc.
Communication with Navy (lead agency)	Navy NTR/RPM	Bryan Peed	bryan.peed@navy.mil	Mr. Peed is the primary point of contact (POC) for the Navy; he may delegate communication to other internal or external POC(s). As RPM, Mr. Peed will notify USEPA and VDEQ via e-mail or by telephone call within 24 hours if field changes affecting the scope or implementation of the design occur. The Navy will have 30 days for work plan review.
Communication with USEPA Region 3	USEPA Region 3 RPM	Jeffrey Boylan	boylan.jeffrey@epamail.epa.gov	Mr. Boylan is the primary POC for USEPA; he may delegate communication to other internal or external POC(s). Upon notification of field changes, USEPA will have 24 hours to approve or comment on the field changes.
Communication with VDEQ	VDEQ RPM	Paul Herman, P.E.	peherman@deg.virginia.gov	Mr. Herman is the primary POC for VDEQ; he may delegate communication to other internal or external POC(s). Upon notification of field changes, VDEQ will have 24 hours to approve or comment on the field changes.
Communication regarding overall project status and implementation and primary POC with Navy RPM, EPA, and VDEQ	Osage Program Manager	Shaun Whitworth	swhitworth@osageva.com	Mr. Whitworth will oversee the overall project and will be informed of project status by the Project Manager. If field changes occur, Program Manager will work with the Navy RPM to communicate field changes to the team via email within 24 hours. As Program Manager, Mr. Whitworth may delegate these duties to the Project Manager.
Communications regarding project management, implementation, field team and subcontractors; data tracking from field collection to database upload	Osage Project Manager	Cathy Weber	cweber@osageva.com	Information and materials about the project will be forwarded to the Navy and Program Manager as necessary. Ms. Weber will also serve as the POC for the field sampling team and subcontractors. Responsible for ensuring adherence to work plan by the field team and by subcontractors. Ms. Weber will also track data from sample collection through database upload.
Communications regarding CQA	CH2M HILL Project Manager	Paul Landin, P.E.	paul.landin@ch2m.com	Mr. Landin will provide CQA for NAVFAC during the project construction for groundwater monitoring well installation and during remedial action implementation.

SAP Worksheet #6 – Communication Pathways (continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure, Pathway, etc.
Work plan changes in field. QAPP field changes/ Field Progress Reports	Osage Field Team Leader	TBD	TBD	The field team leader will document any deviations from the IP in the field book, with the approval of the Project Manager and/or QAO. The field team leader will provide daily progress reports to the Project Manager. Deviations will be made only with approval from the Project Manager.
Health & Safety (H&S)	Osage Onsite H&S Officer	TBD	TBD	Responsible for personnel's adherence to the Health and Safety Plan (HASP) requirements. The onsite H&S Officer will report H&S incidents and near losses to the Project Manager.
Reporting lab data quality Issues	TestAmerica Project Manager	Bernard Kirkland	bernard.kirkland@testamericainc.com	Mr. Kirkland will report any quality assurance / quality control (QA/QC) issues with project field samples within two days to the Project Manager. The Navy RPM will be contacted if there are major laboratory issues, whom at his discretion will contact the Navy chemist.
Reporting lab data quality Issues	TestAmerica Buffalo Project Manager	Sally Hoffman	sally.hoffman@testamericainc.com	Ms. Hoffman will report any QA/QC issues to Bernard Kirkland, TestAmerica Savannah Project manager.
Reporting lab data quality Issues	Microseeps	Julianne Sproull	jsproull@microseeps.com	Ms. Sproull will report any QA/QC issues with project field samples within two days to the Project Manager. The Navy RPM will be contacted if there are major laboratory issues, whom at his discretion will contact the Navy chemist.
Reporting data validation issues	TestAmerica Data Validator	Nancy Weaver	nweaver@env-data.com	Ms. Weaver will copy the Project Manager on communications regarding data validation issues that require resubmissions from the laboratory. The data validation report will be due to Osage within 14 calendar days of data receipt.
Field and analytical corrective actions (CAs); release of analytical data	Osage QAO and/or Project Manager	David Cohn	dcohn@osageva.com	Any CAs for field and analytical issues will be determined by the field team leader, QAO, and/or the Project Manager and be reported to the Project Manager within four hours. Analytical data may not be released until validation of the data is completed and has been approved by the QAO and/or the Project Manager. The Project Manager and/or QAO will review analytical results within seven days of receipt for release to the project team. Should any field or analytical issues be identified that would cause project delays such that data quality objectives (DQOs) or project schedule cannot be met, the Project Manager will notify the Navy QAO.

SAP Worksheet #6 – Communication Pathways (continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure, Pathway, etc.
Field CAs	Osage Project Manager, Program Manager, and/or QAO	Cathy Weber	cweber@osageva.com	Field and analytical issues that require CA will be determined by the Program Manager, Project Manager and/or QAO; the Project Manager will ensure SAP requirements are met by field staff.

SAP Worksheet #7 -- Personnel Responsibilities and Qualifications Table

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional) ¹
Bryan Peed	NTR	NAVFAC Mid-Atlantic	Oversees project.	
John Noel	CM; ACO	JEB Little Creek-Fort Story FEAD	Approve waste disposal.	
Jeffrey Boylan	RPM	USEPA Region 3	Review, comment, and approve reports.	
Paul Herman, P.E.	State RPM	VDEQ	Review, comment, and approve reports.	
Paul Landin, P.E.	Project Manager / CQA	CH2M HILL	Oversight during project construction phases.	
Shaun Whitworth	Program Manager	Osage	Oversees project activities and provides support for remedial action implementation.	Bachelor of Science (B.S.) Geology, 10 years' experience.
Cathy Weber	Project Manager		Manages project and coordinates project tasks and project staff.	B.S. Geo-Environmental Engineering, Master of Science (M.S.) Environmental Engineering, 12 years' experience.
David Cohn	QAO		QA.	Bachelor of Arts (B.A.) Interdisciplinary Studies with Minors in Chemistry, Biology and Environmental Science, 10 years' experience.
TBD	Field Team Leader		Implement field activities.	
TBD	Project Health and Safety Officer		Ensure HASP is implemented properly in the field (see HASP provided in Attachment A).	
Bernard Kirkland	Laboratory Project Manager		TestAmerica Savannah	Oversee laboratory analyses and internal laboratory QA/QC.
Andrea Teal	QAM	Responsible for audits and checks of QA performance within the laboratory.		B.A. Chemistry, B.A Mathematics, 15 years' experience.
Sally Hoffman	Laboratory Project Manager	TestAmerica Buffalo	Oversee laboratory projects.	8 years Project Manager experience
Mark Mikesell	Laboratory Manager	Microseeps	Oversee laboratory analyses and internal laboratory QA/QC	B.A. Chemistry, 23 years' experience
Char Washloski	QAO		Responsible for audits and checks of QA performance within the laboratory	
Nancy Weaver	Data Validator	EDS	Data validation for usability.	

1. Resumes are held by the individuals' organizations and may be made available upon request. Upon project implementation, staff may be substituted if needed, or removed if not necessary.

SAP Worksheet #8 -- Special Personnel Training Requirements Table

Project Function	Specialized Training By Title or Description of Course	Training Provider	Training Date	Personnel / Groups Receiving Training	Personnel Titles / Organizational Affiliation	Location of Training Records / Certificates
All Personnel	40 Hour HAZWOPR	Various	Various	All Personnel	Various	Available Upon Request
All Personnel	8 Hour HAZWOPR Refresher	Various	Various	All Personnel	Various	Available Upon Request

SAP Worksheet #9 – Project Scoping Session Participants Sheet

Project Name: Site 11a Remedial Action Projected Date(s) of Sampling: May 2012 through April 2013 Project Manager: Cathy Weber		Site Name: Site 11a – Building 3033 Former Vehicle Repair Facility and Waste Oil Tank Site Location: JEB Little Creek-Fort Story, Virginia Beach, VA		
Date of Session: August 2011: In lieu of scoping session, the Final Record of Decision (ROD) and Final 90% Design for Site 11a were used as the basis of for the scope of work (SOW) for this SAP Work Plan (NAVFAC, 2011 and CH2MHILL, 2011b). Scoping Session Purpose: The scope of remediation was outlined in the Final ROD and the Final 90% Design for Site 11a (NAVFAC, 2011 and CH2MHILL, 2011b)				
Name	Title/Project Role	Affiliation	Phone #	E-mail Address
Bryan Peed	RPM	NAVFAC Mid-Atlantic	(757) 341-0480	bryan.peed@navy.mil
Jeffrey Boylan	EPA RPM	USEPA Region 3	(215) 814-2094	boylan.jeffrey@epamail.epa.gov
Paul Herman, P.E.	VDEQ RPM	VDEQ	(804) 698-4464	peherman@deq.virginia.gov
Comments: The Final ROD and the Final 90% Design for the Site 11a provided the basis for the remedial action at Site 11a (NAVFAC, 2011 and CH2MHILL, 2011b). This document outlined the remedial approach including emulsified vegetable oil (EVO) injection, baseline groundwater monitoring and performance monitoring. Baseline monitoring includes sampling and analysis of 15 existing site wells and five (5) new wells. Performance monitoring will be conducted at one-month, three-month, and six-month intervals. Performance monitoring will be conducted to monitor and evaluate the success of the remediation. Seven (7) groundwater monitoring wells will be sampled and analyzed during the one-month and three-month performance monitoring events, and 20 wells will be sampled and analyzed during the six-month performance monitoring event.				
Action Items: Submit UFP-SAP Work Plan				
Consensus Decisions: The VDEQ and USEPA comments on the design were addressed in the Final 90% Submittal Design for Site 11a (CH2MHILL, 2011b). The scope may be modified slightly upon receipt of baseline groundwater sampling results.				

SAP Worksheet #10 – Problem Definition

JEB Little Creek-Fort Story Base History

The JEB Little Creek-Fort Story (formerly known as Naval Amphibious Base (NAB) Little Creek), located in Virginia Beach, VA, began operations as a permanent base in 1946 and currently covers approximately 2,215 acres. As shown on Figure 1, the Base is bounded to the north by the Chesapeake Bay, to the south by Shore Drive, to the west by Little Creek Channel and Shore Drive, and to the east by Lake Bradford and Chub Lake. Site 11a is located in the central portion of the Base, primarily northeast of the intersection of 7th and Grasp Streets.

NAB Little Creek was created as a result of the escalation of World War II in the early 1940s. Four bases (Camp Bradford, Camp Shelton, United States (U.S.) Naval Frontier Base, and Amphibious Training Base) were constructed on the Whitehurst Farm located near the mouth of the Chesapeake Bay. More than 350,000 service personnel trained in various amphibious assault tactics at the conglomerate of bases during World War II. After the war, the four bases were consolidated into one and NAB Little Creek was commissioned in 1945. On October 1, 2009, the first Joint Base was formed in Hampton Roads creating JEB Little Creek – Fort Story; which is comprised of the former NAB Little Creek and the Army Post, Fort Story.

As described in the NAVFAC Environmental Multiple Award Contract (EMAC) SOW dated August 5, 2011, the base's mission was the training of landing craft personnel for operational assignments. JEB Little Creek-Fort Story has expanded in both area and the complexity of its mission over the past 65 years. Base personnel provide logistical facilities and support services for local commands, organizations, home-ported ships, and other U.S. and allied units to meet the amphibious warfare-training requirements of the U.S. Armed Forces. Past and present operations at JEB Little Creek-Fort Story include vehicle and boat maintenance, boat painting and sandblasting, construction and repair of buildings and piers, mixing and application of pesticides, electroplating of musical instruments, laundry and dry cleaning, medical and dental treatment, and the generation of steam for heat. Land development surrounding the base is residential, commercial, and industrial.

Site 11a Background - Building 3033 Former Vehicle Repair Facility and Waste Oil Tank

Site 11a is a former vehicle repair facility and associated underground storage tank (UST) in the central portion of the JEB Little Creek-Fort Story. The 11a boundary encompasses approximately seven acres. Site 11a was identified in 1998 when volatile organic compounds (VOCs) were detected in groundwater from an Environmental Restoration Program (ERP) Site 11 upgradient monitoring well (LS11-MW16D) during Site 11 Supplemental Remedial Investigation. Groundwater samples were collected in 1999 in the Site 11a vicinity as part of Site 11 investigations to identify a potential upgradient source of VOCs. Consequently, the trichloroethene (TCE) groundwater contamination upgradient of Site 11 became identified in the Federal Facilities Agreement (FFA) in 2001 as Site 11a, and was proposed for investigation under CERCLA.

Surface features at Site 11a consist of Buildings 3606 and 3606A, their surrounding asphalt parking areas, and an open, mown grass field. Building 3606 is a five-story barracks building used as a single residence lodging for active duty personnel. Building 3606A is a one-story building used primarily for administrative and recreational activities associated with the barracks. The open field south of Building 3606 is chiefly utilized as a recreational area for building occupants.

SAP Worksheet #10 -- Problem Definition (continued)

Two former buildings, Buildings 3033 and 3034, were located at the site. Former Building 3033, used as a 12-bay vehicle repair facility, was immediately south of the current barracks building. Historical records indicate the presence of a waste oil UST associated with the vehicle repair activities. The tank was identified as solid waste management unit (SWMU) 60 in the SWMU/Installation Restoration (IR) Summary report. The contents of the tank were not documented, and there is no record of solvent disposal in the tank. The tank was reportedly excavated and removed in 1988 under the UST Program; however, documentation of tank closure is not available. Prior to NAB Little Creek's placement on the National Priorities List (NPL) in 1999, SWMU 60 was closed under CERCLA with no further action via a desktop audit performed by the Naval Amphibious Base Little Creek. (NAB Little Creek, 2000). SWMU 60 was documented in the FFA as closed with no further CERCLA action. Former Building 3034, used as a garden supply center, was in the grass-covered field. No releases associated with the building have been documented.

The Final ROD and Final 90% Design for Site 11a, identified enhanced reductive dechlorination (ERD) by EVO injections for the site remedy (NAVFAC, 2011 and CH2MHILL, 2011b). EVO injections are planned in the plume source area and along the dissolved plume boundaries to reduce the groundwater VOCs concentrations. Baseline groundwater monitoring will be conducted prior to EVO injections to establish baseline conditions for ERD effectiveness evaluation. To evaluate injection efficacy, performance monitoring will be implemented following EVO injections and compared to the baseline groundwater data.

PREVIOUS ENVIRONMENTAL INVESTIGATIONS

Previous environmental investigations conducted at Site 11a were:

- **Groundwater Investigation** - August 2001
- **Supplemental Investigation** - May through June 2002 (CH2MHILL, 2003a)
- **Membrane Interface Probe and Direct Push Technology Investigation** - October 2003 (CH2MHILL, 2003b)
- **Monitoring Well Installation and Groundwater Sampling** - February 2004
- **Treatability Study** - January through November 2005 (CH2MHILL, 2006)
- **Remedial Investigation (RI)** - September through October 2007 (CH2MHILL, 2010a)
- **Data Gap Investigation** - September 2009 through April 2010 (CH2MHILL, 2010b)
- **Vapor Intrusion Investigation** - November 2009 through March 2010 (CH2MHILL, 2011c)

These investigations included collection and analysis of shallow groundwater, surface soil, subsurface soil, sub-slab soil vapor, indoor air, and outdoor air samples. The RI concluded that there was no risk to ecological receptors from exposure to any site media (soil, sediment, surface water and groundwater). Potential human health or ecological risks were not identified from exposure to soil or indoor air. Potential human health risks were identified from chlorinated VOC (cVOC) exposure in shallow groundwater. The groundwater investigation and risk assessment results were presented in the RI Report, the Site 11a Data Gap Investigation Technical Memorandum, and the RI Addendum Report. Pertinent site information from these reports is summarized below.

SAP Worksheet #10 -- Problem Definition (continued)

PHYSICAL SETTING, GEOLOGY, and HYDROGEOLOGY

The Site 11a topography is relatively flat; unpaved surface areas have been landscaped with shrubs, bushes, grass, and several large trees surrounding Buildings 3606 and 3606A. Natural drainage features are not evident and no surface water bodies are located on the site.

Stormwater drop inlets located on the site convey surface water runoff to outfalls, which discharge to surface water bodies within JEB Little Creek (CH2MHILL, 2011).

The overburden subsurface geology at Site 11a consists primarily of medium- and fine-grained sands of the Columbia aquifer, underlain by a high-plasticity clay of the Yorktown confining unit. Shallow groundwater at Site 11a is within the Columbia aquifer, encountered at a depth between five and 10 feet (ft) below ground surface (bgs). The Columbia aquifer is approximately 20 to 30 ft deep and is underlain by the Yorktown confining unit, which separates the Columbia aquifer from the underlying Yorktown aquifer. Based on the RI data, the Yorktown aquifer has not been affected by Site 11a activities.

As shown on Figure 2, the groundwater flow direction is predominantly to the west-southwest, though it has been shown to fluctuate based upon weather events (CH2MHILL, 2011). This flow direction is consistent with the groundwater contaminant plume orientation. Based upon the RI, a small groundwater flow gradient to the north is occasionally observed at the northeast corner of the site (CH2MHILL, 2010a). Though, it is not believed to have a significant impact on contaminant migration due to the fact that chemicals of concern (COCs) were not detected in the northernmost monitoring well (LS11- MW20D). As shown on Figure 2, the groundwater gradient at the site is relatively flat and varies by less than one foot across the site. As estimated during the RI, the average shallow groundwater flow velocity is estimated to be 2.4 feet per year (CH2MHILL, 2010a). The Columbia aquifer groundwater is not used as a potable water supply, currently, nor is it expected to be used as such in the future. The City of Virginia Beach provides potable water to the base and surrounding community. Groundwater wells are present at the base golf course, approximately 1,900 feet northwest of Site 11a, and provide water from the Yorktown aquifer for irrigation.

NATURE AND EXTENT OF GROUNDWATER CONTAMINATION

Tetrachloroethene (PCE) and TCE were detected in groundwater at concentrations above their USEPA Maximum Contaminant Levels (MCLs). As shown in Figure 3, the dissolved plume follows the primary direction of groundwater flow to the south-southwest, starting from the source area near the footprint of the former Building 3033 and the suspected location of the former waste oil UST. However, groundwater data collected from points just north and south of Building 3606 show cVOCs extending beneath the building, indicating that groundwater may also be dispersing outward from the source area due to the low groundwater gradient.

TCE has extended further horizontally than PCE, while PCE is primarily concentrated in the source area and extends slightly south. Based on the RI data, the cVOC plume is predominately present in the bottom five-foot interval above the confining unit (from approximately 23 to 28 ft bgs) (CH2MHILL, 2011). Based groundwater grab sample analytical results, the Site 11a and Site 11 plumes appear to be comingled in the vicinity of 7th Street (see Figure 3). For the remedial design, the entire shallow groundwater plume is defined as the area where the TCE or PCE concentration is above 5 micrograms per liter ($\mu\text{g/L}$), which is the MCL for both constituents.

SAP Worksheet #10 -- Problem Definition (continued)

Maximum PCE and TCE groundwater concentrations detected at Site 11a are as follows:

- PCE: 1,800 µg/L
- TCE: 1,100 µg/L

As discussed in the 90% Design, migration of dissolved cVOCs via advection is the primary mechanism for constituent transport at Site 11a. Dispersion and diffusion from the source area caused by mechanical mixing during transport through the aquifer matrix play a secondary, less prominent transport mechanism. Sorption of contaminants to soil surfaces, natural degradation, and volatilization from groundwater to the gas phase are the primary mechanisms responsible for the fate of the COCs. Limited biodegradation of PCE to TCE may be occurring, but data collected to date shows limited complete transformation of TCE to cis-1,2-dichloroethene (DCE) and vinyl chloride (VC) at the site.

ERD REMEDY

The primary objective of the ERD remedy is to reduce cVOC concentrations in groundwater that are present above Project Action Limits (PALs), which are defined in Worksheet #11. Figure 4 presents the injection point layout and groundwater monitoring well network for performance monitoring. EVO will be delivered into injection points to provide substrate that is intended to stimulate reductive dechlorination of cVOCs.

The groundwater monitoring well network (currently 15 wells) will be enhanced through the addition of five new groundwater monitoring wells. The depth to the Yorktown confining unit will be confirmed via one soil boring each per monitoring well location and advancing two additional soil borings. Attachment B presents the field Standard Operating Procedures (SOPs) for the field activities.

Following the new groundwater monitoring well installation, a baseline groundwater sampling event will be conducted to establish aquifer baseline conditions (sampling details are presented in Worksheets #14, #17, and #18). Laboratory analyses will be performed by TestAmerica of Savannah, South Carolina, and Buffalo, New York, as well as by Microseeps of Pittsburgh, Pennsylvania. Attachment C provides the TestAmerica Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP) Certificate.

Following review of the baseline groundwater sample results, the injection layout configuration may be modified, as appropriate, to optimize the injection locations, if necessary. Based upon existing data, the current design specifies EVO injections to 46 injection points: 26 injection points located within the plume source area and 20 injection points located along the dissolved plume western and southern boundaries (which could be modified based upon review of the baseline groundwater sample results).

Attachment D presents the design details including monitoring well logs for the existing 15 wells, project specifications, EVO design drawings, and EVO dosing calculations (based upon the existing groundwater data). EVO will be injected at a 5% dilution into each injection point, for approximately 1,234 gallons of diluted solution per injection point, and a total diluted volume of 56,764 gallons. Worksheet #14 presents additional details on the EVO injection system.

SAP Worksheet #10 -- Problem Definition (continued)

Following EVO injections, performance monitoring will be conducted at one-month, three-month, and six-month intervals. The groundwater results will be used to evaluate the EVO distribution and remedy effectiveness. Monitoring may continue past one year post-injection until PALs are met (under a separate contract).

PROBLEM DEFINITION

Historical activities and investigations have shown that COCs are present in groundwater at Site 11a at concentrations requiring action. Previous groundwater sampling has shown that cVOCs were above USEPA MCLs.

The environmental questions and problems to be addressed by the ERD Remedy are:

1. What are the baseline groundwater conditions prior to remedy implementation?

This question will be addressed by collecting groundwater samples from the existing 15 Site 11a groundwater monitoring wells and an additional five (5) newly installed groundwater monitoring wells. These locations are shown on Figure 3. The groundwater sampling results will be used to establish the baseline groundwater conditions, to assess the current groundwater plume extents, and to document baseline groundwater geochemistry prior to treatment. Figure 3 presents the most recent groundwater plume configuration from groundwater samples collected in October 2007.

2. How will the baseline data be utilized to locate injection points?

The baseline groundwater results will refine the current plume configuration. Based on this current data, adjustments to the injection layout shown in Figure 4 will be made as necessary to maximize the effectiveness of the injection well locations, to the extent practicable. CH2M HILL will assist in data evaluation and refinement of injection point layout as specified in the 90% Design to prepare the 100% design for injection activities.

Source area injection locations as well as the dissolved plume boundary injection locations are planned to be spaced at 20-ft centers. This spacing is based on a design radius of influence (ROI) of 10 ft. Source area injections are focused on the area of the plume exhibiting total combined PCE and TCE concentrations above 500 µg/L. Dissolved plume boundary injection locations are focused on the southern and western leading edges of the plume with a PCE and/or TCE concentration(s) above 5 µg/L (and combined concentration below 500 µg/L). Injection dosage quantities and design information are detailed in Worksheets #11 and #14 and provided in Attachment D.

3. How will the remedy effectiveness be evaluated?

Performance monitoring will be conducted following substrate injection at one-month, three-month, and six-month intervals. Groundwater samples will be collected from the monitoring well network shown in Figure 4¹ and analyzed for COCs to assess the ERD process.

¹ The full set of 20 site groundwater monitoring wells will be sampled during the baseline groundwater sampling and the six-month post-injection groundwater sampling events. During the one-month and three-month post-injection groundwater sampling events, a subset (i.e., seven (7) wells, as listed in Worksheet #18) of the groundwater monitoring wells will be sampled and analyzed. The groundwater monitoring wells selected for the one-month and three-month groundwater sampling events are located within the plume centerline or along the

SAP Worksheet #10 -- Problem Definition (continued)

Additionally, performance monitoring indicator parameters (PMIPs) consisting of dissolved metals (arsenic, iron, and manganese), methane, ethane, and ethane (MEE), nitrate as N, sulfate, sulfide, total organic carbon (TOC), dissolved hydrogen (H₂) and volatile fatty acids (VFAs) will be laboratory analyzed to provide additional data for substrate effectiveness evaluations. Finally, water quality parameter measurements collected in the field will include pH, dissolved oxygen (DO), oxygen-reduction potential (ORP), turbidity, salinity, specific conductivity, and temperature. Further details are provided in Worksheet #17, Sampling Design and Rationale.

4. How will it be demonstrated that clean-up levels have been achieved?

If necessary, additional periodic monitoring could be conducted following remedy implementation and six-month performance monitoring to track COC concentrations along with select PMIPs (under a separate contract). The need for additional groundwater monitoring will be evaluated following completion of the six-month performance monitoring event. If further monitoring and/or injection events are deemed necessary, they could be performed under this SAP via a SAP addendum or modification. Because ERD alters the aquifer's redox potential and may mobilize arsenic, iron, and/or manganese, these metals could also be monitored periodically to assess their stabilization to pre-remedy conditions. Water quality parameter measurements would include pH, DO, ORP, turbidity, salinity, specific conductivity, and temperature.

Reporting

Project reporting is discussed in Worksheet #14, Summary of Project Tasks.

SAP Worksheet #11 -- Project Quality Objectives (PQOs)/Systematic Planning Process Statements

This section presents the PQOs for the Remedial Action.

Who will use the data?

The groundwater data will be used by Osage and the Tier I Partnering Team to evaluate the remedy effectiveness by assessing groundwater quality at the perimeter and source areas to verify plume containment and source area concentration reduction. Data validation will also be conducted by a third party data validator to assess the data usability. Evaluations may also be performed to assess the remedial design effectiveness as well as the site characteristics.

What are the PALs? (specific detailed list is provided in WS#15)

PALs have been established for constituents with concentrations contributing to unacceptable risks and hazards from exposure to shallow groundwater within Site 11a. The cleanup levels were developed from the preliminary remediation goals, which were established in the FS as the MCLs after consideration of the total risks/hazards associated with their use. Cleanup levels (i.e., PALs) for the Site 11a COCs are as follows:

PCE: 5 µg/L

TCE: 5 µg/L

The Navy acknowledges the Commonwealth of Virginia's and USEPA's expectation to return groundwaters to their beneficial uses wherever practicable. Therefore, although not identified as site-specific COCs requiring action, the degradation of PCE and TCE may result in temporary increases to the concentrations of daughter products cis-1,2-DCE and vinyl chloride (VC) above their respective MCLs. RAOs cannot be met if these constituents are above their MCLs. As a result, cis-1,2-DCE and VC will be monitored during remedy implementation to ensure concentrations remain below their respective MCLs. The daughter product MCLs are as follows:

cis-1,2-DCE: 70 µg/L

VC: 2 µg/L

Additionally, the ERD process may mobilize certain metals, particularly arsenic. Therefore, dissolved arsenic will be monitored during remedy implementation with a goal of returning concentrations to the baseline condition or the MCL (10 µg/L) whichever is higher. Project indicator levels (PILs) for the PMIPs that will be monitored during remedy implementation are also detailed in Worksheet #15, with evaluative criteria.

The PIL for the injection ROI is 10 ft or more.

The Site 11a Remedial Action Objectives (RAOs) established in the Final ROD are (NAVFAC, 2011):

1. Reduce concentrations of COCs in the source area and downgradient plume to cleanup levels (maximum contaminant levels [MCLs]) through treatment to the maximum extent practicable within a reasonable amount of time.
2. Prevent exposure to Site 11a groundwater and groundwater emissions in indoor air until concentrations of COCs have been reduced to levels that allow for unlimited use and unrestricted exposure (UU/UE).

SAP Worksheet #11 -- PQOs/Systematic Planning Process Statements (continued)

Note that the second RAO is not actively being addressed with respect to potential groundwater emissions to indoor air in this SAP.¹

What will the data be used for?

- Lithology and soil boring information will be used to confirm the depth to the top of the Yorktown confining unit as it relates to the installation of new monitoring wells as well as confirming the injection interval above the confining unit.
- Baseline groundwater sampling data will be utilized to establish baseline conditions that will be used for comparison and performance effectiveness evaluative purposes throughout the project. The baseline groundwater sampling data will also be used to assess whether the location and/or number of injection points needs to be modified.
- Post-injection groundwater data from the performance monitoring wells will be used to measure overall reduction of COCs, evaluate remedy performance, and monitor aquifer conditions as follows:
 - **COCs:** COC data will be used to assess the change in groundwater concentration over time by comparison of baseline groundwater sampling data to one-month, three-month, and six-month groundwater sampling results. COC concentrations will also be compared to the PALs to assess remedy effectiveness and plume containment.
 - **PMIPs:** PMIP results will be used to compare against baseline data to evaluate injection efficacy, e.g., whether aquifer conditions indicate reducing conditions, EVO persistence, presence of terminal electron acceptors, and if the final end products of COCs (i.e., MEE) are present. Detailed discussion of PMIP Project Indicator Levels (PILs) and the desired effect to be observed is provided in Worksheet #15.
 - **Water quality parameters:** Water quality parameters (pH, DO, ORP, turbidity, salinity, specific conductivity, and temperature) are measured during low-flow groundwater sampling to assess aquifer stabilization at the time of groundwater sample collection. Additionally, these parameters may be used to assess aquifer reducing conditions.

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

Worksheet # 17 contains detailed information on the types of data needed for this project.

- Soil lithology information from soil borings and groundwater monitoring well installations is needed to evaluate the depth of the Yorktown confining unit and assess the depth of injection points for substrate injections.

¹ Vapor intrusion is to be addressed during long-term monitoring following remedy construction, which will be addressed in a separate SAP.

SAP Worksheet #11 -- PQOs/Systematic Planning Process Statements (continued)

- Low-flow groundwater samples will be collected from groundwater monitoring wells using a peristaltic pump as per the field SOP (Attachment B). Samples will be analyzed for select cVOCs, dissolved arsenic, iron, and manganese, MEE, nitrate as N, sulfate, sulfide, TOC, dissolved H₂, and VFAs. Water quality parameters (pH, DO, ORP, turbidity, salinity, specific conductivity, and temperature) will be recorded in the field using a water quality multimeter (e.g., Horiba U-22 or YSI 556 with flowthrough cell).

How “good” do the data need to be in order to support the environmental decision?

- Laboratory data will be validated by a third-party data validator for analytical method validation against measurement performance criteria (MPC) contained in this SAP. Level IV data packages will be obtained and QC sampling and analysis will be performed. After third-party data validation, the Partnering Team will use the data to evaluate substrate performance, overall remedy effectiveness, and protection of human health and the environment. Monitoring will continue past one year post-injection, if necessary, until PALs are met (under a separate contract). QC data requirements are detailed in Worksheet #20 and Worksheets #28-1 through #28-9.
- Survey and global positioning system (GPS) data needs to be of sufficient quality to accurately record the horizontal location of injection points and for making groundwater flow maps from groundwater elevation measurements.
- QA/QC samples will be collected to check sampling and analytical protocols.

How much data should be collected?

The number of samples and rationale are presented in Worksheet #17, and summarized below. Field QA/QC samples will be collected as outlined in Worksheet #20.

- Baseline groundwater monitoring well samples will be collected from 20 site groundwater monitoring wells (15 existing and five (5) newly-installed). Samples will be analyzed for select cVOCs, dissolved arsenic, iron, and manganese, MEE, nitrate as N, sulfate, sulfide, TOC, dissolved H₂, and VFAs. Water quality parameters (pH, DO, ORP, turbidity, salinity, specific conductivity, and temperature) will be recorded in the field using a water quality multimeter (e.g., Horiba U-22 or YSI 556 with flowthrough cell).
- One-month and three-month performance groundwater monitoring well samples will be collected from seven site groundwater monitoring wells (four (4) existing and three (3) newly-installed). One-month performance monitoring samples will be analyzed for select cVOCs, dissolved arsenic, iron, and manganese, MEE, nitrate as N, sulfate, sulfide, and TOC. Three-month performance monitoring samples will be analyzed for this same list plus dissolved H₂, and VFAs.
- Six-month performance groundwater monitoring well samples will be collected from the same 20 site groundwater monitoring wells as the baseline groundwater monitoring, and analyzed for the same parameter list as well as field water quality parameters.

SAP Worksheet #11 -- PQOs/Systematic Planning Process Statements (continued)

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

- Baseline Groundwater Monitoring Well Sampling — As shown on Figure 4, Baseline groundwater monitoring well samples will be collected from 15 existing site wells and five (5) newly-installed groundwater monitoring wells, as detailed in Worksheets #17 and #18. Baseline groundwater monitoring well sampling will be conducted prior to EVO injections. Worksheet #16 presents the project schedule.
- Post-Injection One-Month and Three-Month Performance Monitoring — Performance monitoring sampling will be conducted from seven site monitoring wells (four (4) existing and three (3) new wells as shown in Figure 4), as detailed in Worksheets #17 and 18. These samples will be collected one month and three months following EVO injections.
- Post-injection Six-Month Performance Monitoring — Performance monitoring sampling will be conducted from the 20 site monitoring wells, as detailed in Worksheets #17 and 18. These samples will be collected six months following EVO injections.
- Additional Groundwater Monitoring — The need for additional groundwater monitoring will be evaluated following review of the six-month groundwater monitoring results. Additional groundwater monitoring may be conducted under a modification to this SAP, but will be under a separate contract.

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

- Osage staff will collect groundwater samples and oversee the EVO injections.
- Data will be reported in a Construction Complete Report, a One-Month and Three-Month Groundwater Monitoring Results Technical Memorandum (Tech Memo), and a Six-Month Groundwater Monitoring Results Tech Memo (details on these reports' contents are presented in Worksheet #14). Groundwater monitoring will continue until RAOs are achieved, and may be conducted under a modification to this SAP (under a separate contract).
- A VA-licensed surveyor under subcontract to Osage will perform surveying of groundwater monitoring wells for horizontal and vertical control.
- A professional well driller under subcontract to Osage will perform soil boring advancement and monitoring well installation and well development, with oversight provided by Osage staff.
- Laboratory analytical services will be provided by TestAmerica and Microseeps, under subcontract to Osage.
- Once provided by TestAmerica, laboratory analytical data will be validated by EDS. Osage will utilize validated data to generate summary tables for the Tech Memos.

SAP Worksheet #11 -- PQOs/Systematic Planning Process Statements (continued)

How will the data be archived?

Data will be archived according to Osage's contract requirements with NAVFAC. Data will be uploaded into the centralized electronic database, Naval Installation Restoration Information Solution (NIRIS), accessible to the Navy.

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

The PQOs for the environmental media sample data collected at the site are presented below.

- If after six months of groundwater monitoring following remedy implementation, post-injection groundwater monitoring results do not indicate that the substrate is reducing COC concentrations in groundwater, the Navy, USEPA, and VDEQ may evaluate the current site conditions and remedy optimization options. This may include documentation in the form of a memo to file, Explanation of Significant Difference, or a ROD amendment.
- If after six months of groundwater monitoring following remedy implementation, groundwater results indicate that the substrate is reducing COC concentrations in groundwater, a long-term groundwater monitoring program may be initiated to monitor natural attenuation until groundwater COC concentrations are reduced to the clean-up goals (PALs) or reduced to the maximum extent practicable.

SAP Worksheet #12-1 – Measurement Performance Criteria (MPC) Table – Field QC Samples

Matrix: Groundwater
 Analytical Group: Select cVOCs

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	MPC	QC Sample Assesses Error for Sampling (S), Analytical (A) or both S&A
Field Duplicate	Select cVOCs	One (1) per 10 samples	Precision	Relative percent difference (RPD) \leq 25%	S&A
Rinsate Blank		One (1) per sampling event	Bias/ Contamination	No analyte detected > limit of quantitation (LOQ)	S&A
Trip Blank		One (1) per cooler containing VOCs samples	Bias/Contamination	No analyte detected > LOQ	S&A
Temperature Blank		One (1) per cooler	Accuracy / Representativeness	0-6 degrees Celsius ($^{\circ}$ C)	S
Matrix Spike (MS) / Matrix Spike Duplicate (MSD)		One (1) per 20 set of field samples	Accuracy/Bias and Precision	See recovery limits in Worksheet #28; RPD \leq 30%	A

SAP Worksheet #12-2 – MPC Table- Field QC Samples

Matrix: Groundwater
 Analytical Group: Dissolved Metals (Arsenic, Iron, and Manganese)

QC Sample	Analytical Group	Frequency	DQIs	MPC	QC Sample Assesses Error for S, A or both S&A
Field Duplicate	Dissolved As, Fe, and Mn	One (1) per 10 samples	Precision	RPD \leq 25%	S&A
Rinsate Blank		One (1) per sampling event	Bias/ Contamination	No analyte detected > LOQ	S
Temperature Blank		One (1) per cooler	Accuracy / Representativeness	0-6 $^{\circ}$ C	S
MS/MSD		One (1) per 20 set of field samples	Accuracy/Bias and Precision	See recovery limits in Worksheet #28; RPD \leq 30%	A

Note: Field QC samples are planned for constituents with PALs and not for performance monitoring indicator parameters.

SAP Worksheet #13 – Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation / collection dates)	How Data Will Be Used	Limitations on Data Use
RI	CH2MHILL, RI Report for Site 11a – Building 3033 Former Vehicle Repair Facility and Waste Oil Tank, July 2010	CH2MHILL, groundwater data from July, 1999 to October 2007	Assess historical groundwater concentrations.	cVOC data was collected and analyzed in 2007 and may not be representative of current conditions; hence baseline groundwater monitoring will be conducted.

SAP Worksheet #14 -- Summary of Project Tasks

Project Approach

Work is planned to be performed in Level D personal protective equipment (PPE), which includes hard hat, safety glasses, safety toed boots, and hearing protection. Optional PPE may include the use of Tyvek® coveralls. PPE upgrades are outlined in the HASP (Attachment A), and would be implemented according to the HASP, as needed.

Fire hydrant(s) located in the site vicinity will be used for water supply for the substrate dilution. The hydrant use will be coordinated with the base fire department prior to fire hydrant use, and the volume of water used during the injection process will be monitored using a water meter/backflow prevention device provided by the base Public Works Center (PWC).

A temporary staging area will be located onsite to store injection materials and equipment (Figure 4). The staging area will be enclosed within a locked fence to prevent unauthorized access. The temporary staging area will be removed following the injection activities.

Following the substrate injections, the site will be restored to its original condition. Temporary fencing will be removed and tire tracks on the grass will be reseeded, returned to approximate existing grade, and covered with straw, as needed.

The following is a summary of tasks to be conducted under the Remedial Action.

- **Buried utility location**

Miss Utility of VA, Base personnel, and a professional underground utility locator will be consulted to identify any subsurface utilities within 20 feet of the injection locations and new groundwater monitoring wells. Injection borings and/or groundwater monitoring wells within four feet of any underground utility will be conducted by hand to a minimum four foot depth to avoid damaging the line(s). Alternatively, locations may be relocated to avoid potential utility interference, while maintaining the remedial design objectives.

- **Pre-Injection Activities**

- Groundwater Monitoring Well Installation

Five (5) new permanent monitoring wells will be installed (Figure 4) prior to conducting injection activities to enhance the current groundwater monitoring well network. Soil borings will be advanced via direct push technology (DPT) for continuous soil lithology information to the depth of the Yorktown confining unit (approximately 23 ft bgs). Soil descriptions will be recorded following Unified Soil Classification System (USCS) and will include color, grain size, moisture, consistency, soil structure, mineralogy, and other relevant information concerning contamination (odor, staining, photoionization detector (PID) reading), if observed. The new groundwater monitoring wells will be installed to the depth of the Yorktown Confining Unit using hollow stem auger (HSA) drilling methods. Appendix B provides the field SOPs for soil borings and monitoring well construction.

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

- Groundwater Monitoring Well Development

The five (5) new groundwater monitoring wells will be developed following their installation. The monitoring well development procedures outlined in SOP 6 (Attachment B) will be followed. At least three (3) well volumes of water will be removed with a submersible pump, in addition to any water volume that was added during installation. Well development will proceed until the water is clear and free of sediment or until two 55-gallon drums have been filled, whichever occurs first. Well development data will be collected and recorded in the field logbook and will include pH, DO, ORP, turbidity, specific conductance, temperature, and gallons removed.

- Soil Borings

In addition to the groundwater monitoring well installations, two (2) soil borings will be advanced to the top of the Yorktown confining unit. One (1) boring each will be advanced in the main source treatment area and one (1) at the convergence of the two boundary injection lines. The purpose of these soil borings is to confirm the depth to the confining unit for the injections.

- Surveying

Groundwater monitoring wells will be surveyed for both horizontal and vertical control by a surveyor licensed in the State of Virginia. Elevations will be surveyed to the nearest 0.01 foot, while horizontal location will be established to the nearest 0.1 foot.

- Baseline Groundwater Sampling

The 15 existing and five (5) new groundwater monitoring wells will be sampled prior to EVO injections. Groundwater sampling will be performed using a peristaltic pump and following low-flow groundwater sampling techniques, as described in the field SOP in Attachment B. Samples will be collected from the mid-point of the screen and analyzed as detailed in Worksheet #18. The current groundwater monitoring well construction details are provided in Attachment D.

• Remedial Action Construction

- Mobilization

A mobilization period will include identifying, briefing, and mobilizing staff and subcontractors. Mobilization activities will include a project kickoff and site safety meeting. Additionally, prior to commencing excavation work, the necessary equipment and supplies will be mobilized to the 11a site.

- Injection Points

Injection points will be installed via DPT, which will be advanced to the Yorktown confining layer located between 20 and 30 ft bgs. The depth to the Yorktown confining unit will be confirmed through soil borings and monitoring well

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

installations, as discussed above. Injections will be conducted across a 10-ft vertical interval, in two five-foot delivery intervals. The barrier point injection zone spans from 14 to 24 ft bgs and the source points span approximately or 18 to 28 ft bgs (source points).

- EVO Preparation

EVO dosage was developed in the 90% Design and is detailed in Attachment D (CH2MHILL, 2011). Concentrated Slow Release Substrate-Small Droplet (SRS®-SD) EVO will be mixed with water to form solution in 275-gallon totes that will be outfitted with mixers to keep the solution in suspension. A target dilution of 5% is planned.

- EVO Injection

As shown on Figure 4, EVO will be injected at 46 injection locations, inclusive of 26 locations within the source area, and 20 dissolved plume boundary locations. The injection system will be truck-mounted to easily transport equipment between injection points and during overnight storage. No more than 1,320 gallons of EVO will be stored on site at any one time; hence, a Spill Prevention Countermeasures Control (SPCC) Plan will not be required.

As shown in the process flow diagram in Figure 5, flow meters will be used to monitor the volume of SRS leaving the SRS storage tank to be mixed with water from the fire hydrant prior to the mixture being injected into the wells. The diluted substrate will be distributed to up to five (5) lines for simultaneous application to up to five (5) injection wells. Each of the five (5) lines will be equipped with a flow meter to monitor injection volume and pressure gauges and flow meters/volume totalizers will be used to monitor the flow and to shut off the line to the injection point once the pre-defined target volume has been injected.

Injection of the shallower 5-ft delivery interval will be completed first, and then the injection tool will be pushed down to injection across the lower 5-ft delivery interval. The total planned injection volume per point will be distributed evenly across the two injection intervals, as practicable. If necessary, preference will be given to injecting more in the deeper interval.

Injection pressures are assumed to be low, less than 20 pounds per square inch (psi). The injection flow rate per injection location is expected to be 3.0 gallons per minute (gpm), as specified in Section 2.2.2 of the 90% Design. A total flow rate of 15 gpm is planned, based upon simultaneous distribution to five (5) injection points. A total of 1,234 gallons of diluted solution per injection point is planned, for a total of 56,764 gallons of diluted solution for the site.

The injection assembly will be fitted with a pressure gauge to monitor pressure in each injection point. When the total injection volume has been reached, the pressure will be released to ensure that the injection hose is safe to disconnect. Before EVO injection, the system will be tested for leaks and proper functioning using water from the fire hydrant. Any leaks will be repaired prior to use of the

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

system. An additional pressure test will be performed with the system connected to the five injection points.

The system will be pressurized with water from the fire hydrant. Each line will be activated individually and then all five points will be brought on line concurrently. As the lines are activated, the system will be evaluated to ensure that the system is functioning properly and is leak-free. Once all lines are activated and the system is functioning properly, the flow will be equalized. A branch of the system or the entire system will be temporarily stopped if a leak develops, an injection point backs up, additional EVO mixture is needed, and/or an injection point well receives its target volume. The ROI will be verified using electrical conductivity (EC) techniques on the first day of injections. An EC probe will be advanced via DPT through the injection zone at varying radii. EC readings will be compared with readings from a background location indicating the vertical and horizontal distance travelled by the reagent. Approximately five to seven pushes will be advanced at varying locations.

- Injection Point Abandonment

Injection points will be abandoned through the use of 100 percent bentonite grout, following the procedures outlined in the field SOP for borehole abandonment (Attachment B).

- **Post-injection Performance Monitoring**

- Performance Monitoring

Samples will be collected from seven (7) performance groundwater monitoring wells at one (1), three (3), and six (6) months following injection. An additional 13 performance groundwater monitoring wells will be sampled six (6) months following injection. The sampling plan is detailed in Worksheets #17 and #18. The performance groundwater monitoring well network is shown in Figure 4. Six (6) groundwater performance monitoring wells are located within a 10 ft ROI of the injection points. Groundwater samples will be collected using a peristaltic pump following low-flow sampling protocol as described in the field sampling SOP (Attachment B).

- Post-Remediation Monitoring

After the six (6)-month performance monitoring results are reviewed, the need for additional groundwater monitoring will be evaluated. Additional groundwater monitoring could be conducted under this SAP; however, the current contract task order does not cover groundwater monitoring beyond the six (6)-month performance monitoring event.

- **Equipment Decontamination**

Non-disposable sampling equipment and drilling equipment will be decontaminated before use and immediately after each use in accordance with the field SOP (Attachment B).

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

Waste Management Plan

Investigative derived waste (IDW) will include soil from the monitoring well installations and soil borings/injection points, groundwater purge water, and solutions used to decontaminate non-disposable sampling equipment. Groundwater purge water will include well development water and pre-sampling purge water. IDW will be containerized in Department of Transportation (DOT)-approved, steel 55-gallon drums, which will be stored at an approved IDW satellite location. Storage of IDW will comply with applicable Virginia Waste Management Regulations.

Pre-injection baseline aqueous IDW will be characterized for appropriate offsite disposal using generator knowledge and toxicity characteristic leaching procedure (TCLP) VOC analysis, and will be removed from the site within 90 days of generation. Post-injection IDW will be characterized for appropriate offsite disposal using generator knowledge and full TCLP analysis, and will be removed from the site within 90 days of generation.

Solid IDW generated during monitoring well installation and injection point installation will include drill cuttings from monitoring/injection well installation. Solid IDW will be contained in DOT-approved, steel 55-gallon drums, which will be removed from the site and stored at an approved IDW satellite location. To verify that solid IDW is nonhazardous, soil IDW will be characterized for appropriate offsite disposal using generator knowledge and full TCLP analysis. Waste characterization samples will be collected from the drums and composited for laboratory analysis.

Upon receipt of waste characterization results, the IDW will be transported offsite for disposal at an approved disposal facility that is authorized to accept offsite, non-hazardous, CERCLA-generated waste. A licensed waste transportation contractor will be retained to transport IDW to the identified disposal facility. Waste manifests will be signed by a JEB Little Creek-Fort Story representative.

Water Level Elevation Survey

Prior to groundwater sampling, a complete round of water levels will be recorded from the 20 site groundwater monitoring wells. Water elevation surveying will follow the SOPs established in SOP 1 (Attachment B). The depth to water and time measured will be recorded in the field logbook. This information will be used to create updated groundwater potentiometric maps for the site.

QC

- Implement SOPs for field (Attachment B) and laboratory activities being performed.
- QC samples to be collected are outlined on Worksheet #20.

Surveying

- Injection point and soil boring locations will be horizontally located using a GPS.

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

· Laboratory Analysis

- The laboratory will maintain, test, inspect, and calibrate analytical instruments in accordance with Worksheets #24 and #25.
- The laboratory will process and prepare samples for analysis. The laboratory will analyze samples for analytes as indicated on Worksheet #18.

· Data management and review and third-party data validation

Data management activities will consist of entering field and validated laboratory data onto spreadsheets and tabulating field and validated analytical results for report preparation. An independent data validator (EDS) will be retained to validate laboratory analytical data. The validated analytical results will be evaluated to assess the technical adequacy and usability of the data. Procedures for recording data, including guidelines for recording and correcting data are provided in Worksheets #31-32 and 35-37.

Once the data is received from the laboratory and is validated, an evaluation of the data will be completed. In addition, this task involves the evaluation of field-generated data including laboratory analytical data, water level measurements, boring log and well construction records, water quality measurements, and other field notes. See Worksheet #20 for details on QA/QC techniques.

The laboratory analytical results will be compared against the PALs. Analytical and survey data will be provided to NAVFAC or appropriate contractor for uploading to the JEB Little Creek-Fort Story electronic database.

· Documentation and reporting

Reporting will include results of baseline groundwater sampling, summary of EVO injections, and results of performance monitoring sampling. The groundwater sampling reports and their anticipated contents will include the following:

1. Baseline Groundwater Monitoring Results Tech Memo
2. One-Month and Three-Month Groundwater Monitoring Results Tech Memo
3. Six-Month Groundwater Monitoring Results Tech Memo
 - Brief description of site 11a (site characteristics, COCs, and results of site investigations)
 - Identification of RAOs and cleanup standards
 - Results of baseline groundwater sampling (or one- and three-month results, or six-month results, as applicable)
 - Data validation summary
 - Disposal confirmation
 - Project photographs
 - The post-injection Groundwater Monitoring Well Results Tech Memos (one- and three-month results and six-month results) will each include an effectiveness evaluation, comparing performance monitoring data to the initial baseline data.

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

Draft Tech Memos will be submitted to the Partnering Team for review prior to submittal to USEPA and VDEQ. Review comments will be addressed in the Final Tech Memos.

A Construction Complete Report will be provided following EVO injections to document the injection activities. This report is anticipated to include:

- Monitoring well installation documentation and soil boring lithology
- Injection points installation
- EVO mixing operation details and injection volumes
- Survey documentation
- Photographic documentation
- Injection points abandonment

SAP Worksheet #15-1 – Reference Limits and Evaluation Table

Matrix: Groundwater
 Analytical Group: Select Volatiles (8260B Low Level)

Analyte	Chemical Abstract Services (CAS) Number	PAL ¹ (µg/L)	PAL Reference	Project Quantitation Limit (QL) Goal (µg/L)	Laboratory-specific			MS/MSD and Laboratory Control Sample (LCS) Recoveries		
					LOQ (ug/L)	Limit of Detection (LOD) (ug/L)	Detection Limit (DL) (ug/L)	Lower Confidence Limit (LCL) (%)	Upper Confidence Limit (UCL) (%)	RPD (%)
cis-1,2-DCE	156-59-2	70	MCLs ²	14	1.0	0.25	0.15	70	130	30
PCE	127-18-4	5		1	1.0	0.25	0.15	70	130	30
TCE	79-01-6	5		1	1.0	0.25	0.13	70	130	30
VC	75-01-6	2		1	1.0	0.50	0.18	67	134	30

1. PALs reflect the most conservative value for that constituent based upon applicable regulatory criteria. The PALs listed here are the USEPA MCLs, current as of January 2012. Note that the PALs for PCE and TCE are established cleanup levels; however, cis-1,2-DCE and VC are being monitored because they are breakdown products of the reductive dechlorination process.

2. The promulgation date of each of the above listed USEPA MCLs are:

cis-1,2-DCE: January, 1991
 PCE: January, 1991
 TCE: June, 1987
 VC: June, 1987

SAP Worksheet #15-2 – Reference Limits and Evaluation Table

Matrix: Groundwater
 Analytical Group: Varied – Performance Monitoring Indicator Parameters

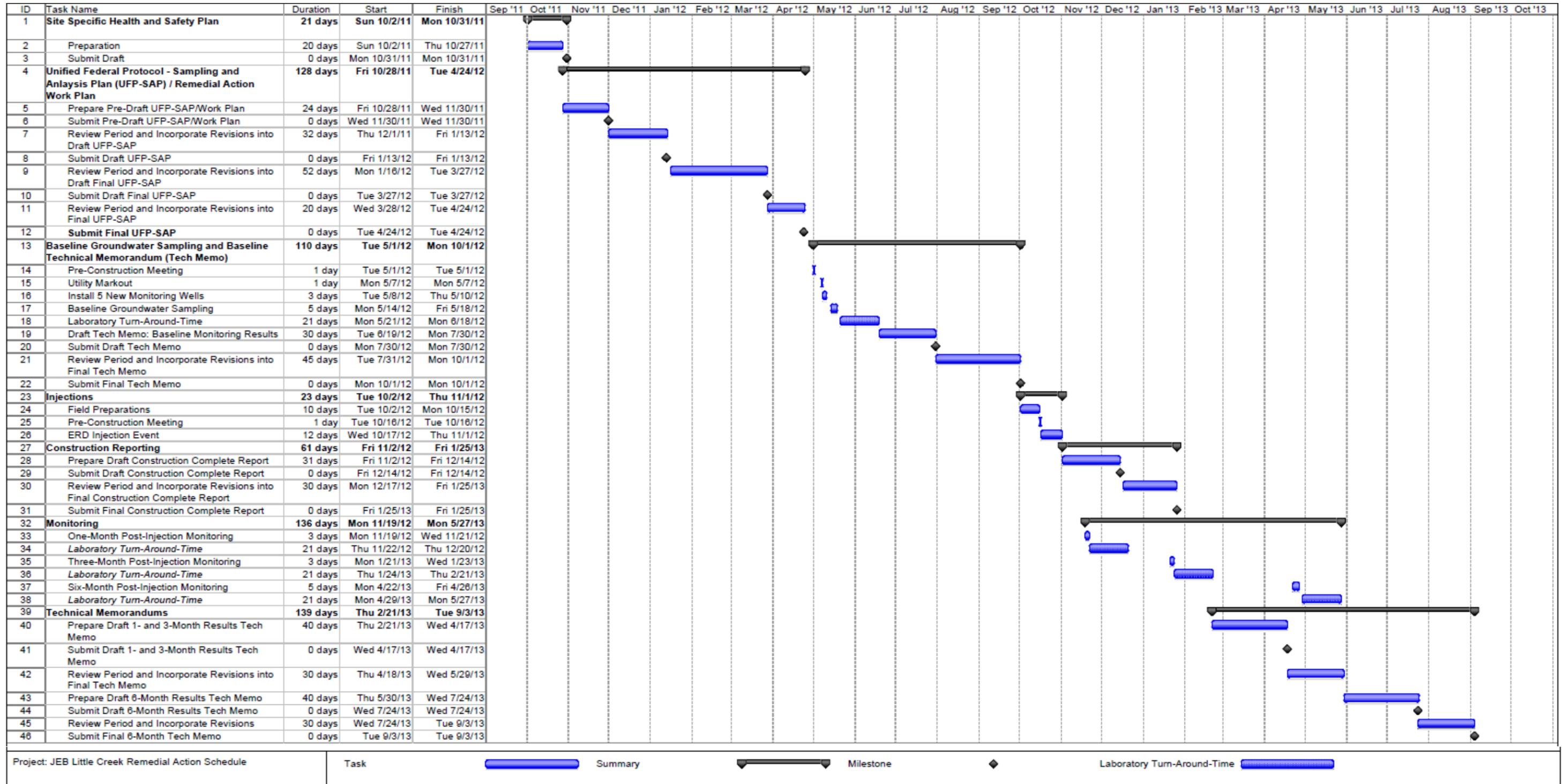
Analyte	CAS Number	Project Indicator Level (PIL)	Effect	Laboratory-specific			MS/MSD and LCS Recoveries		
				LOQ (ug/L)	LOD (ug/L)	DL (ug/L)	LCL (%)	UCL (%)	RPD (%)
Dissolved Arsenic	7440-38-2	≤ baseline concentration or MCL (10 ug/L), whichever is higher	Increased arsenic indicates mobilization due to reducing conditions. Because mobilization of arsenic is not beneficial (can reduce microbial activity), the PIL is set to a goal of returning to baseline conditions or below the MCL.	20	10	10	75	125	20
Dissolved Iron		> baseline concentration	Highly reducing conditions may cause increased dissolved iron concentrations by reduction and dissolution.	50	40	24	75	125	20
Dissolved Manganese	7439-96-5	> baseline concentration	Increased manganese concentrations indicate manganese-reducing conditions, showing the aquifer is sufficiently reduced for reductive dechlorination to occur.	10	3.0	3.0	75	125	20
Methane	74-82-8	> 0.5 milligram per liter (mg/L)	Increased methane concentrations are anticipated under highly reducing conditions, which is a degradation byproduct of methanogenic bacteria.	0.58	0.29	0.29	75	125	30
Ethane	74-84-0	Order of magnitude above baseline	These are the final end products of chlorinated ethanes/ethenes reductive dechlorination. These parameters indicate the extent of complete dechlorination. Increasing concentrations indicate reductive dechlorination is occurring.	1.1	0.55	0.55	75	125	30
Ethene	74-85-1			1.0	0.50	0.50	75	125	30
Nitrate as N	14797-55-8	< 1 mg/L	Decreased nitrate concentrations are indicative of reducing aquifer conditions. If nitrate is present at high concentrations, then denitrification may compete with the reductive dechlorination pathway.	0.25 mg/L	0.075 mg/L	0.075 mg/L	90	110	10
Sulfate	14808-79-8	< 20 mg/L	Decreased sulfate concentrations, as compared to background, may indicate that the aquifer is sufficiently reduced for reductive dechlorination to occur. If sulfate is present at high concentrations, then sulfate reduction may compete with reductive dechlorination.	5.0 mg/L	2.6 mg/L	2.6 mg/L	90	110	10

SAP Worksheet #15-2 – Reference Limits and Evaluation Table (continued)

Matrix: Groundwater
 Analytical Group: Varied – Performance Monitoring Indicator Parameters (continued)

Analyte	CAS Number	PIL	Effect	Laboratory-specific			MS/MSD and LCS Recoveries		
				LOQ (mg/L)	LOD (mg/L)	DL (mg/L)	LCL (%)	UCL (%)	RPD (%)
Sulfide	18496-25-8	> 1 mg/L	Sulfide is a final product of reductive dechlorination. Increasing sulfide is indicative of the reductive dechlorination pathway.	10	10	10	50	150	50
TOC	7440-44-0	> 20 mg/L	TOC indicates the total organic matter available to microbial communities for use as a carbon source in cVOC degradation. Increased TOC concentrations are a positive indicator of effective ERD and substrate distribution.	1.0	0.50	0.50	80	120	25
Alkalinity		> 50 mg/L	Measures buffering capacity of aquifer against pH change, which can affect the rate of cVOC degradation. Decreasing alkalinity may indicate that pH is highly susceptible to changes from acidity, resulting from reductive dechlorination. Increasing alkalinity may suggest an increase in biological activity.	5.0	5.0	5.0	80	120	30
H2	1333-74-0	> baseline; increasing	H2 can be used during reductive dechlorination as an electron donor, and is released when EVO is metabolized. Increased H2 concentrations indicate EVO persistence in the subsurface.	0.60 nano-molar (nM)	0.25 nM	0.60 nM	80	120	20
Lactic Acid	50-21-5	> baseline, increasing	EVO is broken down into lower molecular weight VFAs in groundwater. These intermediates resulting from biodegradation of complex organics serve as carbon and energy sources. Increased VFAs indicate EVO persistence in the subsurface.	1.0	0.14	0.14	80	120	20
Propionic Acid	79-09-4			1.0	0.17	0.17	80	120	20
Butyric Acid	107-92-6			1.0	0.16	0.16	80	120	20
Pyruvic Acid	127-17-3			1.0	0.08	0.08	80	120	20
Acetic Acid	64-19-7			1.0	0.15	0.15	80	120	20

SAP Worksheet #16 – Project Schedule / Timeline Table



SAP Worksheet #17 -- Sampling Design and Rationale

Matrix	Depth of Samples	Analysis	Method	Number of Samples	Rationale	Sampling Strategy	
Groundwater samples	Middle of screen	Select cVOCs	USEPA SW-846 Method 8260B	75	Evaluate cVOC degradation and contaminant distribution.	Groundwater monitoring wells will be sampled via low-flow sampling methodology (Field SOP #2).	
		Dissolved As, Fe, and Mn	USEPA SW-846 Method 6010B	67	As and Mn: Monitor for possible dissolution and assess aquifer reducing conditions. Fe: Assess aquifer reducing conditions.		
		MEE	RSK ¹ 175	58	Assess complete vinyl chloride degradation to harmless daughter products.		
		Nitrate as N	USEPA Method 300.0	58	Assess aquifer reducing conditions.	See Figure 4 for the groundwater monitoring well network (20 total wells: 15 existing and five new wells). These 20 wells will be sampled for baseline groundwater conditions and six months following injections.	
		Sulfate		58			
		Sulfide	USEPA Method 376.1	58	Assess aquifer reducing conditions and complete cVOC degradation.		
		TOC	USEPA Method 415.1	58	Assess zone of influence of injected substrate and organic substrate availability/longevity.		One-Month and Three-Month Post-Injection Performance Monitoring: Seven groundwater monitoring wells will be sampled.
		Alkalinity	USEPA Method 310.1	58	Measure the buffering capacity of the aquifer.		
		H2	AM20GAX / SM9	25	Assess terminal electron acceptor process, EVO persistence, and likelihood for reductive dechlorination to occur.		Groundwater monitoring wells will be sampled via low-flow sampling methodology (Field SOP #2).
VFAs	TestAmerica SOP BF-MB-009	25	Assess substrate distribution and organic substrate availability/longevity; assess degradation of more complex substrates.	See Figure 4 for the groundwater monitoring well network (20 total wells: 15 existing and five new wells). These 20 wells will be sampled for baseline groundwater conditions and six months following injections. Three-Month Post-Injection Performance Monitoring: Seven groundwater monitoring wells will be sampled.			

