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TIER II SAMPLING AND ANALYSIS PLAN BUILDING 148 STUDY AREA 56 AREA C
SOUTHWEST NTC ORLANDO FL
4/9/2013
RESOLUTION CONSULTANTS

**TIER II SAMPLING AND ANALYSIS PLAN
BUILDING 148/STUDY AREA 56 at
AREA C SOUTHWEST
FORMER NAVAL TRAINING CENTER ORLANDO,
FLORIDA**

FINAL

**Resolution Consultants Job No. :
60285781**

Prepared for:



**Department of the Navy
Naval Facilities Engineering Command Southeast
BRAC Program Management Office, SE
4130 Faber Place Drive
North Charleston, South Carolina 29405**

**Comprehensive Long-Term Environmental Action Navy
Contract No. N62470-11-D-8013**

CTO JM42

Prepared by:



**RESOLUTION
CONSULTANTS**

**Resolution Consultants
A Joint Venture of AECOM & EnSafe
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Norfolk, VA 23510**

9 April 2013

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SAP WORKSHEET #1: TITLE AND APPROVAL PAGE

Final

TIER II SAMPLING AND ANALYSIS PLAN

9 April 2013

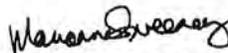
**BUILDING 148/SA 56 AT
AREA C SOUTHWEST
FORMER NTC ORLANDO, FLORIDA**

**Prepared for:
Department of the Navy
Naval Facilities Engineering Command Southeast
Building 135 N, P.O. Box 30
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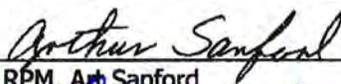
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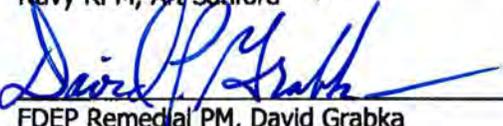
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Chemist, Ken Bowers

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(as required) Navy RPM, Art Sanford Date

Other Approval Signature:  David Grabka 4/19/13
(as required) FDEP Remedial PM, David Grabka Date

SAP WORKSHEET #1: TITLE AND APPROVAL PAGE

Draft

TIER II SAMPLING AND ANALYSIS PLAN

18 March 2013

**BUILDING 148/SA 56 AT
AREA C SOUTHWEST
FORMER NTC ORLANDO, FLORIDA**

**Prepared for:
Department of the Navy
Naval Facilities Engineering Command Southeast
Building 135 N, P.O. Box 30
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Navy Quality Assurance Officer/
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Navy RPM, Art Sanford Date

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FDEP Remedial PM, David Grabka Date

EXECUTIVE SUMMARY

On behalf of the Navy, Resolution Consultants is submitting this Sampling and Analysis Plan (SAP) to document the proposed sampling to be performed at Department of Navy Environmental Restoration Program Site Building 148 area and Study Area 56 (SA 56) at Area C Southwest (Area C SW) located at Former Naval Training Center (NTC) Orlando, Florida. The site will be referred to in this SAP as Building 148/SA 56. This SAP was prepared in accordance with the applicable Navy, United States Environmental Protection Agency (USEPA) Region 4, and FDEP requirements, regulations, guidance, and technical standards, as appropriate. This includes the Department of Defense, Department of Energy, and USEPA Interagency Data Quality Task Force environmental requirements regarding federal facilities, as specified in the UFP-QAPP guidance (USEPA, 2005).

Following the *Naval Facilities Engineering Command (NAVFAC) Tiered Approach for Developing Sampling and Analysis Plans* letter from the Department of the Navy dated June 3, 2011, this SAP was prepared to follow NAVFAC's Tier II UFP-QAPP template, developed to allow for an effective and efficient process for smaller and less complex sites such as Building 148/SA 56.

Area C SW is the 19.73-acre parcel in the southwest portion of Area C that was transferred to the City of Orlando in January 2009 through the Federal Lands to Parks Program of the United States Department of Interior, National Park Service, for Public Park and public recreation area purposes.

This SAP addresses the portion of Area C SW consisting of the Building 148 area and SA 56. Building 148 (Former Cold Storage Warehouse) has also historically been referred to as SA 11. SA 56 encompasses the southern part of Area C SW, including Building 1104 (Former Hazardous Material Storage Building), referred to as SA 55. Building 1053 (SA 15) and Buildings 1052, 1054, and 1055, all of which have been demolished, were located in the northeast part of Area C SW and are not considered in this SAP.

At Building 148 (Former Cold Storage Warehouse), investigated as SA 11, an emergency generator system was located next to the northeast corner of the building. The system included a pad-mounted generator unit and a 100-gallon aboveground storage tank (AST) containing fuel oil. The system was removed and the site received a clean tank closure in July 1996. Two areas of environmental concern identified in 1996 consisted of a small area of oil-stained soil and stressed vegetation near the generator pad and an abandoned 55-gallon drum containing dried paint residue located in the brush north of Building 148. The area of stained soil and stressed vegetation was addressed in a Tank Closure Assessment Report that was approved by the Florida Department of Environmental Protection (FDEP). Analysis of soil from a soil boring adjacent to the drum did not identify any indications of contamination.

Following the transfer of Area C SW to the City of Orlando through the Federal Lands to Parks Program, in May 2011, in preparation for park site development, Building 148 was demolished by the City. Following demolition, soil beneath the building was stockpiled and sampled prior to disposal by the City's environmental consultant, Professional Services Industries, Inc. (PSI). The Navy received a Notice of Environmental Claim letter dated July 22, 2011 from George Schlossberg, City of Orlando legal, officially notifying the Navy that surface soil sampling results from Building 148 indicated concentrations of carcinogenic polynuclear (aka polycyclic) aromatic hydrocarbons (PAHs) and dieldrin greater than FDEP Soil Cleanup Target Levels (SCTLs). The Navy sampled the stockpiled soil in September 2011 and disposed of the soil off-site in March 2012. Further sampling by the Navy of soil beneath and in the vicinity of the former Building 148 indicated the presence of carcinogenic PAHs and dieldrin at concentrations above SCTLs.

At SA 55, soil removal was conducted in February 2004, and using the 95 percent Upper Confidence Limit (UCL), it was concluded that carcinogenic PAH-contaminated surface soils had been mitigated to levels compatible with future Residential use. In addition, in August 1998, as part site screening for SA 55, a groundwater sample was collected from one microwell. No analytes were detected above their respective Florida Groundwater Cleanup Target Levels (GCTLs). FDEP concurred that soil removal activities at SA 55 remediated the site to levels acceptable for unrestricted use. Based on this and the absence of detections in groundwater above the GCTLs, FDEP agreed that no further action was required at SA 55 (FDEP, 2004).

Following the transfer of Area C SW to the City of Orlando through the Federal Lands to Parks Program, in August 2011, in preparation for park site development, the City's environmental consultant, PSI, collected 8 surface soil samples from areas proposed to be developed as a playground, community garden, and dog run area in the southern part of Area C SW (SA 56). On September 22, 2011, the City provided the Navy with a copy of the report documenting the soil sampling activities (PSI, September 2011). The results indicated concentrations of carcinogenic PAHs greater than FDEP Residential SCTLs in the playground and dog run areas. These results prompted additional soil investigation activities by the Navy to delineate the extent of carcinogenic PAHs in SA 56.

The activities proposed in this SAP are being conducted to complete the delineation of carcinogenic PAHs in soil both horizontally and vertically in the Building 148 area and SA 56. Based on recent soil sampling conducted in the Building 148 area, it appears that the delineation of dieldrin contamination is complete. Impacts of carcinogenic PAHs and dieldrin to groundwater, if any, will also be evaluated. Although there were no detections exceeding GCTLs in the analysis of the August 1998 sample from the one microwell at SA 55, laboratory detection limits for several analytes, including benzo(a)pyrene (BaP)



and dieldrin, were greater than the GCTLs. Therefore, these analytes could have been present at concentrations exceeding the GCTL, but because the concentrations were less than the detection limit, they would not be detected, i.e., not be “seen” by the analysis.

A site-specific Conceptual Site Model (CSM) that summarizes the presently known site conditions for Building 148/SA 56 is presented in Section 4.0 (**Worksheet #10**). This CSM includes sections on the site history, physical setting characteristics, and summary of previous investigations. The CSM for the site will be validated and further refined based on data and information collected during this proposed effort.

This SAP was completed under the Naval Facilities Engineering Command Southeast (NAVFAC SE) Contract No. N62470-11-D-8013, Contract Task Order (CTO) No. JM42.

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ACRONYMS AND ABBREVIATIONS

ABB-ES	ABB Environmental Services, Inc.
Area C SW	Area C Southwest
ARARs	Applicable or Relevant and Appropriate Requirements
AST	aboveground storage tank
BaP	Benzo(a)pyrene
BEC	BRAC Environmental Coordinator
bls	below land surface
BNA	Base Neutral Acid Compounds
BPSS	Bureau of Petroleum Storage Systems
BRAC	Base Realignment and Closure
PMO	Program Management Office
CBU	Construction Battalion Unit
COCs	Chemicals of Concern
COPCs	Chemicals of Potential Concern
CPG	Certified Professional Geologist
CSM	Conceptual Site Model
CTO	Contract Task Order
DDT	Dichlorodiphenyltrichloroethane
DoD	Department of Defense
DoN	Department of the Navy
DQI	Data Quality Indicator
DQO	Data Quality Objective
EBST	Environmental Baseline Survey for Transfer
ECD	Electron Capture Detector
EICP	Extracted Ion Current Profile
ELAP	Environmental Laboratory Accreditation Program
ENCO	Environmental Conservation Laboratories, Inc.
EPA	Environmental Protection Agency
EPC	Exposure Point Concentration
EPM	Exposure Pathway Model
FID	Flame Ionization Detector
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FOST	Finding of Suitability for Transfer
FTM	Field Task Manager
GC	Gas Chromatograph
GCTLs	Groundwater Cleanup Target Levels
GPS	Global Positioning System
HLA	Harding Lawson Associates

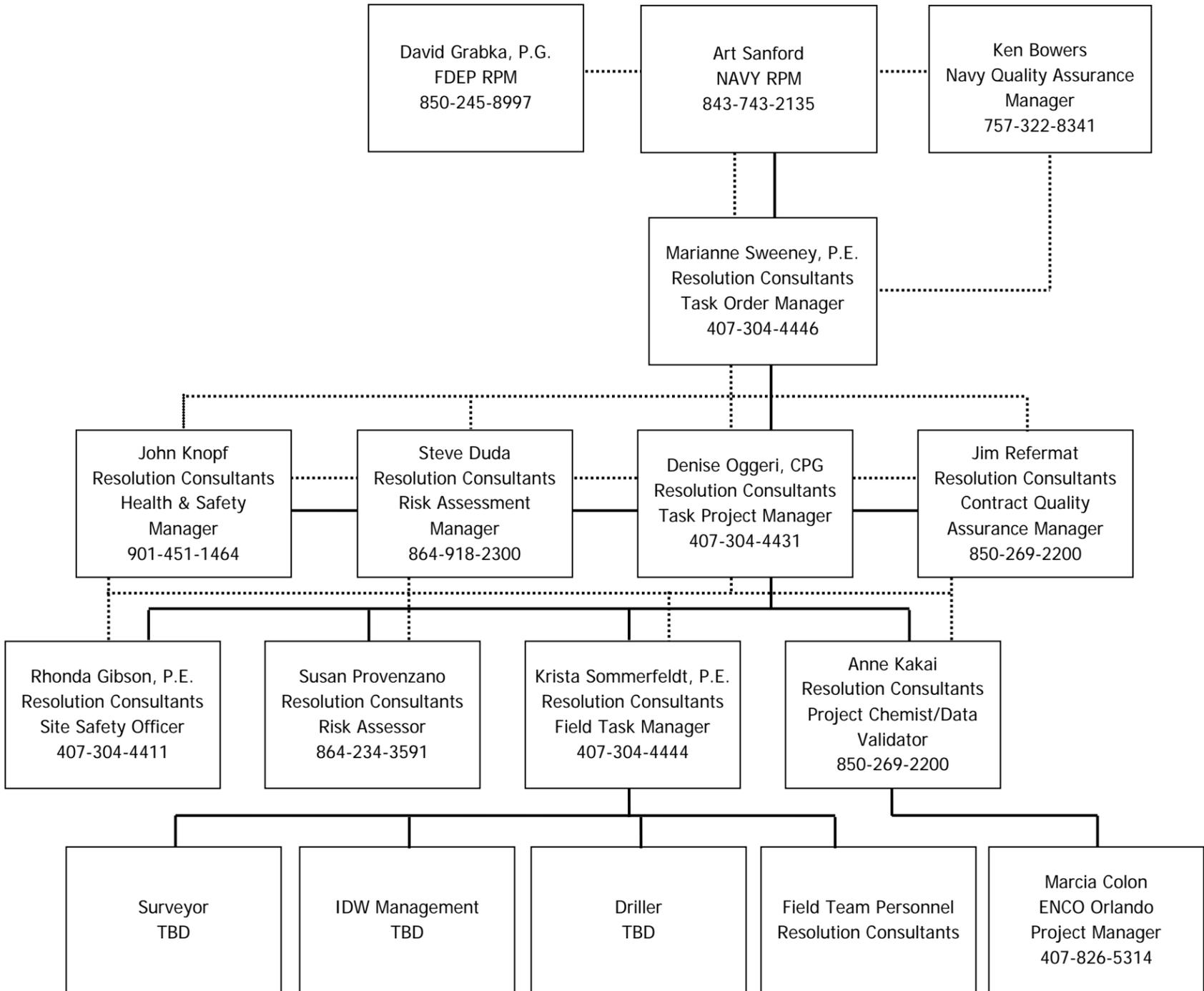
HSM	Health & Safety Manager
ICAL	Initial Calibration
ID	identification
IDQTF	Intergovernmental Data Quality Task Force
IDW	Investigative Derived Waste
IS	Internal Standards
K _{oc}	organic carbon adsorption coefficient
LCS	Laboratory Control Sample
LOD	Limit of Detection
LOQ	Limit of Quantitation
mg/kg	milligrams per kilogram
MPC	Measurement Performance Criteria
MS	Matrix Spike
MSD	Matrix Spike Duplicate
msl	mean sea level
NA	Not Applicable
NAD83	North American Datum 1983
NAVD88	North American Vertical Datum 1988
NAVFAC	Naval Facilities Engineering Command
NAVFAC LANT	Naval Facilities Engineering Command Atlantic
NAVFAC SE	Naval Facilities Engineering Command Southeast
NIRIS	Naval Installation Restoration Information Solution
NTC	Naval Training Center
OWS	oil water separator
OU	Operable Unit
PAHs	Polynuclear Aromatic Hydrocarbons
PALs	Project Action Levels
PCB	polychlorinated biphenyl
P.E.	Professional Engineer
PM	Project Manager
PMO	Project Management Office
PPE	Personal protective equipment
PSI	Professional Services Industries, Inc.
PVC	polyvinyl chloride
QA	Quality Assurance
QAM	Quality Assurance Manager
QC	Quality Control
QSM	Quality Systems Manual
RPM	Remedial Program Manager
RT	Retention Time
SA	Study Area



SAP	Sampling and Analysis Plan
SCTLs	Soil Cleanup Target Levels
SE	Southeast
SIM	Selective Ion Monitoring
SOPs	Standard Operating Procedures
SOW	Statement of Work
SSO	Site Safety Officer
SSOCOF	Sunshine State One Call of Florida
SVOC	Semi-Volatile Organic Compound
SW	Southwest
TBD	To Be Determined
TOM	Task Order Manager
TPM	Task Project Manager
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plans
UCL	Upper Confidence Limit
USGS	United States Geologic Survey
VOC	Volatile Organic Compound
WBZ	water-bearing zone

1.0 SAP Worksheet #5: Project Organizational Chart

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



CPG – Certified Professional Geologist

IDW – investigation-derived waste

PE – Professional Engineer

RPM – Remedial Project Manager

TBD – To be determined

Line of Communication - - - - -

Line of Authority
(Implied Communication) _____

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2.0 SAP Worksheet #6: Communication Pathways

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

This worksheet describes the pathways and modes of communication that will be used during this project, completed under the Naval Facilities Engineering Command Southeast (NAVFAC SE) Contract No. N62470-11-D-8013, Contract Task Order (CTO) No. JM42. Included are points of contact for resolving sampling and analysis problems; distributing preliminary, screening, and definitive level data to managers, users, and the public; and procedures for soliciting concurrence for project modifications. Procedures for soliciting and/or obtaining approval between project personnel, between different contractors, and between samplers and laboratory staff are described. Timing is the maximum amount of time allowed for the communication event to take place. Pathways describe the type of communication such as email, phone, etc.

Table 2-1: Communication Pathways Table

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathway To/From, etc.)
Point of contact for regulatory agency	Navy Remedial Program Manager (RPM)	Art Sanford	843-743-2135	The Navy RPM informs regulatory agency of work progress on a periodic basis.
Modification to this Sampling and Analysis Plan (SAP), changes in Navy management.	Florida Department of Environmental Protection (FDEP) Remedial Project Manager (RPM) Navy RPM	David Grabka	850-245-8997	The FDEP Federal Facilities RPM will be notified by the Navy RPM of pending modifications to the SAP or Navy management changes through written correspondence for documentation purposes. The FDEP Federal Facilities RPM will respond with comments or approval of the modifications to the Navy RPM within the timeframe agreed upon during the initial notification of pending modifications.
		Art Sanford	843-743-2135	
Project Management	Resolution Consultants Task Order Manager (TOM) Navy RPM	Marianne Sweeney	407-304-4446	The TOM will approve all communication to the Navy RPM, including notification of SAP modifications or field deviations by close-of-business of the following day. The TOM will provide monthly status reports to the RPM and NAVFAC SE.
		Art Sanford	843-743-2135	
Site Management	Resolution Consultants Task Project Manager (TPM) Resolution Consultants TOM	Denise Oggeri	407-304-4431	The TPM will assist the TOM with daily project management and activities and communicate routinely with both the TOM and project team.
		Marianne Sweeney	407-304-4446	



Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathway To/From, etc.)
Quality Assurance/Quality Control (QA/QC)	Resolution Consultants Quality Assurance Manager (QAM)	Jim Refermat	850-269-2200	The QAM will communicate with project quality personnel to perform specified QA and QC activities and report to project and program management. Issues and non-conformances and corrective actions will be reported to the PM within one day of nonconformance issuance.
Progress Reports	Resolution Consultants Field Task Manager (FTM) and TPM Resolution Consultants TOM Navy RPM	Krista Sommerfeldt Denise Oggeri Marianne Sweeney Art Sanford	407-304-4444 407-304-4431 407-304-4446 843-743-2135	FTM verbally informs the TPM on a daily basis of field updates. TPM informs TOM on a weekly basis. TOM provides a weekly update to the RPM either by phone message and/or email each Friday afternoon field activities are taking place.
Gaining Site Access	Resolution Consultants FTM Navy RPM	Krista Sommerfeldt Art Sanford	407-304-4444 843-743-2135	Navy RPM will provide Resolution Consultants FTM with the gate combination code. FTM will ensure access is available for all field personnel.
Obtaining Utility Clearances for Intrusive Activities	Resolution Consultants FTM Sunshine State One Call of Florida (SSOCOF) NAVY RPM	Krista Sommerfeldt SSOCOF Art Sanford	407-304-4444 811 843-743-2135	Resolution Consultants FTM will contact SSOCOF either via phone or online at least 3 days in advance of intrusive activities to initiate the utility clearance process for all intrusive sampling locations. The FTM will also contact the Navy RPM to get available on-site utility information for clearance purposes.
Stop Work due to Safety Issues	Resolution Consultants FTM Site Safety Officer (SSO) Resolution Consultants TOM Resolution Consultants Health & Safety Manager (HSM) Navy RPM	Krista Sommerfeldt Rhonda Gibson Marianne Sweeney John Knopf Art Sanford	407-304-4444 407-304-4411 407-304-4446 901-937-4255 843-743-2135	<p>The responsible party verbally informs the FTM, TOM, and subcontractors within one hour of recommendation to stop work and within 24 hours of recommendation to restart work. Responsible party follows verbal notification with an email to the Project Team (including the Navy RPM) within 24 hours.</p> <p>If a subcontractor is the responsible party, the subcontractor PM must verbally inform the Resolution Consultants SSO within 15 minutes, and the Resolution Consultants SSO will then follow the procedure listed above.</p>
SAP Changes in the Field	Resolution Consultants FTM Resolution Consultants TOM Navy RPM	Krista Sommerfeldt Marianne Sweeney Art Sanford	407-304-4444 407-304-4446 843-743-2135	FTM informs TOM verbally within same day; TOM informs Navy RPM via email within 24 hours; TOM sends a concurrence letter to RPM, if warranted, within 7 calendar days, and RPM signs the letter within five business days of receipt. Scope change is to be implemented before work is executed. Document the change on a field task modification request form (within 2 business days) or SAP amendment (within time frame agreed to by Project Team).



Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathway To/From, etc.)
Field Corrective Actions	Resolution Consultants FTM Resolution Consultants TOM Navy RPM	Krista Sommerfeldt Marianne Sweeney Art Sanford	407-304-4444 407-304-4446 843-743-2135	FTM informs TOM verbally within same day; TOM informs Navy RPM via email within 24 hours that corrective actions have been implemented. Corrective actions will be documented in weekly progress reports.
Recommendations to stop work and initiate work upon corrective action	Resolution Consultants FTM Resolution Consultants TOM Resolution Consultants QAM Navy RPM	Krista Sommerfeldt Marianne Sweeney Jim Refermat Art Sanford	407-304-4444 407-304-4446 850-269-2200 843-743-2135	FTM informs TOM verbally within same day; TOM informs Navy RPM via email within 24 hours that corrective actions have been implemented. Corrective actions will be documented in weekly progress reports.
Coordination and communication of fieldwork activities related to data collection	Resolution Consultants Field Task Manager (FTM) Resolution Consultants TOM Project Chemist	Krista Sommerfeldt Marianne Sweeney Anne Kakai	407-304-4444 407-304-4446 850-269-2200	FTM to communicate relevant field information to the TOM and Project Chemist daily during field activities by phone or email.
Coordination with laboratory for field activities	Resolution Consultants Project Chemist	Anne Kakai	850-269-2200	The Project Chemist will contact the laboratory by email to order the necessary sample containers and appropriate shipping for delivery on site before field sampling begins and throughout the project. The Project Chemist will also notify the laboratory of the expected turn-around-time for sampling analysis before field sampling begins.
Daily Chain-of-Custody reports and shipping documentation	Resolution Consultants FTM	Krista Sommerfeldt	407-304-4444	Chains-of-Custody and shipping records will be submitted via fax or email to the PM and FTM at the end of each day that samples are collected for evaluation.
Sample shipment coordination with laboratory	Resolution Consultants FTM	Krista Sommerfeldt	407-304-4444	Coordinate with the laboratory on days of sample shipment to inform them of anticipated shipment arrival dates, including number of coolers shipped. Provide laboratory with Chains-of-Custody, shipment tracking numbers, and any other pertinent information including verification of expected turn-around-time for sampling analysis.
Sample Receipt Variances	Environmental Conservation Laboratories, Inc. (ENCO) Orlando PM	Marcia Colon	407-826-5314	All variances in sample receipt will be reported to the Resolution Consultants project chemist within 24 hours of variance. A signed copy of the Chain-of-Custody Report will be provided to the project chemist within 24 hours of sample receipt.
Laboratory results	ENCO Orlando PM Resolution Consultants Project Chemist	Marcia Colon Anne Kakai	407-826-5314 850-269-2200	Laboratory results will be reported to the Project Chemist in accordance with the laboratory Statement of Work (SOW).



Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathway To/From, etc.)
Reporting laboratory data quality issues	ENCO Orlando PM Project Chemist	Marcia Colon Anne Kakai	407-826-5314 850-269-2200	QA/QC issues that potentially affect data usability will be reported by the Laboratory PM to the Project Chemist by email within one business day.
Reporting serious laboratory issues	Resolution Consultants Project Chemist Resolution Consultants TOM Navy RPM	Anne Kakai Marianne Sweeney Art Sanford	850-269-2200 407-304-4446 843-743-2135	Within one business day of identification of a serious laboratory issue, the Project Chemist will notify the TOM and Navy RPM. The Navy RPM will engage the NAVFAC chemist to ensure the issues with this project can be evaluated to determine impact to other NAVFAC projects
Field and analytical corrective actions	Resolution Consultants Project Chemist Resolution Consultants QAM	Anne Kakai Jim Refermat	850-269-2200 850-269-2200	The Project Chemist will immediately (no later than one business day) notify the Resolution Consultants QAM by email of field or analytical procedures that were not performed in accordance with the planning documents. The Project Chemist, in coordination with the QAM, will complete documentation of the nonconformance and corrective actions (including schedule) to be taken. The Project Chemist will verify that the corrective actions have been implemented according to schedule stated in the corrective action.
Release of analytical data	Resolution Consultants Project Chemist Resolution Consultants TOM	Anne Kakai Marianne Sweeney	850-269-2200 407-304-4446	The Project Chemist will review faxed/emailed data (within five business days of receipt) to verify that data quality objectives are met as described in the planning documents before the data are released. Analytical data will be released to the PM TOM (or designee) within one business day after the Project Chemist has verified that the data are in accordance with the project requirements.
Reporting data validation issues / data validation corrective actions	Resolution Consultants Project Chemist	Anne Kakai	850-269-2200	The Project Chemist will coordinate with the analytical laboratory to ensure data packages provided by the laboratory are complete and allow for full validation. All data validation issues will be reported to the Resolution Consultants QAM by the Project Chemist by telephone or email within one business day. The Project Chemist will generate memos to the laboratory with regard to incomplete deliverables or discrepancies within five business days of review while keeping the QAM informed of any significant data quality issues. The issue(s) will also be reported to the PM within one business day by telephone or email through the Project Chemist.



Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathway To/From, etc.)
Approval and notification of SAP procedure deviation during field activities	Resolution Consultants TOM	Marianne Sweeney	407-304-4446	Within one business day of identification of a SAP deviation, the PM will notify the TOM and Navy RPM of the pending deviation and whether it is considered minor or significant. A minor deviation would require the approval of the PM, TOM, and QAM within one business day of notification. A significant deviation would require the approval of the organizational partners/stakeholders (Navy and FDEP) within the timeframe agreed upon during the initial notification of pending deviation. The PM would notify the FTM within one business day of receiving approval. The PM would ensure the deviation and approval is documented and incorporated into the project files via a field activity report within five business days (e.g., remedial investigation, remediation verification report, etc.).
SAP modifications	Resolution Consultants TPM	Denise Oggeri	407-304-4444	Any modifications to the Final SAP will require the PM prepare amended worksheets and distribute the revised SAP (or revision pages) for review and comment (within the timeframe agreed upon during the initial notification of pending modifications) before the activities begin.
Address comments on SAP revision (or revision pages), prepare final revision (or revision pages), and submit final revision (or revision pages) of the SAP	Resolution Consultants TPM	Denise Oggeri	407-304-4431	The PM will provide responses to comments received on revised SAP (or revision pages) within 2 weeks of receipt, incorporate comments into the document, and then submit the final revision (or revision pages) of the SAP within one month of receiving comments.
Data usability	Resolution Consultants Project Chemist Resolution Consultants QAM	Anne Kakai Jim Refermat	850-269-2200 850-269-2200	The Project Chemist will notify the PM and QAM of any data usability issues that are identified during data validation immediately. The FTM will notify the PM and QAM of any field conditions, sample collection techniques, or sample shipping issues that impact data usability at the end of the day of occurrence or earlier as deemed appropriate.



Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathway To/From, etc.)
Notification of non-usable data	ENCO Laboratory PM	Marcia Colon	407-826-5314	If the laboratory determines that any data they have generated is non-usable, the Laboratory PM will notify (verbally or via email) the Resolution Consultants Project Chemist within one business day of when the issue is discovered.
	Resolution Consultants Project Chemist	Anne Kakai	850-269-2200	The Resolution Consultants Project Chemist will notify (verbally or via email) the Resolution Consultants TOM within one business day of the need for corrective action, if the non-usable data is a significant issue (i.e., critical sample data). Corrective action may include resampling and/or reanalyzing the effected samples.
	Resolution Consultants TOM Navy RPM	Marianne Sweeney Art Sanford	407-304-4446 843-743-2135	If a Resolution Consultants Project Chemist or data validator identifies non-usable data during the data validation process, the TOM will be notified verbally or via email within 48 hours of validation completion that a non-routine and significant laboratory quality deficiency has resulted in non-usable data. The Resolution Consultants TOM will take corrective action appropriate for the identified deficiency to ensure the project objectives are met. The Resolution Consultants TOM will notify (verbally or via e-mail) the Navy RPM on any problems with the laboratory or analysis that could significantly affect the usability of the data or project failures that impact the ability to complete the scope of work. The Navy RPM will engage the NAVFAC LANT (NAVFAC Atlantic) chemist to ensure issues with this project can be evaluated to determine impact to other DoD projects. Such notification will be made within 1 business day of when the issue is discovered. The Navy RPM will notify the FDEP RPM when any significant corrective action is taken.

The TOM and PM will incorporate any document modifications into the Final SAP for inclusion into the administrative record. The document amendment history for this SAP is provided in [Appendix A](#).



3.0 SAP Worksheet #9: Project Scoping Session Participants Sheet

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

The information presented below reflects the first scoping session for the development of this SAP for Building 148 area and Study Area 56 (SA 56) at Area C Southwest (SW).

Table 3-1: Scoping Session 1, 25 February 2013

Project Name: Former Naval Training Center (NTC) Orlando Projected Date(s) of Sampling: Spring 2013 Contract TOM: Marianne Sweeney (Resolution Consultants)			Site Name: Building 148/SA 56 Site Location: Orlando, Florida		
Date of Session: 25 February 2013 Scoping Session Purpose: Discuss soil sampling results from samples collected in January 2013 and plans for additional soil sampling					
Name	Title/Project Role	Affiliation	Phone #	Email Address	Project Role
Art Sanford	Navy RPM/Manages Project Activities for the Navy	NAVFAC SE	843.743.2135	art.sanford.ctr@navy.mil	NAVY RPM
David Criswell	Navy Base Realignment and Closure (BRAC) Environmental Coordinator (BEC)/Technical Representative	NAVFAC SE	843.743.2130	david.criswell@navy.mil	Navy BEC
David Grabka	FDEP RPM/Regulator Input	FDEP Federal Programs Section	850.245.8997	david.grabka@dep.state.fl.us	FDEP RPM
Teresa Grayson	CLEAN Contractor TOM/Manages Project Activities	Tetra Tech	865.220.4701	teresa.grayson@tetrattech.com	TOM
Marianne Sweeney	CLEAN Contractor TOM/Manages Project Activities	Resolution Consultants	407.304.4446	marianne.sweeney@aecom.com	TOM
Denise Oggeri	CLEAN Contractor Task Project Manager	Resolution Consultants	407.304.4431	denise.oggeri@aecom.com	Task Project Manager
Krista Sommerfeldt	CLEAN Contractor Field Task Manager (Scribe)	Resolution Consultants	407.304.4444	krista.sommerfeldt@aecom.com	Field Task Manager

A project scoping session was conducted as described in Section 2.5.1 of the *Uniform Federal Policy for Quality Assurance Project Plans Manual* (UFP-QAPP; Intergovernmental Data Quality Task Force [IDQTF], March 2005a) among project team members on 25 February 2013 to discuss the results from soil samples collected in January 2013 and plans for additional soil sampling at Building 148/SA 56, NTC Orlando, Florida. The following are the minutes from project scoping session.

Recreational Screening Criteria:

David Grabka, the FDEP RPM, does not have any concerns with using 0.4 milligrams per kilogram (mg/kg) as the Recreational screening criterion in soil for benzo(a)pyrene (BaP), which was included in a proposal to FDEP (Tetra Tech, January 2013). FDEP, Bureau of Waste Cleanup, had commented on the proposal initially (FDEP, January 2013) and in follow-up comments (February, 2013) that Mr. Grabka sent to Art Sanford, Navy RPM (February, 2013). Mr. Grabka indicated there would be a restrictive covenant on the portion of the property where cleanup is conducted to meet Recreational screening criteria.

Delineation:

The SAP will propose delineation to Residential SCTLs for Building 148/SA 56. For vertical delineation, the SAP will propose collection of subsurface soil samples (greater than 2 feet below land surface [bls]) in areas where the highest detections are observed in the surface soil samples. This will follow the rationale used to close SA 55. Mr. Grabka agreed a subsurface soil sample is not needed at every location where there is an exceedance in the surface soil, but rather, subsurface soil samples at the locations of highest contaminant concentration in surface soil would be representative of soil in the area.

The playground, community garden, and dog run areas will be divided into exposure units for calculating the 95% UCL. The portion of the Building 148 area which is proposed to be a parking area will be considered as its own exposure unit. Cleanup for the majority of the site will be conducted to meet Residential criteria. A small area in the vicinity of the former Building 148 footprint may be cleaned up to meet the Recreational criteria; however using the Recreational criteria will be limited to as small an area as possible to minimize any restrictions on land use.

Soil Sample Collection:

For purposes of SAP preparation, in areas near asphalt where excavation is planned, Resolution Consultants will assume delineation to the edge of the asphalt.

Along the south boundary of the playground area, adjacent to the sidewalk, BaP has not been delineated to 0.1 mg/kg. There is a narrow area of grass south of the sidewalk which is adjacent to residential properties to the south. Mr. Grabka said if samples north of the sidewalk exceed residential criteria, then sampling would be required south of the sidewalk. Additional sampling in this area will be addressed in the SAP.

Teresa Grayson from Tetra Tech reminded the team that the soil sample collected at G16 within the playground area was collected for the City before the sidewalk was installed.

David Criswell, Navy BEC, asked if the samples proposed to the north (within grids O, S, V, and W) within the vegetated area would have logistical issues for access. Marianne Sweeney, with Resolution Consultants, suggested that the heavy equipment working nearby at Operable Unit (OU) 4 in March 2013 could be used to do some clearing at Building 148/SA 56. Ms. Grayson recommended contacting John Perrone, the Division Manager for the City of Orlando, Parks Division.

Previous Soil Sample Nomenclature:

Samples collected from within the footprint and vicinity of former Building 148, including west, north, and east of it, were labeled as "BLDG148". The samples collected from within the areas planned by the City for the playground, dog run, and community garden were labeled as "SA56". Resolution Consultants will continue to follow this nomenclature. Soil samples labeled "SSDS" were collected by Professional Services Industries, Inc. (PSI) for the City. Samples labeled "GS," "DS," and "PS" were collected from within the future garden area, dog run, and playground, respectively.

Monitoring Well Installation:

Monitoring wells will be installed after soil excavation. Prior to installation, the specific monitoring well locations will be presented to the team after reviewing the results from the soil sampling proposed in the SAP.

SAP Figure Generation:

Resolution Consultants requested all shapefiles and sample location coordinates from Tetra Tech for SAP figure generation. Ms. Grayson provided figure packages to Resolution Consultants after the scoping session.

Laboratory Data:

Tetra Tech has uploaded to Naval Installation Restoration Information Solution (NIRIS) all Building 148/SA 56 laboratory data through 29 Aug 2012. Final Dec 2012 and Jan 2013 data is expected from the laboratory in approximately 30 days. The data presented on Tetra Tech's maps with the orange boxes are from Jan 2013 and have not had final validation.

Tier II SAP Approval Questionnaire:

The completed questionnaire was emailed to Jan Nielson, Navy Chemist, by Resolution Consultants on 22 Feb 2013. Ms. Nielson had concerns with using the Tier II SAP template if there was increased media and public attention to the site. Mr. Criswell said the legal implications are about property rights, not sampling/analytical methodology. Mr. Criswell discussed the use of the Tier II SAP template with Ms. Nielson after the scoping session. On 26 Feb 2013, Ms. Nielson emailed the team the NAVFAC LANT approval to use the Tier II SAP template. Approval to use the Tier II SAP template is provided in [Appendix B](#).

Building 148/SA 56 Schedule:

Resolution Consultants is planning to upload the Tier II SAP to NIRIS for Navy Chemist review the week of 4 Mar 2013. In order to reduce the field schedule, Resolution Consultants will look into the value of quick turnaround time for laboratory analysis. The results of the sampling proposed in this Tier II SAP will be used to determine soil volumes for excavation. These volumes will be used to modify the contract for CH2MHill, who will be performing the soil excavation and disposal activities.

Conference Call with the City, 28 Feb 2013:

Mr. Criswell, Resolution Consultants, and Tetra Tech attended a conference call with the City. Mr. Criswell asked about the City's plans to move the pump track and if there are future plans for the parcels other than recreational. He provided Tetra Tech's maps with Jan 2013 soil sampling results to the City and discussed the results with them, as well as the schedule for additional sampling proposed in this SAP.

4.0 SAP Worksheet #10: Conceptual Site Model

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

4.1 LOCATION

Former NTC Orlando is located in the central portion of the Florida peninsula in Orange County. Area C is located approximately one mile west of the Main Base of former NTC Orlando in the southeast quarter of Section 19, Township 22 South, and Range 30 East, as shown on the Orlando East, Florida, United States Geologic Survey Quadrangle Map (**Figure 4-1**).

Area C SW is the 19.73-acre parcel in the southwest portion of Area C that was transferred to the City of Orlando in January 2009 through the Federal Lands to Parks Program of the United States Department of Interior, National Park Service, for Public Park and public recreation area purposes. A site map of Area C SW was provided as Figure 1, Site Map, Area C SW, in the *Finding of Suitability to Transfer Area C SW* (Department of the Navy [DoN] BRAC Program Management Office [PMO] Southeast [SE], July 2006) and is included in **Appendix C**.

4.2 RECORDS REVIEW

This CSM was prepared after a search and review of NIRIS, the FDEP OCULUS Electronic Document Management System, and the NTC Orlando Administrative Record File (January 1994 through July 2010) for all records pertaining to investigation and remedial activities at Building 148/SA 56. All document references found are listed in Section 13.0. Documents that were referenced, but that Resolution Consultants could not locate, are noted in Section 13.0 with an asterisk.

4.3 SITE HISTORY

Construction of Area C began in 1942 to provide support services for the Army Air Corps Orlando Air Base. Prior to that time, the Subject Property was undeveloped. The Navy acquired NTC Orlando on July 1, 1968 when it was commissioned and functioned as a Naval training facility for recruits, enlisted personnel, and officers until it was decommissioned in the mid-1990s. Area C was used to provide support services and warehousing for NTC Orlando up until NTC Orlando was closed in April 1999 as part of the Defense BRAC Act of 1990. The area was last used as an office and storage space for base closure operations and for storage and vehicle maintenance by the Veteran's Administration (DoN, July 2006; Orlando Partnering Team, January 2010). As stated above, the southwest portion of Area C was transferred to the City of Orlando in January 2009 through the Federal Lands to Parks Program of the United States Department of Interior, National Park Service, for Public Park and public recreation area purposes.

4.4 ADJACENT AND NEARBY SITES/AREAS

The source of the contamination at Building 148/SA 56 currently appears to be associated with activities conducted in this area, and it does not appear as if the contamination at Building 148/SA 56 has affected adjacent areas.

The chlorinated volatile organic compound (VOC [tetrachloroethene, trichloroethene, and cis-1,2-dichloroethene]) groundwater contaminant plume associated with the former laundry facility at OU 4 does not currently appear to impact Building 148/SA 56. This is based on the observed groundwater flow from OU 4 to the west toward Lake Druid and the remediation activities conducted at OU 4 since January 1998 which have successfully reduced VOC concentrations in groundwater reaching Lake Druid to less than FDEP GCTLs. Antimony is also present in groundwater in the southeastern portion of OU 4 at concentrations exceeding FDEP GCTLs. The source of antimony is unknown; however the plume is relatively stationary (DoN, July 2006).

4.5 PHYSIOGRAPHY

Area C SW is located on the Orlando Ridge, which is believed to be a remnant of the “Hawthorn Delta.” The Orlando Ridge is part of the dissected northwest-southeast trending ridge system that includes the Mount Dora and Lake Wales ridges. The surfaces of the ridges represent a mature karst topography, as evidenced by the numerous circular lakes. Elevations are typically between 100 and 120 feet above mean sea level (msl). Area C SW lies at approximately 110 feet above msl with the exception of the shores of Lake Druid, which descend to approximately 95 feet above msl. Topography in this region is level to rolling, with soil slopes ranging from 0 to 8 percent. The topography of the site slopes north and west toward Lake Druid (Navy, 1996).

4.6 SURFACE WATERS

Surface water drainage is to the northwest by overland flow into Lake Druid which is present within the northwest portion of Area C SW. The lake shoreline is approximately 200 feet north of former Building 148. Lake Druid discharges west, entering a conveyance system tributary to Lake Rowena and the Central Orlando Chain of Lakes. Area C SW is located within the St. Johns River Basin, the waters of which are regulated by the St. Johns River Water Management District.

The area around the lake in the northwest portion of Area C SW, including the area between Building 148 and Lake Druid, is highly vegetated. Wetlands occupy approximately 2.5 acres of the site (Tetra Tech, March 2003).

4.7 GEOLOGY AND HYDROGEOLOGY

4.7.1 Geology

Area C SW is underlain by undifferentiated silty sand and clayey, silty sand with thin beds of silty clay. The surficial sediments of upper Miocene to Pleistocene Age range in thickness from 40 to 60 feet. Underlying the surficial sediments is the Hawthorn Group of Miocene Age, which is characterized by phosphatic gray-green clay and clayey sand and silt, and lenses of phosphatic sand and phosphatic limestone. The Hawthorn Group is approximately 120 feet thick in the area of NTC, Orlando. The Hawthorn Group overlies late Eocene marine limestone formations of the Ocala Group. The highly eroded Ocala Group is approximately 25 feet thick and is absent to the south. The Ocala Group overlies the Avon Park Limestone, which overlies the Lake City Limestone, both of middle Eocene Age (DoN, 1996).

4.7.2 Hydrogeology

Minimal hydrogeological data is available for Building 148/SA 56 at Area C SW. No permanent wells have been installed at Area C SW. The groundwater level was reported to be 8 feet bls in the shallow microwell installed at SA 55 in August 1998 (Harding Lawson Associates [HLA], 1999). The groundwater flow direction determined from the three shallow temporary wells installed in November 2006 for the Baseline Survey of Area C SW was to the northwest toward Lake Druid (PSI, January 2007). Water levels in these three wells were not measured relative to ground surface or to ground surface elevation, and therefore, the depth to water in these wells is unknown. It is also unknown if these wells were abandoned; however, since they were installed as temporary wells using Geoprobe[®] methodologies, it is likely that they were abandoned.