1. RSK is the Robert S. Kerr Environmental Research Center in Ada, Oklahoma, where the method was developed.

SAP Worksheet #18 -- Sampling Locations and Methods/SOP Requirements Table

Baseline and Six-Month Post-Injection Groundwater Monitoring Well Sampling

Sampling Location ¹	Matrix	Depth	Screened Interval (ft bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
LS11-MW15D-YYYYQ ²	Groundwater	Middle of Screened Interval	15 – 20	Select cVOCs, Dissolved Metals (As, Fe, Mn), MEE, Nitrate, Sulfate, Sulfide, TOC, Alkalinity, H ₂ , and VFAs	See Worksheets #14 and #20	See Worksheets #14 and #21 and Attachment B
LS11-MW16D-YYYYQ ²			20 – 25			
LS11-MW20D-YYYYQ ²			16 – 26			
LS11-MW21D-YYYYQ ²			19 – 29			
LS11-MW22D-YYYYQ ²			18 – 28			
LS11-MW31D-YYYYQ ²			5 – 30			
LS11-MW32D-YYYYQ			4 – 29			
LS11-MW33D-YYYYQ			5 – 25			
LS11-MW34D-YYYYQ ²			3 – 28			
LS11-MW35D-YYYYQ ²			3 – 23			
LS11A-MW36D-YYYYQ ²			9 – 29			
LS11A-MW37D-YYYYQ ²			8 - 28			
LS11A-MW38D-YYYYQ			20 – 30			
LS11A-MW39D-YYYYQ			8 – 28			
LS11A-MW40D-YYYYQ ²			9 – 29			
LS11A-MW41D-YYYYQ			TBD			
LS11A-MW42D-YYYYQ			TBD			
LS11A-MW43D-YYYYQ			TBD			
LS11A-MW44D-YYYYQ ²	TBD					
LS11A-MW45D-YYYYQ ²	TBD					

SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (continued)

One-Month Post-Injection Groundwater Monitoring Well Sampling

Sampling Location ¹	Matrix	Depth	Screened Interval (ft bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
LS11-MW32D-YYYYQ	Groundwater	Middle of Screened Interval	4 – 29	Select cVOCs, Dissolved Metals (As, Fe, Mn), MEE, Nitrate, Sulfate, Sulfide, TOC, and Alkalinity	See Worksheets #14 and #20	See Worksheets #14 and #21 and Attachment B
LS11-MW33D-YYYYQ			5 – 25			
LS11A-MW38D-YYYYQ			20 – 30			
LS11A-MW39D-YYYYQ			8 – 28			
LS11A-MW41D-YYYYQ			TBD			
LS11A-MW42D-YYYYQ			TBD			
LS11A-MW43D-YYYYQ			TBD			

Three-Month Post-Injection Groundwater Monitoring Well Sampling

Sampling Location ¹	Matrix	Depth	Screened Interval (ft bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
LS11-MW32D-YYYYQ	Groundwater	Middle of Screened Interval	4 – 29	Select cVOCs, Dissolved Metals (As, Fe, Mn), MEE, Nitrate, Sulfate, Sulfide, TOC, Alkalinity, VFAs and H2	See Worksheets #14 and #20	See Worksheets #14 and #21 and Attachment B
LS11-MW33D-YYYYQ			5 – 25			
LS11A-MW38D-YYYYQ			20 – 30			
LS11A-MW39D-YYYYQ			8 – 28			
LS11A-MW41D-YYYYQ			TBD			
LS11A-MW42D-YYYYQ			TBD			
LS11A-MW43D-YYYYQ			TBD			

Note:

1. Refer to Worksheets #10 and #11 and Figure 4 for sample locations. YYYYQ indicates the year and quarter when the sample is collected.
2. Do not include H2 and VFA sampling

SAP Worksheet #19 – Analytical SOP Requirements Table

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference	Containers (number, size, and type)	Sample volume² (units)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time³ (preparation / analysis)
Groundwater	Select cVOCs (i.e., site COCs)	EPA 5030B / EPA 8260B SOP SA-VM-020	3 X 40 milliliter (mL) VOA Vial	40 mL	1:1 HCl, to pH <2 0-6°C	14 Days
Groundwater	Metals: Dissolved arsenic, iron, and manganese	EPA 3005A / EPA 6010B SOP SA-ME-070	250 mL plastic	50 mL	1:1 HNO ₃ , to pH <2	180 Days
Groundwater	Volatiles: MEE	RSK-175 SOP SA-VO-007	3 X 40 mL VOA Vial	40 mL	0-6°C	14 Days
Groundwater	VFAs	SOP BF-MB-009	3 X 40 mL VOA Vial	40 mL	0-6°C	28 days
Groundwater	Wet chemistry: nitrate	EPA 300.0 SOP SA-GE-115	125 mL plastic	5 mL	0-6°C	48 Hours
Groundwater	Wet chemistry: sulfate	EPA 300.0 SOP SA-GE-115	125 mL plastic	5 mL	0-6°C	48 Hours
Groundwater	Wet chemistry: sulfide	EPA 376.1 SOP SA-GE-085	250 mL plastic	250 mL	2N ZnAce/NaOH 0-6°C	7 Days
Groundwater	Wet chemistry: TOC	EPA 415.1 SOP SA-GE-204	125 mL amber glass	25 mL	2 mL 50% HCl 0-6°C	28 Days
Groundwater	Wet chemistry: alkalinity	EPA 310.1 SOP SA-GE-193	250 mL plastic	250 mL	0-6°C	14 Days
Groundwater	Dissolved gas: H ₂	AM20GAX / SM9	20mL clear headspace vial	20 mL	None	14 Days

SAP Worksheet #20 -- Field QC Sample Summary Table

Baseline and Six-Month Post-Injection Groundwater Monitoring Well Sampling

Matrix	Analytical Group	Number of Samples	Number of Field Duplicates	Number of MS/MSDs	Number of Rinsate Blanks	Number of VOA Trip Blanks	Total Number of Samples to Lab
Groundwater	Select cVOCs (i.e., site COCs)	20	2	1/1	1	One (1) per each cooler shipped (approx. 3)	28
	Metals (Dissolved As, Fe, Mn)	20	2	1/1	1	0	25
	Volatiles: MEE	20	0	0	0	0	20
	Wet Chemistry: Nitrate, Sulfate, Sulfide, TOC, Alkalinity	20	0	0	0	0	20
	H2	7	0	0	0	0	7
	VFAs	7	0	0	0	0	7

SAP Worksheet #20 -- Field QC Sample Summary Table (continued)

One-Month Post Injection Groundwater Monitoring Well Sampling

Matrix	Analytical Group	Number of Samples	Number of Field Duplicates	Number of MS/MSDs	Number of Rinsate Blanks	Number of VOA Trip Blanks	Total Number of Samples to Lab
Groundwater	Select cVOCs (i.e., site COCs)	7	1	0	1	One (1) per each cooler shipped (approx. 1)	10
	Metals (Dissolved As, Fe, Mn)	7	1	0	1	0	9
	Volatiles: MEE	7	0	0	0	0	7
	Wet Chemistry: Nitrate, Sulfate, Sulfide, TOC, Alkalinity	7	0	0	0	0	7

SAP Worksheet #20 -- Field QC Sample Summary Table (continued)

Three-Month Post Injection Groundwater Monitoring Well Sampling

Matrix	Analytical Group	Number of Samples	Number of Field Duplicates	Number of MS/MSDs	Number of Rinsate Blanks	Number of VOA Trip Blanks	Total Number of Samples to Lab
Groundwater	Select cVOCs (i.e., site COCs)	7	1	0	1	One (1) per each cooler shipped (approx. 1)	10
	Metals (Dissolved As, Fe, Mn)	7	1	0	1	0	9
	Volatiles: MEE	7	0	0	0	0	7
	Wet Chemistry: Nitrate, Sulfate, Sulfide, TOC, Alkalinity	7	0	0	0	0	7
	H2	7	0	0	0	0	7
	VFAs	7	0	0	0	0	7

SAP Worksheet #21 -- Project Sampling SOP References Table

The field SOPs are summarized below and are provided in Attachment B.

Reference Number	Title, Revision Date and / or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
1	Water Level Measurements, 10/2011	Osage	Water level probe	N	None
2	Low-Flow Groundwater Sampling, 10/2011		Peristaltic pump, tubing, Horiba U-22, turbidity meter		
3	PID Air Monitoring, 11/2011		MiniRAE 3000 with 11.7 electronvolt (eV) lamp and datalogging and alarm capability		
4	Direct Push Technology Soil Sampling, 10/2011		DPT rig, steel spoon, steel mixing bowl		
5	Logging of Soil Borings, 10/2011		Field book, Munsell soil color chart, USCS chart		None
6	Installation of Shallow Monitoring Wells, 10/2011		DPT rig, purge pump		
7	Decontamination of Personnel and Equipment 10/2011		Decontamination materials (i.e., Alconox, towels, clean containers, etc.)		
8	Sample Packaging and Shipping Procedures, 10/2011		Coolers, tape, chain of custody, ice, bubble wrap, sealable bags, airbills, etc.		

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

Field Equipment	Activity	Frequency	Acceptance Criteria	Corrective Action (CA)	Resp. Person	SOP Reference	Comments
Water Level Meter	Maintenance	As Needed, regularly	As per manual	Trouble shooting and/or switch out equipment	Field Team Leader	SOP-1	
Peristaltic Pump	Maintenance	As Needed, regularly	As per manual	Trouble shooting and/or switch out equipment	Field Team Leader	SOP-2	
Water quality meter	Calibrate probes	Daily and as needed	Parameter specific and as per manual	Trouble shooting, rental provider technical support, and/or switch out equipment	Field Team Leader	SOP-2	
PID	Maintenance and Calibration	Maintenance is performed regularly by the rental provider and calibration will be performed prior to shipment as well as daily in the field by field personnel.	As per manual	Field: Trouble shooting, rental provider technical support, and/or switch out equipment	The Field Team Leader will be responsible for daily calibrations and field CAs, if necessary	SOP-5	

SAP Worksheet #23 -- Analytical SOP References Table

The laboratory SOPs are summarized below.

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
SA-VM-020	Volatile Compounds by gas chromatogram/mass spectrometer (GC/MS) Rev. 7, 01/06/2011	Definitive	Aqueous / VOCs	GC/MS	TestAmerica Savannah	N
SA-ME-070	Elements by inductively coupled plasma (ICP) Rev. 13, 04/04/2011	Definitive	Aqueous / Metals	ICP	TestAmerica Savannah	N
SA-V0-007	Dissolved Gases in Water Rev. 0, 06/23/2011	Screening	Aqueous / Dissolved Gases	GC/FID GC/TCD	TestAmerica Savannah	N
SA-GE-115	Anions by Ion Chromatography Rev. 12, 01/06/2011	Screening	Aqueous / Anions	IC	TestAmerica Savannah	N
SA-GE-085	Sulfide: Titrimetric Preparation and Analysis Rev. 7, 06/09/2011	Screening	Aqueous / Sulfide	None	TestAmerica Savannah	N
SA-GE-204	Carbon Content in Water: TC, TOC, and TIC Rev. 1, 01/06/2011	Screening	Aqueous / TOC	Shimadzu TOC Carbon Analyzer	TestAmerica Savannah	N
SA-GE-193	Measurement of Analytes Using the PC Titrate AutoAnalyzer Rev. 2, 10/15/2011	Screening	Aqueous / Alkalinity	PC Titrate	TestAmerica Savannah	N
BF-MB-009	VFAs Rev. 1, 08/16/2011	Screening	Aqueous / IC	IC	TestAmerica Buffalo	N
SM9	SOP for the Analysis of Biodegradative Indicator Gases Rev. 11.0 10/12/2010	Screening	Aqueous/ Vapor	GC/FID/TCD RGD	Microseeps	N

SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
ICP (USEPA Method 6010B)	Single standard and a blank, or multi-point w/3 standards and a blank	Daily	Correlation >0.995 (for multipoint curves)	Recalibrate	Analyst	SA-ME-070
	Second Source Calibration Verification (ICV)	After each initial calibration (ICAL)	Within ±10% of the true value	Correct problem. Re-calibrate or re-analyze ICV.	Analyst	SA-ME-070
	Continuing Calibration Verification (CCV)	At the beginning and end of the analysis, and every 10 samples	Within ±10% of the true value	Correct problem. Re-analyze CCV and all affected samples.	Analyst	SA-ME-070
	Continuing Calibration Blank (CCB)	At the beginning and end of the analysis, and every 10 samples	< LOQ	Correct problem. Re-analyze CCB and all affected samples.	Analyst	SA-ME-070
GC/MS (USEPA Method 8260B)	Bromofluorobenzene (BFB) Tune	Prior to ICAL and CCV; every 12 hours	SOP Criteria	Retune instrument	Analyst	SA-VM-020
	ICAL - Minimum 5 points. Lowest point at or below LOQ. Upper point defines calibration range.	Initially, and when CCV is unacceptable	- Calibration check compound (CCC): %RSD < 30% - System Performance Check Compound (SPCC): Relative Response Factor (RRF) avg > Attachment 5 of SOP - If %RSD >15%, use curve fit with r2 > 0.990. - Grand Mean Exception rule (GME): Avg %RSD <15%; No single analyte %RSD > 45%.	Correct problem. Re-calibrate.	Analyst	SA-VM-020
	ICV	After each ICAL	Percent Difference (%D) <20% for 95% of analytes	Correct problem. Re-calibrate or re-analyze ICV.	Analyst	SA-VM-020
	CCV	Initially, after every 12 hours or 20 samples	- CCC: %D < 20% - SPCC: RRF > Attachment 5 of SOP - Non-CCC and non-SPCC: Avg %D <20%; No single analyte %D >60%	Correct problem. Re-analyze CCV and all affected samples.	Analyst	SA-VM-020

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

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference
GC - FID/TCD (RSK175)	ICAL - Minimum 5 points. Lowest point at or below LOQ. Upper point defines calibration range.	Initially, and when CCV is unacceptable	<25% RSD r ² >0.990	Correct problem. Re-calibrate.	Analyst	SA-V0-007
	ICV	After each ICAL	<25% D	Correct problem. Re-calibrate or re-analyze ICV.	Analyst	SA-V0-007
	CCV	Every 24 hours or 20 samples, and at end of sequence	<25% D	Correct problem. Re-analyze CCV and all affected samples.	Analyst	SA-V0-007
IC (EPA 300.0)	ICAL - Minimum 3 points. Lowest point at or below LOQ. Upper point defines calibration range.	Initially, and when CCV is unacceptable	Minimum 3 points r ² >0.990	Correct problem. Re-calibrate.	Analyst	SA-GE-115
	ICV	After each ICAL	<10% D	Correct problem. Re-calibrate or re-analyze ICV.	Analyst	SA-GE-115
	CCV	Initially, after every 10 samples, and at the end of the sequence	<10% D (Mid-Level) <25% (Low-Level)	Correct problem. Re-analyze CCV and all affected samples.	Analyst	SA-GE-115

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

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference
PC-Titrate	ICAL - Minimum 3 points. Lowest point at or below LOQ. Upper point defines calibration range.	Initially, and when CCV is unacceptable	Minimum 3 points Each buffer w/in 0.05 pH units from true value	Correct problem. Re-calibrate.	Analyst	SA-GE-193
	ICV	After each ICAL	0.1 pH units from true value	Correct problem. Re-calibrate or re-analyze ICV.	Analyst	SA-GE-193
	Continuing Calibration Verification (CCV)	Initially, after every 10 samples, and at the end of the sequence	0.1 pH units from true value	Correct problem. Re-analyze CCV and all affected samples.	Analyst	SA-GE-193
Shimadzu TOC VCPN Carbon Analyzer	ICAL - Minimum 4 points. Lowest point at or below LOQ. Upper point defines calibration range.	Initially, and when CCV is unacceptable	Minimum 4 points $r^2 > 0.995$	Correct problem. Re-calibrate.	Analyst	SA-GE-204
	ICV	After each ICAL	<10% D	Correct problem. Re-calibrate or re-analyze ICV.	Analyst	SA-GE-204
	CCV	Initially, after every 10 samples, and at the end of the sequence	<10% D	Correct problem. Re-analyze CCV and all affected samples.	Analyst	SA-GE-204

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

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference
H2 AM20GAX	Ical with minimum five (5) point calibration	As necessary	Correlation >0.995 (for multipoint curves)	Recalibrate	Analyst	AM20GAX
	ICV	After each ICAL	Within ±15% of the true value	Correct problem. Recalibrate or re-analyze ICV.	Analyst	AM20GAX
	Second Source CCV	At the beginning and end of the analysis, and every 15 samples	Within ±15% of the true value	Correct problem. Re-analyze CCV and all affected samples.	Analyst	AM20GAX
	CCB	At the beginning and end of the analysis, and every 15 samples	<1/2 LOQ	Correct problem. Re-analyze CCB and all affected samples.	Analyst	AM20GAX
Dionex DX-120 (VFA)	ICAL - Minimum 6 points. Lowest point at or below LOQ. Upper point defines calibration range.	Initially, and when CCV is unacceptable	Minimum 6 points r>0.995	Correct problem. Recalibrate.	Analyst	BF-MB-009
	ICV	After each ICAL	80-120%	Correct problem. Recalibrate or re-analyze ICV.	Analyst	BF-MB-009
	CCV	Initially, after every 10 samples, and at the end of the sequence	80-120%	Correct problem. Re-analyze CCV and all affected samples.	Analyst	BF-MB-009

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

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action (CA)	Responsible Person	SOP Reference
ICP (EPA 6010B)	Clean nebulizer, replace pump tubing, clean or replace filters, clean or replace chiller water filters, clean or replace injector tip / torch, replace tubing connectors	Detector signals	Instrument performance and sensitivity	As needed	CCV passes criteria	Re-perform as needed; reanalyze CCV; recalibrate instrument	Analyst	SA-ME-070
GC/MS (EPA 8260B)	Change injector port components; clean sparge tubes; change column	Detector signals and chromatogram review	Instrument performance and sensitivity	As needed	Tune and CCV pass criteria	Reinspect injector port; cut additional column; reanalyze CCV; recalibrate instrument	Analyst	SA-VM-020
GC - FID/TCD	Change septum, clean injection port, change or clip column, install new liner	Detector signals and chromatogram review	Instrument performance and sensitivity	As needed	CCV passes criteria	Reinspect injector port; cut additional column; reanalyze CCV; recalibrate instrument	Analyst	SA-VO-07
IC (EPA 300.0)	Change eluent and column	Chromatogram review	Instrument performance and sensitivity	As needed	CCV passes criteria	Reanalyze CCV; recalibrate instrument	Analyst	SA-GE-115
PC-Titrate	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	SA-GE-193
Shimadzu TOC VCPN Carbon Analyzer	Replace combustion tube. Check carrier gas pressure and humidifier water level	Detector signals	Instrument performance and sensitivity	As needed. Daily	CCV passes criteria	Replace combustion tube or gas cylinder. Refill humidifier.	Analyst	SA-GE-204
IC (VFA)	Change eluent and column	Chromatogram review	Instrument performance and sensitivity	As needed	CCV passes criteria	Reanalyze CCV; recalibrate instrument	Analyst	BF-MB-009

SAP Worksheet #26 -- Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): TBD / Osage
Sample Packaging (Personnel/Organization): TBD / Osage
Coordination of Shipment (Personnel/Organization): TBD / Osage
Type of Shipment/Carrier: Overnight Carrier / FedEx
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample Receiving Department / TestAmerica Savannah Sample Receiving Department / Microseeps
Sample Custody and Storage (Personnel/Organization): Sample Receiving & Laboratory Departments / TestAmerica Savannah Sample Receiving Department / Microseeps
Sample Preparation (Personnel/Organization): Digestion Department / TestAmerica Savannah Not Applicable/Microseeps
Sample Determinative Analysis (Personnel/Organization): Analytical Departments / TestAmerica Savannah Analytical Departments / Microseeps
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): NA
Sample Extract/Digestate Storage (No. of days from extraction/digestion): Extracts and Digestates may be disposed of 30 days after report invoicing. Not Applicable / Microseeps
Biological Sample Storage (No. of days from sample collection): NA
SAMPLE DISPOSAL
Personnel/Organization: Sample Disposal Technician/ TestAmerica Savannah and Buffalo Laboratory Departments/ Microseeps
Number of Days from Analysis: Samples may be disposed of 30 days after report invoicing. 90 Days / Microseeps

SAP Worksheet #27 – Sample Custody Requirements Table

TestAmerica

Custody seals are supplied with all bottle orders. They are affixed to the cooler after sampling. The presence or absence of custody seals is noted on the Sample Receipt Checklist.

Upon receipt of samples from the field, the laboratory sample receiving personnel in Savannah will sign the chain of custody, open the sample cooler(s), verify sample integrity and conduct a check against the chain of custody. If there is a discrepancy or problem (i.e. broken sample containers) the laboratory will contact the client. Additionally, the sample receiving personnel completes a Sample Receipt Checklist, which documents visual inspection of the samples. Discrepancies or changes will be documented.

The laboratory sample receiving personnel assigns a unique laboratory job number for the entire sample set listed on the chain of custody. The samples are then logged into the laboratory information system (TALS). Each sample within a job is labeled numerically. Each container of a particular sample is uniquely identified by adding an alphabetical suffix to the sample number. The laboratory labels each sample container with a bar code, which will remain on the sample bottle for the duration of the laboratory sample storage. Personnel use the barcode to document sample removal from and return to sample storage.

Samples for analysis by TestAmerica Buffalo will be packaged in Savannah and sent to Buffalo for analysis following barcoding and entry into TALS. Samples are stored at the laboratory in refrigerators, if required by the reference method, prior to, during, and after analysis. Refrigerators at the laboratory are monitored daily for temperature to ensure sample integrity and preservation. Samples are retained by the laboratory for a period of 30 days after the invoice is sent to the client. The laboratory then disposes of non-hazardous samples, following certified disposal practices. Hazardous samples are either returned to the client or disposed of through a licensed waste disposal facility. Documentation of disposal is maintained by the laboratory.

Microseeps

Upon receipt of samples from the field, the laboratory sample receiving personnel will sign the chain of custody, open the sample cooler(s), verify sample integrity and conduct a check against the chain of custody. If there is a discrepancy or problem (i.e. broken sample containers) the laboratory will contact the client. Additionally, the sample receiving personnel completes a Cooler Receipt Form, which documents visual inspection of the samples. Discrepancies or changes will be documented.

The laboratory sample receiving personnel assigns a unique laboratory job number for the entire sample set listed on the chain of custody. The samples are then logged into the laboratory information management system (LIMS). Each sample within a Job is labeled numerically. Each container of a particular sample is uniquely identified by adding a numerical suffix to the sample number. The laboratory labels each sample container with a bar code, which will remain on the sample bottle for the duration of the laboratory sample storage. Personnel use the barcode to document sample removal from and return to sample storage.

Samples are stored at the laboratory in refrigerators, if required by the reference method, prior to, during, and after analysis. Refrigerators at the laboratory are monitored daily for temperature to ensure sample integrity and preservation. Samples are retained by the laboratory for a period of 90 days. The laboratory then disposes of non-hazardous samples, following certified disposal practices. Hazardous samples are either returned to the client or disposed of through a licensed waste disposal facility. Documentation of disposal is maintained by the laboratory.

SAP Worksheet #28-1 – Laboratory QC Samples Table

Matrix	Water					
Analytical Group	Select cVOCs					
Analytical Method/ SOP Reference	USEPA SW-846 Method 8260B SA-VM-020					
QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	DQI	Measurement Performance Criteria (MPC)
Method Blank	One (1) per batch	<LOQ for common laboratory contaminant (CLC); <1/2LOQ for non-CLC	Re-analyze batch. Qualify data as appropriate. Report results if sample results >10x blank result or sample results ND.	Analyst	Contamination	No Target Compounds >1/2LOQ; no common lab contaminants >LOQ.
LCS	One (1) per batch	70-130% for DCE, PCE, and TCE 64-1134% for VC ¹	Re-analyze batch. Qualify data as appropriate.		Accuracy, Bias	70-130 percent recovery (%R) for DCE, PCE, and TCE 64-1134 %R for VC
Internal Standard	Every sample and QC Item	-50 to +100%	Check calculations and instrument performance; recalculate,		Accuracy, Bias	-50 to +100 %R
Surrogate	Every sample and QC Item	70-130%	Check calculations and instrument performance; recalculate, reanalyze.		Accuracy, Bias	70-130 %R

¹ DoD Quality Systems Manual cites a range of 70-125% (DoD, 2010).

SAP Worksheet #28-2 – Laboratory QC Samples Table

Matrix	Water					
Analytical Group	Metals (Dissolved As, Fe, and Mn)					
Analytical Method/ SOP Reference	USEPA SW-846 Method 6010B SA-ME-070					
QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	MPC
Method Blank	One (1) per batch	<1/2LOQ	Re-digest batch. Qualify data as appropriate. Report results if sample results >10x blank result or sample results ND.	Analyst	Contamination	No Target Analytes >1/2LOQ; no common lab contaminants >LOQ.
LCS	One (1) per batch	75-125 ¹ %	Re-digest batch. Qualify data as appropriate.		Accuracy, Bias	75-125 ¹ %R
Serial Dilution	One (1) per batch	90-110 ² %	Post-digestion Spike		Matrix Interference	90-110 %R

¹ DoD Quality Systems Manual cites a range of 80-120% (DoD, 2010).

² Provided concentration is at 50X MDL.

SAP Worksheet #28-3 – Laboratory QC Samples Table

Matrix	Water					
Analytical Group	Dissolved Gases (MEE)					
Analytical Method/ SOP Reference	RSK175					
QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	MPC
Method Blank	One (1) per batch	<1/2LOQ	If sufficient sample is available, reanalyze samples. Qualify data as needed.	Analyst	Contamination	no analytes >1/2LOQ.
LCS	One (1) per batch	85-115%			Accuracy, Bias	85-115 %R

SAP Worksheet #28-4 – Laboratory QC Samples Table

Matrix	Water					
Analytical Group	Anions by IC (Nitrate as N, Sulfate)					
Analytical Method/ SOP Reference	USEPA Method 300.0					
QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	MPC
Method Blank	One (1) per batch	<1/2LOQ	Re-analyze batch. Qualify data as appropriate. Report results if sample results >10x blank result or sample results ND.	Analyst	Contamination	<1/2LOQ
LCS	One (1) per batch	90-110%	Re-analyze batch. Qualify data as appropriate.		Accuracy, Bias	90-110%

SAP Worksheet #28-5 – Laboratory QC Samples Table

Matrix	Water					
Analytical Group	Sulfide					
Analytical Method/ SOP Reference	USEPA Method 376.1					
QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	MPC
Method Blank	One (1) per batch	<1/2LOQ	Re-prepare batch. Qualify data as appropriate. Report results if sample results >10x blank result or sample results ND.	Analyst	Contamination	<1/2LOQ
LCS	One (1) per batch	50-150% Rec	Re-prepare batch. Qualify data as appropriate.		Accuracy, Bias	50-150 %R
Sample Duplicate	One (1) per batch	50% RPD	Determine root cause; flag data; discuss in narrative.		Accuracy, Bias, Precision	50 %RPD

SAP Worksheet #28-6 -- Laboratory QC Samples Table

Matrix	Water					
Analytical Group	TOC					
Analytical Method/ SOP Reference	USEPA Method 415.1					
QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	MPC
Method Blank	One (1) per batch	<1/2LOQ	Re-analyze batch. Qualify data as appropriate. Report results if sample results >10x blank result or sample results ND.	Analyst	Contamination	<1/2LOQ
LCS	One (1) per batch	80-120% Rec	Re-analyze batch. Qualify data as appropriate.		Accuracy, Bias	80-120 %R

SAP Worksheet #28-7 – Laboratory QC Samples Table

Matrix	Water					
Analytical Group	Alkalinity					
Analytical Method/ SOP Reference	USEPA Method 310.1					
QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	MPC
Method Blank	One (1) per batch	<LOQ	Re-analyze batch. Qualify data as appropriate. Report results if sample results >10x blank result or sample results ND.	Analyst	Contamination	<LOQ
LCS	One (1) per batch	80-120% Rec	Re-analyze batch. Qualify data as appropriate.		Accuracy, Bias	80-120% Rec
LCS Duplicate	One (1) per batch	80-120% Rec 30% RPD	Re-analyze. Qualify data as appropriate.		Accuracy, Bias	80-120 %R 30% RPD
Sample Duplicate	10% of samples	30% RPD	Determine root cause; flag data; discuss in narrative.		Precision	30% RPD

SAP Worksheet #28-8 – Laboratory QC Samples Table

Matrix	Water					
Analytical Group	H2					
Analytical Method/ SOP Reference	AM20GAX					
QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	MPC
Method Blank	One (1) per batch	<1/2DL/LOQ	Re-analyze batch. Qualify data as appropriate.	Analyst	Contamination	No Target Compounds > 1/2LOQ; no common lab contaminants > LOQ.
LCS	One (1) per batch	80-120%	Re-analyze batch. Qualify data as appropriate.		Accuracy, Bias	80-120 %R

SAP Worksheet #28-9 – Laboratory QC Samples Table

Matrix	Water					
Analytical Group	VFA by IC					
Analytical Method/ SOP Reference	BF-MB-009					
QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	MPC
Method Blank	One (1) per batch	<LOQ	Re-analyze batch. Qualify data as appropriate. Report results if sample results >10x blank result or sample results ND.	Analyst	Contamination	<LOQ
LCS	One (1) per batch	80-120%	Re-analyze batch. Qualify data as appropriate.		Accuracy, Bias	80-120 %R

SAP Worksheet #29 -- Project Documents and Records Table

Document	Where Maintained
Osage Documents	
Field Notebooks Chain of Custody Forms Air Bills Equipment/Instrument check logs Equipment Maintenance, Testing, and Inspection Logs Reported Result for QC Checks Field Photograph Log Daily Project Reports Daily Health and Safety documents	Sample collection documents and records will be scanned and saved on the network server.
Training Records QC Documentation and reports Meeting Agendas, Minutes, presentations, etc. Summary Reports Electronic Data Deliverables	These documents and records will be stored on the network server. Final reports will be uploaded to NIRIS.
Offsite Laboratory Documents	
Sample Receipt, Chain of Custody, and Tracking Records Standard Traceability Logs Equipment Calibration Logs Sample Prep Logs Run Logs Equipment Maintenance, Testing, and Inspection Logs CA Forms Reported Result for Standards, QC Checks, and QC Samples Instrument printouts (raw data) for Field Samples, Standards, QC Checks, and QC Samples Data Package Completeness Checklists Sample disposal records Extraction/Clean-up Records Raw Data (stored on disk)	Offsite analysis documents and records will be archived after a period of 6 months. Hardcopy deliverables from the data validator will be scanned and saved on the Osage network server.

SAP Worksheet #30 -- Analytical Services Table

Matrix	Analytical Group	Sample Locations/ ID Number	Analytical Method	Data Package Turnaround Time	Laboratory / Organization	Backup Laboratory / Organization
Groundwater	Select VOCs	See Worksheet #18	USEPA SW-846 Method 8260B	21 calendar days	Test America Savannah 5102 LaRoche Avenue Savannah, GA 31404 (912) 354.7858	TBD
	Dissolved As, Fe, and Mn		USEPA SW-846 Method 6010B			
	Volatiles: MEE		RSK-175			
	VFAs		SOP BF-MB-009		TestAmerica Buffalo 10 Hazelwood Drive, Amherst, NY (716) 691-2600	
	Nitrate		USEPA Method 300.0		Test America Savannah 5102 LaRoche Avenue Savannah, GA 31404 (912) 354.7858	
	Sulfate		USEPA Method 300.0			
	Sulfide		USEPA Method 376.1			
	TOC		USEPA Method 415.1			
	Alkalinity		USEPA Method 310.1			
	H2		AM20GAX		Microseeps 220 William Pitt Way Pittsburgh, PA 15238-1328 (412) 826-5245	

SAP Worksheet #31 -- Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (title and organizational affiliation)	Person(s) Responsible for Responding to Assessment Findings (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CAs) (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (title and organizational affiliation)
Offsite Laboratory Technical Systems Audit	Laboratory must have current DoD ELAP certification which will identify the period of performance. The laboratory must be re-evaluated prior to expiration of the period of performance.	External	Third Party Accrediting Body	TBD, Third-Party Accrediting Body	Laboratory Manager, TestAmerica	Laboratory Manager, TestAmerica	TBD

SAP Worksheet #32 -- Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings	Timeframe of Notification	Nature of Corrective Action (CA) Response Documentation	Individual(s) Receiving CA Response	Timeframe for Response
Laboratory Performance and Systems Audits	Written Audit Report	TestAmerica QAO	Within two (2) months of audit.	Memorandum	DoD ELAP, TBD	Within two (2) months of receipt of initial notification.

SAP Worksheet #33 -- QA Management Reports Table

Type of Report	Frequency	Project Delivery Date(s)	Person(s) Responsible for Report Preparation	Report Recipient(s)
Field Audit Report	One during sampling activities.	Submitted with Final Report.	Cathy Weber Osage Project Manager	Included in project files.

SAP Worksheet #34 -- Verification (Step I) Process Table

Verification Input	Description	Internal / External	Responsible for Verification
Chain of Custody and shipping forms	Chains of Custody and shipping documents will be reviewed and checked against the samples contained in coolers. A copy of the Chain of Custody will be maintained with the field files and the original and any duplicate copies will be secured with the cooler for shipment.	Internal	TBD, Osage
UPF-SAP Work Plan	Documentation of approval from regulatory agency.	Internal	Cathy Weber, Osage
Field Log Notebooks	Field notes will be reviewed to ensure completeness of information and will document any deviations from the scope with appropriate justification.	Internal	Cathy Weber, Osage
Chain of Custody Documentation	Samples will be cross-referenced with Chain of Custody records by the laboratory upon receipt and throughout the analytical process. Any discrepancies will be rectified.	External	Sample Receiving and Analysts, TestAmerica Sample Receiving and Analysts, Microseeps
QC Summary Report	A summary of all QC sample results will be verified for completeness following receipt for the laboratory. Also, the lab data will be reviewed to ensure that the laboratory met requested LODs.	External	Cathy Weber, Osage

SAP Worksheet #35 -- Validation (Steps IIa and IIb) Process Table

Step IIa / IIb¹	Validation Input	Description	Responsible for Validation (name, organization)
IIa	SOPs	Review field notebooks, laboratory case narratives, and data deliverables for compliance to methods.	Cathy Weber, Osage Nancy Weaver, EDS
IIa	QC Results	Establish that all QC samples were run and compliant with method required limits.	Nancy Weaver, EDS
IIb	QC Results	Verify that QC samples were run and compliant with limits established in the UFP-SAP.	Nancy Weaver, EDS
IIb	Project QLs	Check that sample results met the project QLs and PALs specified in the UFP-SAP.	Cathy Weber, Osage Nancy Weaver, EDS
IIb	Raw data	10% review of raw data to confirm laboratory calculations.	Nancy Weaver, EDS

Note:

1. IIa is for compliance with methods, procedures, and contracts. IIb is for comparison with MPC in the SAP.

SAP Worksheet #36 –Analytical Data Validation (Steps IIa and IIb) Summary Table

Step IIa / IIb	Matrix	Analytical Group	Validation Criteria	Data Validator (title and organizational affiliation)
IIa	Groundwater	Volatiles	The specified analytical methods and laboratory SOPs as identified in this SAP will be used to evaluate compliance with QA/QC criteria. Should there be QA/QC deficiencies, data may be qualified. The data qualifiers that would be used are those presented in <i>Region III Modifications to National Functional Guidelines for Organic Data Review</i> (September, 1994). National Functional Guidelines will not be used for data validation; however, the specific qualifiers listed therein may be applied to data should nonconformances against the QA/QC criteria as presented in this SAP be identified.	Nancy Weaver, EDS
IIa	Groundwater	Metals, Wet Chemistry, VFAs	The specified analytical methods and laboratory SOPs as identified in this SAP will be used to evaluate compliance with QA/QC criteria. Should there be QA/QC deficiencies, data may be qualified. The data qualifiers that would be used are those presented in <i>Region III Modifications to National Functional Guidelines for Inorganic Data Review</i> (April, 1993). National Functional Guidelines will not be used for data validation; however, the specific qualifiers listed therein may be applied to data should nonconformances against the QA/QC criteria as presented in this SAP be identified.	Nancy Weaver, EDS
IIb	Groundwater	Volatiles Metals, Wet Chemistry, VFAs	PALs in Worksheet #15.	Cathy Weber, Osage

SAP Worksheet #37 – Usability Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:

- Site contaminants that are not detected above DLs will be evaluated to ensure that project required QLs in Worksheet #15 were achieved. If project QLs were achieved and the verification and validation steps demonstrate that the data is acceptable, then the data will be considered usable.
- The third-party data validator is the only entity that may apply data qualifiers. Minor QC exceedances will be qualified as “estimated” data, represented by J, NJ, or UJ qualifiers. Data that is considered to be biased high or low will be qualified as K or L, respectively. Non-detect values that are considered to be biased low (i.e., the detection limit is probably higher) will be qualified as UL. Major QC exceedances will be qualified as “rejected” data, represented by an R qualifier. The impact on usability of rejected results will be evaluated.
- If statistical calculations are performed, half the DL will be used for non-detect values. For duplicate sample results, project decisions will be based upon the most conservative value (i.e., highest value).
- Analytical data will be verified following transfer to the electronic database to ensure that concentration values and any applicable qualifiers are correctly transferred. Checks will be performed by comparing hardcopy data and qualifiers to the electronic data deliverable.
- Field and laboratory precision will be calculated as %RPD between the two results.
- Deviations from the SAP will be assessed to evaluate whether CA is warranted and with respect to achieving project goals.

Describe the evaluative procedures used to assess overall measurement error associated with the project.

- To evaluate whether data is of sufficient quality for remedial decisions, data will be compared against MPC following validation.
- If laboratory QA/QC samples are observed to have significant biases, the impact on remedial decisions will be evaluated. Low biases will be assessed in detail since they may limit the ability to detect compounds that may be present at the site.
- If significant variances are noted between lab and field precision, the cause will be investigated to assess possible impacts on decision-making

Identify the personnel responsible for performing the usability assessment.

The Osage team, including the Project Manager and Program Manager and Data Validator, will review the data and compile a summary for the Tier I Partnering Team. The Tier I Partnering Team as a whole will assess the usability of the data.

References

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- Department of Defense. 2010. *DoD Quality Systems Manual for Environmental Laboratories Version 4.2*. October 2010.
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- USEPA. 2002. *Guidance for QAPPs, USEPA QA/G-5, Quality Assurance Management Section (QAMS). EPA QA/G-5*. October.
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Figures

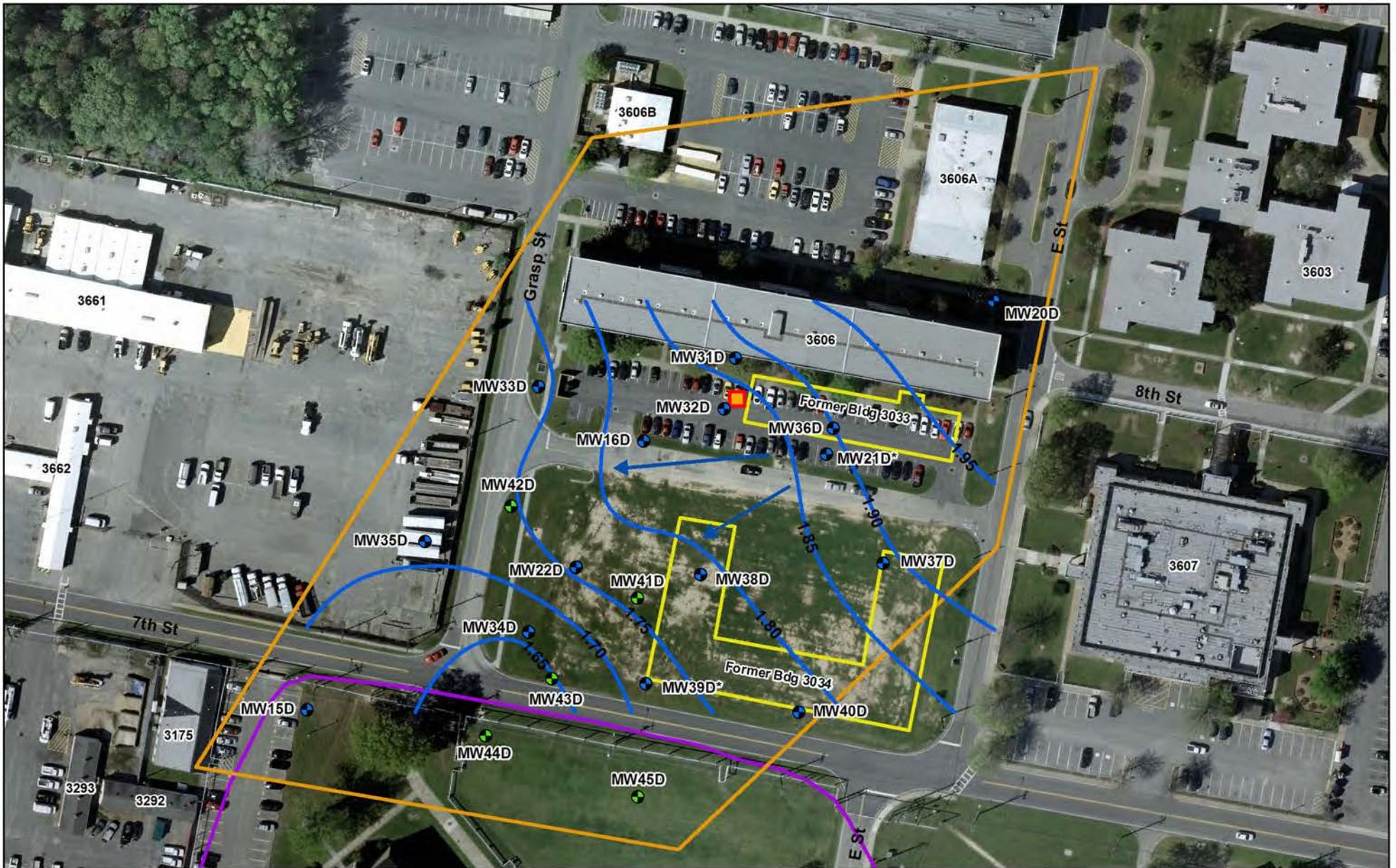


- Legend**
- Site 11a
 - Site 11
 - Little Creek Facility Boundary



Figure 1 - Aerial Site Location Map
 Site 11a Remedial Action Work Plan
 Joint Expeditionary Base (JEB) Little Creek
 Virginia Beach, Virginia



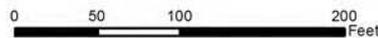


- Legend**
- Groundwater Monitoring Well
 - Proposed Groundwater Monitoring Well
 - Groundwater Elevation Contours (0.05ft)
 - ➔ Inferred Groundwater Flow Direction
 - Site 11 Boundary
 - ▭ Demolished Building
 - Approximate Location of Former Underground Waste Oil Tank
 - ▭ Site 11a Boundary

Monitoring Well IDs are shortened on this figure:
Actual IDs start with "LS11" or "LS11A"

Based upon groundwater elevation data
collected October 2007

* No access to MW21D during the survey
Elevation at MW39D was anomalous



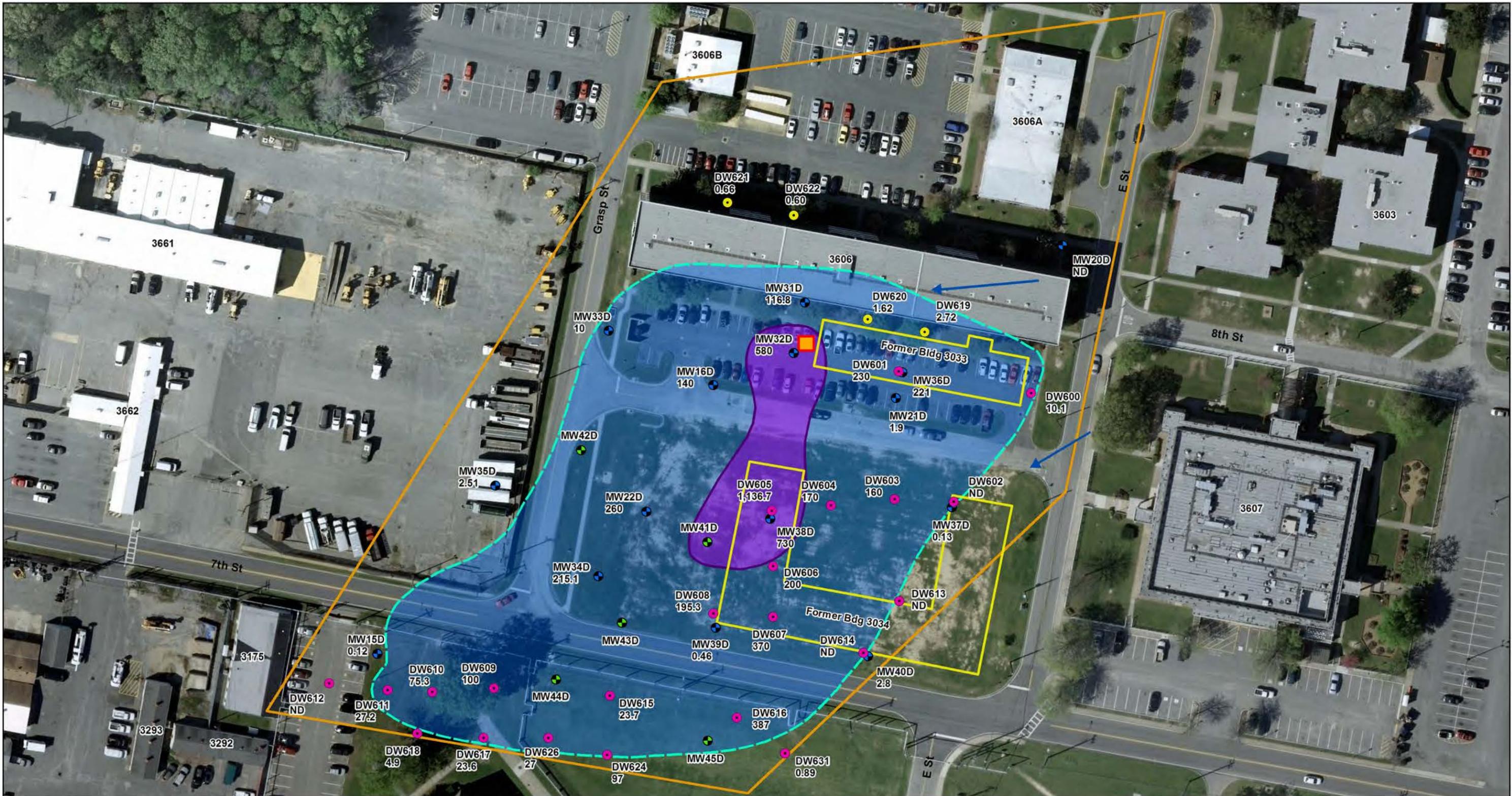
Potentiometric Surface Map and Proposed Groundwater Monitoring Wells

Site 11a Remedial Action Work Plan

JEB Little Creek

Virginia Beach, Virginia





- Legend**
- Groundwater Monitoring Well
 - Proposed Groundwater Monitoring Well
 - Grab Groundwater Location (collected 4ft intervals from 8ft bgs to bottom aquifer)
 - Grab Groundwater Location (collected at top 4ft of aquifer)
 - Inferred Groundwater Flow Direction (October 2007)
 - Demolished Building
 - Approximate Location of Former Underground Waste Oil Tank
 - Site 11a Boundary

Concentrations (µg/L)

- Above 5 µg/L of PCE and/or TCE
- Above 500 µg/L of PCE and/or TCE

Notes:
 ND - Not Detected
 µg/L - Micrograms per Liter
 All Sample IDs begin with base and site identification "LS11" or "LS11a"
 Value shown below sample ID indicates total Contaminant of Concern (COC) in µg/L
 The plume was estimated using the 2007 analytical data from the monitoring wells and grab groundwater samples collected north of Building 3606

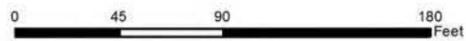
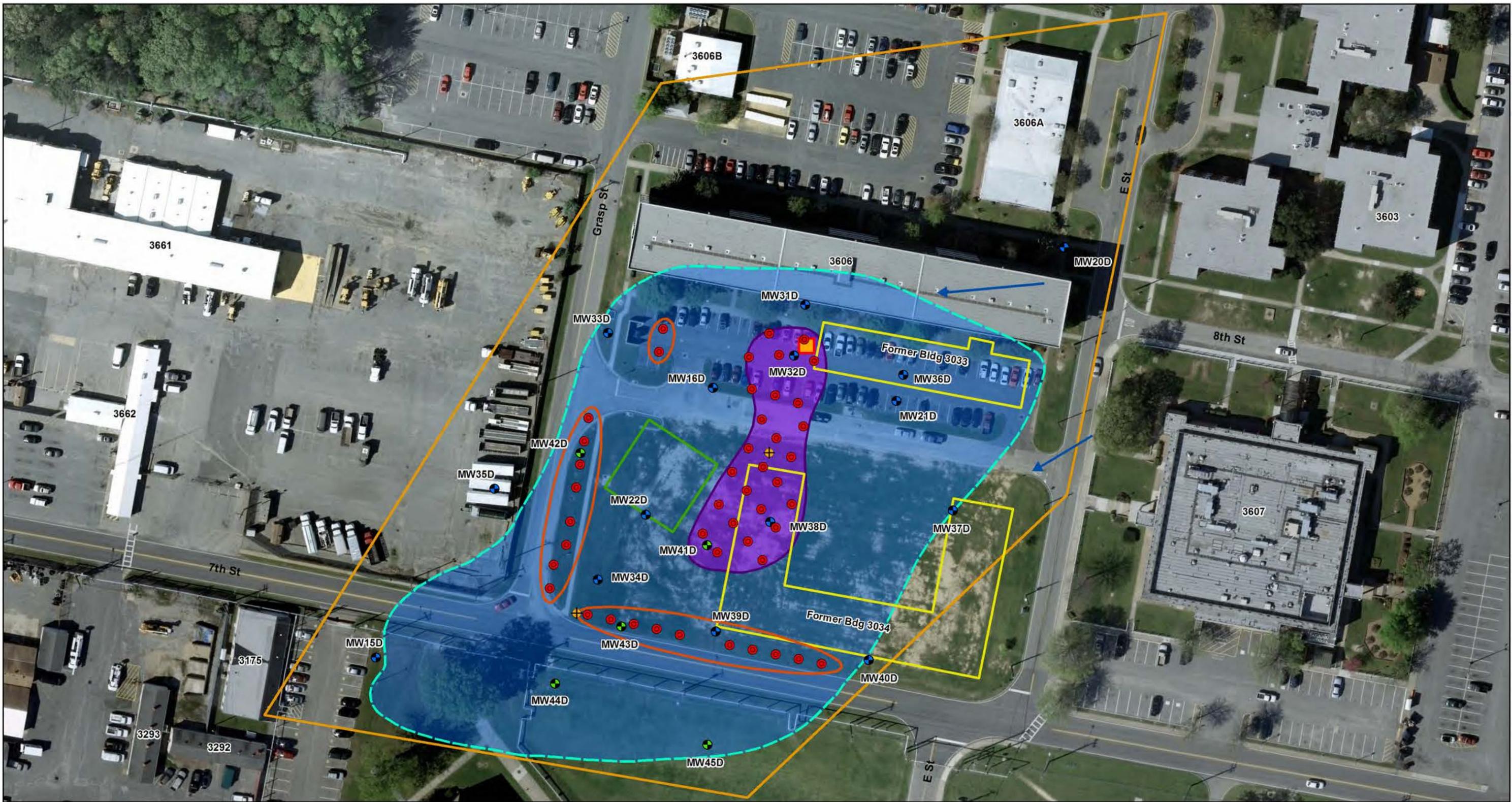


Figure 3
 Shallow Groundwater PCE/TCE Plume
 Site 11a Remedial Action Work Plan
 JEB Little Creek
 Virginia Beach, Virginia



Figure based upon: CH2M Hill 90%% Submittal Basis of Design for Site 11a (August 2011)



- Legend**
- ERD Direct Push Injection Point - Source Area
 - ERD Direct Push Injection Point - Barrier
 - Groundwater Monitoring Well
 - Proposed Groundwater Monitoring Well
 - ⊕ Proposed Soil Boring Location
 - Demolished Building
 - Approximate Location of Former Underground Waste Oil Tank

- Concentrations (µg/L)**
- Above 5 µg/L of PCE and/or TCE
 - Above 500 µg/L of PCE and/or TCE
 - Source Area
 - Inferred Groundwater Flow Direction (October 2007)
 - Equipment Staging Area
 - Site 11a Boundary

Notes:
 Injection layout subject to change based upon baseline groundwater sampling results
 All Sample IDs begin with base and site identification "LS11" or "LS11a"
 Value shown below sample ID indicates total Contaminant of Concern (COC) in µg/L
 The plume was estimated using the 2007 analytical data from the monitoring wells and grab groundwater samples collected north of Building 3606

Enhanced Reductive Dechlorination Injection Layout and Monitoring Well Locations
 Site 11a Remedial Action Work Plan



0 45 90 180 Feet

JEB Little Creek
 Virginia Beach, Virginia



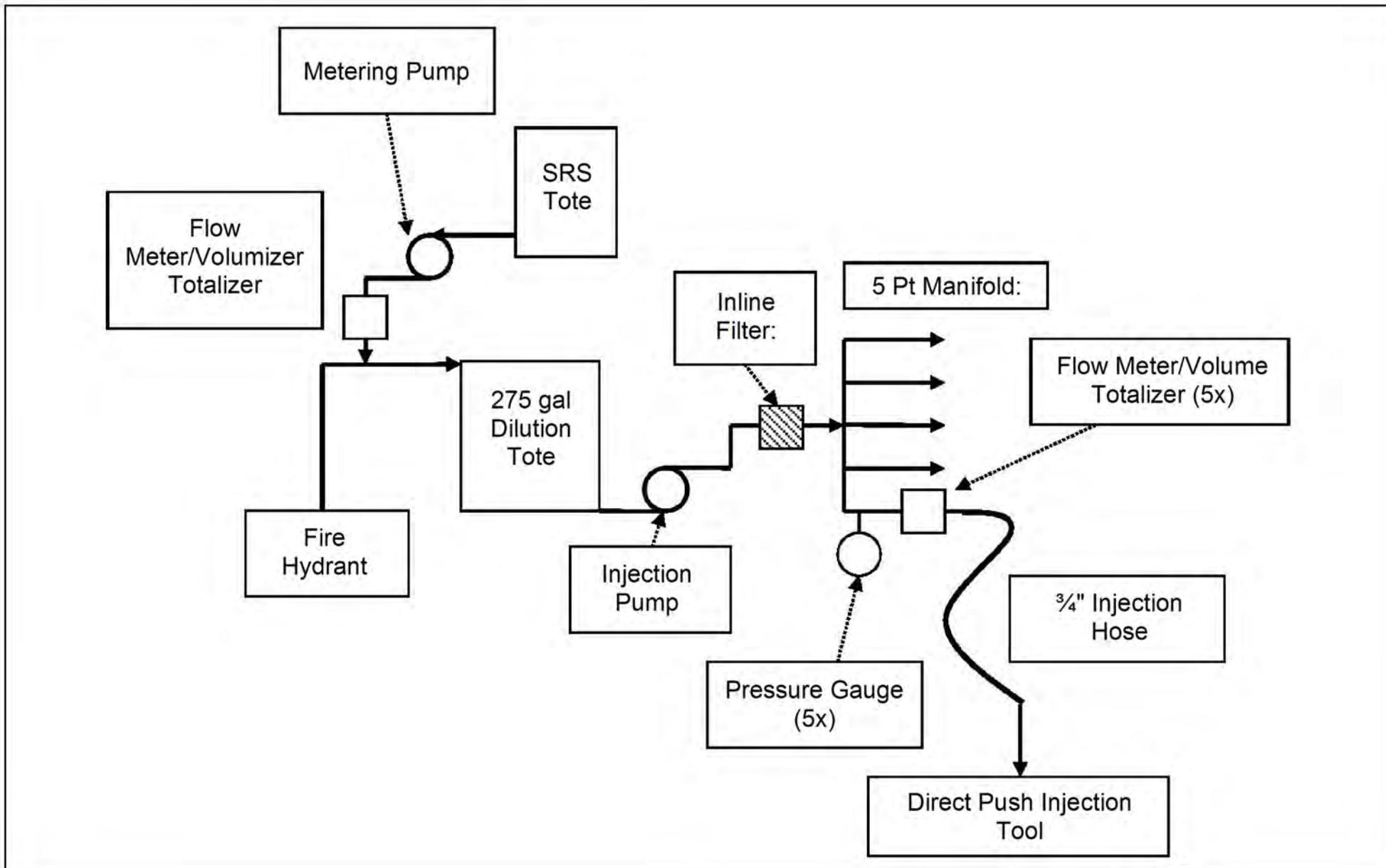


Figure 5
 Emulsified Vegetable Oil Injection Process Flow Diagram
 Site 11a Remedial Action Work Plan
 JEB Little Creek
 Virginia Beach, Virginia

Attachment A
Health and Safety Plan

FINAL

**Health and Safety Plan
for Enhanced Reductive Dechlorination Remedial Action
and Performance Monitoring
Site 11A**

**Joint Expeditionary Base Little Creek
Virginia Beach, Virginia**

October 2011

Prepared for:

**Department of the Navy
Naval Facilities Engineering Command
Mid-Atlantic**



Contract No. N40085-11-D-0045

Contract Task Order No. 0002

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1.0 INTRODUCTION

1.1 OBJECTIVE

The objective of this plan is to provide a mechanism for establishing safe working conditions at the site. The safety organization, procedures, and protective equipment have been established based upon an analysis of potential hazards. Specific hazard control methodologies have been evaluated and selected to minimize the potential of accident or injury.