Since minimal data is available for Area C SW, the following information is provided from OU 4 located northeast of Area C SW (Orlando Partnering Team, January 2010).

Three distinct zones of groundwater have been identified at OU 4. The uppermost is the shallow surficial aquifer approximately five to 60 feet bls. Below this zone is a layer of silty clay, underlain by a second zone of water from 80 to 130 feet bls, referred to as the Hawthorne water-bearing zone (WBZ). A layer of very thick (more than 150 feet), dense clay separates the top two zones of groundwater from the much deeper Floridan aquifer below. The Floridan aquifer, which begins more than 300 feet below the ground surface, is a source of drinking water. The depth of groundwater contamination at OU 4 has not been found greater than 135 feet bls.

Groundwater flow in the shallow surficial aquifer at OU 4 flows west toward Lake Druid. It is assumed that groundwater flow at Area C SW is to the north also toward Lake Druid. In the deeper Hawthorn WBZ at OU 4, groundwater flow appears to be to the north.

The surficial aquifer at OU 4 can be separated into two layers with different hydraulic conductivities. Values are provided in the following table.

Table 4-1: Aquifer Characteristics

Layer	Horizontal Hydraulic Conductivity	Vertical Hydraulic Conductivity
Upper (0-20 feet bls)	10 feet per day	3.8 feet per day
Lower (20-60 feet bls)	40 feet per day	17 feet per day

Based on groundwater levels measured in the Hawthorn wells on March 16, 2009 at OU 4, the groundwater flow direction within the central portion of the Hawthorn WBZ is toward the north, with a calculated hydraulic gradient of 0.003 feet/foot and an average linear groundwater velocity of 0.036 feet/day, or about 13.1 feet per year.

4.8 PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

Previous investigations and remedial actions at Building 148/SA 56 at Area C SW are documented in the list of reports provided in [Table 4-2](#). These reports were reviewed for the development of the CSM.

Table 4-2: Listing of Historical Reports for Building 148/SA 56 at Area C SW

Report Title	Date	Summary of Investigation Findings and Remedial Actions
<i>BRAC Environmental Baseline Survey Report (ABB-ES)</i>	1994	<ul style="list-style-type: none"> Identified three areas of concern within Area C SW including SA 11 (Building 148) and SA 55 (Building 1104; located within SA 56) and recommended further site assessment in these areas.
<i>BRAC Environmental Site-Screening Report, Study Area 11 (ABB-ES)</i>	1996	<ul style="list-style-type: none"> Identified two areas of concern at Building 148: 1) stained soil and stressed vegetation north and south ends of generator pad; and 2) abandoned 55-gallon drum north of northwest corner of the building Soil sample at drum indicated no contamination; recommended drum removal Area of stained soil and stressed vegetation addressed in a Tank Closure Assessment Report (January 4, 1996) with recommendation for no further assessment. Approved by FDEP on March 12, 1996.

<i>BRAC Environmental Site-Screening Report, Study Area 55 (HLA)</i>	1999	<ul style="list-style-type: none"> • Site screening conducted in the vicinity of Building 1104 (SA 55; located within SA 56) used for storage of polychlorinated biphenyl (PCB)-laden oil and other waste and hazardous materials • Identified arsenic and BaP in surface soil (0 to 1 foot bls) at concentrations greater than Residential SCTLs, but lower than Industrial SCTLs. Since current and projected land use was industrial no further investigation or cleanup conducted. • Installed one microwell downgradient of Building 1104. No contaminants detected at concentrations greater than respective GCTLs; however laboratory detection limits for several analytes, including BaP and dieldrin were greater than the GCTLs. These analytes could have been present at concentrations exceeding the GCTL, but because concentrations were less than the detection limit, they would not be detected, i.e., not be “seen” by the analysis.
<i>Environmental Baseline Survey for Transfer (EBST), Area C (NAVFAC, Southern Division)</i>	2000	<ul style="list-style-type: none"> • Provided detailed description of all buildings/structures in Area C in preparation for transferring property to Veterans Administration (VA) for use as warehousing for prescription drug distribution. VA subsequently declined the transfer.
<i>Finding of Suitability for Transfer (FOST) and EBST, South Area C (Tetra Tech)</i>	2003	<ul style="list-style-type: none"> • FOST documented that Area C South excluding SA 55 (located within SA 56) was suitable for transfer • EBST documented environmental condition of Area C South, excluding SA 55 pending additional investigation and soil removal activities • Summarized environmental concerns regarding SA 11 (Building 148) and SA 55.
<i>Site Investigation Report for Study Area 55 (Tetra Tech)</i>	2004	<ul style="list-style-type: none"> • Collected soil samples to delineate the extent of arsenic and carcinogenic PAH exceedances in surface soil and determine the soil volume to be removed to meet the requirements for residential reuse. • Arsenic did not exceed, however carcinogenic PAHs did exceed residential SCTLs in surface soil (0 to 2 feet bls). 95% UCL was used to determine soil volume for removal to meet residential SCTL.
<i>Decision Document, Study Area 55 (Tetra Tech)</i>	2004	<ul style="list-style-type: none"> • Summarized investigations conducted at SA 55, including soil sampling and removal to address carcinogenic PAH contamination • Concluded that following soil removal and replacement with clean fill, surface soil meets Residential SCTLs and groundwater has not been impacted. • Indicated SA 55 was suitable for transfer for unrestricted use
<i>Technical Memorandum, Summary of Soil Removal Activities and Results Study Area 55 (AGVIO-CH2M HILL Joint Venture II)</i>	2004	<ul style="list-style-type: none"> • Summarized removal and disposal of carcinogenic PAH-contaminated surface soil (0 to 2 feet bls) that exceeded Residential SCTLs in SA 55 performed February 16 to 25, 2004. • Removed 372 tons of carcinogenic PAH-contaminated soils
<i>FOST and EBST, Area C SW (DoN)</i>	2006	<ul style="list-style-type: none"> • FOST documented that Area C SW was suitable for transfer • EBST documented environmental condition of Area C SW; Considered as an addendum to March 2003 EBST for Area C, South; provided information available as of July 2006
<i>Baseline Assessment Report (PSI)</i>	2007	<ul style="list-style-type: none"> • Collected surface and subsurface soil samples from 7 borings (3 of them near Building 1104 in SA56) for field screening using an organic vapor analyzer (OVA) equipped with a flame ionization detector (FID). Also collected 4 composite soil samples from depth of 0 to 1 ft bls (one near Building 148 and one near Building 1065 in SA56) and groundwater samples from 3 shallow temporary wells (one near Building 1104). • OVA/FID responses less than 1 part per million in all soil samples. Dieldrin exceeded leachability SCTL near Building 148. Total chromium, lead, and antimony exceeded GCTLs, but since dissolved (field filtered) samples did not exceed GCTLs, it was concluded that groundwater was not impacted.

<i>Limited Soil Sampling and Analysis Report (PSI)</i>	2011	<ul style="list-style-type: none"> PSI collected 8 surface soil samples from areas proposed to be developed as a playground, community garden, and dog run area in the southern part of Area C SW. Concentrations of carcinogenic PAHs greater than FDEP Residential SCTLs were detected in the areas planned for the playground and dog run, prompting additional soil investigation activities by the Navy in the southern portion of Area C SW, referred to as SA 56.
<i>Technical Memorandum, Proposed Recreational SCTL, Area C SW</i>	2013	<ul style="list-style-type: none"> Developed and proposed an alternative recreational SCTL of 0.4 mg/kg for BaP and BaP equivalents for Area C SW

4.9 EXTENT AND DISTRIBUTION OF CONTAMINANTS

Carcinogenic PAHs have been detected at concentrations greater than respective FDEP Residential SCTLs in surface soil samples from areas proposed to be developed as a playground, community garden, and dog run area in the southern part of Area C SW (SA 56) and in the vicinity of former Building 148. Dieldrin has also been detected at concentrations above the respective Residential SCTL in the vicinity of former Building 148. The current extent of soil contamination in Building 148/SA 56 is shown on Tables and Figures prepared by Tetra Tech in [Appendix D](#). These include figures for carcinogenic PAHs and dieldrin in surface soil at 0 to 6 and 0 to 12 inches bls. A separate figure is provided for the 6 to 24 inch bls interval, and includes a few samples collected at depths greater than 24 inches in order to evaluate the vertical extent of contamination. Considerable soil sampling has been conducted in Building 148/SA 56; however, the extent of soil contamination is not yet defined. Sampling proposed to complete delineation of soil contamination in Building 148/SA 56 is presented in Section 7.0.

Currently, there are no permanent monitoring wells at Building 148/SA 56. Results from temporary wells installed near Buildings 1104 and 1065 in past investigations did not indicate any impacts to groundwater.

4.9.1 List of Chemicals of Concern

Chemicals of Concern (COCs) in the areas of SA 56 and the former Building 148 are as follows:

SA 56 COCs

- Surface soil (0 to 2 feet bls)
 - Carcinogenic PAHs (i.e., BaP and other carcinogenic PAHs used to in calculation of the BaP equivalents)
- Subsurface soil (below 2 feet)
 - Carcinogenic PAHs
- Groundwater
 - unknown

Former Building 148

- Surface soil (0 to 2 feet bls)
 - Select PAHs: Carcinogenic PAHs
 - Select Pesticide: dieldrin
- Subsurface soil (below 2 feet)
 - Carcinogenic PAHs
 - Select Pesticide: dieldrin
- Groundwater
 - unknown

4.9.2 Potential Sources of Contaminants

The specific source of carcinogenic PAHs and dieldrin contamination is unknown. Based the distribution of dieldrin concentrations, with higher concentrations adjacent to and in the front of the building where deliveries would occur, the dieldrin may be related to routing pesticide spraying to control pests. Based on the generally higher concentrations of carcinogenic PAHs adjacent to the roadways and parking area, the PAHs may be related to runoff from the asphalt or exhaust from motor vehicles (Prabhukumar ad Pagilla, October 2010). The former Building 148, SA 56, and surrounding areas were used for industrial operations prior to transferring ownership to the City of Orlando in January 2009. Section 4.3 describes the history of the site.

4.9.3 Site-Specific Fate and Transport

The constituents exceeding SCTLs at Building 148/SA 56 include dieldrin and carcinogenic PAHs, which are the heavier (4- and 5-ring) PAHs. Volatilization is an insignificant pathway for dieldrin and these PAHs due to their low volatilities. Migration to the atmosphere adsorbed to dust particles is also considered to be a minor pathway due to the presence of vegetation and the relatively humid climate typical of the region. Surface runoff with storm water and intermittent flooding during severe storm events is the most likely migration pathway for contaminants associated with soil particles.

Each of the carcinogenic PAHs detected at the site have a relatively high organic carbon adsorption coefficient (K_{oc}) and therefore, there is a strong tendency for these contaminants to partition to the organic carbon in soil and sediment rather than dissolve in water. Because the carcinogenic PAHs are strongly adsorbed, they typically will remain in the upper part of the soil column and not leach into groundwater. This is supported by the absence of carcinogenic PAHs above GCTLs in the groundwater in the one well in SA 55, although elevated concentrations of carcinogenic PAHs were

present in the surface soil in SA 55. Sorption is likely the key mechanism at the site that hinders vertical migration in soil by infiltration and percolation.

Dieldrin also has a high K_{oc} value that limits migration and results in attenuation by organic carbon in soil. Pesticides are persistent, as they have low volatilities and long half-life values that are often measured in years rather than days or weeks. Pesticides tend to sorb strongly to the soil matrices and if migration to groundwater occurs, they are slow biodegrade in water.

Even if carcinogenic PAHs and dieldrin are released into the water column, they would be largely associated with particulate matter. These contaminants in the water column would rapidly become adsorbed to sediment or particulate matter. Possibly, the contaminants could also slowly desorb from soil, sediment, or particulate matter into the aqueous phase.

4.10 RECEPTORS AND EXPOSURE PATHWAYS

Receptors and exposure pathways relevant to contaminants at Building 148/SA 56 are summarized in the following sections. A preliminary Exposure Pathway Model (EPM) diagram has been developed to illustrate the potential exposure pathways for Building 148/SA 56 (**Figure 4-4**).

4.10.1 Receptors

The identification of potential receptors to Building 148/SA 56 contaminants and exposure scenarios is dependent on land use. Land use conditions for current and future land uses at Building 148/SA 56 are outlined in the following table.

Table 4-3: Land Use Conditions

Current Land Use:		Surrounding Land Use:		Future Land Use:	
	Residential	X	Residential		Residential
	Industrial	X	Industrial		Industrial
	Commercial	X	Commercial		Commercial
	Agricultural		Agricultural		Agricultural
X	Recreational	X	Recreational	X	Recreational
	Other		Other		Other

Access to Building 148/SA 56 is controlled by a six foot chain link fence installed on the east, west, and south perimeters of the site. There is a locked access gate at the southwest corner. Under the current land use, potential receptors to Area C contaminants include trespassers. Future land use scenarios may also include construction workers (particularly excavation and park construction) and recreators (children and adult). Future residential use of the site is prohibited by deed restrictions.

Building 148/SA 56 provides minimal potential habitat for ecological receptors. The site consists of an open area with dense trees to the north towards Lake Druid. The area to the south and southwest of former Building 148/SA 56 is residential.

4.10.2 Site-Specific Exposure Pathway Model

Potential human exposure pathways will be identified in the context of the current and potential future land uses. A complete pathway includes: a chemical source and release mechanism, a transport or retention medium, an exposure point where human contact with the contaminated medium occurs, and a route of intake for the contaminant into the body at the exposure point. If any of these elements is missing, the pathway is incomplete and is not considered further. In the EPM diagram (**Figure 4-4**), the potentially complete pathways to be quantitatively evaluated are indicated by an "X" in a box. A box without an "X" indicates an incomplete pathway (which occurs when at least one of the pathway elements is missing).

4.10.2.1 Human Health Exposures

Under current land use conditions, a potential for exposure to a trespasser exists. Therefore, potential surface and subsurface soil exposure pathways are considered to be complete. Surface and subsurface soil exposure routes include ingestion, dermal absorption, and inhalation of airborne particulates are potential exposure pathways. For trespassers, it is assumed that exposures to site groundwater are incomplete.

Exposure to surface water and sediment through incidental ingestion and dermal contact are not potentially complete pathways because there are no naturally occurring surface water bodies on or in the immediate vicinity of the currently known extent of contamination. The shoreline of Lake Druid is approximately 200 feet north of the currently known contamination based on sampling conducted to date. If future sampling results indicate contamination extends further north to where potential impacts to Lake Druid may occur, the surface water and sediment exposure pathway will be examined. Potential groundwater exposure pathways are incomplete under current conditions because the trespasser receptor will not come in contact with site groundwater while onsite.

Receptors with the potential for exposure to site-related contaminants under the future land use scenarios include construction workers and recreators (children and adult). Potential surface and subsurface soil exposure pathways exist for future scenarios. The potential for exposure of construction workers to groundwater exist at the site because the depth to groundwater at the site is generally 8 feet bls. Potential groundwater exposure routes for the construction worker includes dermal absorption.

For future recreators (children and adult), surface and subsurface soil exposure routes including ingestion, dermal absorption, and inhalation of airborne particulates are potential exposure pathways. For adult and child recreators, it is assumed that exposures to site groundwater are incomplete.

4.10.2.2 Ecological Exposures

As shown on the EPM diagram ([Figure 4-4](#)), the potential for exposure of ecological receptors from potentially complete pathways at Building 148/SA 56 would be negligible and would not be sufficient to warrant evaluation. Building 148/SA 56 is open space providing minimal habitat, although some receptors (e.g., birds or rodents) may be exposed to contaminated surface soil while foraging occasionally in this open area. Thus, the potential for significant exposures and adverse effects on terrestrial wildlife populations is negligible. Also, there are no impacted surface water bodies on or near the site that could provide ecological exposure pathways as a result of groundwater discharge.

5.0 SAP Worksheet #11: Data Quality Objectives/Systematic Planning Process Statements

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

The Data Quality Objectives (DQOs), as defined through the seven-step process (EPA, February 2006), are as follows:

Table 5-1: Data Quality Objectives for Building 148/SA 56 at Area C SW

DQO Step	Description
1. State the Problem	Carcinogenic PAHs and dieldrin exceed the Residential SCTLs and Leachability to GW SCTLs in surface soil (0 to 2 feet) and for carcinogenic PAHs, in a few subsurface soil sample locations. Delineation of the carcinogenic PAH contamination has not yet been determined. Groundwater has not been analyzed other than one sample collected from one microwell in August 1998 as part site screening for SA 55. Although there were no detections above GCTLs in this sample, detection limits for BaP and dieldrin exceeded the respective GCTLs.
2. Identify the Goals of the Study (Alternative Actions presented in Step 5)	1. For the Building 148 area, including former building footprint and west, north and east of the footprint, delineate the extent of carcinogenic PAHs in soil to the Chapter 62-777 Residential SCTLs. For the remaining area within Area C SW, delineate the extent of carcinogenic PAHs in soil to the Chapter 62-777 Residential SCTLs.
	2. Determine exposure units within Area C SW and use 95%UCL to calculate EPCs. Determine the extent of soil to excavate to meet EPCs.
	3. Determine if groundwater contamination exists for dieldrin and the carcinogenic PAHs.
3. Identify Information Inputs	1. Preliminary CSM provided in Section 4.0 (Worksheet #10).
	2. Types of data to be collected as follows: Chemical Data: Definitive off-site laboratory analyses of soil from soil borings for the following analytical parameters: carcinogenic PAHs by Environmental Protection Agency (EPA) Method SW8270D Selective Ion Monitoring (SIM). Definitive off-site laboratory analyses of groundwater from proposed surficial aquifer monitoring wells for the following analytical parameters: carcinogenic PAHs by EPA Method SW8270D SIM and dieldrin by EPA Method SW8081B. Physical Data: Prior to each groundwater sampling event, a full round of water level data (i.e., a synoptic sampling event) will be collected from the monitoring wells to support site-specific groundwater flow determinations. Groundwater stabilization parameters (pH, temperature, specific conductance, dissolved oxygen, oxidation reduction potential, and turbidity) will be collected during purging to ensure the collection of representative samples. Types of soil sampling equipment used to collect the data: stainless steel hand augers, spoons, and bowls. Types of groundwater sampling equipment used to collect the data: peristaltic, variable speed pumps, and disposable Teflon® tubing. Sampling locations and sampling collection methodologies (discrete) presented in Section 7.0 (Worksheet #17).
	3. Analytical data for soil and groundwater, including historical data and results from proposed sample locations.
	4. Project action levels (PALs) provided in Section 9.0 (Worksheet #15) are the Chapter 62-777 Residential SCTLs for soil and the Chapter 62-777 GCTLs for groundwater.
	4. Define the Boundaries of the Study



DQO Step	Description
5. Develop the Analytic Approach	<p>1. Soil sampling will be conducted at step out locations from previous locations where soil sampling conducted by Tetra Tech indicated the PALs provided in Section 9.0 (Worksheet #15) were exceeded. Samples will be collected at one step-out distance from the exceedances (i.e., the initial sample), and possibly a second step-out distance (i.e., the contingency sample). The initial sample will be analyzed, and pending laboratory analytical results from this initial sample, the contingency sample may be collected and analyzed. If the soil sample results exceed the PALs provided in Section 9.0 (Worksheet #15), or cause the EPC (calculated using the 95%UCL) to exceed the PALs, then the next step out sample will be collected and analyzed. Conversely, if the results for a sample do not exceed these PALs or cause the EPC (calculated using the 95%UCL), to exceed these PALs, then the next step out sample will not be collected and analyzed, since delineation will be complete at that location.</p> <p>2. For vertical delineation, a subsurface soil sample (greater than 2 feet below land surface [bls]) will not be collected at every location where there is an exceedance in surface soil; rather, subsurface soil samples will be collected at the locations of the highest contaminant concentrations in the surface soil that are representative of soil in an area. If the soil sample results exceed the PALs provided in Section 9.0 (Worksheet #15), or cause the EPC (calculated using the 95%UCL) to exceed the PALs, then the next vertically deeper sample will be analyzed. Conversely, if the results for a sample do not exceed these PALs or cause the EPC (calculated using the 95%UCL), to exceed these PALs, then the next vertically deeper sample will not be collected, since vertical delineation will be complete at that location.</p> <p>3. If soil concentrations exceed the PALs in samples collected north of the sidewalk in the southwest portion of the site, then contingency soil samples will be collected south of the sidewalk, south of where the exceedances are observed.</p> <p>4. If soil concentrations exceed the PALs in samples collected adjacent to the road, then no further step out sampling will be conducted, that is, the road will be considered the boundary of the contamination.</p> <p>5. EPCs will be calculated for ¼ acre exposure units based on future site use (i.e., playground, community garden, and dog run), and soil excavation will be conducted such that EPCs for remaining soils do not exceed the PALs provided in Section 9.0 (Worksheet #15) in order to obtain NFA for soils in accordance with Chapter 62-770 Florida Administrative Code (FAC).</p> <p>6. Monitoring wells will be installed at locations anticipated to be the source (potentially southwest corner of former Building 148) and upgradient and downgradient of these areas.</p> <p>7. The groundwater analytical results will be screened against the PALs provided in Section 9.0 (Worksheet #15). If groundwater concentrations exceed the PALs, then, the team will evaluate whether additional wells are required to bound the groundwater plume. Groundwater will be monitored quarterly for one year to meet the requirements of Chapter 62-780 FAC.</p>
6. Specify Performance or Acceptance Criteria	<p>For sampling and analytical tasks, erroneous decisions can be attributed to sampling error and measurement error. Sampling error occurs when the design and implementation of the field sampling plan does not provide representative data for the site. Measurement error occurs because of performance variance from laboratory instrumentation, analytical methods, and operator error. The EPA identifies the combination of all these errors as a “total study error” (EPA, 2006).</p> <p>1. Errors generated from sampling and analysis tasks will be minimized to the extent practical through the use of Standard Operating Procedures (SOPs) presented in Section 8.0 to maximize confidence in the selected decision. Most of these procedures are adapted entirely or in part from FDEP and EPA guidance.</p> <p>2. The acceptable limits for detection thresholds and precision, accuracy, representativeness, completeness, and comparability criteria for data collection and analysis procedures are presented in Section 6.0 (Worksheet #12).</p> <p>3. Analytical data from all phases of the sampling conducted in support of this SAP will be generated by a fixed-base laboratory from discrete media samples and validated in accordance with the data validation procedures discussed in Section 12.0 (Worksheets #34, #35, and #36). The quality of the data collected during this SAP must be adequate to complete soil delineation to Chapter 62-777 Residential SCTLs and determine groundwater impacts, if any.</p>



DQO Step	Description	
7. Develop the Plan for Obtaining Data	<ul style="list-style-type: none">• Collect soil samples.• Collect groundwater samples.• Evaluate if remedial alternative other than soil excavation is necessary.	The sampling design for the site was developed to optimize resources and generate data to satisfy the DQOs. The sampling design and rationale for field sampling activities are presented in Section 7.0 (Worksheet #17).

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6.0 SAP Worksheet #12: Field Quality Control Samples

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

This worksheet identifies the Measurement Performance Criteria (MPC) for QC samples collected during all media sampling at Building 148/SA 56. The type of QC samples, associated analytical groups, frequency, data quality indicators (DQIs), MPC, and targeted assessment error assignment, were selected in accordance with *Department of Defense (DoD) Quality Systems Manual (QSM) V4.2*. (DoD, October 2010)

Table 6-1: Programmatic Measurement Performance Criteria Table – Field QC Samples

QC Sample	Analytical Group ^a	Minimum Frequency	DQIs	Measurement Performance Criteria (MPC)
Equipment Rinsate Blank	All	5% of total samples planned for collection for each sampling technique utilized.	Accuracy/Bias	No target analytes greater than 1/2 the method limit of quantitation (LOQ)
Temperature Blank	All but waste samples	One per sample cooler requiring preservation to 4°C ±2°C.	Accuracy/Bias	Temperature not to exceed <0°C or ≥6°C
Field Duplicate ^b (Organic Constituents)	All	10% of total samples planned for collection for each sampling technique utilized.	Precision	Relative Percent Differences (RPDs) ≤35% for waters RPDs ≤45% for soils
Matrix Spike (MS)	All	One per 20 samples per media. If total number of samples is less than 20, one MS will still be collected, (should be collected from a location expected to be relatively free from contamination.)	Bias	For matrix evaluation, use QC acceptance criteria specified by DoD QSM V4.2 (DoD, October 2010)
MSD (Matrix Spike Duplicate)	All	One per 20 samples per media. If total no. of samples is less than 20, one MSD will still be collected.	Bias	For matrix evaluation, use QC acceptance criteria specified by DoD QSM V4.2 (DoD, October 2010)
MS/MSD (Organic Constituents)	All	One pair per 20 samples.	Precision	RPDs ≤40% for waters RPDs ≤50% for soils

Notes:

^a If information varies within an analytical group, separate by individual analyte.

^b The field duplicate(s) must not be collected from the same sample that will become the laboratory matrix spike (organic analysis) where applicable, but can be collected from the sample used as a laboratory duplicate (metals analysis).

QC samples and associated MPC as provided in Section 6.0 (**Worksheet #12**) are applicable for all laboratory analyses intended for definitive data use and apply to both fixed and mobile laboratories without exception.



Duplicate samples and associated MPC as provided in Section 6.0 (**Worksheet #12**) are applicable for onsite field analyses intended for screening level data, excluding field measurements (e.g., water quality parameters) in support of definitive sample data collection.
Minimum frequency, DQI and MPC apply to concentrated levels (low, mid and high).

7.0 SAP Worksheet #17: Sampling Design and Rationale

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

The sampling design for this investigation will be a combination of judgmental and systematic grid sampling approaches for the purpose of delineating the extent of carcinogenic PAHs in soil. For groundwater, a judgmental approach will also be used to: 1) determine if groundwater is impacted (i.e., if constituents are present in groundwater at concentrations exceeding PALs); and 2) if groundwater is found to be impacted, delineate the extent of groundwater contamination.

Soil sampling locations will be selected at step out points from locations where soil samples have exceeded PALs, as provided in Section 9.0 (**Worksheet #15**), in the currently established grid pattern. Groundwater sampling locations will be selected initially at suspected source locations, based on historical site use and soil sample results, and upgradient and downgradient of source locations. If groundwater is found to be impacted based on initial groundwater sampling results, additional groundwater sampling locations will be selected by the Project Team, if needed, to delineate the extent of groundwater contamination.

Details of the field project implementation tasks, including site access procedures, field and laboratory SOPs, and a sample detail summary table to be implemented during the execution of the sampling summarized below, is provided in Section 8.0. Sampling locations are depicted on **Figures 4-2** and **4-3**. The target analytes for all proposed analysis is provided in Section 9.0 (**Worksheet #15**).

7.1 Soil Sampling

Soil sampling results from samples collected by Tetra Tech are presented on tables and figures in **Appendix D**. These results along with proposed sample locations based on the results are shown on **Figures 4-2** and **4-3** and tabulated on the Sample Details **Tables 8-3** and **8-4a**, **8-4b**, and **8-4c** within the text. The proposed sample locations have been selected in order to delineate the extent of carcinogenic PAHs above the PALs as provided in Section 9.0 (**Worksheet #15**).

The proposed locations have been selected at initial step out locations from where soil exceeds the PALs, using the currently established grid pattern. Additional contingency samples will be collected at a further step out distance pending results from the initial samples. Because Resolution Consultants' office is close to the site, contingency samples will be collected during a second mobilization to the site. Initial and contingency soil samples will be collected at one or more of the following depth intervals as indicated on **Tables 8-4a**, **8-4b** and **8-4c**: land surface to six inches, six inches to two feet, and two-foot intervals thereafter to the water table in accordance with Chapter 62-780, FAC.

Soil samples will be collected in accordance with FDEP SOP FS 3000, Soil Sampling and submitted to ENCO, a DoD Environmental Laboratory Accreditation Program (ELAP)-accredited laboratory for definitive laboratory analysis of PAHs (EPA Method SW8270D Selective Ion Monitoring [SIM]).

7.2 Groundwater Sampling

Following soil excavation to address carcinogenic PAHs and dieldrin in soil, shallow wells will be installed at suspected source locations, based on historical site use and the soil sample results, and upgradient and downgradient of suspected source locations. It is anticipated that one well will be installed near the southwest corner of former Building 148 where elevated PAH and dieldrin concentrations were observed and one well will be installed downgradient to the north and one upgradient to the south. Additional well locations will be selected based on initial groundwater sampling results in order to delineate the extent of groundwater contamination. Up to 10 shallow monitoring wells will be installed.

Wells will be installed as described in Section 8.4.

Samples from up to 10 monitoring wells will be collected and submitted to ENCO, a DoD ELAP-accredited laboratory, for definitive analysis of PAHs (EPA Method SW8270D SIM) and dieldrin (EPA Method SW8081B).

The monitoring wells will be sampled using low-flow, quiescent sampling methods to minimize turbidity in accordance with FDEP SOP FS 2200, Groundwater Sampling. Field parameters will also be measured including temperature, specific conductivity, oxygen reduction potential, pH, dissolved oxygen, and turbidity.

Prior to purging, the water level will be measured in order to provide groundwater elevation data. These data will be used to determine groundwater flow direction.

8.0 SAP Worksheet #14: Field Project Tasks

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

This section provides a summary of tasks that will be implemented during the execution of this SAP.

8.1 Site Access

The property owner for Building 148/SA 56 is the City of Orlando. Either the Navy RPM, or under Navy's direction the TOM, will inform the City's point of contact about the planned field work. The site is surrounded by a six foot chain link fence with a locked gate at the southwest corner.

8.2 Permits

The subsurface intrusive activities at Building 148/SA 56, which include soil borings using a hand auger and well installation with a hollow stem auger drill rig, will require Resolution Consultants to contact SSOCOF either via phone or online at least three days in advance of intrusive activities to initiate the utility clearance process for all intrusive sampling locations. The purpose of obtaining SSOCOF clearance is to provide notice to the utilities in the area of the planned intrusive work and each utility will send a locator to mark the approximate location of underground lines, pipes, and cables to prevent injury to any individual performing intrusive activity as well as avoid damage to utilities, and to ensure uninterrupted utility service.

8.3 Locating Water Hook-Ups and IDW Management Area

The TOM will consult with the City to arrange access to a potable water supply for field activities. An Investigative Derived Waste (IDW) Management Area will be identified to temporarily store IDW before disposal. Waste management activities are discussed further in Section 8.4.5 of this worksheet.

8.4 Building 148/SA 56 Field Tasks

Building 148/SA 56 field tasks include soil sampling, monitoring well installation and development, groundwater sampling, waste management, and site restoration as discussed in the following sections.

8.4.1 Soil Sampling

The field tasks for Building 148/SA 56 include the completion of soil borings and the collection of soil samples for laboratory analysis from each boring at discrete depth intervals (described in Section 7.1) in order to delineate the carcinogenic PAHs contamination in surface and subsurface soil. Rationale for selection of the sample locations was provided in Section 7.1, and the soil boring locations are indicated on **Figures 4-2** and **4-3**.

8.4.2 Monitoring Well Installation

Up to ten new permanent, flush-mounted, shallow monitoring wells are proposed for groundwater analysis of carcinogenic PAHs and dieldrin. The locations for the proposed monitoring wells will be determined by the NTC Orlando Partnering Team after reviewing results from the proposed soil sampling. Monitoring well installation will be completed by a licensed driller utilizing hollow stem auger technique. Prior to installation, well permits will be obtained from the St. Johns River Water Management District. Soil samples for lithology evaluation will be collected from split-spoon samplers. The shallow monitor wells will be installed to a depth where the water table intersects the well screen interval. Final well screen placements will be determined in the field based on field observations. The well will be constructed of 2-inch schedule 40 polyvinyl chloride (PVC) with 10 feet of 0.010-inch slotted screen and 2 feet of riser. The filter pack will consist of 30/45-grade silica sand with a 30/65-grade fine sand seal. The remainder of the borehole annular space will be filled with Portland cement grout. An 8-inch diameter flush-mounted well vault and 2-foot square concrete pad will be installed at the surface.

The top of casing elevations will be surveyed relative to the elevation of an existing monitor wells. Well installation and development will be in general accordance with FDEP SOP PCS-006.

8.4.3 Surveying

All newly installed monitoring well locations will be surveyed by a Florida Registered Land Surveyor. The locations will be surveyed horizontally to one foot and vertically to 0.10 foot. Surveyed horizontal control will utilize North American Datum 1983 (NAD83) and surveyed elevations will be referenced to North American Vertical Datum 1988 (NAVD88).

8.4.4 Groundwater Sampling

Groundwater samples will be collected using low flow quiescent sampling methods to minimize turbidity, and field parameters as listed in Section 7.3 will be collected.

8.4.5 Waste Management

All waste management and disposal will be conducted by Resolution Consultants. Waste sampling will be conducted in accordance with DEP-SOP-001/01 FS 5000 Waste Sampling, included in [Appendix E](#). Waste may be classified as either non-investigative waste or IDW as defined below.

Non-investigative waste, such as litter and household/office garbage, shall be collected on an as-needed basis to maintain the site in a clean and orderly manner. This waste shall be containerized and transported to the designated collection bin or sanitary landfill. Acceptable containers shall be sealed boxes or plastic garbage bags.

Investigative activities at Building 148/SA 56 may produce the following types of IDW:

- Drummed soil cuttings from monitoring well installation;
- Development and purge water (monitoring wells);
- Decontamination fluids;
- Personal protective equipment (PPE) and disposable sampling equipment; and
- Packing and shipping materials.

Proper management and disposal of IDW and PPE will be the responsibility of Resolution Consultants, unless otherwise directed by the Navy RPM. Waste profiles, manifests, bills of lading, and/or certifications of disposal/treatment/recycling will be provided to the appropriate Navy point of contact as directed by the Navy RPM. No Hazardous Waste Manifests are anticipated with proposed activities. Documentation of proper management and disposal will be provided to the Navy RPM.

IDW will be properly containerized and temporarily stored at the site prior to transportation, unless otherwise directed by the Navy or City, and an IDW plan detailing off-site IDW management is amended and approved in this SAP. Acceptable containers for IDW shall be sealed United States Department of Transportation-approved steel, 55-gallon drums; tanks made of polyethylene or steel; overpacks; or small dumping bins with lids (roll-off bins).

Soil cuttings and liquid IDW (decontamination fluids and purged groundwater) are anticipated for site activities. Each container shall be properly labeled with the date, site identification, sampling point, matrix, constituents of concern, and other pertinent information for handling. Labels shall also identify the Navy point of contact and Resolution Consultants point of contact, and include contact information with telephone number(s) as a minimum requirement. Labeling shall be of a permanent nature such that it is unaffected by exposure to outdoor elements over an extended period of time.

Used PPE, disposable sampling equipment, and other trash will be consolidated in trash bags at the end of each day and sealed. It is the responsibility of Resolution Consultants to properly dispose of all debris, PPE, and other trash off site. The appropriate method of disposal will be selected based upon the available data from the site and direct analytical data from representative samples of the IDW. If IDW analytical testing results show no exceedances of applicable criteria/standards, then

certain IDW, such as groundwater and/or decontamination water, may be placed on the ground of the project site (i.e., returned to the source area from which it originated), if doing so does not endanger human health or the environment or violate federal or state regulations.

The following table summarizes approved management and disposal practices for various types of IDW.

Table 8-1: Approved Management and Disposal Practices

TYPE	HAZARDOUS	NON-HAZARDOUS
PPE-Disposable	Containerize in plastic 5-gallon bucket or similar container with tight-fitting lid. Identify and properly dispose of.	Place waste in trash bag, then into dumpster.
PPE-Reusable	Decontaminate in accordance with the procedures outlined in SOPs (Appendix E). If the equipment cannot be decontaminated, containerize in plastic 5-gallon bucket or similar container with tight-fitting lid. Identify and properly dispose of.	Decontaminate in accordance with the procedures outlined in SOPs (Appendix E).
Soil Cuttings	Containerize in Department of Transportation-approved container with tight-fitting lid. Identify and arrange for testing and proper disposal.	Containerize in an appropriate container with tight-fitting lid. Identify and leave on site for proper disposal based on analytical results.*
Groundwater	Containerize in Department of Transportation-approved container with tight-fitting lid. Identify and arrange for testing and proper disposal.	Containerize in an appropriate container with tight-fitting lid. Identify and leave on site for proper disposal based on analytical results.*
Decontamination Water	Containerize in Department of Transportation-approved container with tight-fitting lid. Identify and arrange for testing and proper disposal.	Containerize in an appropriate container with tight-fitting lid. Identify and leave on site for proper disposal based on analytical results.*
Disposable Equipment	Containerize in Department of Transportation-approved container or 5-gallon plastic bucket with tight-fitting lid. Identify and arrange for testing and proper disposal.	Containerize in an appropriate container with tight-fitting lid. Identify and leave on site for proper disposal based on analytical results.
Trash	Not Applicable (NA)	Place waste in trash bag, then into dumpster.

* These materials may be placed on the ground of the project site (i.e., returned to the source area from which it originated) if doing so does not endanger human health or the environment or violate federal or state regulations.

8.4.6 Site Restoration

Efforts will be made to minimize impacts to the site and sampling locations. Following the completion of work at the site, all drums, trash, and other waste will be removed. Decontamination and/or purge water and PPE will be transported to the designated IDW Management staging area and disposed of properly.

8.5 SAP Worksheet #21: Field SOP References Table

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

The SOPs that will be followed during the field projects tasks are listed in the table below.

Table 8-2: Field SOP References Table

SOP Reference Number	Title, Revision Date and / or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
FC1000	FDEP SOP FC1000, Field Decontamination, Effective 3 Dec 2008	FDEP	None	N	None
FD1000	FDEP SOP FD1000, Documentation, Effective 3 Dec 2008	FDEP	None	N	None
FQ1000	FDEP SOP FQ1000, Quality Control, Effective 3 Dec 2008	FDEP	None	N	None
FS1000	FDEP SOP FS1000, General Sampling, Effective 3 Dec 2008	FDEP	None	N	None
FS2200	FDEP SOP FS2200, Groundwater Sampling, Effective 3 Dec 2008	FDEP	Peristaltic Pump, Multi-meter	N	None
FS3000	FDEP SOP FS3000, Soil, Effective 3 Dec 2008	FDEP	Hand Auger	N	None
FS5000	FDEP SOP FS5000, Waste Sampling, Effective 3 Dec 2008	FDEP	None	N	None
FT1000	FDEP SOP FT1000, Field Testing General, Effective 3 Dec 2008	FDEP	None	N	None
FT1100	FDEP SOP FT1100, Field pH, Effective 3 Dec 2008	FDEP	Multi-meter	N	None
FT1200	FDEP SOP FT1200, Field Specific Conductance, Effective 3 Dec 2008	FDEP	Multi-meter	N	None
FT1400	FDEP SOP FT1400, Field Temperature, Effective 3 Dec 2008	FDEP	Multi-meter	N	None
FT1500	FDEP SOP FT1500, Field Dissolved Oxygen, Effective 3 Dec 2008	FDEP	Multi-meter	N	None
FT1600	FDEP SOP FT1600, Field Turbidity, Effective 3 Dec 2008	FDEP	Turbidity-meter or Multi-meter	N	None
PCS-004	FDEP Bureau of Petroleum Storage Systems (BPSS) PCP, SOP PCS-004, Soil Assessment and Sampling Methods for Florida BPSS Sites, Effective 1 Oct 2001	FDEP	Hand Auger	N	None
3-01	Utility Clearance, Rev 0, May 2012	Resolution Consultants	Hand auger, Schonstedt utilities locator	N	None
3-02	Logbooks, Rev 0, May 2012	Resolution Consultants	NA	N	None



SOP Reference Number	Title, Revision Date and / or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
3-03	Recordkeeping, Sample Labeling, and Chain-of-Custody, Rev 0, May 2012	Resolution Consultants	NA	N	None
SESDPROC 110-R3	EPA Region 4, SOP SESDPROC-110-R2, Global Positioning System, Effective 20 Apr 2011	EPA	Global Positioning System (GPS)	N	None

8.6 SAP Worksheets #18, 19, 20, and 30: Sample Details Table

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

Details for each of the sampling locations are provided in **Table 8-3** for groundwater and **Tables 8-4a, 8-4b, and 8-4c** for soil.

Table 8-3: Sample Details Table for Groundwater

CTO JM42 Area C SW Sampling Dates TBD					Analysis Group	PAHs	Dieldrin
					Preparation and Analytical Method	EPA Method SW8270D SIM	EPA Method SW8081B
Environmental Conservation Laboratories, Inc. (ENCO Orlando) 10775 Central Port Drive Orlando, FL 32824 Point of Contact: Marcia Colon Phone: 407-826-5314					Analytical Laboratory/ Preparation and Analytical SOP Reference	ENCO Orlando / SOP EXSV-27 and SOP SVGCMS-03	ENCO Orlando / SOP EXSV-27 and SOP SVGC-04
					Data Package Turnaround Time	21 Calendar days	21 Calendar days
					Container Type/ Volume required (if different than container volume)	2 x 1 L, Amber G Teflon-lined cap	2 x 1 L, Amber G Teflon-lined cap
					Preservative	Ice to 4°C	Ice to 4°C
					Holding Time (Preparation/ Analysis)	7 days/40 days	7 days/40 days
					Site	Matrix	Sample ID
		X	Y				
Area C Southwest, Bldg 148	Groundwater	OLD-BLDG148-01	TBD	TBD	Shallow, TBD	1	1
Area C Southwest, Bldg 148	Groundwater	OLD-BLDG148-02	TBD	TBD	Shallow, TBD	1	1
Area C Southwest, Bldg 148	Groundwater	OLD-BLDG148-03	TBD	TBD	Shallow, TBD	1	1
Area C Southwest, Bldg 148	Groundwater	OLD-BLDG148-04	TBD	TBD	Shallow, TBD	1	1
Area C Southwest, Bldg 148	Groundwater	OLD-BLDG148-05	TBD	TBD	Shallow, TBD	1	1
Area C Southwest, SA 56	Groundwater	OLD-SA56-01	TBD	TBD	Shallow, TBD	1	1
Area C Southwest, SA 56	Groundwater	OLD-SA56-02	TBD	TBD	Shallow, TBD	1	1
Area C Southwest, SA 56	Groundwater	OLD-SA56-03	TBD	TBD	Shallow, TBD	1	1
Area C Southwest, SA 56	Groundwater	OLD-SA56-04	TBD	TBD	Shallow, TBD	1	1
Area C Southwest, SA 56	Groundwater	OLD-SA56-05	TBD	TBD	Shallow, TBD	1	1
Field QC Samples ¹					Total Number of Primary Samples	10	10
Area C Southwest, Bldg 148	Field Duplicate	OLD-BLDG148-XX			Shallow, TBD	1	1
Area C Southwest, Bldg 148	MS	OLD-BLDG148-XX			Shallow, TBD	1	1
Area C Southwest, Bldg 148	MSD	OLD-BLDG148-XX			Shallow, TBD	1	1
Area C Southwest, Bldg 148	Equipment Blank	NA			NA	1	1
					Total Number of Samples to the Laboratory	14	14

Notes:

¹Frequency of QA/QC sample collection is provided in Section 6.0 (Worksheet #12).

Table 8-4a: Sample Details Table for Surface Soil

					Analysis Group	PAHs
					Preparation and Analytical Method	EPA Method SW8270D SIM
					Analytical Laboratory/ Preparation and Analytical SOP Reference	ENCO Orlando / SOP EXSV-16 and SOP SVGCMS-03
					Data Package Turnaround Time	21 Calendar days
Environmental Conservation Laboratories, Inc. (ENCO Orlando) 10775 Central Port Drive Orlando, FL 32824 Point of Contact: Marcia Colon Phone: 407-826-5314					Container Type/ Volume required (if different than container volume)	1 x 4 oz G, Teflon-lined septum sealed cap
					Preservative	Ice to 4°C
					Holding Time (Preparation/ Analysis)	14 days/40 days
Site	Matrix	Sample ID	Coordinates (NAD 1983, Feet)		Depth/ Sampling Interval	
			X	Y		
Area C Southwest, Bldg 148	Soil	BLDG148-SS-AA0-0006	544435.104	1536175.115	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-AA00-0006	544435.289	1536199.783	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-AA1-0006	544434.915	1536150.118	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-B6-0624	543881.603	1536013.710	06 - 24 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-B7-0006	543881.812	1535989.372	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-C5-0006	543906.923	1536039.500	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-C5-0624	543906.923	1536039.500	06 - 24 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-D3-0006	543933.018	1536089.338	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-D3-0624	543933.018	1536089.338	06 - 24 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-D8-0006	543932.328	1535962.809	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-F2-0006	543981.826	1536114.772	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-G2-0006	544006.924	1536114.648	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-I3-0006	544056.826	1536089.772	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-K4-0006	544106.826	1536064.772	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-K4-0624	544106.826	1536064.772	06 - 24 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-K5-0006	544106.897	1536039.907	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-K9-0006	544107.535	1535939.391	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-K9-0624	544106.864	1535940.142	06 - 24 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-K10-0006	544108.425	1535914.301	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-K10-0624	544107.298	1535914.317	06 - 24 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-K11-0006	544109.003	1535892.483	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-K11-0624	544109.003	1535892.483	06 - 24 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-L5-0006	544132.466	1536039.336	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-L5-0624	544131.820	1536040.619	06 - 24 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-L6-0624	544132.252	1536014.519	06 - 24 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-L8-0006	544132.966	1535963.678	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-L8-0624	544132.905	1535964.448	06 - 24 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-N00-0006	544182.096	1536189.328	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-N2-0624	544183.357	1536115.222	06 - 24 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-O00-0006	544207.778	1536189.617	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-P01-0006	544233.546	1536219.356	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-Q00-0006	544261.029	1536197.023	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-R0-0006	544287.336	1536171.205	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-S00-0006	544309.760	1536200.156	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-S1-0624	544308.387	1536151.959	06 - 24 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-T0-0624	544334.072	1536172.458	06 - 24 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-U1-0624	544359.258	1536150.391	06 - 24 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-V00-0006	544384.629	1536200.323	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-V00-0624	544384.455	1536198.982	06 - 24 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-W00-0006	544408.629	1536200.023	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-W1-0006	544408.941	1536150.491	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AA18-0624	543987.816	1535781.005	06 - 24 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AA22-0006	543989.504	1535718.703	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AB19-0624	544004.363	1535767.175	06 - 24 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AC22-0006	544019.452	1535719.137	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AD17-0624	544034.598	1535797.564	06 - 24 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AD21-0006	544034.508	1535737.902	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AG18-0624	544079.196	1535782.240	06 - 24 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AG21-0006	544079.233	1535737.716	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AH21-0006	544094.130	1535737.339	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AI16-0624	544108.988	1535813.724	06 - 24 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AI17-0006	544109.022	1535797.886	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AI17-0624	544109.241	1535798.043	06 - 24 inch	1

Table 8-4a: Sample Details Table for Surface Soil

					Analysis Group	PAHs
					Preparation and Analytical Method	EPA Method SW8270D SIM
CTO JM42 Area C SW Sampling Dates TBD					Analytical Laboratory/ Preparation and Analytical SOP Reference	ENCO Orlando / SOP EXSV-16 and SOP SVGCM5-03
					Data Package Turnaround Time	21 Calendar days
Environmental Conservation Laboratories, Inc. (ENCO Orlando) 10775 Central Port Drive Orlando, FL 32824 Point of Contact: Marcia Colon Phone: 407-826-5314					Container Type/ Volume required (if different than container volume)	1 x 4 oz G, Teflon-lined septum sealed cap
					Preservative	Ice to 4°C
					Holding Time (Preparation/ Analysis)	14 days/40 days
					Depth/ Sampling Interval	
Site	Matrix	Sample ID	Coordinates (NAD 1983, Feet)		Depth/ Sampling Interval	
			X	Y		
Area C Southwest, SA 56	Soil	SA56-SS-AI18-0006	544109.167	1535782.535	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AI18-0624	544108.735	1535782.361	06 - 24 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AI19-0006	544109.250	1535767.479	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AI20-0006	544109.233	1535752.716	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AJ16-0006	544124.201	1535812.893	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-BA16-0006	544349.286	1535814.040	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-BH18-0006	544454.484	1535783.994	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-H17-0624	544274.233	1535800.125	06 - 24 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-I16-0624	544289.181	1535815.007	06 - 24 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-X28-0006	544704.425	1535719.251	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-Z24-0624	544733.502	1535779.084	06 - 24 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-Z25-0624	544734.405	1535764.645	06 - 24 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-Z26-0624	544734.766	1535749.484	06 - 24 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZA21-0006	543809.190	1535726.454	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZB18-0624	543822.591	1535765.199	06 - 24 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZB21-0006	543824.276	1535725.683	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZC21-0006	543838.116	1535722.750	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZD21-0006	543855.236	1535726.333	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZF17-0624	543885.322	1535791.131	06 - 24 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZF19-0006	543884.464	1535758.226	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZI19-0624	543929.997	1535765.229	06 - 24 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZI20-0006	543929.462	1535750.477	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZI21-0006	543929.037	1535735.632	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZJ18-0624	543943.855	1535780.758	06 - 24 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZJ22-0006	543945.234	1535718.703	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZK17-0624	543960.896	1535798.047	06 - 24 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZK19-0624	543959.661	1535766.928	06 - 24 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZL19-0624	543973.738	1535766.434	06 - 24 inch	1
Field QC Samples ¹					Total Number of Primary Samples	81
Area C Southwest, Bldg 148	Field Duplicate	BLDG148-SS-XX-XXXX			TBD	8
Area C Southwest, Bldg 148	MS	BLDG148-SS-XX-XXXX			TBD	4
Area C Southwest, Bldg 148	MSD	BLDG148-SS-XX-XXXX			TBD	4
Area C Southwest, Bldg 148	Equipment Blank	NA			NA	4
					Total Number of Samples to the Laboratory	101

Notes:

¹Frequency of QA/QC sample collection is provided in Section 6.0 (Worksheet #12).

Table 8-4b: Contingency Sample Details Table for Surface Soil

					Analysis Group	PAHs
					Preparation and Analytical Method	EPA Method SW8270D SIM
<p style="text-align: center;">CTO JM42 Area C SW Sampling Dates TBD</p>					Analytical Laboratory/ Preparation and Analytical SOP Reference	ENCO Orlando / SOP EXSV-16 and SOP SVGCMS-03
					Data Package Turnaround Time	21 Calendar days
<p style="text-align: center;">Environmental Conservation Laboratories, Inc. (ENCO Orlando) 10775 Central Port Drive Orlando, FL 32824 Point of Contact: Marcia Colon Phone: 407-826-5314</p>					Container Type/ Volume required (if different than container volume)	1 x 4 oz G, Teflon-lined septum sealed cap
					Preservative	Ice to 4°C
					Holding Time (Preparation/ Analysis)	14 days/40 days
Site	Matrix	Sample ID	Coordinates (NAD 1983, Feet)		Depth/ Sampling Interval	
			X	Y		
Area C Southwest, Bldg 148	Soil	BLDG148-SS-AA01-0006	544435.248	1536224.013	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-B7-0624	543881.812	1535989.372	06 - 24 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-B8-0006	543881.569	1535964.772	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-BB0-0006	544459.411	1536175.069	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-BB00-0006	544459.600	1536200.120	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-BB1-0006	544459.077	1536150.039	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-C9-0006	543906.582	1535939.507	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-G1-0006	544006.826	1536139.772	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-I2-0006	544056.864	1536114.996	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-J3-0006	544081.641	1536089.814	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-L6-0006	544132.252	1536014.519	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-M00-0006	544158.665	1536190.123	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-M2-0624	544156.785	1536114.557	06 - 24 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-N01-0006	544181.966	1536216.223	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-O01-0006	544206.684	1536216.151	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-P02-0006	544234.811	1536242.415	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-Q01-0006	544259.661	1536222.614	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-R00-0006	544285.350	1536199.556	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-S01-0006	544309.035	1536224.079	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-V01-0006	544384.617	1536224.019	00 - 06 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-V01-0624	544384.207	1536225.298	06 - 24 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-W00-0624	544408.947	1536200.559	06 - 24 inch	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-W01-0006	544409.955	1536223.579	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AA23-0006	543990.009	1535701.583	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AC23-0006	544019.885	1535702.590	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AD22-0006	544035.226	1535719.686	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AE21-0006	544049.551	1535738.071	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AG22-0006	544079.695	1535719.571	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AH22-0006	544093.534	1535718.389	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AI19-0624	544109.250	1535767.479	06 - 24 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AI21-0006	544109.233	1535737.716	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AJ17-0006	544124.459	1535798.267	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AJ17-0624	544126.060	1535797.790	06 - 24 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AJ18-0006	544124.233	1535782.681	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AJ18-0624	544126.566	1535782.741	06 - 24 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AJ19-0006	544124.461	1535767.995	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-AJ20-0006	544124.346	1535752.567	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-BA17-0006	544349.286	1535799.040	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-BH19-0006	544454.286	1535769.040	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-W28-0006	544689.120	1535719.133	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-X29-0006	544703.529	1535703.223	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-Y24-0624	544719.064	1535779.264	06 - 24 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZA22-0006	543811.053	1535706.048	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZB17-0624	543824.528	1535780.637	06 - 24 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZB22-0006	543824.691	1535704.912	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZC23-0006	543839.123	1535705.292	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZD23-0006	543854.808	1535704.343	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZF18-0624	543884.335	1535772.915	06 - 24 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZF20-0006	543884.200	1535742.627	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZG20-0006	543899.699	1535748.666	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZH20-0006	543914.418	1535748.783	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZH21-0006	543914.233	1535733.827	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZI22-0006	543929.532	1535718.550	00 - 06 inch	1
Area C Southwest, SA 56	Soil	SA56-SS-ZJ23-0006	543945.047	1535700.983	00 - 06 inch	1

Table 8-4b: Contingency Sample Details Table for Surface Soil

				Analysis Group		PAHs
				Preparation and Analytical Method		EPA Method SW8270D SIM
CTO JM42 Area C SW Sampling Dates TBD				Analytical Laboratory/ Preparation and Analytical SOP Reference		ENCO Orlando / SOP EXSV-16 and SOP SVGCMS-03
				Environmental Conservation Laboratories, Inc. (ENCO Orlando) 10775 Central Port Drive Orlando, FL 32824 Point of Contact: Marcia Colon Phone: 407-826-5314		
Container Type/ Volume required (if different than container volume)		1 x 4 oz G, Teflon-lined septum sealed cap				
Preservative		Ice to 4°C				
Holding Time (Preparation/ Analysis)		14 days/40 days				
Site	Matrix	Sample ID	Coordinates (NAD 1983, Feet)		Depth/ Sampling Interval	
			X	Y		
Field QC Samples ¹					Total Number of Primary Samples	54
Area C Southwest, Bldg 148	Field Duplicate	BLDG148-SS-XX-XXXX			TBD	5
Area C Southwest, Bldg 148	MS	BLDG148-SS-XX-XXXX			TBD	2
Area C Southwest, Bldg 148	MSD	BLDG148-SS-XX-XXXX			TBD	2
Area C Southwest, Bldg 148	Equipment Blank	NA			NA	2
					Total Number of Samples to the Laboratory	65

Notes:

¹Frequency of QA/QC sample collection is provided in Section 6.0 (Worksheet #12).

Table 8-4c: Sample Details Table for Subsurface Soil (includes Contingency Samples)

					Analysis Group	PAHs
					Preparation and Analytical Method	EPA Method SW8270D SIM
CTO JM42 Area C SW Sampling Dates TBD					Analytical Laboratory/ Preparation and Analytical SOP Reference	ENCO Orlando / SOP EXSV-16 and SOP SVGMS-03
					Data Package Turnaround Time	21 Calendar days
Environmental Conservation Laboratories, Inc. (ENCO Orlando) 10775 Central Port Drive Orlando, FL 32824 Point of Contact: Marcia Colon Phone: 407-826-5314					Container Type/ Volume required (if different than container volume)	1 x 4 oz G, Teflon-lined septum sealed cap
					Preservative	Ice to 4°C
					Holding Time (Preparation/ Analysis)	14 days/40 days
					Depth/ Sampling Interval	
Site	Matrix	Sample ID	Coordinates (NAD 1983, Feet)		Depth/ Sampling Interval	
		X	Y			
Area C Southwest, Bldg 148	Soil	BLDG148-SS-F7-3660	543983.757	1535992.989	3 - 5 feet	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-F7-6084 (HOLD)	543983.757	1535992.989	5 - 7 (or water table) feet	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-J5-3660	544080.759	1536039.858	3 - 5 feet	1
Area C Southwest, Bldg 148	Soil	BLDG148-SS-J5-6084 (HOLD)	544080.759	1536039.858	5 - 7 (or water table) feet	1
Field QC Samples ¹					Total Number of Primary Samples	4
Area C Southwest, Bldg 148	Field Duplicate	BLDG148-SS-XX-XXXX			TBD	1
Area C Southwest, Bldg 148	MS	BLDG148-SS-XX-XXXX			TBD	1
Area C Southwest, Bldg 148	MSD	BLDG148-SS-XX-XXXX			TBD	1
Area C Southwest, Bldg 148	Equipment Blank	NA			NA	1
					Total Number of Samples to the Laboratory	8

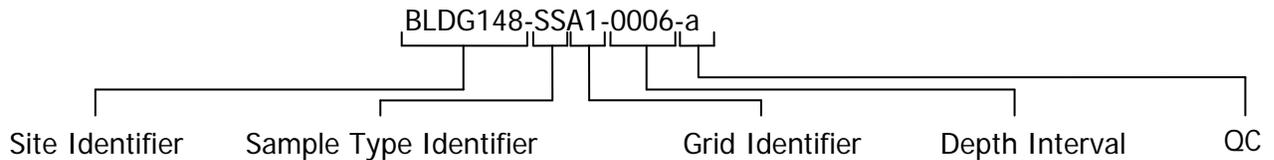
Notes:

¹Frequency of QA/QC sample collection is provided in Section 6.0 (**Worksheet #12**).

8.7 Sample ID Nomenclature

This section describes the application and interpretation of the naming convention used to identify data collection locations at Building 148/SA 56. Data collection locations shall be assigned an identification (ID) consisting of a string of characters as described below.

8.7.1 Soil Boring Sample IDs

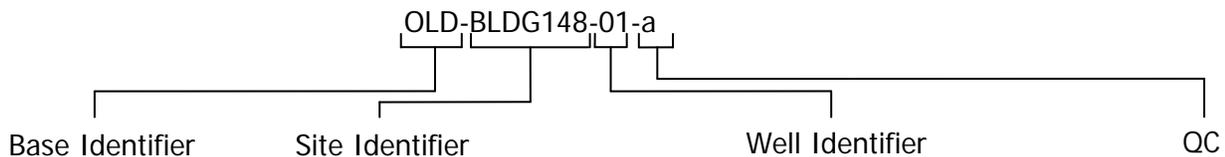


- Site Identifier: Either "SA56" or "BLDG148" depending on which area the sample location falls within.
- Sample Type Identifier: Soil samples collected from a hand auger are identified with the type identifier of SS and from a monitoring well installation boring are identified with the type identifier of MW.
- Grid Identifier: Grid location, letter followed by number identified on [Figures 4-2](#) and [4-3](#).
- Depth Interval: First two characters identify the depth of the top of the interval and the last two characters identify the depth of the bottom of the interval. The first two feet bls is shown in inches (i.e., 0006, 0624). Below two feet bls, the depth is shown in feet (i.e., 0204, 0406, 0608).
- QC: This field is only used when a QC sample is collected. QC samples are denoted by adding a QC extension at the end of the sample ID. The extensions are as follows:

QC Extension	QC Type
a	field duplicate
b	field split (to quality assurance lab)
d	rinsate or equipment blank
ms	matrix spike
msd	matrix spike duplicate
g	water used for decontamination, blank collection, etc.

8.7.2 Monitoring Well Location and Sample IDs

A permanent monitoring well's location and sample IDs are the same, except for QC samples where a suffix is applied to the end of the sample ID.



- Base Identifier: "OLD" identifies Former NTC Orlando.
- Site Identifier: Either "SA56" or "BLDG148" depending on which area the sample location falls within.
- Well Identifier: The first monitoring wells installed at both SA 56 or former Building 148 will have a well identifier of "01". Each consecutive well's identifier will be sequentially numbered. A deep well is not proposed in this SAP, however, if one is later proposed the Deep Well Identifier of "D" would immediately follow next sequential Well Identifier (i.e., OLD-BLDG148-11D). A deep well will not have the same Well Identifier as a neighboring shallow well.
- QC: Same definition as presented for soil boring sample IDs.

8.8 CSM Validation and Refinement

After completion of the activities proposed in this SAP, the data collected over the course of the project shall be evaluated against the current CSM. As appropriate, the content of the CSM shall be validated and/or updated with refinement based on the new data. An updated CSM that documents the post-investigation level of understanding of site conditions will be prepared and incorporated into the Building 148/SA 56 Completion Report.

8.9 Completion Report

The Building 148/SA 56 Completion Report will document the Building 148/SA 56 field activities completed by Tetra Tech and Resolution Consultants, soil excavation by CH2MHill, and monitoring well installation and the first quarter of groundwater sampling.

8.10 Health and Safety Plan

The activities proposed in this SAP will be completed in accordance with the site specific Health and Safety Plan presented in [Appendix F](#).

9.0 SAP Worksheet #15: Reference Limits and Evaluation Tables

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

This worksheet identifies the target analyte list, required PALs and associated sources, achievable Limits of Detection (LODs) and LOQs for each analyte of concern at the site. Details for each of the analytical methods and target analytes are provided in **Table 9-1** for groundwater and **Table 9-2** for soil.

There may be instances where a laboratory's LOQ/LOD/DL for a specific analyte, when using best available technology, will be greater than the corresponding PAL. The results will be used for decision making as long as values below the limits of quantitation are "J" qualified and discussed in the uncertainties section of the report.

In accordance with FDEP 62-777, calculation of the BaP equivalents concentration will be conducted for a sample, if at least one of the carcinogenic PAHs is detected in the sample at a concentration equal to or higher than the DL, whether the detected value is quantified with certainty (i.e., the concentration reported has no qualifier) or estimated (i.e., the concentration reported has a qualifier indicating it is estimated). If the 95% UCL is calculated, one-half the reported non-detect result will be used for non-detects.



Table 9-1: Reference Limits and Evaluation Tables for Groundwater Samples for Fixed-Base Laboratory (Definitive-Level Data)

Building 148/SA 56 at Area C SW, Former NTC Orlando, Florida Analyte List
 Matrix: Aqueous
 Units: µg/L

Analyte	CAS Number	Data Quality Objectives - Direct Exposure		Laboratory Specific Limits		
		PAL ¹	LOQ Goal	LOQ	LOD	DL
		FDEP GCTL				
Analytical Group: TCL Polynuclear Aromatic Hydrocarbons by EPA Method SW8270D SIM						
Benzo[a]anthracene	56-55-3	0.05	0.080	0.10	0.080	0.049
Benzo[a]pyrene	50-32-8	0.2	0.10	0.10	0.080	0.058
Benzo[b]fluoranthene	205-99-2	0.05	0.080	0.10	0.080	0.051
Benzo[k]fluoranthene	207-08-9	0.5	0.10	0.10	0.080	0.054
Chrysene	218-01-9	4.8	0.10	0.10	0.080	0.040
Dibenz[a,h]anthracene	53-70-3	0.005	0.080	0.10	0.080	0.069
Indeno[1,2,3-cd]pyrene	193-39-5	0.05	0.080	0.10	0.080	0.067
Analytical Group: TCL Organochlorine Pesticides by EPA Method SW8081B						
Dieldrin	60-57-1	0.002	0.050	0.10	0.050	0.031

NOTES:

¹PAL determined by the FDEP GCTLs from Chapter 62-777 FAC (values used are the risk-based values [minimum criteria-carcinogen, minimum criteria-systemic toxicant, minimum criteria-health advisory level]).

Bolded: The laboratory's LOQ/LOD/DL are greater than the corresponding PAL. The results will be used for decision making as long as values below the limits of quantitation are "J" qualified and discussed in the uncertainties section of the report.



Table 9-2: Reference Limits and Evaluation Tables for Soil Samples for Fixed-Base Laboratory (Definitive-Level Data)

Building 148/SA 56 at Area C SW, Former NTC Orlando, Florida Analyte List

Matrix: Solids

Units: mg/kg

Analyte	CAS Number	Data Quality Objectives - Direct Exposure		Laboratory Specific Limits		
		PAL ¹	LOQ Goal	LOQ	LOD	DL
		FDEP Residential SCTL				
Analytical Group: TCL Polynuclear Aromatic Hydrocarbons by EPA Method SW8270D SIM						
Benzo[a]anthracene ^{2, #}	56-55-3	NS	0.033	0.033	0.025	0.0093
Benzo[a]pyrene	50-32-8	0.1	0.017	0.033	0.025	0.0074
Benzo[b]fluoranthene ^{2, #}	205-99-2	NS	0.033	0.033	0.025	0.013
Benzo[k]fluoranthene ^{2, #}	207-08-9	NS	0.033	0.033	0.025	0.012
Chrysene ^{2, #}	218-01-9	NS	0.033	0.033	0.025	0.012
Dibenz[a,h]anthracene ^{2, #}	53-70-3	NS	0.033	0.033	0.025	0.013
Indeno[1,2,3-cd]pyrene ^{2, #}	193-39-5	NS	0.033	0.033	0.025	0.012

NOTES:

¹PAL Values are based on Residential FDEP Soil Cleanup Target Levels from Table II of Chapter 62-777 FAC.

²Analyte will be screened for benzo(a)pyrene equivalence.

#Site concentrations for carcinogenic PAHs must be converted to benzo(a)pyrene equivalents before comparison with the appropriate direct exposure SCTL for benzo(a)pyrene using the approach described in the Final Technical Report: Development of Cleanup Target Levels (February 2005).

NS = There is no specific FDEP Residential SCTL for this analyte. As indicated, the analyte will be screened for benzo(a)pyrene equivalence.

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10.0 SAP Worksheet #23: Analytical SOP References Table

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

Table 10-1: Analytical SOP References Table for ENCO Orlando

Environmental Conservation Laboratories, Inc. of Orlando

10775 Central Port Drive Orlando, FL 32824

Point of Contact: Marcia Colon

Phone: 407-826-5314

Lab SOP Number	Title, Revision Date, and Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to QSM	Modified for Project Work? (Y/N)
Preparation Method / SOP Reference						
EXSV-16	EXTRACTION OF SOIL/SOLID SAMPLES USING SONICATION (Revision 6, Effective 3/23/2010).	Definitive	Solids Base Neutral Acid Compounds (BNAs)	NA	N	N
EXSV-27	EXTRACTION OF AQUEOUS SAMPLES USING SEPARATORY FUNNEL TECHNIQUES (Revision 4, Effective 3/2/2010).	Definitive	Aqueous BNAs	NA	N	N
Analytical Method / SOP Reference						
SVGC-04	ORGANOCHLORINE PESTICIDES BY GAS CHROMATOGRAPH (GC)/ELECTRON CAPTURE DETECTOR (ECD) ANALYSIS (Revision 10, Effective 9/21/2011)	Definitive	Solids and Aqueous Pesticides	GC/ECD	N	N
SVGCMS-03	SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MASS SPECTROMETER (Revision 17, Effective 8/15/2011)	Definitive	Solids and Aqueous Semi-Volatile Organic Compounds (SVOCs)	GC/Mass Spectrometer	N	N

Note:

Under DoD-ELAP Certification No. 3000.01 (valid through 31 March 2014), ENCO Orlando is certified to perform the analysis listed above. The ELAP Certification for ENCO Orlando is provided in [Appendix G](#).

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11.0 SAP Worksheet #28: Laboratory QC Samples Table

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

Table 11-1: Laboratory QC Samples Table

Matrix **Aqueous**
Analytical Group **PAHs (SIM)**
Analytical Method/ SOP Reference **EPA Method SW8270D SIM/ SW3550B and lab SOP SVGCMS-03/EXSV-27**

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Laboratory Control Sample	Each group of 20 or less prior to analysis of samples	QC acceptance criteria specified by <i>DoD QSM V4.2</i> (DoD, October 2010) where applicable; lab historical acceptance criteria will be used for analytes not specified in <i>DoD QSM V4.2</i> .	Correct problem, then re-prep and reanalyze the Laboratory Control Sample (LCS) and all samples in the associated batch for failed analytes in all samples in the associated batch, if sufficient material is available.	Analyst Lab QA Officer Project Chemist	Accuracy	QC acceptance criteria specified by <i>DoD QSM V4.2</i> (DoD, October 2010) where applicable; lab historical acceptance criteria will be used for analytes not specified in <i>DoD QSM V4.2</i> .
Breakdown check Dichlorodiphenyltrichloroethane (DDT)	At the beginning of each 12-hour period, prior to analysis of samples	Degradation \leq 20% for DDT. Benzidine and pentachlorophenol should be present at their normal responses, and should not exceed a tailing factor of 2.	Correct problem then repeat breakdown checks.	Analyst, Laboratory Supervisor	Accuracy / Bias	Degradation \leq 20% for DDT. Benzidine and pentachlorophenol should be present at their normal responses, and should not exceed a tailing factor of 2.



Matrix **Aqueous**
 Analytical Group **PAHs (SIM)**
 Analytical Method/ SOP Reference **EPA Method SW8270D SIM/ SW3550B and lab SOP SVGCMS-03/EXSV-27**

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Method Blank	Each time samples are extracted and one per matrix per analytical method for each batch of at most 20 samples	No analytes detected > 1/2 LOQ. For common laboratory contaminants, no analytes detected ≥ LOQ as shown in Worksheet #15 (Tables 9-1 and 9-2)	Correct problem, then re-prep and reanalyze the method blank and all samples in the associated batch for failed analytes in all samples in the associated batch, if sufficient material is available.	Analyst Lab QA Officer Project Chemist	Sensitivity/Bias	No analytes detected > 1/2 LOQ. For common laboratory contaminants, no analytes detected > LOQ.
MS/MSD	One per matrix spike pair per analytical method for each batch of at most 20 samples	For matrix evaluation, use QC acceptance criteria specified by <i>DoD QSM V4.2</i> (DoD, October 2010).	Examine the project-specific DQOs. Notify lab QA Officer and Project Chemist as to additional measures to be taken.	Analyst Lab QA Officer Project Chemist	Accuracy/Precision	For matrix evaluation, use QC acceptance criteria specified by <i>DoD QSM V4.2</i> (DoD, October 2010).
Surrogate Spike	All field and QC samples	For matrix evaluation, use QC acceptance criteria specified by <i>DoD QSM V4.2</i> (DoD, October 2010).	Correct problem, then re-prep and reanalyze all failed samples for failed surrogates in the associated batch, if sufficient material is available.	Analyst Lab QA Officer Project Chemist	Accuracy/Precision	QC acceptance criteria specified by <i>DoD QSM V4.2</i> (DoD, October 2010) where applicable; lab historical acceptance criteria will be used for analytes not specified in <i>DoD QSM V4.2</i> .



Matrix **Aqueous**
 Analytical Group **PAHs (SIM)**
 Analytical Method/ SOP Reference **EPA Method SW8270D SIM/ SW3550B and lab SOP SVGCMS-03/EXSV-27**

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Internal Standards (IS)	6 per sample. Recommended: 1,4-Dichlorobenzene-d4 Naphthalene-d8 Acenaphthene-d10 Phenanthrene-d10 Chrysene-d12 Perylene-d12	Retention time +/- 30 seconds from retention time (RT) of the initial calibration (ICAL) midpoint standard, and the Extracted Ion Current Profile (EICP) area within -50% to +100 % of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory.	Analyst, Laboratory Supervisor, and Data Validator.	Accuracy/Bias	Retention time +/- 30 seconds from RT of the ICAL midpoint standard, and the extracted ion current potential (EICP) area within -50% to +100 % of ICAL midpoint standard.

Matrix **Aqueous**
Analytical Group **Dieldrin**
Analytical Method/ SOP Reference **EPA Method SW8081B/3550B and lab SOP SVGC-04/EXSV-27**

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Laboratory Control Sample	Each group of 20 or less prior to analysis of samples	QC acceptance criteria specified by <i>DoD QSM V4.2</i> (DoD, October 2010) where applicable; lab historical acceptance criteria will be used for analytes not specified in <i>DoD QSM V4.2</i> .	Correct problem, then re-prep and reanalyze the LCS and all samples in the associated batch for failed analytes in all samples in the associated batch, if sufficient material is available.	Analyst Lab QA Officer Project Chemist	Accuracy	QC acceptance criteria specified by <i>DoD QSM V4.2</i> (DoD, October 2010) where applicable; lab historical acceptance criteria will be used for analytes not specified in <i>DoD QSM V4.2</i> .
Method Blank	Each time samples are extracted and one per matrix per analytical method for each batch of at most 20 samples	No analytes detected > 1/2 LOQ. For common laboratory contaminants, no analytes detected \geq LOQ as shown in Worksheet #15 (Tables 9-1 and 9-2)	Correct problem, then re-prep and reanalyze the method blank and all samples in the associated batch for failed analytes in all samples in the associated batch, if sufficient material is available.	Analyst Lab QA Officer Project Chemist	Sensitivity/Bias	No analytes detected > 1/2 LOQ. For common laboratory contaminants, no analytes detected > LOQ.
MS/MSD	One per matrix spike pair per analytical method for each batch of at most 20 samples	For matrix evaluation, use QC acceptance criteria specified by <i>DoD QSM V4.2</i> (DoD, October 2010).	Examine the project-specific DQOs. Notify lab QA Officer and Project Chemist as to additional measures to be taken	Analyst Lab QA Officer Project Chemist	Accuracy/Precision	For matrix evaluation, use QC acceptance criteria specified by <i>DoD QSM V4.2</i> (DoD, October 2010).



Matrix **Aqueous**
 Analytical Group **Dieldrin**
 Analytical Method/ SOP Reference **EPA Method SW8081B/3550B and lab SOP SVGC-04/EXSV-27**

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Surrogate Spike	All field and QC samples	QC acceptance criteria specified by <i>DoD QSM V4.2</i> (DoD, October 2010) where applicable; lab historical acceptance criteria will be used for analytes not specified in <i>DoD QSM V4.2</i> .	Correct problem, then re-prep and reanalyze all failed samples for failed surrogates in the associated batch, if sufficient material is available.	Analyst Lab QA Officer Project Chemist	Accuracy/Precision	QC acceptance criteria specified by <i>DoD QSM V4.2</i> (DoD, October 2010) where applicable; lab historical acceptance criteria will be used for analytes not specified in <i>DoD QSM V4.2</i> .
IS	All field and QC samples	Retention time +/- 30 seconds from RT of the ICAL midpoint standard, and the EICP area within -50% to +100 % of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory.	Analyst, Laboratory Supervisor, and Data Validator.	Accuracy/Bias	Retention time +/- 30 seconds from RT of the ICAL midpoint standard, and the EICP area within -50% to +100 % of ICAL midpoint standard.



Matrix
 Analytical Group
 Analytical Method/ SOP Reference

Solids
PAHs (SIM)
EPA Method SW8270D SIM/SW3550B and lab SOP SVGCMS-03/EXSV-16

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Breakdown check DDT	At the beginning of each 12-hour period, prior to analysis of samples.	Degradation \leq 20% for DDT. Benzidine and pentachlorophenol should be present at their normal responses and should not exceed a tailing factor of 2.	Correct problem then repeat breakdown checks.	Analyst, Laboratory Supervisor	Accuracy/Bias	Degradation \leq 20% for DDT. Benzidine and pentachlorophenol should be present at their normal responses, and should not exceed a tailing factor of 2.
Laboratory Control Sample	Each group of 20 or less prior to analysis of samples	QC acceptance criteria specified by <i>DoD QSM V4.2</i> (DoD, October 2010) where applicable; lab historical acceptance criteria will be used for analytes not specified in <i>DoD QSM V4.2</i> .	Correct problem, then re-prep and reanalyze the LCS and all samples in the associated batch for failed analytes in all samples in the associated batch, if sufficient material is available.	Analyst Lab QA Officer Project Chemist	Accuracy	QC acceptance criteria specified by <i>DoD QSM V4.2</i> (DoD, October 2010) where applicable; lab historical acceptance criteria will be used for analytes not specified in <i>DoD QSM V4.2</i> .
Method Blank	Each time samples are extracted and one per matrix per analytical method for each batch of at most 20 samples	No analytes detected $>$ 1/2 LOQ. For common laboratory contaminants, no analytes detected \geq LOQ as shown in Worksheet #15 (Tables 9-1 and 9-2)	Correct problem, then re-prep and reanalyze the method blank and all samples in the associated batch for failed analytes in all samples in the associated batch, if sufficient material is available.	Analyst Lab QA Officer Project Chemist	Sensitivity/Bias	No analytes detected $>$ 1/2 LOQ. For common laboratory contaminants, no analytes detected $>$ LOQ



Matrix
 Analytical Group
 Analytical Method/ SOP Reference

Solids
PAHs (SIM)
EPA Method SW8270D SIM/SW3550B and lab SOP SVGCMS-03/EXSV-16

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MS/MSD	One per MS pair per analytical method for each batch of at most 20 samples	For matrix evaluation, use QC acceptance criteria specified by <i>DoD QSM V4.2</i> (DoD, October 2010).	Examine the project-specific DQOs. Notify lab QA Officer and Project Chemist as to additional measures to be taken.	Analyst Lab QA Officer Project Chemist	Accuracy/Precision	For matrix evaluation, use QC acceptance criteria specified by <i>DoD QSM V4.2</i> (DoD, October 2010).
Surrogate Spike	All field and QC samples	QC acceptance criteria specified by <i>DoD QSM V4.2</i> (DoD, October 2010) where applicable; lab historical acceptance criteria will be used for analytes not specified in <i>DoD QSM V4.2</i> .	Correct problem, then re-prep and reanalyze all failed samples for failed surrogates in the associated batch, if sufficient material is available.	Analyst Lab QA Officer Project Chemist	Accuracy/Precision	QC acceptance criteria specified by <i>DoD QSM V4.2</i> (DoD, October 2010) where applicable; lab historical acceptance criteria will be used for analytes not specified in <i>DoD QSM V4.2</i> .
IS	6 per sample. Recommended: 1,4-Dichlorobenzene-d4 Naphthalene-d8 Acenaphthene-d10 Phenanthrene-d10 Chrysene-d12 Perylene-d12	Retention time +/- 30 seconds from RT of the ICAL midpoint standard, and the EICP area within -50% to +100 % of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory.	Analyst, Laboratory Supervisor and Data Validator.	Accuracy/Bias	Retention time +/- 30 seconds from RT of the ICAL midpoint standard, and the EICP area within -50% to +100 % of ICAL midpoint standard.