1.2 POLICY STATEMENT

The policy of Osage of Virginia, Inc. (Osage) is to provide a safe and healthful work environment for all employees. Osage considers no phase of operations or administration to be of greater importance than injury and illness prevention. Safety takes precedence over expediency and shortcuts. At Osage, it is believed all accidents and injuries are preventable. Osage will take every reasonable step to reduce the possibility of injury, illness, or accident.

This Health and Safety Plan (HASP) prescribes the procedures that must be followed during referenced site activities. Operational changes that could affect the health and safety of personnel, the community, or the environment will not be made without the prior approval of the Project Manager and the Health and Safety Manager.

The provisions of this plan are mandatory for all personnel and subcontractors assigned to the project. All visitors to the work site must abide by the requirements of the plan.

1.3 REFERENCES

This HASP complies with applicable Occupational Safety and Health Administration (OSHA), U.S. Environmental Protection Agency (EPA), and Osage Health & Safety policies and procedures. This plan follows the guidelines established in the following:

- Standard Operating Safety Guides, EPA (Publication 9285.1-03, June 1992).
- Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH, OSHA, USCG, EPA (86-116, October 1985).
- Title 29 of the Code of Federal Regulations (CFR), Part 1910.
- Title 29 of the Code of Federal Regulations (CFR), Part 1926.
- Health and Safety Requirements Manual, US Army Corps. Of Engineers, EM 385-1-1, 15 September 2008
- LANTDIV Program Health and Safety Procedures Manual.

1.4 DISCLAIMER

The following HASP has been designed for the methods presently contemplated by Osage for execution of the proposed work. Therefore, the HASP may not be appropriate if the work

is not performed by or using the methods presently contemplated by Osage. In addition, as the work is performed, conditions different from those anticipated might be encountered and the HASP may have to be modified. Therefore, Osage only makes representations or warranties as to the adequacy of the HASP for currently anticipated activities and conditions.

2.0 SITE HISTORY/SCOPE OF WORK

2.1 SITE HISTORY/BACKGROUND

This Health and Safety Plan (HASP) has been prepared to support the Remedial Action (RA) implementation and Performance Monitoring Site 11A, Building 3033 Former Vehicle Repair Facility and Waste Oil Tank, at Joint Expeditionary Base (JEB) Little Creek, Virginia Beach, VA.

The JEB Little Creek (formerly known as Naval Amphibious Base [NAB] Little Creek) is an approximately 2,215-acre naval installation in northwestern Virginia Beach adjacent to the Chesapeake Bay that began operations as a permanent base in 1946. The base's mission was the training of landing craft personnel for operational assignments. JEB Little Creek has expanded in both area and the complexity of its mission over the past 65 years. Base personnel provide logistic facilities and support services for local commands, organizations, home-ported ships, and other United States (U.S.) and allied units to meet amphibious warfare-training requirements of the U.S. Armed Forces. Past and present operations at JEB Little Creek include vehicle and boat maintenance, boat painting and sandblasting, construction and repair of buildings and piers, mixing and application of pesticides, electroplating of musical instruments, laundry and dry cleaning, medical and dental treatment, and the generation of steam for heat. Land development surrounding the base is residential, commercial, and industrial.

Site 11a is a former vehicle repair facility and associated underground storage tank (UST) in the central portion of the JEB Little Creek. The 11a boundary encompasses approximately seven acres. Site 11a was identified in 1998 when chlorinated volatile organic compounds (cVOCs) were detected in groundwater from an Environmental Restoration Program (ERP) Site 11 upgradient monitoring well (LS11-MW16D) during Site 11 Supplemental Remedial Investigation. Groundwater samples were collected in 1999 in the Site 11a vicinity as part of Site 11 investigations to identify a potential upgradient source of cVOCs. Consequently, the trichloroethene (TCE) groundwater contamination upgradient of Site 11 became identified in the Federal Facilities Agreement (FFA) in 2001 as Site 11a, and was proposed for investigation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

Surface features at Site 11a consist of Buildings 3606 and 3606A, their surrounding asphalt parking areas, and an open, mown grass field. Building 3606 is a five-story barracks building used as a single residence lodging for active duty personnel. Building 3606A is a one-story building used primarily for administrative and recreational activities associated with the barracks. The open field south of Building 3606 is used primarily as a recreational area for building occupants.

Two former buildings, Buildings 3033 and 3034, were located at the site. Former Building 3033, used as a 12-bay vehicle repair facility, was immediately south of the current barracks building. Historical records indicate the presence of a waste oil UST associated with the vehicle repair activities. The tank was identified as solid waste management unit (SWMU) 60 in the SWMU/Installation Restoration (IR) Summary report. The contents of the tank were not documented, and there is no record of solvent disposal in the tank. The tank was reportedly excavated and removed in 1988 under the UST Program; however, documentation of tank closure is not available. Prior to JEB Little Creek's placement on the National Priorities List (NPL) in 1999, SWMU 60 was closed under CERCLA with no further action following a desktop audit. SWMU 60 was documented in the FFA as closed with no further CERCLA action. Former Building 3034, used as a garden supply center, was in the grass-covered field. No releases associated with the building have been documented.

The 90% Submittal, Basis of Design for Site 11a (CH2MHill, 2011), identified enhanced reductive dechlorination (ERD) by emulsified vegetable oil (EVO) injections for the site remedy. EVO injections are planned in the plume source area and along the dissolved plume boundaries to reduce the groundwater cVOCs' concentrations. Baseline groundwater monitoring will be conducted prior to EVO injections to establish baseline conditions for ERD effectiveness evaluation. Following EVO injections, performance monitoring will be conducted at one month, three months, and six months, for comparison to baseline groundwater data to evaluate injection efficacy.

2.2 SCOPE OF WORK

This HASP focuses on the remediation activities at Site 11a.

The principal tasks to be conducted are listed below:

- Monitoring Well Installation
- EVO Injection
- Groundwater Monitoring Well Sampling

3.0 KEY PERSONNEL AND MANAGEMENT

The Project Manager (PM), Site Supervisor (SS), Site Safety Officer (SSO), and the Health and Safety Manager (HSM) are responsible for formulating and enforcing health and safety requirements, and for implementing this HASP. The following summarizes the health and safety responsibilities of the site management.

3.1 PROJECT SAFETY RESPONSIBILITIES

The PM has the overall responsibility for the project and to assure that the requirements of the contract are attained in a manner consistent with the HASP requirements. The PM will coordinate with the SS and the SSO to assure that the work is completed in a manner consistent with the HASP. The SS is responsible for field implementation of the HASP. The SS will be the main contact in any on-site emergency situation and will insure offsite emergency agencies have been contacted prior to the start of work. The HM and SSO are authorized to administer this HASP. The HM and SSO is authorized to stop work when an imminent health or safety risk exists. The HSC and/or HSM are responsible for reviewing the HASP and ensuring that the HASP is complete and accurate. The HSC and/or HSM also provide technical and administrative support for the Health and Safety Program and will be available for consultation when required. Each employee is responsible for personal safety as well as the safety of others in the work area. All personnel entering the work area are required to sign the Site Safety Plan Acknowledgment in Appendix A.

3.2 KEY SAFETY PERSONNEL

The following individuals share responsibility for health and safety at the site:

Project Manager	Ms. Cathy Weber (757) 440-0400 (office) (757) 619-4690 (cellular)
Site Supervisor/ Site Safety Officer	To Be Determined To Be Determined (cellular)
Health and Safety Manager	Mr. David Cohn (757) 440-0400 (office) (757) 754-4043 (cellular)

4.0 ACTIVITY HAZARD ANALYSIS

This section outlines the potential chemical and physical hazards, which workers may be exposed to during work at JEB Little Creek. Table 4-1 lists the possible contaminants at the site. Chemicals that may be brought to the site require an MSDS, as well as the known site chemicals of concern (COCs); they are included in Appendix B. Specific contaminants for the site as relating to the work tasks to be performed are outlined in the site-specific Activity Hazard Analysis (AHA) presented in Appendix C.

4.1 CHEMICAL HAZARDS

Based on site historical records and previous investigations, the primary site COCs at JEB Little Creek Site 11a could include the following:

TABLE 4-1 Chemical Hazards

CHEMICAL	EXPOSURE ROUTES	PEL/TLV	HEALTH HAZARDS/ PHYSICAL HAZARDS
cis-1,2-dichloroethene (DCE)	Skin, eye, inhalation, absorption, ingestion	OSHA: 200 ppm (790 mg/m ³), 8-hr TWA ACGIH: 200 ppm, 8-hr TWA	<ul style="list-style-type: none"> Irritation from skin contact; headache, nausea, vomiting, dizziness, and central nervous system (CNS) depression; Long term exposure can affect the kidneys and liver. Flammable liquid, keep away from sources of ignition. Will liberate toxic phosgene gas and hydrogen chloride when heated. Avoid contact with strong oxidizers and bases, aluminum, ammonia, and nitric acid.
Tetrachloroethene (PCE)	Skin, eye, inhalation, absorption, ingestion	OSHA: 100 ppm (670 mg/m ³), 8-hr TWA ACGIH: 25 ppm (790 mg/m ³), 8-hr TWA	<ul style="list-style-type: none"> Eye, respiratory system irritation; CNS depression, light-headedness, dizziness, euphoria, nausea, vomiting, weakness, tremor, epigastric cramps; dermatitis. Potential narcosis, CNS effects, and skin irritation.
TCE	Skin, eye, inhalation, absorption, ingestion	OSHA: 100 ppm (535 mg/m ³), 8-hr TWA ACGIH: 10 ppm, 8-hr TWA	<ul style="list-style-type: none"> A skin and eye irritant; dermatitis; headache, vertigo, visual distortion, fatigue, nausea, vomiting, irregular heart rhythm A dangerous fire hazard, reacts with strong caustics and chemically reactive metals, will emit toxic phosgene gas when heated.
Vinyl chloride (VC)	Skin, eye, inhalation, absorption, ingestion	OSHA: 1 ppm, 8-hr TWA ACGIH: 1 ppm, 8-hr TWA	<ul style="list-style-type: none"> A carcinogen; headache, vertigo, narcosis, collapse; affects CNS; skin and eye irritation A severe fire and explosion hazard; reacts with copper, aluminum, and hydroquinone; forms toxic decomposition products when involved with fires or heat; HCl, carbon monoxide, and phosgene.

ACGIH = American Conference of Governmental Industrial Hygienists; ppm = parts per million;
 PEL = permissible exposure limit; TLV = threshold limit value

The following general symptoms may indicate exposure to a hazardous chemical. Personnel will be removed from the work site and provided immediate medical attention if the following symptoms occur or if exposure is suspected:

- Dizziness or stupor
- Nausea, headaches, or cramps
- Irritation of the eyes, nose, or throat
- Chest pains and coughing
- Rashes or burns

4.2 SAFETY MEETINGS

4.2.1 Site Orientation

All employees and subcontractors will undergo a site orientation prior to commencement of work. Outlines of the site orientation for OSAGE / subcontractor personnel and visitors are presented below:

OSAGE/SUBCONTRACTORS	VISITOR ORIENTATION
<ul style="list-style-type: none"> • HASP review and sign off • Sign in/out procedures • Site background • Chain of command • Rules and regulations • Hours of work • Absences • Equipment • Emergency Information • Emergency signal • Gathering point • Responsibilities/roles • Emergency phone numbers • Work Zones • Contaminants and Material Safety Data Sheets (MSDS) [Hazard Communication Program] • AHAs (Phase Safety Plans) • Forms, site specific • Incident Reporting 	<ul style="list-style-type: none"> • Sign in/out procedures • Review of Site map • Work Zones in progress • Hazard Communication • Emergency plan/signals • Training/medical requirements • Zones/areas open to visitors

4.2.2 Weekly Safety Briefs/Toolbox Meetings

A weekly on-site safety meeting will be held and documented by the SS or SSO. The frequency of this meeting may be increased if new phases of work or job activities, severe weather, etc. warrant the action. A Safety Brief Form is available in Appendix A.

4.3 HAZARD COMMUNICATION

The purpose of hazard communication (Employee Right-to-Know) is to ensure that the hazards of all chemicals located at any field project site are transmitted (communicated) according to 29 CFR 1926.59 to all personnel and subcontractors. Hazard communication will include:

4.3.1 Container Labeling

Osage personnel will ensure that all drums and containers are labeled according to contents. These drums and containers will include those from manufacturers and those produced on site by operations. All incoming and outgoing labels shall be checked for identity, hazard warning, and name and address of responsible party.

4.3.2 Material Safety Data Sheets

There will be an MSDS located on site for each hazardous chemical known to be used on site. All hazardous chemical MSDSs will be located in the Appendices of the site-specific HASP. The HASP will be kept on-site at all times.

4.3.3 Employee Information and Training

Training employees on chemical hazards is accomplished through an ongoing corporate training program. Additionally, chemical hazards are communicated to employees through daily safety meetings held at Osage field projects and/or by an initial site orientation meeting.

At a minimum, Osage and related subcontractor employees will be instructed on the following:

- An in-depth review of the contaminants of concern identified
- OSHA regulated chemicals and their hazards in the work area
- How to prevent exposure to these hazardous chemicals
- What the company has done to prevent workers' exposure to these chemicals
- Procedures to follow if they are exposed to these chemicals.
- How to read and interpret labels and MSDSs for hazardous substances found on Osage sites
- Emergency spill procedures
- Proper storage and labeling

Before any new hazardous chemical is introduced on-site, each Osage and related subcontractor employee will be given notification. The SS will be responsible for seeing that the MSDS for the new chemical is available for review by on-site personnel. The information pertinent to the chemical's hazards will be communicated to project personnel.

Morning safety meetings will be held and the hazardous materials used on-site will be discussed. Attendance is mandatory for all on-site employees.

Refer to the Appendices of the site-specific HASP to find a list of hazardous chemicals anticipated to be on the site and the corresponding MSDSs for these chemicals.

4.4 HAZARDS AND PROCEDURES

To minimize physical hazards, Osage has developed standard safety protocols that will be followed at all times. Failure to follow safety protocols will result in removal of an employee from the site and appropriate disciplinary actions.

The SS and SSO will observe the general work practices of each crew member and equipment operator, and enforce safe work practices. The SS will inspect work areas. All hazards will be identified and corrected in a timely manner. A variety of chemical, physical, and biological hazards may be encountered during work activities at each site. Activity Hazard Analyses will be developed for each principal activity and will identify all major hazards to which employees may be exposed. Site-specific hazards and all necessary precautions will be discussed during safety meetings.

An outline of several hazards and their control procedures are provided below.

4.4.1 Proper Housekeeping, Slips Trips, Falls

Slips, trips, and falls are the most common and easily preventable cause of injury. Many accidents may be averted by maintaining a clean work area and good housekeeping practices. High-traffic areas should always be kept free of debris, cords, cables, or hoses whenever possible. Tools, ladders, other equipment and supplies should always be stored in an orderly manner away from high-traffic areas. Clean-up of the site should be ongoing as work progresses. All trash and loose debris should be placed in a trash or recycling receptacle. Slippery floors, broken or loose floorboards, bumps or cracks in floor surfaces should be reported to the HSM and cleaned, repaired, or marked off as soon as possible. Dim lighting should be augmented with supplementary lights as needed.

4.4.2 Heat Stress

The combination of warm ambient temperature and protective clothing increases the potential for heat stress. Heat stress disorders include heat rash, heat cramps, heat exhaustion, and heat stroke.

Heat stress prevention will be reviewed during safety meetings. Workers are encouraged to increase consumption of water and electrolyte-containing beverages (e.g. Gatorade). Heat stress may be avoided by working during the cooler part of the day, providing rest periods, or assigning extra relief workers working in shifts. Heat stress can be prevented by assuring an adequate work/rest schedule. Guidelines are presented below.

Workers are encouraged to take rests and report symptoms whenever they feel any adverse effects that may be heat-related. The frequency of breaks may need to be increased based on worker recommendation to the SSO and SS. Heat stress can be prevented by assuring an adequate work/rest schedule and adequate fluid consumption. A guide for work-rest schedules for various protection levels is given below. The number of hours before a work-rest period is based on experience with similar work. The time periods should be considered maximum. It must also be taken into consideration that individuals have differing physical capabilities and some tasks may require revisions to site plans. This table should be used as a general guideline only. Professional judgment of the SS and SSO is necessary to assure a fully protective plan to prevent heat stress disorders.

GUIDELINES FOR WORK-REST PERIODS				
PROTECTION LEVEL NUMBER OF HOURS BEFORE REST PERIOD				
Temperature	Level D	Level C	Level B	Level A
90 F	2.0	1.5	1.0	0.5
87.5 F	2.5	2.0	1.5	1.0
82.5 F	3.0	2.5	2.0	1.5
77.5 F	3.5	3.0	2.5	1.5
72.5	4.0	3.5	2.5	1.5

Symptoms of each variety of heat stress and first aid measures are listed below:

4.4.2.1 Heat Stroke

Symptoms of heat stroke:

- Slurred speech
- Hot, dry skin
- Chills
- High body temperature
- Confusion, dizziness

Personnel who exhibit symptoms of heat stroke should be moved to a cool, shaded area. Water may be soaked over the injured worker’s clothes for a cooling effect. Seek immediate medical attention and notify the HSM.

4.4.2.2 Heat Exhaustion

Symptoms of heat exhaustion:

- Heavy sweating
- Weakness, fatigue
- Dizziness, confusion
- Nausea
- Cramps
- Clammy, moist skin

Move the heat exhaustion victim to a cool, shaded area and have them drink plenty of water. Water may be soaked over the injured worker’s clothes for a cooling effect. Seek immediate medical attention and notify the HSM.

4.4.2.3 Heat Cramps

Heat Cramps involve muscle pain or spasm in the abdomen, arms, or legs. Workers experiencing heat cramps should stop all activity and rest in a cool place. Continue to rehydrate with a sports beverage containing electrolytes. Seek immediate medical attention and notify the HSM.

4.4.2.4 Heat Rash

Heat rash is a skin irritation containing pimples or small blisters usually located on the neck or upper chest or in the elbow creases. Treat heat rash by seeking a cooler less humid environment and drying the affected area(s). Notify the HSM.

4.4.3 Cold Stress

Employees who are exposed to cold environments may be at risk to cold stress. Hypothermia is a common form of cold stress.

If exposed to temperatures cold enough, the body will lose heat faster than it can be generated which can lead to abnormally low body temperatures and hypothermia. Early symptoms of hypothermia include shivering, fatigue, loss of coordination and confusion. Late symptoms of hypothermia include blue skin, dilated pupils, lack of shivering, reduced pulse and breathing and/or loss of consciousness. If it is suspected that a worker has experienced hypothermia, the individual should be moved to a warm room, vehicle, or other form of shelter. Any wet clothing should be removed and the employee should be wrapped in a blanket or other dry clothing. Seek immediate professional medical attention and notify the HSM.

4.4.4 Lightning

The procedures provided below will be used to protect site personnel from lightning related injuries.

4.4.4.1 Training

A tailgate safety meeting will be conducted to increase awareness to the hazards and prevention of lightning related incidents should there be a possibility of severe weather.

4.4.4.2 Detection of Lightning

The Site Supervisor will be proactive in monitoring conditions that may produce thunderstorms and lightning. A daily and weekly weather forecast will be tracked and communicated to site personnel. When signs of impending storms, i.e., increasing wind, darkening skies, or lightning appear, local weather monitoring will be increased. If necessary, all exterior work will be halted. The National Weather Service (www.nws.noaa.gov/) should be consulted frequently. Personnel will be notified when thunderstorms may impact the site.

The “flash/bang” (f/b) technique of measuring the distance to lightning will be reviewed with all personnel. The f/b technique is defined as: for each five seconds from the time of

observing the lightning flash to hearing the associated thunder, the lightning is one mile away.

4.4.4.3 Suspension/Resumption of Activities

All outside activities will be suspended when a lightning flash is immediately in the area or a f/b of 20 seconds (4 miles away) is noted. Personnel may continue indoor work activities. Outdoor activities will resume when 30 minutes has passed since the last observable f/b is 20 seconds or greater.

4.4.4.4 Lightning Protection

When notification is given, all outside work activities will stop and personnel will gather in the support zone or indoors for a head count and further instructions. Indoor work may continue, except for the use of electrical equipment, telephones and computers. When a safe location is not present and personnel are caught by a sudden lightning event, employees should seek the lowest possible area, away from large objects which might attract lightning or fall over (e.g., trees, utility poles). The employee should assume a crouching position with their head lowered and hands over their ears. Avoid water, high ground, heavy equipment and tall, isolated objects.

4.4.4.5 First Aid

An employee that is struck by lightning needs immediate assistance (call 911 or other appropriate emergency services immediately). The body will not carry an electrical charge, but receives a severe electrical shock and may be burned. Personnel certified in first aid/CPR should inspect for shock and burns around fingers, toes, buckles and jewelry. Stay with the injured employee until medical help arrives. Report any severe incidents to the PM or HSM immediately.

4.4.5 Vehicle Safety

Motor vehicle incidents are the number one cause of occupational fatalities, accounting for one in three deaths. Fifty percent or more of vehicle safety incidents occur while backing up. Osage requires employees to use seat belts at all times when traveling in Osage owned or leased/rented vehicles. The SS and/or SSO will develop a parking area plan, including backing vehicles into parking spaces, using spotters for backing vehicles and policy mandated vehicle inspections.

Osage employees are expected to incorporate safe actions and preparations to avoid vehicle accidents and personal injury during work and off-hours. Breaks should be planned into lengthy job mobilizations and demobilizations, including rotation of drivers at regular intervals. If parking areas are busy or crowded and more than one worker is traveling in the same vehicle, one worker should remain outside the vehicle as it leaves the parking space to assist the driver with traffic observation. Vehicles traveling before dawn and at dusk in rural or wooded areas should be prepared for wildlife, e.g. deer crossing roadways.

Osage employees arriving at work areas should park vehicles away from delivery, heavy equipment and vehicle loading/unloading locations to prevent parked vehicles from damage

by various deliveries. Heavy equipment operators should inspect areas and request vehicles to be moved or spotters used if necessary, to maneuver equipment in tight areas. Employees who observe near misses or potential risks to parked or moving vehicles must report these to the SS or SSO immediately.

Osage employees are expected to use the vehicle inspection form and check/test the safety systems on the vehicle on a daily basis. Check the following: brakes, mirrors, seat belts, tires, leakage from the undercarriage, lights and turn signals. Vehicles with safety deficiencies must be reported immediately and not driven until properly repaired. Vehicles running errands from different project sites should have telephone numbers of the job site in the vehicle in case calls for assistance are required.

Because of the different ways alcohol can affect behavior, even in very small amounts, the best and safest course is not to drink before driving. At Osage, a driver with blood alcohol concentration (BAC) over 0.04% is considered to be under the influence and subject to disciplinary action. Personnel involved in motor vehicle incidents are subject to drug and alcohol testing.

Weather conditions can have a profound effect on driving. On slippery roads, drive more slowly. Stop and turn with care. Keep several car lengths from other vehicles. At speeds in excess of 35 mph, the chances of hydroplaning increase with speed. As a general rule, keep back 1 car length for every 10 mph to prevent striking the car ahead.

Vehicles will be operated in accordance with the requirements listed below:

- Seatbelt use is mandatory for all passengers;
- Personnel may not ride in the back of cargo vehicles;
- The driver must make a 360 degree walk around the assigned vehicle prior to vehicle movement;
- A ground guide is used to back up any vehicle;
- Vehicle speed is limited to the posted speed limits for developed roadways, 25 mph maximum on dirt roads and 10 mph maximum off-road (based on conditions);
- Vehicle driven in four wheel low and low gear when on dirt roads or off road driving where steep grades dictate;
- All operators must possess a valid driver's license;
- Fuel or gasoline are not transported inside the passenger compartment;
- No vehicle is left running when unattended; and
- Parking brakes are used when vehicles are parked.

In the event of a vehicle incident, notify your Site Supervisor *immediately* and complete all required reports.

4.4.6 Electrical

Only authorized qualified personnel may work on energized systems. All wiring should be considered energized until lockout/tagout procedures have been completed. Damaged electrical equipment (extension cords, etc.) should never be utilized and promptly be

removed from service.

4.4.7 Power Tools

Power tools should only be operated by qualified personnel. Each tool should be operated and maintained in compliance with the manufacturer's specifications. Damaged tools should not be utilized and should be removed from service or repaired when possible. Maintain safe distances from personnel operating power tools at all times.

4.4.8 Compressed Gas Cylinders

Compressed gas cylinders may represent the potential exposure to mechanical and chemical hazards. Gases contained within compressed gas cylinders may be flammable, explosive, poisonous or corrosive. Compressed gases should only be handled by properly trained authorized personnel. Compressed gas cylinders should be stored upright in a well-ventilated area. Cylinders greater than 18 inches in length must be secured with a chain or belt above the midpoint but below the shoulder. All cylinders must be capped when not in use and kept away from flammable or incompatible substances. Damaged or leaking cylinders must be reported to the HSM and removed from service for proper disposal.

4.4.9 Confined Spaces

A confined space is not intended for occupancy and has limited openings for entry or exit. Confined spaces may include storage tanks, boilers, pits, silos, ducts, tunnels, sewers, utility vaults, and pipelines. Confined spaces may contain contaminants or dangerous or unhealthy atmospheres. Confined spaces should never be entered without the appropriate authorization, permit, training, and safety procedures. Neither Osage employees nor subcontractors will be permitted to enter confined spaces unless properly trained and the appropriate entry safety measures and procedures have been taken. Authorization must be received from the HSD.

4.4.10 Underground Utilities

Underground utilities pose a significant threat for injury or even death. Local public utility services must be contacted prior to initiation of any intrusive work. A separate private locating contractor will be procured to ensure the accuracy of the utility markings. No intrusive activity may begin until all utilities have been designated. Boring, digging, or any other intrusive activity shall not take place within three feet of any marked utility.

4.4.11 Ladders

The area around the base and top of the ladder must be kept clear at all times. Ladders may never be tied or fastened together to create longer sections. Foldout ladders must have a metal spreader that is in the locked position when in use. Ladders must be free from oil, grease or any other slippery substances. The top rung of a ladder may never be utilized as a work platform. Non self-supporting ladders must extend approximately three feet above the landing and should be tied off. Ladders should never be moved or shifted when occupied.

4.4.12 Lifting

Safe lifting techniques should always be used to reduce the threat of injury. Use mechanical lifting aids if necessary, or whenever possible. Reduce loads by moving the items in several smaller loads if possible. Ask for help if you need it; heavier or awkward items may require

two or more people. Remove any obstacles from your intended path prior to lifting the object. Utilize work gloves if necessary to avoid splinters, burrs, or pinches. Bend at your knees and not your waist to pick the item up. Lift and lower the load in unison if using a partner.

4.4.13 Noise

Ear plugs or muffs should be used when noise hazards may be present (heavy equipment, airplanes, etc.). Prolonged exposure to any noise above 85 decibels may cause hearing loss. Engineering controls (mufflers or acoustic barriers) may also be utilized to reduce noise hazards.

4.4.14 Biological Hazards

The following Environmental and Biological hazards may be present during project activities:

4.4.14.1 Poison Ivy, Poison Oak, and Poison Sumac

Poison ivy, poison oak, and poison sumac may be encountered in or near woodland or forested areas. These plants contain oil called urushiol; contact with the skin may cause redness, itching, and painful rashes. The best controls are avoidance and protective clothing (long pants and long-sleeved shirt that cover bare skin). Familiarize yourself with the identity of these plants so contact may be averted. Poison ivy grows as a vine and is generally found east of the Rocky Mountains. Its leaves grow in clusters of three. Poison oak is typically encountered west of the Rocky Mountains. Poison oak may grow as a bush or vine and has leaves in groups of three, five, or seven. Poison sumac is found most often in the Southeast and contains thirteen leaves on each stem. The appearance of all three of these plants may vary slightly between seasons and regions. Dead plants may still be capable of transmitting oils to the skin. If contact is made with any of these plants, the affected area should immediately be washed with soap and water.

4.4.14.2 Ticks

Ticks are small arachnids that survive on the blood of mammals, and sometimes birds, reptiles, or amphibians. There are several varieties of ticks and they are widely distributed around the world. Ticks are commonly found in brush, tall grass, or woodland areas. Ticks attach themselves to a host by way of a bite and ingest that host's blood. Ticks are vectors for several diseases including Lyme disease and Rocky Mountain Spotted Fever. Light colored clothing with long sleeves and pant legs which are taped or tucked in to boots are good preventative measures. Frequently check yourself for ticks and remove them when located. If a tick has attached itself, remove the tick with a pair of tweezers. Grasp the tick as close to the head or point of attachment as possible, remove it, and disinfect the bite area. Place the tick in a container, save it, and report the bite to the HSM. Continue to monitor the bite area for several days. If a target or red spots appear, seek medical attention immediately.

4.4.14.3 Snakes

Snakes may be found in grassy or woodland/forested areas. The best control is avoidance. If

a snake is encountered, the best course of action is to leave the area utilizing the same path that was taken. In the unlikely event that a bite occurs, note the markings, colors, and size of the snake for identification. Never try to capture the snake. Seek medical attention immediately and report the incident to the HSM.

4.4.14.4 Spiders

Female black widow spiders are shiny black and may or may not have a prominent red hourglass figure on the underside of the abdomen. They are found on every continent of the world except Antarctica. Black widow spiders contain a neurotoxic venom and should be avoided at all times. If bitten seek immediate medical attention and report the incident to the HSM.

4.4.14.5 Wasps, Bees, and Other Stinging Insects

Wasps, bees and other stinging insects are commonly encountered and represent a significant allergic hazard to some. If you have had allergic reactions to stings in the past, you should have an epi-pen available at all times. Notify the HSM if you have allergic reactions to stings. If a sting occurs, administer the epi-pen as necessary. Remove any stingers with tweezers, disinfect the wound area and apply ice.

4.5 CHEMICAL INJECTIONS (EVO)

The Site 11a ERD remedial action will be implemented via EVO injections. Safe work practices associated with the implementation of the EVO treatment technology are identified below.

- PPE use and air monitoring will be carried out as described in Section 6.0 to attempt to minimize potential dermal and respiratory exposures to site COCs or EVO materials during site operations. Furthermore, proper personal hygiene must be maintained (see section 7.1.3 of this HASP).
- If system injection equipment repairs are needed after injection has begun, chemical hosing must be relieved of pressure prior to commencing any repairs, and systems must be de-energized, as applicable.
- Chemicals must be stored in a designated area, and only with compatible materials (see Appendix B for MSDSs).
- Any chemical drums must be moved using a drum dolly or automated lift equipment to ensure the drum weight is properly handled and secure while it is transported.
- Empty chemical containers should be rinsed, as appropriate, prior to disposal to an appropriate location.
- The injection system must be operated by qualified, trained personnel.
- Spill response kit(s) for site chemicals must be available at the job site, and spill response shall only be performed by personnel with proper equipment, PPE, and experience/training.
- A portable eye wash station and emergency shower will be available in the immediate work area.
- Material Safety Data Sheets (MSDSs) are located in Appendix B for the

following substances:

Injection Chemicals

- EVO Slow Release Substrate-Small Droplet
- Sodium Bicarbonate

4.6 ACTIVITY HAZARD ANALYSES

Appendix C contains the site-specific AHAs for the primary tasks to be conducted. They contain detailed information on physical and chemical hazards, and provide control measures for these hazards. The AHAs will be field checked by the SS/SSO on an ongoing basis and revised as necessary. All revisions will be communicated to the work crew.

5.0 WORK AND SUPPORT AREAS

To prevent migration of contamination from personnel and equipment, work areas will be clearly specified as designated below prior to beginning operations. Each work area will be clearly identified using signs or physical barriers.

- Exclusion Zone
- Contamination Reduction Zone
- Support Zone

A log of all personnel visiting, entering or working on the site shall be maintained by the SSO. No visitor will be allowed in the EZ without showing proof of training and medical certification, per 29 CFR 1910.120(e), (f) and 29 CFR 1926.65. Visitors will attend a site orientation given by the SSO and sign the HASP.

The following are standard safe work practices that apply to all site personnel and will be discussed in the safety briefing prior to initiating work on the site:

- Eating, drinking, chewing gum or tobacco, smoking is prohibited in the EZ/CRZs.
- Hands and face must be washed upon leaving the EZ and before eating, drinking, chewing gum or tobacco and smoking.
- A buddy system will be used. Hand signals will be established to maintain communication.
- During site operations, each worker will consider himself as a safety backup to his partner. Off-site personnel provide emergency assistance.
- Visual contact will be maintained between buddies on site when performing hazardous duties.
- No personnel will be admitted to the site without the proper safety equipment, training, and medical surveillance certification.
- All personnel must comply with established safety procedures. Any staff member who does not comply with safety policy, as established by the SS, will be immediately dismissed from the site.
- Proper decontamination procedures must be followed before leaving the site.
- All employees and visitors must sign in and out of the site.

6.0 PERSONNEL PROTECTION

This section specifies the levels of personal protective equipment (PPE) which are or may be required for each principal activity performed at this site, as well as air monitoring to be performed during intrusive work. The level of protection for each task will be clearly outlined in the specific addenda to this plan for the work activities. All site personnel must be trained in the use of all PPE utilized. The PPE program contained in HS600 will be applied to project activities. The use and maintenance of respiratory protection is specified in HS601. It is assumed that Level D PPE will be used for the work occurring at the site, and Modified Level D PPE may be used if deemed necessary.

6.1 PROTECTION LEVEL DESCRIPTIONS

This section lists the minimum requirements for each protection level. Modification to these requirements may have been noted above.

6.1.1 Level D

Level D consists of the following:

- Safety glasses with side shields
- Hard hat
- Reflective safety vest
- Steel-toed work boots
- Work clothing as prescribed by weather

6.1.2 Modified Level D

Modified Level D consists of the following:

- Safety glasses with side shields
- Hard hat
- Steel-toed work boots
- Protective coveralls
- Protective Poly-coated Coveralls (when handling liquid contaminants)
- Chemical resistant overboots
- Nitrile inner liner gloves
- Nitrile outer gloves
- Face shield and goggles (when projectiles or splashes pose a hazard)
- Rain gear if necessary

6.2 AIR MONITORING

Air monitoring for the presence of cVOCs during field work will be performed with a flame ionization detector (FID) or a photoionization detector (PID) with an 11.7 electronvolt (eV) lamp or equivalent that is able to detect cVOCs. During drilling and injection work, breathing zone readings will be taken periodically (approximately every 15 minutes), unless the SSO determines that more frequent monitoring is required. Field personnel will perform a daily calibration of the PID/FID using 100 ppm isobutylene and will operate the instrument

according to the manufacturer's instructions. A sustained reading for 15 minutes of 1 ppm above background in the breathing zone will be action level to re-evaluate for the potential need to upgrade PPE.

The PID/FID will be inspected and tested prior to use in the field. The instruction manual will be available for trouble-shooting and routine repairs in the field. Field equipment routine maintenance may include the following to ensure the PID/FID stays in good repair and is functioning properly:

- Removing surface dirt and debris
- Replacing/cleaning filters/membranes when needed
- Ensuring proper storage of equipment (instrument is sensitive to extreme temperature fluctuations)
- Charging battery packs when not in use
- Maintaining spare and replacement parts in field to minimize downtime.

7.0 DECONTAMINATION PROCEDURES

This section describes the procedures necessary to ensure that both personnel and equipment are free from contamination when they leave the work site.

7.1 PERSONNEL DECONTAMINATION

Decontamination procedures will ensure that material which workers may have contacted in the EZ does not result in personal exposure and is not spread to clean areas of the site. This sequence describes the general decontamination procedure. The specific stages will vary depending on the site, the task, and the protection level, etc.

7.1.1 Level D Decontamination

- 1) Remove outer gloves and discard
- 2) Remove inner sample gloves if utilized and discard
- 3) Wash face and hands

7.1.2 Modified Level D Decontamination

- 1) Go to end of EZ
- 2) Remove and discard latex booties
- 3) Remove outer gloves and discard
- 4) Remove protective suit (if applicable)
- 5) Remove inner sample gloves and discard
- 6) Wash face and hands

7.1.3 Personal Hygiene

Before any eating, smoking, or drinking, personnel will wash hands, arms, neck and face.

7.2 EQUIPMENT DECONTAMINATION

All contaminated equipment will be decontaminated before leaving the site. Decontamination procedures will vary depending upon the contaminant involved, but may include sweeping, wiping, scraping, hosing, or steaming the exterior of the equipment. Personnel performing this task will wear the proper PPE as prescribed by the SSO.

7.3 DISPOSAL

All decontamination liquids and disposable clothing will be treated as contaminated waste unless determined otherwise by accepted testing methods. Wastes will be disposed of according to state and federal regulations.

7.4 SUSPECTED CONTAMINATION

Any employee suspected of sustaining skin contact with chemical materials will remove clothing, shower, don clean clothing, and immediately be taken to the first aid station. Medical attention will be provided based on the degree of injury.

8.0 EMERGENCY RESPONSE

8.1 PRE-EMERGENCY PLANNING

Prior to engaging in construction activities at the site, Osage will plan for possible emergency situations and have available adequate supplies and manpower to respond. In addition site personnel will receive training during the site orientation concerning proper emergency response procedures.

The following situations would warrant emergency response implementation:

Fire/Explosion	<ul style="list-style-type: none"> • The potential for human injury exists. • Toxic fumes or vapors are released. • The fire could spread on site or off site and possibly ignite other flammable materials or cause heat-induced explosions. • The use of water and/or chemical fire suppressants could result in contaminated run-off. • An imminent danger of explosion exists.
Spill or Release of Hazardous Materials	<ul style="list-style-type: none"> • The spill could result in the release of flammable liquids or vapors, thus causing a fire or gas explosion hazard. • The spill could cause the release of toxic liquids or fumes in sufficient quantities or in a manner that is hazardous to or could endanger human health.
Natural Disaster	<ul style="list-style-type: none"> • A rainstorm exceeds the flash flood level. • The facility is in a projected tornado path or a tornado has damaged facility property. • Severe wind gusts are forecasted or have occurred and have caused damage to the facility.
Medical Emergency	<ul style="list-style-type: none"> • Overexposure to hazardous materials. • Trauma injuries (broken bones, severe lacerations/bleeding, burns). • Eye/skin contact with hazardous materials. • Loss of consciousness. • Heat stress (Heat stroke). • Heart attack. • Respiratory failure. • Allergic reaction.

The following measures will be taken to assure the availability of adequate equipment and manpower resources:

- Sufficient equipment and materials will be kept on site and dedicated for emergencies only. The inventory will be replenished after each use.
- On-site emergency responders will be current in regards to training and medical surveillance programs. Copies of all applicable certificates will be kept on file for on-site personnel required to respond.
- It will be the responsibility of the emergency coordinator to brief the on-site response team on anticipated hazards at the site. The emergency coordinator shall also be responsible for anticipating and requesting equipment that will be needed for response activities.
- Emergency response activities will be coordinated with the Local Emergency Management Agency (EMA) in compliance with SARA Title III requirements.

Communications will be established prior to commencement of any activities at the remediation site. Communication will be established so that all responders on site have availability to all pertinent information to allow them to conduct their activities in a safe and healthful manner. A telephone will be located at the command post to summon assistance in an emergency.

Primary communication with local responders in the event of an emergency will be accomplished using commercial telephone lines.

8.2 EMERGENCY RECOGNITION AND PREVENTION

Because unrecognized hazards may result in emergency incidents, it will be the responsibility of the Site Manager and the SSO, through daily site inspections and employee feedback (daily safety meetings and AHA reviews) to recognize and identify all hazards that are found at the site. These may include the following (see next page):

Chemical Hazards	<ul style="list-style-type: none"> • Materials at the site • Materials brought to the site
Physical Hazards	<ul style="list-style-type: none"> • Fire/explosion • Slip/trip/fall • Electrocutation • Excessive noise
Mechanical Hazards	<ul style="list-style-type: none"> • Heavy equipment • Pinch points • Electrical equipment • Vehicle traffic
Environmental Hazards	<ul style="list-style-type: none"> • Electrical Storms • High winds • Heavy Rain • Temperature Extremes (Heat/Cold Stress) • Poisonous Plants/Animals

Once a hazard has been recognized, the SS and the SSO will take immediate action to prevent the hazard from becoming an emergency. This may be accomplished by the following:

- Daily safety meeting
- Task specific training prior to commencement of activity
- PPE selection/use
- Air monitoring
- Following all Osage standard operating procedures
- Practice drills for fire, medical emergency, and hazardous substances spills

TABLE 8-1

EMERGENCY CONTACT INFORMATION	
<u>Local Agencies –</u> Ambulance Fire Police	911 911 911
<u>Hospital -</u> Bon Secours DePaul Medical Center (off base 9.5 miles) Sentara Norfolk General (off base 13.8 miles)	(757) 889-5000 (off-base) (757) 388-3000 (off-base)
Regional Poison Control Center	800-552-6337
<u>State Agencies</u> State Highway Patrol	(804) 674-2000
<u>Federal Agencies</u> Agency for Toxic Substances and Disease Registry EPA Region Branch Response Center National Response Center	(404) 639-0615 (24 hr.) (404) 347-3931 800-424-8802
<u>NAVFAC Contact</u> Mr. Bryan Peed	(757) 445-6671 (office)
<u>Facilities Engineering and Acquisition Division (FEAD)</u> John Noel	(757) 462-4884
<u>Osage Personnel</u> Project Manager – Ms. Cathy Weber Site Supervisor/ Site Health and Safety Officer – To Be Determined Health & Safety Manger – David Cohn	(757) 440-0400 (office) (757) 619-4690 (cellular) To Be Determined (cellular) (757) 440-0400 (office) (757) 754-4043 (cellular)
Osage of Virginia, Inc. - 24 hour contact number	(757) 560-5767 (757) 408-2349

8.3 PERSONNEL ROLES, LINES OF AUTHORITY, AND COMMUNICATIONS

This section describes the various roles, responsibilities, and communication procedures that will be followed by personnel involved in emergency responses.

The primary emergency coordinator for this site is the Site Supervisor. In the event an emergency occurs and the emergency coordinator is not on site, the SS or the highest ranking employee on site will serve as the emergency coordinator until he arrives. The emergency coordinator will determine the nature of the emergency and take appropriate action.

The emergency coordinator will implement responses immediately as required. The decision to implement the plan will depend upon whether the actual incident threatens human health or the environment. Immediately after being notified of an emergency incident, the emergency coordinator or his designee will evaluate the situation to determine the appropriate action.

8.3.1 Responsibilities and Duties

This section describes the responsibilities and duties assigned to the emergency coordinator.

It is recognized that the structure of the “Incident Command System” will change as additional response organizations are added. Osage will follow procedures as directed by the fire department, LEPC, State and Federal Agencies as required. Osage will defer to the local Fire Department chief to assume the role of Incident Commander upon arriving on site. Additional on-site personnel may be added to the Site Emergency Response Team as required to respond effectively.

8.3.2 On-Site Emergency Coordinator Duties

The on-site emergency coordinator is responsible for implementing and directing the emergency procedures. All emergency personnel and their communications will be coordinated through the emergency coordinator. Specific duties are as follows:

- Identify the source and character of the incident, type and quantity of any release. Assess possible hazards to human health or the environment that may result directly from the problem or its control.
- Discontinue operations in the vicinity of the incident if necessary to ensure that fires, explosions, or spills do not recur or spread to other parts of the site. While operations are dormant, monitor for leaks, pressure build-up, gas generation, or ruptures in valves, pipes, or other equipment, where appropriate.
- Notify local Emergency Response Teams if their help is necessary to control the incident. Table 8-1 provides telephone numbers for emergency assistance.
- Direct on-site personnel to control the incident until, if necessary, outside help arrives.
- Ensure that the building or area where the incident occurred and the surrounding area are evacuated and shut off possible ignition sources, if appropriate. The Emergency Response Team is responsible for directing site personnel such that they avoid the area of the incident and leave emergency control procedures unobstructed.
- If fire or explosion is involved, notify facility Fire Department.
- Notify Osage Project Manager
- Have protected personnel, in appropriate PPE, on standby for rescue.

If the incident may threaten human health or the environment outside of the site, the emergency coordinator should immediately determine whether evacuation of area outside of the site may be necessary and, if so, notify the Police Department and the Office of Emergency Management.

When required, notify the National Response Center. The following information should be provided to the National Response Center:

- Name and telephone number
- Name and address of facility

- Time and type of incident
- Name and quantity of materials involved, if known
- Extent of injuries
- Possible hazards to human health or the environment outside of the facility.

The emergency telephone number for the National Response Center is 800-424-8802.

If hazardous waste has been released or produced through control of the incident, ensure that:

- Waste is collected and contained.
- Containers of waste are removed or isolated from the immediate site of the emergency.
- Treatment or storage of the recovered waste, contaminated soil or surface water, or any other material that results from the incident or its control is provided.
- Ensure that no waste that is incompatible with released material is treated or stored in the facility until cleanup procedures are completed.
- Ensure that all emergency equipment used is decontaminated, recharged, and fit for its intended use before operations are resumed.

8.4 SAFE DISTANCES AND PLACES OF REFUGE

The emergency coordinator for all activities will be the SS. No single recommendation can be made for evacuation or safe distances because of the wide variety of emergencies that could occur. Safe distances can only be determined at the time of an emergency based on a combination of site and incident specific criteria. However, the following measures are established to serve as general guidelines.

In the event of minor hazardous materials releases (small spills of low toxicity), workers in the affected area will report initially to the contamination reduction zone. Small spills or leaks (generally less than 55 gallons) will require initial evacuation of at least 50 feet in all directions to allow for cleanup and to prevent exposure. After initial assessment of the extent of the release and potential hazards, the emergency coordinator or his designee will determine the specific boundaries for evacuation. Appropriate steps such as caution tape, rope, traffic cones, barricades, or personal monitors will be used to secure the boundaries.

In the event of a major hazardous material release (large spills of high toxicity/greater than 55 gallons), workers will be evacuated from the building/site. Workers will assemble at the entrance to the site for a head count by their foremen and to await further instruction.

If an incident may threaten the health or safety of the surrounding community, the public will be informed and, if necessary, evacuated from the area. The emergency coordinator or his designee will inform the proper agencies in the event that this is necessary. Telephone numbers are listed in Table 8-1.

Places of refuge will be established prior to the commencement of activities. These areas must be identified for the following incidents:

- Chemical release
- Fire/explosion
- Power loss
- Medical emergency
- Hazardous weather

In general, evacuation will be made to the crew trailers (Lot 203), unless the emergency coordinator determines otherwise. It is the responsibility of the emergency coordinator to determine when it is necessary to evacuate personnel to off-site locations.

In the event of an emergency evacuation, all the employees will gather at the entrance to the site until a head count establishes that all are present and accounted for. No one is to leave the site without notifying the emergency coordinator.

8.5 EVACUATION ROUTES AND PROCEDURES

All emergencies require prompt and deliberate action. In the event of an emergency, it will be necessary to follow an established set of procedures. Such established procedures will be followed as closely as possible. However, in specific emergency situations, the emergency coordinator may deviate from the procedures to provide a more effective plan for bringing the situation under control. The emergency coordinator is responsible for determining which situations require site evacuation.

8.5.1 Evacuation Signals and Routes

Only the emergency coordinator will initiate total site evacuation, however, in his absence, decision to preserve the health and safety of employees will take precedence. Evacuation routes will be posted in each outside work area. Signs inside buildings will be posted on walls or other structural element of a building. Periodic drills will be conducted to familiarize each employee with the proper routes and procedures.

8.5.2 Evacuation Procedures

In the event evacuation is necessary, the following actions will be taken:

- An emergency signal will be activated.
- No further entry of visitors, contractors, or trucks will be permitted. Vehicle traffic within the site will cease in order to allow safe exit of personnel and movement of emergency equipment.
- Shut off all machinery if safe to do so.
- ALL on-site personnel, visitors, and contractors in the support zone will assemble at the entrance to the site for a head count and await further instruction from the emergency coordinator.
- ALL persons in the exclusion zone and contamination reduction zone will be accounted for by their immediate crew leaders (e.g., foreman). Leaders will

determine the safest exits for employees and will also choose an alternate exit if the first choice is inaccessible.

- During exit, the crew leader should try to keep the group together. Immediately upon exit, the crew leader will account for all employees in his crew.
- Upon completion of the head count, the crew leader will provide the information to the emergency coordinator.
- Contract personnel and visitors will also be accounted for.
- The names of emergency response team members involved will be reported to the emergency spill control coordinator.
- The emergency coordinator or designee will make a final tally of persons. No attempt to find persons not accounted for will involve endangering lives of Osage or other employees by re-entry into emergency areas.

In all questions of accountability, immediate crew leaders will be held responsible for those persons reporting to them. Visitors will be the responsibility of those employees they are seeing. Contractors and truck drivers are the responsibility of the Site Manager. The security guard will aid in accounting for visitors, contractors, and truckers by reference to sign in sheets available from the guard shack.

- Personnel will be assigned by the emergency coordinator to be available at the main gate to direct and brief emergency responders.
- Re-entry into the site will be made only after the emergency coordinator gives clearance. At his direction, a signal or other notification will be given for re-entry into the facility.
- Drills will be held periodically to practice all of these procedures and will be treated with the same seriousness as an actual emergency.

8.6 EMERGENCY SPILL RESPONSE PROCEDURES AND EQUIPMENT

In the event of an emergency involving a hazardous material spill or release, the following general procedures will be used for rapid and safe response and control of the situation. Emergency contacts found in Table 8-1 provide a quick reference guide to follow in the event of a major spill.

8.6.1 Notification Procedures

If an employee discovers a chemical spill or process upset resulting in a vapor or material release, he or she will immediately notify the on-site emergency coordinator.

On-site Emergency Coordinator will obtain information pertaining to the following:

- The material spilled or released.
- Location of the release or spillage of hazardous material.
- An estimate of quantity released and the rate at which it is being released.
- The direction in which the spill, vapor or smoke release is heading.
- Any injuries involved.
- Fire and/or explosion or possibility of these events.
- The area and materials involved and the intensity of the fire or explosion.

This information will help the on-site emergency coordinator to assess the magnitude and potential seriousness of the spill or release.

8.6.2 Procedure for Containing/Collecting Spills

The initial response to any spill or discharge will be to protect human health and safety, and then the environment. Identification, containment, treatment, and disposal assessment will be the secondary response.

If for some reason a chemical spill is not contained within a dike or sump area, an area of isolation will be established around the spill. The size of the area will generally depend on the size of the spill and the materials involved. If the spill is large (greater than 55 gallons) and involves a tank or a pipeline rupture, an initial isolation of at least 100 ft. in all directions will be used. Small spills (less than or equal to 55 gallons) or leaks from a tank or pipe will require evacuation of at least 50 ft. in all directions to allow cleanup and repair and to prevent exposure. When any spill occurs, only those persons involved in overseeing or performing emergency operations will be allowed within the designated hazard area. If possible the area will be roped or otherwise blocked off.

If the spill results in the formation of a toxic vapor cloud (by reaction with surrounding materials or by outbreak of fire) and its release (due to high vapor pressures under ambient conditions), further evacuation will be enforced. In general an area at least 500 feet wide and 1,000 feet long will be evacuated downwind if volatile materials are spilled. (Consult the DOT Emergency Response Guide for isolation distances for listed hazardous materials.)

If an incident may threaten the health or safety of the surrounding community, the public will be informed and possibly evacuated from the area. The on-site emergency coordinator will inform the proper agencies in the event this is necessary. (Refer to Table 8-1)

As called for in regulations developed under the Comprehensive Environmental Response Compensation Liability Act of 1980 (Superfund), Osage's practice is to report a spill of a pound or more of any hazardous material for which a reportable quantity has not been established and which is listed under the Solid Waste Disposal Act, Clean Air Act, Clean Water Act, or TSCA. Osage also follows the same practice for any substances not listed in the Acts noted above but which can be classified as a hazardous waste under RCRA.

Cleanup personnel will take the following measures:

- Make sure all unnecessary persons are removed from the hazard area.
- Put on protective clothing and equipment.
- If a flammable material is involved, remove all ignition sources, and use spark and explosion proof equipment for recovery of material.
- Remove all surrounding materials that could be especially reactive with materials in the waste. Determine the major components in the waste at the time of the spill.
- If wastes reach a storm sewer, try to dam the outfall by using sand, earth, sandbags, etc. If this is done, pump this material out into a temporary holding tank or drums as soon as possible.
- Place all small quantities of recovered liquid wastes (55 gallons or less) and contaminated soil into drums for incineration or removal to an approved disposal site.
- Spray the spill area with foam, if available, if volatile emissions may occur.
- Apply appropriate spill control media (e.g. clay, sand, lime, etc.) to absorb discharged liquids.
- For large spills, establish diking around leading edge of spill using booms, sand, clay or other appropriate material. If possible, use diaphragm pump to transfer discharged liquid to drums or holding tank.

8.6.3 Emergency Response Equipment

The following equipment will be staged in the support zone and throughout the site, as needed, to provide for safety and first aid during emergency responses. (Emergency eyewash equipment meets ANSI Standard;

- ABC type fire extinguisher
- First aid kit, industrial size
- Eyewash/safety shower

8.6.4 Emergency Spill Response Cleanup Materials and Equipment

A sufficient supply of appropriate emergency response cleanup and personal protective equipment will be inventoried and inspected, visually, on a weekly basis.

The materials listed below may be kept on site for spill control, depending on the types of hazardous materials present on site. The majority of this material will be located in the support zone, in a supply trailer or storage area. Small amounts will be placed on pallets and located in the active work areas.

- Appropriate solvents, e.g., CITRIKLEEN, for decontamination of structures or equipment.
- Sand or clay to solidify/absorb liquid spills.

The following equipment will be made available for spill cleanup:

- Plastic shovels for recovering corrosive and flammable materials.
- Sausage shaped absorbent booms for diking liquid spills, drains, or sewers.
- Sorbent sheets (diapers) for absorbing liquid spills.
- Overpack drums for containerizing leaking drums.
- 55-gallon open top drums for containerization of waste materials.

***NOTE:** All contaminated soils, absorbent materials, solvents and other materials resulting from the cleanup of spilled or discharged substances shall be properly stored, labeled, and disposed of off-site.

8.7 EMERGENCY CONTINGENCY PLAN

This section details the contingency measures Osage will take to prepare for and respond to fires, explosions, spills and releases of hazardous materials, hazardous weather, and medical emergencies.

8.8 MEDICAL EMERGENCY CONTINGENCY MEASURES

The procedures listed below will be used to respond to medical emergencies. The SSO will contact the local hospital and inform them of the site hazards and potential emergency situations. A minimum of two First Aid/CPR trained personnel will be maintained on site.

8.8.1 Response

The nearest workers will immediately assist a person who shows signs of medical distress or who is involved in an accident. The work crew supervisor will be summoned.

The work crew supervisor will immediately make contact with the on-site emergency coordinator to alert him of a medical emergency situation. The supervisor will advise the following information:

- Location of the victim at the work site
- Nature of the emergency
- Whether the victim is conscious
- Specific conditions contributing to the emergency, if known

The Emergency Coordinator will notify the Site Safety Officer. The following actions will then be taken depending on the severity of the incident:

Life Threatening Incident

If an apparent life threatening condition exists, the crew supervisor will inform the emergency coordinator, and the local Emergency Response Services (EMS) will be immediately called. An on-site person will be appointed who will meet the EMS and have him/her quickly taken to the victim. Any injury within the EZ will be evacuated by Osage personnel to a clean area for treatment by EMS personnel. No one will be able to enter the EZ without showing proof of training, medical surveillance and site orientation.

Non Life Threatening Incident

If it is determined that no threat to life is present, the Site Manager will direct the injured person through decontamination procedures (see below) appropriate to the nature of the illness or accident. Appropriate first aid or medical attention will then be administered.

***NOTE:** The area surrounding an accident site must not be disturbed until the scene has been cleared by the Site Manager.

Any personnel requiring emergency medical attention will be evacuated from exclusion and contamination reduction zones if doing so would not endanger the life of the injured person or otherwise aggravate the injury. Personnel will not enter the area to attempt a rescue if their own lives would be threatened. The decision whether or not to decontaminate a victim prior to evacuation is based on the type and severity of the illness or injury and the nature of the contaminant. For some emergency victims, immediate decontamination may be an essential part of life saving first aid. For others, decontamination may aggravate the injury or delay life saving first aid. Decontamination will be performed if it does not interfere with essential treatment.

If decontamination can be performed, observe the following procedures:

- Wash external clothing and cut it away.
- If decontamination cannot be performed, observe the following procedures.
- Wrap the victim in blankets or plastic to reduce contamination of other personnel.
- Alert emergency and off-site medical personnel to potential contamination; instruct them about specific decontamination procedures.
- Send site personnel familiar with the incident and chemical safety information, e.g. MSDS, with the affected person.

All injuries, no matter how small, will be reported to the SS and SSO. An accident/injury/illness report will be completely and properly filled out and submitted to the Health and Safety Manager, in accordance with Osage's reporting procedures.

A list of emergency telephone numbers is given in Table 8-1.

8.8.2 Notification

The following personnel/agencies will be notified in the event of a medical emergency:

- Local Fire Department or EMS
- On-site Emergency Coordinator
- Workers in the affected areas

8.9 FIRE CONTINGENCY MEASURES

Osage personnel and subcontractors are not trained professional firefighters. Therefore, if there is any doubt that a fire can be quickly contained and extinguished, personnel will notify the emergency coordinator by radio and vacate the structure or area. The emergency

coordinator will immediately notify the local Fire Department.

The following procedures will be used to prevent the possibility of fires and resulting injuries:

- Sources of ignition will be kept away from where flammable materials are handled or stored.
- “No smoking” signs will be conspicuously posted in areas where flammable materials are present.
- Fire extinguishers will be placed in all areas where a fire hazard may exist.
- Before workers begin operations in an area, the foreman will give instruction on egress procedures and assembly points. Egress routes will be posted in work areas and exit points clearly marked.

8.9.1 Response

The following procedures will be used in the event of a fire:

- Anyone who sees a fire will notify his or her supervisor who will then contact the Emergency Coordinator.
- When the emergency is recognized, workers will disconnect electrical equipment in use (if possible) and proceed to the nearest fire exit.
- Work crews will be comprised of pairs of workers (buddy system) who join each other immediately and remain together throughout the emergency. Workers will assemble at a predetermined rally point for a head count.
- When a worker has extinguished a small fire, the emergency coordinator will be notified.

8.10 HAZARDOUS WEATHER CONTINGENCY MEASURES

Operations will not be started or continued when the following hazardous weather conditions are present:

- Lightning
- Heavy Rains
- High Winds

8.10.1 Response

- Excavation/soil stockpiles will be covered with plastic liner.
- All equipment will be shut down and secured to prevent damage.
- Personnel will be moved to safe refuge, initially crew trailers. The emergency coordinator will determine when it is necessary to evacuate personnel to off-site locations and will coordinate efforts with fire, police and other agencies.

8.10.2 Notification

The emergency coordinator will be responsible for assessing hazardous weather conditions and notifying personnel of specific contingency measures. Notifications will include:

- Osage employees and subcontractors
- Local Emergency Management Agency

8.11 SPILL/RELEASE CONTINGENCY MEASURES

In the event of release or spill of a hazardous material the following measures will be taken:

8.11.1 Response

Any person observing a spill or release will act to remove and/or protect injured/contaminated persons from any life threatening situation. First aid and/or decontamination procedures will be implemented as appropriate.