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12.0 SAP Worksheets #34, 35, 36: Data Verification and Validation (Steps I and IIa/IIb) Process Table

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

Table 12-1: Data Verification and Validation (Steps I and IIa/IIb) Process Table

Data Review Input	Description	Responsible for Verification (name, organization)	Internal/External¹
Review of Field SOPs	Determines whether field SOPs are performed in accordance with this SAP and prescribed SOPs. Frequency is once or more depending on size and complexity of project and experience of field personnel.	Krista Sommerfeldt, Resolution Consultants	External
Review of Field Notes	Determines whether field procedures are performed in accordance with this SAP and prescribed procedures. Notes allow reconstruction of activities and identification of sampling locations. The field logbook and any field notes will be reviewed internally on a weekly basis and placed in the project file. Copies of the field logbook and field notes will be provided to the TOM and included in the Field Audit Report.	Krista Sommerfeldt, Resolution Consultants	External
Review of field instrument calibration sheets	Determines whether field instruments are calibrated and used in accordance with manufacturers' requirements. Frequency is daily during instrument use.	Krista Sommerfeldt, Resolution Consultants Anne Kakai, Resolution Consultants	External
Review of Chain-of-Custody Forms	Chain-of-Custody forms will be reviewed internally upon their completion and verified against the packed sample coolers they represent. A determination will then be made to verify whether samples are labeled and handled in accordance with this SAP and prescribed procedures, and the correct analysis is selected. The final Chain-of-Custody verification step is to compare the reported analytical results against the Chain-of-Custody to ensure all requested analysis were performed and reported.	Krista Sommerfeldt, Resolution Consultants Anne Kakai, Resolution Consultants	External
Review of Chain-of-Custody Forms	The Laboratory Sample Custodian will review the sample shipment for completeness and integrity and will sign the Chain-of-Custody forms accepting the shipment. In addition, the Chain-of-Custody forms will be reviewed internally upon receipt at the laboratory and verified for appropriateness of containers and sample preservation for each analytical method. The Chain-of-Custody forms will then be reviewed against the sample log-ins to verify that all requested analyses have been logged in.	Laboratory Sample Custodian and Marcia Colon, ENCO	Internal



Data Review Input	Description	Responsible for Verification (name, organization)	Internal/External ¹
Analytical Data Package	All analytical data packages will be verified internally by the laboratory performing the work for completeness prior to submittal of the data to Resolution Consultants. All analytical data will be verified according to the data validation procedures specified in the Validation section after the data are received from the analytical laboratory.	Marcia Colon, ENCO	Internal
Review of fixed laboratory instrument calibration sheets and laboratory analysis procedures	Determine whether laboratory instruments are used in accordance with manufactures' requirements and determine whether the laboratory analysis is performed in accordance with the procedures described in the laboratory-specific SOPs. Frequency is once during the project.	Anne Kakai, Resolution Consultants	External
Laboratory Data Assessment	Determines whether electronic and hard copy data upon receipt are comparable and contain the proper reporting format. The assessment will consist of reviewing both types of data to verify that data were delivered in the proper fields and that all required fields are populated correctly.	Jim Refermat, Resolution Consultants	External
NIRIS Review	Determines whether electronic data upon receipt is comparable and contains the proper reporting format. The assessment will consist of reviewing data to verify that data was delivered in the proper fields and that all required fields are populated correctly.	Jim Refermat, Resolution Consultants	External
SOP Deviation (if any)	Document and assess the impact on the data from any deviations of the analytical or field SOPs.	Denise Oggeri, Resolution Consultants	External

VALIDATION (STEPS IIA AND IIB) PROCESS TABLE

On-site data	All on-site data will be reviewed against SAP requirements for completeness, precision and accuracy based on the field calibration requirements, and overall project DQOs.	Denise Oggeri, Resolution Consultants	External
Field Water Quality Parameters	Review of instrument calibration procedures and overall method sensitivity, precision, accuracy, and completeness.	Krista Sommerfeldt, Resolution Consultants	External
Environmental Restoration Programs	Ensures that all sampling and analytical SOPs were followed.	Krista Sommerfeldt, Resolution Consultants	External
Chain-of-Custody and Field QC logbook	Examines traceability of data from sample collection to generation of project data	Denise Oggeri, Resolution Consultants	External
Project LODs and LOQs and data qualifiers	Review LODs and LOQs achieved as outlined in the SAP and verify that the laboratory successfully analyzed all samples submitted and the PAL was attained where achievable. Evaluate the impact data qualifiers have on the project objectives and required corrective action, if any.	Jim Refermat, Resolution Consultants	External
SAP	Determine whether the number and type of samples specified in Sample Details Table were collected and analyzed.	Denise Oggeri, Resolution Consultants	External



Data Review Input	Description	Responsible for Verification (name, organization)	Internal/External ¹
SAP and Laboratory SOW	Determines whether all analytes specified in Worksheet #15 (Tables 9-1 and 9-2) were analyzed and reported by the laboratory.	Anne Kakai, Resolution Consultants	External
Laboratory Data and SAP requirements	Assess and document the performance of the analytical process. A summary of all QC samples and results will be verified for MPC and completeness. Full verification will be performed on 10% of the data and Standard Level verification will be performed on 90% of the data. A report shall be prepared within 21 days of receipt of the data package from the laboratory.	Jim Refermat, Resolution Consultants	External
Methods, Field QC logbook and SAP requirements	Determines impacts of any deviations from methods and corrective actions implemented during sampling and analysis.	Anne Kakai, Resolution Consultants	External

VALIDATION (STEPS IIA AND IIB) SUMMARY TABLE

Step Iia/Iib ^a	Matrix/Analytical Group	Responsible (Name, Organization)	Validation Criterion
Iia/Iib Aqueous/PAH (SIM)	Full Validation Procedure for GC/MS Polynuclear Aromatic Hydrocarbons by EPA Method SW8270D SIM, using <i>DoD QSM V4.2</i> and modeled after the EPA National Functional Guidelines for Data Review to the extent possible	Anne Kakai, Resolution Consultants	External
Iia/Iib Aqueous/Dieldrin	Full Validation Procedure for Organochlorine Pesticides by EPA Method SW8081B, using <i>DoD QSM V4.2</i> and modeled after the EPA National Functional Guidelines for Data Review to the extent possible	Anne Kakai, Resolution Consultants	External
Iia/Iib Solids/PAH (SIM)	Full Validation Procedure for GC/MS Polynuclear Aromatic Hydrocarbons by EPA Method SW8270D SIM, using <i>DoD QSM V4.2</i> and modeled after the EPA National Functional Guidelines for Data Review to the extent possible	Anne Kakai, Resolution Consultants	External

¹ "Internal" is completed by the laboratory, "External" is not completed by the laboratory

^a Iia Compliance with methods, procedures, and contracts (see Table 10, page 117, *UFP-QAPP Manual, V.1, IDQTF, March 2005a*)

Iib Comparison with measurement performance criteria in the SAP (see Table 11, page 118, *UFP-QAPP Manual, V.1, IDQTF, March 2005a*)

All analyses will be performed at low concentration levels

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13.0 References

ABB Environmental Services, Inc (ABB-ES), December, 1994. *Base Realignment and Closure (BRAC) Environmental Baseline Survey Report, Naval Training Center, Orlando, Florida.*

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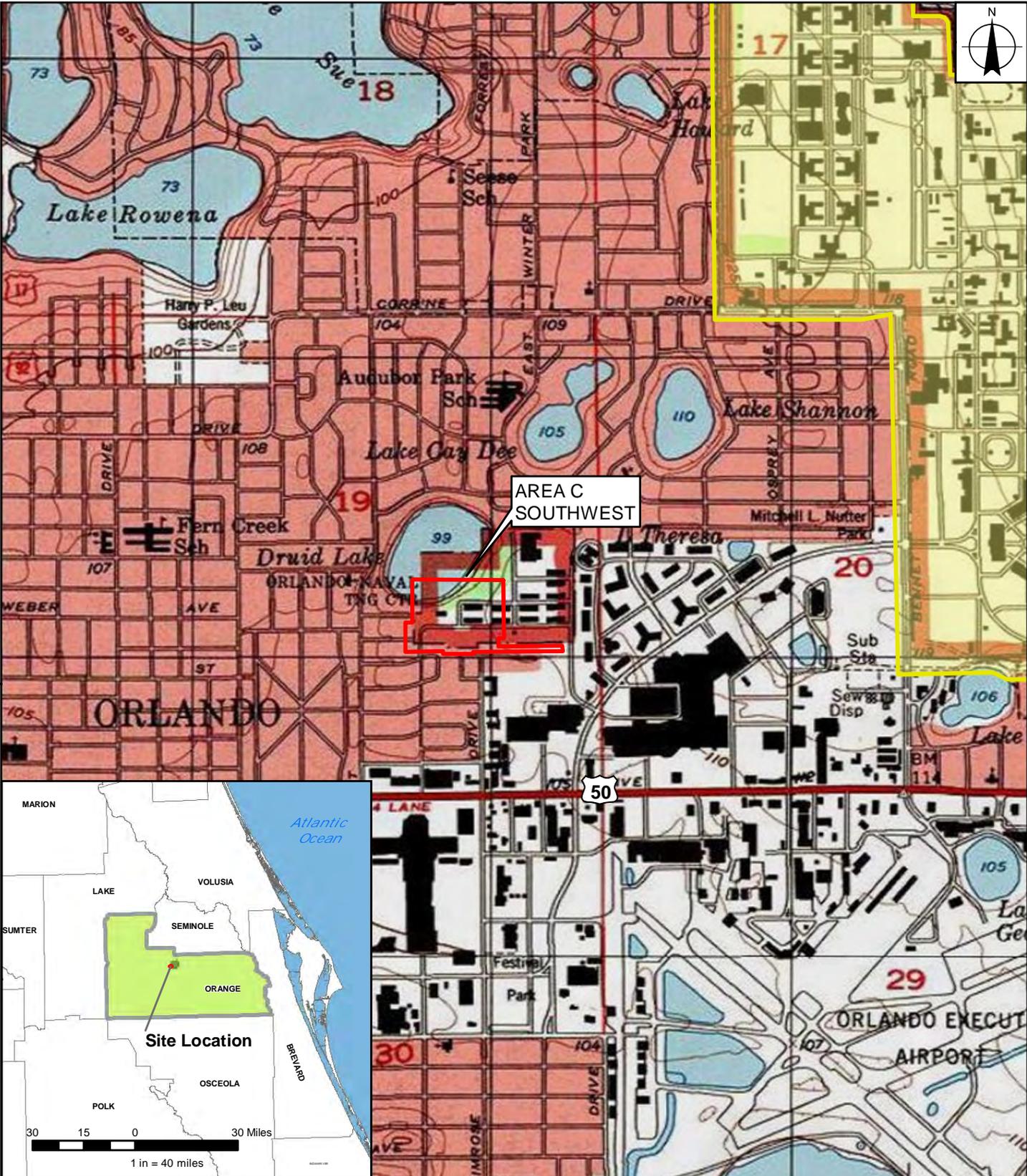
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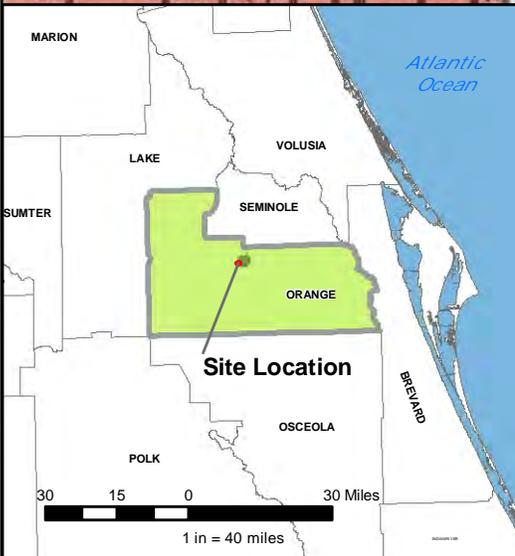
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FIGURES

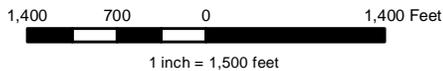


AREA C
SOUTHWEST



Legend

- Area C Southwest Boundary
- NTC Orlando - Main Base Boundary



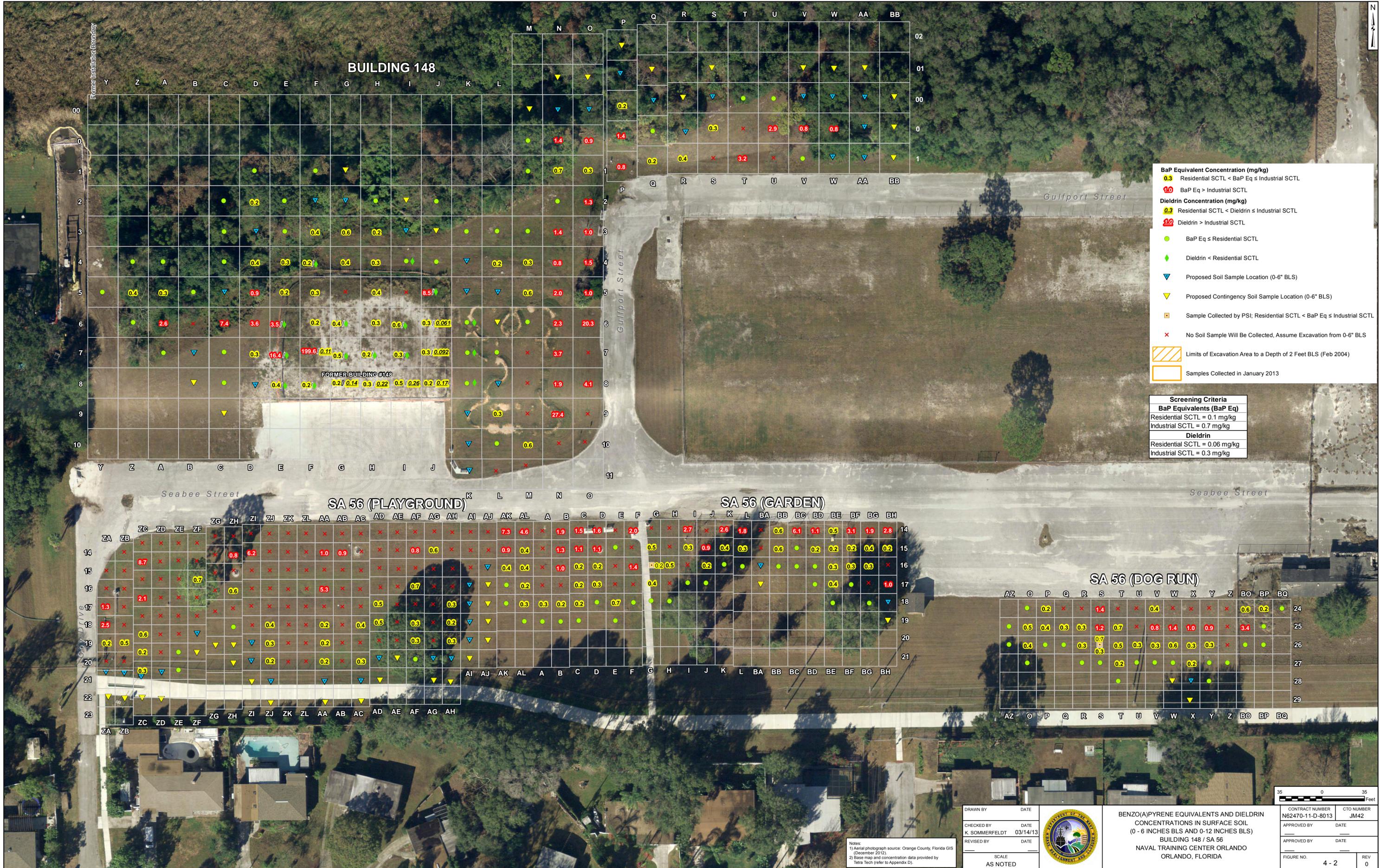
USGS Quad Map: Orlando East
 Section(s): 19
 Township: 22S
 Range: 30E
 Basemap Source: Esri World Imagery
http://services.arcgisonline.com/arcgis/services/World_Imagery
 © 2011 Esri, i-cubed, National Geographic Society,
 USDA FSA, USGS, AEX, GeoEye, AeroGRID, Getmapping, IGP

FIGURE 4-1
 LOCATION OF AREA C SOUTHWEST
 BUILDING 148 / SA 56
 FORMER NAVAL TRAINING CENTER,
 ORLANDO, FLORIDA



REQUESTED BY: M. Sweeney
 DRAWN BY: M. Martin

DATE: 3/6/2013
 TASK ORDER NUMBER: JM22



BaP Equivalent Concentration (mg/kg)
0.3 Residential SCTL < BaP Eq ≤ Industrial SCTL
1.0 BaP Eq > Industrial SCTL

Dieldrin Concentration (mg/kg)
0.3 Residential SCTL < Dieldrin ≤ Industrial SCTL
1.0 Dieldrin > Industrial SCTL

● BaP Eq ≤ Residential SCTL
 ◆ Dieldrin < Residential SCTL
 ▼ Proposed Soil Sample Location (0-6" BLS)
 ▼ Proposed Contingency Soil Sample Location (0-6" BLS)

■ Sample Collected by PSI; Residential SCTL < BaP Eq ≤ Industrial SCTL
 × No Soil Sample Will Be Collected, Assume Excavation from 0-6" BLS

▨ Limits of Excavation Area to a Depth of 2 Feet BLS (Feb 2004)
 □ Samples Collected in January 2013

Screening Criteria	
BaP Equivalents (BaP Eq)	
Residential SCTL =	0.1 mg/kg
Industrial SCTL =	0.7 mg/kg
Dieldrin	
Residential SCTL =	0.06 mg/kg
Industrial SCTL =	0.3 mg/kg

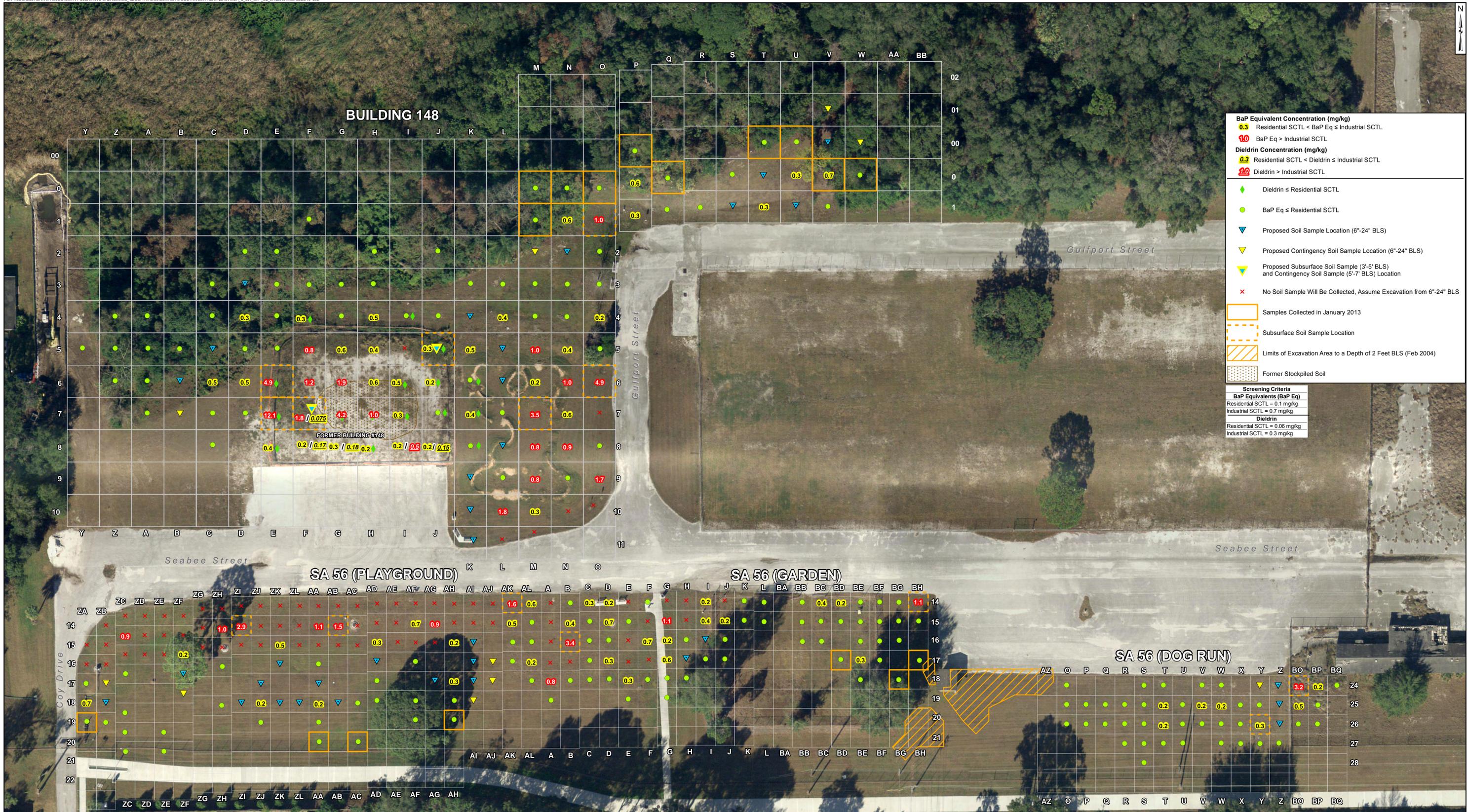
Notes:
 1) Aerial photograph source: Orange County, Florida GIS (December 2012).
 2) Base map and concentration data provided by Tetra Tech (refer to Appendix D).

DRAWN BY	DATE
CHECKED BY	DATE
REVISOR	DATE
SCALE	AS NOTED



BENZO(A)PYRENE EQUIVALENTS AND DIELDRIN CONCENTRATIONS IN SURFACE SOIL (0 - 6 INCHES BLS AND 0-12 INCHES BLS) BUILDING 148 / SA 56 NAVAL TRAINING CENTER ORLANDO ORLANDO, FLORIDA

CONTRACT NUMBER	CTO NUMBER
N62470-11-D-8013	JM42
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO.	REV
4 - 2	0



BaP Equivalent Concentration (mg/kg)
0.3 Residential SCTL < BaP Eq ≤ Industrial SCTL
1.0 BaP Eq > Industrial SCTL

Dieldrin Concentration (mg/kg)
0.3 Residential SCTL < Dieldrin ≤ Industrial SCTL
0.9 Dieldrin > Industrial SCTL

◆ Dieldrin ≤ Residential SCTL
 ● BaP Eq ≤ Residential SCTL
 ▼ Proposed Soil Sample Location (6"-24" BLS)
 ▼ Proposed Contingency Soil Sample Location (6"-24" BLS)
 ▼ Proposed Subsurface Soil Sample (3'-5' BLS) and Contingency Soil Sample (5'-7' BLS) Location
 × No Soil Sample Will Be Collected, Assume Excavation from 6"-24" BLS

□ Samples Collected in January 2013
 □ Subsurface Soil Sample Location
 □ Limits of Excavation Area to a Depth of 2 Feet BLS (Feb 2004)
 □ Former Stockpiled Soil

Screening Criteria

BaP Equivalents (BaP Eq)	
Residential SCTL = 0.1 mg/kg	Industrial SCTL = 0.7 mg/kg
Dieldrin	
Residential SCTL = 0.06 mg/kg	Industrial SCTL = 0.3 mg/kg

SUBSURFACE SOIL SAMPLE RESULTS

AREA	SAMPLE LOCATION	SAMPLE DEPTH	BaP Eq (mg/kg)
Bldg 148	E6	2-4'	0.1
	E7	2-4'	0.2
	F7	4-6'	0.0
	F7	2-3'	0.7
	J5	2-3'	0.1
	M7	2-4'	0.7
O1	2-4'	0.0	
O6	2-4'	0.0	

SUBSURFACE SOIL SAMPLE RESULTS

AREA	SAMPLE LOCATION	SAMPLE DEPTH	BaP Eq (mg/kg)
Playground	ZI15	2-3'	0.1
	AB15	2-3'	0.0
	AK14	2-3'	0.0
	BH14	2-3'	0.0

SUBSURFACE SOIL SAMPLE RESULTS

AREA	SAMPLE LOCATION	SAMPLE DEPTH	DIELDRIN (mg/kg)
Bldg 148	G8	2-3'	0.0013
	I8	2-3'	0.0054
Dog Run	Y26	2-3'	0.1
	BO24	2-3'	0.0

SUBSURFACE SOIL SAMPLE RESULTS

AREA	SAMPLE LOCATION	SAMPLE DEPTH	BaP Eq (mg/kg)
Dog Run	Y26	2-3'	0.1
	BO24	2-3'	0.0

DRAWN BY: _____ DATE: _____
 CHECKED BY: K. SOMMERFELDT DATE: 03/20/13
 REVISED BY: _____ DATE: _____
 SCALE: AS NOTED

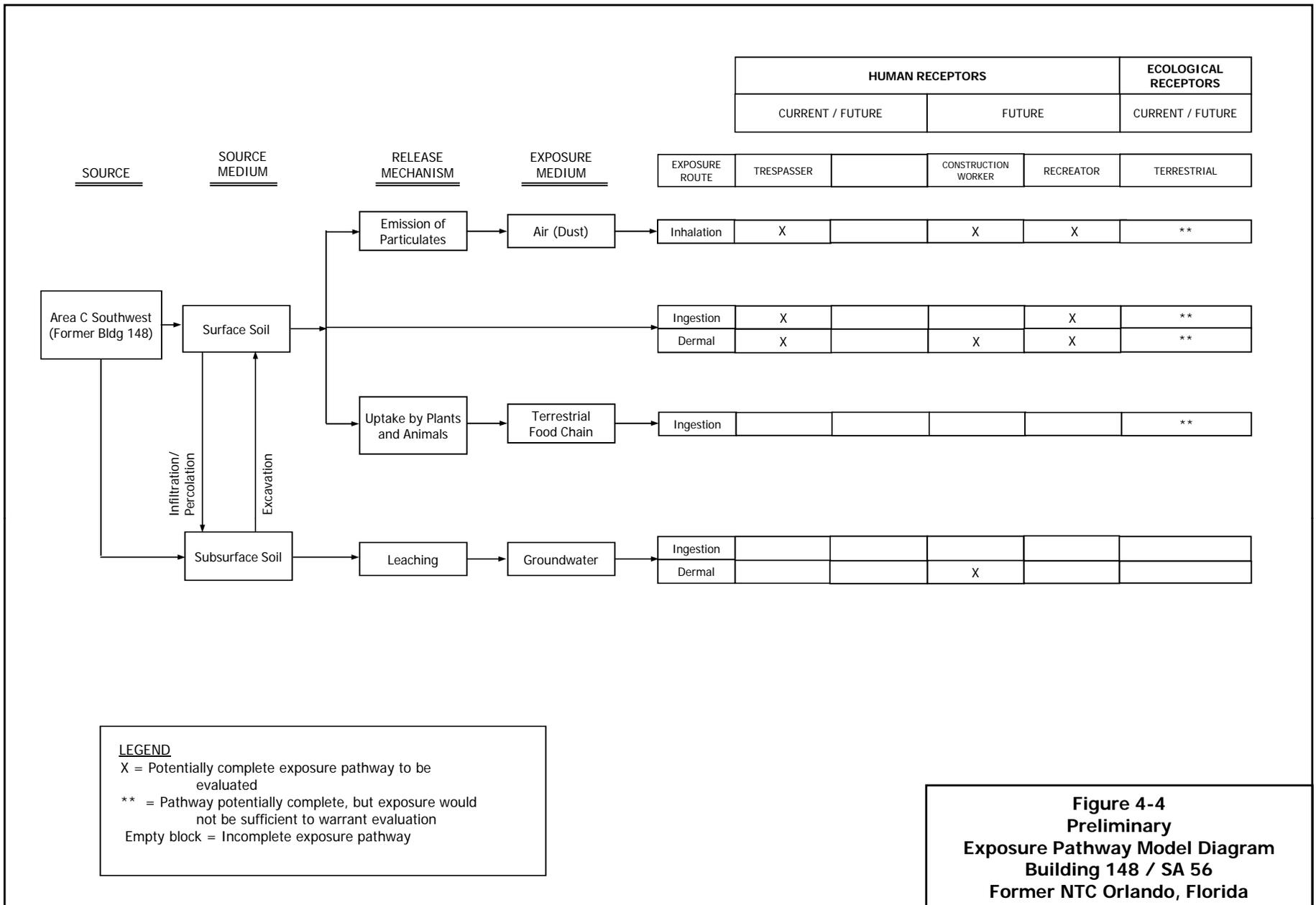


BENZO(A)PYRENE EQUIVALENTS AND DIELDRIN CONCENTRATIONS IN SURFACE SOIL (6 - 24 INCHES BLS) AND SUBSURFACE SOIL (GREATER THAN 24 INCHES BLS) BUILDING 148 / SA 56 NAVAL TRAINING CENTER ORLANDO ORLANDO, FLORIDA

CONTRACT NUMBER	N62470-11-D-8013	CTO NUMBER	JM42
APPROVED BY	DATE	APPROVED BY	DATE
APPROVED BY	DATE	APPROVED BY	DATE
FIGURE NO.	4-3	REV	0

Notes:
 1) Aerial photograph source: Orange County, Florida GIS (December 2012).
 2) Base map and concentration data provided by Tetra Tech (refer to Appendix D)





APPENDIX A
SAP AMENDMENT HISTORY
(PROVIDED ON CD ONLY)

APPENDIX B
TIER II SAP TEMPLATE USE APPROVAL
(PROVIDED ON CD ONLY)

Sommerfeldt, Krista

From: Nielsen, Janice L CIV NAVFAC LANT, EV [janice.nielsen@navy.mil]
Sent: Tuesday, February 26, 2013 6:31 AM
To: Sommerfeldt, Krista
Cc: Sanford, Art F CTR NAVFACHQ, BRAC PMO; Criswell, David CIV NAVFACHQ, BRAC PMO; Sweeney, Marianne; Bowers, Kenneth A CIV NAVFAC LANT, EV
Subject: RE: Tier II SAP Approval Request - NTC Orlando, FL
Signed By: janice.nielsen@navy.mil

Krista: Yes, David and I discussed the site specifics and I am on board for the Tier II approach. Please include/reference this e-mail documenting LANT approval for the Tier II. Thanks, Jan

Jan Nielsen
EV33 Restoration Engineering
NAVFAC LANT
757.322.8339
757.617.0987 (Mobile)

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

From: Sommerfeldt, Krista [<mailto:Krista.Sommerfeldt@aecom.com>]
Sent: Monday, February 25, 2013 16:32
To: Nielsen, Janice L CIV NAVFAC LANT, EV
Cc: Sanford, Art F CTR NAVFACHQ, BRAC PMO; Criswell, David CIV NAVFACHQ, BRAC PMO; Sweeney, Marianne; Bowers, Kenneth A CIV NAVFAC LANT, EV
Subject: RE: Tier II SAP Approval Request - NTC Orlando, FL

Jan,

Art Sanford just gave me a call and let me know that Dave Criswell was able to discuss this site with you and it was decided to continue with SAP prep using the Tier II template. We will move forward with the preparation of the Tier II UFP-SAP for Navy Chemist review.

Thanks,
Krista

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

From: Nielsen, Janice L CIV NAVFAC LANT, EV [<mailto:janice.nielsen@navy.mil>]
Sent: Monday, February 25, 2013 8:55 AM
To: Sommerfeldt, Krista
Cc: Sanford, Art F CTR NAVFACHQ, BRAC PMO; Sweeney, Marianne; Bowers, Kenneth A CIV NAVFAC LANT, EV
Subject: RE: Tier II SAP Approval Request - NTC Orlando, FL

Krista: Because this site has had former disputes with the stakeholders and there is increased media and public attention to the site the team should consider not using a Tier II. Since this is a data gap, is there a previous SAP that did the initial work? If so, the team may want to consider an addendum. The entire team must be on board with a Tier II and the EPA reps in Region 4 have not always supported the use of a Tier II. You can reach me at the number below if you would like to discuss further. V/R Jan Nielsen

Jan Nielsen
EV33 Restoration Engineering
NAVFAC LANT

757.322.8339
757.617.0987 (Mobile)

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

From: Sommerfeldt, Krista [<mailto:Krista.Sommerfeldt@aecom.com>]
Sent: Friday, February 22, 2013 11:02
To: Nielsen, Janice L CIV NAVFAC LANT, EV
Cc: Sanford, Art F CTR NAVFACHQ, BRAC PMO; Sweeney, Marianne
Subject: Tier II SAP Approval Request - NTC Orlando, FL

Jan,

A completed Tier II SAP Questionnaire for NTC Orlando, Site Bldg 148/SA 56 (aka Area C Southwest), is attached for your review. The team's SAP prep, Navy approval, and regulatory review schedule is tight because we are aiming to enter the field on 4/1/13. We do not plan on submitting the four preliminary WSs (10, 11, 15, 17). We would like the first submittal to NIRIS to be the Internal Draft Tier II SAP for Navy Chemist review.

Thank you,

Krista Sommerfeldt, P.E.
NAVFAC Atlantic CLEAN, Project Engineer
D 407.304.4444 M 407.900.4683
krista.sommerfeldt@aecom.com <<mailto:john.petraglia@aecom.com>>

Resolution Consultants

A Joint Venture of AECOM & EnSafe
320 East South Street, Orlando, FL 32801 T 407.304.4400 F 407.304.4401 www.aecom.com
<<http://www.aecom.com/>>

**TIER II SAP APPROVAL QUESTIONNAIRE
FOR NAVFAC LANT CLEAN PROJECTS**

Please answer the following questions and send it to Jan Nielsen (janice.nielsen@navy.mil) and **CC the RPM** via e-mail attachment before generating a Tier-II SAP. Approval or disapproval will be indicated in the Navy response to your e-mail.

Name of Installation / Site: Former NTC Orlando / Bldg 148/SA 56 (aka Area C SW)

NAVFAC LANT RPM: Art Sanford (art.sanford.ctr@navy.mil, ph 843-743-2135)

	Question	Comments
1.	What base and Site/SWMU/AOC, etc., is associated with this work?	Former NTC Orlando / Bldg 148/SA 56 (aka Area C Southwest)
2.	What is the phase of the site actions? (LTM, RAO, SI, RI, etc.)	IRA
3.	What is the purpose of the sampling? (LTM, Data Gap, Initial Investigation, etc.)	Data Gap (complete delineation efforts)
4.	Who are the primary stakeholders (EPA/State regulators, agencies, special interest groups)?	FDEP (the City of Orlando has interest in the site because they are the property owner, but they are not a stakeholder)
5.	Is the entire team on board with a Tier II or graded SAP?	Yes
6.	Have there been any disputes at this site? (Regulators, community, other stakeholders)	Yes. The site was transferred to the City of Orlando for recreational use. Due to contamination identified by the City during construction of a city park, the City requested further investigation be completed by the Navy.
7.	Is it likely that this site might be the subject of litigation in the future (e.g. known PRP issues, potential cancer clusters, environmental justice concerns, BRAC turnover issues, media attention, etc.)?	Yes. BRAC turnover issues, media attention, community attention.
8.	Are there any analytical methods that do not meet the QSM? List the analytical methods that will be used? Include non QSM methods in this question and ask if methods responding yes to this question are definitive or screening data.	No. Groundwater & Soil: Pesticides 8081B, PAHs 8270D SIM All methods are definitive.
9.	Is the lab required to be ELAP accredited for all methods/analytes? If not, please provide justification.	Yes

	Question	Comments
10.	What are the sampling methods that will be used? Are there any specialized sampling methods being used? If so, please describe?	FDEP SOP FS 2200, Groundwater Sampling FDEP SOP FS 3000, Soil Sampling No specialized sampling methods will be used.

Note: 1 = If documentation is needed for any of the above items then consider adding the WS or portions of the WS from the 37 worksheet format into the Tier II SAP to capture the information.

I certify that the answers provided above are accurate.

Signature:  Sommerfeldt, Krista
2013.02.22 10:50:34
-05'00' Date: 2/21/13

Print Name/Title: Krista Sommerfeldt / Engineer

Based on the information provided above the use of the Tier II SAP format is:

PERMITTED:

NOT PERMITTED:

Signature: _____ Date: _____

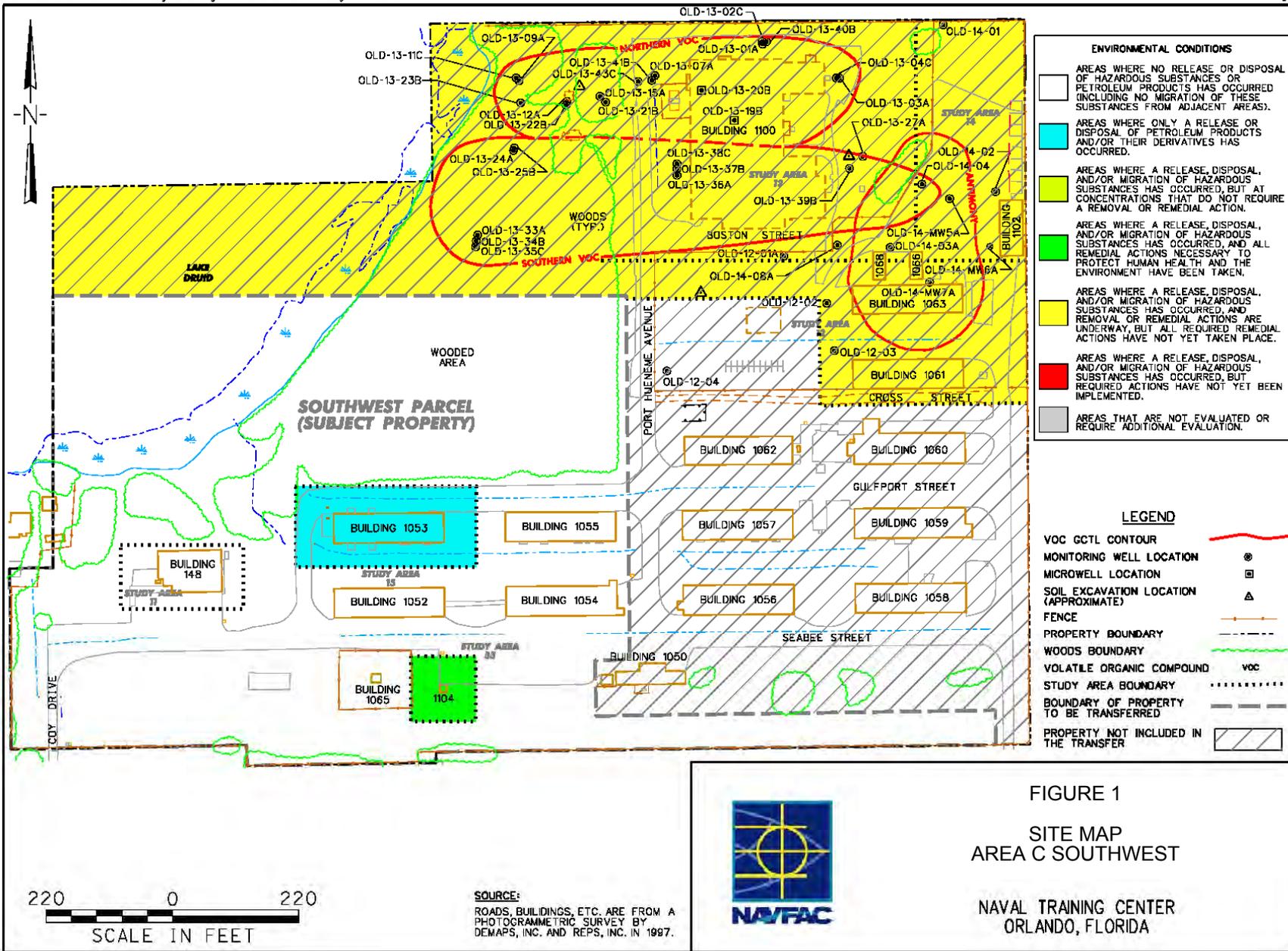
Print Name/Title: _____

**APPENDIX C
EXCERPTS FROM HISTORICAL REPORTS**

(PROVIDED ON CD ONLY)

From *Finding of Suitability to Transfer Area C SW* (DoN BRAC PMO SE, July 2006):

Figure 1, Site Map, Area C SW



ENVIRONMENTAL CONDITIONS

- AREAS WHERE NO RELEASE OR DISPOSAL OF HAZARDOUS SUBSTANCES OR PETROLEUM PRODUCTS HAS OCCURRED (INCLUDING NO MIGRATION OF THESE SUBSTANCES FROM ADJACENT AREAS).
- AREAS WHERE ONLY A RELEASE OR DISPOSAL OF PETROLEUM PRODUCTS AND/OR THEIR DERIVATIVES HAS OCCURRED.
- AREAS WHERE A RELEASE, DISPOSAL, AND/OR MIGRATION OF HAZARDOUS SUBSTANCES HAS OCCURRED, BUT AT CONCENTRATIONS THAT DO NOT REQUIRE A REMOVAL OR REMEDIAL ACTION.
- AREAS WHERE A RELEASE, DISPOSAL, AND/OR MIGRATION OF HAZARDOUS SUBSTANCES HAS OCCURRED, AND ALL REMEDIAL ACTIONS NECESSARY TO PROTECT HUMAN HEALTH AND THE ENVIRONMENT HAVE BEEN TAKEN.
- AREAS WHERE A RELEASE, DISPOSAL, AND/OR MIGRATION OF HAZARDOUS SUBSTANCES HAS OCCURRED, AND REMOVAL OR REMEDIAL ACTIONS ARE UNDERWAY, BUT ALL REQUIRED REMEDIAL ACTIONS HAVE NOT YET TAKEN PLACE.
- AREAS WHERE A RELEASE, DISPOSAL, AND/OR MIGRATION OF HAZARDOUS SUBSTANCES HAS OCCURRED, BUT REQUIRED ACTIONS HAVE NOT YET BEEN IMPLEMENTED.
- AREAS THAT ARE NOT EVALUATED OR REQUIRE ADDITIONAL EVALUATION.

LEGEND

- VOC GCTL CONTOUR
- MONITORING WELL LOCATION
- MICROWELL LOCATION
- SOIL EXCAVATION LOCATION (APPROXIMATE)
- FENCE
- PROPERTY BOUNDARY
- WOODS BOUNDARY
- VOLATILE ORGANIC COMPOUND voc
- STUDY AREA BOUNDARY
- BOUNDARY OF PROPERTY TO BE TRANSFERRED
- PROPERTY NOT INCLUDED IN THE TRANSFER



FIGURE 1
SITE MAP
AREA C SOUTHWEST
NAVAL TRAINING CENTER
ORLANDO, FLORIDA

SOURCE:
 ROADS, BUILDINGS, ETC. ARE FROM A
 PHOTOGRAMMETRIC SURVEY BY
 DEWAPS, INC. AND REPS, INC. IN 1987.

Naval Training Center Orlando
 Finding of Suitability to Transfer
 Area C Southwest

APPENDIX D
TETRA TECH SOIL SAMPLING DATA
(PROVIDED ON CD ONLY)

Table 1, PAH Concentrations in SA 56 (Dog Run Portion)

Table 2, PAH Concentrations in SA 56 (Playground Portion)

Table 3, Pesticide and PAH Concentrations in Building 148

Table 4, Pesticide and PAH Concentrations in Building 148

Figure 1, Benzo(a)pyrene Equivalent Concentration in Surface Soil (0-6 inches)

Figure 2, Benzo(a)pyrene Equivalent Concentration in Surface Soil (0-6 and 0-12 inches)

Figure 1, Dieldrin Concentration in Surface Soil (6-24 inches)

Figure 2, Dieldrin Concentration in Surface Soil (6-24 inches)

Technical Memo (Tetra Tech, 5 October 2011), Limited Soil Sampling and Analysis Report
Building 148, Area C

Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION					AZ-25 NTC56-AZ-25 NTC56SSDSA250006	AZ-26 NTC56-AZ-26 NTC56SSDSA260006	BO-24 NTC56-BO-24 NTC56SSDSBO240006	BO-24 NTC56-BO-24 NTC56SSDSBO240624
LOCATION	FDEP	FDEP	FDEP	Minimum	20120713	20120829	20120710	20120710
SAMPLE ID	Residential	Industrial	Soil to GW		NORMAL	NORMAL	NORMAL	NORMAL
SAMPLE DATE					SO	SO	SO	SO
SAMPLE CODE					0	0	0	0.5
MATRIX					0.5	0.5	0.5	2
TOP DEPTH (FEET)					544554.3116	544554.3116	544749.3116	544749.3116
BOTTOM DEPTH (FEET)					1535764.22	1535749.22	1535779.22	1535779.22
EASTING								
NORTHING								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.024 U	0.022 U	0.043 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.024 U	0.022 U	0.043 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.025 U	0.023 U	0.046 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.021 U	0.022 J	0.2	0.86
ANTHRACENE	21000	300000	2500	2500	0.016 U	0.015 U	0.062 J	0.22
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.0	0.1	0.6	3.2
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.012 J	0.018 J	0.18	1
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.0083 U	0.036	0.37	2.1
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.015 U	0.088	0.77	3.3
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.013 U	0.033 J	0.4	1.8
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.013 U	0.019 J	0.2	1.1
CHRYSENE	NC	NC	77	77	0.013 U	0.038	0.46	1.9
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.015 U	0.014 U	0.097	0.51
FLUORANTHENE	3200	59000	1200	1200	0.015 U	0.032 J	0.45	1.4
FLUORENE	2600	33000	160	160	0.024 U	0.022 U	0.043 U	0.073
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.013 U	0.026 J	0.31	1.4
NAPHTHALENE	55	300	1.2	1.2	0.026 U	0.024 U	0.048 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.02 U	0.019 U	0.14	0.42
PYRENE	2400	45000	880	880	0.013 U	0.038	0.5	1.8

Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION					BO-24	BO-25	BO-25	BO-26
LOCATION					NTC56-BO-24	NTC56-BO-25	NTC56-BO-25	NTC56-BO-26
SAMPLE ID					NTC56SSDSBO242436	NTC56SSDSBO250006	NTC56SSDSBO250624	NTC56SSDSBO260006
SAMPLE DATE	FDEP	FDEP	FDEP	Minimum	20120801	20120710	20120710	20120710
SAMPLE CODE	Residential	Industrial	Soil to GW		NORMAL	NORMAL	NORMAL	NORMAL
MATRIX					SO	SO	SO	SO
TOP DEPTH (FEET)					2	0	0.5	0
BOTTOM DEPTH (FEET)					3	0.5	2	0.5
EASTING					544749.3116	544749.3116	544749.3116	544749.3116
NORTHING					1535779.22	1535764.22	1535764.22	1535749.22
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.026 U	0.043 U	0.022 U	0.021 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.026 U	0.043 U	0.022 U	0.021 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.027 U	0.045 U	0.023 U	0.022 U
ACENAPHTHYLENE	1800	20000	27	27	0.023 U	1	0.13	0.026 J
ANTHRACENE	21000	300000	2500	2500	0.017 U	0.29	0.032 J	0.014 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.0	3.4	0.5	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.02 J	1.1	0.16	0.029 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.019 J	2.2	0.32	0.053
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.047	4.1	0.63	0.12
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.015 U	2.1	0.36	0.058
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.015 U	1.2	0.19	0.036
CHRYSENE	NC	NC	77	77	0.026 J	2.5	0.4	0.065
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.016 U	0.54	0.091	0.016 J
FLUORANTHENE	3200	59000	1200	1200	0.032 J	1.8	0.31	0.068
FLUORENE	2600	33000	160	160	0.026 U	0.086	0.022 U	0.021 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.015 U	1.6	0.28	0.048
NAPHTHALENE	55	300	1.2	1.2	0.028 U	0.047 U	0.024 U	0.023 U
PHENANTHRENE	2200	36000	250	250	0.022 U	0.47	0.071	0.021 J
PYRENE	2400	45000	880	880	0.037 J	2.2	0.37	0.076

**Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida**

LOCATION	FDEP	FDEP	FDEP	Minimum	BO-26 NTC56-BO-26 NTC56SSDSBO260624 20120710 NORMAL SO 0.5 2 544749.3116 1535749.22	BP-24 NTC56-BP-24 NTC56SSDSBP240006 20120713 NORMAL SO 0 0.5 544764.3116 1535779.22	BP-24 NTC56-BP-24 NTC56SSDSBP240624 20120713 NORMAL SO 0.5 2 544764.3116 1535779.22	BP-25 NTC56-BP-25 NTC56SSDSBP250006 20120713 NORMAL SO 0 0.5 544764.3116 1535764.22
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.021 U	0.008 J	0.024 J	0.0055 J
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.021 U	0.011 J	0.033	0.0071 J
ACENAPHTHENE	2400	20000	2.1	2.1	0.022 U	0.0052 U	0.0051 U	0.0051 U
ACENAPHTHYLENE	1800	20000	27	27	0.019 U	0.068	0.1	0.053
ANTHRACENE	21000	300000	2500	2500	0.014 U	0.021 J	0.032 J	0.016 J
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.0	0.2	0.2	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.015 J	0.072	0.063	0.04
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.014 J	0.14 J	0.13 J	0.08 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.032 J	0.22	0.23	0.15
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.016 J	0.12	0.12	0.068
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.012 U	0.062	0.062	0.041
CHRYSENE	NC	NC	77	77	0.016 J	0.12	0.12	0.077
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.013 U	0.028 J	0.028 J	0.018 J
FLUORANTHENE	3200	59000	1200	1200	0.019 J	0.16	0.17	0.099
FLUORENE	2600	33000	160	160	0.021 U	0.0044 U	0.0043 U	0.0043 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.012 J	0.091 J	0.092 J	0.055 J
NAPHTHALENE	55	300	1.2	1.2	0.023 U	0.009 J	0.026 J	0.0075 J
PHENANTHRENE	2200	36000	250	250	0.018 U	0.048	0.082	0.038
PYRENE	2400	45000	880	880	0.022 J	0.17	0.2	0.11

Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION	FDEP	FDEP	FDEP	Minimum	BP-25 NTC56-BP-25 NTC56SSDSBP250624 20120713 NORMAL SO 0.5 2 544764.3116 1535764.22	BP-26 NTC56-BP-26 NTC56SSDSBP260006 20120713 NORMAL SO 0 0.5 544764.3116 1535749.22	BP-26 NTC56-BP-26 NTC56SSDSBP260624 20120713 NORMAL SO 0.5 2 544764.3116 1535749.22	BQ-24 NTC56-BQ-24 NTC56SSDSBQ24000 20120801 NORMAL SO 0 0.5 544779.3116 1535779.22
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.0053 U	0.0052 U	0.0052 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.0039 U	0.0043 J	0.0038 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.0053 U	0.0052 U	0.0052 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.037	0.033 J	0.0049 J	0.032 J
ANTHRACENE	21000	300000	2500	2500	0.011 J	0.012 J	0.005 U	0.015 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.1	0.1	0.0	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.027 J	0.033 J	0.011 J	0.043
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.053 J	0.059 J	0.0082 J	0.072
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.094	0.12	0.016 J	0.16
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.046	0.05	0.0072 J	0.039
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.028 J	0.026 J	0.0059 U	0.044
CHRYSENE	NC	NC	77	77	0.051	0.06	0.0075 J	0.095
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.011 J	0.012 J	0.0041 UJ	0.014 U
FLUORANTHENE	3200	59000	1200	1200	0.061	0.077	0.011 J	0.12
FLUORENE	2600	33000	160	160	0.0044 U	0.0044 U	0.0043 U	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.035 J	0.04 J	0.0059 J	0.038
NAPHTHALENE	55	300	1.2	1.2	0.0048 U	0.0057 J	0.0047 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.024 J	0.026 J	0.0051 U	0.045
PYRENE	2400	45000	880	880	0.069	0.08	0.011 J	0.13

Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION	FDEP	FDEP	FDEP	Minimum	BQ-24 NTC56-BQ-24 NTC56SSDSBQ24062	O-24 NTC56-O-24 NTC56SSDSO240006	O-24 NTC56-O-24 NTC56SSDSO240624	O-25 NTC56-O-25 NTC56SSDSO250006
LOCATION								
SAMPLE ID								
SAMPLE DATE	FDEP	FDEP	FDEP		20120801	20120612	20120612	20120612
SAMPLE CODE	Residential	Industrial	Soil to GW		NORMAL	NORMAL	NORMAL	NORMAL
MATRIX					SO	SO	SO	SO
TOP DEPTH (FEET)					0.5	0	0.5	0
BOTTOM DEPTH (FEET)					2	0.5	2	0.5
EASTING					544779.3116	544569.3116	544569.3116	544569.3116
NORTHING					1535779.22	1535779.22	1535779.22	1535764.22
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.024 U	0.022 U	0.023 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.024 U	0.022 U	0.023 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.025 U	0.023 U	0.024 U
ACENAPHTHYLENE	1800	20000	27	27	0.02 U	0.022 U	0.02 U	0.15
ANTHRACENE	21000	300000	2500	2500	0.015 U	0.016 U	0.015 U	0.036
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.0 U	0.1	0.0	0.5
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.0099 U	0.035 J	0.013 J	0.14
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.0079 U	0.051	0.0078 U	0.34
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.014 U	0.12	0.014 J	0.69
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.013 U	0.038	0.013 U	0.24
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.013 U	0.029 J	0.013 U	0.21
CHRYSENE	NC	NC	77	77	0.013 U	0.064	0.013 U	0.35
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.014 U	0.015 U	0.014 U	0.061
FLUORANTHENE	3200	59000	1200	1200	0.014 U	0.071	0.014 U	0.26
FLUORENE	2600	33000	160	160	0.022 U	0.024 U	0.022 U	0.023 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.013 U	0.03 J	0.013 U	0.2
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.026 U	0.024 U	0.025 U
PHENANTHRENE	2200	36000	250	250	0.019 U	0.021 U	0.019 U	0.07
PYRENE	2400	45000	880	880	0.013 U	0.07	0.013 U	0.31

Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION					O-25 NTC56-O-25 NTC56SSDSO250624	O-26 NTC56-O-26 NTC56SSDSO260006	O-26 NTC56-O-26 NTC56SSDSO260006-	O-26 NTC56-O-26 NTC56SSDSO260624
LOCATION	FDEP	FDEP	FDEP	Minimum	20120612	20120710	20120710	20120710
SAMPLE ID	Residential	Industrial	Soil to GW		NORMAL	ORIG	DUP	NORMAL
SAMPLE DATE					SO	SO	SO	SO
SAMPLE CODE					0.5	0	0	0.5
MATRIX					2	0.5	0.5	2
TOP DEPTH (FEET)					544569.3116	544569.3116	544569.3116	544569.3116
BOTTOM DEPTH (FEET)					1535764.22	1535749.22	1535749.22	1535749.22
EASTING								
NORTHING								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.021 U	0.021 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.021 U	0.021 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.022 U	0.022 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.02 U	0.13	0.12	0.02 U
ANTHRACENE	21000	300000	2500	2500	0.015 U	0.029 J	0.03 J	0.014 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.0	0.4	0.4	0.0
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.016 J	0.12	0.11	0.01 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.021 J	0.28	0.26	0.0076 U
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.05	0.48	0.46	0.013 J
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.023 J	0.31	0.28	0.012 U
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.015 J	0.13	0.11	0.012 U
CHRYSENE	NC	NC	77	77	0.022 J	0.23	0.23	0.012 U
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.014 U	0.078	0.071	0.013 U
FLUORANTHENE	3200	59000	1200	1200	0.019 J	0.14	0.13	0.013 U
FLUORENE	2600	33000	160	160	0.022 U	0.021 U	0.021 U	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.016 J	0.23	0.21	0.012 U
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.023 U	0.023 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.019 U	0.036	0.035	0.019 U
PYRENE	2400	45000	880	880	0.024 J	0.18	0.17	0.012 U

Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION					O-27 NTC56-O-27 NTC56SSDSO270006	P-24 NTC56-P-24 NTC56SSDSP240006	P-25 NTC56-P-25 NTC56SSDSP250006	P-25 NTC56-P-25 NTC56SSDSP250624
LOCATION	FDEP	FDEP	FDEP	Minimum				
SAMPLE ID								
SAMPLE DATE	Residential	Industrial	Soil to GW		20120713	20120507	20120507	20120507
SAMPLE CODE					NORMAL	NORMAL	NORMAL	NORMAL
MATRIX					SO	SO	SO	SO
TOP DEPTH (FEET)					0	0	0	0.5
BOTTOM DEPTH (FEET)					0.5	0.5	0.5	2
EASTING					544569.3116	544584.3116	544584.3116	544584.3116
NORTHING					1535734.22	1535779.22	1535764.22	1535764.22
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.0052 U	0.021 U	0.021 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.0039 U	0.021 U	0.021 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.0052 U	0.022 U	0.022 U	0.024 U
ACENAPHTHYLENE	1800	20000	27	27	0.018 J	0.034	0.099	0.02 U
ANTHRACENE	21000	300000	2500	2500	0.0064 J	0.014 U	0.03 J	0.015 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.1	0.2	0.4	0.0
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.021 J	0.097	0.11	0.015 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.035 J	0.14	0.25	0.016 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.062	0.26	0.54	0.036
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.04	0.14	0.19	0.013 U
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.018 J	0.08	0.15	0.013 U
CHRYSENE	NC	NC	77	77	0.042	0.17	0.28	0.018 J
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.0094 J	0.029 J	0.04	0.014 U
FLUORANTHENE	3200	59000	1200	1200	0.056	0.2	0.27	0.02 J
FLUORENE	2600	33000	160	160	0.0044 U	0.021 U	0.021 U	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.029 J	0.11	0.15	0.013 U
NAPHTHALENE	55	300	1.2	1.2	0.0047 U	0.023 U	0.023 U	0.025 U
PHENANTHRENE	2200	36000	250	250	0.024 J	0.051	0.083	0.019 U
PYRENE	2400	45000	880	880	0.06	0.19	0.28	0.02 J

Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION					P-26 NTC56-P-26 NTC56SSDSP260006 20120612 NORMAL SO 0 0.5 544584.3116 1535749.22	P-26 NTC56-P-26 NTC56SSDSP260624 20120612 NORMAL SO 0.5 2 544584.3116 1535749.22	Q-25 NTC56-Q-25 NTC56SSDSQ250006 20120508 NORMAL SO 0 0.5 544599.3116 1535764.22	Q-25 NTC56-Q-25 NTC56SSDSQ250624 20120508 NORMAL SO 0.5 2 544599.3116 1535764.22
LOCATION	FDEP	FDEP	FDEP	Minimum				
SAMPLE ID	Residential	Industrial	Soil to GW					
SAMPLE DATE								
SAMPLE CODE								
MATRIX								
TOP DEPTH (FEET)								
BOTTOM DEPTH (FEET)								
EASTING								
NORTHING								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.022 U	0.021 U	0.026 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.022 U	0.021 U	0.026 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.023 U	0.022 U	0.028 U
ACENAPHTHYLENE	1800	20000	27	27	0.043	0.02 U	0.079	0.024 U
ANTHRACENE	21000	300000	2500	2500	0.015 U	0.015 U	0.017 J	0.018 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.1	0.0	0.3	0.0
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.044	0.017 J	0.072	0.013 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.098	0.016 J	0.19	0.0093 U
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.21	0.033 J	0.41	0.017 J
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.063	0.015 J	0.24	0.015 U
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.059	0.013 U	0.087	0.015 U
CHRYSENE	NC	NC	77	77	0.11	0.016 J	0.23	0.015 U
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.015 J	0.014 U	0.046	0.016 U
FLUORANTHENE	3200	59000	1200	1200	0.1	0.014 J	0.2	0.016 U
FLUORENE	2600	33000	160	160	0.022 U	0.022 U	0.021 U	0.026 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.054	0.013 U	0.18	0.015 U
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.024 U	0.023 U	0.029 U
PHENANTHRENE	2200	36000	250	250	0.029 J	0.019 U	0.057	0.023 U
PYRENE	2400	45000	880	880	0.11	0.019 J	0.22	0.015 U

Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION					Q-26 NTC56-Q-26 NTC56SSDS80006010	Q-26 NTC56-Q-26 NTC56SSDS80624010	R-25 NTC56-R-25 NTC56SSDS13000601	R-25 NTC56-R-25 NTC56SSDS13062401
LOCATION	FDEP	FDEP	FDEP	Minimum				
SAMPLE ID								
SAMPLE DATE	Residential	Industrial	Soil to GW		20120104	20120104	20120105	20120105
SAMPLE CODE					NORMAL	NORMAL	NORMAL	NORMAL
MATRIX					SO	SO	SO	SO
TOP DEPTH (FEET)					0	0.5	0	0.5
BOTTOM DEPTH (FEET)					0.5	2	0.5	2
EASTING					544599.3116	544599.3116	544614.3116	544614.3116
NORTHING					1535749.22	1535749.22	1535764.22	1535764.22
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.021 U	0.021 U	0.021 U	0.021 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.021 U	0.021 U	0.021 U	0.021 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.022 U	0.022 U	0.022 U	0.022 U
ACENAPHTHYLENE	1800	20000	27	27	0.019 J	0.019 U	0.097	0.019 U
ANTHRACENE	21000	300000	2500	2500	0.014 U	0.014 U	0.02 J	0.014 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.1	0.0	0.3	0.0
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.031 J	0.014 J	0.094	0.018 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.058	0.012 J	0.22	0.03 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.12	0.03 J	0.44	0.063
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.08	0.02 J	0.23	0.029 J
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.034	0.012 U	0.13	0.018 J
CHRYSENE	NC	NC	77	77	0.055	0.013 J	0.24	0.029 J
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.012 J	0.011 U	0.042	0.011 U
FLUORANTHENE	3200	59000	1200	1200	0.06	0.015 J	0.23	0.026 J
FLUORENE	2600	33000	160	160	0.021 U	0.021 U	0.021 U	0.021 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.053	0.014 J	0.17	0.022 J
NAPHTHALENE	55	300	1.2	1.2	0.023 U	0.023 U	0.023 U	0.023 U
PHENANTHRENE	2200	36000	250	250	0.018 U	0.018 U	0.058	0.018 U
PYRENE	2400	45000	880	880	0.057	0.015 J	0.24	0.028 J

Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION					R-26 NTC56-R-26 NTC56SSDS60006010	R-26 NTC56-R-26 NTC56SSDS60624010	R-27 NTC56-R-27 NTC56SSDS16000601	R-27 NTC56-R-27 NTC56SSDS16062401
LOCATION	FDEP	FDEP	FDEP	Minimum				
SAMPLE ID								
SAMPLE DATE	Residential	Industrial	Soil to GW		20120104	20120104	20120105	20120105
SAMPLE CODE					NORMAL	NORMAL	NORMAL	NORMAL
MATRIX					SO	SO	SO	SO
TOP DEPTH (FEET)					0	0.5	0	0.5
BOTTOM DEPTH (FEET)					0.5	2	0.5	2
EASTING					544614.3116	544614.3116	544614.3116	544614.3116
NORTHING					1535749.22	1535749.22	1535734.22	1535734.22
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.021 U	0.022 U	0.021 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.021 U	0.022 U	0.021 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.022 U	0.023 U	0.022 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.087	0.025 J	0.044	0.019 U
ANTHRACENE	21000	300000	2500	2500	0.019 J	0.014 U	0.014 U	0.014 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.3	0.1	0.1	0.0
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.084	0.027 J	0.055	0.018 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.2	0.05	0.11	0.018 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.41	0.1	0.21	0.039
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.18	0.046	0.085	0.015 J
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.1	0.038	0.08	0.012 U
CHRYSENE	NC	NC	77	77	0.2	0.052	0.12	0.019 J
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.036	0.011 U	0.011 U	0.011 U
FLUORANTHENE	3200	59000	1200	1200	0.18	0.044	0.13	0.013 U
FLUORENE	2600	33000	160	160	0.021 U	0.022 U	0.021 U	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.14	0.035	0.067	0.012 J
NAPHTHALENE	55	300	1.2	1.2	0.023 U	0.024 U	0.023 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.046	0.018 U	0.039	0.018 U
PYRENE	2400	45000	880	880	0.2	0.05	0.14	0.024 J

Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION					S-24 NTC56-S-24 NTC56SSDS11000601	S-24 NTC56-S-24 NTC56SSDS11062401	S-25 NTC56-S-25 NTC56SSDS30006010	S-25 NTC56-S-25 NTC56SSDS30006010
LOCATION	FDEP	FDEP	FDEP	Minimum				
SAMPLE ID	Residential	Industrial	Soil to GW					
SAMPLE DATE					20120104	20120104	20120104	20120104
SAMPLE CODE					NORMAL	NORMAL	ORIG	DUP
MATRIX					SO	SO	SO	SO
TOP DEPTH (FEET)					0	0.5	0	0
BOTTOM DEPTH (FEET)					0.5	2	0.5	0.5
EASTING					544629.3116	544629.3116	544629.3116	544629.3116
NORTHING					1535779.22	1535779.22	1535764.22	1535764.22
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.021 U	0.021 U	0.021 U	0.021 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.021 U	0.021 U	0.021 U	0.021 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.022 U	0.022 U	0.022 U	0.022 U
ACENAPHTHYLENE	1800	20000	27	27	0.45	0.035	0.16 J	0.33 J
ANTHRACENE	21000	300000	2500	2500	0.088	0.014 U	0.034 J	0.069 J
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	1.4	0.1	0.5	1.2
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.38	0.029 J	0.13 J	0.44 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.94	0.059	0.31 J	0.81 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	1.9	0.12	0.74 J	1.4 J
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.93	0.07	0.35	0.57
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.62	0.035	0.19 J	0.41 J
CHRYSENE	NC	NC	77	77	0.96	0.064	0.36 J	0.85 J
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.18	0.013 J	0.065 J	0.12 J
FLUORANTHENE	3200	59000	1200	1200	0.74	0.052	0.33 J	0.68 J
FLUORENE	2600	33000	160	160	0.035	0.021 U	0.021 U	0.026 J
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.7	0.05	0.26 J	0.49 J
NAPHTHALENE	55	300	1.2	1.2	0.023 U	0.023 U	0.023 U	0.023 U
PHENANTHRENE	2200	36000	250	250	0.16	0.018 U	0.077	0.099
PYRENE	2400	45000	880	880	0.85	0.058	0.35 J	0.89 J

Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION					S-25 NTC56-S-25 NTC56SSDS30624010	S-26 NTC56-S-26 NTC56SSDS21201042	S-26 NTC56-S-26 NTC56SSDS22401042	S-27 NTC56-S-27 NTC56SSDS50006010
LOCATION	FDEP	FDEP	FDEP	Minimum				
SAMPLE ID								
SAMPLE DATE	Residential	Industrial	Soil to GW		20120104	20120104	20120104	20120104
SAMPLE CODE					NORMAL	NORMAL	NORMAL	NORMAL
MATRIX					SO	SO	SO	SO
TOP DEPTH (FEET)					0.5	1	2	0
BOTTOM DEPTH (FEET)					2	1	2	0.5
EASTING					544629.3116	544629.3116	544629.3116	544629.3116
NORTHING					1535764.22	1535749.22	1535749.22	1535734.22
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.021 U	0.021 U	0.021 U	0.021 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.021 U	0.021 U	0.021 U	0.021 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.022 U	0.022 U	0.022 U	0.022 U
ACENAPHTHYLENE	1800	20000	27	27	0.034	0.088	0.019 U	0.019 U
ANTHRACENE	21000	300000	2500	2500	0.014 U	0.018 J	0.014 U	0.014 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.1	0.3	0.0	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.035	0.087	0.012 J	0.037
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.063	0.21	0.0069 U	0.057
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.15	0.43	0.015 J	0.12
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.065	0.21	0.012 U	0.044
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.04	0.11	0.012 U	0.033 J
CHRYSENE	NC	NC	77	77	0.081	0.2	0.011 U	0.07
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.013 J	0.042	0.011 U	0.012 J
FLUORANTHENE	3200	59000	1200	1200	0.067	0.15	0.013 U	0.1
FLUORENE	2600	33000	160	160	0.021 U	0.021 U	0.021 U	0.021 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.05	0.16	0.012 U	0.04
NAPHTHALENE	55	300	1.2	1.2	0.023 U	0.023 U	0.024 U	0.023 U
PHENANTHRENE	2200	36000	250	250	0.018 J	0.036	0.018 U	0.028 J
PYRENE	2400	45000	880	880	0.073	0.17	0.012 U	0.091

Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION					S-27 NTC56-S-27 NTC56SSDS50624010	S-28 NTC56-S-28 NTC56SSDS12062401	T-24 NTC56-T-24 NTC56SSDST240624	T-25 NTC56-T-25 NTC56SSDS14000601
LOCATION	FDEP	FDEP	FDEP	Minimum				
SAMPLE ID								
SAMPLE DATE	Residential	Industrial	Soil to GW		20120104	20120104	20120508	20120105
SAMPLE CODE					NORMAL	NORMAL	NORMAL	NORMAL
MATRIX					SO	SO	SO	SO
TOP DEPTH (FEET)					0.5	0.5	0.5	0
BOTTOM DEPTH (FEET)					2	2	2	0.5
EASTING					544629.3116	544629.3116	544644.3116	544644.3116
NORTHING					1535734.22	1535719.22	1535779.22	1535764.22
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.021 U	0.022 U	0.022 U	0.021 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.021 U	0.022 U	0.022 U	0.021 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.022 U	0.023 U	0.023 U	0.022 U
ACENAPHTHYLENE	1800	20000	27	27	0.019 U	0.019 U	0.019 U	0.21
ANTHRACENE	21000	300000	2500	2500	0.014 U	0.014 U	0.014 U	0.043
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.0	0.0	0.0	0.7
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.0098 J	0.011 J	0.014 J	0.18
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.0068 U	0.0069 U	0.0079 J	0.45
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.012 U	0.012 U	0.017 J	1
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.012 U	0.012 U	0.012 U	0.48
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.012 U	0.012 U	0.012 U	0.27
CHRYSENE	NC	NC	77	77	0.011 U	0.011 U	0.013 J	0.47
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.011 U	0.011 U	0.013 U	0.091
FLUORANTHENE	3200	59000	1200	1200	0.013 U	0.013 U	0.018 J	0.39
FLUORENE	2600	33000	160	160	0.021 U	0.022 U	0.022 U	0.021 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.012 U	0.012 U	0.012 U	0.36
NAPHTHALENE	55	300	1.2	1.2	0.023 U	0.024 U	0.024 U	0.023 U
PHENANTHRENE	2200	36000	250	250	0.018 U	0.018 U	0.018 U	0.086
PYRENE	2400	45000	880	880	0.012 U	0.012 U	0.021 J	0.42

Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION					T-25 NTC56-T-25 NTC56SSDS14062401	T-26 NTC56-T-26 NTC56SSDS40006010	T-26 NTC56-T-26 NTC56SSDS40624010	T-27 NTC56-T-27 NTC56SSDS15000601
LOCATION	FDEP	FDEP	FDEP	Minimum	20120105	20120104	20120104	20120105
SAMPLE ID	Residential	Industrial	Soil to GW		NORMAL	NORMAL	NORMAL	NORMAL
SAMPLE DATE					SO	SO	SO	SO
SAMPLE CODE					0.5	0	0.5	0
MATRIX					2	0.5	2	0.5
TOP DEPTH (FEET)					544644.3116	544644.3116	544644.3116	544644.3116
BOTTOM DEPTH (FEET)					1535764.22	1535749.22	1535749.22	1535734.22
EASTING								
NORTHING								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.021 U	0.021 U	0.021 U	0.021 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.021 U	0.021 U	0.021 U	0.021 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.022 U	0.022 U	0.022 U	0.022 U
ACENAPHTHYLENE	1800	20000	27	27	0.051	0.13	0.059	0.047
ANTHRACENE	21000	300000	2500	2500	0.014 U	0.026 J	0.014 U	0.014 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.2	0.5	0.2	0.2
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.05	0.15	0.065	0.058
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.11	0.33	0.14	0.12
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.22	0.64	0.26	0.24
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.12	0.28	0.13	0.11
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.062	0.16	0.096	0.074
CHRYSENE	NC	NC	77	77	0.1	0.31	0.12	0.13
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.023 J	0.058	0.027 J	0.011 U
FLUORANTHENE	3200	59000	1200	1200	0.071	0.26	0.08	0.14
FLUORENE	2600	33000	160	160	0.021 U	0.021 U	0.021 U	0.021 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.086	0.22	0.098	0.087
NAPHTHALENE	55	300	1.2	1.2	0.023 U	0.023 U	0.023 U	0.023 U
PHENANTHRENE	2200	36000	250	250	0.018 U	0.052	0.019 J	0.038
PYRENE	2400	45000	880	880	0.08	0.29	0.096	0.14

Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION					T-27 NTC56-T-27 NTC56SSDS15062401	T-28 NTC56-T-28 NTC56SSDST280006	U-25 NTC56-U-25 NTC56SSDSU250624	U-26 NTC56-U-26 NTC56SSDS70006010
LOCATION	FDEP	FDEP	FDEP	Minimum				
SAMPLE ID								
SAMPLE DATE	Residential	Industrial	Soil to GW		20120105	20120508	20120508	20120104
SAMPLE CODE					NORMAL	NORMAL	NORMAL	NORMAL
MATRIX					SO	SO	SO	SO
TOP DEPTH (FEET)					0.5	0	0.5	0
BOTTOM DEPTH (FEET)					2	0.5	2	0.5
EASTING					544644.3116	544644.3116	544659.3116	544659.3116
NORTHING					1535734.22	1535719.22	1535764.22	1535749.22
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.021 U	0.021 U	0.022 U	0.021 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.021 U	0.021 U	0.022 U	0.021 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.022 U	0.022 U	0.023 U	0.022 U
ACENAPHTHYLENE	1800	20000	27	27	0.019 U	0.019 U	0.02 U	0.072
ANTHRACENE	21000	300000	2500	2500	0.014 U	0.014 U	0.015 U	0.015 J
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.0	0.1	0.0	0.3
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.014 J	0.032 J	0.018 J	0.07
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.0095 J	0.047	0.018 J	0.17
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.021 J	0.095	0.042	0.35
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.012 U	0.049	0.024 J	0.2
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.012 U	0.029 J	0.013 U	0.11
CHRYSENE	NC	NC	77	77	0.011 U	0.066	0.021 J	0.18
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.011 U	0.013 U	0.014 U	0.034
FLUORANTHENE	3200	59000	1200	1200	0.013 U	0.082	0.018 J	0.17
FLUORENE	2600	33000	160	160	0.021 U	0.021 U	0.022 U	0.021 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.012 U	0.041	0.018 J	0.14
NAPHTHALENE	55	300	1.2	1.2	0.023 U	0.023 U	0.024 U	0.023 U
PHENANTHRENE	2200	36000	250	250	0.018 U	0.034	0.019 U	0.042
PYRENE	2400	45000	880	880	0.012 J	0.084	0.023 J	0.18

Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION					U-26 NTC56-U-26 NTC56SSDS70624010	U-27 NTC56-U-27 NTC56SSDSU270006	U-27 NTC56-U-27 NTC56SSDSU270624	V-24 NTC56-V-24 NTC56SSDSV240006
LOCATION	FDEP	FDEP	FDEP	Minimum				
SAMPLE ID								
SAMPLE DATE	Residential	Industrial	Soil to GW		20120104	20120508	20120508	20120508
SAMPLE CODE					NORMAL	NORMAL	NORMAL	NORMAL
MATRIX					SO	SO	SO	SO
TOP DEPTH (FEET)					0.5	0	0.5	0
BOTTOM DEPTH (FEET)					2	0.5	2	0.5
EASTING					544659.3116	544659.3116	544659.3116	544674.3116
NORTHING					1535749.22	1535734.22	1535734.22	1535779.22
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.021 U	0.021 U	0.021 U	0.021 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.021 U	0.021 U	0.021 U	0.021 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.022 U	0.022 U	0.022 U	0.022 U
ACENAPHTHYLENE	1800	20000	27	27	0.024 J	0.019 U	0.019 U	0.13
ANTHRACENE	21000	300000	2500	2500	0.014 U	0.014 U	0.014 U	0.026 J
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.1	0.0	0.0	0.4
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.032 J	0.022 J	0.015 J	0.16
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.063	0.028 J	0.013 J	0.24
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.12	0.06	0.025 J	0.42
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.064	0.03 J	0.017 J	0.22
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.036	0.017 J	0.012 U	0.12
CHRYSENE	NC	NC	77	77	0.057	0.041	0.013 J	0.33
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.012 J	0.013 U	0.013 U	0.043
FLUORANTHENE	3200	59000	1200	1200	0.04	0.054	0.018 J	0.41
FLUORENE	2600	33000	160	160	0.021 U	0.021 U	0.021 U	0.021 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.047	0.025 J	0.012 J	0.18
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.023 U	0.023 U	0.023 U
PHENANTHRENE	2200	36000	250	250	0.018 U	0.02 J	0.018 U	0.17
PYRENE	2400	45000	880	880	0.046	0.054	0.019 J	0.49

Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION	FDEP	FDEP	FDEP	Minimum	V-24 NTC56-V-24 NTC56SSDSV240624 20120508 NORMAL SO 0.5 2 544674.3116 1535779.22	V-25 NTC56-V-25 NTC56SSDSV250006 20120508 ORIG SO 0 0.5 544674.3116 1535764.22	V-25 NTC56-V-25 NTC56SSDSV250006- 20120508 DUP SO 0 0.5 544674.3116 1535764.22	V-25 NTC56-V-25 NTC56SSDSV250624 20120508 ORIG SO 0.5 2 544674.3116 1535764.22
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.021 U	0.021 U	0.021 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.021 U	0.021 U	0.021 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.022 U	0.022 U	0.022 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.028 J	0.22	0.19	0.051
ANTHRACENE	21000	300000	2500	2500	0.014 U	0.045	0.047	0.014 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.1	0.8	0.6	0.2
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.032 J	0.23	0.16	0.048
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.048	0.53	0.44	0.12 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.091	1.1	0.97	0.26 J
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.05	0.57 J	0.24 J	0.14 J
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.024 J	0.29	0.22	0.07 J
CHRYSENE	NC	NC	77	77	0.07	0.57	0.43	0.14 J
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.013 U	0.12	0.063	0.028 J
FLUORANTHENE	3200	59000	1200	1200	0.089	0.4	0.3	0.12 J
FLUORENE	2600	33000	160	160	0.021 U	0.021 U	0.021 U	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.041	0.43 J	0.21 J	0.11 J
NAPHTHALENE	55	300	1.2	1.2	0.023 U	0.023 U	0.023 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.041	0.096	0.083	0.032 J
PYRENE	2400	45000	880	880	0.1	0.49	0.36	0.14 J

**Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida**

LOCATION					V-25 NTC56-V-25 NTC56SSDSV250624-	V-26 NTC56-V-26 NTC56SSDS90006010	V-26 NTC56-V-26 NTC56SSDS90624010	V-27 NTC56-V-27 NTC56SSDSV270006
LOCATION	FDEP	FDEP	FDEP	Minimum	20120508	20120104	20120104	20120508
SAMPLE ID	Residential	Industrial	Soil to GW		DUP	NORMAL	NORMAL	NORMAL
SAMPLE DATE					SO	SO	SO	SO
SAMPLE CODE					0.5	0	0.5	0
MATRIX					2	0.5	2	0.5
TOP DEPTH (FEET)					544674.3116	544674.3116	544674.3116	544674.3116
BOTTOM DEPTH (FEET)					1535764.22	1535749.22	1535749.22	1535734.22
EASTING								
NORTHING								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.021 UJ	0.021 UJ	0.021 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.021 UJ	0.021 UJ	0.021 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.022 UJ	0.022 UJ	0.022 U
ACENAPHTHYLENE	1800	20000	27	27	0.02 U	0.083 J	0.019 UJ	0.022 J
ANTHRACENE	21000	300000	2500	2500	0.014 U	0.019 J	0.014 UJ	0.014 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.0	0.3	0.0	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.015 J	0.081 J	0.017 J	0.029 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.012 J	0.2 J	0.018 J	0.054
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.036 J	0.4 J	0.041 J	0.12
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.012 UJ	0.26 J	0.025 J	0.059
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.012 UJ	0.14 J	0.013 J	0.031 J
CHRYSENE	NC	NC	77	77	0.013 J	0.21 J	0.018 J	0.075
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.013 U	0.043 J	0.011 UJ	0.013 U
FLUORANTHENE	3200	59000	1200	1200	0.013 J	0.21 J	0.017 J	0.079
FLUORENE	2600	33000	160	160	0.022 U	0.021 UJ	0.021 UJ	0.021 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.012 UJ	0.18 J	0.018 J	0.047
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.023 UJ	0.023 UJ	0.023 U
PHENANTHRENE	2200	36000	250	250	0.019 U	0.049 J	0.018 UJ	0.028 J
PYRENE	2400	45000	880	880	0.015 J	0.22 J	0.02 J	0.085

Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION					W-24 NTC56-W-24 NTC56SSDSW240006	W-24 NTC56-W-24 NTC56SSDSW240624	W-25 NTC56-W-25 NTC56SSDSW250006	W-25 NTC56-W-25 NTC56SSDSW250624
LOCATION	FDEP	FDEP	FDEP	Minimum	20120508	20120508	20120508	20120508
SAMPLE ID	Residential	Industrial	Soil to GW		NORMAL	NORMAL	NORMAL	NORMAL
SAMPLE DATE					SO	SO	SO	SO
SAMPLE CODE					0	0.5	0	0.5
MATRIX					0.5	2	0.5	2
TOP DEPTH (FEET)					544689.3116	544689.3116	544689.3116	544689.3116
BOTTOM DEPTH (FEET)					1535779.22	1535779.22	1535764.22	1535764.22
EASTING								
NORTHING								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.021 U	0.021 U	0.021 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.021 U	0.021 U	0.021 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.022 U	0.022 U	0.022 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.039	0.019 U	0.41	0.065
ANTHRACENE	21000	300000	2500	2500	0.014 U	0.014 U	0.097	0.016 J
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.1	0.0	1.4	0.2
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.05	0.012 J	0.35	0.059
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.079	0.0075 U	0.94	0.14
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.15	0.013 J	2	0.33
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.066	0.012 U	0.64	0.11
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.043	0.012 U	0.59	0.087
CHRYSENE	NC	NC	77	77	0.11	0.012 U	0.93	0.17
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.013 J	0.013 U	0.16	0.025 J
FLUORANTHENE	3200	59000	1200	1200	0.13	0.014 J	0.6	0.13
FLUORENE	2600	33000	160	160	0.021 U	0.021 U	0.031 J	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.054	0.012 U	0.52	0.089
NAPHTHALENE	55	300	1.2	1.2	0.023 U	0.023 U	0.023 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.061	0.018 U	0.16	0.037
PYRENE	2400	45000	880	880	0.15	0.016 J	0.73	0.15

Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION					W-26 NTC56-W-26 NTC56SSDSW260006	W-26 NTC56-W-26 NTC56SSDSW260624	W-27 NTC56-W-27 NTC56SSDSW270006	W-27 NTC56-W-27 NTC56SSDSW270624
LOCATION	FDEP	FDEP	FDEP	Minimum	20120508	20120508	20120508	20120508
SAMPLE ID	Residential	Industrial	Soil to GW		NORMAL	NORMAL	NORMAL	NORMAL
SAMPLE DATE					SO	SO	SO	SO
SAMPLE CODE					0	0.5	0	0.5
MATRIX					0.5	2	0.5	2
TOP DEPTH (FEET)					544689.3116	544689.3116	544689.3116	544689.3116
BOTTOM DEPTH (FEET)					1535749.22	1535749.22	1535734.22	1535734.22
EASTING								
NORTHING								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.021 U	0.021 U	0.021 U	0.021 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.021 U	0.021 U	0.021 U	0.021 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.022 U	0.022 U	0.022 U	0.022 U
ACENAPHTHYLENE	1800	20000	27	27	0.15	0.019 U	0.028 J	0.019 U
ANTHRACENE	21000	300000	2500	2500	0.031 J	0.014 U	0.014 U	0.014 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.6	0.1	0.1	0.0
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.12	0.02 J	0.034	0.011 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.36	0.037	0.066	0.0075 U
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.72	0.093	0.16	0.014 J
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.39	0.032 J	0.041	0.012 U
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.22	0.028 J	0.047	0.012 U
CHRYSENE	NC	NC	77	77	0.35	0.049	0.094	0.012 U
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.085	0.013 U	0.013 U	0.013 U
FLUORANTHENE	3200	59000	1200	1200	0.25	0.037	0.099	0.013 U
FLUORENE	2600	33000	160	160	0.021 U	0.021 U	0.021 U	0.021 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.3	0.025 J	0.033	0.012 U
NAPHTHALENE	55	300	1.2	1.2	0.023 U	0.023 U	0.023 U	0.023 U
PHENANTHRENE	2200	36000	250	250	0.066	0.018 U	0.038	0.018 U
PYRENE	2400	45000	880	880	0.3	0.043	0.11	0.012 U

Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION					X-25 NTC56-X-25 NTC56SSDSX250006	X-25 NTC56-X-25 NTC56SSDSX250006-	X-25 NTC56-X-25 NTC56SSDSX250624	X-25 NTC56-X-25 NTC56SSDSX250624-
LOCATION	FDEP	FDEP	FDEP	Minimum	20120612	20120612	20120612	20120612
SAMPLE ID	Residential	Industrial	Soil to GW		ORIG	DUP	ORIG	DUP
SAMPLE DATE					SO	SO	SO	SO
SAMPLE CODE					0	0	0.5	0.5
MATRIX					0.5	0.5	2	2
TOP DEPTH (FEET)					544704.3116	544704.3116	544704.3116	544704.3116
BOTTOM DEPTH (FEET)					1535764.22	1535764.22	1535764.22	1535764.22
EASTING								
NORTHING								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.021 U	0.021 U	0.021 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.021 U	0.021 U	0.021 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.022 U	0.022 U	0.022 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.41	0.34	0.019 U	0.052
ANTHRACENE	21000	300000	2500	2500	0.1	0.077	0.014 U	0.015 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	1.0	0.8	0.0	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.25	0.21	0.017 J	0.041
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.64	0.5	0.017 J	0.089 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	1.8	1.5	0.043 J	0.25 J
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.012 UJ	0.4 J	0.016 J	0.07
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.4	0.35	0.013 J	0.074
CHRYSENE	NC	NC	77	77	0.88	0.79	0.021 J	0.16 J
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.097	0.066	0.013 U	0.014 J
FLUORANTHENE	3200	59000	1200	1200	0.72	0.72	0.022 J	0.14 J
FLUORENE	2600	33000	160	160	0.034	0.027 J	0.021 U	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.35	0.24	0.012 J	0.051
NAPHTHALENE	55	300	1.2	1.2	0.023 U	0.023 U	0.023 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.22	0.22	0.018 U	0.054
PYRENE	2400	45000	880	880	0.81	0.8	0.026 J	0.16 J

Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION					X-26 NTC56-X-26 NTC56SSDSX260006	X-26 NTC56-X-26 NTC56SSDSX260624	X-27 NTC56-X-27 NTC56SSDSX270006	X-27 NTC56-X-27 NTC56SSDSX270624
LOCATION	FDEP	FDEP	FDEP	Minimum				
SAMPLE ID								
SAMPLE DATE	Residential	Industrial	Soil to GW		20120612	20120612	20120710	20120710
SAMPLE CODE					NORMAL	NORMAL	NORMAL	NORMAL
MATRIX					SO	SO	SO	SO
TOP DEPTH (FEET)					0	0.5	0	0.5
BOTTOM DEPTH (FEET)					0.5	2	0.5	2
EASTING					544704.3116	544704.3116	544704.3116	544704.3116
NORTHING					1535749.22	1535749.22	1535734.22	1535734.22
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.023 U	0.023 U	0.021 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.023 U	0.023 U	0.021 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.024 U	0.024 U	0.022 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.08	0.02 U	0.043	0.019 U
ANTHRACENE	21000	300000	2500	2500	0.02 J	0.015 U	0.014 U	0.014 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.3	0.0	0.2	0.0
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.073	0.016 J	0.044	0.013 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.19	0.012 J	0.093	0.0093 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.41	0.033 J	0.2	0.016 J
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.19	0.018 J	0.11	0.012 U
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.095	0.013 J	0.053	0.012 U
CHRYSENE	NC	NC	77	77	0.23	0.018 J	0.12	0.012 U
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.04	0.014 U	0.027 J	0.013 U
FLUORANTHENE	3200	59000	1200	1200	0.21	0.019 J	0.13	0.013 U
FLUORENE	2600	33000	160	160	0.023 U	0.023 U	0.021 U	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.15	0.013 J	0.083	0.012 U
NAPHTHALENE	55	300	1.2	1.2	0.025 U	0.025 U	0.023 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.059	0.019 U	0.044	0.018 U
PYRENE	2400	45000	880	880	0.23	0.023 J	0.14	0.014 J

Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION	FDEP	FDEP	FDEP	Minimum	Y-25 NTC56-Y-25 NTC56SSDSY250006 20120612 NORMAL SO 0 0.5 544719.3116 1535764.22	Y-25 NTC56-Y-25 NTC56SSDSY250624 20120612 NORMAL SO 0.5 2 544719.3116 1535764.22	Y-26 NTC56-Y-26 NTC56SSDSY260006 20120612 NORMAL SO 0 0.5 544719.3116 1535749.22	Y-26 NTC56-Y-26 NTC56SSDSY260624 20120612 NORMAL SO 0.5 2 544719.3116 1535749.22
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.022 U	0.03 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.022 U	0.03 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.023 U	0.032 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.36	0.05	0.075	0.12
ANTHRACENE	21000	300000	2500	2500	0.089	0.015 U	0.02 U	0.024 J
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.9	0.1	0.3	0.3
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.25	0.037	0.078	0.086
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.59	0.083	0.18	0.22
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	1.3	0.19	0.38	0.46
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.7	0.11	0.17	0.21
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.44	0.058	0.12	0.14
CHRYSENE	NC	NC	77	77	0.82	0.12	0.24	0.29
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.13	0.017 J	0.031 J	0.04
FLUORANTHENE	3200	59000	1200	1200	0.64	0.097	0.22	0.23
FLUORENE	2600	33000	160	160	0.029 J	0.022 U	0.03 U	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.47	0.075	0.14	0.16
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.024 U	0.033 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.19	0.027 J	0.062	0.081
PYRENE	2400	45000	880	880	0.74	0.11	0.24	0.27

**Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida**

LOCATION	FDEP	FDEP	FDEP	Minimum	Y-26 NTC56-Y-26 NTC56SSDSY262436 20120801 NORMAL SO 2 3 544719.3116 1535749.22	Y-27 NTC56-Y-27 NTC56SSDSY270006 20120710 NORMAL SO 0 0.5 544719.3116 1535734.22	Y-27 NTC56-Y-27 NTC56SSDSY270624 20120710 NORMAL SO 0.5 2 544719.3116 1535734.22	Y-28 NTC56-Y-28 NTC56SSDSY280006 20120713 NORMAL SO 0 0.5 544719.3116 1535719.22
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.027 U	0.021 U	0.022 U	0.0052 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.027 U	0.021 U	0.022 U	0.0039 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.028 U	0.022 U	0.023 U	0.0052 U
ACENAPHTHYLENE	1800	20000	27	27	0.032 J	0.019 J	0.02 U	0.02 J
ANTHRACENE	21000	300000	2500	2500	0.018 U	0.014 U	0.014 U	0.0078 J
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.1	0.1	0.0	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.035 J	0.03 J	0.013 J	0.025 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.056	0.047	0.0077 U	0.038 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.13	0.099	0.013 U	0.08
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.036 J	0.05	0.012 U	0.03 J
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.032 J	0.028 J	0.012 U	0.02 J
CHRYSENE	NC	NC	77	77	0.081	0.065	0.012 U	0.047
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.017 U	0.014 J	0.013 U	0.0068 J
FLUORANTHENE	3200	59000	1200	1200	0.088	0.083	0.013 U	0.072
FLUORENE	2600	33000	160	160	0.027 U	0.021 U	0.022 U	0.0044 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.032 J	0.042	0.012 U	0.024 J
NAPHTHALENE	55	300	1.2	1.2	0.03 U	0.023 U	0.024 U	0.0047 U
PHENANTHRENE	2200	36000	250	250	0.034 J	0.032 J	0.019 U	0.03 J
PYRENE	2400	45000	880	880	0.098	0.088	0.013 J	0.076

**Table 1
PAH Concentrations in SA 56 (Dog Run Portion)
Building 148/SA 56
Former NTC Orlando, Florida**

LOCATION					Z-27 NTC56-Z-27 NTC56SSDSZ270006	Z-27 NTC56-Z-27 NTC56SSDSZ270624
LOCATION						
SAMPLE ID						
SAMPLE DATE	FDEP	FDEP	FDEP	Minimum	20120710	20120710
SAMPLE CODE	Residential	Industrial	Soil to GW		NORMAL	NORMAL
MATRIX					SO	SO
TOP DEPTH (FEET)					0	0.5
BOTTOM DEPTH (FEET)					0.5	2
EASTING					544734.3116	544734.3116
NORTHING					1535734.22	1535734.22
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)						
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.021 U	0.021 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.021 U	0.021 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.022 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.019 U	0.019 U
ANTHRACENE	21000	300000	2500	2500	0.014 U	0.014 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.0	0.0
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.021 J	0.012 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.022 J	0.0076 U
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.047	0.013 U
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.023 J	0.012 U
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.015 J	0.012 U
CHRYSENE	NC	NC	77	77	0.031 J	0.012 U
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.013 U	0.013 U
FLUORANTHENE	3200	59000	1200	1200	0.041	0.013 U
FLUORENE	2600	33000	160	160	0.021 U	0.021 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.02 J	0.012 U
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.018 J	0.018 U
PYRENE	2400	45000	880	880	0.044	0.012 U

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	A-18 NTC56SSPSA180006 20120710 NORMAL SO 0 0.5 544169.2326 1535783.202	A-18 NTC56SSPSA180624 20120710 NORMAL SO 0.5 2 544169.2326 1535783.202	A-19 NTC56SSPSA190006 20120801 NORMAL SO 0 0.5 544169.2326 1535768.22	A-19 NTC56SSPSA190624 20120801 NORMAL SO 0.5 2 544169.2326 1535768.22
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.023 U	0.022 U	0.027 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.023 U	0.022 U	0.027 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.024 U	0.023 U	0.028 U
ACENAPHTHYLENE	1800	20000	27	27	0.1	0.35	0.02 U	0.024 U
ANTHRACENE	21000	300000	2500	2500	0.028 J	0.11	0.015 U	0.018 U
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.3	0.8	0.1	0.0 U
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.099	0.25	0.032 J	0.012 U
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.17	0.48	0.039	0.0094 U
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.33	0.97	0.068	0.017 U
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.18	0.5	0.037	0.015 U
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.088	0.26	0.022 J	0.015 U
CHRYSENE	NC	NC	77	77	0.24	0.76	0.042	0.015 U
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.04	0.12	0.014 U	0.017 U
FLUORANTHENE	3200	59000	1200	1200	0.29	0.83	0.063	0.017 U
FLUORENE	2600	33000	160	160	0.022 U	0.035 J	0.022 U	0.027 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.14	0.41	0.03 J	0.015 U
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.025 U	0.024 U	0.029 U
PHENANTHRENE	2200	36000	250	250	0.11	0.36	0.021 J	0.023 U
PYRENE	2400	45000	880	880	0.32	0.96	0.062	0.015 U

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	AA-15 NTC56SSPSAA150006 20120802 NORMAL SO 0 0.5 543989.2326 1535825.772	AA-15 NTC56SSPSAA150624 20120802 NORMAL SO 0.5 2 543989.2326 1535825.772	AA-17 NTC56SSPSAA170006 20120829 NORMAL SO 0 0.5 543989.2326 1535795.772	AA-17 NTC56SSPSAA170624 20120829 NORMAL SO 0.5 2 543989.2326 1535795.772
SAMPLE DATE	Residential	Industrial	Soil to GW					
SAMPLE CODE								
MATRIX								
TOP DEPTH (FEET)								
BOTTOM DEPTH (FEET)								
EASTING								
NORTHING								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.022 U	0.11	0.023 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.022 U	0.14	0.023 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.024 U	0.023 U	1	0.024 U
ACENAPHTHYLENE	1800	20000	27	27	0.29	0.49	0.26	0.021 U
ANTHRACENE	21000	300000	2500	2500	0.1	0.12	1.8	0.015 U
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	1.0	1.1	5.3	0.0
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.53	0.51	4	0.011 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.71	0.74	3.7	0.0081 U
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	1.2	1.2	5.8	0.014 U
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.32	0.46	1.4	0.013 U
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.38	0.38	1.6	0.013 U
CHRYSENE	NC	NC	77	77	0.81	1.1	4.1	0.013 U
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.093	0.12	0.43	0.014 U
FLUORANTHENE	3200	59000	1200	1200	1	1.2	10	0.014 U
FLUORENE	2600	33000	160	160	0.034 J	0.058	0.89	0.023 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.31	0.44	1.5	0.013 U
NAPHTHALENE	55	300	1.2	1.2	0.025 U	0.024 U	0.29	0.025 U
PHENANTHRENE	2200	36000	250	250	0.39	0.77	8.7	0.02 U
PYRENE	2400	45000	880	880	1.1	1.5	8	0.014 J

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	AA-19 NTC56SSPSAA190006	AA-19 NTC56SSPSAA190624	AB-15 NTC56SSPSAB150006	AB-15 NTC56SSPSAB150624
SAMPLE DATE	FDEP	FDEP	FDEP		20120829	20120829	20120802	20120802
SAMPLE CODE	Residential	Industrial	Soil to GW		NORMAL	NORMAL	NORMAL	NORMAL
MATRIX					SO	SO	SO	SO
TOP DEPTH (FEET)					0	0.5	0	0.5
BOTTOM DEPTH (FEET)					0.5	2	0.5	2
EASTING					543989.2326	543989.2326	544004.2326	544004.2326
NORTHING					1535765.772	1535765.772	1535825.772	1535825.772
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.024 U	0.023 U	0.022 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.024 U	0.023 U	0.022 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.025 U	0.024 U	0.043	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.083	0.079	0.22	0.68
ANTHRACENE	21000	300000	2500	2500	0.021 J	0.021 J	0.093	0.15
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.2	0.2	0.9	1.5
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.078	0.069	0.5	0.57
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.12	0.11	0.64	1
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.22	0.21	0.95	1.4
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.064	0.075	0.41	0.73
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.069	0.058	0.33	0.45
CHRYSENE	NC	NC	77	77	0.17	0.16	0.77	1.1
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.018 J	0.017 J	0.11	0.2
FLUORANTHENE	3200	59000	1200	1200	0.21	0.2	1.1	1
FLUORENE	2600	33000	160	160	0.024 U	0.023 U	0.051	0.055
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.063	0.065	0.38	0.6
NAPHTHALENE	55	300	1.2	1.2	0.026 U	0.026 U	0.025 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.1	0.092	0.6	0.51
PYRENE	2400	45000	880	880	0.24	0.23	1.1	1.3

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	AF-15 NTC56SSPSAF150006 20120802 NORMAL SO 0 0.5 544064.3595 1535827.833	AF-15 NTC56SSPSAF150624 20120802 NORMAL SO 0.5 2 544064.3595 1535827.833	AF-17 NTC56SSPSAF170006 20120829 NORMAL SO 0 0.5 544064.3595 1535797.833	AF-17 NTC56SSPSAF170624 20120829 NORMAL SO 0.5 2 544064.3595 1535797.833
SAMPLE DATE	Residential	Industrial	Soil to GW					
SAMPLE CODE								
MATRIX								
TOP DEPTH (FEET)								
BOTTOM DEPTH (FEET)								
EASTING								
NORTHING								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.023 U	0.024 U	0.023 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.023 U	0.024 U	0.023 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.024 U	0.026 U	0.024 U
ACENAPHTHYLENE	1800	20000	27	27	0.21	0.29	0.15	0.053
ANTHRACENE	21000	300000	2500	2500	0.067	0.057	0.081	0.015 J
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.8	0.7	0.7	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.45	0.3	0.45	0.051
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.58	0.5	0.48	0.071
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	1.1	0.71	0.83	0.15
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.27	0.27	0.21	0.038
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.32	0.24	0.27	0.031 J
CHRYSENE	NC	NC	77	77	0.73	0.54	0.62	0.11
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.078	0.086	0.054	0.014 U
FLUORANTHENE	3200	59000	1200	1200	0.96	0.57	0.9	0.16
FLUORENE	2600	33000	160	160	0.029 J	0.031 J	0.028 J	0.023 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.27	0.25	0.2	0.037
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.025 U	0.027 U	0.025 U
PHENANTHRENE	2200	36000	250	250	0.35	0.29	0.37	0.071
PYRENE	2400	45000	880	880	0.96	0.69	0.88	0.17

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	AF-19 NTC56SSPSAF190006 20120829 NORMAL SO 0 0.5 544064.3595 1535767.833	AF-19 NTC56SSPSAF190624 20120829 NORMAL SO 0.5 2 544064.3595 1535767.833	AG-15 NTC56SSPSAG150006 20120802 ORIG SO 0 0.5 544079.2326 1535827.681	AG-15 NTC56SSPSAG150006- 20120802 DUP SO 0 0.5 544079.2326 1535827.681
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.025 U	0.023 U	0.021 U	0.021 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.025 U	0.023 U	0.021 U	0.021 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.026 U	0.024 U	0.022 U	0.022 U
ACENAPHTHYLENE	1800	20000	27	27	0.11	0.04	0.16	0.17
ANTHRACENE	21000	300000	2500	2500	0.03 J	0.015 U	0.05	0.05
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.3	0.1	0.5	0.6
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.1	0.034 J	0.25	0.27
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.17	0.045	0.35	0.37
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.35	0.092	0.54	0.63
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.099	0.034 J	0.22	0.25
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.099	0.03 J	0.17	0.18
CHRYSENE	NC	NC	77	77	0.24	0.075	0.44	0.47
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.025 J	0.014 U	0.058	0.071
FLUORANTHENE	3200	59000	1200	1200	0.3	0.095	0.55	0.63
FLUORENE	2600	33000	160	160	0.025 U	0.023 U	0.021 U	0.021 J
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.088	0.028 J	0.21	0.23
NAPHTHALENE	55	300	1.2	1.2	0.027 U	0.025 U	0.023 U	0.023 U
PHENANTHRENE	2200	36000	250	250	0.12	0.057	0.21	0.27
PYRENE	2400	45000	880	880	0.35	0.11	0.61	0.66

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	AG-15 NTC56SSPSAG150624 20120802 NORMAL SO 0.5 2 544079.2326 1535827.681	AK-14 NTC56SSPSAK140006 20120713 NORMAL SO 0 0.5 544139.2326 1535843.202	AK-14 NTC56SSPSAK140624 20120713 NORMAL SO 0.5 2 544139.2326 1535843.202	AK-15 NTC56SSPSAK150006 20120713 NORMAL SO 0 0.5 544139.2326 1535828.202
SAMPLE DATE	Residential	Industrial	Soil to GW					
SAMPLE CODE								
MATRIX								
TOP DEPTH (FEET)								
BOTTOM DEPTH (FEET)								
EASTING								
NORTHING								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.023 U	0.07 J	0.023 J	0.034
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.023 U	0.089 J	0.035	0.042
ACENAPHTHENE	2400	20000	2.1	2.1	0.024 U	0.23	0.036	0.016 J
ACENAPHTHYLENE	1800	20000	27	27	0.42	0.55	0.52	0.38
ANTHRACENE	21000	300000	2500	2500	0.094	0.81	0.18	0.13
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.9	7.3	1.6	0.9
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.38	4.9	0.79	0.42
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.58	5 J	1.2 J	0.62 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.87	7.8	1.6	1
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.43	2.5	0.49	0.3
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.25	2.4	0.42	0.27
CHRYSENE	NC	NC	77	77	0.77	5.1	0.93	0.67
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.11	0.74 J	0.15 J	0.085 J
FLUORANTHENE	3200	59000	1200	1200	0.87	10	1.4	1
FLUORENE	2600	33000	160	160	0.037	0.21	0.018 J	0.014 J
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.37	2.2 J	0.46 J	0.28 J
NAPHTHALENE	55	300	1.2	1.2	0.025 U	0.12 J	0.045	0.051
PHENANTHRENE	2200	36000	250	250	0.44	4	0.51	0.48
PYRENE	2400	45000	880	880	1	8.7	1.4	1.1

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	AK-15 NTC56SSPSAK150624 20120713 NORMAL SO 0.5 2 544139.2326 1535828.202	AK-16 NTC56SSPSAK160006 20120713 NORMAL SO 0 0.5 544139.2326 1535813.202	AK-16 NTC56SSPSAK160624 20120713 NORMAL SO 0.5 2 544139.2326 1535813.202	AK-17 NTC56SSPSAK170006 20120713 NORMAL SO 0 0.5 544139.2326 1535798.202
SAMPLE DATE	Residential	Industrial	Soil to GW					
SAMPLE CODE								
MATRIX								
TOP DEPTH (FEET)								
BOTTOM DEPTH (FEET)								
EASTING								
NORTHING								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.013 J	0.02 J	0.0057 U	0.0074 J
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.016 J	0.028 J	0.0042 U	0.01 J
ACENAPHTHENE	2400	20000	2.1	2.1	0.011 J	0.0079 J	0.0057 U	0.0055 U
ACENAPHTHYLENE	1800	20000	27	27	0.28	0.18	0.016 J	0.059
ANTHRACENE	21000	300000	2500	2500	0.073	0.06	0.0056 J	0.019 J
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.5	0.4	0.0	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.21	0.16	0.023 J	0.053
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.32 J	0.26 J	0.022 J	0.083 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.46	0.44	0.037	0.16
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.21	0.17	0.014 J	0.061
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.15	0.12	0.012 J	0.035
CHRYSENE	NC	NC	77	77	0.39	0.31	0.03 J	0.1
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.051 J	0.042 J	0.0045 UJ	0.015 J
FLUORANTHENE	3200	59000	1200	1200	0.58	0.5	0.048	0.15
FLUORENE	2600	33000	160	160	0.0064 J	0.0052 J	0.0048 U	0.0046 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.17 J	0.15 J	0.012 J	0.051 J
NAPHTHALENE	55	300	1.2	1.2	0.025 J	0.036	0.0051 U	0.013 J
PHENANTHRENE	2200	36000	250	250	0.36	0.27	0.028 J	0.076
PYRENE	2400	45000	880	880	0.7	0.56	0.051	0.17

**Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida**

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	AK-17 NTC56SSPSAK170624	AK-18 NTC56SSPSAK180006	AK-18 NTC56SSPSAK180006	AL-14 NTC56SSPSAL140006
SAMPLE DATE	Residential	Industrial	Soil to GW		20120713	20120801	20120801	20120710
SAMPLE CODE					NORMAL	ORIG	DUP	ORIG
MATRIX					SO	SO	SO	SO
TOP DEPTH (FEET)					0.5	0	0	0
BOTTOM DEPTH (FEET)					2	0.5	0.5	0.5
EASTING					544139.2326	544139.2326	544139.2326	544154.2326
NORTHING					1535798.202	1535783.202	1535783.202	1535843.202
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.0078 J	0.022 U	0.022 U	0.11 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.01 J	0.022 U	0.022 U	0.11 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.0053 U	0.023 U	0.023 U	0.14 J
ACENAPHTHYLENE	1800	20000	27	27	0.075	0.026 J	0.029 J	0.71
ANTHRACENE	21000	300000	2500	2500	0.025 J	0.015 U	0.015 U	0.49
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.1	0.1	0.1	4.6
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.057	0.037	0.038	2.8
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.09 J	0.065	0.07	3.2
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.15	0.13	0.12	5.6
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.06	0.071	0.052	1.6
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.048	0.037	0.034 J	1.6
CHRYSENE	NC	NC	77	77	0.13	0.084	0.077	3.7
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.014 J	0.02 J	0.014 U	0.42
FLUORANTHENE	3200	59000	1200	1200	0.18	0.1	0.096	5.3
FLUORENE	2600	33000	160	160	0.0044 U	0.022 U	0.022 U	0.16 J
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.052 J	0.057	0.044	1.5
NAPHTHALENE	55	300	1.2	1.2	0.015 J	0.024 U	0.024 U	0.12 U
PHENANTHRENE	2200	36000	250	250	0.1	0.033 J	0.031 J	2.1
PYRENE	2400	45000	880	880	0.21	0.11	0.11	4.9

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID SAMPLE DATE SAMPLE CODE MATRIX TOP DEPTH (FEET) BOTTOM DEPTH (FEET) EASTING NORTHING	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	AL-14 NTC56SSPSAL140006- 20120710 DUP SO 0 0.5 544154.2326 1535843.202	AL-14 NTC56SSPSAL140624 20120710 NORMAL SO 0.5 2 544154.2326 1535843.202	AL-15 NTC56SSPSAL150006 20120710 NORMAL SO 0 0.5 544154.2326 1535828.202	AL-15 NTC56SSPSAL150624 20120710 ORIG SO 0.5 2 544154.2326 1535828.202
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.045 U	0.022 U	0.022 U	0.023 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.045 U	0.022 U	0.022 U	0.023 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.11	0.023 U	0.023 U	0.024 U
ACENAPHTHYLENE	1800	20000	27	27	0.6	0.29	0.11	0.064
ANTHRACENE	21000	300000	2500	2500	0.35	0.058	0.046	0.016 J
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	3.9	0.6	0.4	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	2.3	0.2	0.21	0.052
BENZO(A)PYRENE	0.1	0.7	8	0.1	2.7	0.46	0.24	0.08
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	4.6	0.65	0.44	0.13
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	1.2	0.27	0.14	0.052
BENZO(K)FLUORANTHENE	NC	NC	24	24	1.3	0.19	0.13	0.038
CHRYSENE	NC	NC	77	77	3	0.31	0.32	0.095
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.34	0.077	0.038	0.014 J
FLUORANTHENE	3200	59000	1200	1200	4	0.3	0.46	0.12
FLUORENE	2600	33000	160	160	0.13	0.023 J	0.022 U	0.023 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	1.2	0.24	0.13	0.048
NAPHTHALENE	55	300	1.2	1.2	0.05 U	0.024 U	0.024 U	0.025 U
PHENANTHRENE	2200	36000	250	250	1.6	0.092	0.19	0.065
PYRENE	2400	45000	880	880	3.9	0.36	0.45	0.14

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID SAMPLE DATE SAMPLE CODE MATRIX TOP DEPTH (FEET) BOTTOM DEPTH (FEET) EASTING NORTHING	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	AL-15 NTC56SSPSAL150624- 20120710 DUP SO 0.5 2 544154.2326 1535828.202	AL-16 NTC56SSPSAL160006 20120710 NORMAL SO 0 0.5 544154.2326 1535813.202	AL-16 NTC56SSPSAL160624 20120710 NORMAL SO 0.5 2 544154.2326 1535813.202	AL-17 NTC56SSPSAL170006 20120710 NORMAL SO 0 0.5 544154.2326 1535798.202
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.023 U	0.023 U	0.023 U	0.021 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.023 U	0.023 U	0.023 U	0.021 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.024 U	0.025 U	0.024 U	0.022 U
ACENAPHTHYLENE	1800	20000	27	27	0.08	0.15	0.036 J	0.094
ANTHRACENE	21000	300000	2500	2500	0.019 J	0.048	0.016 U	0.029 J
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.1	0.4	0.1	0.2
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.067	0.19	0.05	0.086
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.095	0.26	0.059	0.14
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.16	0.46	0.12	0.28
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.073	0.14	0.038	0.097
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.058	0.13	0.035 J	0.078
CHRYSENE	NC	NC	77	77	0.13	0.35	0.085	0.22
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.022 J	0.037	0.014 U	0.026 J
FLUORANTHENE	3200	59000	1200	1200	0.16	0.48	0.12	0.28
FLUORENE	2600	33000	160	160	0.023 U	0.023 U	0.023 U	0.021 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.066	0.14	0.036 J	0.091
NAPHTHALENE	55	300	1.2	1.2	0.025 U	0.026 U	0.026 U	0.023 U
PHENANTHRENE	2200	36000	250	250	0.084	0.21	0.056	0.13
PYRENE	2400	45000	880	880	0.19	0.52	0.13	0.31

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID SAMPLE DATE SAMPLE CODE MATRIX TOP DEPTH (FEET) BOTTOM DEPTH (FEET) EASTING NORTHING	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	AL-17 NTC56SSPSAL170624 20120710 NORMAL SO 0.5 2 544154.2326 1535798.202	AL-18 NTC56SSPSAL180006 20120713 NORMAL SO 0 0.5 544154.2326 1535783.202	AL-18 NTC56SSPSAL180624 20120713 NORMAL SO 0.5 2 544154.2326 1535783.202	AL-19 NTC56SSPSAL190006 20120801 NORMAL SO 0 0.5 544154.2326 1535768.22
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.023 U	0.014 J	0.0054 U	0.023 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.023 U	0.021 J	0.0045 J	0.023 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.024 U	0.0057 J	0.0054 U	0.024 U
ACENAPHTHYLENE	1800	20000	27	27	0.11	0.14	0.03 J	0.021 U
ANTHRACENE	21000	300000	2500	2500	0.034 J	0.05	0.01 J	0.015 U
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.2	0.3	0.0	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.11	0.12	0.022 J	0.042
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.16	0.21 J	0.033 J	0.048
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.31	0.39	0.062	0.083
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.1	0.15	0.025 J	0.044
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.081	0.11	0.02 J	0.029 J
CHRYSENE	NC	NC	77	77	0.25	0.24	0.042	0.053
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.029 J	0.036 J	0.0059 J	0.014 U
FLUORANTHENE	3200	59000	1200	1200	0.33	0.34	0.056	0.084
FLUORENE	2600	33000	160	160	0.023 U	0.0047 U	0.0045 U	0.023 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.096	0.13 J	0.021 J	0.04
NAPHTHALENE	55	300	1.2	1.2	0.025 U	0.032 J	0.0073 J	0.025 U
PHENANTHRENE	2200	36000	250	250	0.17	0.15	0.028 J	0.029 J
PYRENE	2400	45000	880	880	0.37	0.39	0.065	0.08

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	B-14 NTC56SSPSB140006 20120612 NORMAL SO 0 0.5 544184.2326 1535843.202	B-14 NTC56SSPSB140624 20120612 NORMAL SO 0.5 2 544184.2326 1535843.202	B-15 NTC56SSPSB150006 20120612 NORMAL SO 0 0.5 544184.2326 1535828.202	B-15 NTC56SSPSB150624 20120612 NORMAL SO 0.5 2 544184.2326 1535828.202
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.12 U	0.022 U	0.12 U	0.023 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.12 U	0.022 U	0.12 U	0.023 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.12 U	0.024 U	0.12 U	0.024 U
ACENAPHTHYLENE	1800	20000	27	27	0.69	0.056	0.44	0.2
ANTHRACENE	21000	300000	2500	2500	0.17 J	0.015 U	0.12 J	0.039
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	1.9	0.1	1.3	0.4
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	1	0.067	0.68	0.22
BENZO(A)PYRENE	0.1	0.7	8	0.1	1.4	0.084	0.93	0.31
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	2.3	0.15	1.6	0.55
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.72	0.05	0.47	0.16
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.76	0.051	0.49	0.16
CHRYSENE	NC	NC	77	77	1.8	0.11	1.2	0.47
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.14 J	0.014 U	0.092 J	0.031 J
FLUORANTHENE	3200	59000	1200	1200	2.3	0.14	1.7	0.59
FLUORENE	2600	33000	160	160	0.12 U	0.022 U	0.12 U	0.024 J
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.65	0.044	0.42	0.14
NAPHTHALENE	55	300	1.2	1.2	0.13 U	0.025 U	0.13 U	0.025 U
PHENANTHRENE	2200	36000	250	250	0.94	0.049	0.75	0.35
PYRENE	2400	45000	880	880	2.5	0.16	1.8	0.69

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	B-16 NTC56SSPSB160006 20120612 ORIG SO 0 0.5 544184.2326 1535813.202	B-16 NTC56SSPSB160006- 20120612 DUP SO 0 0.5 544184.2326 1535813.202	B-16 NTC56SSPSB160624 20120612 ORIG SO 0.5 2 544184.2326 1535813.202	B-16 NTC56SSPSB160624- 20120612 DUP SO 0.5 2 544184.2326 1535813.202
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.12 U	0.023 U	0.038	0.12 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.12 U	0.023 U	0.031 J	0.12 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.12 U	0.024 U	0.025 U	0.12 U
ACENAPHTHYLENE	1800	20000	27	27	0.5	0.4	0.69 J	1.2 J
ANTHRACENE	21000	300000	2500	2500	0.12 J	0.088	0.15 J	0.28 J
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	1.0	1.0	1.3	3.4
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.51	0.39	0.62 J	1.8 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.74	0.66	0.94 J	2.4 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	1.4	1.1	1.8 J	3.9 J
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.33	0.48	0.46 J	1.3 J
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.47	0.36	0.57 J	1.2 J
CHRYSENE	NC	NC	77	77	1.1	0.97	1.7	2.8
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.077 J	0.1	0.096 J	0.32 J
FLUORANTHENE	3200	59000	1200	1200	1.5	1.3	2 J	3.7 J
FLUORENE	2600	33000	160	160	0.12 U	0.046	0.088	0.12 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.31	0.42	0.43 J	1.2 J
NAPHTHALENE	55	300	1.2	1.2	0.13 U	0.027 J	0.044	0.13 U
PHENANTHRENE	2200	36000	250	250	0.76	0.69	1.4	1.3
PYRENE	2400	45000	880	880	1.7	1.5	2.4	4

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	B-18 NTC56SSPSB180006 20120710 NORMAL SO 0 0.5 544184.2326 1535783.202	B-18 NTC56SSPSB180624 20120710 NORMAL SO 0.5 2 544184.2326 1535783.202	B-19 NTC56SSPSB190006 20120801 NORMAL SO 0 0.5 544184.2326 1535768.22	BB-14 NTC56SSPSBB140006 20120710 NORMAL SO 0 0.5 544364.2856 1535844.04
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.022 U	0.025 U	0.021 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.022 U	0.025 U	0.021 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.024 U	0.026 U	0.022 U
ACENAPHTHYLENE	1800	20000	27	27	0.078	0.02 U	0.022 U	0.15
ANTHRACENE	21000	300000	2500	2500	0.022 J	0.015 U	0.016 U	0.062
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.2	0.0	0.1	0.6
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.076	0.02 J	0.039	0.31
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.12	0.021 J	0.042	0.37
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.25	0.042	0.08	0.64
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.12	0.024 J	0.044	0.29
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.062	0.015 J	0.026 J	0.23
CHRYSENE	NC	NC	77	77	0.17	0.03 J	0.049	0.46
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.031 J	0.014 U	0.015 U	0.069
FLUORANTHENE	3200	59000	1200	1200	0.21	0.04	0.078	0.65
FLUORENE	2600	33000	160	160	0.022 U	0.022 U	0.025 U	0.021 J
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.1	0.019 J	0.034 J	0.26
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.025 U	0.027 U	0.023 U
PHENANTHRENE	2200	36000	250	250	0.085	0.019 U	0.027 J	0.28
PYRENE	2400	45000	880	880	0.24	0.047	0.076	0.63

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	BB-14 NTC56SSPSBB140624 20120710 NORMAL SO 0.5 2 544364.2856 1535844.04	BB-15 NTC56SSPSBB150006 20120710 NORMAL SO 0 0.5 544364.2856 1535829.04	BB-15 NTC56SSPSBB150624 20120710 NORMAL SO 0.5 2 544364.2856 1535829.04	BB-16 NTC56SSPBB160006 20120713 NORMAL SO 0 0.5 544364.2856 1535814.04
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.021 U	0.022 U	0.0054 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.021 U	0.022 U	0.0041 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.022 U	0.023 U	0.0054 U
ACENAPHTHYLENE	1800	20000	27	27	0.02 U	0.21	0.02 U	0.024 J
ANTHRACENE	21000	300000	2500	2500	0.014 U	0.052	0.015 U	0.0089 J
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.0	0.6	0.0 U	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.015 J	0.33	0.0099 U	0.031 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.011 J	0.4	0.0078 U	0.045 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.02 J	0.6	0.014 U	0.085
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.012 U	0.27	0.013 U	0.034 J
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.012 U	0.17	0.013 U	0.026 J
CHRYSENE	NC	NC	77	77	0.012 U	0.52	0.013 U	0.048
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.013 U	0.076	0.014 U	0.0076 J
FLUORANTHENE	3200	59000	1200	1200	0.013 U	0.49	0.014 U	0.073
FLUORENE	2600	33000	160	160	0.022 U	0.021 U	0.022 U	0.0046 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.012 U	0.24	0.013 U	0.028 J
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.024 U	0.024 U	0.0052 J
PHENANTHRENE	2200	36000	250	250	0.018 U	0.13	0.019 U	0.025 J
PYRENE	2400	45000	880	880	0.015 J	0.63	0.013 U	0.07

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID SAMPLE DATE SAMPLE CODE MATRIX TOP DEPTH (FEET) BOTTOM DEPTH (FEET) EASTING NORTHING	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	BB-16 NTC56SSPBB160624 20120713 NORMAL SO 0.5 2 544364.2856 1535814.04	BC-14 NTC56SSPBC140006 20120713 NORMAL SO 0 0.5 544379.2856 1535844.04	BC-14 NTC56SSPBC140624 20120713 NORMAL SO 0.5 2 544379.2856 1535844.04	BC-15 NTC56SSPSBC150006 20120713 NORMAL SO 0 0.5 544379.2856 1535829.04
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.0052 U	0.056	0.0051 U	0.0054 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.0038 U	0.083	0.0059 J	0.0062 J
ACENAPHTHENE	2400	20000	2.1	2.1	0.0052 U	0.073	0.01 J	0.0054 U
ACENAPHTHYLENE	1800	20000	27	27	0.0037 U	2.1	0.15	0.067
ANTHRACENE	21000	300000	2500	2500	0.005 U	0.78	0.049	0.021 J
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.0	6.1	0.4	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.0044 U	3.1	0.18	0.064
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.0058 UJ	4.3 J	0.27 J	0.1 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.0048 J	6.3	0.4	0.19
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.0035 U	1.9	0.13	0.06
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.0059 U	1.9	0.13	0.045
CHRYSENE	NC	NC	77	77	0.0049 U	3.9	0.25	0.11
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.0042 UJ	0.61 J	0.035 J	0.015 J
FLUORANTHENE	3200	59000	1200	1200	0.0047 U	5	0.32	0.19
FLUORENE	2600	33000	160	160	0.0044 U	0.024 J	0.0043 U	0.0045 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.005 UJ	1.8 J	0.11 J	0.055 J
NAPHTHALENE	55	300	1.2	1.2	0.013 J	0.12	0.0091 J	0.0093 J
PHENANTHRENE	2200	36000	250	250	0.0051 U	1.1	0.073	0.079
PYRENE	2400	45000	880	880	0.0044 U	5.7	0.38	0.19

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	BC-15 NTC56SSPBC150624 20120713 NORMAL SO 0.5 2 544379.2856 1535829.04	BC-16 NTC56SSPBC160006 20120713 NORMAL SO 0 0.5 544379.2856 1535814.04	BC-16 NTC56SSPBC160624 20120713 NORMAL SO 0.5 2 544379.2856 1535814.04	BD-14 NTC56SSPBD140006 20120801 NORMAL SO 0 0.5 544394.2856 1535844.04
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.0052 U	0.0053 U	0.0052 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.0039 U	0.0039 U	0.0039 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.0052 U	0.0053 U	0.0052 U	0.026 J
ACENAPHTHYLENE	1800	20000	27	27	0.0074 J	0.019 J	0.0038 U	0.24
ANTHRACENE	21000	300000	2500	2500	0.005 U	0.0069 J	0.005 U	0.13
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.0	0.1	0.0	1.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.0044 U	0.028 J	0.0044 U	0.7
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.0058 UJ	0.044 J	0.0059 UJ	0.75
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.007 J	0.086	0.0065 J	1.3
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.0036 U	0.028 J	0.0036 U	0.44
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.0059 U	0.023 J	0.006 U	0.42
CHRYSENE	NC	NC	77	77	0.0049 U	0.046	0.0049 U	1.2
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.0042 UJ	0.0072 J	0.0042 UJ	0.12
FLUORANTHENE	3200	59000	1200	1200	0.005 J	0.07	0.0047 U	1.7
FLUORENE	2600	33000	160	160	0.0044 U	0.0044 U	0.0044 U	0.06
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.005 UJ	0.025 J	0.005 UJ	0.42
NAPHTHALENE	55	300	1.2	1.2	0.0047 U	0.0047 U	0.0047 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.0051 U	0.024 J	0.0051 U	1.1
PYRENE	2400	45000	880	880	0.0057 J	0.07	0.0046 J	1.8

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	BD-14 NTC56SSPSBD140624	BD-15 NTC56SSPSBD150006	BD-15 NTC56SSPSBD150624	BD-16 NTC56SSPSBD160006
SAMPLE DATE	Residential	Industrial	Soil to GW		20120801	20120801	20120801	20120829
SAMPLE CODE					NORMAL	NORMAL	NORMAL	NORMAL
MATRIX					SO	SO	SO	SO
TOP DEPTH (FEET)					0.5	0	0.5	0
BOTTOM DEPTH (FEET)					2	0.5	2	0.5
EASTING					544394.2856	544394.2856	544394.2856	544394.2856
NORTHING					1535844.04	1535829.04	1535829.04	1535814.04
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.023 U	0.022 U	0.023 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.023 U	0.022 U	0.023 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.024 U	0.023 U	0.024 U
ACENAPHTHYLENE	1800	20000	27	27	0.055	0.056	0.02 U	0.041
ANTHRACENE	21000	300000	2500	2500	0.015 U	0.016 U	0.015 U	0.015 U
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.2	0.2	0.0	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.089	0.082	0.014 J	0.047
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.12	0.13	0.012 J	0.082
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.2	0.23	0.025 J	0.17
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.082	0.13	0.016 J	0.047
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.055	0.066	0.013 U	0.05
CHRYSENE	NC	NC	77	77	0.15	0.16	0.017 J	0.12
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.024 J	0.032 J	0.014 U	0.014 U
FLUORANTHENE	3200	59000	1200	1200	0.18	0.17	0.023 J	0.13
FLUORENE	2600	33000	160	160	0.022 U	0.023 U	0.022 U	0.023 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.076	0.11	0.013 U	0.041
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.025 U	0.024 U	0.025 U
PHENANTHRENE	2200	36000	250	250	0.054	0.064	0.019 U	0.048
PYRENE	2400	45000	880	880	0.21	0.2	0.026 J	0.15

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	BE-14 NTC56SSPSBE140006	BE-14 NTC56SSPSBE140624	BE-15 NTC56SSPSBE150006	BE-15 NTC56SSPSBE150624
SAMPLE DATE	Residential	Industrial	Soil to GW		20120801	20120801	20120829	20120829
SAMPLE CODE					NORMAL	NORMAL	NORMAL	NORMAL
MATRIX					SO	SO	SO	SO
TOP DEPTH (FEET)					0	0.5	0	0.5
BOTTOM DEPTH (FEET)					0.5	2	0.5	2
EASTING					544409.2856	544409.2856	544409.2856	544409.2856
NORTHING					1535844.04	1535844.04	1535829.04	1535829.04
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.022 U	0.024 U	0.025 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.022 U	0.024 U	0.025 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.023 U	0.025 U	0.026 U
ACENAPHTHYLENE	1800	20000	27	27	0.18	0.02 U	0.067	0.022 U
ANTHRACENE	21000	300000	2500	2500	0.047	0.015 U	0.018 J	0.017 U
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.5	0.0	0.2	0.0 U
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.21	0.012 J	0.064	0.011 U
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.35	0.01 J	0.12	0.0088 U
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.62	0.023 J	0.24	0.015 U
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.32	0.013 J	0.068	0.014 U
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.17	0.012 U	0.073	0.014 U
CHRYSENE	NC	NC	77	77	0.43	0.012 J	0.15	0.014 U
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.079	0.014 U	0.021 J	0.015 U
FLUORANTHENE	3200	59000	1200	1200	0.47	0.016 J	0.16	0.015 U
FLUORENE	2600	33000	160	160	0.022 U	0.022 U	0.024 U	0.025 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.27	0.012 U	0.061	0.014 U
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.024 U	0.026 U	0.027 U
PHENANTHRENE	2200	36000	250	250	0.16	0.019 U	0.062	0.021 U
PYRENE	2400	45000	880	880	0.53	0.02 J	0.2	0.014 U

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	BE-16 NTC56SSPSBE160006 20120829 NORMAL SO 0 0.5 544409.2856 1535814.04	BE-16 NTC56SSPSBE160624 20120829 NORMAL SO 0.5 2 544409.2856 1535814.04	BF-14 NTC56SSPSBF140006 20120829 NORMAL SO 0 0.5 544424.2856 1535844.04	BF-14 NTC56SSPSBF140624 20120829 NORMAL SO 0.5 2 544424.2856 1535844.04
SAMPLE DATE	Residential	Industrial	Soil to GW					
SAMPLE CODE								
MATRIX								
TOP DEPTH (FEET)								
BOTTOM DEPTH (FEET)								
EASTING								
NORTHING								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.023 U	0.022 U	0.025 J	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.023 U	0.022 U	0.038	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.024 U	0.023 U	0.052	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.14	0.02 U	1.3	0.025 J
ANTHRACENE	21000	300000	2500	2500	0.033 J	0.015 U	0.32	0.015 U
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.3	0.0 U	3.1	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.11	0.0099 U	1.3	0.033 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.21	0.0079 U	2.2	0.039
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.43	0.014 U	3.5	0.066
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.16	0.013 U	1	0.026 J
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.12	0.013 U	1.1	0.021 J
CHRYSENE	NC	NC	77	77	0.28	0.013 U	2	0.039
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.044	0.014 U	0.3	0.014 U
FLUORANTHENE	3200	59000	1200	1200	0.27	0.014 U	1.6	0.056
FLUORENE	2600	33000	160	160	0.023 U	0.022 U	0.11	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.14	0.013 U	0.96	0.022 J
NAPHTHALENE	55	300	1.2	1.2	0.025 U	0.024 U	0.051	0.024 U
PHENANTHRENE	2200	36000	250	250	0.1	0.019 U	0.49	0.019 J
PYRENE	2400	45000	880	880	0.31	0.013 U	2.1	0.059

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	BF-15 NTC56SSPSBF150006	BF-15 NTC56SSPSBF150624	BG-14 NTC56SSPSBG140006	BG-14 NTC56SSPSBG140624
SAMPLE DATE	Residential	Industrial	Soil to GW		20120829	20120829	20120829	20120829
SAMPLE CODE					NORMAL	NORMAL	NORMAL	NORMAL
MATRIX					SO	SO	SO	SO
TOP DEPTH (FEET)					0	0.5	0	0.5
BOTTOM DEPTH (FEET)					0.5	2	0.5	2
EASTING					544424.2856	544424.2856	544439.2856	544439.2856
NORTHING					1535829.04	1535829.04	1535844.04	1535844.04
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.023 U	0.022 U	0.023 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.023 U	0.022 U	0.029 J	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.024 U	0.023 U	0.026 J	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.077	0.02 U	0.95	0.02 U
ANTHRACENE	21000	300000	2500	2500	0.019 J	0.015 U	0.22	0.015 U
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.2	0.0 U	1.9	0.0
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.064	0.0099 U	0.79	0.017 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.11	0.0079 U	1.4	0.015 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.25	0.014 U	2.2	0.031 J
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.089	0.013 U	0.66	0.013 U
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.063	0.013 U	0.76	0.013 U
CHRYSENE	NC	NC	77	77	0.16	0.013 U	1.4	0.014 J
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.014 U	0.014 U	0.18	0.014 U
FLUORANTHENE	3200	59000	1200	1200	0.17	0.014 U	1.2	0.014 U
FLUORENE	2600	33000	160	160	0.023 U	0.022 U	0.088	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.078	0.013 U	0.6	0.013 U
NAPHTHALENE	55	300	1.2	1.2	0.025 U	0.025 U	0.047	0.024 U
PHENANTHRENE	2200	36000	250	250	0.064	0.019 U	0.32	0.019 U
PYRENE	2400	45000	880	880	0.19	0.013 U	1.5	0.018 J