First aid will be administered to injured/contaminated personnel. Unsuspecting persons/vehicles will be warned of the hazard. All personnel will act to prevent any unsuspecting persons from coming in contact with spilled materials by alerting other nearby persons. Attempt to stop the spill at the source, if possible. Without taking unnecessary risks, personnel will attempt to stop the spill at the source. This may involve activities such as uprighting a drum, closing a valve or temporarily sealing a hole with a plug.

The emergency coordinator will be notified of the spill/release, including information on material spilled, quantity, personnel injuries and immediate life threatening hazards. Air monitoring will be implemented by the emergency coordinator and SSO to determine the potential impact on the surrounding community. Notification procedures will be followed to inform on-site personnel and off-site agencies. The emergency coordinator will make a rapid assessment of the spill/release and direct confinement, containment and control measures. Depending upon the nature of the spill, measures may include:

- Construction of a temporary containment berm utilizing on-site clay absorbent earth
- Digging a sump, installing a polyethylene liner and
- Diverting the spill material into the sump placing drums under the leak to collect the spilling material before it flows over the ground
- Transferring the material from its original container to another container

Emergency response personnel will cleanup all spills following the spill cleanup plan developed by the emergency coordinator. Supplies necessary to cleanup a spill will be immediately available on-site. Such items may include, but are not limited to:

- Shovel, rake
- Absorbent material
- Polyethylene liner
- Personal safety equipment
- Steel drums

- Pumps and miscellaneous hand tools

The major supply of material and equipment will be located in the Support Zone. Smaller supplies will be kept at active work locations. If necessary, soil, water or air samples may be taken and analyzed to demonstrate the effectiveness of the spill cleanup effort. The emergency coordinator will determine the cause of the spill and determine remedial steps to ensure that recurrence is prevented.

9.0 TRAINING REQUIREMENTS

As a requirement for work at this site, in any hazardous waste work area, all field personnel will be required to take a 40-hour training class. This training must cover the requirements in 29 CFR 1910.120 and 29 CFR 1926.65: personal protective equipment, toxicological effects of various chemicals, hazard communication, blood borne pathogens, handling of unknown tanks and drums, confined space entry procedures, electrical safety, etc. In addition, all personnel must receive annual 8-hour refresher training.

All personnel entering the exclusion zone will be trained in the provisions of this site safety plan and be required to sign the Site Safety Plan Acknowledgment in Appendix A.

Outlines of the orientation for Osage / subcontract personnel and visitors are presented below:

OSAGE/SUBCONTRACTORS	VISITOR ORIENTATION
<ul style="list-style-type: none"> • HASP sign off • Sign in/out procedures • Site background • Chain of command • Rules and regulations • Hours of work • Absences • Equipment • Emergency Information • Emergency signal • Gathering point • Responsibilities/roles • Emergency phone numbers • Work Zones • COCs and MSDSs (Hazard Communication Program) • Forms, site specific • Incident Reporting 	<ul style="list-style-type: none"> • Sign in/out procedures • Review of Site map • Work Zones in progress • Hazard Communication • Emergency plan/signals • Training/medical requirements • Zones/areas open to visitors

10.0 MEDICAL SURVEILLANCE PROGRAM

All Osage personnel participate in a medical and health monitoring program. This program is initiated when the employee starts work with a complete physical and medical history and is continued on a regular basis. A listing of Osage's worker medical profile is shown below. This program was developed in conjunction with a consultant toxicologist and Osage's occupational health physician. Other medical consultants are retained when additional expertise is required.

The medical surveillance program meets the requirements of the OSHA Standard 29 CFR 1910.120/1926.65(f).

No specific tests are expected for this project.

The following information is provided in the event that medical attention is necessary.

The Osage Medical Director is:

Michael Diane McCullough
Phone: (757) 440-0400

Address:

2618 Colley Ave
Norfolk, VA 23517-1132

The Osage Medical Director and the HSM will be immediately notified of any suspected exposures to hazardous materials/wastes.



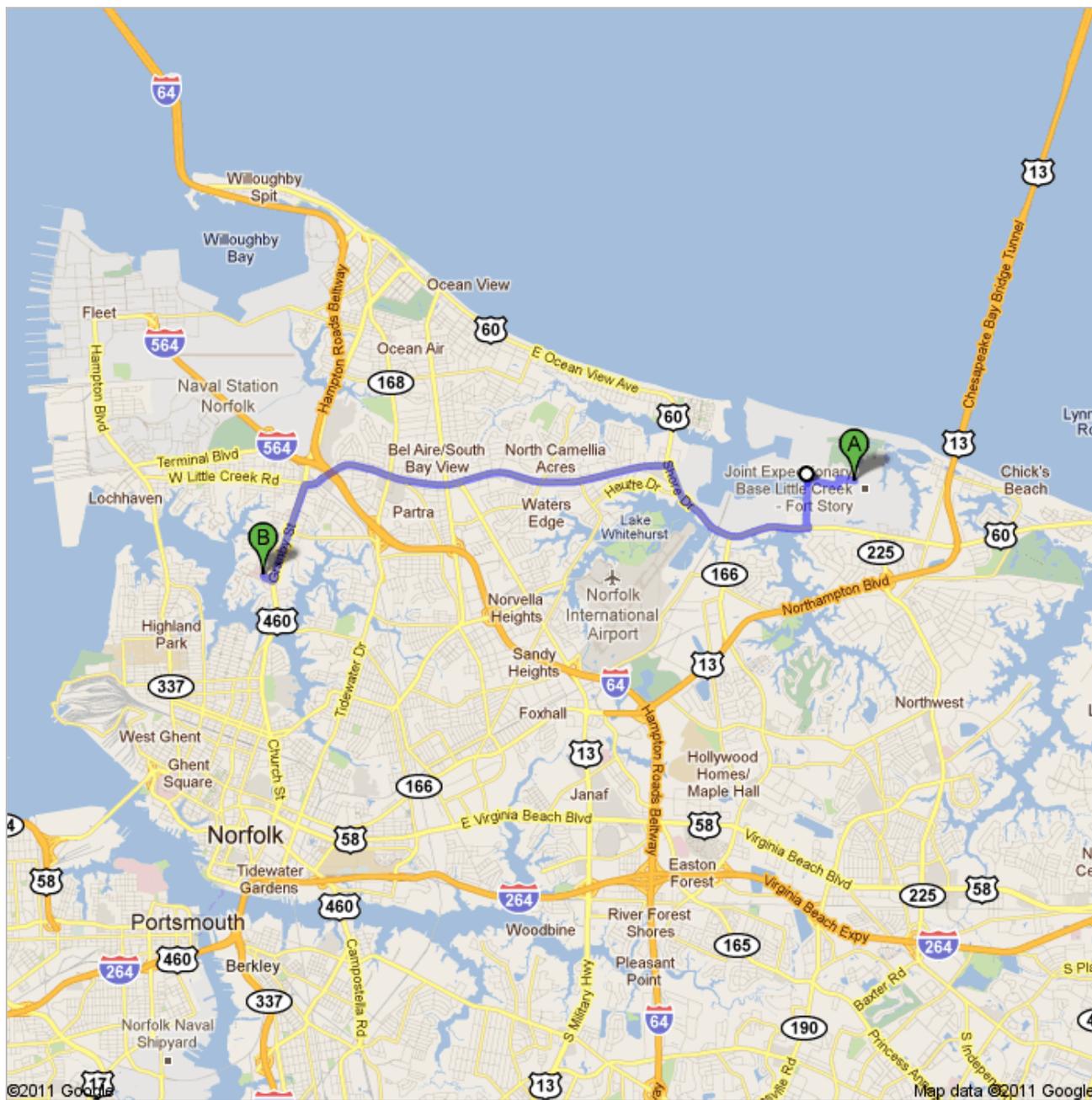
Directions to Bon Secours DePaul Medical Center

Norfolk, Virginia - (757) 889-5264

9.5 mi – about 22 mins

Hospital Route Map

Little Creek Site 11A to Bon Secours De Paul



**7th St & Grasp St, Virginia Beach, VA 23455**

- | | | |
|----|---|---------------------------|
| 1. | Head west on 7th St toward F St
Restricted usage road | go 0.2 mi
total 0.2 mi |
| | 2. Turn left onto G St
Restricted usage road | go 459 ft
total 0.3 mi |
| | 3. Take the 1st right onto Gator Blvd
Restricted usage road
About 1 min | go 0.4 mi
total 0.7 mi |
| | 4. Turn left onto Helicopter Rd
Restricted usage road
About 2 mins | go 0.6 mi
total 1.3 mi |
| | 5. Take the 2nd right onto Shore Dr
About 4 mins | go 2.2 mi
total 3.5 mi |
| | 6. Turn left onto E Little Creek Rd
About 10 mins | go 4.6 mi
total 8.1 mi |
| | 7. Turn left onto Granby St
About 3 mins | go 1.2 mi
total 9.3 mi |
| | 8. Turn right onto Kingsley Ln | go 0.1 mi
total 9.4 mi |
| | 9. Take the 1st right
Destination will be on the right | go 177 ft
total 9.5 mi |

**Bon Secours DePaul Medical Center**
Norfolk, Virginia - (757) 889-5264

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Map data ©2011 Google

Directions weren't right? Please find your route on www.google.com and click "Report a problem" at the bottom left.

 7th St & Grasp St, Virginia Beach, VA 23455

- | | | |
|--|--|----------------------------|
| | 1. Head west on 7th St toward F St
Restricted usage road | go 0.2 mi
total 0.2 mi |
|  | 2. Turn left onto G St
Restricted usage road | go 459 ft
total 0.3 mi |
|  | 3. Take the 1st right onto Gator Blvd
Restricted usage road
About 1 min | go 0.4 mi
total 0.7 mi |
|  | 4. Turn left onto Helicopter Rd
Restricted usage road
About 2 mins | go 0.6 mi
total 1.3 mi |
|  | 5. Take the 2nd right onto Shore Dr
About 2 mins | go 1.0 mi
total 2.3 mi |
|  | 6. Turn left onto Diamond Springs Rd
About 3 mins | go 1.1 mi
total 3.4 mi |
|  | 7. Take the ramp to I-64 | go 0.3 mi
total 3.7 mi |
|  | 8. Merge onto US-13 S
About 1 min | go 1.0 mi
total 4.7 mi |
|  | 9. Take the exit onto I-64 E toward Chesapeake/Suffolk
About 3 mins | go 2.1 mi
total 6.8 mi |
|  | 10. Take exit 284A to merge onto I-264 W toward Norfolk
About 6 mins | go 4.8 mi
total 11.7 mi |
|  | 11. Take exit 10 to merge onto E City Hall Ave | go 0.4 mi
total 12.0 mi |
|  | 12. Turn right onto St Pauls Blvd
About 2 mins | go 0.5 mi
total 12.5 mi |
|  | 13. Turn left onto W Brambleton Ave
About 1 min | go 0.4 mi
total 12.9 mi |
|  | 14. Turn right onto Duke St | go 0.2 mi
total 13.1 mi |
|  | 15. Turn left onto W Olney Rd
Destination will be on the right
About 3 mins | go 0.7 mi
total 13.8 mi |

 **Sentara Norfolk General Hospital**
600 Gresham Drive, Norfolk, VA 23510 - (757) 388-3000

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Map data ©2011 Google

Directions weren't right? Please find your route on www.google.com and click "Report a problem" at the bottom left.

Appendix B
Material Safety Data Sheets (MSDS)

MSDS Number: A2052 * * * * * Effective Date: 08/03/07 * * * * * Supercedes: 02/16/06



From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. And Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

ALCONOX®

1. Product Identification

Synonyms: Proprietary blend of sodium linear alkylaryl sulfonate, alcohol sulfate, phosphates, and carbonates.

CAS No.: Not applicable.

Molecular Weight: Not applicable to mixtures.

Chemical Formula: Not applicable to mixtures.

Product Codes: A461

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Alconox® proprietary detergent mixture	N/A	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

CAUTION! MAY BE HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT.

SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 1 - Slight

Flammability Rating: 0 - None

Reactivity Rating: 0 - None

Contact Rating: 2 - Moderate

Lab Protective Equip: GOGGLES; LAB COAT; PROPER GLOVES

Storage Color Code: Green (General Storage)

Potential Health Effects

Inhalation:

May cause irritation to the respiratory tract. Symptoms may include coughing and shortness of breath.

Ingestion:

May cause irritation to the gastrointestinal tract. Symptoms may include nausea, vomiting and diarrhea.

Skin Contact:

No adverse effects expected.

Eye Contact:

May cause irritation, redness and pain.

Chronic Exposure:

No information found.

Aggravation of Pre-existing Conditions:

No information found.

4. First Aid Measures

Inhalation:

Remove to fresh air. Get medical attention for any breathing difficulty.

Ingestion:

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention.

Skin Contact:

Wash exposed area with soap and water. Get medical advice if irritation develops.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Not expected to be a fire hazard.

Explosion:

No information found.

Fire Extinguishing Media:

Dry chemical, foam, water or carbon dioxide.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust. When mixed with water, material foams profusely. Small amounts of residue may be flushed to sewer with plenty of water.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Moisture may cause material to cake. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

None established.

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures as low as possible. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

For conditions of use where exposure to dust or mist is apparent and engineering controls are not feasible, a particulate respirator (NIOSH type N95 or better filters) may be worn. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-face positive-pressure, air-supplied respirator. **WARNING:** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear protective gloves and clean body-covering clothing.

Eye Protection:

Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

White powder interspersed with cream colored flakes.

Odor:

No information found.

Solubility:

Moderate (1-10%)

Specific Gravity:

No information found.

pH:

No information found.

% Volatiles by volume @ 21C (70F):

0

Boiling Point:

No information found.

Melting Point:

No information found.

Vapor Density (Air=1):

No information found.

Vapor Pressure (mm Hg):

No information found.

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

Carbon dioxide and carbon monoxide may form when heated to decomposition.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

No information found.

Conditions to Avoid:

No information found.

11. Toxicological Information

No LD50/LC50 information found relating to normal routes of occupational exposure.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Alconox® proprietary detergent mixture	No	No	None

12. Ecological Information

Environmental Fate:

This product is biodegradable.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----				
Ingredient	TSCA	EC	Japan	Australia
Alconox® proprietary detergent mixture	Yes	No	No	No

-----\Chemical Inventory Status - Part 2\-----				
Ingredient	--Canada--			
	Korea	DSL	NDSL	Phil.

-----\Federal, State & International Regulations - Part 1\-----				
Ingredient	-SARA 302- RQ	TPQ	-SARA 313- List	Chemical Catg.
Alconox® proprietary detergent mixture	No	No	Yes	No
-----\Federal, State & International Regulations - Part 2\-----				
Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)	
Alconox® proprietary detergent mixture	No	No	No	

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: No Fire: No Pressure: No
Reactivity: No (Pure / Solid)

Australian Hazchem Code: None allocated.

Poison Schedule: None allocated.

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **0** Flammability: **0** Reactivity: **0**

Label Hazard Warning:

CAUTION! MAY BE HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT.

Label Precautions:

Avoid contact with eyes.
Keep container closed.
Use with adequate ventilation.
Avoid breathing dust.
Wash thoroughly after handling.

Label First Aid:

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of eye contact, immediately flush eyes with plenty of water for at least 15 minutes. In all cases, get medical attention.

Product Use:

Laboratory Reagent.

Revision Information:

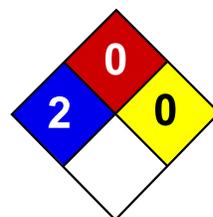
MSDS Section(s) changed since last revision of document include: 3.

Disclaimer:

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Prepared by: Environmental Health & Safety

Phone Number: (314) 654-1600 (U.S.A.)



Health	2
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet Bentonite MSDS

Section 1: Chemical Product and Company Identification

Product Name: Bentonite

Catalog Codes: SLB1441, SLB2935, SLB4435

CAS#: 1302-78-9

RTECS: CT9450000

TSCA: TSCA 8(b) inventory: Bentonite

CI#: Not applicable.

Synonym: Montmorillonite;

Chemical Name: Not available.

Chemical Formula:

(Al,Fe1.67Mg.33)Si10(OH)2Na(+)/Ca(++)/2.33

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Bentonite	1302-78-9	100

Toxicological Data on Ingredients: Bentonite LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of eye contact (irritant), of inhalation. Slightly hazardous in case of skin contact (irritant), of ingestion.

Potential Chronic Health Effects:

Hazardous in case of inhalation. CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to lungs.

Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Do not breathe dust. Avoid contact with eyes. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:

Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 10 from ACGIH (TLV) [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Odorless.

Taste: Not available.

Molecular Weight: Not available.

Color: Beige. (Light.)

pH (1% soln/water): Not available.

Boiling Point: Not available.

Melting Point: Decomposes.

Critical Temperature: Not available.

Specific Gravity: 2.5 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:

Very slightly soluble in cold water, hot water. Insoluble in methanol, diethyl ether, n-octanol, acetone.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Not available.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Eye contact. Inhalation.

Toxicity to Animals:

LD50: Not available. LC50: Not available.

Chronic Effects on Humans: Causes damage to the following organs: lungs.

Other Toxic Effects on Humans:

Hazardous in case of inhalation. Slightly hazardous in case of skin contact (irritant), of ingestion.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations: TSCA 8(b) inventory: Bentonite

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC): R36- Irritating to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

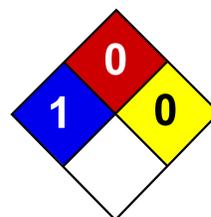
References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:14 PM

Last Updated: 11/01/2010 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.



Health	1
Fire	0
Reactivity	0
Personal Protection	B

Material Safety Data Sheet

Buffer Solution, pH 10.00/BLUE MSDS

Section 1: Chemical Product and Company Identification

Product Name: Buffer Solution, pH 10.00/BLUE

Catalog Codes: SLB4270

CAS#: Mixture.

RTECS: Not applicable.

TSCA: TSCA 8(b) inventory: Alphazurine A; Sodium borate; Sodium hydroxide; Water

CI#: Not applicable.

Synonym:

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Alphazurine A	3486-30-4	0.00002
Sodium borate	1303-96-4	0.476
Sodium hydroxide	1310-73-2	0.0732
Water	7732-18-5	99.5

Toxicological Data on Ingredients: Sodium borate: ORAL (LD50): Acute: 2660 mg/kg [Rat.].

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (corrosive, irritant), of eye contact (irritant), of ingestion.

Potential Chronic Health Effects:

Non-corrosive for skin. Non-irritant for skin. Non-sensitizer for skin. Non-permeator by skin. Non-irritating to the eyes. Non-hazardous in case of ingestion. Non-hazardous in case of inhalation. CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:

Absorb with an inert material and put the spilled material in an appropriate waste disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep container dry. Do not breathe gas/fumes/ vapor/spray. Avoid contact with skin. Never add water to this product. Wear suitable protective clothing. If you feel unwell, seek medical attention and show the label when possible.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Personal Protection: Safety glasses. Lab coat. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

Sodium borate TWA: 0.31 TWA: 5 from ACGIH (TLV) [United States] [1995] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Not available.

Molecular Weight: Not applicable.

Color: Clear Blue.

pH (1% soln/water): Neutral.

Boiling Point: The lowest known value is 100°C (212°F) (Water).

Melting Point: Not available.

Critical Temperature: Not available.

Specific Gravity: The only known value is 1 (Water = 1) (Water).

Vapor Pressure: The highest known value is 2.3 kPa (@ 20°C) (Water).

Vapor Density: The highest known value is 0.62 (Air = 1) (Water).

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Is not dispersed in cold water, hot water.

Solubility: Insoluble in cold water, hot water, methanol.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity:

Slightly corrosive in presence of aluminum, of zinc. Non-corrosive in presence of glass, of steel, of copper, of stainless steel(304), of stainless steel(316).

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Not available.

Section 11: Toxicological Information

Routes of Entry: Not available.

Toxicity to Animals:

LD50: Not available. LC50: Not available.

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Ingestion of 5-10 grams has produced severe vomiting, diarrhea, shock and death. (Sodium borate)

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: Not available.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:

Pennsylvania RTK: Sodium borate; Sodium hydroxide Massachusetts RTK: Sodium borate; Sodium hydroxide TSCA 8(b) inventory: Alphazurine A; Sodium borate; Sodium hydroxide; Water

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): Not controlled under WHMIS (Canada).

DSCL (EEC):

This product is not classified according to the EU regulations.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 0

Reactivity: 0

Personal Protection: b

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Not applicable. Safety glasses.

Section 16: Other Information

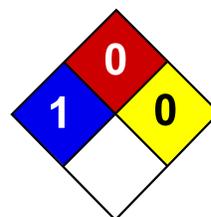
References: Not available.

Other Special Considerations: Not available.

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Health	1
Fire	0
Reactivity	0
Personal Protection	B

Material Safety Data Sheet

Buffer Solution, pH 4.0/RED MSDS

Section 1: Chemical Product and Company Identification

Product Name: Buffer Solution, pH 4.0/RED

Catalog Codes: SLB1987

CAS#: Mixture.

RTECS: Not applicable.

TSCA: TSCA 8(b) inventory: Potassium biphthalate; Amaranth; Hydrochloric acid; Methyl paraben; Propyl paraben; Water

CI#: Not applicable.

Synonym:

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Potassium biphthalate	877-24-7	1.02
Amaranth	915-67-3	0.0004
Hydrogen chloride	7647-01-0	0-0.37
Water	7732-18-5	97-100
Methyl paraben	99-76-3	0.1
Propyl paraben	94-13-3	0.025

Toxicological Data on Ingredients: Potassium biphthalate LD50: Not available. LC50: Not available. Hydrogen chloride LD50: Not available. LC50: Not available. Methyl paraben: ORAL (LD50): Acute: 501 mg/kg [Rat]. 8001 mg/kg [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:

Slightly hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:

Non-corrosive for skin. Non-sensitizer for skin. Non-permeator by skin. Non-hazardous in case of inhalation. CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to lungs, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention if irritation occurs.

Skin Contact:

Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops. Cold water may be used.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Absorb with an inert material and put the spilled material in an appropriate waste disposal. Neutralize the residue with a dilute solution of sodium carbonate. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage**Precautions:**

Keep container dry. Do not breathe gas/fumes/ vapor/spray. Avoid contact with skin. Never add water to this product. Wear suitable protective clothing. If you feel unwell, seek medical attention and show the label when possible.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection**Engineering Controls:**

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Personal Protection: Safety glasses. Lab coat. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

Hydrogen chloride TWA: 5 CEIL: 5 from OSHA (PEL) [United States] TWA: 7.5 CEIL: 7 from OSHA (PEL) [United States]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Not available.

Molecular Weight: Not applicable.

Color: Clear Red.

pH (1% soln/water): Acidic.

Boiling Point: The lowest known value is 100°C (212°F) (Water).

Melting Point: Not available.

Critical Temperature: Not available.

Specific Gravity: Weighted average: 1 (Water = 1)

Vapor Pressure: The highest known value is 2.3 kPa (@ 20°C) (Water).

Vapor Density: The highest known value is 0.62 (Air = 1) (Water).

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether, acetone.

Solubility:

Easily soluble in cold water, methanol. Soluble in hot water, diethyl ether, acetone.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Slightly reactive to reactive with metals, alkalis.

Corrosivity:

Slightly corrosive in presence of steel, of aluminum, of copper. Non-corrosive in presence of glass, of stainless steel(304), of stainless steel(316).

Special Remarks on Reactivity: Reacts violently with water especially when water is added to the product. (Hydrogen chloride)

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Not available.

Toxicity to Animals:

LD50: Not available. LC50: Not available.

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:

Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract. (Hydrogen chloride)

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation:

Decomposes and burns to form smoke, carbon monoxide and carbon dioxide. Fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard. (Methyl paraben)

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:

Pennsylvania RTK: Hydrochloric acid Massachusetts RTK: Hydrochloric acid TSCA 8(b) inventory: Potassium biphthalate; Amaranth; Hydrochloric acid; Methyl paraben; Propyl paraben; Water SARA 302/304/311/312 extremely hazardous substances: Hydrochloric acid SARA 313 toxic chemical notification and release reporting: Hydrochloric acid 0.5% CERCLA: Hazardous substances.: Hydrochloric acid;

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

This product is not classified according to the EU regulations.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 0

Reactivity: 0

Personal Protection: b

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.

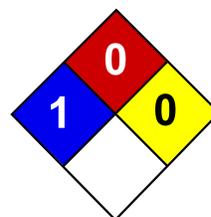
Other Special Considerations: Not available.

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Health	1
Fire	0
Reactivity	0
Personal Protection	A

Material Safety Data Sheet

Buffer Solution, pH 7.0, Phosphate MSDS

Section 1: Chemical Product and Company Identification

Product Name: Buffer Solution, pH 7.0, Phosphate

Catalog Codes: SLB3358

CAS#: Mixture.

RTECS: Not applicable.

TSCA: TSCA 8(b) inventory: Water; Potassium phosphate monobasic; Sodium phosphate, dibasic

CI#: Not available.

Synonym: Phosphate Buffer, pH 7.0

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Water	7732-18-5	94
Potassium phosphate monobasic	7778-77-0	2.54
Sodium phosphate, dibasic	7558-79-4	3.41

Toxicological Data on Ingredients:

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion. Non-corrosive for skin. Non-corrosive to the eyes. Non-corrosive for lungs.

Potential Chronic Health Effects: CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops. Cold water may be used.

Serious Skin Contact: Not available.

Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion: If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances: Non-explosive in presence of open flames and sparks, of shocks.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of acetic acid. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill: Poisonous liquid. Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of acetic acid. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions: Keep locked up.. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. If ingested, seek medical advice immediately and show the container or the label.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area. Do not store above 25°C (77°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls: Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Personal Protection: Safety glasses. Lab coat.

Personal Protection in Case of a Large Spill: Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Not available.

Molecular Weight: Not applicable.

Color: Clear Colorless.

pH (1% soln/water): Basic.

Boiling Point: The lowest known value is 100°C (212°F) (Water).

Melting Point: Not available.

Critical Temperature: Not available.

Specific Gravity: Weighted average: 1.02 (Water = 1)

Vapor Pressure: The highest known value is 2.3 kPa (@ 20°C) (Water).

Vapor Density: The highest known value is 0.62 (Air = 1) (Water).

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: The product is much more soluble in water.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility: Easily soluble in cold water, hot water. Insoluble in methanol, n-octanol.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Slightly reactive to reactive with acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Hygroscopic; keep container tightly closed. Incompatible with magnesium, alkaloids, antipyrine, chloral hydrate, lead acetate, pyrogallol, resorcinol, strong mineral acids, strong organic acids. (Sodium phosphate, dibasic)

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact.

Toxicity to Animals: Acute oral toxicity (LD50): 17000 mg/kg [Rat]. (Sodium phosphate, dibasic). Acute dermal toxicity (LD50): >4650 mg/kg [Rabbit]. (Potassium phosphate monobasic).

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Lowest Published Lethal Dose: LD₅₀ [Rat] - Route: Oral; Dose: 4640 mg/kg (Potassium phosphate monobasic)

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Acute Potential Health Effects: Skin: Causes mild skin irritation. Eyes: Causes mild eye irritation. Ingestion: May cause irritation of the digestive tract. Expected to be a low ingestion hazard for usual industrial handling. Inhalation: May cause respiratory tract and mucous membrane irritation. Low hazard for usual industrial handling. Chronic Potential Health Effects: No information available. (Sodium phosphate, dibasic) Acute Potential Health Effects: Skin: May cause skin irritation. Risk of skin absorption is slight. Eyes: Dust may cause eye irritation. Inhalation: Inhalation may cause respiratory tract irritation, coughing and choking. Ingestion: Ingestion of large amounts may cause nausea, vomiting, abdominal discomfort (cramps), diarrhea. Also, symptoms of potassium poisoning may occur, which may include slow heartbeat, peripheral vascular collapse with fall in blood pressure, cardiac arrhythmias, heart block, accelerated breathing, and muscle weakness, heaviness of the legs, flaccid paralysis, cold skin, gray pallor, . May affect behavior (listlessness, mental confusion), . Chronic Potential Health Effects: Dermatitis may develop from repeated or prolonged skin contact. (Potassium Phosphate, Monobasic)

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation: Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal: Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations: New York release reporting list: Sodium phosphate, dibasic Pennsylvania RTK: Sodium phosphate, dibasic Massachusetts RTK: Sodium phosphate, dibasic New Jersey: Sodium phosphate, dibasic TSCA 8(b) inventory: Water; Potassium phosphate monobasic; Sodium phosphate, dibasic

Other Regulations: Not available. or of its ingredients

Other Classifications:

WHMIS (Canada): Not controlled under WHMIS (Canada).

DSCL (EEC): R25- Toxic if swallowed. S1/2- Keep locked up and out of the reach of children. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 0

Reactivity: 0

Personal Protection: a

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment: Not applicable. Lab coat. Not applicable. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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Material Safety Data Sheet



Nonflammable Gas Mixture: 1,1 Dichlorethane / Cis-1,2-Dichloroethylene / Nitrogen / Trans-1,2-Dichloroethylene

Section 1. Chemical product and company identification

Product Name : Nonflammable Gas Mixture: 1,1 Dichlorethane / Cis-1,2-Dichloroethylene / Nitrogen / Trans-1,2-Dichloroethylene

Supplier : AIRGAS INC., on behalf of its subsidiaries
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

Product use : Synthetic/Analytical chemistry.

MSDS# : 006533

Date of Preparation/Revision : 11/2/2006.

In case of emergency : 1-866-734-3438

Section 2. Hazards identification

Physical state : Gas.

Emergency overview : Warning!
CONTENTS UNDER PRESSURE.
CONTAINS MATERIAL WHICH CAUSES DAMAGE TO THE FOLLOWING ORGANS:
KIDNEYS, LUNGS, LIVER, RESPIRATORY TRACT, SKIN, CENTRAL NERVOUS SYSTEM, EYE, LENS OR CORNEA.
MAY BE HARMFUL IF SWALLOWED.
Do not ingest. Do not puncture or incinerate container. Wash thoroughly after handling.
Contact with rapidly expanding gases can cause frostbite.

Routes of entry : Inhalation

Potential acute health effects

Eyes : Irritating to eyes.

Skin : Irritating to skin.

Inhalation : Acts as a simple asphyxiant.

Ingestion : Ingestion is not a normal route of exposure for gases

Potential chronic health effects : **CARCINOGENIC EFFECTS** Classified A4 (Not classifiable for human or animal.) by ACGIH [1,1-dichloroethane].
MUTAGENIC EFFECTS Not available.
TERATOGENIC EFFECTS: Not available.

Medical conditions aggravated by overexposure : Acute or chronic respiratory conditions may be aggravated by overexposure to this gas.

See toxicological information (section 11)

Section 3. Composition, Information on Ingredients

<u>Name</u>	<u>CAS number</u>	<u>% Volume</u>	<u>Exposure limits</u>
Nitrogen	7727-37-9	94 - 99	ACGIH TLV (United States, 1/2005). TWA: 793 mg/m ³ 8 hour(s). Form: All forms TWA: 200 ppm 8 hour(s). Form: All forms
1,2-Trans Dichloroethylene	156-60-5	0.02 - 2	
1,2-Cis Dichloroethylene	156-59-2	0.02 - 2	ACGIH TLV (United States, 1/2005). TWA: 793 mg/m ³ 8 hour(s). Form: All forms TWA: 200 ppm 8 hour(s). Form: All forms
1,1-Dichloroethane	75-34-3	0.01 - 2	ACGIH TLV (United States, 1/2005). Notes: 1996 Adoption Refers to Appendix A -- Carcinogens. TWA: 405 mg/m ³ 8 hour(s). Form: All forms TWA: 100 ppm 8 hour(s). Form: All forms

Nonflammable Gas Mixture: 1,1 Dichlorethane / Cis-1,2-Dichloroethylene / Nitrogen / Trans-1,2-Dichloroethylene

TWA: 100 ppm 8 hour(s). Form: All forms
NIOSH REL (United States, 12/2001). Notes:
See Appendix C (Chloroethanes)
TWA: 400 mg/m³ 10 hour(s). Form: All forms
TWA: 100 ppm 10 hour(s). Form: All forms
OSHA PEL (United States, 8/1997).
TWA: 400 mg/m³ 8 hour(s). Form: All forms
TWA: 100 ppm 8 hour(s). Form: All forms

Section 4. First aid measures

No action shall be taken involving any personal risk or without suitable training. If fumes are still suspected to be present, the rescuer should wear an appropriate mask or a self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

- Eye contact** : In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.
- Skin contact** : In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.
- Frostbite** : Try to warm up the frozen tissues and seek medical attention.
- Inhalation** : If inhaled, remove to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Get medical attention.
- Ingestion** : Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.

Section 5. Fire fighting measures

- Flammability of the product** : Non-flammable.
- Products of combustion** : These products are carbon oxides (CO, CO₂), nitrogen oxides (NO, NO₂...), halogenated compounds, hydrogen chloride.
- Fire fighting media and instructions** : Use an extinguishing agent suitable for surrounding fires.

If involved in fire, shut off flow immediately if it can be done without risk. Apply water from a safe distance to cool container and protect surrounding area.
No specific hazard.
- Special protective equipment for fire-fighters** : Fire fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full facepiece operated in positive pressure mode.

Section 6. Accidental release measures

- Personal precautions** : Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (Section 8). Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.
- Environmental precautions** : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 7. Handling and storage

- Handling** : Do not ingest. Do not puncture or incinerate container. Wash thoroughly after handling. High pressure gas. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.
- Storage** : Keep container tightly closed. Keep container in a cool, well-ventilated area. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure Controls, Personal Protection

Engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits.

Personal protection

Eyes : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.

Skin : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

The applicable standards are (US) 29 CFR 1910.134 and (Canada) Z94.4-93

Hands : Chemical-resistant, impervious gloves or gauntlets complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Personal protection in case of a large spill : A self-contained breathing apparatus should be used to avoid inhalation of the product.

Consult local authorities for acceptable exposure limits.

Section 9. Physical and chemical properties

Molecular weight : Not applicable.

Molecular formula : Not applicable.

Boiling/condensation point : Not available.

Melting/freezing point : -209.99°C (-346°F) based on data for: Nitrogen.

Critical temperature : The lowest known value is -146.9°C (-232.4°F) (Nitrogen).

Vapor density : The highest known value is 0.967 (Air = 1) (Nitrogen).

Specific Volume (ft³/lb) : Not applicable.

Gas Density (lb/ft³) : Weighted average: 0.07

Section 10. Stability and reactivity

Stability and reactivity : The product is stable.

Incompatibility with various substances : Slightly reactive to reactive with moisture.

Hazardous decomposition products : These products are halogenated compounds, hydrogen chloride.

Section 11. Toxicological information

<u>Ingredient name</u>	<u>Test</u>	<u>Result</u>	<u>Route</u>	<u>Species</u>
1,2-Trans Dichloroethylene	LD50	1235 mg/kg	Oral	Rat
	LD50	2122 mg/kg	Oral	Mouse
1,1-Dichloroethane	LD50	725 mg/kg	Oral	Rat

Chronic effects on humans : **CARCINOGENIC EFFECTS** Classified A4 (Not classifiable for human or animal.) by ACGIH [1,1-dichloroethane].

Contains material which causes damage to the following organs: kidneys, lungs, liver, upper respiratory tract, skin, central nervous system (CNS), eye, lens or cornea.

Other toxic effects on humans : No specific information is available in our database regarding the other toxic effects of this material for humans.

Specific effects

Carcinogenic effects : No known significant effects or critical hazards.

Nonflammable Gas Mixture: 1,1 Dichlorethane / Cis-1,2-Dichloroethylene / Nitrogen / Trans-1,2-Dichloroethylene**Mutagenic effects** : No known significant effects or critical hazards.**Reproduction toxicity** : No known significant effects or critical hazards.**Section 12. Ecological information****Products of degradation** : These products are carbon oxides (CO, CO₂) and water, nitrogen oxides (NO, NO₂...), halogenated compounds.**Toxicity of the products of biodegradation** : The products of degradation are as toxic as the product itself.**Environmental fate** : Not available.**Environmental hazards** : No known significant effects or critical hazards.**Toxicity to the environment** : Not available.**Section 13. Disposal considerations****Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, local regulation. Return cylinders with residual product to Airgas, Inc. Do not dispose of locally.****Section 14. Transport information**

Regulatory information	UN number	Proper shipping name	Class	Packing group	Label	Additional information
DOT Classification	UN1956	COMPRESSED GAS, N.O.S.	2.2	Not applicable (gas).		-
TDG Classification	UN1956	COMPRESSED GAS, N.O.S.	2.2	Not applicable (gas).		Explosive Limit and Limited Quantity Index 0.125 Passenger Carrying Road or Rail Index 75
Mexico Classification	UN1956	COMPRESSED GAS, N.O.S.	2.2	Not applicable (gas).		-

Section 15. Regulatory information**United States**

U.S. Federal regulations : TSCA 8(a) PAIR: 1,1-dichloroethane
TSCA 8(b) inventory: Nitrogen; trans-dichloroethylene; cis-dichloroethylene; 1,1-dichloroethane
SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: Nitrogen; trans-dichloroethylene; cis-dichloroethylene; 1,1-dichloroethane
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: Nitrogen: Sudden Release of Pressure; trans-dichloroethylene: Fire hazard, reactive, Immediate (Acute) Health Hazard, Delayed (Chronic) Health Hazard; cis-dichloroethylene: Fire hazard, Delayed (Chronic) Health Hazard; 1,1-dichloroethane: Fire hazard, Delayed (Chronic) Health Hazard
Clean Water Act (CWA) 307: trans-dichloroethylene; cis-dichloroethylene; 1,1-dichloroethane

Nonflammable Gas Mixture: 1,1 Dichloroethane / Cis-1,2-Dichloroethylene / Nitrogen / Trans-1,2-Dichloroethylene

Clean Water Act (CWA) 311: No products were found.
 Clean air act (CAA) 112 accidental release prevention: No products were found.
 Clean air act (CAA) 112 regulated flammable substances: No products were found.
 Clean air act (CAA) 112 regulated toxic substances: No products were found.

SARA 313

	<u>Product name</u>	<u>CAS number</u>	<u>Concentration</u>
Form R - Reporting requirements	: 1,1-Dichloroethane	75-34-3	0.01 - 2
Supplier notification	: 1,1-Dichloroethane	75-34-3	0.01 - 2

SARA 313 notifications must not be detached from the MSDS and any copying and redistribution of the MSDS shall include copying and redistribution of the notice attached to copies of the MSDS subsequently redistributed.

State regulations : Pennsylvania RTK: Nitrogen: (generic environmental hazard); trans-dichloroethylene: (environmental hazard, generic environmental hazard); cis-dichloroethylene: (generic environmental hazard); 1,1-dichloroethane: (environmental hazard, generic environmental hazard)
 Massachusetts RTK: Nitrogen; trans-dichloroethylene; cis-dichloroethylene; 1,1-dichloroethane
 New Jersey: Nitrogen; trans-dichloroethylene; 1,1-dichloroethane

California prop. 65 : **WARNING:** This product contains a chemical known to the State of California to cause cancer.

<u>Ingredient name</u>	<u>Cancer</u>	<u>Reproductive</u>	<u>No significant risk level</u>	<u>Maximum acceptable dosage level</u>
1,1-Dichloroethane	Yes.	No.	Yes.	No.

Canada

WHMIS (Canada) : Class A: Compressed gas.
 Class D-2A: Material causing other toxic effects (VERY TOXIC).
 Class D-2B: Material causing other toxic effects (TOXIC).
 CEPA DSL: Nitrogen; trans-dichloroethylene; 1,1-dichloroethane
 CEPA NDSL: cis-dichloroethylene

Section 16. Other information

United States

Label Requirements : CONTENTS UNDER PRESSURE.
 CONTAINS MATERIAL WHICH CAUSES DAMAGE TO THE FOLLOWING ORGANS: KIDNEYS, LUNGS, LIVER, RESPIRATORY TRACT, SKIN, CENTRAL NERVOUS SYSTEM, EYE, LENS OR CORNEA.
 MAY BE HARMFUL IF SWALLOWED.

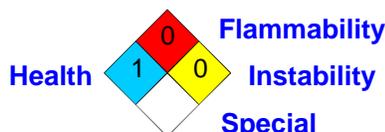
Canada

Label Requirements : Class A: Compressed gas.
 Class D-2A: Material causing other toxic effects (VERY TOXIC).
 Class D-2B: Material causing other toxic effects (TOXIC).

Hazardous Material Information System (U.S.A.)

Health	*	1
Fire hazard		0
Reactivity		0
Personal protection		C

National Fire Protection Association (U.S.A.)



Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above named supplier nor any of its subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

MATERIAL SAFETY DATA SHEET

SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Ready Mix Concrete, Pre-Mixed Concrete, Transit Mixed Concrete. Grout
MSDS covers all Concrete Mix Designs prepared by Inland.

CAS No: N/A

Product Use: Ready Mix Concrete is a structural component used in structural and civil engineering.

MSDS Information: This product is classified as hazardous, according to criteria of WHMIS regulations.

Product Code:

Chemical Family: N/A

Chemical Name And Synonyms: N/A

Formula: This product consists of portland cement, flyash, sand, aggregate, and ad mixtures, individual compositions of constituents will vary within the mix design ranges.

Supplier/Manufacturer: Inland Concrete Limited

Emergency Contact Information: Inland Concrete Limited
Jan Morris (403) 531-3000

SECTION 2 - COMPOSITION/INFORMATION ON INGREDIENTS

Ready Mix Concrete Ingredients & Their Exposure Limits:

Current ACIH TLV for 8 hour Exposure

Chemical Entity/Ingredient	CAS No:	Percentage of Mix	Total Dust (Mass) mg/m ³	Respirable Dust (Mass) mg/m ³
Crushed stone or gravel		0 to 60	10 mg/m ³	5 mg/m ³
Sand		1 to 50	10 mg/m ³	5 mg/m ³
Portland Cement	65997-15-1	1 to 25	10 mg/m ³	5 mg/m ³
Water				
Fly Ash		1 to 25	10 mg/m ³	5 mg/m ³
Crystalline Silica	14808-60-7	0.01 to 5	2 mg/m ³	0.05 mg/m ³

Note:

Cements and sand and gravel may contain 0.1% - 60% crystalline silica (CAS No. 14808-60-7) depending on the proportion and crystalline silica content of the ingredients. All ingredients may contain crystalline silica. Wet stage poses no risk or hazard.

MATERIAL SAFETY DATA SHEET

SECTION 3 – HAZARDS IDENTIFICATION

Emergency Overview:

Concrete is a light gray fluid mixture that poses an immediate hazard to eye tissue. Exposure of sufficient duration to wet concrete can cause serious, potentially irreversible tissue (skin or eye) destruction in the form of chemical (caustic) burns, including third degree burns.

If footwear or clothing becomes saturated with wet concrete, remove immediately and wash area with water and mild soap. Do not allow prolonged contact.

Potential Health Effects:

- **Relevant routes of exposure are:**
- EYE CONTACT and SKIN CONTACT

Effects Resulting From EYE CONTACT:

Exposure to wet concrete may cause immediate or delayed irritation or inflammation. Eye contact by splashes of wet concrete may cause effects ranging from moderate eye irritation to chemical burns and blindness. Such exposures require immediate first aid and medical attention to prevent significant damage to the eye.

Effects Resulting From SKIN CONTACT:

Discomfort or pain cannot be relied upon to alert a person to a hazardous skin exposure. Consequently, the only effective means of avoiding skin injury or illness involves minimizing skin contact, particularly contact with wet concrete. Exposed persons may not feel discomfort until hours after the exposure has ended and significant injury has occurred.

Exposure to moist or wet concrete may cause more severe skin effects including thickening, cracking, fissuring of the skin. Prolonged exposure can cause severe skin damage in the form of (caustic) chemical burns.

Effects Resulting From INHALATION:

Concrete may contain amounts of crystalline silica. Prolonged exposure to respirable free crystalline silica may aggravate other lung conditions. It may also cause delayed lung injury including silicosis, a disabling and potentially fatal lung disease, and/or other diseases. (Also see "Carcinogenic Potential" below.)

Respirable exposure to silica in concrete may occur only if concrete is drilled, cut, ground or polished. Exposure to concrete dust may cause irritation to the moist mucous membranes of the nose, throat, and upper respiratory system. The dust may also leave unpleasant deposits in the nose.

Effects Resulting From INGESTION:

Not Applicable

- **Chronic Effects**

Some individuals may exhibit an allergic response upon exposure to ready-mix concrete. The response may appear in a variety of forms ranging from a mild rash to severe skin ulcers. Persons already sensitized may react to their first contact with the product. Others may first experience this effect after years of contact with ready-mix concrete. Minimizing contact with skin is the basic protection to reduce this exposure.

MATERIAL SAFETY DATA SHEET

- **Carcinogenic Potential**

Ready Mix Concrete is not listed as a carcinogen by NTP, OSHA, or IARC. It may, however, contain trace amounts of substances listed as carcinogens by those organizations.

Crystalline silica, a potential trace level contaminant in portland cement, is found in the aggregate components in varying percentages and is classified by IRAC as a known human carcinogen (Group 1). NTP has characterized respirable silica as "reasonably anticipated to be [a] carcinogen".

- **Medical Conditions That May Be Aggravated By Inhalation or Dermal Exposure:**

- ◇ Pre-existing upper respiratory and lung diseases.
- ◇ Previous exposure to dust from hardened product.
- ◇ Unusual or (hyper) sensitivity to hexavalent chromium (chromium (+6)) salts.

SECTION 4 – FIRST AID MEASURES

- **Eyes**

Immediately flush eyes thoroughly with water. Continue flushing for 15 minutes, including under the lids, for at least 15 minutes. Seek medical attention immediately.

- **Skin**

Wash skin with water and pH neutral soap or mild detergent intended for use on skin.

If clothing or footwear is saturated remove immediately and wash area with water and mild soap. If contact has been severe enough to cause reddening or actual burns to skin, place sterile bandage on area and seek medical attention.

- **Inhalation**

In wet form, concrete cannot be inhaled.

- **Ingestion**

In wet form, concrete is unlikely to be ingested. If concrete enters mouth, wash out with water immediately. Seek medical attention if any burning sensation or actual burns occur.

SECTION 5 – FIRE EXPLOSION DATA / FIRE FIGHTING MEASURES

Flammability:	Not Flammable.	Flash Point:	Not Applicable.
Lower Explosive Limit:	Not Applicable.	Upper Explosive Limit:	Not Applicable.
Auto ignition Temperature:	Not Applicable.	Sensitivity To Static Discharge:	Not Applicable.
Sensitivity To Impact:	Not Applicable.	Extinguishing Media:	Not Applicable.
Special Fire-Fighting Procedures:	None.	Hazardous Combustion Products:	Not Applicable.
Unusual Fire And Explosion Hazards:	Not Applicable.		

MATERIAL SAFETY DATA SHEET

SECTION 6 – STABILITY AND REACTIVITY

Stability:	Stable
Incompatibility:	Portland cement reacts with water to produce a caustic solution, pH 12 to pH 13. Wet concrete is alkaline. As such it is incompatible with acids, ammonium salts, and aluminum metal. Aluminum powder and other alkali and alkaline earth elements will react in wet mortar or concrete, liberating hydrogen gas. Concrete dissolves in hydrofluoric acid producing corrosive silicon tetrafluoride gas. Silicates react with powerful oxidizers such as fluorine, chlorine, trifluorides, and oxygen difluoride.
Hazardous Decomposition:	Will not occur.
Hazardous Polymerization:	Will not occur.

SECTION 7 - HANDLING AND STORAGE

Normal temperatures and pressures do not affect the material.

Promptly remove dusty clothing or clothing which is wet with concrete fluids and launder before reuse. Wash thoroughly after exposure to dust or wet cement mixtures or fluids.

Ready Mix Concrete is premixed at a plant or in a truck mixer drum and delivered to the end user in semi-fluid state ready to be placed to set in final form.

SECTION 8 - EXPOSURE CONTROLS/PERSONAL PROTECTION

Eye Protection:

Safety glasses with side shields, or goggles, should be worn when engaged in activities where cement dust, wet cement, or concrete could contact the eye. In extremely dusty environments and unpredictable environments, wear unvented or indirectly vented goggles to avoid eye irritation or injury. Contact lenses should not be worn when working with ready mix concrete or fresh concrete products.

Skin Protection:

Prevention is essential to avoid potentially severe skin injury. Avoid contact with unhardened (wet) concrete products. If contact occurs, promptly wash affected area with soap and water. Wear impervious clothing and gloves to eliminate skin contact where prolonged exposure to unhardened ready mix concrete products might occur. Wear boots that are impervious to water to eliminate foot and ankle exposure. If standing in wet concrete rubber boots must be worn to prevent injury.

Wet concrete may splash into open boot tops and saturate socks and remain in contact for a lengthy period of time. Prevention is to ensure that boots are fully laced up.

Do not rely on barrier creams; barrier creams should not be used in place of gloves.

Periodically wash areas in contact with dry portland cement, wet cement, or concrete fluids with a pH-neutral soap. Wash again at the end of workday. If irritation occurs, immediately wash the affected area and seek treatment. Clothing saturated with wet concrete should be removed immediately and replaced with clean, dry clothing. Do not allow clothing saturated with wet concrete to remain in contact with skin for any period of time.

MATERIAL SAFETY DATA SHEET

Respiratory Protection:

Avoid actions that cause dust to become airborne. Use local or general ventilation to control exposures to below applicable exposure limits.

Use NIOSH/MSHA-approved (under 30 CFR 11) or NIOSH-approved (under 42 CFR 84 after July 10, 1998) respirators in poorly ventilated areas, if an applicable exposure limit is exceeded, or when dust causes discomfort or irritation.

Ventilation:

Use local exhaust or general dilution ventilation to control exposure within applicable limits.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	gray fluid / hydraulic mixture	Odor:	No distinct odor.
Odor Threshold:	Not applicable.	Physical State:	Solid (powder).
pH (as a solid):	Not applicable.	pH:	12 to 13
Solubility In Water:	Not applicable.	Vapor Pressure:	Not applicable.
Vapor Density:	Not applicable.	Boiling Point:	Not applicable (i.e., >1000°C).
Freezing Point:	Not applicable.	Melting Point:	Not applicable.
Specific Gravity (H₂O = 1.0):	3.15	Evaporation Rate:	Not applicable.
Coeff. Water/Oil Dist.:	Not applicable.		

SECTION 10 - TOXICOLOGICAL INFORMATION

Effects Of Acute Exposure:

Wet concrete mixtures can dry the skin, cause alkali burns, and irritate the eyes and upper respiratory tract. Ingestion can cause irritation of the throat.

Effects Of Chronic Exposure:

Dust from concrete can cause inflammation/irritation of the tissue lining the interior of the nose and the cornea (white) of the eye.

SECTION 11 - ECOLOGICAL INFORMATION

Ecotoxicity: No recognized unusual toxicity to plants or animals.

SECTION 12 - DISPOSAL CONSIDERATIONS

Dispose of waste material according to local, provincial, state, and federal regulations. (Since set concrete is stable, allow material to harden).

Dispose in an approved landfill.

MATERIAL SAFETY DATA SHEET

SECTION 13 - TRANSPORT INFORMATION

Hazardous materials description/ proper shipping name:	Ready Mix Concrete is not hazardous under the TDG Act (Canada) or DOT regulations (USA).
Hazard Class:	Not applicable.
Identification Number:	Not applicable.
Required Label Text:	Not applicable.
Hazardous substances/reportable quantities (RO):	Not applicable.

SECTION 14 - REGULATORY INFORMATION

Status under USDOL-OSHA Hazard Communication Rule, 29 CFR 1910.1200:

Ready Mix Concrete is considered a "hazardous chemical" under this regulation and should be part of any hazard communication program.

Status under CERCLA/Superfund, 40 CFR 117 and 302:

Not listed.

Hazard Category under SARA (Title III), Sections 311 and 312:

Ready Mix Concrete qualifies as a "hazardous substance" with delayed health effects.

Status under SARA (Title III), Section 313:

Not subject to reporting requirements under Section 313.

SECTION 15 - REGULATORY INFORMATION (CONTINUED)

Status under TSCA (as of May 1997):

Some substances in Ready Mix Concrete are on the TSCA inventory list.

Status under the Federal Hazardous Substances Act:

Ready Mix Concrete is a "hazardous substance" subject to statutes promulgated under the subject act.

Status under California Proposition 65:

This product contains chemicals (trace metals) known to the State of California to cause cancer, birth defects, or other reproductive harm. California law requires the manufacturer to give the above warning in the absence of definitive testing to prove the defined risks do not exist.

Status under Canadian Environmental Protection Act:

Not listed.

MATERIAL SAFETY DATA SHEET

Status under WHMIS:

Portland cement is considered to be a hazardous material under the Hazardous Products Act as defined by the Controlled Products Regulations and is therefore subject to the labeling and MSDS requirements of the Workplace Hazardous Materials Information System (WHMIS).

This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

SECTION 16 - OTHER INFORMATION

Prepared By:	Robin Cowdrey
Approved By:	Greg McCaughey
Approval Date or Revision Date:	October 1, 2004
Date Of Previous MSDS:	October 15, 2002
MSDS Number:	Not Applicable

Other Important Information:

Concrete should only be used by knowledgeable persons. Vital to using the product safely requires the user to recognize that portland cement chemically reacts with water and that some of the intermediate products of this reaction, during the setting stage, are the cause of the hazards when handling this product.

While the information provided in this material safety data sheet is believed to provide a useful summary of the hazards of concrete, as it is commonly used, one cannot anticipate and provide all of the information that might be needed in every situation. Inexperienced product users should obtain proper training before using this product.

The data furnished in this sheet does not address hazards that may be posed by other materials mixed with concrete. Users should review other relevant material safety data sheets before working with concrete or working with products containing portland cement.

No representations or warranties with respect to the accuracy or correctness of this information, or of any kind or nature whatsoever are given, made, or intended by Inland Concrete Limited. No legal responsibility whatsoever is assumed for this information, or for any injuries or damages, however caused, which may result from the use of this information. This information is offered solely for informational purposes and is subject to your own independent investigation and verification.



60% SMALL DROPLET SLOW RELEASE EMULSIFIED VEGETABLE OIL SUBSTRATE (SRS[®]-SD) MSDS

Effective Date: 01/01/2011

1. Product Identification

Synonyms: 60% Small Droplet Slow Release Emulsified Vegetable Oil Substrate (SRS[®]-SD)

CAS No.: Mixture

Molecular Weight: Not applicable.

Chemical Formula: Not applicable.

Supplier: Terra Systems, Inc.

1035 Philadelphia Pike

Suite E

Wilmington DE 19809

Telephone (302) 798-9553

Facsimile: (302) 798-9554

2. Composition/Information on Ingredients

Ingredient	CAS #	Percent	Hazardous
Food grade edible soy bean oil	NA	60%	No
Emulsifiers and proprietary nutrient package containing nitrogen, phosphorus and vitamin B ₁₂	Mixture	5 – 15%	No
Sodium Lactate	72-17-3	<5%	Yes
Water	7732-18-5	20 - 30%	No

3. Hazards Identification

Emergency Overview

CAUTION! MAY CAUSE EYE IRRITATION.

Health Rating: 1 - Slight

1035 Philadelphia Pike
Suite E
Wilmington Delaware 19809
302-798-9553
Fax 302-798-9554
www.terrasystems.net





Flammability Rating: 1 - Slight

Reactivity Rating: 1 - Slight

Contact Rating: 1 - Slight

Lab Protective Equip: GOGGLES; LAB COAT; PROPER GLOVES

Storage Color Code: Green (General Storage)

Potential Health Effects

Inhalation:

Not expected to be a health hazard. If heated, may produce vapors or mists that irritate the mucous membranes and cause irritation, dizziness, and nausea. Remove to fresh air.

Ingestion:

Not expected to be a health hazard via ingestion. Large doses may produce abdominal spasms, diarrhea.

Skin Contact:

No adverse effects expected. May cause irritation or sensitization in sensitive individuals.

Eye Contact:

May cause mild irritation, possible reddening.

Chronic Exposure:

No information found.

Aggravation of Pre-existing Conditions:

No information found.

4. First Aid Measures

Inhalation:

Not expected to require first aid measures. Remove to fresh air. Get medical attention for any breathing difficulty.

Ingestion:

If large amounts were swallowed, give water to drink and get medical advice.

Skin Contact:

Not expected to require first aid measures. Wash exposed area with soap and water. Get medical advice if irritation develops.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get medical attention if irritation persists.

5. Fire Fighting Measures

Fire:

Flash point: >200 °C (>392 °F)

Not considered to be a fire hazard.

Explosion:

1035 Philadelphia Pike
Suite E
Wilmington Delaware 19809
302-798-9553
Fax 302-798-9554
www.terrasystems.net





Not considered to be an explosion hazard.

Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Clean-up personnel may require protective clothing. Absorb in sand, paper towels, "Oil Dry", or other inert material. Scoop up and containerize for disposal. Flush trace residues to sewer with soap and water. Containerized waste may be sent to an approved waste disposal facility.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Containers of this material are not hazardous when empty since they do not contain vapors or harmful substances; observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

None established.

Ventilation System:

Not expected to require any special ventilation.

Personal Respirators (NIOSH Approved):

Not expected to require personal respirator usage.

Skin Protection:

Wear protective gloves and clean body-covering clothing.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible.



9. Physical and Chemical Properties

Appearance:

White liquid.

Odor:

Vegetable oil.

Solubility:

Soluble in water.

Specific Gravity:

0.95-0.98 g/mL

pH:

7-8 (40% aqueous solution)

% Volatiles by volume @ 21C (70F):

Negligible.

Boiling Point:

≥ 100C (≥ 212F)

Melting Point:

No information found.

Vapor Density (Air=1):

No information found.

Vapor Pressure (mm Hg):

< 1.0 @ 20C (68F)

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

Carbon dioxide and carbon monoxide may form when heated to decomposition.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

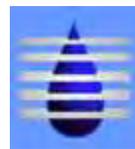
Strong oxidizers, acids.

Conditions to Avoid:

Incompatibles.

11. Toxicological Information

Sodium Lactate. Oral rat LD50: 2,000 mg/kg. 100 mg caused mild irritation to rabbit eye in Draize test.





12. Ecological Information

Environmental Fate:

No information found.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

OSHA STATUS: This product is not hazardous under the criteria of the Federal OSHA hazard Communication Standard 29 CFR 1910.1200. However, thermal processing and decomposition fumes from this product may be hazardous as noted in Section 10.

TSCA STATUS: No component of this product is listed on the TSCA inventory.

CERCLA (Comprehensive Response Compensation, and Liability Act): Not reportable.

SARA TITLE III (Superfund Amendments and Reauthorization Act)

Section 312 Extremely Hazardous Substances: None

Section 311/312 Hazard Categories: Non-hazardous Under Section 311/312

Section 313 Toxic Chemicals: None

RCRA STATUS: If discarded in its purchased form, this product would not be a hazardous waste either by listing or by characteristic. However, under RCRA, it is the responsibility of the product user to determine at the time of disposal, whether a material containing the product or derived from the product should be classified as a hazardous waste. (40 CFR 261.20-24)

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302-798-9553
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www.terrasystems.net





CALIFORNIA PROPOSITION 65: The following statement is made in order to comply with the California safe Drinking Water and Toxic Enforcement Act of 1986. The product contains no chemicals known to the State of California to cause cancer.

16. Other Information

NFPA Ratings: Health: **1** Flammability: **1** Reactivity: **0**

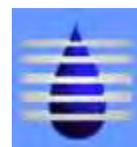
Revision Information:

MSDS Section(s) changed since last revision of document include: None.

Disclaimer:

Terra Systems, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. TERRA SYSTEMS, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, TERRA SYSTEMS, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

Prepared by: Terra Systems, Inc.
Phone Number: (302) 798-9553 (U.S.A.)