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID SAMPLE DATE SAMPLE CODE MATRIX TOP DEPTH (FEET) BOTTOM DEPTH (FEET) EASTING NORTHING	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	C-14 NTC56SSPSC140006 20120612 NORMAL SO 0 0.5 544199.2326 1535844.148	C-14 NTC56SSPSC140624 20120612 NORMAL SO 0.5 2 544199.2326 1535844.148	C-15 NTC56SSPSC150006 20120612 NORMAL SO 0 0.5 544199.2326 1535829.148	C-15 NTC56SSPSC150624 20120612 NORMAL SO 0.5 2 544199.2326 1535829.148
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.14 U	0.022 U	0.12 U	0.023 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.14 U	0.022 U	0.12 U	0.023 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.15 U	0.023 U	0.12 U	0.024 U
ACENAPHTHYLENE	1800	20000	27	27	0.43	0.15	0.31	0.036
ANTHRACENE	21000	300000	2500	2500	0.12 J	0.025 J	0.097 J	0.015 U
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	1.5	0.3	1.1	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.85	0.14	0.56	0.035 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	1.1	0.25	0.8	0.046
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	1.9	0.41	1.5	0.096
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.36	0.1	0.34	0.023 J
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.47	0.12	0.4	0.029 J
CHRYSENE	NC	NC	77	77	1.3	0.22	0.94	0.07
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.11 J	0.027 J	0.081 J	0.014 U
FLUORANTHENE	3200	59000	1200	1200	1.7	0.21	1.3	0.086
FLUORENE	2600	33000	160	160	0.14 U	0.022 U	0.12 U	0.023 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.37	0.098	0.31	0.022 J
NAPHTHALENE	55	300	1.2	1.2	0.16 U	0.025 U	0.13 U	0.025 U
PHENANTHRENE	2200	36000	250	250	0.7	0.075	0.51	0.047
PYRENE	2400	45000	880	880	1.9	0.27	1.3	0.1

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	C-16 NTC56SSPSC160006 20120507 NORMAL SO 0 0.5 544199.2326 1535814.148	C-16 NTC56SSPSC160624 20120507 NORMAL SO 0.5 2 544199.2326 1535814.148	C-17 NTC56SSPSC170006 20120612 NORMAL SO 0 0.5 544199.2326 1535799.148	C-17 NTC56SSPSC170624 20120612 NORMAL SO 0.5 2 544199.2326 1535799.148
SAMPLE DATE	Residential	Industrial	Soil to GW					
SAMPLE CODE								
MATRIX								
TOP DEPTH (FEET)								
BOTTOM DEPTH (FEET)								
EASTING								
NORTHING								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.026 U	0.024 U	0.022 U	0.024 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.026 U	0.024 U	0.022 U	0.024 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.027 U	0.025 U	0.023 U	0.025 U
ACENAPHTHYLENE	1800	20000	27	27	0.086	0.022 U	0.09	0.031 J
ANTHRACENE	21000	300000	2500	2500	0.02 J	0.016 U	0.023 J	0.016 U
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.2	0.0	0.2	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.1	0.022 J	0.083	0.03 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.16	0.022 J	0.14	0.041
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.28	0.042	0.28	0.087
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.16	0.025 J	0.063	0.02 J
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.079	0.014 U	0.085	0.028 J
CHRYSENE	NC	NC	77	77	0.22	0.031 J	0.2	0.067
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.027 J	0.015 U	0.015 J	0.015 U
FLUORANTHENE	3200	59000	1200	1200	0.28	0.043	0.27	0.091
FLUORENE	2600	33000	160	160	0.026 U	0.024 U	0.022 U	0.024 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.12	0.017 J	0.061	0.018 J
NAPHTHALENE	55	300	1.2	1.2	0.028 U	0.026 U	0.025 U	0.026 U
PHENANTHRENE	2200	36000	250	250	0.13	0.023 J	0.12	0.052
PYRENE	2400	45000	880	880	0.32	0.05	0.3	0.1

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID SAMPLE DATE SAMPLE CODE MATRIX TOP DEPTH (FEET) BOTTOM DEPTH (FEET) EASTING NORTHING	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	C-18 NTC56SSPSC180006 20120710 NORMAL SO 0 0.5 544199.2326 1535784.148	C-18 NTC56SSPSC180624 20120710 NORMAL SO 0.5 2 544199.2326 1535784.148	C-19 NTC56SSPSC190006 20120801 NORMAL SO 0 0.5 544199.2326 1535769.157	D-14 NTC56SSPSD140006 20120507 ORIG SO 0 0.5 544214.2326 1535844.148
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.023 U	0.023 U	0.023 U	0.043 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.023 U	0.023 U	0.023 U	0.043 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.024 U	0.024 U	0.024 U	0.046 U
ACENAPHTHYLENE	1800	20000	27	27	0.065	0.02 U	0.021 U	0.35
ANTHRACENE	21000	300000	2500	2500	0.021 J	0.015 U	0.015 U	0.12
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.2	0.0	0.1	1.4
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.079	0.014 J	0.031 J	0.64
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.12	0.0086 J	0.034 J	0.98
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.22	0.016 J	0.063	1.8
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.11	0.013 U	0.032 J	0.61
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.07	0.013 U	0.016 J	0.52
CHRYSENE	NC	NC	77	77	0.16	0.013 U	0.04	1.2
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.014 U	0.014 U	0.014 U	0.13
FLUORANTHENE	3200	59000	1200	1200	0.2	0.014 J	0.062	1.6
FLUORENE	2600	33000	160	160	0.023 U	0.023 U	0.023 U	0.043 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.093	0.013 U	0.026 J	0.55
NAPHTHALENE	55	300	1.2	1.2	0.025 U	0.025 U	0.025 U	0.048 U
PHENANTHRENE	2200	36000	250	250	0.085	0.019 U	0.022 J	0.63
PYRENE	2400	45000	880	880	0.23	0.016 J	0.06	1.6

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID SAMPLE DATE SAMPLE CODE MATRIX TOP DEPTH (FEET) BOTTOM DEPTH (FEET) EASTING NORTHING	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	D-14 NTC56SSPSD140006- 20120507 DUP SO 0 0.5 544214.2326 1535844.148	D-14 NTC56SSPSD140624 20120507 ORIG SO 0.5 2 544214.2326 1535844.148	D-14 NTC56SSPSD140624- 20120507 DUP SO 0.5 2 544214.2326 1535844.148	D-15 NTC56SSPSD150006 20120507 NORMAL SO 0 0.5 544214.2326 1535829.148
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.044 U	0.022 U	0.022 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.044 U	0.022 U	0.022 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.046 U	0.023 U	0.023 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.35	0.044	0.055	0.38
ANTHRACENE	21000	300000	2500	2500	0.12	0.015 U	0.015 J	0.1
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	1.6	0.2	0.2	1.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.73	0.081	0.11	0.44
BENZO(A)PYRENE	0.1	0.7	8	0.1	1.1	0.12	0.16	0.77
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	2.2	0.22	0.29	1.4
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.5	0.085	0.12	0.49
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.74	0.067	0.077	0.41
CHRYSENE	NC	NC	77	77	1.4	0.15	0.19	0.95
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.12	0.017 J	0.025 J	0.096
FLUORANTHENE	3200	59000	1200	1200	1.9	0.19	0.28	1.1
FLUORENE	2600	33000	160	160	0.045 J	0.022 U	0.022 U	0.03 J
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.49	0.072	0.11	0.41
NAPHTHALENE	55	300	1.2	1.2	0.048 U	0.024 U	0.024 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.64	0.07	0.098	0.45
PYRENE	2400	45000	880	880	1.8	0.2	0.27	1.3

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID SAMPLE DATE SAMPLE CODE MATRIX TOP DEPTH (FEET) BOTTOM DEPTH (FEET) EASTING NORTHING	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	D-15 NTC56SSPSD150624 20120507 NORMAL SO 0.5 2 544214.2326 1535829.148	D-16 NTC56SSPSD160006 20120507 NORMAL SO 0 0.5 544214.2326 1535814.148	D-16 NTC56SSPSD160624 20120507 NORMAL SO 0.5 2 544214.2326 1535814.148	D-17 NTC56SSPSD170006 20120507 NORMAL SO 0 0.5 544214.2326 1535799.148
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.021 U	0.022 U	0.023 U	0.021 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.021 U	0.022 U	0.023 U	0.021 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.022 U	0.023 U	0.024 U	0.022 U
ACENAPHTHYLENE	1800	20000	27	27	0.29	0.069	0.069	0.12
ANTHRACENE	21000	300000	2500	2500	0.066	0.018 J	0.018 J	0.029 J
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.7	0.2	0.1	0.3
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.31	0.07	0.065	0.11
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.47	0.11	0.099	0.19
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.84	0.19	0.18	0.37
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.4	0.076	0.075	0.13
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.25	0.059	0.055	0.11
CHRYSENE	NC	NC	77	77	0.74	0.15	0.15	0.29
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.074	0.016 J	0.015 J	0.025 J
FLUORANTHENE	3200	59000	1200	1200	0.96	0.2	0.19	0.39
FLUORENE	2600	33000	160	160	0.036	0.022 U	0.023 U	0.021 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.33	0.065	0.064	0.11
NAPHTHALENE	55	300	1.2	1.2	0.023 U	0.024 U	0.025 U	0.023 U
PHENANTHRENE	2200	36000	250	250	0.55	0.082	0.098	0.19
PYRENE	2400	45000	880	880	1.1	0.22	0.22	0.43

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	D-17 NTC56SSPSD170624 20120507 NORMAL SO 0.5 2 544214.2326 1535799.148	D-18 NTC56SSPSD180006 20120612 NORMAL SO 0 0.5 544214.2326 1535784.148	D-18 NTC56SSPSD180624 20120612 NORMAL SO 0.5 2 544214.2326 1535784.148	E-15 NTC56SSPSE150006 20120507 NORMAL SO 0 0.5 544229.2326 1535829.148
SAMPLE DATE	Residential	Industrial	Soil to GW					
SAMPLE CODE								
MATRIX								
TOP DEPTH (FEET)								
BOTTOM DEPTH (FEET)								
EASTING								
NORTHING								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.021 U	0.024 U	0.023 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.021 U	0.024 U	0.023 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.022 U	0.025 U	0.025 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.15	0.046	0.021 U	0.035
ANTHRACENE	21000	300000	2500	2500	0.036	0.016 U	0.016 U	0.015 U
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.3	0.1	0.0	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.12	0.061	0.015 J	0.055
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.21	0.098	0.0089 J	0.085
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.41	0.2	0.019 J	0.17
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.14	0.046	0.013 U	0.062
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.12	0.06	0.013 U	0.05
CHRYSENE	NC	NC	77	77	0.34	0.13	0.013 U	0.11
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.028 J	0.015 U	0.015 U	0.016 J
FLUORANTHENE	3200	59000	1200	1200	0.46	0.17	0.017 J	0.15
FLUORENE	2600	33000	160	160	0.021 U	0.024 U	0.023 U	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.12	0.044	0.013 U	0.054
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.026 U	0.026 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.26	0.071	0.02 U	0.058
PYRENE	2400	45000	880	880	0.52	0.18	0.019 J	0.15

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID SAMPLE DATE SAMPLE CODE MATRIX TOP DEPTH (FEET) BOTTOM DEPTH (FEET) EASTING NORTHING	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	E-15 NTC56SSPSE150624 20120507 NORMAL SO 0.5 2 544229.2326 1535829.148	E-18 NTC56SSPSE180006 20120507 NORMAL SO 0 0.5 544229.2326 1535784.148	E-18 NTC56SSPSE180624 20120507 NORMAL SO 0.5 2 544229.2326 1535784.148	E-19 NTC56SSPSE190006 20120612 NORMAL SO 0 0.5 544229.2326 1535769.157
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.022 U	0.022 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.022 U	0.022 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.023 U	0.023 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.02 U	0.32	0.17	0.02 U
ANTHRACENE	21000	300000	2500	2500	0.015 U	0.085	0.04	0.015 U
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.0 U	0.7	0.3	0.0
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.0097 U	0.26	0.16	0.027 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.0077 U	0.46	0.2	0.028 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.014 U	0.91	0.37	0.057
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.013 U	0.32	0.11	0.013 U
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.013 U	0.27	0.096	0.016 J
CHRYSENE	NC	NC	77	77	0.013 U	0.62	0.28	0.033 J
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.014 U	0.064	0.025 J	0.014 U
FLUORANTHENE	3200	59000	1200	1200	0.014 U	0.75	0.36	0.051
FLUORENE	2600	33000	160	160	0.022 U	0.034	0.022 U	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.013 U	0.28	0.1	0.013 J
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.024 U	0.024 U	0.025 U
PHENANTHRENE	2200	36000	250	250	0.019 U	0.31	0.16	0.019 J
PYRENE	2400	45000	880	880	0.013 U	0.84	0.43	0.047

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	E-19 NTC56SSPSE190624 20120612 NORMAL SO 0.5 2 544229.2326 1535769.157	F-14 NTC56SSPSF140006 20120507 NORMAL SO 0 0.5 544244.2326 1535844.148	F-14 NTC56SSPSF140624 20120507 NORMAL SO 0.5 2 544244.2326 1535844.148	F-16 NTC56SSPS60006010 20120105 ORIG SO 0 0.5 544244.2326 1535814.148
SAMPLE DATE	Residential	Industrial	Soil to GW					
SAMPLE CODE								
MATRIX								
TOP DEPTH (FEET)								
BOTTOM DEPTH (FEET)								
EASTING								
NORTHING								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.023 U	0.058 U	0.022 U	0.046 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.023 U	0.058 U	0.022 U	0.046 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.024 U	0.061 U	0.023 U	0.048 U
ACENAPHTHYLENE	1800	20000	27	27	0.021 U	0.73	0.1	0.57
ANTHRACENE	21000	300000	2500	2500	0.015 U	0.22	0.024 J	0.14
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.0	2.0	0.1	1.4
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.011 J	1.2	0.036	0.52
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.021 J	1.4	0.057	1
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.037	2.3	0.13	2.4
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.017 J	0.56	0.048	0.42
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.013 U	0.58	0.031 J	0.63
CHRYSENE	NC	NC	77	77	0.013 U	1.8	0.076	1.3
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.014 U	0.14	0.014 U	0.096
FLUORANTHENE	3200	59000	1200	1200	0.014 U	2.7	0.091	1.6
FLUORENE	2600	33000	160	160	0.023 U	0.098	0.022 U	0.046 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.015 J	0.54	0.038	0.4
NAPHTHALENE	55	300	1.2	1.2	0.025 U	0.064 J	0.024 U	0.055 J
PHENANTHRENE	2200	36000	250	250	0.02 U	1	0.046	0.49
PYRENE	2400	45000	880	880	0.013 U	3	0.11	1.7

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	F-16 NTC56SSPS60006010	F-16 NTC56SSPS60624010	F-16 NTC56SSPS60624010	F-18 NTC56SSPSF180006
SAMPLE DATE	Residential	Industrial	Soil to GW		20120105	20120105	20120105	20120507
SAMPLE CODE					DUP	ORIG	DUP	NORMAL
MATRIX					SO	SO	SO	SO
TOP DEPTH (FEET)					0	0.5	0.5	0
BOTTOM DEPTH (FEET)					0.5	2	2	0.5
EASTING					544244.2326	544244.2326	544244.2326	544244.2326
NORTHING					1535814.148	1535814.148	1535814.148	1535784.148
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.046 U	0.022 U	0.022 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.046 U	0.022 U	0.022 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.048 U	0.023 U	0.023 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.57	0.31	0.059	0.041
ANTHRACENE	21000	300000	2500	2500	0.14	0.072	0.015 U	0.015 U
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	1.4	0.7	0.1	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.53	0.27	0.031 J	0.058
BENZO(A)PYRENE	0.1	0.7	8	0.1	1	0.51	0.046 J	0.094
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	2.5	1.2	0.08 J	0.18
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.38	0.19	0.061 J	0.051
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.72	0.33	0.028 J	0.061
CHRYSENE	NC	NC	77	77	1.2	0.64	0.053 J	0.13
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.086	0.046	0.011 U	0.013 U
FLUORANTHENE	3200	59000	1200	1200	1.6	0.78	0.066 J	0.17
FLUORENE	2600	33000	160	160	0.054 J	0.029 J	0.022 U	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.37	0.19	0.042 J	0.047
NAPHTHALENE	55	300	1.2	1.2	0.05 J	0.024 U	0.024 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.49	0.25	0.025 J	0.068
PYRENE	2400	45000	880	880	1.6	0.86	0.074 J	0.18

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	F-18 NTC56SSPSF180624 20120507 NORMAL SO 0.5 2 544244.2326 1535784.148	G-15 NTC56SSPS30006010 20120105 NORMAL SO 0 0.5 544259.2326 1535830.125	G-15 NTC56SSPS30624010 20120105 NORMAL SO 0.5 2 544259.2326 1535830.125	G-16 NTC56SSPS10624010 20120105 NORMAL SO 0.5 2 544259.2326 1535815.125
SAMPLE DATE	Residential	Industrial	Soil to GW					
SAMPLE CODE								
MATRIX								
TOP DEPTH (FEET)								
BOTTOM DEPTH (FEET)								
EASTING								
NORTHING								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.022 U	0.023 U	0.023 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.022 U	0.023 U	0.023 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.023 U	0.024 U	0.024 U
ACENAPHTHYLENE	1800	20000	27	27	0.02 U	0.03 J	0.29	0.088
ANTHRACENE	21000	300000	2500	2500	0.015 U	0.015 U	0.063	0.019 J
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.0	0.5	1.1	0.2
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.02 J	0.21	0.42	0.073
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.018 J	0.37	0.75	0.16 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.041	0.69	1.5	0.34 J
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.013 U	0.19	0.39	0.15 J
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.013 U	0.21	0.47	0.099
CHRYSENE	NC	NC	77	77	0.026 J	0.38	0.84	0.22 J
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.014 U	0.039	0.084	0.027 J
FLUORANTHENE	3200	59000	1200	1200	0.037	0.53	1.1	0.25 J
FLUORENE	2600	33000	160	160	0.022 U	0.022 U	0.023 U	0.023 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.013 U	0.18	0.37	0.12 J
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.024 U	0.025 U	0.025 U
PHENANTHRENE	2200	36000	250	250	0.019 U	0.084	0.27	0.087
PYRENE	2400	45000	880	880	0.04	0.44	1.1	0.26 J

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID SAMPLE DATE SAMPLE CODE MATRIX TOP DEPTH (FEET) BOTTOM DEPTH (FEET) EASTING NORTHING	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	G-17 NTC56SSPS50006010 20120105 NORMAL SO 0 0.5 544259.2326 1535800.125	G-17 NTC56SSPS50624010 20120105 NORMAL SO 0.5 2 544259.2326 1535800.125	G-18 NTC56SSPSG180006 20120507 NORMAL SO 0 0.5 544259.2326 1535785.125	G-18 NTC56SSPSG180624 20120507 NORMAL SO 0.5 2 544259.2326 1535785.125
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.023 U	0.022 U	0.022 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.023 U	0.022 U	0.022 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.024 U	0.023 U	0.023 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.099	0.32	0.03 J	0.036
ANTHRACENE	21000	300000	2500	2500	0.021 J	0.057	0.015 U	0.014 U
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.4	0.6	0.1	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.17	0.23	0.046	0.033 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.31	0.44	0.076	0.052
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.63	0.99	0.15	0.12
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.11	0.17	0.059	0.047
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.19	0.28	0.038	0.027 J
CHRYSENE	NC	NC	77	77	0.36	0.68	0.11	0.097
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.026 J	0.039	0.015 J	0.013 U
FLUORANTHENE	3200	59000	1200	1200	0.5	0.94	0.15	0.13
FLUORENE	2600	33000	160	160	0.023 U	0.024 J	0.022 U	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.12	0.17	0.052	0.041
NAPHTHALENE	55	300	1.2	1.2	0.025 U	0.024 U	0.024 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.15	0.45	0.056	0.067
PYRENE	2400	45000	880	880	0.46	1	0.15	0.14

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	G-19 NTC56SSPS20624010	H-16 NTC56SSPS40006010	H-16 NTC56SSPS40624010	H-18 NTC56SSPSH180006
SAMPLE DATE	Residential	Industrial	Soil to GW		20120105	20120105	20120105	20120507
SAMPLE CODE					NORMAL	NORMAL	NORMAL	NORMAL
MATRIX					SO	SO	SO	SO
TOP DEPTH (FEET)					0.5	0	0.5	0
BOTTOM DEPTH (FEET)					2	0.5	2	0.5
EASTING					544259.2658	544274.2326	544274.2326	544274.2326
NORTHING					1535770.147	1535815.125	1535815.125	1535785.125
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.022 U	0.023 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.022 U	0.023 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.023 U	0.024 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.02 U	0.18	0.022 J	0.025 J
ANTHRACENE	21000	300000	2500	2500	0.015 U	0.039	0.015 U	0.014 U
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.0	0.5	0.1	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.012 J	0.18	0.025 J	0.042
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.007 U	0.36	0.035 J	0.054
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.012 U	0.83	0.081	0.11
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.012 U	0.18	0.018 J	0.045
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.012 U	0.25	0.024 J	0.03 J
CHRYSENE	NC	NC	77	77	0.011 U	0.47	0.044	0.087
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.011 U	0.039	0.012 U	0.013 U
FLUORANTHENE	3200	59000	1200	1200	0.014 U	0.6	0.014 U	0.12
FLUORENE	2600	33000	160	160	0.022 U	0.022 U	0.023 U	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.012 U	0.17	0.017 J	0.039
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.024 U	0.025 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.019 U	0.19	0.02 J	0.054
PYRENE	2400	45000	880	880	0.012 U	0.6	0.056	0.13

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	H-18 NTC56SSPSH180624 20120507 NORMAL SO 0.5 2 544274.2326 1535785.125	I-14 NTC56SSPSI140006 20120507 NORMAL SO 0 0.5 544289.2326 1535845.125	I-14 NTC56SSPSI140624 20120507 NORMAL SO 0.5 2 544289.2326 1535845.125	I-15 NTC56SSPSI150006 20120507 NORMAL SO 0 0.5 544289.2326 1535830.125
SAMPLE DATE	Residential	Industrial	Soil to GW					
SAMPLE CODE								
MATRIX								
TOP DEPTH (FEET)								
BOTTOM DEPTH (FEET)								
EASTING								
NORTHING								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.043 U	0.022 U	0.021 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.043 U	0.022 U	0.021 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.045 U	0.023 U	0.022 U
ACENAPHTHYLENE	1800	20000	27	27	0.02 U	0.94	0.074	0.12
ANTHRACENE	21000	300000	2500	2500	0.015 U	0.24	0.02 J	0.025 J
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.0 U	2.7	0.2	0.3
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.0097 U	0.9	0.081	0.1
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.0077 U	1.8	0.15	0.21
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.014 U	3.8	0.31	0.39
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.012 U	1.3	0.2	0.25
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.012 U	1.1	0.085	0.12
CHRYSENE	NC	NC	77	77	0.012 U	2.6	0.23	0.29
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.014 U	0.28	0.033 J	0.043
FLUORANTHENE	3200	59000	1200	1200	0.014 U	3	0.26	0.32
FLUORENE	2600	33000	160	160	0.022 U	0.043 U	0.022 U	0.021 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.012 U	1.1	0.14	0.19
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.057 J	0.024 U	0.023 U
PHENANTHRENE	2200	36000	250	250	0.019 U	1.2	0.12	0.14
PYRENE	2400	45000	880	880	0.012 U	3.3	0.29	0.36

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID SAMPLE DATE SAMPLE CODE MATRIX TOP DEPTH (FEET) BOTTOM DEPTH (FEET) EASTING NORTHING	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	I-15 NTC56SSPSI150624 20120507 NORMAL SO 0.5 2 544289.2326 1535830.125	I-17 NTC56SSPSI170006 20120507 NORMAL SO 0 0.5 544289.2326 1535800.125	I-17 NTC56SSPSI170624 20120507 NORMAL SO 0.5 2 544289.2326 1535800.125	J-15 NTC56SSPSJ150006 20120507 NORMAL SO 0 0.5 544304.2326 1535830.125
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.022 U	0.022 U	0.021 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.022 U	0.022 U	0.021 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.023 U	0.023 U	0.022 U
ACENAPHTHYLENE	1800	20000	27	27	0.14	0.02 U	0.02 U	0.32
ANTHRACENE	21000	300000	2500	2500	0.032 J	0.015 U	0.015 U	0.079
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.4	0.0	0.0 U	0.9
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.14	0.015 J	0.0097 U	0.39
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.25	0.0087 J	0.0077 U	0.65
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.48	0.02 J	0.014 U	1.2
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.28	0.013 U	0.013 U	0.38
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.13	0.013 U	0.013 U	0.41
CHRYSENE	NC	NC	77	77	0.37	0.013 J	0.013 U	0.85
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.049	0.014 U	0.014 U	0.08
FLUORANTHENE	3200	59000	1200	1200	0.42	0.021 J	0.014 U	0.98
FLUORENE	2600	33000	160	160	0.022 U	0.022 U	0.022 U	0.034
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.21	0.013 U	0.013 U	0.33
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.024 U	0.024 U	0.023 U
PHENANTHRENE	2200	36000	250	250	0.19	0.019 U	0.019 U	0.41
PYRENE	2400	45000	880	880	0.48	0.021 J	0.013 U	1.1

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID SAMPLE DATE SAMPLE CODE MATRIX TOP DEPTH (FEET) BOTTOM DEPTH (FEET) EASTING NORTHING	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	J-15 NTC56SSPSJ150624 20120507 NORMAL SO 0.5 2 544304.2326 1535830.125	J-16 NTC56SSPSJ160006 20120507 NORMAL SO 0 0.5 544304.2326 1535815.125	J-16 NTC56SSPSJ160624 20120507 NORMAL SO 0.5 2 544304.2326 1535815.125	J-17 NTC56SSPSJ170006 20120507 NORMAL SO 0 0.5 544304.2326 1535800.125
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.028 U	0.022 U	0.028 U	0.021 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.028 U	0.022 U	0.028 U	0.021 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.029 U	0.023 U	0.029 U	0.022 U
ACENAPHTHYLENE	1800	20000	27	27	0.081	0.046	0.025 U	0.019 U
ANTHRACENE	21000	300000	2500	2500	0.019 U	0.014 U	0.019 U	0.014 U
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.2	0.2	0.0	0.0
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.072	0.066	0.013 J	0.026 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.12	0.1	0.0098 U	0.029 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.24	0.19	0.017 U	0.082
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.12	0.11	0.016 U	0.02 J
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.072	0.063	0.016 U	0.077
CHRYSENE	NC	NC	77	77	0.19	0.14	0.016 U	0.045
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.02 J	0.021 J	0.017 U	0.013 U
FLUORANTHENE	3200	59000	1200	1200	0.19	0.18	0.017 U	0.062
FLUORENE	2600	33000	160	160	0.028 U	0.022 U	0.028 U	0.021 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.088	0.093	0.016 U	0.017 J
NAPHTHALENE	55	300	1.2	1.2	0.031 U	0.024 U	0.03 U	0.023 U
PHENANTHRENE	2200	36000	250	250	0.08	0.069	0.024 U	0.03 J
PYRENE	2400	45000	880	880	0.23	0.19	0.016 U	0.064

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	J-17 NTC56SSPSJ170624 20120507 NORMAL SO 0.5 2 544304.2326 1535800.125	K-14 NTC56SSPSK140006 20120612 NORMAL SO 0 0.5 544319.2326 1535845.125	K-14 NTC56SSPSK140624 20120612 NORMAL SO 0.5 2 544319.2326 1535845.125	K-15 NTC56SSPSK150006 20120612 NORMAL SO 0 0.5 544319.2326 1535830.125
SAMPLE DATE	Residential	Industrial	Soil to GW					
SAMPLE CODE								
MATRIX								
TOP DEPTH (FEET)								
BOTTOM DEPTH (FEET)								
EASTING								
NORTHING								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.021 U	0.11 U	0.022 U	0.023 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.021 U	0.11 U	0.022 U	0.023 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.022 U	0.12 U	0.023 U	0.024 U
ACENAPHTHYLENE	1800	20000	27	27	0.019 U	0.63	0.023 J	0.12
ANTHRACENE	21000	300000	2500	2500	0.014 U	0.19	0.015 U	0.028 J
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.0	2.6	0.1	0.4
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.012 J	0.99	0.035	0.14
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.0075 U	1.7	0.049	0.26
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.013 U	3.3	0.1	0.52
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.012 U	1.6	0.052	0.12
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.012 U	0.86	0.026 J	0.17
CHRYSENE	NC	NC	77	77	0.012 U	2.2	0.069	0.38
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.013 U	0.3	0.014 U	0.029 J
FLUORANTHENE	3200	59000	1200	1200	0.013 J	2.7	0.073	0.51
FLUORENE	2600	33000	160	160	0.021 U	0.11 U	0.022 U	0.023 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.012 U	1.2	0.039	0.12
NAPHTHALENE	55	300	1.2	1.2	0.023 U	0.13 U	0.025 U	0.025 U
PHENANTHRENE	2200	36000	250	250	0.018 U	0.98	0.025 J	0.22
PYRENE	2400	45000	880	880	0.013 J	2.8	0.083	0.53

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID SAMPLE DATE SAMPLE CODE MATRIX TOP DEPTH (FEET) BOTTOM DEPTH (FEET) EASTING NORTHING	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	K-15 NTC56SSPSK150624 20120612 NORMAL SO 0.5 2 544319.2326 1535830.125	K-16 NTC56SSPSK160006 20120612 NORMAL SO 0 0.5 544319.2326 1535815.125	L-14 NTC56SSPSL140006 20120612 NORMAL SO 0 0.5 544334.2856 1535844.04	L-14 NTC56SSPSL140624 20120612 NORMAL SO 0.5 2 544334.2856 1535844.04
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.023 U	0.12 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.023 U	0.12 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.025 U	0.12 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.049	0.021 J	0.72	0.02 U
ANTHRACENE	21000	300000	2500	2500	0.015 U	0.016 U	0.15 J	0.015 U
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.1	0.1	1.8	0.0
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.048	0.069	1	0.018 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.08	0.09	1.3	0.014 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.16	0.16	2.3	0.033 J
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.09	0.072	0.63	0.013 U
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.042	0.048	0.87	0.013 J
CHRYSENE	NC	NC	77	77	0.13	0.1	1.7	0.02 J
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.016 J	0.015 J	0.13 J	0.014 U
FLUORANTHENE	3200	59000	1200	1200	0.16	0.15	2	0.014 U
FLUORENE	2600	33000	160	160	0.022 U	0.023 U	0.12 U	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.071	0.066	0.57	0.013 U
NAPHTHALENE	55	300	1.2	1.2	0.025 U	0.026 U	0.13 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.077	0.043	0.79	0.019 U
PYRENE	2400	45000	880	880	0.18	0.15	2.2	0.03 J

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID SAMPLE DATE SAMPLE CODE MATRIX TOP DEPTH (FEET) BOTTOM DEPTH (FEET) EASTING NORTHING	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	L-15 NTC56SSPSL150006 20120612 NORMAL SO 0 0.5 544334.2856 1535829.04	L-15 NTC56SSPSL150624 20120612 NORMAL SO 0.5 2 544334.2856 1535829.04	L-16 NTC56SSPSL160006 20120710 NORMAL SO 0 0.5 544334.2856 1535814.04	ZC-15 NTC56SSPSZC150006 20120802 NORMAL SO 0 0.5 543839.2326 1535818.272
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.023 U	0.022 U	0.022 U	0.05 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.023 U	0.022 U	0.022 U	0.05 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.025 U	0.023 U	0.023 U	0.21
ACENAPHTHYLENE	1800	20000	27	27	0.13	0.02 U	0.022 J	0.24
ANTHRACENE	21000	300000	2500	2500	0.027 J	0.015 U	0.014 U	0.4
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.3	0.0	0.1	8.7
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.14	0.021 J	0.045	4.7
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.22	0.019 J	0.061	6.1
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.45	0.043	0.13	10
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.11	0.013 U	0.06	2.7
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.13	0.013 J	0.043	3.1
CHRYSENE	NC	NC	77	77	0.37	0.029 J	0.087	6.2
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.015 U	0.014 U	0.013 U	0.83
FLUORANTHENE	3200	59000	1200	1200	0.47	0.014 U	0.12	24
FLUORENE	2600	33000	160	160	0.023 U	0.022 U	0.022 U	0.15
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.11	0.013 U	0.053	2.7
NAPHTHALENE	55	300	1.2	1.2	0.026 U	0.024 U	0.024 U	0.055 U
PHENANTHRENE	2200	36000	250	250	0.22	0.02 J	0.042	2.7
PYRENE	2400	45000	880	880	0.52	0.047	0.12	7.5

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID SAMPLE DATE SAMPLE CODE MATRIX TOP DEPTH (FEET) BOTTOM DEPTH (FEET) EASTING NORTHING	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	ZC-15 NTC56SSPSZC150624 20120802 NORMAL SO 0.5 2 543839.2326 1535818.272	ZC-17 NTC56SSPSZC170006 20120829 ORIG SO 0 0.5 543839.2326 1535788.272	ZC-17 NTC56SSPSZC170006 20120829 DUP SO 0 0.5 543839.2326 1535788.272	ZC-17 NTC56SSPSZC170624 20120829 NORMAL SO 0.5 2 543839.2326 1535788.272
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.023 U	0.025 U	0.025 U	0.024 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.023 U	0.025 U	0.025 U	0.024 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.025 U	0.029 J	0.027 J	0.025 U
ACENAPHTHYLENE	1800	20000	27	27	0.24	0.11	0.093	0.022 U
ANTHRACENE	21000	300000	2500	2500	0.071	0.08	0.086	0.016 U
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.9	2.1	1.8	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.45	0.99	0.86	0.062
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.62	1.4	1.3	0.082
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.99	2.3	2.3	0.15
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.39	0.89 J	0.51 J	0.064
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.3	0.71	0.76	0.039
CHRYSENE	NC	NC	77	77	0.73	1.4	1.2	0.079
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.1	0.24	0.16	0.016 J
FLUORANTHENE	3200	59000	1200	1200	0.91	1.8	1.6	0.13
FLUORENE	2600	33000	160	160	0.023 U	0.03 J	0.034 J	0.024 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.36	0.82	0.54	0.053
NAPHTHALENE	55	300	1.2	1.2	0.026 U	0.027 U	0.027 U	0.027 U
PHENANTHRENE	2200	36000	250	250	0.34	0.52	0.5	0.036 J
PYRENE	2400	45000	880	880	0.95	1.7	1.5	0.12

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	ZC-19 NTC56SSPSZC190006	ZC-19 NTC56SSPSZC190624	ZC-19 NTC56SSPSZC190624	ZH-15 NTC56SSPSZH150006
SAMPLE DATE	Residential	Industrial	Soil to GW		20120829	20120829	20120829	20120802
SAMPLE CODE					NORMAL	ORIG	DUP	NORMAL
MATRIX					SO	SO	SO	SO
TOP DEPTH (FEET)					0	0.5	0.5	0
BOTTOM DEPTH (FEET)					0.5	2	2	0.5
EASTING					543839.2326	543839.2326	543839.2326	543914.2326
NORTHING					1535758.272	1535758.272	1535758.272	1535823.827
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.026 U	0.024 U	0.023 U	0.023 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.026 U	0.024 U	0.023 U	0.023 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.027 U	0.025 U	0.024 U	0.024 U
ACENAPHTHYLENE	1800	20000	27	27	0.037 J	0.021 U	0.021 U	0.076
ANTHRACENE	21000	300000	2500	2500	0.027 J	0.016 U	0.016 U	0.051
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.6	0.0	0.0	0.8
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.25	0.015 J	0.011 J	0.44
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.39	0.011 J	0.0082 U	0.54
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.64	0.021 J	0.014 J	0.91
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.24	0.014 U	0.013 U	0.23
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.18	0.014 U	0.013 U	0.28
CHRYSENE	NC	NC	77	77	0.37	0.014 U	0.013 U	0.57
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.059	0.015 U	0.014 U	0.071
FLUORANTHENE	3200	59000	1200	1200	0.52	0.018 J	0.014 U	0.83
FLUORENE	2600	33000	160	160	0.026 U	0.024 U	0.023 U	0.026 J
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.21	0.014 U	0.013 U	0.23
NAPHTHALENE	55	300	1.2	1.2	0.028 U	0.026 U	0.026 U	0.025 U
PHENANTHRENE	2200	36000	250	250	0.15	0.02 U	0.02 U	0.3
PYRENE	2400	45000	880	880	0.5	0.018 J	0.014 J	0.76

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	ZH-15 NTC56SSPSZH150624	ZH-17 NTC56SSPSZH170006	ZH-17 NTC56SSPSZH170624	ZH-19 NTC56SSPSZH190006
SAMPLE DATE	Residential	Industrial	Soil to GW		20120802	20120829	20120829	20120829
SAMPLE CODE					NORMAL	NORMAL	NORMAL	NORMAL
MATRIX					SO	SO	SO	SO
TOP DEPTH (FEET)					0.5	0	0.5	0
BOTTOM DEPTH (FEET)					2	0.5	2	0.5
EASTING					543914.2326	543914.2326	543914.2326	543914.2326
NORTHING					1535823.827	1535793.827	1535793.827	1535763.827
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)								
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.023 U	0.026 U	0.024 U	0.025 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.023 U	0.026 U	0.024 U	0.025 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.038	0.028 U	0.025 U	0.026 U
ACENAPHTHYLENE	1800	20000	27	27	0.24	0.17	0.045	0.034 J
ANTHRACENE	21000	300000	2500	2500	0.098	0.059	0.016 U	0.017 U
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	1.0	0.6	0.1	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.55	0.28	0.054	0.062
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.72	0.41	0.084	0.092
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	1.1	0.73	0.14	0.18
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.42	0.25	0.051	0.053
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.38	0.18	0.036 J	0.046
CHRYSENE	NC	NC	77	77	0.81	0.5	0.11	0.12
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.11	0.06	0.015 J	0.015 U
FLUORANTHENE	3200	59000	1200	1200	1.1	0.68	0.14	0.17
FLUORENE	2600	33000	160	160	0.038	0.026 U	0.024 U	0.025 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.4	0.22	0.051	0.049
NAPHTHALENE	55	300	1.2	1.2	0.025 U	0.029 U	0.026 U	0.027 U
PHENANTHRENE	2200	36000	250	250	0.56	0.29	0.061	0.063
PYRENE	2400	45000	880	880	1.1	0.71	0.15	0.17

Table 2
PAH Concentrations in SA 56 (Playground Portion)
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID SAMPLE DATE SAMPLE CODE MATRIX TOP DEPTH (FEET) BOTTOM DEPTH (FEET) EASTING NORTHING	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	ZH-19 NTC56SSPSZH190624 20120829 NORMAL SO 0.5 2 543914.2326 1535763.827	ZI-15 NTC56SSPSZI150624 20120802 NORMAL SO 0.5 2 543929.2326 1535825.772	ZI-15 NTC56SSPSZI150006 20120802 NORMAL SO 0 0.5 543929.2326 1535825.772
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)							
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.024 U	0.022 U	0.082
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.024 U	0.022 U	0.12
ACENAPHTHENE	2400	20000	2.1	2.1	0.025 U	0.037	0.48
ACENAPHTHYLENE	1800	20000	27	27	0.038	0.75	0.27
ANTHRACENE	21000	300000	2500	2500	0.016 U	0.24	1.1
BAP EQUIVALENT-HALFND	0.1	0.7	8.0	0.1	0.1	2.9	6.2
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.034 J	1.6	4.1
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.051	2	4.3
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.1	3	6.9
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.035 J	1.1	1.7
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.028 J	0.8	1.8
CHRYSENE	NC	NC	77	77	0.079	2.2	4.3
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.015 U	0.37	0.59
FLUORANTHENE	3200	59000	1200	1200	0.1	2.2	8.1
FLUORENE	2600	33000	160	160	0.024 U	0.058	0.45
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.032 J	1	1.8
NAPHTHALENE	55	300	1.2	1.2	0.026 U	0.024 U	0.33
PHENANTHRENE	2200	36000	250	250	0.04	0.83	5.2
PYRENE	2400	45000	880	880	0.12	2.6	6.9

Table 3
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	A-4 NTC148SSA40006 20120802 NORMAL	A-4 NTC148SSA40624 20120802 NORMAL	A-5 NTC148SSA50006 20120712 NORMAL	A-5 NTC148SSA50624 20120712 NORMAL	A-6 NTC148SSA60006 20120712 ORIG	A-6 NTC148SSA60006-D 20120712 DUP	A-6 NTC148SSA60624 20120712 NORMAL	A-7 NTC148SSA70006 20120712 NORMAL
SAMPLE DATE	Residential	Industrial	Soil to GW									
SAMPLE CODE												
MATRIX					SO	SO	SO	SO	SO	SO	SO	SO
TOP DEPTH (FEET)					0	0.5	0	0.5	0	0	0.5	0
BOTTOM DEPTH (FEET)					0.5	2	0.5	2	0.5	0.5	2	0.5
EASTING					543856.5689	543856.5689	543856.5689	543856.5689	543856.5689	543856.5689	543856.5689	543856.5689
NORTHING					1536064.772	1536064.772	1536039.772	1536039.772	1536014.772	1536014.772	1536014.772	1535989.772
PESTICIDES (MG/KG)												
4,4'-DDD	4.2	22	5.8	4.2								
4,4'-DDE	2.9	15	18	2.9								
4,4'-DDT	2.9	15	11	2.9								
ALDRIN	0.06	0.3	0.2	0.06								
ALPHA-BHC	0.1	0.6	0.0003	0.0003								
ALPHA-CHLORDANE	NC	NC	NC	NC								
BETA-BHC	0.5	2.4	0.001	0.001								
DELTA-BHC	24	490	0.2	0.2								
DIELDRIN	0.06	0.3	0.002	0.002								
ENDOSULFAN I	NC	NC	NC	NC								
ENDOSULFAN II	NC	NC	NC	NC								
ENDOSULFAN SULFATE	NC	NC	NC	NC								
ENDRIN	25	510	1	1								
ENDRIN ALDEHYDE	NC	NC	NC	NC								
ENDRIN KETONE	NC	NC	NC	NC								
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009								
GAMMA-CHLORDANE	NC	NC	NC	NC								
HEPTACHLOR	0.2	1	23	0.2								
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1								
ISODRIN	NC	NC	NC	NC								
METHOXYCHLOR	420	8800	160	160								
MIREX	NC	NC	NC	NC								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)												
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.024 U	0.027 U	0.024 U	0.022 U	0.11 J	0.023 UJ	0.022 U	0.021 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.024 U	0.027 U	0.024 U	0.022 U	0.12 J	0.023 UJ	0.022 U	0.021 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.025 U	0.028 U	0.025 U	0.023 U	0.44 J	0.098 J	0.023 U	0.022 U
ACENAPHTHYLENE	1800	20000	27	27	0.022 U	0.024 U	0.03 J	0.02 U	0.061	0.033 J	0.028 J	0.019 U
ANTHRACENE	21000	300000	2500	2500	0.016 U	0.018 U	0.052	0.015 U	0.78 J	0.15 J	0.018 J	0.014 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.1	0.0	0.3	0.0	2.6	0.8	0.1	0.0
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.03 J	0.012 J	0.13	0.025 J	2 J	0.61 J	0.081	0.023 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.039	0.0095 U	0.15	0.025 J	1.8 J	0.6 J	0.085	0.013 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.064	0.017 U	0.41	0.078	2.6 J	0.94 J	0.14	0.024 J
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.028 J	0.015 U	0.11	0.02 J	0.88 J	0.21 J	0.05	0.012 U
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.022 J	0.015 U	0.12	0.019 J	0.88 J	0.36 J	0.04	0.012 U
CHRYSENE	NC	NC	77	77	0.035 J	0.015 U	0.17	0.027 J	2.1 J	0.63 J	0.095	0.012 U
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.015 U	0.017 U	0.036 J	0.014 U	0.26 J	0.061 J	0.014 U	0.013 U
FLUORANTHENE	3200	59000	1200	1200	0.055	0.017 U	0.16	0.026 J	4.4 J	1.2 J	0.17	0.021 J
FLUORENE	2600	33000	160	160	0.024 U	0.027 U	0.024 U	0.022 U	0.45 J	0.079 J	0.022 U	0.021 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.023 J	0.015 U	0.12	0.022 J	0.89 J	0.21 J	0.049	0.012 U
NAPHTHALENE	55	300	1.2	1.2	0.027 U	0.029 U	0.026 U	0.024 U	0.31 J	0.029 J	0.024 U	0.023 U
PHENANTHRENE	2200	36000	250	250	0.021 U	0.023 U	0.034 J	0.019 U	3.5 J	0.79 J	0.099	0.018 U
PYRENE	2400	45000	880	880	0.049	0.015 U	0.21	0.036	3.2 J	1 J	0.16	0.019 J