MSDS Number: **S8237** * * * * * *Effective Date: 11/21/08* * * * * * *Supersedes: 03/16/06*

MSDS**Material Safety Data Sheet**

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

SULFURIC ACID, 10 - 51%

1. Product Identification

Synonyms: Oil of vitriol; Babcock acid; sulphuric acid

CAS No.: 7664-93-9

Molecular Weight: 98.07

Chemical Formula: H₂SO₄ in H₂O

Product Codes:

J.T. Baker: 0331, 0397, 4700, 4701, 5253, 5691, 5951, 9696, S8237

Mallinckrodt: H378, H379, V011

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Sulfuric Acid	7664-93-9	10 - 51%	Yes
Water	7732-18-5	49 - 90%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR CONTACTED WITH SKIN. HARMFUL IF INHALED. AFFECTS TEETH. WATER REACTIVE. CANCER HAZARD. STRONG INORGANIC ACID MISTS CONTAINING SULFURIC ACID CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.

SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 4 - Extreme (Poison)

Flammability Rating: 0 - None

Reactivity Rating: 2 - Moderate

Contact Rating: 4 - Extreme (Corrosive)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

Storage Color Code: White (Corrosive)

Potential Health Effects

Inhalation:

Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. Symptoms may include irritation of the nose and throat, and labored breathing. May cause lung edema, a medical emergency.

Ingestion:

Corrosive. Swallowing can cause severe burns of the mouth, throat, and stomach, leading to death. Can cause sore throat, vomiting, diarrhea. Circulatory collapse with clammy skin, weak and rapid pulse, shallow respirations, and scanty urine may follow ingestion or skin contact. Circulatory shock is often the immediate cause of death.

Skin Contact:

Corrosive. Symptoms of redness, pain, and severe burn can occur. Circulatory collapse with clammy skin, weak and rapid pulse, shallow respirations, and scanty urine may follow skin contact or ingestion. Circulatory shock is often the immediate cause of death.

Eye Contact:

Corrosive. Contact can cause blurred vision, redness, pain and severe tissue burns. Can cause blindness.

Chronic Exposure:

Long-term exposure to mist or vapors may cause damage to teeth. Chronic exposure to mists containing sulfuric acid is a cancer hazard.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician immediately.

Ingestion:

DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Call a physician immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Excess acid on skin can be neutralized with a 2% solution of bicarbonate of soda. Call a physician immediately.

Eye Contact:

Immediately flush eyes with gentle but large stream of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Call a physician immediately.

5. Fire Fighting Measures

Fire:

Concentrated material is a strong dehydrating agent. Reacts with organic materials and may cause ignition of finely divided materials on contact.

Explosion:

Contact with most metals causes formation of flammable and explosive hydrogen gas.

Fire Extinguishing Media:

Dry chemical, foam or carbon dioxide. Do not use water on material. However, water spray may be used to keep fire exposed containers cool.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Structural firefighter's protective clothing is ineffective for fires involving this material. Stay away from sealed containers.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB® acid neutralizers are recommended for spills of this product.

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, always add the acid to water; never add water to the acid. When opening metal containers, use non-sparking tools because of the possibility of hydrogen gas being present. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

For Sulfuric Acid:

- OSHA Permissible Exposure Limit (PEL) -

1 mg/m³ (TWA)

- ACGIH Threshold Limit Value (TLV) -

0.2 mg/m³(T) (TWA) for sulfuric acid - A2 Suspected Human Carcinogen for sulfuric acid contained in strong inorganic mists.

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering controls are not feasible, a full facepiece respirator with an acid gas cartridge and particulate filter (NIOSH type N100 filter) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P particulate filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air purifying respirators do not protect workers in oxygen-deficient atmospheres. Where respirators are required, you must have a written program covering the basic requirements in the OSHA respirator standard. These include training, fit testing, medical approval, cleaning, maintenance, cartridge change schedules, etc. See 29CFR1910.134 for details.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Clear oily liquid.

Odor:

Odorless.

Solubility:

Miscible with water, liberates much heat.

Specific Gravity:

1.40 (50%), 1.07 (10%)

pH:

1 N solution (ca. 5% w/w) = 0.3; 0.1 N solution (ca. 0.5% w/w) = 1.2; 0.01 N solution (ca. 0.05% w/w) = 2.1.

% Volatiles by volume @ 21C (70F):

No information found.

Boiling Point:

ca. 290C (ca. 554F) (decomposes at 340C)

Melting Point:

3C (100%), -32C (93%), -38C (78%), -64C (65%).

Vapor Density (Air=1):

3.4

Vapor Pressure (mm Hg):

1 @ 145.8C (295F)

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Concentrated solutions react violently with water, spattering and liberating heat.

Hazardous Decomposition Products:

Toxic fumes of oxides of sulfur when heated to decomposition. Will react with water or steam to produce toxic and corrosive fumes. Reacts with carbonates to generate carbon dioxide gas, and with cyanides and sulfides to form poisonous hydrogen cyanide and hydrogen sulfide respectively.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Water, potassium chlorate, potassium perchlorate, potassium permanganate, sodium, lithium, bases, organic material, halogens, metal acetylides, oxides and hydrides, metals (yields hydrogen gas), strong oxidizing and reducing agents and many other reactive substances.

Conditions to Avoid:

Heat, moisture, incompatibles.

11. Toxicological Information

Toxicological Data:

Oral rat LD50: 2140 mg/kg; inhalation rat LC50: 510 mg/m³/2H; standard Draize, eye rabbit, 250 ug (severe); investigated as a tumorigen, mutagen, reproductive effector.

Carcinogenicity:

Cancer Status: The International Agency for Research on Cancer (IARC) has classified "strong inorganic acid mists containing sulfuric acid" as a known human carcinogen, (IARC category 1). This classification applies only to mists containing sulfuric acid and not to sulfuric acid or sulfuric acid solutions.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Sulfuric Acid (7664-93-9)	No	No	None
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:

When released into the soil, this material may leach into groundwater. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition. When released into the air, this material may be removed from the atmosphere to a moderate extent by dry deposition.

Environmental Toxicity:

LC50 Flounder 100 to 330 mg/l/48 hr aerated water/Conditions of bioassay not specified;
 LC50 Shrimp 80 to 90 mg/l/48 hr aerated water /Conditions of bioassay not specified; LC50
 Prawn 42.5 ppm/48 hr salt water /Conditions of bioassay not specified.
 This material may be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: SULFURIC ACID (WITH NOT MORE THAN 51% ACID)

Hazard Class: 8

UN/NA: UN2796

Packing Group: II

Information reported for product/size: 20L**International (Water, I.M.O.)****Proper Shipping Name: SULPHURIC ACID (WITH NOT MORE THAN 51% ACID)****Hazard Class: 8****UN/NA: UN2796**

Packing Group: II

Information reported for product/size: 20L

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----

Ingredient	TSCA	EC	Japan	Australia
Sulfuric Acid (7664-93-9)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

-----\Chemical Inventory Status - Part 2\-----

Ingredient	Korea	--Canada--		Phil.
		DSL	NDSL	
Sulfuric Acid (7664-93-9)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

-----\Federal, State & International Regulations - Part 1\-----

Ingredient	-SARA 302-		-----SARA 313-----	
	RQ	TPQ	List	Chemical Catg.
Sulfuric Acid (7664-93-9)	1000	1000	Yes	No
Water (7732-18-5)	No	No	No	No

-----\Federal, State & International Regulations - Part 2\-----

Ingredient	CERCLA	-RCRA-	-TSCA-
		261.33	8(d)
Sulfuric Acid (7664-93-9)	1000	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: Yes
 SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
 Reactivity: Yes (Pure / Liquid)

Australian Hazchem Code: 2P**Poison Schedule: None allocated.****WHMIS:**

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **2** Other: **Water reactive**

Label Hazard Warning:

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR CONTACTED WITH SKIN. HARMFUL IF INHALED. AFFECTS TEETH. WATER REACTIVE. CANCER HAZARD. STRONG INORGANIC ACID MISTS CONTAINING SULFURIC ACID CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.

Label Precautions:

Do not get in eyes, on skin, or on clothing.

Do not breathe mist.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

Do not contact with water.

Label First Aid:

In all cases call a physician immediately. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before re-use. Excess acid on skin can be neutralized with a 2% bicarbonate of soda solution. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

Product Use:

Laboratory Reagent.

Revision Information:

No Changes.

Disclaimer:

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: **H3886** * * * * * *Effective Date: 02/13/09* * * * * * *Supercedes: 10/16/08*

MSDS

Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

HYDROCHLORIC ACID (10%-33%)

1. Product Identification

Synonyms: This MSDS applies to the concentrated standard used to make laboratory solutions and any solution that contains more than 10% but less than 33% Hydrochloric acid. For diluted product, see MSDS for Hydrochloric Acid (less than 10%).

CAS No.: 7647-01-0

Molecular Weight: 36.46

Chemical Formula: HCl in H₂O

Product Codes:

J.T. Baker: 0323, 0327, 0365, 4654, 4657, 5618, 5619

Mallinckrodt: 2608, 2625, H151, H168, V035

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Hydrogen Chloride	7647-01-0	10 - 33%	Yes
Water	7732-18-5	67 - 90%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED.

SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)

Flammability Rating: 0 - None

Reactivity Rating: 2 - Moderate

Contact Rating: 4 - Extreme (Corrosive)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

Storage Color Code: White (Corrosive)

Potential Health Effects

Inhalation:

Corrosive! Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death.

Ingestion:

Corrosive! Swallowing hydrochloric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract. May cause nausea, vomiting, and diarrhea, and in severe cases, death.

Skin Contact:

Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and discolor skin.

Eye Contact:

Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.

Chronic Exposure:

Long-term exposure to concentrated vapors may cause erosion of teeth. Long term exposures seldom occur due to the corrosive properties of the acid.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or eye disease may be more susceptible to the effects of this substance.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Ingestion:

DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Not considered to be a fire hazard. May react with metals or heat to release flammable hydrogen gas.

Explosion:

Not considered to be an explosion hazard.

Fire Extinguishing Media:

Water or water spray. Neutralize with soda ash or slaked lime.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Structural firefighter's protective clothing is ineffective for fires involving hydrochloric acid. Stay away from ends of tanks. Cool tanks with water spray until well after fire is out.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB® acid neutralizers are recommended for spills of this product.

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When

diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. When opening metal containers, use non-sparking tools because of the possibility of hydrogen gas being present. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

For Hydrochloric acid:

- OSHA Permissible Exposure Limit (PEL):

5 ppm (Ceiling)

- ACGIH Threshold Limit Value (TLV):

2 ppm (Ceiling), A4 Not classifiable as a human carcinogen

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering controls are not feasible, a full facepiece respirator with an acid gas cartridge may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Clear, colorless liquid.

Odor:

Pungent odor.

Solubility:

Infinitely soluble.

Density:

1.05 @ 15 C (59 F)

pH:

For HCL solutions: 0.1 (1.0 N), 1.1 (0.1 N), 2.02 (0.01 N)

% Volatiles by volume @ 21C (70F):

100

Boiling Point:

101 - 103C (214 - 217F)

Melting Point:

No information found.

Vapor Density (Air=1):

No information found.

Vapor Pressure (mm Hg):

No information found.

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

When heated to decomposition, emits toxic hydrogen chloride fumes and will react with water or steam to produce heat and toxic and corrosive fumes. Thermal oxidative decomposition produces toxic chlorine fumes and explosive hydrogen gas.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

A strong mineral acid, concentrated hydrochloric acid is highly reactive with strong bases, metals, metal oxides, hydroxides, amines, carbonates and other alkaline materials. Incompatible with materials such as cyanides, sulfides, sulfites, and formaldehyde.

Conditions to Avoid:

Heat, direct sunlight.

11. Toxicological Information

Hydrochloric acid: Inhalation rat LC50: 3124 ppm/1H; Oral rabbit LD50: 900 mg/kg.
Investigated as a tumorigen, mutagen, reproductive effector.

Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Hydrogen Chloride (7647-01-0)	No	No	3
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:

When released into the soil, this material is not expected to biodegrade. When released into the soil, this material may leach into groundwater.

Environmental Toxicity:

This material is expected to be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: HYDROCHLORIC ACID

Hazard Class: 8

UN/NA: UN1789

Packing Group: II

Information reported for product/size: 200L

International (Water, I.M.O.)

Proper Shipping Name: HYDROCHLORIC ACID

Hazard Class: 8

UN/NA: UN1789

Packing Group: II

Information reported for product/size: 200L

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\----- Ingredient	TSCA	EC	Japan	Australia
Hydrogen Chloride (7647-01-0)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

-----\Chemical Inventory Status - Part 2\-----
 --Canada--

Ingredient	Korea	DSL	NDSL	Phil.
Hydrogen Chloride (7647-01-0)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

-----\Federal, State & International Regulations - Part 1\-----				
Ingredient	-SARA 302-		-----SARA 313-----	
	RQ	TPQ	List	Chemical Catg.
Hydrogen Chloride (7647-01-0)	5000	500*	Yes	No
Water (7732-18-5)	No	No	No	No

-----\Federal, State & International Regulations - Part 2\-----			
Ingredient	CERCLA	-RCRA-	-TSCA-
		261.33	8(d)
Hydrogen Chloride (7647-01-0)	5000	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: Yes
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: 2R

Poison Schedule: None allocated.

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0**

Label Hazard Warning:

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED.

Label Precautions:

Do not get in eyes, on skin, or on clothing.

Avoid breathing vapor or mist.

Keep container closed.

Use with adequate ventilation.

Wash thoroughly after handling.

Label First Aid:

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 14.

Disclaimer:

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: **N3660** * * * * * *Effective Date: 11/07/08* * * * * * *Supercedes: 02/15/08*

MSDS

Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865



Mallinckrodt
CHEMICALS



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

NITRIC ACID, 50-70%

1. Product Identification

Synonyms: Aqua Fortis; Azotic Acid; Nitric Acid 50%; Nitric Acid 65%; nitric acid 69-70%

CAS No.: 7697-37-2

Molecular Weight: 63.01

Chemical Formula: HNO₃

Product Codes:

J.T. Baker: 5371, 5796, 5801, 5826, 5856, 5876, 5896, 9597, 9598, 9600, 9601, 9602, 9603, 9604, 9606, 9607, 9608, 9610, 9616, 9617, 9670, 9761

Mallinckrodt: 1409, 2704, 2705, 2706, 2707, 2716, 6623, H862, H988, H993, H998, V077, V650

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Nitric Acid	7697-37-2	50 - 70%	Yes
Water	7732-18-5	30 - 50%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.

SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 4 - Extreme (Poison)

Flammability Rating: 0 - None

Reactivity Rating: 3 - Severe (Oxidizer)

Contact Rating: 4 - Extreme (Corrosive)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

Storage Color Code: White (Corrosive)

Potential Health Effects

Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison.

Inhalation:

Corrosive! Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract.

Ingestion:

Corrosive! Swallowing nitric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract.

Skin Contact:

Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color.

Eye Contact:

Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.

Chronic Exposure:

Long-term exposure to concentrated vapors may cause erosion of teeth and lung damage.

Long-term exposures seldom occur due to the corrosive properties of the acid.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders, eye disease, or cardiopulmonary diseases may be more susceptible to the effects of this substance.

4. First Aid Measures

Immediate first aid treatment reduces the health effects of this substance.

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:

DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition. Can react with metals to release flammable hydrogen gas.

Explosion:

Reacts explosively with combustible organic or readily oxidizable materials such as: alcohols, turpentine, charcoal, organic refuse, metal powder, hydrogen sulfide, etc. Reacts with most metals to release hydrogen gas which can form explosive mixtures with air.

Fire Extinguishing Media:

Water spray may be used to keep fire exposed containers cool. Do not get water inside container.

Special Information:

Increases the flammability of combustible, organic and readily oxidizable materials. In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB® acid neutralizers are recommended for spills of this product.

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

-OSHA Permissible Exposure Limit (PEL):

2 ppm (TWA), 4 ppm (STEL)

-ACGIH Threshold Limit Value (TLV):

2 ppm (TWA); 4 ppm (STEL)

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Nitric acid is an oxidizer and should not come in contact with cartridges and canisters that contain oxidizable materials, such as activated charcoal. Canister-type respirators using sorbents are ineffective.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Colorless to yellowish liquid.

Odor:

Suffocating, acrid.

Solubility:

Infinitely soluble.

Specific Gravity:

1.41

pH:

1.0 (0.1M solution)

% Volatiles by volume @ 21C (70F):

100 (as water and acid)

Boiling Point:

122C (252F)

Melting Point:

-42C (-44F)

Vapor Density (Air=1):

2-3

Vapor Pressure (mm Hg):

48 @ 20C (68F)

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Containers may burst when heated.

Hazardous Decomposition Products:

When heated to decomposition, emits toxic nitrogen oxides fumes and hydrogen nitrate.

Will react with water or steam to produce heat and toxic and corrosive fumes.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

A dangerously powerful oxidizing agent, concentrated nitric acid is incompatible with most substances, especially strong bases, metallic powders, carbides, hydrogen sulfide, turpentine, and combustible organics.

Conditions to Avoid:

Light and heat.

11. Toxicological Information

Nitric acid: Inhalation rat LC50: 244 ppm (NO2)/30M; Investigated as a mutagen, reproductive effector. Oral (human) LDLo: 430 mg/kg.

Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Nitric Acid (7697-37-2)	No	No	None
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:

No information found.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: NITRIC ACID**Hazard Class:** 8**UN/NA:** UN2031**Packing Group:** II**Information reported for product/size:** 6.5GL**International (Water, I.M.O.)**

Proper Shipping Name: NITRIC ACID**Hazard Class:** 8**UN/NA:** UN2031**Packing Group:** II**Information reported for product/size:** 6.5GL

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\----- Ingredient	TSCA	EC	Japan	Australia
Nitric Acid (7697-37-2)	Yes	Yes	Yes	Yes

Water (7732-18-5) Yes Yes Yes Yes

-----\Chemical Inventory Status - Part 2\-----

Ingredient	--Canada--			
	Korea	DSL	NDSL	Phil.
Nitric Acid (7697-37-2)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

-----\Federal, State & International Regulations - Part 1\-----

Ingredient	-SARA 302-		-----SARA 313-----	
	RQ	TPQ	List	Chemical Catg.
Nitric Acid (7697-37-2)	1000	1000	Yes	No
Water (7732-18-5)	No	No	No	No

-----\Federal, State & International Regulations - Part 2\-----

Ingredient	CERCLA	-RCRA-	-TSCA-
		261.33	8(d)
Nitric Acid (7697-37-2)	1000	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
 SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
 Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: 2PE

Poison Schedule: S6

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0** Other: **Oxidizer**

Label Hazard Warning:

POISON! DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.

Label Precautions:

Do not get in eyes, on skin, or on clothing.

Do not breathe vapor or mist.

Use only with adequate ventilation.

Wash thoroughly after handling.

Keep from contact with clothing and other combustible materials.

Do not store near combustible materials.

Store in a tightly closed container.

Remove and wash contaminated clothing promptly.

Label First Aid:

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 14.

Disclaimer:

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Prepared by: Environmental Health & Safety

Phone Number: (314) 654-1600 (U.S.A.)

Material Safety Data Sheet

Sodium hydroxide, 10% solution

ACC# 88811

Section 1 - Chemical Product and Company Identification

MSDS Name: Sodium hydroxide, 10% solution**Catalog Numbers:** M091, MCC-030346**Synonyms:** Caustic soda; Soda lye; Sodium hydrate.**Company Identification:**

Fisher Scientific
 1 Reagent Lane
 Fair Lawn, NJ 07410

For information, call: 201-796-7100**Emergency Number:** 201-796-7100**For CHEMTREC assistance, call:** 800-424-9300**For International CHEMTREC assistance, call:** 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
7732-18-5	Water	90	231-791-2
1310-73-2	Sodium hydroxide	10	215-185-5

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: colorless clear liquid.

Danger! Causes burns by all exposure routes.**Target Organs:** Respiratory system, gastrointestinal system, eyes, skin, mucous membranes.**Potential Health Effects****Eye:** Causes severe eye burns.**Skin:** May be harmful if absorbed through the skin. Causes severe burns.**Ingestion:** Causes gastrointestinal tract burns. May be harmful if swallowed.**Inhalation:** Causes chemical burns to the respiratory tract. May be harmful if inhaled.**Chronic:** Prolonged or repeated skin contact may cause dermatitis. Effects may be delayed.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.**Skin:** Get medical aid immediately. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.

Ingestion: Do not induce vomiting. Get medical aid immediately. Call a poison control center.

Inhalation: Get medical aid immediately. Remove from exposure and move to fresh air immediately. If breathing is difficult, give oxygen. Do not use mouth-to-mouth resuscitation if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.

Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. May react exothermically with water, causing liberation of heat and possible spattering of material.

Extinguishing Media: Use foam, dry chemical, or carbon dioxide. DO NOT USE WATER!

Flash Point: Not applicable.

Autoignition Temperature: Not applicable.

Explosion Limits, Lower: Not available.

Upper: Not available.

NFPA Rating: (estimated) Health: 3; Flammability: 0; Instability: 2; Special Hazard: -W-

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Wear a self contained breathing apparatus and appropriate personal protection. (See Exposure Controls, Personal Protection section). Provide ventilation. Do not expose spill to water. Do not let this chemical enter the environment.

Section 7 - Handling and Storage

Handling: Do not get in eyes, on skin, or on clothing. Do not ingest or inhale. Do not allow contact with water. Use only in a chemical fume hood.

Storage: Store in a tightly closed container. Store in a dry area. Corrosives area. Water free area. Store at 2-8°C.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use only under a chemical fume hood.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Water	none listed	none listed	none listed
Sodium hydroxide	2 mg/m ³ Ceiling	10 mg/m ³ IDLH	2 mg/m ³ TWA

OSHA Vacated PELs: Water: No OSHA Vacated PELs are listed for this chemical. Sodium

hydroxide: No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

Section 9 - Physical and Chemical Properties

Physical State: Clear liquid

Appearance: colorless

Odor: none reported

pH: Alkaline

Vapor Pressure: 14 mm Hg

Vapor Density: > 1.0

Evaporation Rate: Not available.

Viscosity: > 1 (ether=1)

Boiling Point: 105 - 140 deg C

Freezing/Melting Point: 10 - 12 deg C

Decomposition Temperature: Not available.

Solubility: Soluble.

Specific Gravity/Density: 1.0

Molecular Formula: NaOH

Molecular Weight: Not available.

Section 10 - Stability and Reactivity

Chemical Stability: Absorbs carbon dioxide from the air. Reacts with water.

Conditions to Avoid: Incompatible materials, exposure to air, exposure to moist air or water.

Incompatibilities with Other Materials: Metals, acids, flammable liquids, halogenated hydrocarbons, nitromethane, nitro compounds.

Hazardous Decomposition Products: Sodium oxide.

Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:

CAS# 7732-18-5: ZC0110000

CAS# 1310-73-2: WB4900000

LD50/LC50:

CAS# 7732-18-5:

Oral, rat: LD50 = >90 mL/kg;

CAS# 1310-73-2:

Draize test, rabbit, eye: 400 ug Mild;
 Draize test, rabbit, eye: 1% Severe;
 Draize test, rabbit, eye: 50 ug/24H Severe;
 Draize test, rabbit, eye: 1 mg/24H Severe;
 Draize test, rabbit, skin: 500 mg/24H Severe;

Carcinogenicity:

CAS# 7732-18-5: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

CAS# 1310-73-2: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: No information found

Teratogenicity: No information found

Reproductive Effects: No information found

Mutagenicity: No information found

Neurotoxicity: No information found

Other Studies:

Section 12 - Ecological Information

Ecotoxicity: No data available. No information available.

Environmental: No information available.

Physical: No information available.

Other: Do not empty into drains.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series: None listed.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	SODIUM HYDROXIDE SOLUTION	SODIUM HYDROXIDE SOLUTION
Hazard Class:	8	8
UN Number:	UN1824	UN1824
Packing Group:	II	II

Section 15 - Regulatory Information

US FEDERAL**TSCA**

CAS# 7732-18-5 is listed on the TSCA inventory.

CAS# 1310-73-2 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs

CAS# 1310-73-2: 1000 lb final RQ; 454 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPO.

SARA Codes

CAS # 1310-73-2: immediate, reactive.

Section 313 No chemicals are reportable under Section 313.

Clean Air Act:

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

CAS# 1310-73-2 is listed as a Hazardous Substance under the CWA.

None of the chemicals in this product are listed as Priority Pollutants under the CWA.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 7732-18-5 is not present on state lists from CA, PA, MN, MA, FL, or NJ.

CAS# 1310-73-2 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

C

Risk Phrases:

R 35 Causes severe burns.

Safety Phrases:

S 26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

S 37/39 Wear suitable gloves and eye/face protection.

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

WGK (Water Danger/Protection)

CAS# 7732-18-5: No information available.

CAS# 1310-73-2: 1

Canada - DSL/NDSL

CAS# 7732-18-5 is listed on Canada's DSL List.

CAS# 1310-73-2 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of E.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List

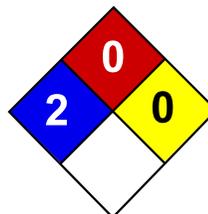
CAS# 1310-73-2 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information
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MSDS Creation Date: 9/02/1997

Revision #7 Date: 10/02/2007

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.



Health	2
Fire	0
Reactivity	0
Personal Protection	G

Material Safety Data Sheet Tetrachloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Tetrachloroethylene

Catalog Codes: SLT3220

CAS#: 127-18-4

RTECS: KX3850000

TSCA: TSCA 8(b) inventory: Tetrachloroethylene

CI#: Not available.

Synonym: Perchloroethylene; 1,1,2,2-Tetrachloroethylene; Carbon bichloride; Carbon dichloride; Ankilostin; Didakene; Dilatin PT; Ethene, tetrachloro-; Ethylene tetrachloride; Perawin; Perchlor; Perclene; Perclene D; Percosolve; Tetrachloroethene; Tetraleno; Tetralox; Tetravec; Tetroguer; Tetropil

Chemical Name: Ethylene, tetrachloro-

Chemical Formula: C₂-Cl₄

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Tetrachloroethylene	127-18-4	100

Toxicological Data on Ingredients: Tetrachloroethylene: ORAL (LD50): Acute: 2629 mg/kg [Rat]. DERMAL (LD): Acute: >3228 mg/kg [Rabbit]. MIST(LC50): Acute: 34200 mg/m 8 hours [Rat]. VAPOR (LC50): Acute: 5200 ppm 4 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of eye contact (irritant), of ingestion.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (anticipated carcinogen) by NTP. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, peripheral nervous system, respiratory tract, skin, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact:

In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:

Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with skin. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, metals, acids, alkalis.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Personal Protection:

Safety glasses. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 25 (ppm) from OSHA (PEL) [United States] TWA: 25 STEL: 100 (ppm) from ACGIH (TLV) [United States] TWA: 170 (mg/m³) from OSHA (PEL) [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Ethereal.

Taste: Not available.

Molecular Weight: 165.83 g/mole

Color: Clear Colorless.

pH (1% soln/water): Not available.

Boiling Point: 121.3°C (250.3°F)

Melting Point: -22.3°C (-8.1°F)

Critical Temperature: 347.1°C (656.8°F)

Specific Gravity: 1.6227 (Water = 1)

Vapor Pressure: 1.7 kPa (@ 20°C)

Vapor Density: 5.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 5 - 50 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.4

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:

Miscible with alcohol, ether, chloroform, benzene, hexane. It dissolves in most of the fixed and volatile oils. Solubility in water: 0.015 g/100 ml @ 25 deg. C It slowly decomposes in water to yield Trichloroacetic and Hydrochloric acids.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, metals, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Oxidized by strong oxidizing agents. Incompatible with sodium hydroxide, finely divided or powdered metals such as zinc, aluminum, magnesium, potassium, chemically active metals such as lithium, beryllium, barium. Protect from light.

Special Remarks on Corrosivity: Slowly corrodes aluminum, iron, and zinc.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 2629 mg/kg [Rat]. Acute dermal toxicity (LD50): >3228 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 5200 4 hours [Mouse].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (Some evidence.) by NTP. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. May cause damage to the following organs: kidneys, liver, peripheral nervous system, upper respiratory tract, skin, central nervous system (CNS).

Other Toxic Effects on Humans:

Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of ingestion.

Special Remarks on Toxicity to Animals:

Lowest Published Lethal Dose/Conc: LDL [Rabbit] - Route: Oral; Dose: 5000 mg/kg LDL [Dog] - Route: Oral; Dose: 4000 mg/kg LDL [Cat] - Route: Oral; Dose: 4000 mg/kg

Special Remarks on Chronic Effects on Humans:

May cause adverse reproductive effects and birth defects (teratogenic). May affect genetic material (mutagenic). May cause cancer.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: Causes skin irritation with possible dermal blistering or burns. Symptoms may include redness, itching, pain, and possible dermal blistering or burns. It may be absorbed through the skin with possible systemic effects. A single prolonged skin exposure is not likely to result in the material being absorbed in harmful amounts. Eyes: Contact causes transient eye irritation, lacrimation. Vapors cause eye/conjunctival irritation. Symptoms may include redness and pain. Inhalation: The main route to occupational exposure is by inhalation since it is readily absorbed through the lungs. It causes respiratory tract irritation, . It can affect behavior/central nervous system (CNS depressant and anesthesia ranging from slight inebriation to death, vertigo, somnolence, anxiety, headache, excitement, hallucinations, muscle incoordination, dizziness, lightheadness, disorientation, seizures, emotional instability, stupor, coma). It may cause pulmonary edema. Ingestion: It can cause nausea, vomiting, anorexia, diarrhea, bloody stool. It may affect the liver, urinary system (proteinuria, hematuria, renal failure, renal tubular disorder), heart (arrhythmias). It may affect behavior/central nervous system with symptoms similar to that of inhalation. Chronic Potential Health Effects: Skin: Prolonged or repeated skin contact may result in excessive drying of the skin, and irritation. Ingestion/Inhalation: Chronic exposure can affect the liver (hepatitis, fatty liver degeneration), kidneys, spleen, and heart (irregular heartbeat/arrhythmias, cardiomyopathy, abnormal EEG), brain, behavior/central nervous system/peripheral nervous system (impaired memory, numbness of extremities, peripheral neuropathy and other

Section 12: Ecological Information

Ecotoxicity:

Ecotoxicity in water (LC50): 18.4 mg/l 96 hours [Fish (Fathead Minnow)]. 18 mg/l 48 hours [Daphnia (daphnia)]. 5 mg/l 96 hours [Fish (Rainbow Trout)]. 13 mg/l 96 hours [Fish (Bluegill sunfish)].

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Tetrachloroethylene UNNA: 1897 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Tetrachloroethylene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Tetrachloroethylene Connecticut hazardous material survey.: Tetrachloroethylene Illinois toxic substances disclosure to employee act: Tetrachloroethylene Illinois chemical safety act: Tetrachloroethylene New York release reporting list: Tetrachloroethylene Rhode Island RTK hazardous substances: Tetrachloroethylene Pennsylvania RTK: Tetrachloroethylene Minnesota: Tetrachloroethylene Michigan critical material: Tetrachloroethylene Massachusetts RTK: Tetrachloroethylene Massachusetts spill list: Tetrachloroethylene New Jersey: Tetrachloroethylene New Jersey spill list: Tetrachloroethylene Louisiana spill reporting: Tetrachloroethylene California Director's List of Hazardous Substances: Tetrachloroethylene TSCA 8(b) inventory: Tetrachloroethylene TSCA 8(d) H and S data reporting: Tetrachloroethylene: Effective date: 6/1/87; Sunset date: 6/1/97 SARA 313 toxic chemical notification and release reporting: Tetrachloroethylene CERCLA: Hazardous substances.: Tetrachloroethylene: 100 lbs. (45.36 kg)

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):

CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

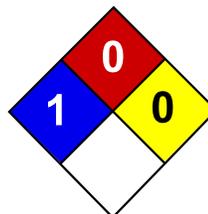
R40- Possible risks of irreversible effects. R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. S23- Do not breathe gas/fumes/vapour/spray S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S37- Wear suitable gloves. S61- Avoid release to the environment. Refer to special instructions/Safety data sheets.

HMIS (U.S.A.):**Health Hazard:** 2**Fire Hazard:** 0**Reactivity:** 0**Personal Protection:** g**National Fire Protection Association (U.S.A.):****Health:** 2**Flammability:** 0**Reactivity:** 0**Specific hazard:****Protective Equipment:**

Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information**References:** Not available.**Other Special Considerations:** Not available.**Created:** 10/10/2005 08:29 PM**Last Updated:** 11/01/2010 12:00 PM

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Health	1
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Sodium bicarbonate MSDS

Section 1: Chemical Product and Company Identification

Product Name: Sodium bicarbonate

Catalog Codes: SLS3241, SLS2446, SLS3868

CAS#: 144-55-8

RTECS: VZ0950000

TSCA: TSCA 8(b) inventory: Sodium bicarbonate

CI#: Not available.

Synonym: Baking Soda; Bicarbonate of soda; Sodium acid carbonate; Monosodium carbonate; Sodium hydrogen carbonate; Carbonic acid monosodium salt

Chemical Name: Sodium Bicarbonate

Chemical Formula: NaHCO₃

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Sodium bicarbonate	144-55-8	100

Toxicological Data on Ingredients: Not applicable.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention if irritation occurs.

Skin Contact:

Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops. Cold water may be used.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: When heated to decomposition it emits acrid smoke and irritating fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:

Do not ingest. Do not breathe dust. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as acids.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Odorless.

Taste: Saline. Alkaline.

Molecular Weight: 84.01g/mole

Color: White.

pH (1% soln/water): Not available.

Boiling Point: Not available.

Melting Point: Not available.

Critical Temperature: Not available.

Specific Gravity: Density: 2.159 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility:

Soluble in cold water. Slightly soluble in alcohol. Solubility in Water: 6.4, 7.6, 8.7, 10.0, 11.3, 12.7, 14.2, 16.5, 19.1 g/100 solution at 0, 10, 20, 30, 40, 50, 60, 80, and 100 deg. C, respectively. Solubility in Water: 6.9, 8.2, 9.6, 11.1, 12.7, 14.5, 16.5, 19.7, and 23.6 g/100g water at 0, 10, 20, 30, 40, 50, 60, 80, 100 deg. C, respectively.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, Moisture. Stable in dry air, but slowly decomposes in moist air.

Incompatibility with various substances: Reactive with acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Reacts with acids to form carbon dioxide. Dangerous reaction with monoammonium phosphate or a sodium-potassium alloy.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 3360 mg/kg [Mouse].

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

Sodium Bicarbonate as produced genetic effects in rats (unscheduled DNA synthesis). However, no affects have been found in humans.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: May cause mild skin irritation. Eyes: May cause mild eye irritation. Inhalation: May cause respiratory tract irritation. Symptoms may include coughing and sneezing. Ingestion: Symptoms of overexposure to Sodium Bicarbonate include thirst, abdominal pain, gastroenteritis, and inflammation of the digestive tract. Chronic Potential Health Effects: Skin: Repeated or prolonged skin contact may cause irritation, drying or cracking of the skin. Ingestion and Inhalation: Chronic toxicity usually occurs within 4 to 10 days following ingestion of very large amounts. Repeated or prolonged ingestion or inhalation of large amounts may cause metabolic abnormalities, and sodium retention. Metabolic abnormalities such as acidosis, hypernatremia, hypochloremia, alkalosis, hypocalcemia, or sodium retention may affect the blood, kidneys, respiration (cyanosis, apnea secondary to metabolic acidosis or pulmonary edema), and cardiovascular system (tachycardia, hypotension). Severe toxicity may also affect behavior/central nervous system/nervous system. Neurological changes may result from metabolic abnormalities. These may include fatigue, irritability, dizziness, mental confusion, paresthesia, seizures, tetany, cerebral edema Medical Conditions Aggravated by Exposure: Persons with pre-existing skin conditions might have increased sensitivity. Predisposing conditions that contribute to a mild alkali syndrome include, renal disease, dehydration, and electrolyte imbalance, hypertension, sarcoidosis, congestive heart failure, edema, or other sodium retaining conditions.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations: TSCA 8(b) inventory: Sodium bicarbonate

Other Regulations: Not available.

Other Classifications:

WHMIS (Canada): Not controlled under WHMIS (Canada).

DSCL (EEC):

This product is not classified according to the EU regulations. Not applicable.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Safety glasses.

Section 16: Other Information

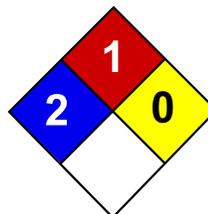
References: Not available.

Other Special Considerations: Not available.

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Last Updated: 11/01/2010 12:00 PM

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Health	2
Fire	1
Reactivity	0
Personal Protection	H

Material Safety Data Sheet Trichloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Trichloroethylene

Catalog Codes: SLT3310, SLT2590

CAS#: 79-01-6

RTECS: KX4560000

TSCA: TSCA 8(b) inventory: Trichloroethylene

CI#: Not available.

Synonym:

Chemical Formula: C₂HCl₃

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Trichloroethylene	79-01-6	100

Toxicological Data on Ingredients: Trichloroethylene: ORAL (LD50): Acute: 5650 mg/kg [Rat]. 2402 mg/kg [Mouse]. DERMAL (LD50): Acute: 20001 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects: Hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH.

MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:

After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:

Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 420°C (788°F)

Flash Points: Not available.

Flammable Limits: LOWER: 8% UPPER: 10.5%

Products of Combustion: These products are carbon oxides (CO, CO₂), halogenated compounds.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:

Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/

spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes.

Storage:

Keep container dry. Keep in a cool place. Ground all equipment containing material. Carcinogenic, teratogenic or mutagenic materials should be stored in a separate locked safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 50 STEL: 200 (ppm) from ACGIH (TLV) TWA: 269 STEL: 1070 (mg/m³) from ACGIH Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 131.39 g/mole

Color: Clear Colorless.

pH (1% soln/water): Not available.

Boiling Point: 86.7°C (188.1°F)

Melting Point: -87.1°C (-124.8°F)

Critical Temperature: Not available.

Specific Gravity: 1.4649 (Water = 1)

Vapor Pressure: 58 mm of Hg (@ 20°C)

Vapor Density: 4.53 (Air = 1)

Volatility: Not available.

Odor Threshold: 20 ppm

Water/Oil Dist. Coeff.: The product is equally soluble in oil and water; log(oil/water) = 0

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether, acetone.

Solubility:

Easily soluble in methanol, diethyl ether, acetone. Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity:

Extremely corrosive in presence of aluminum. Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

Acute oral toxicity (LD50): 2402 mg/kg [Mouse]. Acute dermal toxicity (LD50): 20001 mg/kg [Rabbit].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH. The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract.

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Passes through the placental barrier in human. Detected in maternal milk in human.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Trichloroethylene : UN1710 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Trichloroethylene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Trichloroethylene Pennsylvania RTK: Trichloroethylene Florida: Trichloroethylene Minnesota: Trichloroethylene Massachusetts RTK: Trichloroethylene New Jersey: Trichloroethylene TSCA 8(b) inventory: Trichloroethylene CERCLA: Hazardous substances.: Trichloroethylene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):

CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):

R36/38- Irritating to eyes and skin. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:54 PM

Last Updated: 11/01/2010 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.

Material Safety Data Sheet



Vinyl Chloride (Chloroethylene)

Section 1. Chemical product and company identification

Product name	: Vinyl Chloride (Chloroethylene)
Supplier	: AIRGAS INC., on behalf of its subsidiaries 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253
Product use	: Synthetic/Analytical chemistry.
Synonym	: Ethylene, chloro-; Chloroethene; Chloroethylene; Monochloroethylene; Vinyl chloride; Vinyl chloride monomer; Vinyl C monomer; C ₂ H ₃ Cl; Ethylene monochloride; Monochloroethene; Chloroethene; Chloroethylene; Chlorure de vinyle; Cloruro di vinile; Rcra waste number U043; Trovidur; UN 1086; VC; VCM; Vinile; Vinylchlorid; Vinyl chloride, inhibited; Vinyle(chlorure de); Winylu chlorek; 1-Chloroethylene
MSDS #	: 001067
Date of Preparation/Revision	: 4/27/2010.
In case of emergency	: 1-866-734-3438

Section 2. Hazards identification

Physical state	: Gas. [COLORLESS GAS OR LIQUID (BELOW 7 F) WITH A PLEASANT ODOR AT HIGH CONCENTRATIONS. [NOTE: SHIPPED AS A LIQUEFIED COMPRESSED GAS.]]
Emergency overview	: WARNING! FLAMMABLE GAS. MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED. MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA. CANCER HAZARD - CAN CAUSE CANCER. CONTENTS UNDER PRESSURE. Keep away from heat, sparks and flame. Do not puncture or incinerate container. Do not ingest. May cause target organ damage, based on animal data. Risk of cancer depends on duration and level of exposure. Use only with adequate ventilation. Wash thoroughly after handling. Keep container closed. Contact with rapidly expanding gases can cause frostbite.
Target organs	: May cause damage to the following organs: blood, kidneys, liver, mucous membranes, lymphatic system, upper respiratory tract, skin, eyes, central nervous system (CNS).
Routes of entry	: Inhalation
Potential acute health effects	
Eyes	: Irritating to eyes.
Skin	: Irritating to skin.
Inhalation	: Acts as a simple asphyxiant.
Ingestion	: Ingestion is not a normal route of exposure for gases
Potential chronic health effects	: CARCINOGENIC EFFECTS: Classified A1 (Confirmed for humans.) by ACGIH, 1 (Proven for humans.) by IARC, 1 (Known to be human carcinogens.) by NTP, + (Proven.) by OSHA, + (Proven.) by NIOSH, 1 (Proven for humans.) by European Union. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available.
Medical conditions aggravated by over-exposure	: Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (section 11)

Section 3. Composition, Information on Ingredients

<u>Name</u>	<u>CAS number</u>	<u>% Volume</u>	<u>Exposure limits</u>
Vinyl Chloride (Chloroethylene)	75-01-4	100	ACGIH TLV (United States, 1/2009). TWA: 1 ppm 8 hour(s). OSHA PEL (United States, 11/2006). STEL: 5 ppm 15 minute(s). TWA: 1 ppm 8 hour(s). OSHA PEL 1989 (United States, 3/1989). STEL: 5 ppm 15 minute(s). TWA: 1 ppm 8 hour(s).

Section 4. First aid measures

No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

- Eye contact** : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.
- Skin contact** : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.
- Frostbite** : Try to warm up the frozen tissues and seek medical attention.
- Inhalation** : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.
- Ingestion** : As this product is a gas, refer to the inhalation section.

Section 5. Fire-fighting measures

- Flammability of the product** : Flammable.
- Auto-ignition temperature** : 471.85°C (881.3°F)
- Flash point** : Open cup: -79.15°C (-110.5°F).
- Flammable limits** : Lower: 4% Upper: 22%
- Products of combustion** : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
halogenated compounds
- Fire-fighting media and instructions** : In case of fire, use water spray (fog), foam or dry chemical.

In case of fire, allow gas to burn if flow cannot be shut off immediately. Apply water from a safe distance to cool container and protect surrounding area. If involved in fire, shut off flow immediately if it can be done without risk.

Contains gas under pressure. Flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.
- Special protective equipment for fire-fighters** : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

- Personal precautions** : Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (section 8). Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.
- Environmental precautions** : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.
- Methods for cleaning up** : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see section 1 for emergency contact information and section 13 for waste disposal.

Section 7. Handling and storage

- Handling** : Use only with adequate ventilation. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Wash thoroughly after handling. High pressure gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Do not ingest. Keep container closed. Keep away from heat, sparks and flame. To avoid fire, eliminate ignition sources. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.
- Storage** : Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Segregate from oxidizing materials. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

- Engineering controls** : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.
- Personal protection**
- Eyes** : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.
- Skin** : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
- Respiratory** : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.
The applicable standards are (US) 29 CFR 1910.134 and (Canada) Z94.4-93
- Hands** : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
- Personal protection in case of a large spill** : Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product.

Product name

vinyl chloride

ACGIH TLV (United States, 1/2009).

TWA: 1 ppm 8 hour(s).

OSHA PEL (United States, 11/2006).

STEL: 5 ppm 15 minute(s).

TWA: 1 ppm 8 hour(s).

OSHA PEL 1989 (United States, 3/1989).

STEL: 5 ppm 15 minute(s).

TWA: 1 ppm 8 hour(s).

Consult local authorities for acceptable exposure limits.

Section 9. Physical and chemical properties

Molecular weight	: 62.5 g/mole
Molecular formula	: C ₂ H ₃ Cl
Boiling/condensation point	: -13.8°C (7.2°F)
Melting/freezing point	: -160°C (-256°F)
Critical temperature	: 158.5°C (317.3°F)
Vapor density	: 2.21 (Air = 1)
Specific Volume (ft³/lb)	: 6.25
Gas Density (lb/ft³)	: 0.16

Section 10. Stability and reactivity

Stability and reactivity	: The product is stable.
Incompatibility with various substances	: Extremely reactive or incompatible with the following materials: oxidizing materials.
Hazardous decomposition products	: Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Hazardous polymerization	: Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Toxicity data

Product/ingredient name	Result	Species	Dose	Exposure
vinyl chloride	LD50 Oral	Rat	500 mg/kg	-
	LC50 Inhalation Gas.	Rat	18 pph	15 minutes
	LC50 Inhalation Gas.	Rat	5000 ppm	1 hours

Chronic effects on humans : **CARCINOGENIC EFFECTS:** Classified A1 (Confirmed for humans.) by ACGIH, 1 (Proven for humans.) by IARC, 1 (Known to be human carcinogens.) by NTP, + (Proven.) by OSHA, + (Proven.) by NIOSH, 1 (Proven for humans.) by European Union. May cause damage to the following organs: blood, kidneys, liver, mucous membranes, lymphatic system, upper respiratory tract, skin, eyes, central nervous system (CNS).

Other toxic effects on humans : No specific information is available in our database regarding the other toxic effects of this material to humans.

Specific effects

Carcinogenic effects	: Can cause cancer. Risk of cancer depends on duration and level of exposure.
Mutagenic effects	: No known significant effects or critical hazards.
Reproduction toxicity	: No known significant effects or critical hazards.

Section 12. Ecological information

Aquatic ecotoxicity

Not available.

Products of degradation	: Products of degradation: carbon oxides (CO, CO ₂) and water, halogenated compounds.
Environmental fate	: Not available.
Environmental hazards	: No known significant effects or critical hazards.
Toxicity to the environment	: Not available.

Vinyl Chloride (Chloroethylene)

Section 13. Disposal considerations

Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, local regulation. Return cylinders with residual product to Airgas, Inc. Do not dispose of locally.

Section 14. Transport information

Regulatory information	UN number	Proper shipping name	Class	Packing group	Label	Additional information
DOT Classification	UN1086	VINYL CHLORIDE, STABILIZED	2.1	Not applicable (gas).		Reportable quantity 1 lb. (0.454 kg) Limited quantity Yes. Packaging instruction Passenger aircraft Quantity limitation: Forbidden. Cargo aircraft Quantity limitation: 150 kg Special provisions 21, B44, T50
TDG Classification	UN1086	VINYL CHLORIDE, STABILIZED	2.1	Not applicable (gas).		Explosive Limit and Limited Quantity Index 0.125 ERAP Index 3000 Passenger Carrying Road or Rail Index Forbidden
Mexico Classification	UN1086	VINYL CHLORIDE, STABILIZED	2.1	Not applicable (gas).		-

“Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product.”

Section 15. Regulatory information

United States

- U.S. Federal regulations** : **United States inventory (TSCA 8b):** This material is listed or exempted.
SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: vinyl chloride
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: vinyl chloride: Fire hazard, reactive, Sudden release of pressure, Immediate (acute) health hazard, Delayed (chronic) health hazard
Clean Water Act (CWA) 307: vinyl chloride
Clean Water Act (CWA) 311: No products were found.
Clean Air Act (CAA) 112 accidental release prevention: vinyl chloride
Clean Air Act (CAA) 112 regulated flammable substances: vinyl chloride
Clean Air Act (CAA) 112 regulated toxic substances: No products were found.

SARA 313

	<u>Product name</u>	<u>CAS number</u>	<u>Concentration</u>
Form R - Reporting requirements	: Vinyl Chloride (Chloroethylene)	75-01-4	100
Supplier notification	: Vinyl Chloride (Chloroethylene)	75-01-4	100

SARA 313 notifications must not be detached from the MSDS and any copying and redistribution of the MSDS shall include copying and redistribution of the notice attached to copies of the MSDS subsequently redistributed.

- State regulations** : **Connecticut Carcinogen Reporting:** This material is not listed.
Connecticut Hazardous Material Survey: This material is not listed.
Florida substances: This material is not listed.
Illinois Chemical Safety Act: This material is not listed.
Illinois Toxic Substances Disclosure to Employee Act: This material is not listed.
Louisiana Reporting: This material is not listed.
Louisiana Spill: This material is not listed.
Massachusetts Spill: This material is not listed.
Massachusetts Substances: This material is listed.
Michigan Critical Material: This material is not listed.
Minnesota Hazardous Substances: This material is not listed.
New Jersey Hazardous Substances: This material is listed.
New Jersey Spill: This material is not listed.
New Jersey Toxic Catastrophe Prevention Act: This material is not listed.
New York Acutely Hazardous Substances: This material is listed.
New York Toxic Chemical Release Reporting: This material is not listed.
Pennsylvania RTK Hazardous Substances: This material is listed.
Rhode Island Hazardous Substances: This material is not listed.

- California Prop. 65** : **WARNING:** This product contains a chemical known to the State of California to cause cancer.

<u>Ingredient name</u>	<u>Cancer</u>	<u>Reproductive</u>	<u>No significant risk level</u>	<u>Maximum acceptable dosage level</u>
Vinyl Chloride (Chloroethylene)	Yes.	No.	Yes.	No.

Canada

- WHMIS (Canada)** : Class A: Compressed gas.
Class B-1: Flammable gas.
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).
Class F: Dangerously reactive material.

Vinyl Chloride (Chloroethylene)

CEPA Toxic substances: This material is listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

United States

Label requirements : FLAMMABLE GAS.
MAY CAUSE FLASH FIRE.
HARMFUL IF SWALLOWED.
MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.
CANCER HAZARD - CAN CAUSE CANCER.
CONTENTS UNDER PRESSURE.

Canada

Label requirements : Class A: Compressed gas.
Class B-1: Flammable gas.
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).
Class F: Dangerously reactive material.

Hazardous Material Information System (U.S.A.)

Health	*	2
Flammability		4
Physical hazards		2

National Fire Protection Association (U.S.A.)



Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Appendix C
Activity Hazard Analysis

ACTIVITY HAZARD ANALYSIS

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Well drilling and Injection borehole drilling	Stuck by/Pinched Caught in Between	<ul style="list-style-type: none"> · Sufficient separation between support personnel and the operating heavy equipment must be maintained. · Wear reflective vests or high visibility clothing to promote visibility of ground personnel by equipment operators. · Isolate equipment swing areas from workers, fixed objects or other equipment. Personnel shall avoid positioning themselves between fixed objects, operating equipment. · Make/maintain eye contact with operators before approaching equipment. Do not approach equipment from rear or from blind spot of operator. Stay out of the swing radius of operating heavy equipment. · Step away from operating equipment when adjustments (positioning) are made. · Ensure equipment operator has spotter for obstructed views and backing up. 	<p>Standard Level D PPE or as required by HASP*</p> <p>* Work clothes, reflective vests/ high visibility clothing, hard hat, safety glasses and sturdy hard toed work boots, hand and hearing protection, as dictated by task.</p>
	Slips, Trips, Falls	<ul style="list-style-type: none"> · Be aware of poor footing, potential slipping/tripping hazards in the work areas, stumps/roots, unprotected holes/voids, ditches, rip rap, and various ground protrusions. Observe and avoid identified slip, trip fall hazard areas which can't be eliminated. · Use sturdy hard toe work boots with sufficient ankle support. · Institute and maintain good housekeeping practices. 	<p>Standard Level D PPE or as required by HASP*</p>
	High Ambient Temperature	<ul style="list-style-type: none"> · Provide fluids to prevent worker dehydration. · Monitor for heat stress in accordance with HASP (maintain use of buddy system). · Institute a proper work-break regiment to avoid heat stress symptoms and overexertion. 	<p>Standard Level D PPE or as required by HASP*</p>
	Poor Lighting	<ul style="list-style-type: none"> · Perform tasks in daylight hours whenever possible. If dawn, dusk or dark work is to be performed portable lighting must be provided to sufficient illuminate work area. · Do not enter poorly lit areas without first providing portable illumination. · Do not use non-explosion proof lighting/equipment in areas of flammable or combustible gases or liquids. · Use reflective vests/high visibility clothing in high traffic areas or areas with heavy equipment. 	<p>Standard Level D PPE or as required by HASP*</p>
	Noise	<ul style="list-style-type: none"> · Personnel exposed to loud working environments shall wear hearing protection (in the area of DPT/drilling equipment or air compressors). 	

ACTIVITY HAZARD ANALYSIS				
Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment	Monitoring Devices
Well Gauging, Sampling, and Investigative Derived Waste (IDW) Management	Slips, Trips, Falls	<ul style="list-style-type: none"> • Clear walkways work areas of objects • Identify uneven surfaces or ground protrusions • Institute and maintain good housekeeping practices. • Observe/avoid debris in a work area. • Only walk or climb only on surfaces designed for personnel access. • Be aware of poor footing and potential slipping and tripping hazards in the work area (wet/steep slopes, holes, ditches, rip rap, utilities). Observe and avoid areas of unprotected holes, ramps and ground penetrations or protrusions (stumps, roots, holes curbs, utility structures etc). Employees walking in ditches, swales and other drainage structures adjacent to roads, across undeveloped land or in controlled industrial work/process areas must use caution to prevent slips and falls, which could result in twisted or sprained ankles, knees, and backs. • If steep/uneven terrain must be negotiated, sturdy hard toe work boots that provide ankle support shall be used. Work boots/shoes shall have shank/toe protection in accordance with ANSI. • Avoid wet or slippery stairs, however if unavoidable, maintain contact with stairway handrail. 	<p>Level D or Modified Level D PPE *</p> <p>*Hardhats & safety glasses, Sturdy hard toe work boots. Review HASP for applicability for the addition of chemical resistant gloves, boot covers and disposable coveralls to meet Modified Level D PPE requirements.</p>	Visual Inspection
	Poor Lighting	<ul style="list-style-type: none"> • Perform tasks in daylight hours. • Do not enter poorly lit areas without first providing portable illumination. • Do not use non-explosion proof lighting/equipment in areas of flammable or combustible gases or liquids. • Use reflective vests/high visibility clothing in high traffic areas or areas with heavy equipment. 	<p>Level D or Modified Level D PPE as applicable for task</p>	Visual Inspection

ACTIVITY HAZARD ANALYSIS				
Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment	Monitoring Devices
Well Gauging, Sampling, and IDW Management	Sharp Objects	<ul style="list-style-type: none"> Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects. Do not use razor knives. Cut away from the body and never towards another worker. Maintain all hand and power tools in a safe condition. Remove damaged hand and power tools from service. 	Level D or Modified Level D PPE as applicable for task	Visual Inspection
	Fire	<ul style="list-style-type: none"> Provide ABC (or equivalent) fire extinguisher in the work area. Store flammable and combustible materials in approved containers (metal safety cans) in well ventilated areas. Eliminate ignition sources in work area (open flame, sparks, electric sources). Where ignition sources are required for work, use only controlled sources (sparkers). Be cognizant of the location of flammable or combustible materials. Do not smoke in areas containing flammable/ combustible liquids, gases, vapors or fumes. Only smoke in designated areas. 	Level D or Modified Level D PPE as applicable for task	Visual Inspection
	Biological	<ul style="list-style-type: none"> Observe ground surfaces especially in wet or grassy areas for evidence and presence of snakes (poisonous). Observe ground surfaces or surrounding vegetation or structures for presence fire ants, spiders, bee/wasp hives rabid animals etc. Observe areas for presence of stinging insects. Notify supervisors of known allergies to stinging insects and location of antidotes. Use insect repellent. Avoid exposure to blood borne pathogens . Check body and clothing for ticks, chiggers, spiders. 	Level D or Modified Level D PPE as applicable for task Insect repellent, appropriate work attire (clothes sufficiently covering body). w/	Visual Inspection

ACTIVITY HAZARD ANALYSIS				
Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment	Monitoring Devices
Well Gauging, Sampling, and IDW Management	Handling Heavy Objects	<ul style="list-style-type: none"> · Osage or subcontract personnel must notify supervisors or safety representatives of preexisting medical conditions that may be aggravated or re-injured by lifting activities such that the Osage may evaluate safe operational procedures with regard to the required task. · When lifting objects, lift using knees not back. For repetitive lifting tasks, the use of lifting braces/supports should be considered. · Plan storage and staging to minimize lifting or carrying distances. · Split heavy loads into smaller loads. · Have someone assist with the lift— especially for heavy (> 50lbs.) or awkward loads. Make sure the path of travel is clear prior to the lift. · Do not lift manhole covers, open/lift hatches or other access points to vessels, tanks or subsurface structures without proper authorization to do so, proper tools and proper personnel protective equipment. · Use carts, hand trucks additional personnel etc. to move large, awkward loads. · Avoid carrying heavy objects above shoulder level · Never walk/be positioned under or within swing radius a suspended load. · Any accumulated drums of liquid generated by sample events and are transferred by truck shall be secured by a ratchet type, heavy duty tie down to the truck body. Tie downs should be wrapped completely around the drum and attached to the actual truck bed. During transportation, vehicle will proceed slowly and cautiously to destination. Regulated or hazardous waste or materials shall not be transported by Osage vehicles or employees. 	Level D or Modified Level D PPE as applicable for task, cut resistant gloves	Visual Inspection

ACTIVITY HAZARD ANALYSIS				
Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment	Monitoring Devices
Well Gauging, Sampling, and IDW Management	General Site Control	<ul style="list-style-type: none"> · Ensure new site workers review and understand HASP requirements. Ensure Osage personnel have received the · Determine what are the areas of the facility that may not be entered (“restricted areas”). · Determine/know how an emergency be reported. Determine and have available the Facility EMS, Fire, Security Dispatch#. Identify exact facility location and position (where possible). · Have a readily available copy of the Hospital Route Map. · Determine what are standard facility emergency alarms/signals. · Designate an emergency evacuation route. · Designate an evacuation assembly area. · Know how, what, when injuries/accidents are reported and treated. · Project managers and field team leaders to 1) evaluate and ensure worker safety in remote/secluded work areas, 2) confirm if potentially dangerous activities (i.e. coincidence of hunting seasons, live ordinance use, military field exercises/activities, transfer of dangerous cargo/materials etc.) could be occurring in or adjacent to any Osage work areas that may jeopardize worker health and safety and 3) reschedule field activities when potentially dangerous activities are not occurring adjacent to Osage work locations. Ensure proper two communications with workers in remote work areas. ALWAYS Utilize the buddy system during field operations. 	Level D or Modified Level D PPE as applicable for task	Visual Inspection

ACTIVITY HAZARD ANALYSIS				
Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment	Monitoring Devices
Well Gauging, Sampling, and IDW Management	Chemical Exposure	<ul style="list-style-type: none"> · Review Contaminants of Concern for project specific locations. · Identify and understand the PPE and action level requirements identified in the site specific HASP. · Be cognizant of the potential of harmful gas or vapor build-up in the well head. Use air monitoring equipment identified in project specific HASP. · Review contaminants of concern for the project and consult project specific HASP for proper dermal and respiratory protection. · Practice “no hand-face” contact at all times. · Always wash hands before eating, drinking, smoking and leaving site. · Never enter a confined space unless authorized and trained to do so. 	Level D or Modified Level D PPE as applicable for task. Dermal and respiratory protection in accordance with HASP.	Visual Inspection * * Note Utilize air monitoring device identified in Project specific HASP.
	Electric Hazards	<ul style="list-style-type: none"> · For areas where direct exposure to energized electrical equipment may occur, Osage shall be accompanied by qualified facility representative. Maintain safe clearance distances between any electrical conducting material (transformers, electric switch gears, sub-panels, motors). Do not access these features. · If/when electrical extension cords are required to complete work, extension cords must be: <ul style="list-style-type: none"> - Equipped with third-wire grounding. - Covered, elevated, or protected from damage when passing through work areas. - Protected from pinching if routed through doorways. - Not fastened with staples, hung from nails, or suspended with wire. 	Level D or Modified Level D PPE as applicable for task	Visual Inspection

ACTIVITY HAZARD ANALYSIS				
Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment	Monitoring Devices
Well Gauging, Sampling, And IDW Management	Other	<ul style="list-style-type: none"> · Discourage unprofessional and undesirable acts on all Osage project sites. · Remind workers not to respond/participate in unprofessional and undesirable acts started by others. · Personnel to observe drug free work place policy. · Unsafe/undesirable acts to be reported to project management and safety represents for evaluation and/or corrective action. · Employees to represent themselves in a professional manner and appropriate work attire during work hours/on-site. · Do not use cell phones two way radios will driving on military/government facilities or while driving Osage vehicles. · Observe posted speed limits, other traffic signage and always use safety belts. 	NA	NA

ACTIVITY HAZARD ANALYSIS				
Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment	Monitoring Devices
Chemical Injections	Chemical Exposure	<ul style="list-style-type: none"> · Personnel performing this task shall be trained in accordance with 29CFR1910.120 Hazardous Waste Site Operations and Emergency Response (HAZWOPER) and be deemed “fit for duty” by a licensed occupation physician. · Review contaminants of concern for the project and consult project specific HASP for proper dermal and respiratory protection. · Do not touch hands to face. Do not allow dermal contact or incidental ingestion of impacted soil or groundwater. Skin contact with contaminated water, soils, debris, or equipment shall be avoided at all times. Do not kneel or step in potentially contaminated media (soil or ground water). Always wash hands before eating, drinking, smoking and leaving site. · Perform project specific air monitoring and use PPE as identified by HASP. Exercise good hygiene practices. Always wash hands before eating, drinking, smoking and leaving site. Only eat, drink, smoke or chew tobacco in designated areas. · Ensure hoses and associated hose fittings transferring chemical injection materials are in good condition and not potentially subject to rupture. · Personnel involved in chemical injection operations shall review and be familiar with handling and PPE requirements and exposure hazards for the Emulsified Vegetable Oil (EVO) MSDS for prior to use. · Face shields and other applicable PPE shall be used during injection processes to eliminate the potential for exposure to site contaminants of concern and EVO splash in the event a hose rupture occurs during the injection process. · Keep EVO materials in secured locked location when not in use and maintain drum labeling. 	<p>Level D or Modified Level D PPE *</p> <p>*Hardhats & safety glasses, Sturdy hard toe work boots. Review HASP for applicability for the addition of chemical resistant gloves, boot covers and disposable coveralls to meet Modified Level D PPE requirements.</p>	Photoionization detector (PID) or flame ionization detector (FID)

ACTIVITY HAZARD ANALYSIS				
Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment	Monitoring Devices
	Fire	<ul style="list-style-type: none"> · Review and follow JEB Little Creek Fire Prevention procedures and requirements. Secure Hot Work permit as necessary. · Keep appropriately sized, easily accessible ABC fire extinguisher in work area. · Verify requirements for proper grounding of injection pumps to eliminate the potential for buildup of static electricity. 	Level D or Modified Level D PPE as applicable for task	NA
Chemical Injections	Slips, Trips, Falls High Ambient Temperature Poor Lighting Biological Struck by Noise	<ul style="list-style-type: none"> · See above sections 	See above sections	See above sections

PRINT

SIGNATURE

Supervisor Name: _____

Date/Time: _____

Safety Officer Name: _____

Date/Time: _____

Site Personnel: _____

Date/Time: _____

Attachment B
Field Standard Operating Procedures

Osage of Virginia, Inc. (Osage) is committed to conducting environmental monitoring and remediation activities in accordance with the most current procedures and policies as described by North Carolina Department of Environment and Natural Resources (NCDENR), United States Environmental Protection Agency (USEPA), and the Department of the Navy Environmental Restoration Program (NERP). Osage has developed Standard Operating Procedures (SOPs) to be followed while conducting environmental monitoring and remediation activities on federal, state, or private facilities within North Carolina.

SOP-1 Water Level Measurements

Purpose

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.

Equipment and Materials

- Electronic water-level meter (Heron or equivalent) with a minimum 50-foot tape; the tape should have graduations in increments of 0.01 feet or less
- Interface probe (Heron Interface Meter or equivalent)

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 protective casing. If no reference is clearly visible, measure the depth to water from the northern edge of the riser. If access to the top of the riser 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 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., 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:

$$W_{Lc} = W_L + (\text{Free-product thickness} \times 0.80)$$

Where W_{Lc} = Corrected water level elevation

W_L = 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.

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 deionized water. Leave the unit turned off when not in use.

SOP-2 Low-Flow Groundwater Sampling

Purpose

This procedure 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.

Equipment and Materials

- Flow-through cell with inlet/ outlet ports for purged groundwater and watertight ports for each probe
- Meters to monitor pH, specific conductance, turbidity, dissolved oxygen, oxidation-reduction potential (ORP), and temperature (e.g., Horiba U-22 multi-parameter water quality meter or similar)
- Water level indicator
- Adjustable-rate positive-displacement pump, submersible pump, or peristaltic pump
- Generator (if submersible pump is used)
- Disposable polyethylene tubing
- Well construction information
- Calibrated container and watch with second indicator or stopwatch to determine flow rate
- Sample containers
- Shipping supplies (labels, coolers, and ice)
- Field book

Procedures and Guidelines

Setup and Purging

- For the well to be sampled, information is obtained on well location, diameter(s), depth, and screened interval(s), and the method for disposal of purged water.
- Instruments are calibrated according to manufacturer's instructions.
- The well number, site, date, and condition are recorded in the field logbook.
- 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*.
- Water level measurements are collected in accordance with *SOP Water Level Measurements*. 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 installation log or once sampling is finished.
- Attach and secure the polyethylene tubing to the low-flow pump. Lower the pump or tubing slowly into the well and set it at approximately the middle of the screen. Place the pump intake at least two (2) feet above the bottom of the well to avoid mobilization of

any sediment present in the bottom. Preferably, the pump intake should be in the middle of the screen.

- 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.
- Start purging the well at 0.3 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.
- 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 0.5-foot). The water level should stabilize for the specific purge rate. There should be at least 1 foot of water over the pump intake so there is no risk of the pump suction being broken, or entrainment of air in the sample. Record adjustments in the purge rate and changes in depth to water in the logbook. Purge rates should, if needed, be decreased (no less than 0.3-liter per minute) to avoid affecting well drawdown.
- If the well goes dry during purging and doesn't recover after several hours, the sampler should attempt to collect the sample on the following day or as soon as practicable. The collection of a "complete sample" is measured as the ability to collect the required volume for a particular analyte, not the entire suite of analytes needed. Therefore, as long as a complete sample can be collected from each trip back to a monitoring well, there is no limit on the number of trips that can be made to facilitate successful collection of the entire suite of analytes needed. If a complete sample (e.g., all the volume of sample bottle(s) required for an analytical scan) cannot be collected in a single trip back, the well may be considered not viable and require either rehabilitation or replacement. To facilitate the collection of a complete sample from a well with poor recovery alternative sample methods (i.e. passive diffusion bags [PDBs]) can be considered, as well as a reduction in the volume of groundwater required by the laboratory.
- During purging, the field parameters are measured frequently (every 3 to 5 minutes) until the parameters have stabilized. Field parameters are considered stabilized when measurements meet the following criteria:
 - pH: within 0.1 pH units
 - Specific conductance: within 3 percent
 - Dissolved oxygen: within 10 percent
 - Turbidity: within 10 percent or as low as practicable given sampling conditions
 - ORP: within 10 mV
- A minimum of one well volume should be purged prior to sampling a well

Collection of Field Data

Field parameters will be recorded on approved data sheets or within a bound logbook for each monitoring well that is sampled. The following data should be recorded:

- Project Name/Number
- Date
- Weather Conditions
- Monitoring Well ID
- Sample ID(s)
- Analyses
- Casing Diameter
- Depth to LNAPL
- Initial depth to water
- Total depth
- Water column (feet)
- Casing volume (gallons)
- Purging/sampling method and equipment used
- Start/stop purge time
- Total volume purged
- Sample time/date
- Personnel ID
- Water quality parameter information
- Problems that were encountered or any other relevant information

As previously described, the water quality parameters that are typically monitored are pH, specific conductivity, dissolved oxygen, turbidity, and oxidation reduction potential. Project-specific requirements may vary and other parameters (salinity, etc.) may need to be documented. A brief description of the various water quality parameters is available in the Virginia Department of Environmental Quality Storage Tank Program Manual Appendices (Sections Z.17.5 through Z.17.11). On occasion, it may become evident that a water quality meter/probe is malfunctioning and may require calibration. If another calibrated replacement meter is available, implement the substitute. In some instances, the unit may require maintenance, for example if supersaturated dissolved oxygen readings are encountered (see chart below), the water quality meter may require a new membrane and electrolyte solution. Water quality meter probes must always be maintained in accordance with the manufacturer's instructions. When a water quality meter is malfunctioning, requires calibration, replacement, or maintenance, it should be noted within the field data notes. Dissolved oxygen readings may also be verified with quantitative test kits such as CHEMetrics ampoules.

Maximum Dissolved Oxygen Concentration Saturation Table

Temperature (degrees C)	DO (mg/L)	Temperature (degrees C)	DO (mg/L)
0	14.60	23	8.56
1	14.19	24	8.40
2	13.81	25	8.24
3	13.44	26	8.09
4	13.09	27	7.95
5	12.75	28	7.81
6	12.43	29	7.67
7	12.12	30	7.54
8	11.83	31	7.41
9	11.55	32	7.28
10	11.27	33	7.16
11	11.01	34	7.05
12	10.76	35	6.93
13	10.52	36	6.82
14	10.29	37	6.71
15	10.07	38	6.61
16	9.85	39	6.51
17	9.65	40	6.41
18	9.45	41	6.31
19	9.26	42	6.22
20	9.07	43	6.13
21	8.90	44	6.04
22	8.72	45	5.95

Sample Collection

Once purging has been completed, the well is ready to be sampled. The elapsed time between completion of purging and collection of the groundwater sample from the well 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 bottles that are appropriate to the respective analysis and that have been cleaned to laboratory standards. Each bottle typically will have been previously prepared with the appropriate preservative, if any.

The following information, at a minimum, will be recorded in the field logbook:

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. 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.
3. Sample disposition (preservative and analysis).

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

- The cap is removed from the sample bottle, and the bottle is tilted slightly.
- The sample is slowly 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 volatile organic compounds (VOCs).
- Samples for analysis for VOCs should be collected first, if such samples are required.
- Adequate space is left in the bottle to allow for expansion, except for VOC vials, which are filled to overflowing and capped.
- The bottle is capped, then labeled clearly and carefully following the procedures in *SOP Sample Packaging and Shipping Procedures*.
- Samples are placed in appropriate containers and, if necessary, packed with ice in coolers as soon as practical.

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. It may not be possible to prevent drawdown in the well if the water bearing unit has sufficiently low permeability. If the water level was within the screened interval to start with, there is not cause for concern because there is no stagnant water in the riser above the screen to begin with.
3. For a 2-inch diameter well, each foot of riser contains 0.163 gallons; for a 4-inch riser, each foot of riser contains 0.653 gallons; for a 6-inch riser, each foot of riser contains 1.47 gallons.
4. Non-dedicated sampling equipment is removed from the well, cleaned, and decontaminated in accordance with *SOP Decontamination of Personnel and Equipment*. Disposable polyethylene tubing is disposed of with personal protective equipment (PPE) and other site trash.

Checks

- 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.
- 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.

SOP-3 Photoionization Detector (PID) Air Monitoring

Purpose

Air monitoring will be performed during the remediation activities (well installation, soil borings, and injection work) to obtain qualitative volatile organic compound (VOC) concentrations in order to protect worker safety. Air monitoring will be conducted in the breathing zone during intrusive activities. If the total VOCs concentration as measured by the PID is above the action level of 1 part per million above background for a sustained reading of 15 minutes, the additional monitoring or stop work may be conducted until further appropriate health and safety measures are taken.

Equipment and materials

- Hand-held (PID) with 11.7 electron volt (eV) lamp
- Calibration Gas (e.g., 100 ppm isobutylene)

Procedures and Guidelines

1. Turn on the instrument.
2. Calibrate the PID using procedures outlined in the owner's manual.
3. Place the tip of the instrument in the breathing zone. This may be approximately 2-5 feet above the ground surface.
4. Having the instrument set on the measurement mode, determine the reading and record in the field monitoring log. Since readings may fluctuate, the highest sustained reading should be recorded.
5. The instrument should operating in continuous operating logging mode with an alarm set for a sustained reading of 1 ppm above background.
6. The instrument should be calibrated at the beginning of each day of use and a check calibration at the finish of each field day.

Checks

- The photoionization detector will be equipped with a 11.7 eV lamp. This is capable of ionizing and detecting compounds with an ionization potential of less than 11.7 eV.
- Calibration will be performed at the beginning of each day of use with a standard calibration gas. The calibration gas has an approximate concentration of 100 parts per million of isobutylene.
- If the unit experiences abnormal perturbation or erratic readings, additional calibration may be required.
- Results of calibration procedures will be recorded in the field log book

SOP-4 Direct Push Technology (DPT) Soil Sampling

Purpose

The purpose of this procedure is to provide a general guideline for the review of soil samples using direct-push (e.g., Geoprobe) sampling methods.

Equipment and materials

- Truck-mounted hydraulic percussion hammer
- Sampling rods
- Sampling tubes and acetate liners (if desired)
- Clean nitrile gloves.

Procedures and Guidelines

1. Decontaminate sampling tubes and other non-dedicated downhole equipment in accordance with *SOP Decontamination of Personnel and Equipment*.
2. Drive sampling tube to the desired depth using the truck-mounted hydraulic percussion hammer. If soil above the desired depth is not to be sampled, first drive the lead rod, without a sampling tube, to the top of the desired depth.
3. Remove the rods and sampling tube from the borehole and remove the sample from the tube. Follow SOP 5 for Logging of Soil Borings.
4. Decontaminate all non-dedicated downhole equipment (rods, sampling tubes, etc.) in accordance with *SOP Decontamination of Personnel and Equipment*.
5. Backfill borehole at each sampling location with grout or bentonite and repair the surface with like material (bentonite, asphalt patch, concrete, etc.), as required.
6. Ensure that all DPT soil cores and other unused cuttings are aggregated with investigation derived waste (IDW) for proper disposal.

Checks

- Verify that the hydraulic percussion hammer is clean and in proper working order.
- Ensure that the direct-push operator thoroughly completes the decontamination process between sampling locations.
- Verify that the borehole made during DPT activities has been properly backfilled.

SOP-5 Logging of Soil Borings

Purpose

This SOP provides guidance to obtain accurate and consistent descriptions of soil characteristics during soil sampling operations. The characterization is based on visual examination and manual tests, not on laboratory determinations.

Equipment and Materials

- Indelible pens
- Tape measure or ruler
- Field logbook
- Soil-color chart (e.g., Munsell)
- Unified Soil Classification System (USCS) index charts and tables to help with soil classification

Procedures and Guidelines

This section covers several aspects of the soil characterization:

Instructions for Completing Soil Boring Logs

Soil boring logs will be completed in the field log books. Information collected should be consistent regardless of logger.

Heading Information

Boring/Well Number - Enter the boring/well number. A numbering system should be chosen that does not conflict with information recorded for previous exploratory work done at the site. Number the sheets consecutively for each boring.

Location - If station, coordinates, mileposts, or similar project layout information is available, indicate the position of the boring to that system using modifiers such as "approximate" or "estimated", as appropriate.

Elevation - Elevation will be determined at the conclusion of field activities.

Drilling Contractor - Enter the name of the drilling company

Drilling Method and Equipment - Identify the bit size and type, drilling fluid (if used), and method of drilling (e.g., rotary, hollow-stem auger, etc.).

Water Level - Enter the depth below ground surface to the apparent water level in the borehole. The information should be recorded as a comment. If free water is not encountered during drilling or cannot be detected because of the drilling method, this information should be noted.

Date of Start and Finish - Enter the dates the boring was begun and completed. Time of day should be added if several borings are performed on the same day.

Logger - Enter the first initial and full last name.

Technical Data

Depth Below Surface - Use a depth scale that is appropriate for the sample spacing and for the complexity of subsurface conditions.

Sample Interval - Note the depth at the top and bottom of the sample interval.

Sample Type - Enter the sample type split spoon, DPT, hand auger, etc.

Sample Recovery - Enter the length to the nearest 0.1-foot of soil sample recovered from the sampler. Often, there will be some wash or caved material above the sample; do not include the wash material in the measurement. Record recovery in feet.

Soil Description

Comments - Include all pertinent observations (changes in drilling fluid color, rod drops, drilling chatter, rod bounce as in driving on a cobble, damaged Shelby tubes, and equipment malfunctions). In addition, note if casing was used, the sizes and depths installed, and if drilling fluid was added or changed. You should instruct the driller to alert you to any significant changes in drilling (changes in material, occurrence of boulders, and loss of drilling fluid).

Classification of Soil

This section presents the format for the field classification of soil. In general, the approach and format for classifying soils should conform to ASTM D 2488.

The USCS is based on numerical values of certain soil properties that are measured by laboratory tests. It is possible, however, to estimate these values in the field with reasonable accuracy using visual-manual procedures.

Soil descriptions must be recorded for every soil section collected. The format and order for soil descriptions should be as follows:

Soil Name - Soil name should be in all capitals in the log, for example "POORLY-GRADED SAND" with appropriate modifiers (use USCS Sheet in the field). Soil name is synonymous with ASTM D 2488 Group Name.

Group symbol - State in parentheses, for example, "(SP)" (use USCS Sheet in the field).

Color - Use Munsell color designation chart.

Moisture content - Use USCS Sheet in the field.

Relative density or consistency - Use USCS Sheet in the field.

Soil structure, mineralogy, or other descriptors - Use USCS Sheet in the field.

Checks

- Check entries to the soil-boring log in the field; because the samples will be disposed of at the end of fieldwork, confirmation and corrections cannot be made later.
- Check that sample numbers and intervals are properly specified.
- Check that drilling and sampling equipment is decontaminated using the procedures defined in *SOP Decontamination of Personnel and Equipment*.

SOP-6 Installation of Shallow Monitoring Wells

Purpose

The purpose of this guideline is to describe methods for drilling and installation of shallow monitoring wells and piezometers in unconsolidated or poorly consolidated materials using hollow stem augers or mud rotary.

Equipment and materials

- Drilling rig (hollow stem auger or mud rotary) and associated tools and equipment
- Polyvinyl chloride (PVC), Schedule 40, minimum 2-inch ID, flush-threaded riser; alternatively, stainless-steel riser
- PVC, Schedule 40, minimum 2-inch ID, flush-threaded, factory slotted screen; alternatively, stainless-steel screen
- PVC bottom cap, threaded to match the well screen; alternatively, stainless steel
- PVC or stainless-steel centering guides (if used)
- Above-grade well completion: PVC well cap, threaded or push-on type, vented
- Flush-mount well completion: PVC well cap, locking, leak-proof seal Stainless steel to be used as appropriate
- Clean silica sand, provided in factory-sealed bags, well-rounded, containing no organic material, anhydrite, gypsum, mica, or calcareous material; primary (coarse) filter pack, and secondary (fine) filter pack.
- Grain size determined based on sediments observed during drilling.
- Pure, additive-free bentonite pellets or chips
- Pure, additive-free powdered bentonite
- Coated bentonite pellets; coating must biodegrade within 7 days
- Cement-Bentonite Grout: proportion 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
- Above-grade well completion: 6-inch minimum ID steel pipe with locking cover, diameter at least 2 inches greater than the well casing, painted with epoxy paint for rust protection; heavy duty lock; protective posts if appropriate
- Flush-mount well completion: Morrison 9-inch or 12-inch 519 manhole cover, or equivalent; rubber seal to prevent leakage; locking cover inside of road box
- Surge block
- Well-development pump and associated equipment
- Calibrated meters to ensure pH, temperature, specific conductance, ORP, and dissolved oxygen of development water
- Containers (e.g., DOT-approved 55-gallon drums) for water produced from well.

Procedures and Guidelines

Drilling Method

Typically, continuous-flight hollow-stem augers with a minimum 4-inch inside diameter (ID) will be used to drill shallow monitoring well boreholes. Alternatively, mud rotary may be used.

The bit of the auger is placed at the ground surface and then turned with the drilling rig. The use of water to assist in hollow-stem auger drilling for monitoring well installation will be avoided, unless required for such conditions as running sands.

Hollow-stem augers, drilling bits, rods, split-spoon samplers, and other downhole drilling tools will be properly decontaminated prior to the initiation of drilling activities and between each borehole location. Split spoon samplers and other down hole soil sampling equipment will also be properly decontaminated before and after each use.

Drill cuttings and decontamination fluids generated during well drilling activities will be contained according to the procedures detailed in the *SOP Disposal of Waste Fluids and Solids*. Mud rotary or other rotary drilling may be used instead of hollow-stem augers. The use of added mud should be kept to a minimum.

Monitoring Well Installation

Shallow monitoring wells will be constructed inside the hollow-stem augers, once the borehole has been advanced to the desired depth, or in the mudded borehole once the drilling rods have been withdrawn. If the borehole has been drilled to a depth greater than that at which the well is to be set, the borehole will be backfilled with bentonite pellets or chips or a bentonite cement slurry to a depth approximately 1 foot below the intended well depth. Approximately 1 foot of clean sand will be placed on top of the bentonite to return the borehole to the proper depth for well installation.

The appropriate lengths of well screen, normally 10 feet (with bottom cap), and casing will be joined, watertight, and lowered inside the augers to the bottom of the borehole. Centering guides, if used, will be placed at the bottom of the screen and above the interval in which the bentonite seal is placed. Selection of the filter pack and well screen intervals for the shallow monitoring wells shall be made in the field.

A primary sand pack (normally Morie #2) consisting of clean silica sand will be placed around the well screen. The sand will be placed into the borehole at a uniform rate, in a manner that will allow even placement of the sand pack. The augers will be raised gradually during sand pack installation to avoid caving of the borehole wall; at no time will the augers be raised higher than the top of the sand pack during installation. During placement of the sand, the position of the top of the sand will be continuously sounded. The primary sand pack will be extended from the bottom of the borehole to a minimum height of 2 feet above the top of the well screen. A secondary, finer-grained (e.g., Morie #00), sand pack will be installed for a minimum of 1 foot above the coarse sand pack. Heights of the coarse and fine sand packs and bentonite seal may be modified in the field to account for a shallow water table and a small saturated thickness of the surficial aquifer.

A bentonite seal at least 2 feet thick will be placed above the sand pack. The seal will be placed into the borehole in a manner that will prevent bridging. The position of the top of the bentonite seal will be verified using a weighted tape measure. If all or a portion of the bentonite seal is above the water table, clean water will be added to hydrate the bentonite. A hydration period of at least 30 minutes will be required following installation of the bentonite seal.

Above the bentonite seal, an annular seal of cement-bentonite grout will be placed. The cement-bentonite grout will be installed continuously in one operation from the bottom of the space to be grouted to the ground surface through a tremie pipe. This will allow the grout to diffuse laterally into the borehole and not disturb the bentonite pellet seal.

Well Completion

For monitoring wells that will be completed above-grade, a locking steel protective casing set in a concrete pad will be installed. The steel protective casing will extend at least 3 feet into the ground and 2 feet above ground but should not penetrate the bentonite seal. The concrete pad should measure at least 24" X 24". The concrete will be sloped away from the protective casing.

Guard posts may be installed in high-traffic areas for additional protection. Four steel guard posts will be installed around the protective casing. Guard posts will be concrete-filled, at least 3 inches in diameter, and will extend at least 2 feet into the ground and 3 feet above the ground. The protective casing and guard posts will be painted with an epoxy paint to prevent rust.

For monitoring wells with flush-mount completions, Morrison 9-inch or 12-inch 519 manhole cover or equivalent, with a rubber-sealed cover and drain will be installed. The top of the manhole cover will be positioned approximately 1 inch above grade. A square concrete pad, approximately 2 to 3 feet per side, will be installed as a concrete collar surrounding the road box cover, and will slope uniformly downward to the adjacent grade. The road box and installation thereof will be of sufficient strength to withstand normal vehicular traffic.

Concrete pads installed at all wells will be a minimum of 6 inches below grade. The concrete pad will be 12 inches thick at the center and taper to 6-inch thick at the edge. The surface of the pad should slope away from the protective casing to prevent water from pooling around the casing. Protective casing, guard posts, and flush mounts will be installed into this concrete.

Well Development

1. Using a peristaltic pump and ¼ inch polyethylene tubing, pump the wells while agitating the well with the tubing to stir up fines silt and silt, and allow this material to flow out with the purged water. Allow the tubing to reach the bottom of the well to remove as much settled material as possible. It may be necessary to completely evacuate the well several times in order to fully remove the fines and settled material.
2. If water from the well is still turbid, it may be necessary to surge the well with a surge block type device in order to remove sediment. After surging the well with the device to flush water in and out of the well through the slot and the sand pack, continue with pumping the well as described above until the water clears.
3. During development, field parameters should be measured (every 3 to 5 minutes) until the parameters have stabilized. Field parameters are considered stabilized when measurements meet the following criteria:
 - pH: within 0.1 pH units
 - Specific conductance: within 3 percent
 - Dissolved oxygen: within 10 percent
 - Turbidity: ≤ 10 NTU or as low as practicable given sampling conditions

- ORP: within 10 mV
4. Well development water will be containerized in 55-gallon DOT-approved steel drums and managed in accordance with work plan and site-specific disposal guidelines, and all state and federal regulations.

Investigation Derived Waste (IDW) Management

The IDW will include cores from the soil borings, auger cuttings, purge water, and solutions used to decontaminate non-disposable sampling equipment. IDW will be containerized in approved 55-gallon drums, which will be stored at an approved IDW satellite location. IDW will be characterized as required by the site-specific work plan. After waste characterization results have been received, an approved IDW disposal contractor will remove all IDW from the installation for proper disposal at an approved facility.

SOP-7 Decontamination of Personnel and Equipment

PERSONNEL DECONTAMINATION

Decontamination procedures will ensure that material which workers may have contacted in the contaminated area does not result in personal exposure and is not spread to clean areas of the site. This sequence describes the general decontamination procedure. The specific stages will vary depending on the site, the task, and the protection level, etc.

Level D+ Decontamination

1. Go to end of exclusion zone
2. Remove and discard latex booties
3. Remove outer gloves and discard
4. Remove protective suit (if applicable)
5. Remove inner sample gloves and discard
6. Wash face and hands

Suspected Contamination

Any employee suspected of sustaining skin contact with chemical materials will first use the emergency shower. Following a thorough drenching, the worker will proceed to the decontamination facility. Here the worker will remove clothing, shower, don clean clothing, and immediately be taken to the first aid station. Medical attention will be provided based on the degree of injury.

Personal Hygiene

Before any eating, smoking, or drinking, personnel will wash hands, arms, neck and face.

EQUIPMENT DECONTAMINATION

All contaminated equipment will be decontaminated before leaving the site and between each use. Decontamination procedures will vary depending upon the contaminant involved, but may include sweeping, wiping, scraping, hosing, or steaming the exterior of the equipment. Personnel performing this task will wear the proper PPE as prescribed by the SSO and the site-specific HASP.

Equipment and materials

- Clean tap water for washing and rinsing (can substitute distilled or deionized water)
- Distilled or de-ionized water for rinsing
- Clean containers for wash water (buckets, spray bottles, etc.)
- Clean containers for tap water rinse (buckets, spray bottles, etc.)
- Clean containers for distilled or de-ionized water rinse (bucket, spray bottle, etc.)
- Alconox
- Scrub brush (soil decontamination)
- Paper towels

Procedures and Guidelines

Groundwater Sampling Equipment – Used for Sampling

This procedure is for reusable equipment that will be used to obtain a water sample. The equipment includes any reusable pump used to collect a laboratory sample. After each sample, the equipment will be cleaned as follows:

1. Pump an Alconox and tap water wash through the pump.
2. Pump tap water through the pump and hosing.
3. Pump distilled or de-ionized water through the pump.
4. Wash the exterior with a mix of Alconox and tap water.
5. Rinse with tap water.
6. Rinse with distilled or de-ionized water.
7. Inspect for remaining particles or surface film and repeat cleaning and rinsing procedures if necessary.

Ground Water Sampling Equipment – Not for Sampling

This procedure is for equipment that will be placed in the well, but will not be used to obtain a water sample. The equipment includes water level indicators, pumps used to develop or purge the well, transducers, and slugs. After each sample, the equipment will be cleaned as follows:

1. Wash or spray the exterior surface of the portion of the equipment that contacted the groundwater with a mix of Alconox and tap water.
2. Rinse with tap water.
3. Rinse with distilled or de-ionized water.
4. Inspect for remaining particles or surface film and repeat cleaning and rinsing procedures if necessary.

Ground Water Sampling Equipment – Water Level Meter / Product Interface Probe

The product interface probe is used in wells that have previously contained free product. After each well is measured the equipment will be cleaned as follows:

1. Wipe the probe and tape with a paper towel.
2. Wash or spray the exterior surface of the portion of the equipment that contacted the groundwater with a mix of Alconox and tap water.
3. Wipe the probe and tape with a paper towel.
4. Rinse with tap water.

Soil Sampling Equipment – Hand Tools

These procedures are for hand tools used for soil sampling including shovels, hand trowels, hand augers, etc. Before collecting a new sample the equipment will be cleaned as follows:

1. Remove loose or attached soil from the tool with a gloved hand, paper towel or brush.

2. Wash and brush the tool in an Alconox and tap water wash.
3. Rinse the tool with tap water.
4. Inspect for remaining particles or surface film and repeat cleaning and rinsing procedures if necessary.

Soil Sampling Equipment – Sampling Probe Equipment

The DPT contractor is responsible for cleaning reusable sampling equipment as follows, to be enforced by Osage personnel:

1. Remove loose or attached soil with a brush.
2. Wash the sampler components in an Alconox and tap water wash.
3. Rinse the sampler components with tap water.

Soil Sampling Equipment – Drill Rig Split Spoon Sampler

The drilling contractor is responsible for cleaning reusable split spoon soil sampling equipment as follows, to be enforced by Osage personnel:

1. Remove loose or attached soil with a brush.
2. Wash the sampler components in a soap and tap water wash.
3. Rinse the sampler components with tap water.

Soil Sampling Equipment – Drill Rig Auger Flights

The drilling contractor is responsible for providing clean auger equipment; however Osage personnel must ensure that proper procedures are followed. Prior to each use the auger flights should be cleaned as follows:

1. Remove loose or attached soil with a brush.
2. Wash the auger flight with a pressure washer and clean water.

DISPOSAL

All decontamination liquids and disposable clothing will be treated as contaminated waste unless determined otherwise by accepted testing methods. Wastes will be disposed of according to state and federal regulations.

SOP-8 Sample Packaging and Shipping Procedures

Purpose

Specific requirements for sample packaging and shipping must be followed to ensure the proper transfer and documentation of environmental samples collected during field operations. Procedures for the careful and consistent transfer of samples from the field to the laboratory are outlined below.

Equipment

- Ice in doubled, sealable bags (e.g., Ziploc[®] bags) or dry ice
- Large plastic garbage bags
- Paper towels
- Coolers
- Bubble wrap
- Clear plastic packing tape
- Duct tape
- Plastic garbage bags
- Scissors
- Chain-of-custody seals
- Airbills for overnight shipment (as applicable)
- Chain-of-custody record/sample analysis request forms.

Procedure

At the sample collection site:

1. Document samples using a field logbook, the required sample container identification (i.e., sample labels and sample tags), and a chain-of-custody record/sample analysis request (COC/SAR) form.
2. Make sure applicable laboratory quality control sample designations have been made on the COC/SAR form. Samples that will be archived for future possible analysis should be clearly identified on the COC/SAR form by noting the following: “Do Not Analyze: Hold and archive.”
3. Clean any gross contamination from the outside of any dirty sample containers to remove any residual material that may lead to cross-contamination.
4. Store VOC sample containers in an individual sealable plastic bag that allows the sample label to be read. Volatile organic analyte (VOA) vials for a single sample must be encased in bubble wrap before being sealed in bags.
5. Place a sufficient amount of ice in the sample cooler to maintain the temperature inside the cooler (e.g., 4°C) throughout the sampling day.

Prior to shipping:

1. Check sample containers against the COC/SAR form to ensure that all samples for shipment are accounted for.

2. If the cooler has an exterior drain at the bottom of the cooler, the drain should be capped and thoroughly taped shut with duct tape to prevent any water leakage.
3. The cooler should be lined with bubble wrap and a large plastic bag should be opened and placed inside the cooler.
4. Individually wrap each glass container in bubble wrap. Place the wrapped samples into the large plastic bag in the cooler; leaving sufficient room for ice to keep the samples cold (i.e., 4°C). Always over-estimate the amount of ice that you think will be required. Ice should be enclosed in a sealable plastic bag and then placed in a second sealable plastic bag to prevent leakage. Avoid separating the samples from the ice with excess bubble wrap because it will insulate the containers from the ice. Ensure that there is no void space so as to prevent samples from shifting during transport.
5. If possible, consolidate all VOA samples in a single cooler and ship them with trip blank(s).
6. If temperature blanks have been provided by the testing laboratory, include one temperature blank in each sample cooler.
7. Sign, date, and include any tracking numbers provided by the shipper on the COC/SAR form. Remove the back copy of the original COC/SAR form and retain this copy for the project records.
8. Place the rest of the signed COC/SAR form in a sealable bag and tape the bag containing the form to the inside of the cooler lid.
9. After the cooler is sufficiently packed to prevent shifting of the containers, close the lid and seal it shut with packing tape. Tape the cooler shut around the opening between the lid and the bottom of the cooler and around the circumference of the cooler at both hinges.
10. Apply a COC seal across the opening of the cooler lid. Be sure the seals is properly affixed to the cooler so it is not removed during shipment. Additional tape across the seal may be necessary if the outside of the cooler is wet.
11. If shipping, use a shipping mailing label and label the cooler with destination and return addresses. If the shipment contains multiple coolers, indicate on the mailing label the number of coolers that the testing laboratory should expect to receive (e.g., 1 of 2; 2 of 2). Place clear tape over the mailing label to firmly affix it to the outside of the cooler and to protect it from the weather.
12. Notify the laboratory contact and the Osage Project Manager that samples will be shipped and the estimated arrival date and time. All environmental samples that are shipped at 4°C will be shipped overnight for next morning delivery.

Attachment C
TestAmerica Department of Defense Environmental Laboratory Accreditation Program
Certificate of Accreditation



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

TEST AMERICA SAVANNAH
 5102 LaRoche Avenue
 Savannah, GA 31404
 Andrea Teal Phone: 912 354 7858

ENVIRONMENTAL

Valid To: February 28, 2013

Certificate Number: 0399.01

In recognition of the successful completion of the A2LA evaluation process, (including an assessment of the laboratory's compliance with ISO IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the current DoD Quality Systems Manual for Environmental Laboratories) accreditation is granted to this laboratory to perform recognized EPA methods using the following testing technologies and in the analyte categories identified below and for the test methods applicable to Kentucky Statute KRS 224.60-130(2)(a):

Testing Technologies

Atomic Absorption/ICP-AES Spectrometry, Gas Chromatography, Gas Chromatography/Mass Spectrometry, Gravimetry, Ion Chromatography, ICP/MS, Methylene Blue Active Substances, Misc.- Electronic Probes (pH, F⁻, O₂), Oxygen Demand, Hazardous Waste Characteristics Tests, Spectrophotometry (Visible), Spectrophotometry (Automated), Titrimetry, Total Organic Carbon, Total Organic Halide, Turbidity

<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Metals				
Aluminum	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A ISM01.2 (ICP) ISM01.2 (ICPMS)	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A ISM01.2 (ICP)

<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Antimony	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A ISM01.2 (ICP) ISM01.2 (ICPMS)	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A ISM01.2 (ICP) ISM01.2 (ICPMS)
Arsenic	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A ISM01.2 (ICP) ISM01.2 (ICPMS)	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A ISM01.2 (ICP) ISM01.2 (ICPMS)
Barium	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A ISM01.2 (ICP) ISM01.2 (ICPMS)	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A ISM01.2 (ICP) ISM01.2 (ICPMS)

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Beryllium	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A ISM01.2 (ICP) ISM01.2 (ICPMS)	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A ISM01.2 (ICP) ISM01.2 (ICPMS)
Boron	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A
Cadmium	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A ISM01.2 (ICP) ISM01.2 (ICPMS)	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A ISM01.2 (ICP) ISM01.2 (ICPMS)

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Calcium	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A ISM01.2 (ICP) ISM01.2 (ICPMS)	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A ISM01.2 (ICP)
Chromium	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A ISM01.2 (ICP) ISM01.2 (ICPMS)	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A ISM01.2 (ICP) ISM01.2 (ICPMS)
Chromium 3+	SM 3500 Cr B_01 SM3500 Cr D	EPA 7196A SM 3500 Cr B_01 SM 3500 Cr D	EPA 7196A SM 3500 Cr B_01 SM 3500 Cr D	EPA 3060A/7196A
Chromium 6+	SM 3500 Cr B_01 SM3500 Cr D	EPA 7196A SM 3500 Cr B_01 SM 3500 Cr D	EPA 7196A SM 3500 Cr B_01 SM 3500 Cr D	EPA 3060A/7196A

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Cobalt	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A ISM01.2 (ICP) ISM01.2 (ICPMS)	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A ISM01.2 (ICP) ISM01.2 (ICPMS)
Copper	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A ISM01.2 (ICP) ISM01.2 (ICPMS)	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A ISM01.2 (ICP) ISM01.2 (ICPMS)
Iron	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A ISM01.2 (ICP) ISM01.2 (ICPMS)	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A ISM01.2 (ICP)

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Iron, Ferric	SM 3500 Fe B_97 SM3500 Fe D	SM 3500 Fe B_97 SM3500 Fe D	SM 3500 Fe B_97 SM3500 Fe D	-----
Iron, Ferrous	SM 3500 Fe B_97 SM3500 Fe D	SM 3500 Fe B_97 SM3500 Fe D	SM 3500 Fe B_97 SM3500 Fe D	-----
Lead	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A ISM01.2 (ICP) ISM01.2 (ICPMS)	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A ISM01.2 (ICP) ISM01.2 (ICPMS)
Magnesium	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A ISM01.2 (ICP) ISM01.2 (ICPMS)	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A ISM01.2 (ICP)



<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Manganese	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A ISM01.2 (ICP) ISM01.2 (ICPMS)	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A ISM01.2 (ICP) ISM01.2 (ICPMS)
Mercury	EPA 200.8 EPA 245.1	EPA 200.8 EPA 245.1 SM 3112B	EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A EPA 7470A ISM01.2 (Hg) SM 3112B	EPA 3050B/6020 EPA 3050B/6020A EPA 7471A EPA 7471B ISM01.2 (Hg)
Molybdenum	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Nickel	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A ISM01.2 (ICP) ISM01.2 (ICPMS)	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A ISM01.2 (ICP) ISM01.2 (ICPMS)
Potassium	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A ISM01.2 (ICP) ISM01.2 (ICPMS)	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A ISM01.2 (ICP)
Selenium	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A ISM01.2 (ICP) ISM01.2 (ICPMS)	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A ISM01.2 (ICP) ISM01.2 (ICPMS)

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Silica	EPA 200.7	EPA 200.7	EPA 6010B EPA 6010C	-----
Silicon	EPA 200.7	EPA 200.7	EPA 6010B EPA 6010C	-----
Silver	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A ISM01.2 (ICP) ISM01.2 (ICPMS)	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A ISM01.2 (ICP) ISM01.2 (ICPMS)
Sodium	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A ISM01.2 (ICP) ISM01.2 (ICPMS)	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A ISM01.2 (ICP)
Sodium Adsorption Ratio	-----	USDA 20B	USDA 20B	-----

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Strontium	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A
Thallium	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A ISM01.2 (ICP) ISM01.2 (ICPMS)	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A ISM01.2 (ICP) ISM01.2 (ICPMS)
Tin	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Titanium	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A
Vanadium	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A ISM01.2 (ICP) ISM01.2 (ICPMS)	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A ISM01.2 (ICP) ISM01.2 (ICPMS)
Zinc	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 3005A/6010B EPA 3010A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B EPA 3005A/6010C EPA 3010A/6010C SM 3030C/EPA 6010C EPA 3005A/6020 EPA 3010A/6020 SM 3030C/EPA 6020 EPA 3005A/6020A EPA 3010A/6020A SM 3030C/EPA 6020A ISM01.2 (ICP) ISM01.2 (ICPMS)	EPA 3050B/6010B EPA 3050B/6010C EPA 3050B/6020 EPA 3050B/6020A ISM01.2 (ICP) ISM01.2 (ICPMS)

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
<u>Nutrients</u>				
Ammonia (as N)	EPA 350.1 SM4500NH3 G	EPA 350.1 SM4500NH3 G	EPA 350.1 SM4500NH3 G	-----
Kjeldahl nitrogen	EPA 351.2	EPA 351.2	EPA 351.2	-----
Nitrate (as N)	EPA 300.0 EPA 353.2	EPA 300.0 EPA 353.2 EPA 9056 EPA 9056A	EPA 300.0 EPA 353.2 EPA 9056 EPA 9056A	EPA 300.0 EPA 9056 EPA 9056A
Nitrate-nitrite (as N)	EPA 300.0 EPA 353.2	EPA 300.0 EPA 353.2 EPA 9056 EPA 9056A	EPA 300.0 EPA 353.2 EPA 9056 EPA 9056A	EPA 300.0 EPA 9056 EPA 9056A
Nitrite (as N)	EPA 300.0 EPA 353.2	EPA 300.0 EPA 353.2 EPA 9056 EPA 9056A	EPA 300.0 EPA 353.2 EPA 9056 EPA 9056A	EPA 300.0 EPA 9056 EPA 9056A
Nitrate (as NO3)	EPA 300.0 EPA 353.2	EPA 300.0 EPA 353.2 EPA 9056 EPA 9056A	EPA 300.0 EPA 353.2 EPA 9056 EPA 9056A	EPA 300.0 EPA 9056 EPA 9056A
Nitrate-nitrite (as NO3-NO2)	EPA 300.0 EPA 353.2	EPA 300.0 EPA 353.2 EPA 9056 EPA 9056A	EPA 300.0 EPA 353.2 EPA 9056 EPA 9056A	EPA 300.0 EPA 9056 EPA 9056A
Nitrite (as NO2)	EPA 300.0 EPA 353.2	EPA 300.0 EPA 353.2 EPA 9056 EPA 9056A	EPA 300.0 EPA 353.2 EPA 9056 EPA 9056A	EPA 300.0 EPA 9056 EPA 9056A
Organic Nitrogen (as N)	-----	TKN minus Ammonia	TKN minus Ammonia	-----
Orthophosphate (as P)	EPA 365.1 SM4500P F	EPA 365.1 SM4500P F	EPA 365.1 SM4500P F	-----
Total Nitrogen (as N)	-----	TKN plus Nitrate-Nitrite (as N)	TKN plus Nitrate-Nitrite (as N)	-----
Total phosphorus	EPA 365.4	EPA 365.4	EPA 365.4	-----
<u>Demands</u>				
Adsorbable organic halides (AOX)	-----	EPA 1650	EPA 1650	-----
Biochemical oxygen demand	EPA 405.1 SM 5210 B	EPA 405.1 SM 5210 B	EPA 405.1 SM 5210 B	-----
Carbonaceous BOD	SM 5210 B	SM 5210 B	SM 5210 B	-----
Chemical oxygen demand	EPA 410.4 SM 5220 D	EPA 410.4 SM 5220 D	EPA 410.4 SM 5220 D	-----



<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Dissolved carbon	EPA 415.1 SM 5310B	EPA 415.1 SM 5310B EPA 9060 EPA 9060A	EPA 415.1 SM 5310B EPA 9060 EPA 9060A	-----
Dissolved inorganic carbon	EPA 415.1 SM 5310B	EPA 415.1 SM 5310B EPA 9060 EPA 9060A	EPA 415.1 SM 5310B EPA 9060 EPA 9060A	-----
Dissolved organic carbon	EPA 415.1 SM 5310B	EPA 415.1 SM 5310B EPA 9060 EPA 9060A	EPA 415.1 SM 5310B EPA 9060 EPA 9060A	-----
Extractable organic halides	-----	-----	-----	EPA 9023
Total carbon	EPA 415.1 SM 5310B	EPA 415.1 SM 5310B EPA 9060 EPA 9060A	EPA 415.1 SM 5310B EPA 9060 EPA 9060A	-----
Total inorganic carbon	EPA 415.1 SM 5310B	EPA 415.1 SM 5310B EPA 9060 EPA 9060A	EPA 415.1 SM 5310B EPA 9060 EPA 9060A	-----
Total organic carbon	EPA 415.1 SM 5310B	EPA 415.1 SM 5310B EPA 9060 EPA 9060A	EPA 415.1 SM 5310B EPA 9060 EPA 9060A	EPA 9060 EPA 9060A Lloyd Kahn
Total organic halides	EPA 9020B	EPA 450.1 EPA 9020B	EPA 9020B EPA 450.1	-----
<u>Wet Chemistry</u>				
Acidity	EPA 305.1 SM 2310B	EPA 305.1 SM 2310B	EPA 305.1 SM 2310B	-----
Alkalinity	EPA 310.1 SM 2320B	EPA 310.1 SM 2320B	EPA 310.1 SM 2320B	-----
Anion/Cation Balance	-----	SM 1030 F	SM 1030 F	-----
Bicarbonate alkalinity	EPA 310.1 SM 2320B	EPA 310.1 SM 2320B	EPA 310.1 SM 2320B	-----
Bromide	EPA 300.1B	EPA 300.0 EPA 9056 EPA 9056A	EPA 300.0 EPA 9056 EPA 9056A	EPA 300.0 EPA 9056 EPA 9056A
Bromate	EPA 300.1B	-----	-----	-----



<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Carbon dioxide, free	EPA 310.1 SM 2320B	EPA 310.1 SM 2320B	EPA 310.1 SM 2320B	-----
Carbonate alkalinity	EPA 310.1 SM 2320B	EPA 310.1 SM 2320B SM 4500 CO2 D	EPA 310.1 SM 2320B SM 4500 CO2 D	-----
Chlorate	EPA 300.1B	-----	-----	-----
Chloride	EPA 300.0 EPA 325.2 SM 4500 Cl- E	EPA 300.0 EPA 325.2 SM4500 Cl- E EPA 9056 EPA 9056A EPA 9251	EPA 9056 EPA 9056A EPA 9251 EPA 300.0 EPA 325.2 SM4500 Cl-E	EPA 300.0 EPA 9056 EPA 9056A EPA 9251
Chloride, residual	EPA 330.3 SM 4500 Cl-B	EPA 330.3 SM4500 Cl-B	EPA 330.3 SM4500 Cl-B	-----
Chlorite	EPA 300.1B	-----	-----	-----
Color	EPA 110.2 SM 2120B	EPA 110.2 SM 2120B	EPA 110.2 SM 2120B	-----
Corrosivity-calc.carb. stability	SM 2330B	SM 2330B	SM 2330B	-----
Cyanide	EPA 335.4 SM 4500-CN-E	EPA 335.4 SM 4500 CN-E ISM01.2 (CN) EPA 9012A EPA 9012B	EPA 9012A EPA 9012B ISM01.2 (CN) EPA 335.4 SM 4500 CN-E	EPA 9012A EPA 9012B ISM01.2 (CN)
Cyanide amenable to chlorination	EPA 335.1	EPA 335.1 EPA 9013/9012A EPA 9013/9012B	EPA 9013/9012A EPA 9013/9012B EPA 335.1	EPA 9013/9012A EPA 9013/9012B
Cyanide, weak acid dissociable	-----	SM 4500-CN-I	SM 4500-CN-I	-----
Fluoride	EPA 300.0 SM 4500-F-C	EPA 300.0 EPA 9056 EPA 9056A SM 4500-F-C	EPA 300.0 EPA 9056 EPA 9056A SM 4500-F-C	EPA 300.0 EPA 9056 EPA 9056A
Hardness (as calcium carbonate)	EPA 130.2 SM 2340B SM 2340C	EPA 130.2 SM 2340B SM 2340C	EPA 130.2 SM 2340B SM 2340C	-----
Hardness, Calcium (as calcium carbonate)	SM 2340B	SM 2340B	SM 2340B	-----
Hardness, Magnesium (as calcium carbonate)	SM 2340B	SM 2340B	SM 2340B	-----



<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Hydroxide alkalinity	EPA 310.1 SM 2320B	EPA 310.1 SM 2320B	EPA 310.1 SM 2320B	-----
Odor	EPA 140.1 SM 2150 B	-----	-----	-----
Oxygen, dissolved	EPA 360.2 SM 4500 O C	EPA 360.2 SM 4500 O C	EPA 360.2 SM 4500 O C	-----
Perchlorate	EPA 314.0	EPA 314.0	EPA 314.0	EPA 314.0
pH	EPA 150.1 SM 4500 H+ B	EPA 150.1 SM 4500 H+ B EPA 9040B EPA 9040C	EPA 9040B EPA 9040C EPA 150.1 SM 4500 H+ B	EPA 9045C EPA 9045D
Phenolphthalein alkalinity	EPA 310.1 SM 2320B	EPA 310.1 SM 2320B	EPA 310.1 SM 2320B	-----
MBAS (Surfactants)	EPA 425.1 SM 5540C	EPA 425.1 SM 5540C	EPA 425.1 SM 5540C	
Oil and Grease (HEM)	-----	EPA 1664A	EPA 1664A	EPA 9071B
Phenols	EPA 420.1	EPA 420.1 EPA 9065 EPA 9065A	EPA 9065 EPA 9065A EPA 420.1	EPA 9065 EPA 9065A
Filterable residue	EPA 160.1 SM 2540C	EPA 160.1 SM 2540C	EPA 160.1 SM 2540C	-----
Nonfilterable residue	EPA 160.2 SM 2540D	EPA 160.2 SM 2540D	EPA 160.2 SM 2540D	-----
Settleable Residue	EPA 160.5 SM 2540F	EPA 160.5 SM 2540F	EPA 160.5 SM 2540F	-----
Total residue	EPA 160.3 SM 2540B	EPA 160.3 SM 2540B	EPA 160.3 SM 2540B	SM2540G
Volatile dissolved residue	-----	SM 2540E	SM 2540E	-----
Total volatile suspended residue	-----	SM 2540E	SM 2540E	-----
Volatile residue	EPA 160.4 SM 2540E	EPA 160.4 SM 2540E	EPA 160.4 SM 2540E	SM2540G
Ash Content	-----	SM 2540E	SM 2540E	SM2540G
Fixed residue	-----	-----	-----	SM2540G
Percent Moisture	-----	-----	-----	SM2540G
Resistivity	EPA 120.1 SM 2510B	EPA 120.1 SM 2510B	EPA 120.1 SM 2510B	-----
Salinity	SM 2520B	SM 2520B	SM 2520B	-----
Specific conductance	EPA 120.1 SM 2510B	EPA 120.1 SM 2510B	EPA 9050A EPA 120.1 SM 2510B	EPA 9050A



<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Sulfide	EPA 376.1 SM4500-S2-F	EPA 376.1 EPA 9030B/9034 SM4500 S2 F	EPA 9030B/9034 EPA 376.1 SM4500 S2 F	EPA 9030B/9034
Sulfate	EPA 300.0 EPA 375.4	EPA 300.0 EPA 375.4 EPA 9038 EPA 9056 EPA 9056A	EPA 300.0 EPA 375.4 EPA 9056 EPA 9056A EPA 9038	EPA 300.0 EPA 9056 EPA 9056A EPA 9038
Sulfite	EPA 377.1 SM4500 SO3 B	EPA 377.1 SM4500 SO3 B	EPA 377.1 SM4500-SO3-B	-----
Tannin & Lignin	-----	SM 5550 B	SM 5550 B	-----
Thiocyanate	SM 4500 CN M	SM 4500 CN M	SM 4500 CN M	-----
Total Petroleum Hydrocarbons (TPH or SGT-HEM)	-----	EPA 1664A	EPA 1664A	EPA 9071B
Turbidity	EPA 180.1 SM 2130B	EPA 180.1 SM 2130B	EPA 180.1 SM 2130B	-----
Unionized ammonia	-----	FL-DEP SOP	FL-DEP SOP	-----
UV-254	SM5910B	-----	-----	-----
<u>Purgeable Organics (Volatiles)</u>				
Acetone	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Acetonitrile	-----	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Acrolein	-----	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Acrylonitrile	-----	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Amyl acetate, mixed isomers	-----	EPA 1666	EPA 1666	-----
Benzene	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
BTEX, Total		EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Bromobenzene	EPA 524.2	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Bromochloromethane	EPA 524.2	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Bromodichloromethane	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Bromoform	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Bromomethane	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
n-Butanol	-----	-----	EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
sec-Butanol	-----	-----	EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
2-Butanone	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
2-Butoxyethanol (Butyl cellosolve)	-----	-----	EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
n-Butyl acetate	-----	EPA 1666	EPA 1666 EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
sec-Butyl acetate	-----	-----	EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
tert-Butyl alcohol (2-methyl-2-propanol)	-----	-----	EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
n-Butylbenzene	EPA 524.2	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Sec-Butylbenzene	EPA 524.2	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Tert-Butylbenzene	EPA 524.2	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Carbon disulfide	-----	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Carbon tetrachloride	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Cellosolve acetate	-----	-----	EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
Chlorobenzene	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Chloroethane	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
2-Chloroethyl vinyl ether	-----	EPA 624	EPA 5030B/8260B	-----
Chloroform	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
1-Chlorohexane	-----	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
4-Isopropyltoluene	EPA 524.2	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Chloromethane	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
3-Chloro-1-propene	-----	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Chloroprene	-----	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Cyclohexane	-----	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
2-Chlorotoluene	EPA 524.2	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
4-Chlorotoluene	EPA 524.2	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Dibromoacetic Acid (DBAA)	EPA 552.2	-----	-----	-----
Dibromochloromethane	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504.1 EPA 524.2	-----	EPA 5030B/8260B EPA 8011	EPA 5030/8260B EPA 5035A/8260B
Dibromomethane	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
1,2-Dibromoethane (EDB)	EPA 504.1 EPA 524.2	EPA 624	EPA 5030B/8260B EPA 8011	EPA 5030/8260B EPA 5035A/8260B
Dichloroacetic Acid (DCAA)	EPA 552.2	-----	-----	-----
1,2-Dichlorobenzene	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
1,3-Dichlorobenzene	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
1,4-Dichlorobenzene	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Trans-1,4-dichloro-2-butene	-----	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Dichlorodifluoromethane	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
1,1-Dichloroethane	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
1,2-Dichloroethane	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
1,1-Dichloroethene	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
cis-1,2-Dichloroethene	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
trans-1,2-Dichloroethene	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
1,2-Dichloroethene, Total	-----	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
1,2-Dichloropropane	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
1,3-Dichloropropane	EPA 524.2	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
2,2-Dichloropropane	EPA 524.2	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
1,1-Dichloropropene	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
cis-1,3-Dichloropropene	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
trans-1,3-Dichloropropene	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
1,3-Dichloropropene, Total	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Diethyl ether	-----	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Diisopropyl ether	EPA 524.2	-----	-----	-----
1,4-Dioxane	-----	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Ethanol	-----	-----	EPA 8015B-DAI EPA 8015C-DAI EPA 5030B/8260B	EPA 8015B-DAI EPA 8015C-DAI EPA 5030/8260B EPA 5035A/8260B
Ethyl acetate	-----	EPA 1666	EPA 1666 EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
Ethyl benzene	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Ethyl methacrylate	-----	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Ethylene glycol	-----	-----	EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
Tetraethylene glycol	-----	-----	EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
Triethylene glycol	-----	-----	EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
Furan	-----	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Haloacetic Acids, Total (HAA5)	EPA 552.2	-----	-----	-----
n-Heptane	-----	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
n-Heptanol	-----	-----	EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
2-Hexanone	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Hexachlorobutadiene	EPA 524.2	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Hexane	-----	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Isoamyl acetate	-----	-----	EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
Isobutanol	-----	-----	EPA 5030B/8260B EPA 8015B-DAI EPA 8015C-DAI	EPA 5030/8260B EPA 5035A/8260B EPA 8015B-DAI EPA 8015C-DAI
Isobutyl acetate	-----	-----	EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
Isopropyl acetate	-----	EPA 1666	EPA 1666 EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
Isopropanol	-----	-----	EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
Isopropyl ether	-----	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Isopropylbenzene	EPA 524.2	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Iodomethane	-----	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Methacrylonitrile	-----	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Methanol	-----	-----	EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
Methyl acetate	-----	-----	EPA 5030B/8260B EPA 8015B-DAI EPA 8015C-DAI	EPA 5030/8260B EPA 5035A/8260B EPA 8015B-DAI EPA 8015C-DAI
Methylene chloride	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Methyl isobutyl ketone	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Methyl methacrylate	-----	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Methyl cyclohexane	-----	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Monobromoacetic Acid (MBAA)	EPA 552.2	-----	-----	-----
Monochloroacetic Acid (MCAA)	EPA 552.2	-----	-----	-----
Methyl tert-butyl ether (MTBE)	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Naphthalene	EPA 524.2	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
2,2'-Oxybisethanol (Diethylene glycol)	-----	-----	EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
Pentachloroethane	-----	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Phenol	-----	-----	EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
n-Propanol	-----	-----	EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
Propionitrile	-----	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
2-Propoxy ethanol (Propyl cellosolve)	-----	-----	EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
n-Propyl acetate	-----	-----	EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
n-Propylbenzene	EPA 524.2	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Propylene glycol	-----	-----	EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
Di-propylene glycol	-----	-----	EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
Di-propylene glycol methyl ether	-----	-----	EPA 8015B-DAI	EPA 8015B-DAI
Styrene	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Tert-amyl alcohol	-----	-----	EPA 8015B-DAI EPA 8015C-DAI	EPA 8015B-DAI EPA 8015C-DAI
Tert-amyl methyl ether (TAME)	EPA 524.2	-----	-----	-----
Tert-butyl alcohol (TBA)	EPA 524.2	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Tert-butyl ethyl ether (ETBE)	EPA 524.2	-----	-----	-----
1,1,1,2- Tetrachloroethane	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
1,1,2,2- Tetrachloroethane	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Tetrachloroethene	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Tetrahydrofuran	-----	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Toluene	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Trichloroacetic acid	EPA 552.2	-----	-----	-----
1,1,1-Trichloroethane	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
1,1,2-Trichloroethane	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Trichloroethene	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Trichlorofluoromethane	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
1,2,3-Trichlorobenzene	EPA 524.2	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
1,2,4-Trichlorobenzene	EPA 524.2	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
1,2,3-Trichloropropane	EPA 524.2 EPA 504.1	-----	EPA 5030B/8260B EPA 8011	EPA 5030/8260B EPA 5035A/8260B
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	EPA 524.2	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
1,2,4-Trimethylbenzene	EPA 524.2	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
1,3,5-Trimethylbenzene	EPA 524.2	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Trihalomethanes, Total	EPA 524.2	-----	-----	-----
Vinyl acetate	-----	-----	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Vinyl chloride	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Xylenes, total	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
1,2-Xylene	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
1,3 & 1,4-Xylene	EPA 524.2	EPA 624	EPA 5030B/8260B	EPA 5030/8260B EPA 5035A/8260B
Gasoline Range Organics	-----	-----	EPA 5030B/8015B EPA 5030B/8015C	EPA 5030/8015B EPA 5035A/8015B EPA 5030/8015C EPA 5035A/8015C

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
<u>Extractable Organics (Semivolatiles)</u>				
Acenaphthene	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Acenaphthylene	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Acetochlor	EPA 525.2	-----	-----	-----
Acetophenone	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
2-Acetylaminofluorene	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Alachlor	EPA 525.2	-----	-----	-----
4-Aminobiphenyl	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Aniline	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Anthracene	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Aramite, Total	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Atrazine	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Benzaldehyde	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Benzidine	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Benzoic acid	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Benzo (a) anthracene	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Benzo (b) fluoranthene	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Benzo (k) fluoranthene	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Benzo (ghi) perylene	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Benzo (a) pyrene	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Benzyl alcohol	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
1,1-Biphenyl	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Bis (2-chloroethoxy) methane	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Bis (2-chloroethyl) ether	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Bis (2-chloroisopropyl) ether	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Bis (2-ethylhexyl) phthalate	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Bromacil	EPA 525.2	-----	-----	-----
4-Bromophenylphenyl ether	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Butachlor	EPA 525.2	-----	-----	-----
Butylate	EPA 525.2	-----	-----	-----
Butyl benzyl phthalate	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
2-sec-Butyl-4,6-dinitrophenol	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Caprolactam	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Carbazole	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
4-Chloroaniline	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
4-Chloro-3-methylphenol	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
2-Chloronaphthalene	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
2-Chlorobiphenyl	EPA 525.2	-----	-----	-----



<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
2-Chlorophenol	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
4-Chlorophenol	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
4-Chlorophenyl phenyl ether	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Chrysene	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Cresols (total methyl phenols)	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Diallate	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Dibenzofuran	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Dibenz(a,h) anthracene	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
1,2-Dichlorobenzene	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
1,3-Dichlorobenzene	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
1,4-Dichlorobenzene	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
3,3-Dichlorobenzidine	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
2,4-Dichlorophenol	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
2,6-Dichlorophenol	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Diethyl phthalate	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Di(2-ethylhexyl)adipate	EPA 525.2	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Dimethoate	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
p-Dimethylaminoazobenzene	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
7,12-Dimethylbenz (a) anthracene	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
3,3'-Dimethylbenzidine	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Alpha-, alpha-Dimethylphenethylamine	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
2,3-Dimethylphenol	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
2,4-Dimethylphenol	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
2,5-Dimethylphenol	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
2,4 & 2,5-Dimethylphenol	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
2,6-Dimethylphenol	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
3,4-Dimethylphenol	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Dimethyl phthalate	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Di-n-butyl phthalate	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Di-n-octyl phthalate	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Diphenyl ether	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
1,3-Dinitrobenzene	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
2,4-Dinitrophenol	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D



<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
2,4-Dinitrotoluene	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
2,6-Dinitrotoluene	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
1,4-Dioxane	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
1,2-Diphenylhydrazine	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Diphenamide	EPA 525.2	-----	-----	-----
EPTC	EPA 525.2	-----	-----	-----
Ethoprop (Mocap)	EPA 525.2	-----	-----	-----
Ethyl methane sulfonate	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Etridiazole	EPA 525.2	-----	-----	-----
Fenarimol	EPA 525.2	-----	-----	-----
Fluoroanthene	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Fluorene	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Fluridone	EPA 525.2	-----	-----	-----
2,2',3,3',4,4',6-Heptachlorobiphenyl	EPA 525.2	-----	-----	-----
Hexachlorobenzene	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Hexachlorbutadiene	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Hexachlorocyclopentadiene	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Hexachloroethane	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Hexachlorophene	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Hexachloropropene	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Hexazinone	EPA 525.2	-----	-----	-----
Indeno (1,2,3-cd) pyrene	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Isophorone	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Isosafrole	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Methapyrilene	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Methylbenzoate	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
3-Methylcholanthrene	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
2-Methyl-4,6-Dinitrophenol	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Methyl methane sulfonate	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
1-Methylnaphthalene	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
2-Methylnaphthalene	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Methyl paraoxon	EPA 525.2	-----	-----	-----
2-Methylphenol	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
3 & 4-Methylphenol	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Metolachlor	EPA 525.2	-----	-----	-----
Metribuzin	EPA 525.2	-----	-----	-----
Mevinphos	EPA 525.2	-----	-----	-----
MGK 264, total (isomer a+b)	EPA 525.2	-----	-----	-----
Molinate	EPA 525.2	-----	-----	-----
Napropamide	EPA 525.2	-----	-----	-----
Naphthalene	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
1,4-Naphthoquinone	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
1-Naphthylamine	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
2-Naphthylamine	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
2-Nitroaniline	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
3-Nitroaniline	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
4-Nitroaniline	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Nitrobenzene	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
2-Nitrophenol	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
4-Nitrophenol	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
N-Nitroso-di-n-butylamine	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
N-Nitrosodiethylamine	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
N-Nitrosodimethylamine	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
N-Nitrosomethylethylamine	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
N-Nitrosomorpholine	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D



<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
N-Nitrosodi-n-propylamine	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
N-Nitrosodiphenylamine	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
N-Nitrosopiperidine	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
N-Nitrosopyrrolidine	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
4-Nitroquinoline-1-oxide	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
trans-Nonachlor	EPA 525.2	-----	-----	-----
Norflurazon	EPA 525.2	-----	-----	-----
Pebulate	EPA 525.2	-----	-----	-----
Pentachlorobenzene	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
2,2',3,4,6-Pentachlorobiphenyl	EPA 525.2	-----	-----	-----
Pentachloronitrobenzene	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Pentachlorophenol	-----	EPA 625 EPA 1653	EPA 3520C/8270C EPA 3520C/8270D EPA 1653	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Permethrin, total	EPA 525.2	-----	-----	-----
Phenacetin	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Phenanthrene	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Phenol	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Phenyl ether	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
p-Phenylene diamine	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Phorate	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
2-Picoline	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
alpha-Pinene	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Pronamide	EPA 525.2	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Propazine	EPA 525.2	-----	-----	-----
Pyrene	EPA 525.2	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Pyridine	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Safrole, Total	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Terbacil	EPA 525.2	-----	-----	-----
1,2,4,5-Tetrachlorobenzene	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
2,2',4,4'-Tetrachlorobiphenyl	EPA 525.2	-----	-----	-----
Tetrachlorocatechol	-----	EPA 1653	EPA 1653	-----
Tetrachloroguaicol	-----	EPA 1653	EPA 1653	-----
2,3,4,6-Tetrachlorophenol	-----	EPA 1653	EPA 1653 EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
2-Toluidine (o-Toluidine)	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Triademefon	EPA 525.2	-----	-----	-----
2,4,5-Trichlorobiphenyl	EPA 525.2	-----	-----	-----
1,2,3-Trichlorobenzene	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
1,2,4-Trichlorobenzene	-----	EPA 625	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
1,3,5-Trichlorobenzene	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
3,4,5-Trichlorocatechol	-----	EPA 1653	EPA 1653	-----
3,4,6-Trichlorocatechol	-----	EPA 1653	EPA 1653	-----
3,4,5-Trichloroguaicol	-----	EPA 1653	EPA 1653	-----
3,4,6-Trichloroguaicol	-----	EPA 1653	EPA 1653	-----
4,5,6-Trichloroguaicol	-----	EPA 1653	EPA 1653	-----
2,4,5-Trichlorophenol	-----	EPA 1653	EPA 3520C/8270C EPA 3520C/8270D EPA 1653	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
2,3,6-Trichlorophenol	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
2,4,6-Trichlorophenol	-----	EPA 625 EPA 1653	EPA 3520C/8270C EPA 3520C/8270D EPA 1653	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
3,4,5-Trichlorophenol	-----	EPA 1653	EPA 1653	-----
Trichlorosyringol	-----	EPA 1653	EPA 1653	-----
Tricyclazole	EPA 525.2	-----	-----	-----
o,o',o"- Triethylphosphorothioate	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Trifluralin	EPA 525.2	-----	-----	-----
1,3,5-Trinitrobenzene	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Vernolate	EPA 525.2	-----	-----	-----
2,3-Xylenol	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
3,4-Xylenol	-----	-----	EPA 3520C/8270C EPA 3520C/8270D	EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
#2 Diesel Fuel (Product Identification)	-----	-----	EPA 3520C/8015B EPA 3520C/8015C	EPA 3550B/8015B EPA 3546/8015B EPA 3550C/8015C EPA 3546/8015C
Diesel Range Organics	-----	-----	EPA 3520C/8015B EPA 3520C/8015C	EPA 3550B/8015B EPA 3546/8015B EPA 3550C/8015C EPA 3546/8015C
Kerosene (Product Identification)	-----	-----	EPA 3520C/8015B EPA 3520C/8015C	EPA 3550B/8015B EPA 3546/8015B EPA 3550C/8015C EPA 3546/8015C
Mineral Spirits (Product Identification)	-----	-----	EPA 3520C/8015B EPA 3520C/8015C	EPA 3550B/8015B EPA 3546/8015B EPA 3550C/8015C EPA 3546/8015C
Motor Oil (Product Identification)	-----	-----	EPA 3520C/8015B EPA 3520C/8015C	EPA 3550B/8015B EPA 3546/8015B EPA 3550C/8015C EPA 3546/8015C

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Oil Range Organics	-----	-----	EPA 3520C/8015B EPA 3520C/8015C	EPA 3550B/8015B EPA 3546/8015B EPA 3550C/8015C EPA 3546/8015C
Petroleum Range Organics	-----	-----	FL-PRO	FL-PRO
<u>Pesticides-Herbicides-PCBs</u>				
Acifluorfen	EPA 515.1	-----	-----	-----
Aldicarb (MS)	EPA 531.1	-----	-----	-----
Aldicarb sulfone	EPA 531.1	-----	-----	-----
Aldicarb sulfoxide	EPA 531.1	-----	-----	-----
Aldrin	EPA 508 EPA 525.2	EPA 608	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
Atrazine	EPA 525.2	-----	-----	-----
Azinphos methyl	-----	EPA 614	EPA 3520C/8141A EPA 3520C/8141B	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B
alpha-BHC	EPA 508 EPA 525.2	EPA 608	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
Bentazon	EPA 515.1	-----	-----	-----
beta-BHC	EPA 508 EPA 525.2	EPA 608	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
delta-BHC	EPA 508 EPA 525.2	EPA 608	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
gamma-BHC	EPA 508 EPA 525.2	EPA 608	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
Bolstar	-----	-----	EPA 3520C/8141A EPA 3520C/8141B	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B
Carbaryl	EPA 531.1	-----	-----	-----

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Carbofuran (MS)	EPA 531.1	-----	-----	-----
Chloramben	EPA 515.1			
Chlordane (technical)	EPA 508	EPA 608	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
Chlordane (alpha)	EPA 525.2	EPA 608	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
Chlordane (gamma)	EPA 525.2	EPA 608	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
Chlorobenzilate	EPA 525.2		EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
Decachlorobiphenyl	-----	EPA 680	EPA 680	EPA 680
Dichlorobiphenyl	-----	EPA 680	EPA 680	EPA 680
Heptachlorobiphenyl	-----	EPA 680	EPA 680	EPA 680
Hexachlorobiphenyl	-----	EPA 680	EPA 680	EPA 680
Monochlorobiphenyl	-----	EPA 680	EPA 680	EPA 680
Nonachlorobiphenyl	-----	EPA 680	EPA 680	EPA 680
Octachlorobiphenyl	-----	EPA 680	EPA 680	EPA 680
Pentachlorobiphenyl	-----	EPA 680	EPA 680	EPA 680
Tetrachlorobiphenyl	-----	EPA 680	EPA 680	EPA 680
Trichlorobiphenyl	-----	EPA 680	EPA 680	EPA 680
Chloroneb	EPA 525.2	-----	-----	-----
Chlorpropham	EPA 525.2	-----	-----	-----
Chlorpyrifos	EPA 525.2	EPA 614	EPA 3520C/8141A EPA 3520C/8141B	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B
Chlorthalonil	EPA 525.2	-----	-----	-----
Coumaphos	-----	-----	EPA 3520C/8141A EPA 3520C/8141B	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B
Cycloate	EPA 525.2	-----	-----	-----
2,4-D	EPA 515.1	EPA 615	EPA 8151A	EPA 8151A
2,6-Dichlorophenol	-----	EPA 615	EPA 8151A	EPA 8151A

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
DCPA (Dacthal)	EPA 515.1 EPA 525.2	-----	EPA 8151A	EPA 8151A
Dalapon	EPA 515.1	EPA 615	EPA 8151A	EPA 8151A
2,4-DB	EPA 515.1	EPA 615	EPA 8151A	EPA 8151A
2,4'-DDD	-----	-----	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
2,4' DDE	-----	-----	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
2,4'-DDT	-----	-----	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
4,4'-DDD	EPA 508 EPA 525.2	EPA 608	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
4,4' DDE	EPA 508 EPA 525.2	EPA 608	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
4,4'-DDT	EPA 508 EPA 525.2	EPA 608	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
Demeton-O	-----	EPA 614	EPA 3520C/8141A EPA 3520C/8141B	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B
Demeton-S	-----	EPA 614	EPA 3520C/8141A EPA 3520C/8141B	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B
Diazinon	-----	EPA 614	EPA 3520C/8141A EPA 3520C/8141B	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B
Dicamba	EPA 515.1	EPA 615	EPA 8151A	EPA 8151A



<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Dichlorvos	EPA 525.2	-----	EPA 3520C/8141A EPA 3520C/8141B	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B
3,5-Dichlorobenzoic acid	EPA 515.1	-----	-----	-----
2,3-Dichlorobiphenyl (PCB 5)	EPA 525.2	-----	-----	-----
Dichloroprop	EPA 515.1	EPA 615	EPA 8151A	EPA 8151A
Dieldrin	EPA 508 EPA 525.2	EPA 608	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
Dimethoate	-----	-----	EPA 3520C/8141A EPA 3520C/8141B	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B
Dinoseb	EPA 515.1	EPA 615	EPA 8151A	EPA 8151A
Diquat	EPA 549.2	-----	-----	-----
Disulfoton	-----	EPA 614	EPA 3520C/8141A EPA 3520C/8141B EPA 3520C /8270C EPA 3520C /8270D	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Endosulfan I (alpha)	EPA 508 EPA 525.2	EPA 608	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
Endosulfan II (beta)	EPA 508 EPA 525.2	EPA 608	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
Endosulfan sulfate	EPA 508 EPA 525.2	EPA 608	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
Endothall	EPA 548.1	-----	-----	-----

Peter Abney

<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Endrin	EPA 508 EPA 525.2	EPA 608	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
Endrin aldehyde	EPA 508 EPA 525.2	EPA 608	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
Endrin ketone	-----	EPA 608	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
EPN	-----	-----	EPA 3520C/8141A EPA 3520C/8141B	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B
Ethoprop (Mocap)	-----	-----	EPA 3520C/8141A EPA 3520C/8141B	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B
Famphur	-----	-----	EPA 3520C/8141A EPA 3520C/8141B EPA 3520C /8270C EPA 3520C /8270D	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Fensulfothion	-----	-----	EPA 3520C/8141A EPA 3520C/8141B	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B
Fenthion	-----	-----	EPA 3520C/8141A EPA 3520C/8141B	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B
Glysophate	EPA 547	-----	-----	-----
Heptachlor	EPA 508 EPA 525.2	EPA 608	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
Heptachlor epoxide	EPA 508 EPA 525.2	EPA 608	EPA 3520C/8081A EPA 3520C/8081B.	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
2,2',4,4',5,6'-Hexachlorobiphenyl (PCB 154)	EPA 525.2	-----	-----	-----
3-Hydroxycarbofuran	EPA 531.1	-----	-----	-----
Isodrin	-----		EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
Malathion	-----	EPA 614	EPA 3520C/8141A EPA 3520C/8141B	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B
MCPA	EPA 515.1	EPA 615	EPA 8151A	EPA 8151A
MCPP	EPA 515.1	EPA 615	EPA 8151A	EPA 8151A
Merphos	-----	-----	EPA 3520C/8141A EPA 3520C/8141B	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B
Methiocarb	EPA 531.1	-----	-----	-----
Methomyl	EPA 531.1	-----	-----	-----
Methoxychlor	EPA 508 EPA 525.2	EPA 608	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
Mevinphos	-----	-----	EPA 3520C/8141A EPA 3520C/8141B	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B
Mirex	-----	-----	EPA 3520C/8081A EPA 3520C/8081B	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B
Monocrotophos	-----	-----	EPA 3520C/8141A EPA 3520C/8141B	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B
Naled	-----	-----	EPA 3520C/8141A EPA 3520C/8141B	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B
4-Nitrophenol	EPA 515.1	-----	-----	-----

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
2,2',3,3',4,5',6,6'-Octachlorobiphenyl (PCB 201)	EPA 525.2	-----	-----	-----
Oxamyl (MS)	EPA 531.1	-----	-----	-----
Paraquat	EPA 549.2	-----	-----	-----
Parathion ethyl	-----	EPA 614	EPA 3520C/8141A EPA 3520C/8141B EPA 3520C /8270C EPA 3520C /8270D	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
Parathion methyl	-----	EPA 614	EPA 3520C/8141A EPA 3520C/8141B EPA 3520C /8270C EPA 3520C /8270D	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
PCB-1016	EPA 508	EPA 608	EPA 3520C/8082 EPA 3520C/8082A	EPA 3550B/8082 EPA 3546/8082 EPA 3550C/8082A EPA 3546/8082A
PCB-1221	EPA 508	EPA 608	EPA 3520C/8082 EPA 3520C/8082A	EPA 3550B/8082 EPA 3546/8082 EPA 3550C/8082A EPA 3546/8082A
PCB-1232	EPA 508	EPA 608	EPA 3520C/8082 EPA 3520C/8082A	EPA 3550B/8082 EPA 3546/8082 EPA 3550C/8082A EPA 3546/8082A
PCB-1242	EPA 508	EPA 608	EPA 3520C/8082 EPA 3520C/8082A	EPA 3550B/8082 EPA 3546/8082 EPA 3550C/8082A EPA 3546/8082A
PCB-1248	EPA 508	EPA 608	EPA 3520C/8082 EPA 3520C/8082A	EPA 3550B/8082 EPA 3546/8082 EPA 3550C/8082A EPA 3546/8082A
PCB-1254	EPA 508	EPA 608	EPA 3520C/8082 EPA 3520C/8082A	EPA 3550B/8082 EPA 3546/8082 EPA 3550C/8082A EPA 3546/8082A

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
PCB-1260	EPA 508	EPA 608	EPA 3520C/8082 EPA 3520C/8082A	EPA 3550B/8082 EPA 3546/8082 EPA 3550C/8082A EPA 3546/8082A
PCB-1262	EPA 508	EPA 608	EPA 3520C/8082 EPA 3520C/8082A	EPA 3550B/8082 EPA 3546/8082 EPA 3550C/8082A EPA 3546/8082A
PCB-1268	EPA 508	EPA 608	EPA 3520C/8082 EPA 3520C/8082A	EPA 3550B/8082 EPA 3546/8082 EPA 3550C/8082A EPA 3546/8082A
PCBs, Total	EPA 508	EPA 608	EPA 3520C/8082 EPA 3520C/8082A	EPA 3550B/8082 EPA 3546/8082 EPA 3550C/8082A EPA 3546/8082A
Pentachlorophenol	EPA 515.1	-----	EPA 8151A	EPA 8151A
Picloram	EPA 515.1	-----	EPA 8151A	EPA 8151A
Phorate	-----	-----	EPA 3520C/8141A EPA 3520C/8141B	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B
Propachlor	EPA 525.2	-----	-----	-----
Propoxur (Baygon)	EPA 531.1	-----	-----	-----
Ronnel	-----	-----	EPA 3520C/8141A EPA 3520C/8141B	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B
Simazine	EPA 525.2	-----	-----	-----
Stirophos	EPA 525.2	-----	EPA 3520C/8141A EPA 3520C/8141B	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B
Sulfotepp	-----	-----	EPA 3520C/8141A EPA 3520C/8141B EPA 3520C /8270C EPA 3520C /8270D	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
2,4,5-T	EPA 515.1	EPA 615	EPA 8151A	EPA 8151A

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<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
Thionazin	-----	-----	EPA 3520C/8141A EPA 3520C/8141B EPA 3520C /8270C EPA 3520C /8270D	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B EPA 3550B/8270C EPA 3546/8270C EPA 3550C/8270D EPA 3546/8270D
2,4,6-Trichlorophenol	-----	EPA 615	EPA 8151A	EPA 8151A
Tokuthion	-----	-----	EPA 3520C/8141A EPA 3520C/8141B	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B
2,4,5-TP (Silvex)	EPA 515.1	EPA 615	EPA 8151A	EPA 8151A
Toxaphene	EPA 508	EPA 608	EPA 3520C/8081A EPA 3520C/8081B EPA 3520C/8276	EPA 3550B/8081A EPA 3546/8081A EPA 3550C/8081B EPA 3546/8081B EPA 3546/8276
Trichloronate	-----	-----	EPA 3520C/8141A EPA 3520C/8141B	EPA 3550B/8141A EPA 3546/8141A EPA 3550C/8141B EPA 3546/8141B
Hp-Sed	-----	-----	EPA 3520C/8276	EPA 3546/8276
Hx-Sed	-----	-----	EPA 3520C/8276	EPA 3546/8276
Parlar 26	-----	-----	EPA 3520C/8276	EPA 3546/8276
Parlar 40	-----	-----	EPA 3520C/8276	EPA 3546/8276
Parlar 41	-----	-----	EPA 3520C/8276	EPA 3546/8276
Parlar 44	-----	-----	EPA 3520C/8276	EPA 3546/8276
Parlar 50	-----	-----	EPA 3520C/8276	EPA 3546/8276
Parlar 62	-----	-----	EPA 3520C/8276	EPA 3546/8276
<u>Hazardous Waste Characteristics</u>				
BTU	-----	ASTM D240	ASTM D240	ASTM D240
Free Liquid	-----	-----	-----	EPA 9095A EPA 9095B
Ignitability	-----	EPA 1010 EPA 1010A	EPA 1010 EPA 1010A	EPA 1030
Specific Gravity	-----	SM2710 F	SM2710 F	SM2710 F
SPLC	-----	-----	EPA 1312	EPA 1312
TCLP	-----	-----	EPA 1311	EPA 1311
<u>Air Testing</u>				

Peter Abney

<u>Parameter/Analyte</u>	<u>Potable Water</u>	<u>Nonpotable Water</u>	<u>Solid Hazardous Waste</u>	
			<u>Aqueous</u>	<u>Solid</u>
<u>Purgeable Organics</u>				
Methane (FID)	-----	RSK-175	RSK-175	-----
Methane (TCD)	-----	RSK-175	RSK-175	-----
Ethane (FID)	-----	RSK-175	RSK-175	-----
Ethene (FID)	-----	RSK-175	RSK-175	-----
<u>Kentucky UST Program</u>				
<u>TCLP Metals</u>				
Arsenic	-----	-----	EPA 3005A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B	EPA 3005A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B
Barium	-----	-----	EPA 3005A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B	EPA 3005A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B
Cadmium	-----	-----	EPA 3005A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B	EPA 3005A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B
Chromium	-----	-----	EPA 3005A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B	EPA 3005A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B
Lead	-----	-----	EPA 3005A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B	EPA 3005A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B
Mercury	-----	-----	EPA 7470A	EPA 7470A
Selenium	-----	-----	EPA 3005A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B	EPA 3005A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B
Silver	-----	-----	EPA 3005A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B	EPA 3005A/6010B EPA 3010A/6010B SM 3030C/EPA 6010B





The American Association for Laboratory Accreditation

World Class Accreditation

Accredited DoD ELAP Laboratory

A2LA has accredited

TEST AMERICA SAVANNAH

Savannah, GA

for technical competence in the field of

Environmental Testing

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

Presented this 5th day of April 2011.

A handwritten signature in black ink, reading "Peter Abney".

President & CEO
For the Accreditation Council
Certificate Number 0399.01
Valid to February 28, 2013



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

Attachment D
Monitoring Well Construction Details and
Technical Specifications



PROJECT NUMBER
142506.FI.FI

WELL NUMBER
LS11-MW16D

SHEET 1 OF 1

WELL COMPLETION DIAGRAM

PROJECT : NAB Little Creek

LOCATION : Site 11

DRILLING CONTRACTOR: Parratt Wolff

NORTHING: 3501460.6

EASTING: 12169509.4

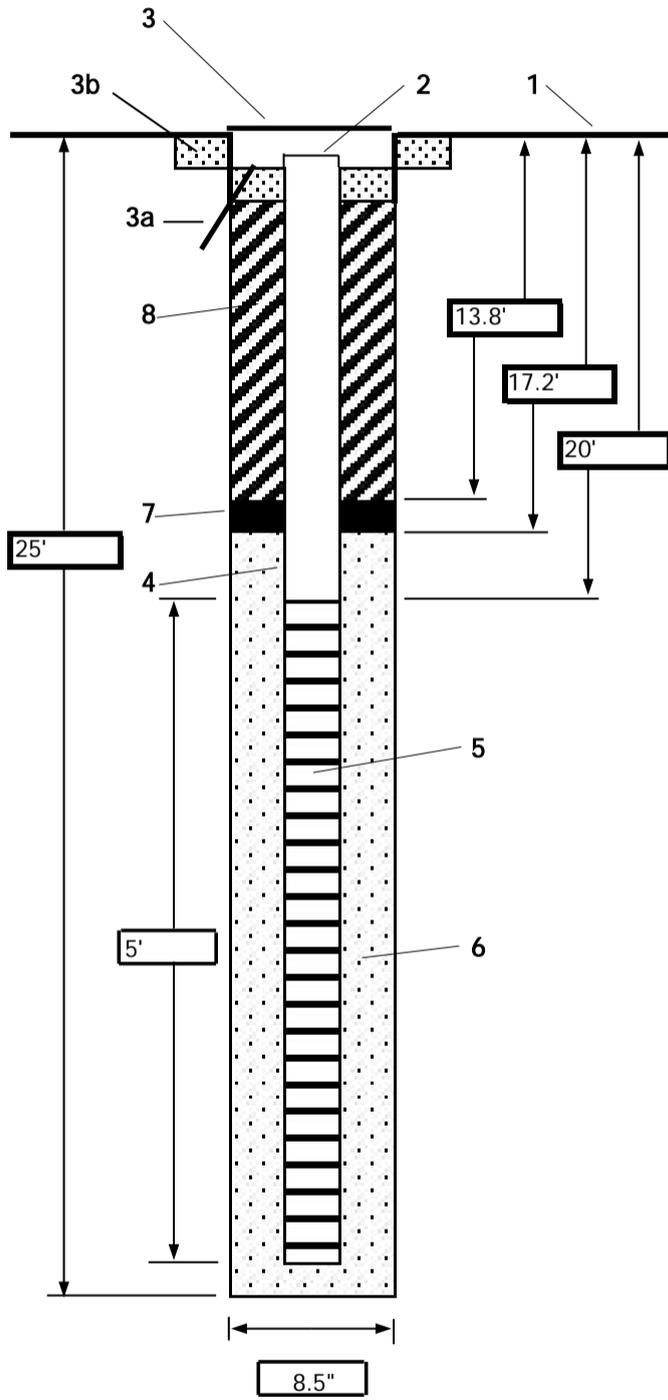
DRILLING METHOD AND EQUIPMENT USED : 4 1/4" HSA, CME 75 DRILL RIG

WATER LEVELS DURING DEVELOPMENT:

START : 6/7/99

END : 6/7/99

LOGGER : M. LOUTH



1- Ground elevation at well	<u>N/A</u>
2- Top of casing elevation	<u>8.44' amsl</u>
3- Wellhead protection cover type	<u>DSI Flushmount - (Circle)</u>
a) drain tube?	<u>no</u>
b) concrete pad dimensions	<u>Approximately 2' diameter</u>
4- Dia./type of well casing	<u>2" PVC Sch. 40</u>
5- Type/slot size of screen	<u>2" PVC Sch. 40 10 slot</u>
6- Type screen filter	<u>DSI #1 Filter Sand</u>
a) Quantity used	<u>4 BAGS</u>
7- Type of seal	<u>Bentonite, 3/8" chips</u>
a) Quantity used	<u>1 Bag</u>
8- Grout	
a) Grout mix used	<u>Portland cement/ Betonite Gell</u>
b) Method of placement	<u>Trimming</u>
c) Vol. of well casing grout	<u>-25 gallons</u>
Development method	<u>Surge/ Submersible pump</u>
Development time	<u>40 mins</u>
Estimated purge volume	<u>45 gallons</u>
Comments	<u>_____</u>
	<u>_____</u>
	<u>_____</u>
	<u>_____</u>



PROJECT NUMBER

WELL NUMBER

LS11A-MW20D

SHEET 1

OF 1

WELL COMPLETION DIAGRAM

PROJECT : NAB Little Creek

LOCATION : Site 11a

DRILLING CONTRACTOR : Parratt Wolff

NORTHING: 3501633.4299

EASTING: 12169803.6149

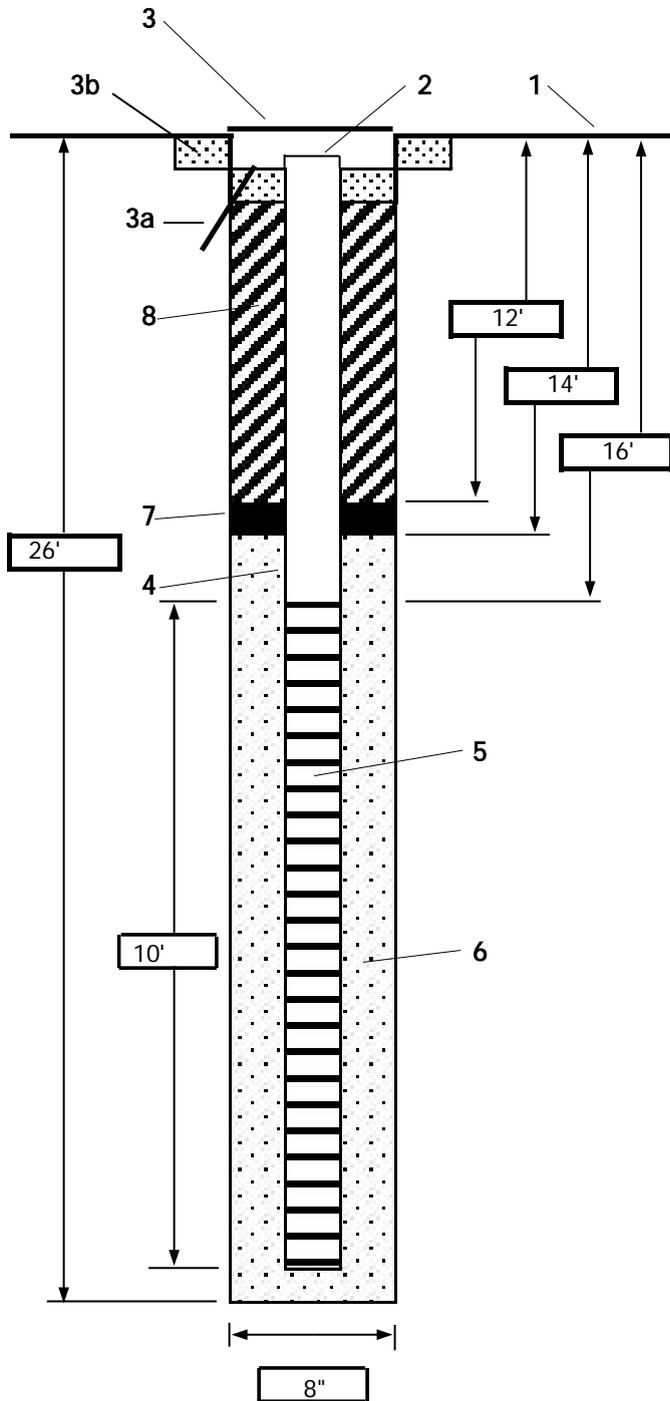
DRILLING METHOD AND EQUIPMENT USED : 4 1/4" hollow stem auger

WATER LEVELS :

START : 0925 6/4/02

END : 1045

LOGGER : E. Mathews



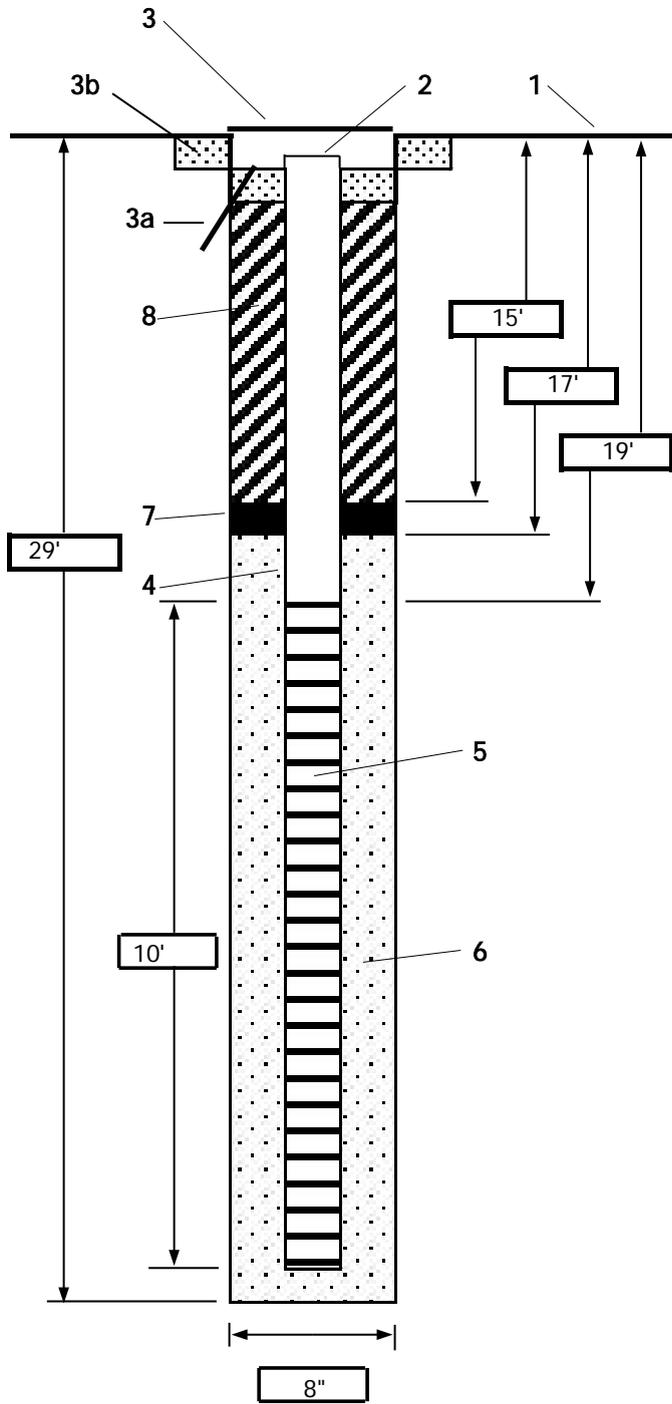
1- Ground elevation at well	9.50' amsl
2- Top of casing elevation	9.17' amsl
3- Wellhead protection cover type	8" steel flushmount protective casing
a) drain tube?	no
b) concrete pad dimensions	
4- Dia./type of well casing	2" PVC
5- Type/slot size of screen	0.010 slot PVC
6- Type screen filter	DSI #1 Sand
a) Quantity used	5 bags
7- Type of seal	Shur-plug 3/8" bentonite chips
a) Quantity used	2 bags
8- Grout	
a) Grout mix used	Portland Cement/bentonite slurry
b) Method of placement	
c) Vol. of well casing grout	
Development method	Surge/ Submersible pump
Development time	
Estimated purge volume	
Comments	



PROJECT NUMBER	WELL NUMBER	SHEET 1	OF 1
	LS11A-MW21D		

WELL COMPLETION DIAGRAM

PROJECT : NAB Little Creek	LOCATION : Site 11a		
DRILLING CONTRACTOR : Parratt Wolff	NORTHING: 3501503.0896	EASTING: 12169660.9117	
DRILLING METHOD AND EQUIPMENT USED : 4 1/4" hollow stem auger			
WATER LEVELS :	START : 1400 6/4/02	END : 1530	LOGGER : E. Mathews



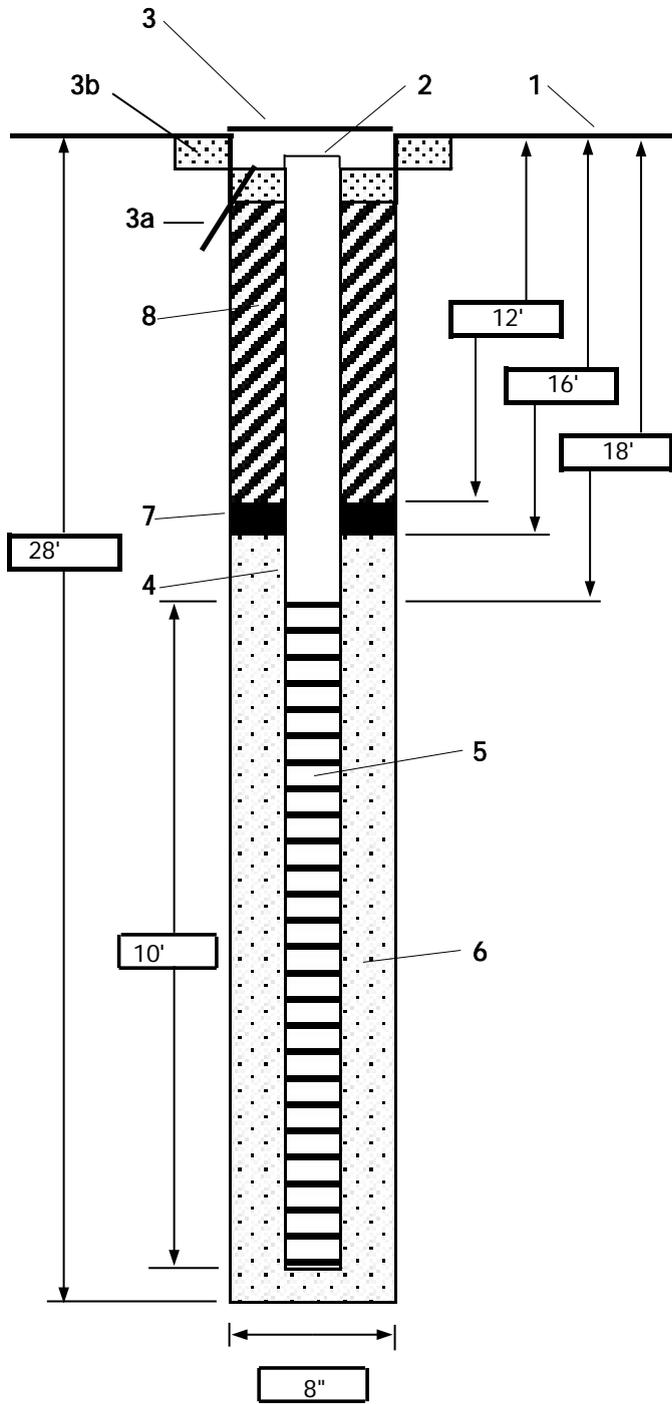
1- Ground elevation at well	8.30' amsl
2- Top of casing elevation	8.03' amsl
3- Wellhead protection cover type 8" steel flushmount protective casing	
a) drain tube?	no
b) concrete pad dimensions	
4- Dia./type of well casing	2" PVC
5- Type/slot size of screen	0.010 slot PVC
6- Type screen filter	DSI #1 Sand
a) Quantity used	4 bags
7- Type of seal	Shur-plug 3/8" bentonite chips
a) Quantity used	1 bag
8- Grout	
a) Grout mix used	Portland Cement/bentonite slurry
b) Method of placement	
c) Vol. of well casing grout	
Development method	Surge/ Submersible pump
Development time	
Estimated purge volume	
Comments	



PROJECT NUMBER	WELL NUMBER	SHEET 1	OF 1
	LS11A-MW22D		

WELL COMPLETION DIAGRAM

PROJECT : NAB Little Creek	LOCATION : Site 11a		
DRILLING CONTRACTOR : Parratt Wolff	NORTHING: 3501406.4402	EASTING: 12169447.6693	
DRILLING METHOD AND EQUIPMENT USED : 4 1/4" hollow stem auger			
WATER LEVELS :	START : 1500 6/3/02	END : 1635	LOGGER : E. Mathews



1- Ground elevation at well	8.60' amsl
2- Top of casing elevation	8.41' amsl
3- Wellhead protection cover type	8" steel flushmount protective casing
a) drain tube?	no
b) concrete pad dimensions	
4- Dia./type of well casing	2" PVC
5- Type/slot size of screen	0.010 slot PVC
6- Type screen filter	DSI #1 Sand
a) Quantity used	4 bags
7- Type of seal	Shur-plug 3/8" bentonite chips
a) Quantity used	1 bag
8- Grout	
a) Grout mix used	Portland Cement/Bentonite slurry
b) Method of placement	
c) Vol. of well casing grout	
Development method	Surge/ Submersible pump
Development time	
Estimated purge volume	
Comments	



PROJECT NUMBER
181794.SI.FQ

WELL NUMBER
LS11A-MW31D

SHEET 1 OF 1

WELL COMPLETION DIAGRAM

PROJECT : NAB Little Creek

LOCATION : Site 11a

DRILLING CONTRACTOR : Parratt Wolff

NORTHING:

EASTING:

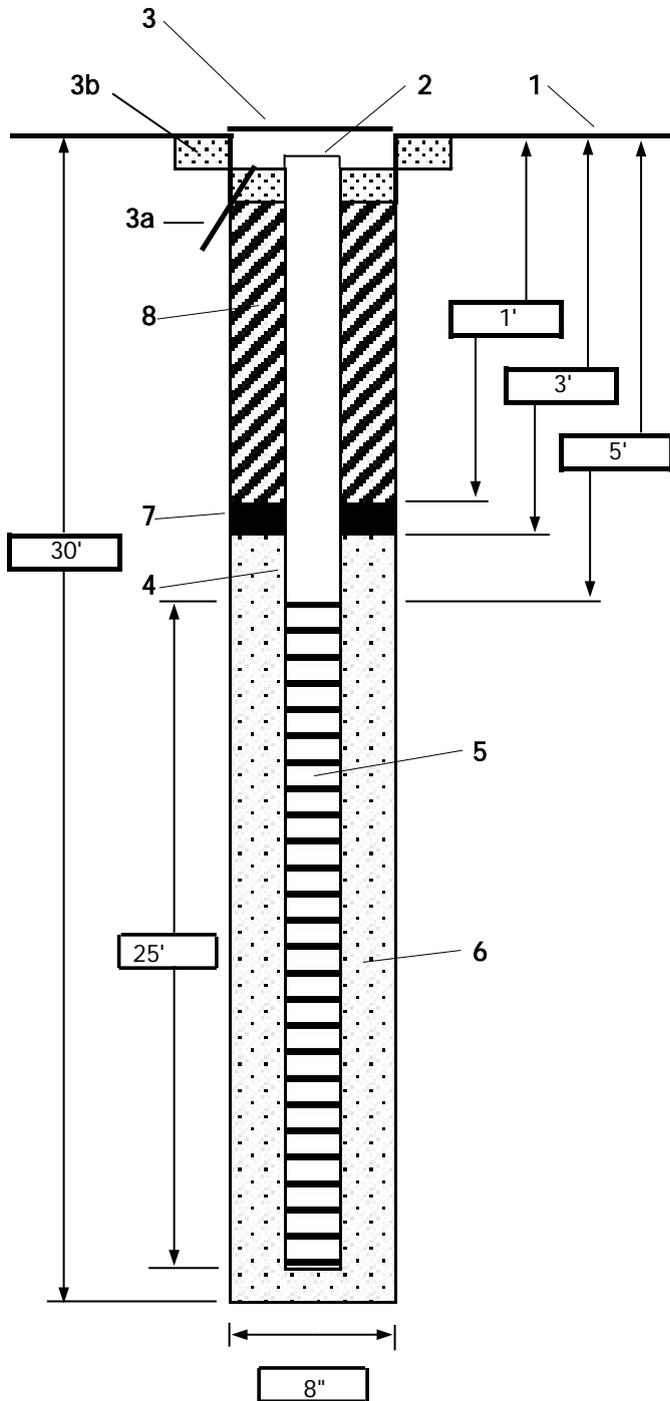
DRILLING METHOD AND EQUIPMENT USED : Ingersollrand A300/ 4.25" hollow stem auger

WATER LEVELS :

START : 1400 2/4/2004

END : 1620

LOGGER : Laura Cook



1- Ground elevation at well	_____
2- Top of casing elevation	_____
3- Wellhead protection cover type 8" steel flushmount protective casing	_____
a) drain tube?	no
b) concrete pad dimensions	24" round
4- Dia./type of well casing	2" PVC
5- Type/slot size of screen	0.010 slot PVC
6- Type screen filter	DSI #1 Sand
a) Quantity used	_____
7- Type of seal	Shur-plug 3/8" bentonite chips
a) Quantity used	_____
8- Grout	_____
a) Grout mix used	Not applicable
b) Method of placement	_____
c) Vol. of well casing grout	_____
Development method	Surge/ Submersible pump
Development time	_____
Estimated purge volume	_____
Comments	_____



PROJECT NUMBER
181794.SI.FQ

WELL NUMBER
LS11A-MW32D

SHEET 1 OF 1

WELL COMPLETION DIAGRAM

PROJECT : NAB Little Creek

LOCATION : Site 11a

DRILLING CONTRACTOR : Parratt Wolff

NORTHING:

EASTING:

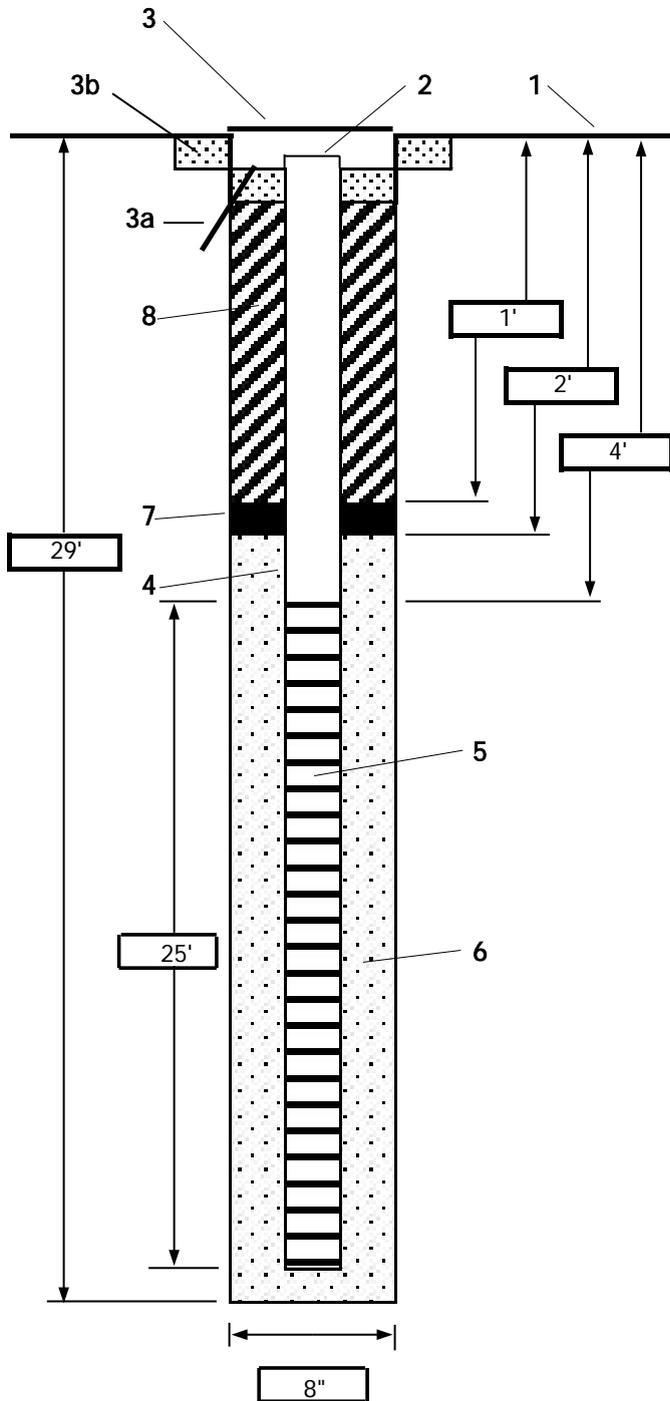
DRILLING METHOD AND EQUIPMENT USED : Ingersollrand A300/ 4.25" hollow stem auger

WATER LEVELS : 6' bgs

START : 0830 2/4/2004

END : 12:00

LOGGER : Laura Cook



1- Ground elevation at well	_____
2- Top of casing elevation	_____
3- Wellhead protection cover type 8" steel flushmount protective casing	_____
a) drain tube?	<u>no</u>
b) concrete pad dimensions	<u>24" round</u>
4- Dia./type of well casing	<u>2" PVC</u>
5- Type/slot size of screen	<u>0.010 slot PVC</u>
6- Type screen filter	<u>DSI #1 Sand</u>
a) Quantity used	<u>13 bags</u>
7- Type of seal	<u>Not applicable</u>
a) Quantity used	_____
8- Grout	_____
a) Grout mix used	<u>Not applicable</u>
b) Method of placement	_____
c) Vol. of well casing grout	_____
Development method	<u>Surge/ Submersible pump</u>
Development time	_____
Estimated purge volume	_____
Comments	_____



PROJECT NUMBER
181794.SI.FQ

WELL NUMBER
LS11A-MW34D

SHEET 1 OF 1

WELL COMPLETION DIAGRAM

PROJECT : NAB Little Creek

LOCATION : Site 11a

DRILLING CONTRACTOR : Parratt Wolff

NORTHING:

EASTING:

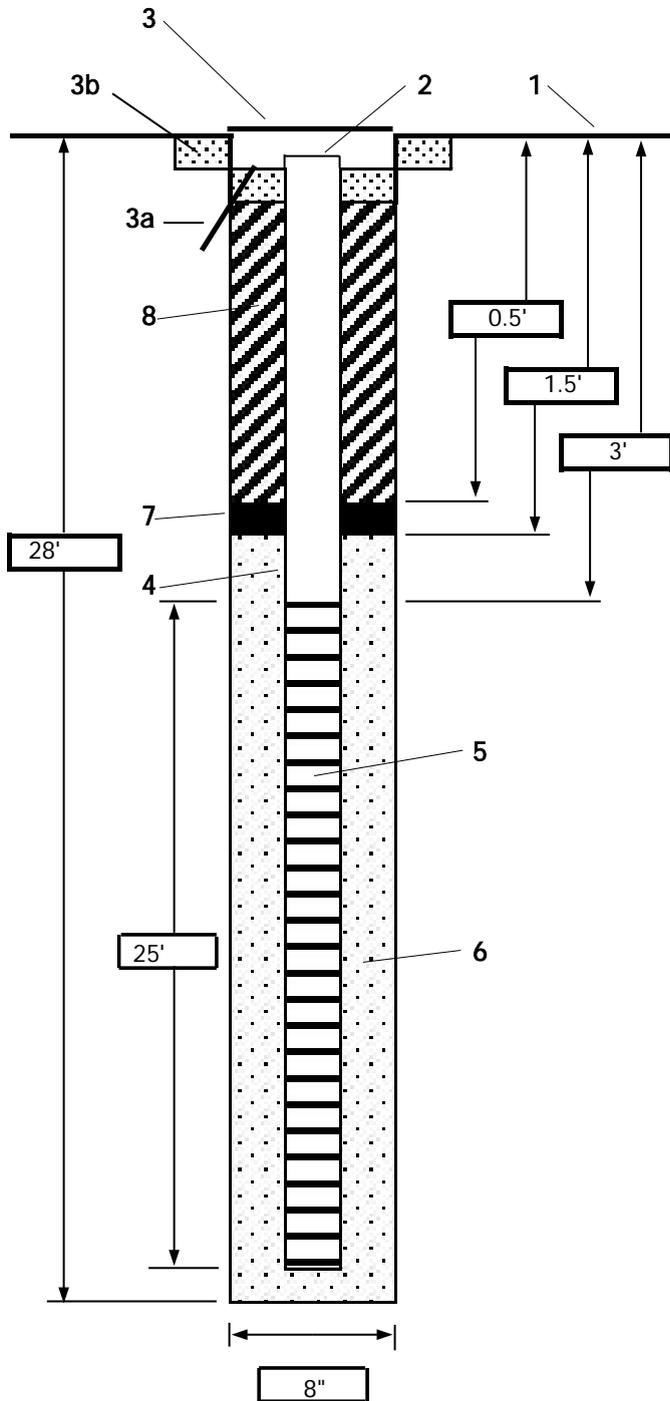
DRILLING METHOD AND EQUIPMENT USED : Ingersollrand A300/ 4.25" hollow stem auger

WATER LEVELS :

START : 1000 2/5/2004

END : 13:00

LOGGER : Laura Cook



1- Ground elevation at well	_____
2- Top of casing elevation	_____
3- Wellhead protection cover type 8" manhole	_____
a) drain tube?	no
b) concrete pad dimensions	24" round
4- Dia./type of well casing	2" PVC
5- Type/slot size of screen	0.010 slot PVC
6- Type screen filter	DSI #1 Sand
a) Quantity used	_____
7- Type of seal	Shur-plug 3/8" bentonite chips
a) Quantity used	_____
8- Grout	_____
a) Grout mix used	Not applicable
b) Method of placement	_____
c) Vol. of well casing grout	_____
Development method	_____
Development time	_____
Estimated purge volume	_____
Comments	_____



PROJECT NUMBER
CTO 23 CLEAN III

WELL NUMBER
MW35D

SHEET 1 OF 1

WELL COMPLETION DIAGRAM

PROJECT : Site 11a

LOCATION : Little Creek

DRILLING CONTRACTOR : Parratt Wolff

NORTHING:

EASTING:

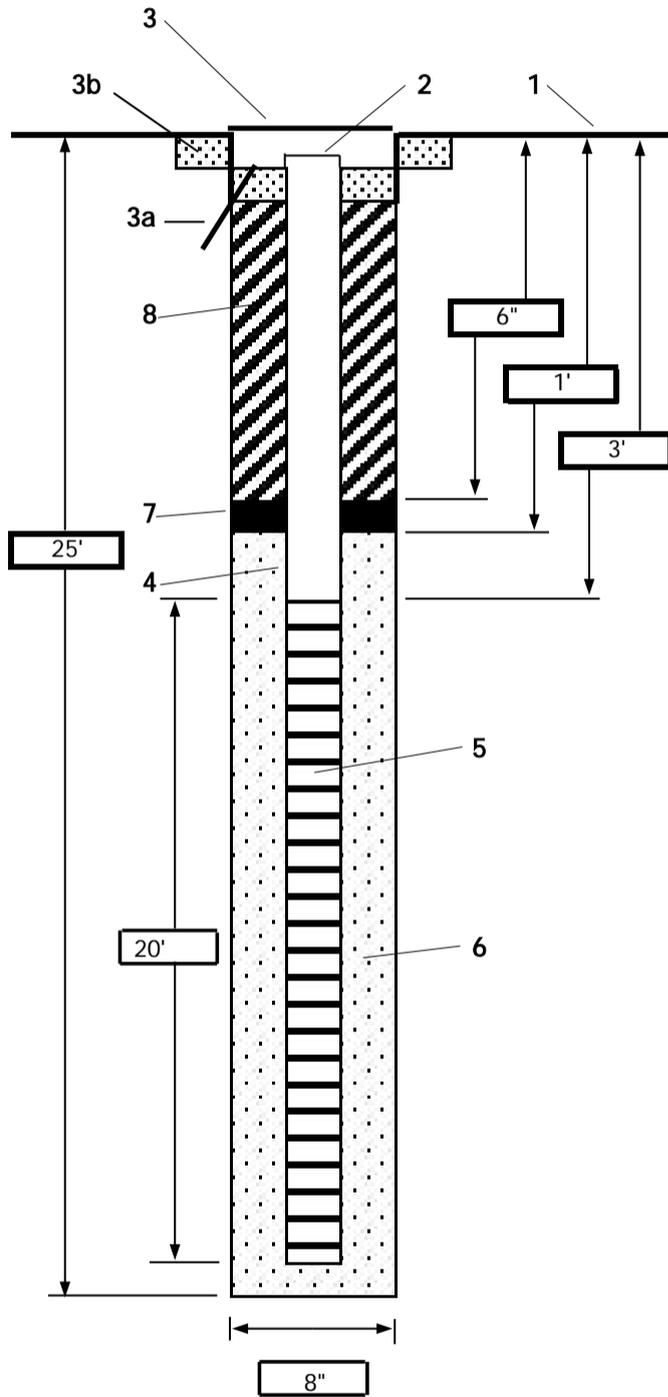
DRILLING METHOD AND EQUIPMENT USED : Hollow stem augers/split spoon sampling

WATER LEVELS :

START : 12/19/04 @ 0800

END : 12/19/04 @ 1000

LOGGER : Paul Landin

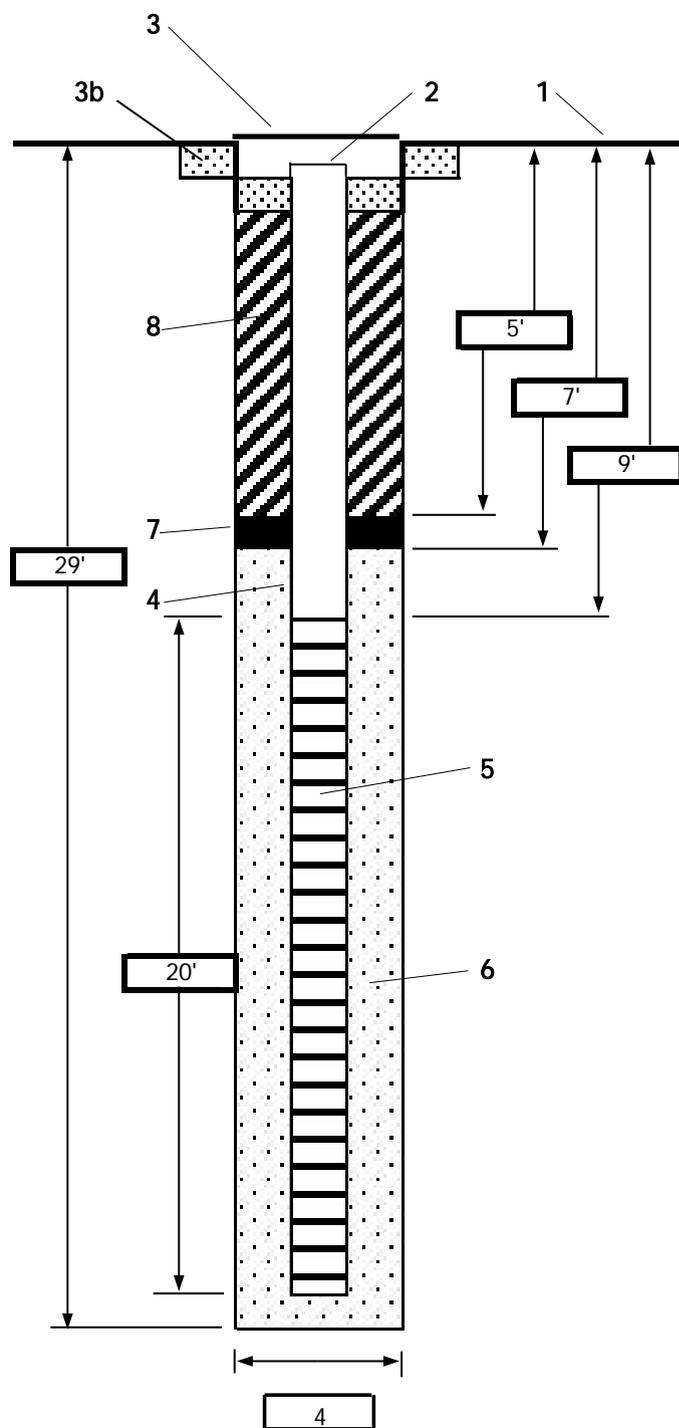


1- Ground elevation at well	_____
2- Top of casing elevation	_____
3- Wellhead protection cover type	Flush Mount
a) drain tube?	N/A
b) concrete pad dimensions	2' diameter x 4" thick
4- Dia./type of well casing	2" diameter Schedule 40 PVC
5- Type/slot size of screen	0.010 Slot Schedule 40 PVC
6- Type screen filter	DSI #1 Sand
a) Quantity used	8 bags
7- Type of seal	bentonite
a) Quantity used	1/2 bag
8- Grout	
a) Grout mix used	No grout used, sand filter to surface
b) Method of placement	_____
c) Vol. of well casing grout	_____
Development method	pump and surge
Development time	90 minutes
Estimated purge volume	55 gallons
Comments	_____



PROJECT NUMBER 345721.SI.SI	WELL NUMBER LS11A-MW36D
SHEET 1 OF 1	
WELL COMPLETION DIAGRAM	

PROJECT : CTO-125 LOCATION NAB Little Creek 11A
 DRILLING CONTRACTOR : Parrat-Wolff NORTHING:3,501,525.19 EASTING:12,169,666.63
 DRILLING METHOD AND EQUIPMENT USED : 4.25 in. hollow auger
 WATER LEVELS : 6.0' bgs START : 10/5/2007 0755 END :10/5/2007 1100 LOGGER : Shaun Whitworth

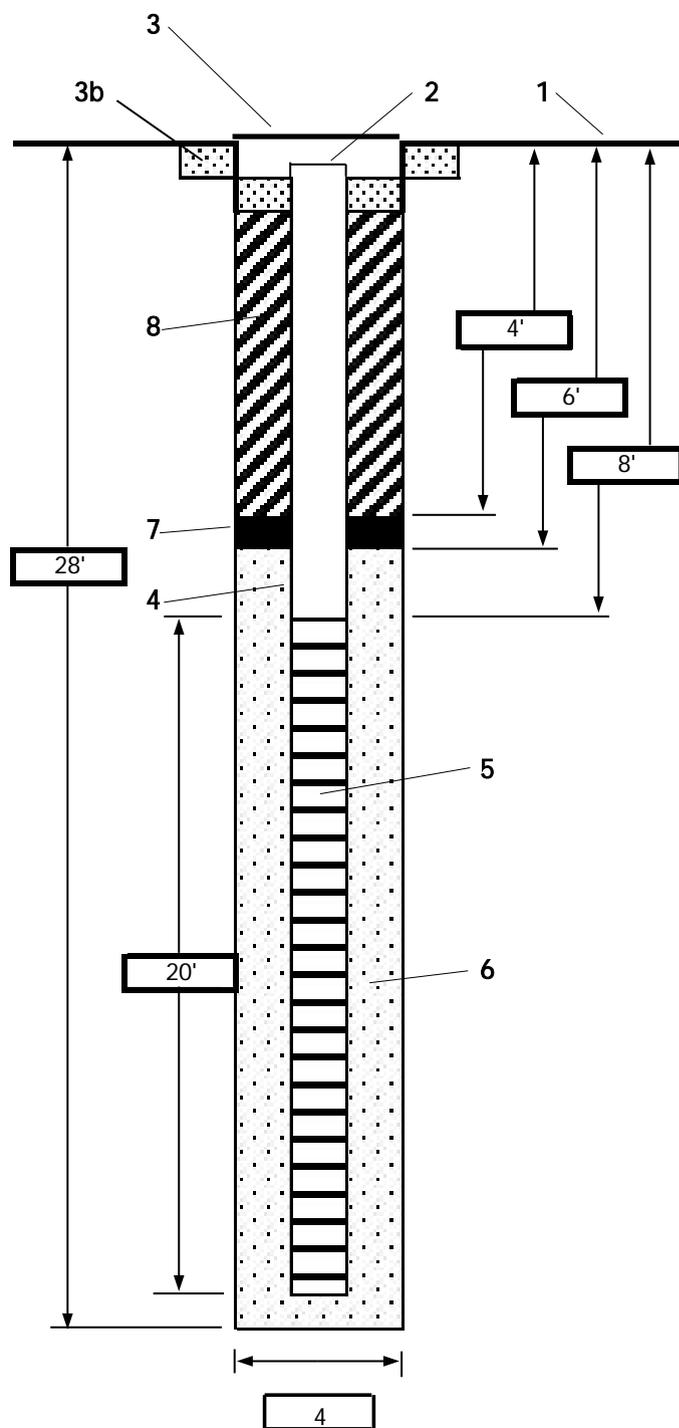


1- Ground elevation at well	8.3'
2- Top of casing elevation	7.97'
3- Wellhead protection cover type:	Flushmount
a) drain tube?	No
b) concrete pad dimensions	2 ft. Diameter Round
4- Dia./type of well casing	2" PVC Sch 40
5- Type/slot size of screen	2" Sch 40 PVC .01 slot
6- Type screen filter	#1 Filter Sand
a) Quantity used	
7- Type of Seal	Shur Plug 3/8" chips
a) Quantity used	
8- Grout	
a) Grout mix used	Portland cement/Bentonite
b) Method of placement	Tremie pipe
c) Vol. of well casing grout	
Development method	Whale Pump
Development time	1.25 hours
Estimated purge volume	80 gallons
Comments	



PROJECT NUMBER 345721.SI.SI	WELL NUMBER LS11A-MW37D
SHEET 1 OF 1	
WELL COMPLETION DIAGRAM	

PROJECT : CTO-125 LOCATION NAB Little Creek 11A
 DRILLING CONTRACTOR : Parrat-Wolff NORTHING:3,501,429.99 EASTING:12,169,708.92
 DRILLING METHOD AND EQUIPMENT USED : 4.25 in. hollow auger
 WATER LEVELS : 6.7' bgs START : 10/3/2007 0930 END :10/3/2007 1230 LOGGER : Shaun Whitworth

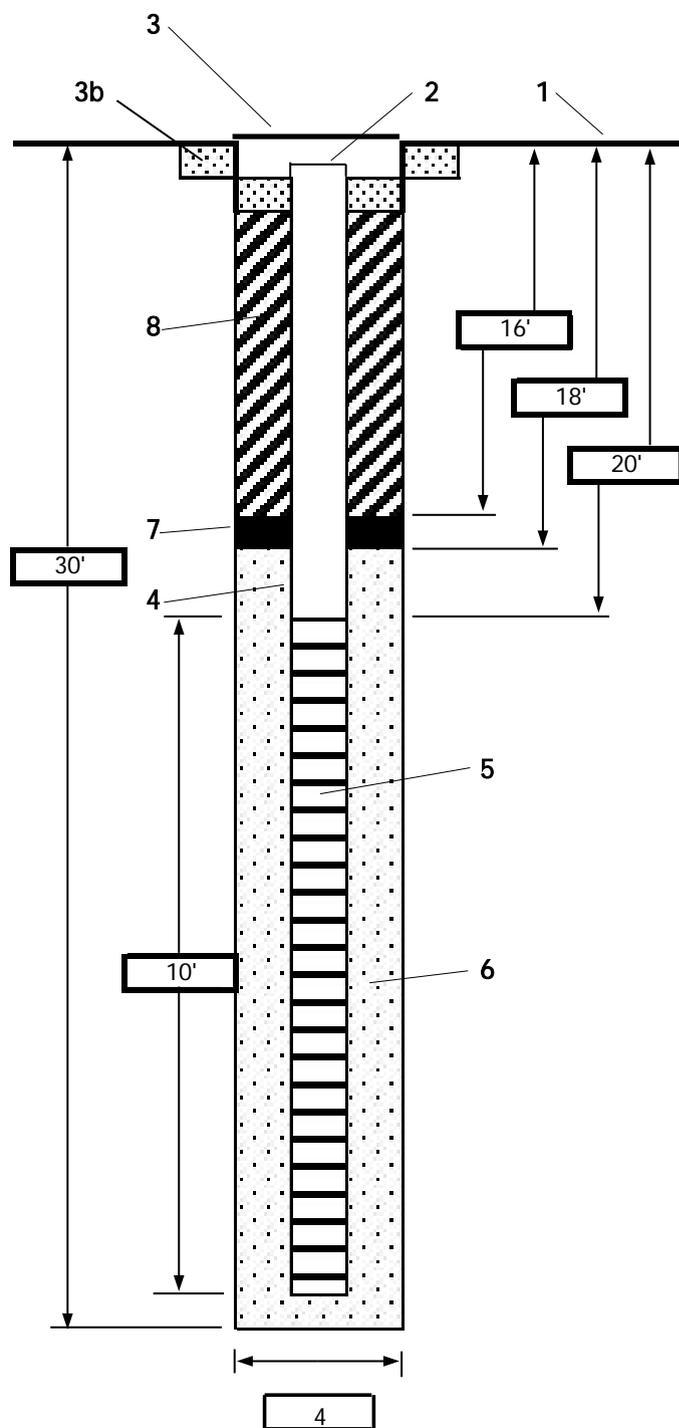


1- Ground elevation at well	9.0'
2- Top of casing elevation	8.60'
3- Wellhead protection cover type:	Flushmount
a) drain tube?	No
b) concrete pad dimensions	2 ft. Diameter Round
4- Dia./type of well casing	2" PVC Sch 40
5- Type/slot size of screen	2" Sch 40 PVC .01 slot
6- Type screen filter	#1 Filter Sand
a) Quantity used	
7- Type of Seal	Shur Plug 3/8" chips
a) Quantity used	
8- Grout	
a) Grout mix used	Portland cement/Bentonite
b) Method of placement	Tremie pipe
c) Vol. of well casing grout	
Development method	Whale Pump
Development time	1 hour
Estimated purge volume	55 gallons
Comments	



PROJECT NUMBER 345721.SI.SI	WELL NUMBER LS11A-MW38D
SHEET 1 OF 1	
WELL COMPLETION DIAGRAM	

PROJECT : CTO-125 LOCATION NAB Little Creek 11A
 DRILLING CONTRACTOR : Parrat-Wolff NORTHING:3,501,400.38 EASTING:12,169,553.55
 DRILLING METHOD AND EQUIPMENT USED : 4.25 in. hollow auger
 WATER LEVELS : 7.1' bgs START : 10/4/2007 1305 END :10/4/2007 1600 LOGGER : Shaun Whitworth

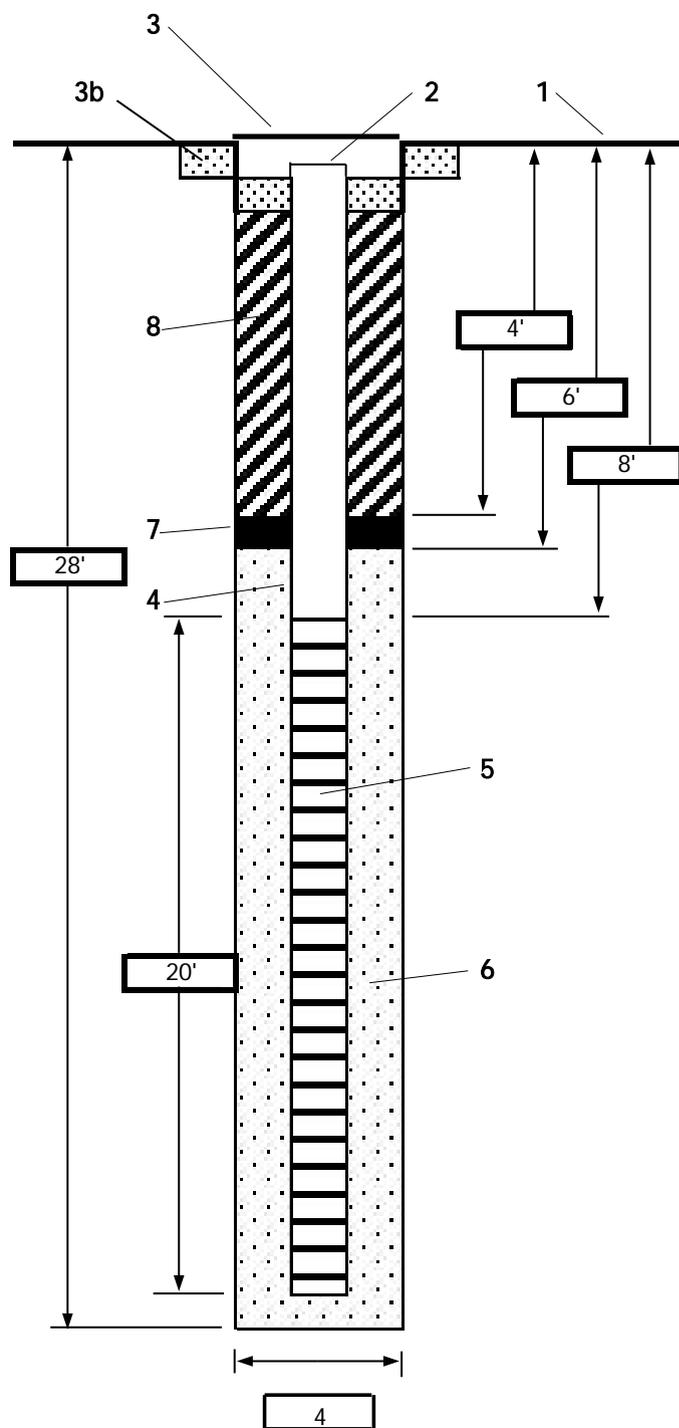


1- Ground elevation at well	9.4'
2- Top of casing elevation	8.97'
3- Wellhead protection cover type:	Flushmount
a) drain tube?	No
b) concrete pad dimensions	2 ft. Diameter Round
4- Dia./type of well casing	2" PVC Sch 40
5- Type/slot size of screen	2" Sch 40 PVC .01 slot
6- Type screen filter	#1 Filter Sand
a) Quantity used	
7- Type of Seal	Shur Plug 3/8" chips
a) Quantity used	
8- Grout	
a) Grout mix used	Portland cement/Bentonite
b) Method of placement	Tremie pipe
c) Vol. of well casing grout	
Development method	Whale Pump
Development time	2.25 hours
Estimated purge volume	70 gallons
Comments	



PROJECT NUMBER 345721.SI.SI	WELL NUMBER LS11A-MW39D
SHEET 1 OF 1	
WELL COMPLETION DIAGRAM	

PROJECT : CTO-125 LOCATION NAB Little Creek 11A
 DRILLING CONTRACTOR : Parrat-Wolff NORTHING:3,501,307.42 EASTING:12,169,507.03
 DRILLING METHOD AND EQUIPMENT USED : 4.25 in. hollow auger
 WATER LEVELS : 9.4' bgs START : 10/4/2007 1655 END :10/4/2007 1930 LOGGER : Shaun Whitworth

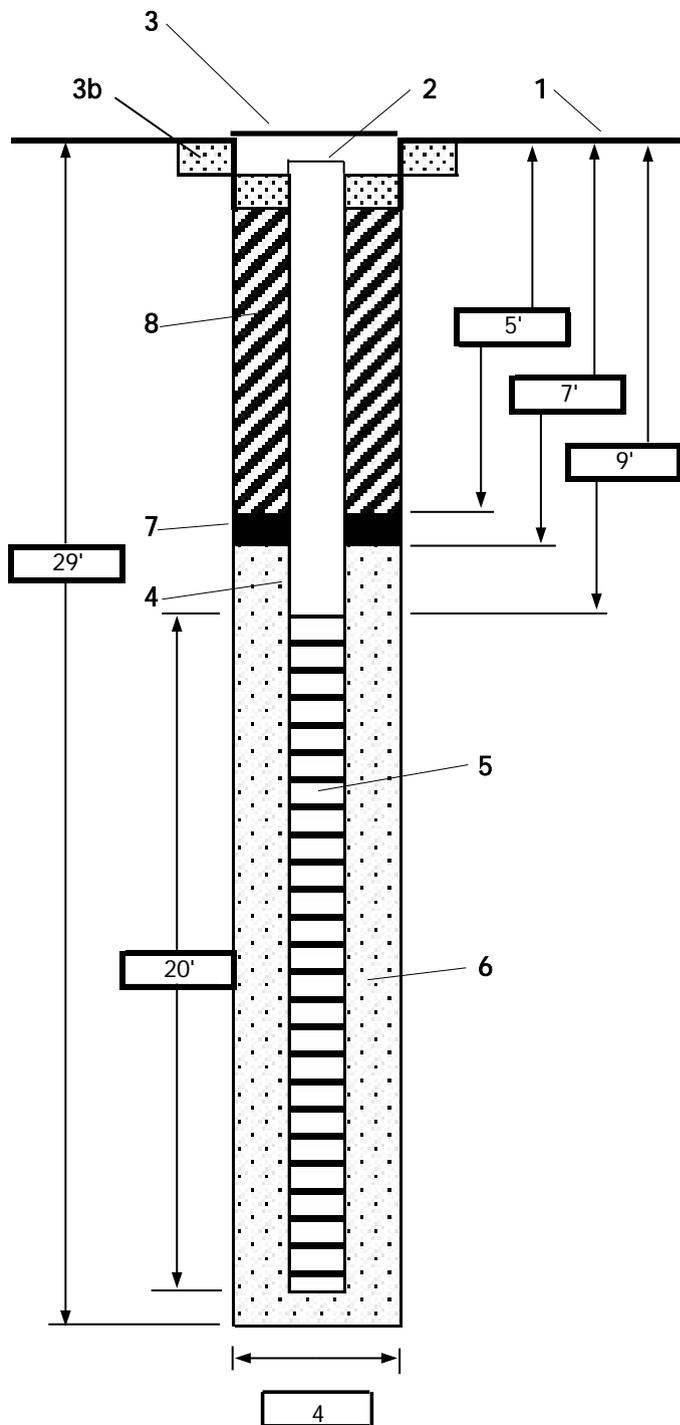


1- Ground elevation at well	9.1'
2- Top of casing elevation	8.90'
3- Wellhead protection cover type:	Flushmount
a) drain tube?	No
b) concrete pad dimensions	2 ft. Diameter Round
4- Dia./type of well casing	2" PVC Sch 40
5- Type/slot size of screen	2" Sch 40 PVC .01 slot
6- Type screen filter	#1 Filter Sand
a) Quantity used	
7- Type of Seal	Shur Plug 3/8" chips
a) Quantity used	
8- Grout	
a) Grout mix used	Portland cement/Bentonite
b) Method of placement	Tremie pipe
c) Vol. of well casing grout	
Development method	Whale Pump
Development time	0.5 hours
Estimated purge volume	50 gallons
Comments	



PROJECT NUMBER 345721.SI.SI	WELL NUMBER LS11A-MW40D
SHEET 1 OF 1	
WELL COMPLETION DIAGRAM	

PROJECT : CTO-125	LOCATION NAB Little Creek 11A
DRILLING CONTRACTOR : Parrat-Wolff	NORTHING:3,501,525.19 EASTING:12,169,666.63
DRILLING METHOD AND EQUIPMENT USED : 4.25 in. hollow auger	
WATER LEVELS : 7.5' bgs	START : 10/5/2007 1415 END :10/5/2007 1615 LOGGER : Shaun Whitworth



1- Ground elevation at well	9.6'
2- Top of casing elevation	9.37'
3- Wellhead protection cover type:	Flushmount
a) drain tube?	No
b) concrete pad dimensions	2 ft. Diameter Round
4- Dia./type of well casing	2" PVC Sch 40
5- Type/slot size of screen	2" Sch 40 PVC .01 slot
6- Type screen filter	#1 Filter Sand
a) Quantity used	
7- Type of Seal	Shur Plug 3/8" chips
a) Quantity used	
8- Grout	
a) Grout mix used	Portland cement/Bentonite
b) Method of placement	Tremie pipe
c) Vol. of well casing grout	
Development method	Whale Pump
Development time	1.00 hours
Estimated purge volume	40 gallons
Comments	

TECHNICAL SPECIFICATION

BIOREMEDIATION OF GROUNDWATER USING
ENHANCED REDUCTIVE DECHLORINATION (ERD) INJECTION
06/11

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
40 CFR 302	Designation, Reportable Quantities, and Notification
40 CFR 144 and 146	Underground Injection
40 CFR 112	Spill Prevention, Control, and Countermeasure (SPCC)

1.2 PROCESS DESCRIPTION

Treatment process shall provide a safe, reliable method to treat contaminated material conforming to paragraph PERFORMANCE REQUIREMENTS and shall be based on the enhanced reductive dechlorination (ERD) injection process described under DESIGN REQUIREMENTS.

1.3 DESIGN REQUIREMENTS

1.3.1 Biostimulation

Injection of emulsified vegetable oil (EVO) and a buffer to increase the buffering capacity if the pH is less than 6.0.

1.3.2 Injection Volume

Assuming a target treatment area of 22,400 square feet, a treatment thickness of 10 feet, and a dry soil bulk density of 100 pounds per cubic foot, the estimated mass of soil to be treated is approximately 11,200 tons. Assuming a maximum oil retention rate by aquifer material of 0.002 kilograms (kg) of oil per kg of soil, and effective (mobile) porosity of 0.17, and an injection contact efficiency of 75 percent, the total estimated quantity of an EVO product with 60 percent oil content (by weight) is 21,677 pounds, or 2,838 gallons. This total volume equates to an EVO requirement of 471 pounds (61.7 gallons) of EVO per injection point. This volume shall be verified based upon the selected EVO product groundwater chemical analyses conducted prior to the injections. EVO must be diluted with water to a target 5 percent solution (20:1 water/EVO volume ratio), and 1,234 gallons of diluted EVO must be injected into each injection point. Dilution water must be

obtained from onsite fire hydrants (coordination is required with the Navy to obtain a backflow preventer and flow meter).

1.3.3 Injection System

A trailer-mounted injection system with a 300-gallon polyethylene tank for mixing EVO, nutrients, and buffering agent, equipt with enough hose to reach each injection point, will maximize the ability to reach injection wells throughout the site. A fixed tank will require extending hose to all injection wells. A Dosatrons® or equivalent chemical injector must be used to dose the appropriate volume of injected materials from the tank to the water source. It is assumed that diluted EVO must be injected into four points simultaneously using one rig with a manifold system that allows concurrent injection. Each of the four lines must be equipped with a flow meter to monitor injection volume and a gate valve to regulate the flow and to turn off the line to the injection well once the target volume has been applied.

1.4 PERFORMANCE REQUIREMENTS

Inject ERD substrate into each injection well to reduce contaminant concentrations to the extent practicable and mitigate plume migration. Measure the radius of influence following injections to determine effectiveness of injection design. Perform sampling and analyses in accordance with an approved Uniform Federal Policy (UFP) Sampling and Analysis Plan (SAP) for the site.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with the Navy's Scope of Work:

SD-01 Preconstruction Submittals

Remedial Action Work Plan for Enhanced Reductive Dechlorination; G

Work plan to identify products to be utilized (SD-03 Product Data), sequencing/order of construction activities, present calculations and associated injection volumes, detail injection process, provide a means for monitoring and confirming the radius of influence, and confirm injection points are installed in accordance with the project. The Remedial Action Work Plan shall also address:

- a. Quality Control Plan
- b. Waste Management Plan

Health and Safety Plan, which includes an Accident Prevention Plan (APP) and Site Specific Health and Safety Plan (SSHP); G

The APP/SSHP is to be prepared in accordance with EM 385-1-1, US Army Corps of Engineers Safety and Health Manual and shall include activity hazard analyses (AHAs) for all tasks to be performed.

Uniform Federal Policy Sampling and Analysis Plan (UFP-SAP); G

A Uniform Federal Policy Sampling and Analysis Plan (UFP-SAP) must be prepared to document the performance monitoring of the ERD remedy. The UFP-SAP will conform to the requirements of:

- a. Guidance for Quality Assurance Project Plans, EPA QA/G-5, QAMS (USEPA, 2002)
- b. Uniform Federal Policy for Quality Assurance Plans (USEPA, 2005)
- c. Guidance on Systematic Planning Using the Data Quality Objectives Process (USEPA, 2006)

Spill Prevention, Control, and Countermeasure (SPCC) Plan; G

A Spill Prevention, Control, and Countermeasure (SPCC) Plan is required if greater than 1,320 gallons of the EVO product must be stored on site at one time. The purpose of the SPCC rule is to help facilities prevent a discharge of oil into navigable waters or adjoining shorelines. This rule is part of the U.S. Environmental Protection Agency's oil spill prevention program and was published under the authority of Section 311(j)(1)(C) of the Federal Water Pollution Control Act (Clean Water Act) in 1974. The rule may be found at Title 40, Code of Federal Regulations, Part 112.

The SPCC Plan must be certified by a licensed Professional Engineer (PE). By certifying the SPCC Plan, the PE confirms that:

- a. He is familiar with the requirements of the rule;
- b. He or an agent has visited and examined the facility;
- c. The SPCC Plan has been prepared in accordance with good engineering practices, including consideration of applicable industry standards, and with the requirements of the rule;
- d. Procedures for required inspections and testing have been established; and
- e. The SPCC Plan is adequate.

Monitoring well locations; G

Proposed locations for groundwater monitoring wells to be installed.

Temporary Injection point layout; G

Proposed temporary injection point layout based upon results of groundwater sampling and utility mark out.

SD-03 Product Data

EVO Product

Sodium bicarbonate or equivalent buffer

SD-07 Certificates

Synthetic or Manufactured Additives

Material safety data sheets (MSDSs), certificates of analysis, and product performance data not more than 45 calendar days after notice to proceed. MSDSs shall be in accordance with 29 CFR 1910 Section 1200 (g).

1.6 QUALIFICATIONS

Provide onsite oversight in accordance with the Quality Control Plan to be included in the Remedial Action Work Plan. Furnish Contractor documentation proving previous injection experience, and appropriate health and safety personnel on staff as required by the Navy's Scope of Work.

PART 2 PRODUCTS

2.1 EVO PRODUCT

Emulsified vegetable oil (EVO) with the following specifications:

- a. A 60 percent (by weight) soybean oil.
- b. At least 4 percent (by weight) readily-degradable soluble substrate (such as sodium lactate).
- c. An oil droplet size less than or equal to approximately 2.5 micrometers (μm).
- d. All components are generally recognized as safe (GRAS).

Based on the above specifications and cost, SRS[®]-SD, distributed by Terra Systems has been selected as the EVO product. SRS[®]-SD is a low-viscosity liquid that contains a combination of slow- and fast-release electron donors and required nutrients for microbial activity. Sodium bicarbonate must be mixed into the EVO product to increase the buffering capacity. To avoid breaking the emulsion of the oil, a concentration of 4 grams per liter (g/L) must be used.

2.2 AMENDMENTS

Amendments shall be free of chemicals, which could result in secondary contamination of groundwater. The concentration of glass, plastic, and other foreign materials in each shipment of amendment shall not exceed 5 percent, by dry weight.

2.3 SYNTHETIC OR MANUFACTURED ADDITIVES

A certificate of analysis shall accompany each shipping unit of synthetic or manufactured additive supplied by the vendor. Additives shall be shipped in

properly labeled containers with instructions for handling and storage. The instructions shall be strictly adhered to.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Project/Site Conditions

Approximate locations of contaminated zones are shown on the drawings. Under existing site conditions, the depth to the confining unit is approximately 20 to 30 feet below ground surface (bgs) and groundwater is approximately 5 to 10 feet bgs. Proper equipment needed to access well locations shall be brought to the site. Contractor should visit site prior to injections, if necessary. Water shall be obtained from local hydrants. Electricity will not be available.

3.1.2 Sequencing

The sequencing of work to be completed for the ERD must be identified in the Remedial Action Work Plan. The primary components are:

- a. Install shallow groundwater monitoring wells in accordance with the project plans.
- b. Measure water levels and collect groundwater samples from the existing site wells, as well as newly installed monitoring wells for chemical analysis. Confirm extent of target treatment area.
- c. Revise temporary injection point layout as appropriate. Provide submittal for the proposed layout of the injection wells.
- d. Conduct biostimulation EVO injections. Following injections, performance monitoring must be conducted in accordance with the required UFP-SAP.

3.1.3 Mobilization

The Contractor shall not mobilize to the site until written approval is received from the Contracting Officer. Delays caused by the Contractor's failure to acquire permits, meet other regulatory requirements, or fulfill other contract requirements shall result in no additional costs. Equipment which may have previously come into contact with contaminated material shall be decontaminated before being brought to the site.

3.1.4 Protection of Existing Conditions

Maintain all existing survey monuments and monitoring wells, and protect against damage from equipment and vehicular traffic. Immediately report and repair any items damaged by the Contractor. Re-install monitoring wells requiring replacement due to Contractor negligence. Prior to subsurface-intrusive activities, underground utility clearances must be conducted.

3.1.5 Investigation Derived Waste (IDW) and Disposal

All development water, soil cuttings, purge water, and decontamination fluids generated must be handled and containerized as contaminated material.

A secondary containment unit shall be used for IDW located at the designated staging area as specified in an approved Waste Management Plan within the Remedial Action Work Plan.

3.1.6 Demobilization

Demobilization shall not commence until written approval is received from the Contracting Officer. Demobilization shall include restoration of the site to its original condition.

3.2 INJECTIONS

SRS®-SD, diluted with water, along with the pH buffer, shall be prepared to a target of 5 percent solution prior to injection. Inject the diluted EVO through DPT rods into multiple points simultaneously using one rig with a manifold system that allows concurrent injection. Equip each of the injection lines with a flow meter to monitor injection volume and a gate valve to regulate the flow and to turn off the line to the injection well once the target volume has been applied.

Injections for the source area must be conducted at the bottom 10 feet of the aquifer. Based on existing monitoring well data, the depth to the bottom of the aquifer is approximately 20 to 30 feet bgs. Injections for the barrier lines must be conducted at a depth of 14 to 24 feet bgs. Depths must be confirmed in the field during the new monitoring well installation. In addition to soil cores collected at the newly installed monitoring wells, two additional soil cores, one within the center of source treatment area and one in the corner where the two boundary lines converge, must be collected to confirm the depth to the confining unit within the injection areas. Injections must be performed using a top-down methodology over the 10-foot vertical interval. Half of the diluted EVO solution must be injected in the top five feet of the injection while the remaining solution must be injected in the bottom 5 feet of the injection interval. During the injections, the drill rig will need to move between the injection points to drive the DPT rods to the deeper injection intervals.

The injection rate and injection pressures must be adjusted in the field to optimize the radius of influence and prevent daylighting of the material. The procedure for determining appropriate injection rates must be provided in the Remedial Action Work Plan. It is assumed that the diluted SRS®-SD must be injected at a total flow rate equivalent to 3 gpm for the entire injection point.

Injection boreholes must be abandoned by filling the hole with granular 100% bentonite slurry in accordance with state and federal regulations. If possible, the injection points must be abandoned prior to performing adjacent injections, to prevent preferential pathways for nearby injections.

3.3 PROCESS MONITORING

3.3.1 Radius of Influence Monitoring

Perform radius of influence monitoring during the injection and performance monitoring events. Monitoring must be detailed in the Remedial Action Work Plan.

3.3.2 Groundwater Levels

Measure groundwater levels at all monitoring wells prior to injections, during injections, and in conjunction with performance monitoring. Perform water level measurement in accordance with ASTM D 4750. Record water level readings to the nearest 0.01 foot. Decontaminate the part of the measuring device that was wetted after each measurement.

3.3.3 Operation, Maintenance and Process Monitoring

Treatment performance must be assessed through groundwater monitoring. Performance monitoring data must be used as the basis for deciding if and when to conduct additional ERD injection, transition to more passive technologies, and/or implement a contingency.

3.3.3.1 Field Analysis

Measure and record field parameters during performance monitoring events as specified in the UFP SAP. Parameters include dissolved oxygen, temperature, pH, oxidation-reduction potential, and specific conductivity. Use an in-situ field probe and low-flow groundwater flow cell.

3.3.3.2 Laboratory Analysis

Laboratory analysis of groundwater samples from up to 20 wells (details must be addressed in the UFP SAP) shall be performed prior to the injections (baseline) and at 1, 3, and 6 months following injections. Take the sample for laboratory analysis immediately after collecting the sample for field analysis at each sample port. Analytes will include COCs, degradation products, and performance monitoring indicator parameters, as specified in the UFP SAP. The performance monitoring sampling strategy is provided below:

Performance Monitoring Sampling Strategy
 Site 11a, JEB Little Creek, Virginia Beach, Virginia

	Station ID	Baseline	1-Month Post Injection	3-Month Post Injection	6-Month Post Injection
Existing Monitoring Wells	LS11-MW15D	VOCs, PMIPs			VOCs, PMIPs
	LS11-MW16D	VOCs, PMIPs			VOCs, PMIPs
	LS11-MW20D	VOCs, PMIPs			VOCs, PMIPs
	LS11-MW21D	VOCs, PMIPs			VOCs, PMIPs
	LS11-MW22D	VOCs, PMIPs			VOCs, PMIPs
	LS11-MW31D	VOCs, PMIPs			VOCs, PMIPs
	LS11-MW32D	VOCs, PMIPs, H2, VFAs	VOCs, PMIPs	VOCs, PMIPs, H2, VFAs	VOCs, PMIPs, H2, VFAs
	LS11-MW33D	VOCs, PMIPs, H2, VFAs	VOCs, PMIPs	VOCs, PMIPs, H2, VFAs	VOCs, PMIPs, H2, VFAs
	LS11-MW34D	VOCs, PMIPs			VOCs, PMIPs
	LS11-MW35D	VOCs, PMIPs			VOCs, PMIPs
	LS11A-MW36D	VOCs, PMIPs			VOCs, PMIPs
	LS11A-MW37D	VOCs, PMIPs			VOCs, PMIPs
	LS11A-MW38D	VOCs, PMIPs, H2, VFAs	VOCs, PMIPs	VOCs, PMIPs, H2, VFAs	VOCs, PMIPs, H2, VFAs
	LS11A-MW39D	VOCs, PMIPs, H2, VFAs	VOCs, PMIPs	VOCs, PMIPs, H2, VFAs	VOCs, PMIPs, H2, VFAs
	LS11A-MW40D	VOCs, PMIPs			VOCs, PMIPs

New Monitoring Wells	LS11A-MW41D	VOCs, PMIPs, H2, VFAs	VOCs, PMIPs	VOCs, PMIPs, H2, VFAs	VOCs, PMIPs, H2, VFAs
	LS11A-MW42D	VOCs, PMIPs, H2, VFAs	VOCs, PMIPs	VOCs, PMIPs, H2, VFAs	VOCs, PMIPs, H2, VFAs
	LS11A-MW43D	VOCs, PMIPs, H2, VFAs	VOCs, PMIPs	VOCs, PMIPs, H2, VFAs	VOCs, PMIPs, H2, VFAs
	LS11A-MW44D	VOCs, PMIPs			VOCs, PMIPs
	LS11A-MW45D	VOCs, PMIPs			VOCs, PMIPs

Notes:

1. VOCs include PCE, TCE, cis-1,2-DCE, and VC.
2. Performance monitoring indicator parameters (PMIPs) include field parameters (pH, conductivity, turbidity, DO, ORP, temperature, salinity) and offsite laboratory parameters (nitrate, dissolved iron, dissolved manganese, dissolved arsenic, methane, ethane, ethene, sulfate, sulfide, total organic carbon, and alkalinity).
3. Hydrogen (H2) and volatile fatty acids (VFAs) must be analyzed for monitoring wells located within the target treatment areas.

3.4 SPILLS

In the event of a spill or release of a hazardous substance (as designated in 40 CFR 302), pollutant, contaminant, or oil (as governed by the Oil Pollution Act (OPA), 33 U.S.C. 2701 et seq.), the Contractor shall notify the Contracting Officer immediately. If the spill exceeds the reporting threshold, the Contractor shall follow the pre-established procedures for immediate reporting to the Contracting Officer. Immediate containment actions shall be taken to minimize the effect of any spill or leak. Clean-up shall be in accordance with applicable federal, state, and local regulations. Additional sampling and testing may be required to verify spills have been cleaned up. Spill cleanup and testing shall be done at no additional cost to the Government.

-- End of Section --

Appendix B

TABLE B-1

EVO Injection Design Calculations (Source Area)

Site 11a, JEB Little Creek, Virginia Beach, Virginia

Parameter	Value	Units	Basis/Notes
Site Data			
Hydraulic Gradient	0.00073	ft/ft	Average value: RI Report
Hydraulic Conductivity	3.15	ft/day	Geomean of slug test results, Columbia Aquifer
Estimated Total Porosity	0.35	---	Estimated for silty sand; RI Report
Estimated Effective Porosity	0.17	---	Assumed mobile porosity
Seepage Velocity	4.9	ft/yr	Calculated
Bulk Density	100	lbs/ft ³	Estimated for silty sand; RI Report
Maximum Oil Retention by aquifer	0.002	lbs oil/lbs soil	Recommend value between 0.002 and 0.003 (60% EVO)
Treatment Zone Dimensions			
Width (perpendicular to groundwater flow)	80	ft	2007 Plume (500 ug/L)
Length per Barrier (parallel to groundwater flow)	20	ft	Assume 10 foot ROI
Treatment Zone Thickness	10	ft	Contaminant Thickness
Total Length of Treatment Area	180	ft	2007 Plume (500 ug/L)
Barrier Layout			
Number of Barriers	7	---	Calculated
Approximate Distance Between Barriers	25	ft	Estimated
Injection Well Layout			
Well Spacing	20	ft	Assume 10 foot ROI
Average Number of Wells per Barrier	4	---	Calculated
Calculated Total Number of Wells	28	---	Calculated
Final Total Number of Wells	26	---	Due to irregularity of treatment area shape, adjust final well number for calculations below
Injection Dosage			
Desired Contact Efficiency- Mass Scaling Factor	0.75	---	Number between 0.2 and 2.0
Mass of Oil Injected per well	471	lbs/well	Calculated from no. of injection points x area within theoretical ROI
EVO Mass	12,252	lbs	Assume 60 percent oil content (by weight)
EVO Volume	1,604	gallons	Estimated from EOS® product; other products (e.g. Terra systems) can be used. Assume 7.64 lbs/gal.
Number of Drums	30		Calculated
Injection Time Requirements			
Dilution Ratio	0.05	---	Assume EVO dilution, no flush water
Estimated Diluted EVO Volume	32,074	gallons	Assume buffering agent and nutrient package will not significantly add to total volume
Estimated Injection Rate	3	gal/min	Similar site in Virginia.
Number of concurrent injection points	4	---	Estimate
Hours of Injection per Day	7	hrs	Estimate
Days of Injection	7	days	Calculated
Maximum Volume			
Dilution Ratio	0.02	---	Assume EVO dilution, no flush water
Estimated Diluted EVO Volume	80,185	gallons	Assume buffering agent and nutrient package will not significantly add to total volume
Estimated EVO Volume per Well	3,084	gallons	Maximum volume required
Minimum Volume			
Dilution Ratio	0.1	---	Assume EVO dilution, no flush water
Estimated Diluted EVO Volume	16,037	gallons	Assume buffering agent and nutrient package will not significantly add to total volume
Estimated Volume per Well	617	gallons	Minimum volume required

Appendix B

TABLE B-2

EVO Injection Design Calculations (Dissolved Plume Boundary)

Site 11a, JEB Little Creek, Virginia Beach, Virginia

Parameter	Value	Units	Basis/Notes
Site Data			
Hydraulic Gradient	0.00073	ft/ft	Average value: RI Report
Hydraulic Conductivity	3.15	ft/day	Geomean of slug test results, Columbia Aquifer
Estimated Total Porosity	0.35	---	Estimated for silty sand; RI Report
Estimated Effective Porosity	0.17	---	Assumed mobile porosity
Seepage Velocity	4.9	ft/yr	Calculated
Bulk Density	100	lbs/ft ³	Estimated for silty sand; RI Report
Maximum Oil Retention by aquifer	0.002	lbs oil/lbs soil	Recommend value between 0.002 and 0.003 (60% EVO)
Treatment Zone Dimensions			
Width (perpendicular to groundwater flow)	200	ft	2007 Plume (500 ug/L)
Length per Barrier (parallel to groundwater flow)	20	ft	Assume 10 foot ROI
Treatment Zone Thickness	10	ft	Contaminant Thickness
Total Length of Treatment Area	40	ft	2007 Plume (500 ug/L)
Barrier Layout			
Number of Barriers	2	---	Calculated
Approximate Distance Between Barriers	20	ft	Estimated
Injection Well Layout			
Well Spacing	20	ft	Assume 10 foot ROI
Average Number of Wells per Barrier	10	---	Calculated
Calculated Total Number of Wells	20	---	Calculated
Injection Dosage			
Desired Contact Efficiency- Mass Scaling Factor	0.75	---	Number between 0.2 and 2.0
Mass of Oil Injected per well	471	lbs/well	Calculated from no. of injection points x area within theoretical ROI
EVO Mass	9,425	lbs	Assume 60 percent oil content (by weight)
EVO Volume	1,234	gallons	Estimated from EOS® product; other products (e.g. Terra systems) can be used. Assume 7.64 lbs/gal.
Number of Drums	23		Calculated
Injection Time Requirements			
Dilution Ratio	0.05	---	Assume EVO dilution, no flush water
Estimated Diluted EVO Volume	24,672	gallons	Assume buffering agent and nutrient package will not significantly add to total volume
Estimated Injection Rate	3	gal/min	Similar site in Virginia.
Number of concurrent injection points	4	---	Estimate
Hours of Injection per Day	7	hrs	Estimate
Days of Injection	5	days	Calculated
Maximum Desired Injection Volume			
Dilution Ratio	0.02	---	Assume EVO dilution, no flush water
Estimated Diluted EVO Volume	61,680	gallons	Assume buffering agent and nutrient package will not significantly add to total volume
Estimated EVO Volume per Well	3,084	gallons	Maximum volume required
Minimum Desired Injection Volume			
Dilution Ratio	0.1	---	Assume EVO dilution, no flush water
Estimated Diluted EVO Volume	12,336	gallons	Assume buffering agent and nutrient package will not significantly add to total volume
Estimated Volume per Well	617	gallons	Minimum volume required

DESIGN DRAWINGS FOR

SITE 11a

REMEDIAL DESIGN

JEB LITTLE CREEK - VIRGINIA BEACH, VIRGINIA

PREPARED FOR

DEPARTMENT OF THE NAVY

NAVAL FACILITIES ENGINEERING COMMAND MID-ATLANTIC

NORFOLK, VIRGINIA

PROJECT LOCATION



JEB LITTLE CREEK
VICINITY MAP
NTS

INDEX OF DRAWINGS

NAVFAC DWG NO	DRAWING NUMBER	SHEET TITLE
-	G-0	COVER SHEET / INDEX
-	G-1	GENERAL NOTES
-	C-1	EXISTING SITE CONDITIONS
-	C-2	SITE PLAN AND INJECTION POINT LAYOUT
-	C-3	DETAILS



PROJECT LOCATION
SITE 11a

LOCATION MAP
NTS

SW	DESCRIPTION	DATE	APPR



APPROVED
FOR COMMANDER NAVFAC

DES	BH	DRW	DS	CHK	PL
<<PM/DM>>					
BRANCH MANAGER					
CHIEF ENG/ARCH					
<<XXX>>					

DEPARTMENT OF THE NAVY
 NAVAL FACILITIES ENGINEERING COMMAND
 NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
 VIRGINIA BEACH, VIRGINIA
 VIRGINIA BEACH, VIRGINIA
SITE 11a REMEDIATION
 COVER SHEET/INDEX

FOR PROJECT INFORMATION, CONTACT:

PAUL LANDIN
 CH2M HILL
 5700 CLEVELAND STREET
 SUITE 101
 VIRGINIA BEACH, VA 23462
 (757) 671- 6238

CH2M HILL PROJECT NO. 420698
 JUNE 2011



SCALE:	AS NOTED
PROJECT NO.:	
CONSTR. CONTR. NO.	
NAVFAC DRAWING NO.	
SHEET	1 OF 5
G-0	

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GENERAL NOTES

1. THE MERIDIAN SOURCE OF THE SURVEY REFERS TO THE VIRGINIA STATE PLANE COORDINATE SYSTEM SOUTH ZONE, NAD 1983/1983 HARN US SURVEY FOOT ESTABLISHED FROM UNITED STATES NAVY PUBLIC WORKS CENTER JEB LITTLE CREEK-FORT STORY STATION NAME: LC10.
2. THE VERTICAL DATUM OF THIS SURVEY IS ESTABLISHED FROM UNITED STATES NAVY PUBLIC WORKS CENTER JEB LITTLE CREEK-FORT STORY STATION NAME: LC10 NAVD 1988 ELEVATION 11.037 FEET.
3. EXISTING CONDITIONS MAY VARY FROM THOSE SHOWN ON THESE PLANS. THE CONTRACTOR SHALL VERIFY EXISTING CONDITIONS AND BURIED UTILITIES, AND ADJUST WORK PLAN ACCORDINGLY PRIOR TO BEGINNING CONSTRUCTION.
4. EXISTING TOPOGRAPHY, STRUCTURES, AND SITE FEATURES ARE SHOWN SCREENED AND/OR LIGHT-LINED.
5. MAINTAIN, RELOCATE, OR REPLACE EXISTING SURVEY MONUMENTS, CONTROL POINTS, AND STAKES WHICH ARE DISTURBED OR DESTROYED. PERFORM THE WORK TO PRODUCE THE SAME LEVEL OF ACCURACY AS THE ORIGINAL MONUMENT(S) IN A TIMELY MANNER, AND AT THE CONTRACTOR'S EXPENSE.
6. THIS PROPERTY IS LOCATED IN FLOOD ZONES "X" AND "AE" AS DETERMINED FROM F.E.M.A. - F.I.R.M. MAP NO. 5155310017F EFFECTIVE DATE: OCT. 3, 1970. MAP REVISED MAY 4, 2009.

REMEDIAL ACTION OBJECTIVES

THE SITE-SPECIFIC REMEDIAL ACTION OBJECTIVES ESTABLISHED IN THE FEASIBILITY STUDY (FS) (CH2M HILL, 2011) AND DOCUMENTED IN THE ROD (NAVFAC, 2011) FOR THE PROTECTION OF HUMAN HEALTH AT SITE 11A ARE AS FOLLOWS:

- REDUCE CONCENTRATIONS OF CONTAMINANTS OF CONCERN IN THE SOURCE AREA AND THE DOWNGRADIENT PLUME TO CLEANUP LEVELS THROUGH TREATMENT TO THE MAXIMUM EXTENT PRACTICABLE WITHIN A REASONABLE AMOUNT OF TIME.

- PREVENT EXPOSURE TO SITE 11A GROUNDWATER AND GROUNDWATER EMISSIONS IN INDOOR AIR UNTIL CONCENTRATIONS OF COCS HAVE BEEN REDUCED TO LEVELS THAT ALLOW FOR UNRESTRICTED USE/UNRESTRICTED EXPOSURE.

CLEANUP LEVELS HAVE BEEN ESTABLISHED FOR CONSTITUENTS WITH CONCENTRATIONS CONTRIBUTING TO UNACCEPTABLE RISKS AND HAZARDS FROM EXPOSURE TO SHALLOW GROUNDWATER WITHIN SITE 11A. THE CLEANUP LEVELS WERE DEVELOPED FROM THE PRELIMINARY REMEDIATION GOALS, WHICH WERE ESTABLISHED IN THE FS AS THE MAXIMUM CONTAMINANT LEVELS (MCL) AFTER CONSIDERATION OF THE TOTAL RISKS/HAZARDS ASSOCIATED WITH THEIR USE. CLEANUP LEVELS FOR THE SITE 11A COCS ARE AS FOLLOWS:

- PCE: 5 µg/L
- TCE: 5 µg/L

EXPECTATION TO RETURN GROUNDWATERS TO THEIR BENEFICIAL USES WHEREVER THE NAVY ACKNOWLEDGES THE COMMONWEALTH OF VIRGINIA'S AND USEPA'S PRACTICABLE. THEREFORE, ALTHOUGH NOT IDENTIFIED AS SITE-SPECIFIC CONTAMINANTS OF CONCERN REQUIRING ACTION, THE DEGRADATION OF PCE AND TCE MAY RESULT IN TEMPORARY INCREASES TO THE CONCENTRATIONS OF DAUGHTER PRODUCTS CIS-1,2-DCE AND VC ABOVE THEIR RESPECTIVE MCLS. REMEDIAL ACTION OBJECTIVES CANNOT BE MET IF THESE CONSTITUENTS ARE ABOVE THEIR MCLS. AS A RESULT, CIS-1,2-DCE AND VC WILL BE MONITORED DURING PERFORMANCE AND LTM TO ENSURE CONCENTRATIONS RETURN TO BELOW THEIR RESPECTIVE MCL TO ACHIEVE UNRESTRICTED USE/UNRESTRICTED EXPOSURE. THE DAUGHTER PRODUCT MCLS ARE AS FOLLOWS:

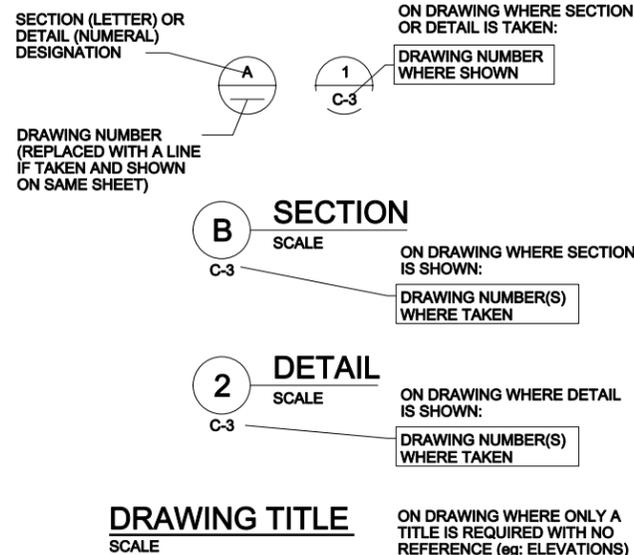
- CIS-1,2-DCE: 70 µG/L
- VC: 2 µG/L

PREFORMANCE OBJECTIVES

PERFORMANCE OBJECTIVES ARE CRITERIA THAT MEASURE THE OPERATIONAL EFFICIENCY AND SUITABILITY OF A PARTICULAR REMEDIAL TECHNOLOGY. THE PRIMARY PERFORMANCE OBJECTIVES FOR THE REMEDIAL DESIGN AT SITE 11A ARE:

- REDUCE CONTAMINANT CONCENTRATIONS IN THE SOURCE AREA TO LESS THAN THE MCLS, TO THE EXTENT PRACTICABLE.
- ENSURE TEMPORARY INCREASES IN CONCENTRATIONS OF DAUGHTER PRODUCTS CIS-1,2-DCE AND VC (DUE TO DEGRADATION OF PCE AND TCE) ABOVE THEIR RESPECTIVE MCLS, DECREASE BELOW THEIR RESPECTIVE MCLS FOLLOWING REMEDY IMPLEMENTATION, DURING LTM, TO THE EXTENT PRACTICABLE.

SECTION / DETAIL DESIGNATIONS



SUMMARY OF WORK

**INCOMPLETE FOR THIS SUBMITTAL. THESE NOTES WILL LINK THE PROJECT DRAWINGS TO THE NAVY'S SCOPE OF WORK. SUMMARY OF WORK WILL BE UPDATED FOR THE FINAL DESIGN DRAWINGS.

ABBREVIATIONS

CIS-1,2-DCE	CIS-1,2-DICHLOROETHENE
COC	CONTAMINANT OF CONCERN
CONC	CONCRETE
DIA	DIAMETER
E	EAST/EASTING
JEB	JOINT EXPEDITIONARY BASE
FS	FEASIBILITY STUDY
FT	FEET/FOOT
MCL	MAXIMUM CONTAMINANT LEVEL
N	NORTH/NORTHING
NAD	NORTH AMERICAN DATUM
NAVFAC	NAVAL FACILITIES ENGINEERING COMMAND
NO	NUMBER
NTS	NOT TO SCALE
ROD	RECORD OF DECISION
PRG	PRELIMINARY REMEDIATION GOAL
PCE	TETRACHLOROETHENE
PVC	POLYVINYL CHLORIDE
SCH	SCHEDULE
TCE	TRICHLOROETHENE
TYP	TYPICAL
UG/L	MICROGRAMS PER LITER
VC	VINYL CHLORIDE



APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO DATE

DES	BH	DRW	DS	CHK	PL
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BRANCH MANAGER

CHIEF ENG/ARCH

<CRK>

DEPARTMENT OF THE NAVY

NAVAL FACILITIES ENGINEERING COMMAND

MID-ATLANTIC VIRGINIA BEACH, VIRGINIA

VIRGINIA BEACH, VIRGINIA

SITE 11a REMEDIATION

GENERAL NOTES

SCALE: AS NOTED

PROJECT NO.:

CONSTR. CONTR. NO.

NAVFAC DRAWING NO.

SHEET 2 OF 5

G-1

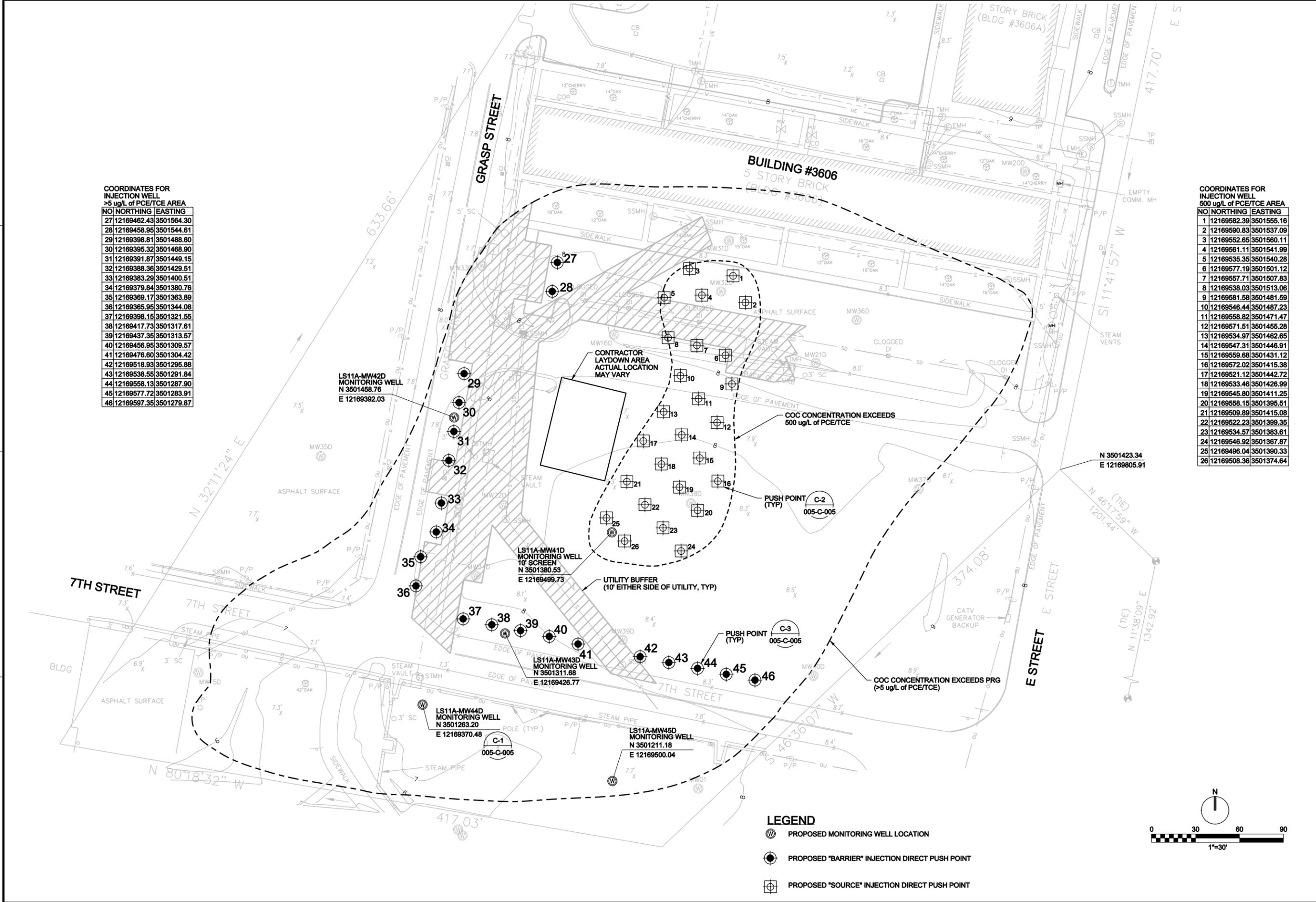
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COORDINATES FOR INJECTION WELL >5 ug/L of PCE/TCE AREA

NO	NORTHING	EASTING
27	12169462.43	3501564.30
28	12169458.95	3501544.61
29	12169398.81	3501486.60
30	12169395.32	3501468.90
31	12169391.87	3501449.15
32	12169388.36	3501429.51
33	12169383.29	3501400.51
34	12169379.84	3501380.76
35	12169369.17	3501363.89
36	12169365.95	3501344.08
37	12169398.15	3501321.55
38	12169417.73	3501317.61
39	12169437.35	3501313.57
40	12169458.95	3501309.57
41	12169476.60	3501304.42
42	12169518.93	3501295.88
43	12169538.55	3501291.84
44	12169558.13	3501287.90
45	12169577.72	3501283.91
46	12169597.35	3501279.87

COORDINATES FOR INJECTION WELL 500 ug/L of PCE/TCE AREA

NO	NORTHING	EASTING
1	12169582.39	3501555.16
2	12169590.83	3501537.09
3	12169552.65	3501560.11
4	12169561.11	3501541.99
5	12169535.35	3501540.28
6	12169577.19	3501501.12
7	12169557.71	3501507.83
8	12169538.03	3501513.06
9	12169581.58	3501481.59
10	12169546.44	3501487.23
11	12169558.82	3501471.47
12	12169571.51	3501455.28
13	12169534.97	3501462.65
14	12169547.31	3501446.91
15	12169559.68	3501431.12
16	12169572.02	3501415.38
17	12169521.12	3501442.72
18	12169533.46	3501426.99
19	12169545.80	3501411.25
20	12169558.15	3501395.51
21	12169509.89	3501415.08
22	12169522.23	3501399.35
23	12169534.57	3501383.61
24	12169546.92	3501367.87
25	12169496.04	3501390.33
26	12169508.36	3501374.64



- LEGEND**
- PROPOSED MONITORING WELL LOCATION
 - PROPOSED "BARRIER" INJECTION DIRECT PUSH POINT
 - PROPOSED "SOURCE" INJECTION DIRECT PUSH POINT

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FOR COMMANDER NAVFAC				
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DES: BH DRAW: DS CHK: PL				
BRANCH MANAGER				
CHIEF ENG/ARCH				
(CHECK)				
DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND - MID-ATLANTIC VIRGINIA BEACH, VIRGINIA SITE 11a				
SITE 11a REMEDIATION				
SITE PLAN AND INJECTION POINT LAYOUT				
SCALE: AS NOTED				
PROJECT NO.:				
CONSTR. CONTR. NO.:				
NAVFAC DRAWING NO.:				
SHEET 4 OF 5				
C-2				
7/13/2011 005-C-002_420698.DGN REVISION: 10 MARCH 2009 420698				

90% DESIGN SUBMITTAL