Table 3
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	A-7 NTC148SSA70624 20120712 NORMAL	B-5 NTC148SSB50006 20120712 NORMAL	B-5 NTC148SSB50624 20120712 ORIG	B-5 NTC148SSB50624-D 20120712 DUP	C-2 NTC148SSC20006 20120802 NORMAL	C-3 NTC148SSC30006 20120712 NORMAL	C-3 NTC148SSC30624 20120712 NORMAL	C-4 NTC148SSC40006 20120712 NORMAL
SAMPLE DATE	Residential	Industrial	Soil to GW									
SAMPLE CODE												
MATRIX					SO	SO	SO	SO	SO	SO	SO	SO
TOP DEPTH (FEET)					0.5	0	0.5	0.5	0	0	0.5	0
BOTTOM DEPTH (FEET)					2	0.5	2	2	0.5	0.5	2	0.5
EASTING					543856.5689	543881.5689	543881.5689	543881.5689	543906.8263	543906.8263	543906.8263	543906.8263
NORTHING					1535989.772	1536039.772	1536039.772	1536039.772	1536114.772	1536089.772	1536089.772	1536064.772
PESTICIDES (MG/KG)												
4,4'-DDD	4.2	22	5.8	4.2								
4,4'-DDE	2.9	15	18	2.9								
4,4'-DDT	2.9	15	11	2.9								
ALDRIN	0.06	0.3	0.2	0.06								
ALPHA-BHC	0.1	0.6	0.0003	0.0003								
ALPHA-CHLORDANE	NC	NC	NC	NC								
BETA-BHC	0.5	2.4	0.001	0.001								
DELTA-BHC	24	490	0.2	0.2								
DIELDRIN	0.06	0.3	0.002	0.002								
ENDOSULFAN I	NC	NC	NC	NC								
ENDOSULFAN II	NC	NC	NC	NC								
ENDOSULFAN SULFATE	NC	NC	NC	NC								
ENDRIN	25	510	1	1								
ENDRIN ALDEHYDE	NC	NC	NC	NC								
ENDRIN KETONE	NC	NC	NC	NC								
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009								
GAMMA-CHLORDANE	NC	NC	NC	NC								
HEPTACHLOR	0.2	1	23	0.2								
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1								
ISODRIN	NC	NC	NC	NC								
METHOXYCHLOR	420	8800	160	160								
MIREX	NC	NC	NC	NC								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)												
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.024 U	0.023 U	0.023 U	0.037 U	0.047 U	0.028 U	0.031 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.024 U	0.023 U	0.023 U	0.037 U	0.047 U	0.028 U	0.031 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.025 U	0.024 U	0.024 U	0.038 U	0.049 U	0.029 U	0.032 U
ACENAPHTHYLENE	1800	20000	27	27	0.02 U	0.021 U	0.02 U	0.021 U	0.033 U	0.042 U	0.025 U	0.028 U
ANTHRACENE	21000	300000	2500	2500	0.015 U	0.016 U	0.015 U	0.015 U	0.024 U	0.031 U	0.019 U	0.021 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.0 U	0.1	0.0	0.0	0.1	0.1	0.0 U	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.0098 U	0.047	0.021 J	0.024 J	0.049 J	0.063 J	0.012 U	0.096
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.0078 U	0.051	0.017 J	0.018 J	0.055 J	0.052 J	0.0099 U	0.1
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.014 U	0.095	0.03 J	0.036	0.12	0.084	0.017 U	0.19
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.013 U	0.032 J	0.013 U	0.013 U	0.023 J	0.033 J	0.016 U	0.054
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.013 U	0.026 J	0.013 U	0.013 U	0.024 J	0.031 J	0.016 U	0.048 J
CHRYSENE	NC	NC	77	77	0.013 U	0.054	0.014 J	0.017 J	0.059	0.05 J	0.016 U	0.12
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.014 U	0.015 U	0.014 U	0.014 U	0.023 U	0.029 U	0.017 U	0.019 U
FLUORANTHENE	3200	59000	1200	1200	0.014 U	0.092	0.028 J	0.034 J	0.099	0.098	0.017 U	0.21
FLUORENE	2600	33000	160	160	0.022 U	0.024 U	0.023 U	0.023 U	0.037 U	0.047 U	0.028 U	0.031 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.013 U	0.03 J	0.013 U	0.013 U	0.025 J	0.031 J	0.016 U	0.055
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.026 U	0.025 U	0.025 U	0.04 U	0.051 U	0.031 U	0.034 U
PHENANTHRENE	2200	36000	250	250	0.019 U	0.03 J	0.019 U	0.02 U	0.031 J	0.04 U	0.024 U	0.077
PYRENE	2400	45000	880	880	0.013 U	0.079	0.025 J	0.03 J	0.088	0.084	0.016 U	0.18

Table 3
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	C-4 NTC148SSC40624 20120712 NORMAL	C-6 NTC148SSC60006 20120613 NORMAL	C-6 NTC148SSC60624 20120613 NORMAL	C-7 NTC148SSC70006 20120612 NORMAL	C-7 NTC148SSC70624 20120612 NORMAL	C-8 NTC148SSC80006 20120612 NORMAL	C-8 NTC148SSC80624 20120612 NORMAL	D-1 NTC148SSD10006 20120802 NORMAL
SAMPLE DATE	Residential	Industrial	Soil to GW									
SAMPLE CODE												
MATRIX					SO							
TOP DEPTH (FEET)					0.5	0	0.5	0	0.5	0	0.5	0
BOTTOM DEPTH (FEET)					2	0.5	2	0.5	2	0.5	2	0.5
EASTING					543906.8263	543906.8263	543906.8263	543906.8263	543906.8263	543906.8263	543906.8263	543931.8263
NORTHING					1536064.772	1536014.772	1536014.772	1535989.772	1535989.772	1535964.772	1535964.772	1536139.772
PESTICIDES (MG/KG)												
4,4'-DDD	4.2	22	5.8	4.2								
4,4'-DDE	2.9	15	18	2.9								
4,4'-DDT	2.9	15	11	2.9								
ALDRIN	0.06	0.3	0.2	0.06								
ALPHA-BHC	0.1	0.6	0.0003	0.0003								
ALPHA-CHLORDANE	NC	NC	NC	NC								
BETA-BHC	0.5	2.4	0.001	0.001								
DELTA-BHC	24	490	0.2	0.2								
DIELDRIN	0.06	0.3	0.002	0.002								
ENDOSULFAN I	NC	NC	NC	NC								
ENDOSULFAN II	NC	NC	NC	NC								
ENDOSULFAN SULFATE	NC	NC	NC	NC								
ENDRIN	25	510	1	1								
ENDRIN ALDEHYDE	NC	NC	NC	NC								
ENDRIN KETONE	NC	NC	NC	NC								
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009								
GAMMA-CHLORDANE	NC	NC	NC	NC								
HEPTACHLOR	0.2	1	23	0.2								
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1								
ISODRIN	NC	NC	NC	NC								
METHOXYCHLOR	420	8800	160	160								
MIREX	NC	NC	NC	NC								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)												
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.026 U	0.41	0.022 U	0.022 U	0.022 U	0.023 U	0.022 U	0.042 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.026 U	0.45	0.022 U	0.022 U	0.022 U	0.023 U	0.022 U	0.042 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.028 U	1.4	0.044	0.023 U	0.023 U	0.024 U	0.023 U	0.044 U
ACENAPHTHYLENE	1800	20000	27	27	0.024 U	0.2	0.025 J	0.02 U	0.02 U	0.021 U	0.02 U	0.038 U
ANTHRACENE	21000	300000	2500	2500	0.018 U	1.6	0.071	0.015 U	0.015 U	0.015 U	0.015 U	0.028 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.0	7.4	0.5	0.0	0.0	0.0	0.0 U	0.0
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.02 J	5.8	0.35	0.025 J	0.015 J	0.014 J	0.0099 U	0.019 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.01 J	5.3	0.33	0.016 J	0.0078 U	0.008 U	0.0079 U	0.015 U
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.018 J	8.1	0.54	0.035	0.014 U	0.015 J	0.014 U	0.026 U
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.015 U	1.8	0.12	0.013 U	0.013 U	0.013 U	0.013 U	0.024 U
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.015 U	3.4	0.2	0.013 U	0.013 U	0.013 U	0.013 U	0.024 U
CHRYSENE	NC	NC	77	77	0.015 U	6.4	0.37	0.017 J	0.013 U	0.013 U	0.013 U	0.024 U
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.016 U	0.47	0.03 J	0.014 U	0.014 U	0.014 U	0.014 U	0.026 U
FLUORANTHENE	3200	59000	1200	1200	0.023 J	12	0.71	0.035	0.015 J	0.014 U	0.014 U	0.026 U
FLUORENE	2600	33000	160	160	0.026 U	1.2	0.038	0.022 U	0.022 U	0.023 U	0.022 U	0.042 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.015 U	1.8	0.12	0.013 U	0.013 U	0.013 U	0.013 U	0.024 U
NAPHTHALENE	55	300	1.2	1.2	0.029 U	1.2	0.024 U	0.024 U	0.024 U	0.025 U	0.024 U	0.046 U
PHENANTHRENE	2200	36000	250	250	0.023 U	10	0.42	0.019 U	0.019 U	0.019 U	0.019 U	0.036 U
PYRENE	2400	45000	880	880	0.019 J	9.9	0.6	0.029 J	0.013 J	0.013 U	0.013 U	0.024 U

Table 3
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	D-2 NTC148SSD20006 20120712 NORMAL	D-2 NTC148SSD20624 20120712 NORMAL	D-4 NTC148SSD40006 20120712 NORMAL	D-4 NTC148SSD40624 20120712 NORMAL	D-5 NTC148SSD50006 20120613 NORMAL	D-5 NTC148SSD50624 20120613 NORMAL	D-6 NTC148SSD60006 20120612 NORMAL	D-6 NTC148SSD60624 20120612 NORMAL
SAMPLE DATE	Residential	Industrial	Soil to GW									
SAMPLE CODE												
MATRIX					SO							
TOP DEPTH (FEET)					0	0.5	0	0.5	0	0.5	0	0.5
BOTTOM DEPTH (FEET)					0.5	2	0.5	2	0.5	2	0.5	2
EASTING					543931.8263	543931.8263	543931.8263	543931.8263	543931.8263	543931.8263	543931.8263	543931.8263
NORTHING					1536114.772	1536114.772	1536064.772	1536064.772	1536039.772	1536039.772	1536014.772	1536014.772
PESTICIDES (MG/KG)												
4,4'-DDD	4.2	22	5.8	4.2								
4,4'-DDE	2.9	15	18	2.9								
4,4'-DDT	2.9	15	11	2.9								
ALDRIN	0.06	0.3	0.2	0.06								
ALPHA-BHC	0.1	0.6	0.0003	0.0003								
ALPHA-CHLORDANE	NC	NC	NC	NC								
BETA-BHC	0.5	2.4	0.001	0.001								
DELTA-BHC	24	490	0.2	0.2								
DIELDRIN	0.06	0.3	0.002	0.002								
ENDOSULFAN I	NC	NC	NC	NC								
ENDOSULFAN II	NC	NC	NC	NC								
ENDOSULFAN SULFATE	NC	NC	NC	NC								
ENDRIN	25	510	1	1								
ENDRIN ALDEHYDE	NC	NC	NC	NC								
ENDRIN KETONE	NC	NC	NC	NC								
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009								
GAMMA-CHLORDANE	NC	NC	NC	NC								
HEPTACHLOR	0.2	1	23	0.2								
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1								
ISODRIN	NC	NC	NC	NC								
METHOXYCHLOR	420	8800	160	160								
MIREX	NC	NC	NC	NC								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)												
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.047 U	0.035 U	0.027 U	0.028 U	0.11 U	0.022 U	0.03 J	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.047 U	0.035 U	0.027 U	0.028 U	0.11 U	0.022 U	0.03 J	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.05 U	0.037 U	0.029 U	0.03 U	0.12 U	0.023 U	0.19	0.024 J
ACENAPHTHYLENE	1800	20000	27	27	0.043 U	0.032 U	0.086	0.065	0.34	0.022 J	0.64	0.07
ANTHRACENE	21000	300000	2500	2500	0.032 U	0.024 U	0.037 J	0.037 J	0.12 J	0.015 U	0.51	0.079
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.2	0.0	0.4	0.3	0.9	0.1	3.6	0.5
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.1	0.024 J	0.2	0.21	0.57	0.068	2.4	0.41
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.12	0.013 J	0.25	0.24	0.63	0.067	2.6	0.36
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.2	0.022 J	0.44	0.4	0.85	0.1	4	0.62
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.076	0.02 U	0.092	0.11	0.51	0.051	0.68	0.11
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.068 J	0.02 U	0.11	0.11	0.28	0.033 J	1.1	0.2
CHRYSENE	NC	NC	77	77	0.13	0.02 U	0.26	0.25	0.67	0.073	2.8	0.42
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.029 U	0.022 U	0.026 J	0.031 J	0.096 J	0.014 U	0.23	0.031 J
FLUORANTHENE	3200	59000	1200	1200	0.23	0.025 J	0.37	0.4	1.1	0.13	4.6	0.78
FLUORENE	2600	33000	160	160	0.047 U	0.035 U	0.027 U	0.028 U	0.11 U	0.022 U	0.23	0.026 J
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.073 J	0.02 U	0.092	0.11	0.39	0.043	0.72	0.11
NAPHTHALENE	55	300	1.2	1.2	0.052 U	0.039 U	0.03 U	0.031 U	0.13 U	0.024 U	0.057	0.024 U
PHENANTHRENE	2200	36000	250	250	0.089	0.03 U	0.11	0.15	0.49	0.049	2.1	0.38
PYRENE	2400	45000	880	880	0.2	0.022 J	0.39	0.38	1.2	0.13	4.7	0.68

Table 3
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	D-7 NTC148SSD70006 20120508 NORMAL	D-7 NTC148SSD70624 20120508 NORMAL	E-2 NTC148SSE20006 20120712 NORMAL	E-2 NTC148SSE20624 20120712 NORMAL	E-3 NTC148SSE30006 20120712 NORMAL	E-3 NTC148SSE30624 20120712 NORMAL	E-4 NTC148SSE40006 20120613 NORMAL	E-4 NTC148SSE40624 20120613 NORMAL
SAMPLE DATE	Residential	Industrial	Soil to GW									
SAMPLE CODE												
MATRIX					SO							
TOP DEPTH (FEET)					0	0.5	0	0.5	0	0.5	0	0.5
BOTTOM DEPTH (FEET)					0.5	2	0.5	2	0.5	2	0.5	2
EASTING					543931.8263	543931.8263	543956.8263	543956.8263	543956.8263	543956.8263	543956.8263	543956.8263
NORTHING					1535989.772	1535989.772	1536114.772	1536114.772	1536089.772	1536089.772	1536064.772	1536064.772
PESTICIDES (MG/KG)												
4,4'-DDD	4.2	22	5.8	4.2								
4,4'-DDE	2.9	15	18	2.9								
4,4'-DDT	2.9	15	11	2.9								
ALDRIN	0.06	0.3	0.2	0.06								
ALPHA-BHC	0.1	0.6	0.0003	0.0003								
ALPHA-CHLORDANE	NC	NC	NC	NC								
BETA-BHC	0.5	2.4	0.001	0.001								
DELTA-BHC	24	490	0.2	0.2								
DIELDRIN	0.06	0.3	0.002	0.002								
ENDOSULFAN I	NC	NC	NC	NC								
ENDOSULFAN II	NC	NC	NC	NC								
ENDOSULFAN SULFATE	NC	NC	NC	NC								
ENDRIN	25	510	1	1								
ENDRIN ALDEHYDE	NC	NC	NC	NC								
ENDRIN KETONE	NC	NC	NC	NC								
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009								
GAMMA-CHLORDANE	NC	NC	NC	NC								
HEPTACHLOR	0.2	1	23	0.2								
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1								
ISODRIN	NC	NC	NC	NC								
METHOXYCHLOR	420	8800	160	160								
MIREX	NC	NC	NC	NC								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)												
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.021 U	0.022 U	0.048 U	0.031 U	0.038 U	0.03 U	0.025 U	0.026 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.021 U	0.022 U	0.048 U	0.031 U	0.038 U	0.03 U	0.025 U	0.026 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.022 U	0.023 U	0.05 U	0.033 U	0.04 U	0.031 U	0.026 U	0.027 U
ACENAPHTHYLENE	1800	20000	27	27	0.019 U	0.02 U	0.043 U	0.028 U	0.034 U	0.027 U	0.037 J	0.023 U
ANTHRACENE	21000	300000	2500	2500	0.05	0.014 U	0.032 U	0.021 U	0.025 U	0.02 U	0.029 J	0.017 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.3	0.0	0.1	0.0 U	0.1	0.0 U	0.3	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.22	0.02 J	0.06 J	0.014 U	0.075	0.013 U	0.24	0.035 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.22	0.014 J	0.057 J	0.011 U	0.078	0.011 U	0.24	0.031 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.34	0.022 J	0.11	0.019 U	0.14	0.019 U	0.47	0.053
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.17	0.012 U	0.036 J	0.018 U	0.037 J	0.017 U	0.084	0.025 J
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.13	0.012 U	0.03 J	0.018 U	0.04 J	0.017 U	0.14	0.017 J
CHRYSENE	NC	NC	77	77	0.25	0.013 J	0.06 J	0.018 U	0.083	0.017 U	0.28	0.033 J
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.035	0.013 U	0.03 U	0.019 U	0.024 U	0.019 U	0.023 J	0.016 U
FLUORANTHENE	3200	59000	1200	1200	0.48	0.026 J	0.11	0.019 U	0.15	0.019 U	0.31	0.058
FLUORENE	2600	33000	160	160	0.021 U	0.022 U	0.048 U	0.031 U	0.038 U	0.03 U	0.025 U	0.026 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.15	0.012 U	0.033 J	0.018 U	0.036 J	0.017 U	0.087	0.021 J
NAPHTHALENE	55	300	1.2	1.2	0.023 U	0.024 U	0.052 U	0.034 U	0.042 U	0.033 U	0.027 U	0.028 U
PHENANTHRENE	2200	36000	250	250	0.25	0.019 U	0.041 J	0.027 U	0.054 J	0.026 U	0.098	0.025 J
PYRENE	2400	45000	880	880	0.39	0.023 J	0.097	0.018 U	0.14	0.017 U	0.3	0.059

Table 3
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	E-5 NTC148SSE50006 20120612 NORMAL	E-5 NTC148SSE50624 20120612 NORMAL	E-6 NTC148SSE60006 20120503 NORMAL	E-6 NTC148SSE60624 20120503 NORMAL	E-7 NTC148SSE70006 20120504 ORIG	E-7 NTC148SSE70006-D 20120504 DUP	E-7 NTC148SSE70624 20120504 ORIG	E-7 NTC148SSE70624-D 20120504 DUP
SAMPLE DATE	Residential	Industrial	Soil to GW		SO	SO	SO	SO	SO	SO	SO	SO
SAMPLE CODE					0	0.5	0	0.5	0	0	0.5	0.5
MATRIX					0.5	2	0.5	2	0.5	0.5	2	2
TOP DEPTH (FEET)					543956.8263	543956.8263	543956.8263	543956.8263	543956.8263	543956.8263	543956.8263	543956.8263
BOTTOM DEPTH (FEET)					1536039.772	1536039.772	1536014.772	1536014.772	1535989.772	1535989.772	1535989.772	1535989.772
EASTING												
NORTHING												
PESTICIDES (MG/KG)												
4,4'-DDD	4.2	22	5.8	4.2								
4,4'-DDE	2.9	15	18	2.9								
4,4'-DDT	2.9	15	11	2.9								
ALDRIN	0.06	0.3	0.2	0.06								
ALPHA-BHC	0.1	0.6	0.0003	0.0003								
ALPHA-CHLORDANE	NC	NC	NC	NC								
BETA-BHC	0.5	2.4	0.001	0.001								
DELTA-BHC	24	490	0.2	0.2								
DIELDRIN	0.06	0.3	0.002	0.002			0.021	0.0033 J	0.0024 U	0.0025 U	0.0025 U	0.0025 U
ENDOSULFAN I	NC	NC	NC	NC								
ENDOSULFAN II	NC	NC	NC	NC								
ENDOSULFAN SULFATE	NC	NC	NC	NC								
ENDRIN	25	510	1	1								
ENDRIN ALDEHYDE	NC	NC	NC	NC								
ENDRIN KETONE	NC	NC	NC	NC								
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009								
GAMMA-CHLORDANE	NC	NC	NC	NC								
HEPTACHLOR	0.2	1	23	0.2								
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1								
ISODRIN	NC	NC	NC	NC								
METHOXYCHLOR	420	8800	160	160								
MIREX	NC	NC	NC	NC								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)												
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.022 U	0.043 U	0.089	0.031 J	0.079	0.045	0.11
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.022 U	0.043 U	0.11	0.023 J	0.077	0.048 J	0.12 J
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.023 U	0.095	0.35	0.32 J	0.64 J	0.34 J	0.88 J
ACENAPHTHYLENE	1800	20000	27	27	0.041	0.02 U	0.52	0.39	0.78 J	1.7 J	1.1	1.2
ANTHRACENE	21000	300000	2500	2500	0.021 J	0.015 U	0.39	1.3	1.1 J	2 J	0.97 J	2 J
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.2	0.0	3.5	4.9	8.3	16.4	7.4	12.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.13	0.022 J	2.2	3.8	6.1 J	12 J	5 J	9.2 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.17	0.015 J	2.5	3.4	6.1 J	12 J	5.4	8.8
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.29	0.028 J	3.8	5.5	7.9 J	16 J	7 J	13 J
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.063	0.012 U	1.3	1.4	2.1 J	4.1 J	2.2	2.6
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.082	0.012 U	1.2	1.6	3.4 J	6.8 J	2.9	4.2
CHRYSENE	NC	NC	77	77	0.15	0.014 J	2.4	3.7	6.2 J	12 J	5.3 J	9.7 J
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.017 J	0.013 U	0.28	0.37	0.59 J	1.1 J	0.58	0.74
FLUORANTHENE	3200	59000	1200	1200	0.21	0.023 J	4.3	7.9	11 J	20 J	8.8 J	19 J
FLUORENE	2600	33000	160	160	0.022 U	0.022 U	0.095	0.47	0.29 J	0.59 J	0.36 J	0.78 J
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.067	0.012 U	1.1	1.4	2.1 J	4.2 J	2.1	2.7
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.024 U	0.047 U	0.24	0.032 J	0.15	0.12 J	0.33 J
PHENANTHRENE	2200	36000	250	250	0.076	0.019 U	1.4	5.5	4.6 J	8.4 J	3.9 J	9.4 J
PYRENE	2400	45000	880	880	0.22	0.025 J	4	6.6	8.7 J	17 J	7.9 J	16 J

Table 3
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	E-8 NTC148SSE80006 20120508 NORMAL	E-8 NTC148SSE80624 20120508 NORMAL	F-1 NTC148SSF10006 20120712 NORMAL	F-1 NTC148SSF10624 20120712 NORMAL	F-3 NTC148SSF30006 20120613 NORMAL	F-3 NTC148SSF30624 20120613 NORMAL	F-4 NTC148SSF40006 20120612 NORMAL	F-4 NTC148SSF40624 20120612 NORMAL
SAMPLE DATE	Residential	Industrial	Soil to GW									
SAMPLE CODE												
MATRIX					SO							
TOP DEPTH (FEET)					0	0.5	0	0.5	0	0.5	0	0.5
BOTTOM DEPTH (FEET)					0.5	2	0.5	2	0.5	2	0.5	2
EASTING					543956.8263	543956.8263	543981.8263	543981.8263	543981.8263	543981.8263	543981.8263	543981.8263
NORTHING					1535964.772	1535964.772	1536139.772	1536139.772	1536089.772	1536089.772	1536064.772	1536064.772
PESTICIDES (MG/KG)												
4,4'-DDD	4.2	22	5.8	4.2								
4,4'-DDE	2.9	15	18	2.9								
4,4'-DDT	2.9	15	11	2.9								
ALDRIN	0.06	0.3	0.2	0.06								
ALPHA-BHC	0.1	0.6	0.0003	0.0003								
ALPHA-CHLORDANE	NC	NC	NC	NC								
BETA-BHC	0.5	2.4	0.001	0.001								
DELTA-BHC	24	490	0.2	0.2								
DIELDRIN	0.06	0.3	0.002	0.002	0.0049	0.0038					0.0044	0.0056
ENDOSULFAN I	NC	NC	NC	NC								
ENDOSULFAN II	NC	NC	NC	NC								
ENDOSULFAN SULFATE	NC	NC	NC	NC								
ENDRIN	25	510	1	1								
ENDRIN ALDEHYDE	NC	NC	NC	NC								
ENDRIN KETONE	NC	NC	NC	NC								
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009								
GAMMA-CHLORDANE	NC	NC	NC	NC								
HEPTACHLOR	0.2	1	23	0.2								
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1								
ISODRIN	NC	NC	NC	NC								
METHOXYCHLOR	420	8800	160	160								
MIREX	NC	NC	NC	NC								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)												
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.022 U	0.033 U	0.03 U	0.036 U	0.028 U	0.024 U	0.024 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.022 U	0.033 U	0.03 U	0.036 U	0.028 U	0.024 U	0.024 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.023 U	0.034 U	0.032 U	0.037 U	0.029 U	0.025 U	0.026 U
ACENAPHTHYLENE	1800	20000	27	27	0.04	0.059	0.03 U	0.027 U	0.038 J	0.025 U	0.031 J	0.048
ANTHRACENE	21000	300000	2500	2500	0.037	0.032 J	0.022 U	0.02 U	0.043 J	0.018 U	0.021 J	0.026 J
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.4	0.4	0.0 U	0.0 U	0.4	0.0 U	0.2	0.3
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.24	0.21	0.015 U	0.013 U	0.36	0.012 U	0.13	0.16
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.26	0.26	0.012 U	0.011 U	0.3	0.0097 U	0.17	0.18
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.38	0.37	0.02 U	0.019 U	0.62	0.017 U	0.28	0.29
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.18	0.17	0.019 U	0.017 U	0.073	0.016 U	0.071	0.095
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.13	0.13	0.019 U	0.017 U	0.2	0.016 U	0.083	0.084
CHRYSENE	NC	NC	77	77	0.25	0.24	0.019 U	0.017 U	0.45	0.016 U	0.16	0.18
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.037	0.035	0.02 U	0.019 U	0.022 U	0.017 U	0.018 J	0.018 J
FLUORANTHENE	3200	59000	1200	1200	0.46	0.37	0.02 U	0.019 U	0.87	0.017 U	0.28	0.3
FLUORENE	2600	33000	160	160	0.022 U	0.022 U	0.033 U	0.03 U	0.036 U	0.028 U	0.024 U	0.024 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.15	0.14	0.019 U	0.017 U	0.081	0.016 U	0.069	0.064
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.024 U	0.036 U	0.033 U	0.039 U	0.03 U	0.026 U	0.027 U
PHENANTHRENE	2200	36000	250	250	0.17	0.14	0.028 U	0.026 U	0.44	0.024 U	0.11	0.17
PYRENE	2400	45000	880	880	0.4	0.35	0.019 U	0.017 U	0.73	0.016 U	0.25	0.3

Table 3
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	F-5 NTC148SSF50006 20120508 NORMAL	F-5 NTC148SSF50624 20120508 NORMAL	F-6 NTC148SSF60006 20120503 NORMAL	F-6 NTC148SSF60624 20120503 NORMAL	F-7 NTC148SSF70624 20120503 NORMAL	F-7 NTC148SSF72436 20120802 NORMAL	F-8 NTC148SSF80006 20120503 NORMAL	F-8 NTC148SSF80624 20120503 NORMAL
SAMPLE DATE	Residential	Industrial	Soil to GW									
SAMPLE CODE												
MATRIX					SO							
TOP DEPTH (FEET)					0	0.5	0	0.5	0.5	2	0	0.5
BOTTOM DEPTH (FEET)					0.5	2	0.5	2	2	3	0.5	2
EASTING					543981.8263	543981.8263	543981.8263	543981.8263	543981.8263	543981.8263	543981.8263	543981.8263
NORTHING					1536039.772	1536039.772	1536014.772	1536014.772	1535989.772	1535989.772	1535964.772	1535964.772
PESTICIDES (MG/KG)												
4,4'-DDD	4.2	22	5.8	4.2								
4,4'-DDE	2.9	15	18	2.9								
4,4'-DDT	2.9	15	11	2.9								
ALDRIN	0.06	0.3	0.2	0.06								
ALPHA-BHC	0.1	0.6	0.0003	0.0003								
ALPHA-CHLORDANE	NC	NC	NC	NC								
BETA-BHC	0.5	2.4	0.001	0.001								
DELTA-BHC	24	490	0.2	0.2								
DIELDRIN	0.06	0.3	0.002	0.002					0.075		0.016	0.17
ENDOSULFAN I	NC	NC	NC	NC								
ENDOSULFAN II	NC	NC	NC	NC								
ENDOSULFAN SULFATE	NC	NC	NC	NC								
ENDRIN	25	510	1	1								
ENDRIN ALDEHYDE	NC	NC	NC	NC								
ENDRIN KETONE	NC	NC	NC	NC								
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009								
GAMMA-CHLORDANE	NC	NC	NC	NC								
HEPTACHLOR	0.2	1	23	0.2								
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1								
ISODRIN	NC	NC	NC	NC								
METHOXYCHLOR	420	8800	160	160								
MIREX	NC	NC	NC	NC								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)												
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.021 U	0.022 U	0.022 U	0.022 J	0.022 U	0.022 U	0.022 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.021 U	0.022 U	0.022 U	0.023 J	0.022 U	0.022 U	0.022 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.022 U	0.047	0.023 U	0.11	0.045	0.046	0.023 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.089	0.12	0.02 U	0.07	0.47	0.071	0.039	0.02 U
ANTHRACENE	21000	300000	2500	2500	0.026 J	0.13	0.027 J	0.13	0.24	0.16	0.038	0.026 J
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.3	0.8	0.2	1.2	1.8	0.7	0.2	0.2
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.14	0.51	0.11	0.81	1.1	0.6	0.16	0.14
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.2	0.54	0.12	0.86	1.3	0.49	0.17	0.13
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.3	0.77	0.16	1.3	1.9	0.74	0.26	0.21
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.14	0.34	0.12	0.58	0.53	0.32	0.15	0.084
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.1	0.27	0.062	0.43	0.61	0.23	0.082	0.068
CHRYSENE	NC	NC	77	77	0.2	0.55	0.12	0.97	1.3	0.59	0.17	0.15
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.025 J	0.07	0.017 J	0.11	0.13	0.075	0.023 J	0.015 J
FLUORANTHENE	3200	59000	1200	1200	0.23	1	0.23	2.1	2.1	1.1	0.29	0.28
FLUORENE	2600	33000	160	160	0.021 U	0.067	0.022 U	0.096	0.072	0.059	0.022 U	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.11	0.28	0.068	0.42	0.46	0.25	0.09	0.056
NAPHTHALENE	55	300	1.2	1.2	0.023 U	0.024 U	0.024 U	0.061	0.024 U	0.025 U	0.024 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.074	0.59	0.11	1.3	0.81	0.63	0.15	0.13
PYRENE	2400	45000	880	880	0.26	0.86	0.19	1.6	2.1	0.93	0.27	0.24

Table 3
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	G-3 NTC148SSG30006 20120613 NORMAL	G-3 NTC148SSG30624 20120613 NORMAL	G-4 NTC148SSG40006 20120612 NORMAL	G-4 NTC148SSG40624 20120612 NORMAL	G-5 NTC148SSG50624 20120503 NORMAL	G-6 NTC148SSG60624 20120503 ORIG	G-6 NTC148SSG60624-D 20120503 DUP	G-7 NTC148SSG70006 20120503 NORMAL
SAMPLE DATE	Residential	Industrial	Soil to GW		SO	SO	SO	SO	SO	SO	SO	SO
SAMPLE CODE					0	0.5	0	0.5	0.5	0.5	0.5	0
MATRIX					0.5	2	0.5	2	2	2	2	0.5
TOP DEPTH (FEET)					544006.8263	544006.8263	544006.8263	544006.8263	544006.8263	544006.8263	544006.8263	544006.8263
BOTTOM DEPTH (FEET)					1536089.772	1536089.772	1536064.772	1536064.772	1536039.772	1536014.772	1536014.772	1535989.772
EASTING												
NORTHING												
PESTICIDES (MG/KG)												
4,4'-DDD	4.2	22	5.8	4.2								
4,4'-DDE	2.9	15	18	2.9								
4,4'-DDT	2.9	15	11	2.9								
ALDRIN	0.06	0.3	0.2	0.06								
ALPHA-BHC	0.1	0.6	0.0003	0.0003								
ALPHA-CHLORDANE	NC	NC	NC	NC								
BETA-BHC	0.5	2.4	0.001	0.001								
DELTA-BHC	24	490	0.2	0.2								
DIELDRIN	0.06	0.3	0.002	0.002								0.012
ENDOSULFAN I	NC	NC	NC	NC								
ENDOSULFAN II	NC	NC	NC	NC								
ENDOSULFAN SULFATE	NC	NC	NC	NC								
ENDRIN	25	510	1	1								
ENDRIN ALDEHYDE	NC	NC	NC	NC								
ENDRIN KETONE	NC	NC	NC	NC								
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009								
GAMMA-CHLORDANE	NC	NC	NC	NC								
HEPTACHLOR	0.2	1	23	0.2								
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1								
ISODRIN	NC	NC	NC	NC								
METHOXYCHLOR	420	8800	160	160								
MIREX	NC	NC	NC	NC								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)												
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.044 J	0.026 U	0.024 U	0.024 U	0.022 U	0.022 U	0.022 J	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.033 J	0.026 U	0.024 U	0.024 U	0.022 U	0.022 U	0.022 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.031 U	0.028 U	0.025 U	0.025 U	0.023 U	0.025 J	0.19 J	0.03 J
ACENAPHTHYLENE	1800	20000	27	27	0.33	0.031 J	0.032 J	0.022 U	0.11	0.048 J	0.14 J	0.029 J
ANTHRACENE	21000	300000	2500	2500	0.092	0.018 U	0.057	0.016 U	0.078	0.11 J	0.56 J	0.082
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.6	0.1	0.4	0.1	0.6	0.6	1.9	0.5
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.3	0.036 J	0.28	0.037 J	0.41	0.49 J	1.7 J	0.32
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.45	0.042	0.25	0.043	0.43	0.42 J	1.3 J	0.33
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.89	0.088	0.44	0.077	0.64	0.62 J	2.3 J	0.51
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.17	0.023 J	0.083	0.02 J	0.24	0.3 J	0.58 J	0.31
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.33	0.028 J	0.14	0.023 J	0.2	0.19 J	0.67 J	0.18
CHRYSENE	NC	NC	77	77	0.84	0.079	0.29	0.053	0.44	0.49 J	1.6 J	0.33
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.039 J	0.016 U	0.026 J	0.015 U	0.039	0.053 J	0.12 J	0.033 J
FLUORANTHENE	3200	59000	1200	1200	1.1	0.12	0.55	0.078	0.74	0.97 J	3.6 J	0.66
FLUORENE	2600	33000	160	160	0.058	0.026 U	0.024 U	0.024 U	0.023 J	0.036 J	0.23 J	0.035
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.17	0.021 J	0.084	0.018 J	0.15	0.21 J	0.43 J	0.12
NAPHTHALENE	55	300	1.2	1.2	0.038 J	0.029 U	0.026 U	0.027 U	0.024 U	0.024 U	0.031 J	0.024 U
PHENANTHRENE	2200	36000	250	250	0.91	0.098	0.25	0.047	0.3	0.39 J	2.3 J	0.35
PYRENE	2400	45000	880	880	1.3	0.14	0.47	0.086	0.7	0.85 J	3.1 J	0.55

Table 3
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	G-7 NTC148SSG70624 20120503 NORMAL	G-8 NTC148SSG80624 20120503 NORMAL	G-8 NTC148SSG82436 20120802 NORMAL	H-2 NTC148SSH20006 20120712 NORMAL	H-2 NTC148SSH20624 20120712 NORMAL	H-3 NTC148SSH30006 20120613 NORMAL	H-3 NTC148SSH30624 20120613 NORMAL	H-4 NTC148SSH40006 20120612 NORMAL
SAMPLE DATE	Residential	Industrial	Soil to GW									
SAMPLE CODE												
MATRIX					SO							
TOP DEPTH (FEET)					0.5	0.5	2	0	0.5	0	0.5	0
BOTTOM DEPTH (FEET)					2	2	3	0.5	2	0.5	2	0.5
EASTING					544006.8263	544006.8263	544006.8263	544031.8263	544031.8263	544031.8263	544031.8263	544031.8263
NORTHING					1535989.772	1535964.772	1535964.772	1536114.772	1536114.772	1536089.772	1536089.772	1536064.772
PESTICIDES (MG/KG)												
4,4'-DDD	4.2	22	5.8	4.2			0.04					
4,4'-DDE	2.9	15	18	2.9			0.0024					
4,4'-DDT	2.9	15	11	2.9			0.0058					
ALDRIN	0.06	0.3	0.2	0.06			0.00053 U					
ALPHA-BHC	0.1	0.6	0.0003	0.0003			0.00053 U					
ALPHA-CHLORDANE	NC	NC	NC	NC			0.00049 U					
BETA-BHC	0.5	2.4	0.001	0.001			0.0011 U					
DELTA-BHC	24	490	0.2	0.2			0.00052 U					
DIELDRIN	0.06	0.3	0.002	0.002	0.0024 U	0.18	0.0013 J					
ENDOSULFAN I	NC	NC	NC	NC			0.00042 U					
ENDOSULFAN II	NC	NC	NC	NC			0.00052 U					
ENDOSULFAN SULFATE	NC	NC	NC	NC			0.00053 U					
ENDRIN	25	510	1	1			0.0008 U					
ENDRIN ALDEHYDE	NC	NC	NC	NC			0.00054 U					
ENDRIN KETONE	NC	NC	NC	NC			0.00049 U					
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009			0.00049 U					
GAMMA-CHLORDANE	NC	NC	NC	NC			0.00049 U					
HEPTACHLOR	0.2	1	23	0.2			0.00057 U					
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1			0.00052 U					
ISODRIN	NC	NC	NC	NC			0.00049 U					
METHOXYCHLOR	420	8800	160	160			0.00093 U					
MIREX	NC	NC	NC	NC			0.00054 U					
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)												
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.045			0.027 U		0.026 U	0.025 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.056		0.022 U		0.026 U	0.025 U	0.025 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.37		0.023 U		0.028 U	0.026 U	0.027 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.18		0.026 J		0.024 U	0.033 J	0.037 J	0.097
ANTHRACENE	21000	300000	2500	2500	0.84		0.037		0.018 U	0.017 U	0.017 U	0.035
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	4.2	0.3		0.1	0.1	0.2	0.0	0.3
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	3.6	0.21		0.063	0.058	0.092	0.023 J	0.16
BENZO(A)PYRENE	0.1	0.7	8	0.1	3	0.21		0.072	0.072	0.12	0.021 J	0.25
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	4.7	0.31		0.13	0.14	0.2	0.04	0.38
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.97		0.2		0.044	0.052	0.049	0.15
BENZO(K)FLUORANTHENE	NC	NC	24	24	1.8		0.13		0.033 J	0.035 J	0.082	0.11
CHRYSENE	NC	NC	77	77	3.5		0.24		0.076	0.083	0.13	0.2
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.27		0.026 J		0.017 U	0.016 U	0.015 U	0.028 J
FLUORANTHENE	3200	59000	1200	1200	7.1 J		0.42		0.12	0.12	0.17	0.3
FLUORENE	2600	33000	160	160	0.36		0.022 U		0.027 U	0.026 U	0.025 U	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.97		0.1		0.038 J	0.032 J	0.044	0.11
NAPHTHALENE	55	300	1.2	1.2	0.13		0.024 U		0.029 U	0.028 U	0.027 U	0.024 U
PHENANTHRENE	2200	36000	250	250	3.6		0.2		0.043	0.044	0.058	0.097
PYRENE	2400	45000	880	880	5.9		0.36		0.12	0.12	0.18	0.3

Table 3
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	H-4 NTC148SSH40624 20120612 NORMAL	H-5 NTC148SSH50006 20120508 NORMAL	H-5 NTC148SSH50624 20120508 NORMAL	H-6 NTC148SSH60006 20120503 ORIG	H-6 NTC148SSH60006-D 20120503 DUP	H-6 NTC148SSH60624 20120503 NORMAL	H-7 NTC148SSH70006 20120503 NORMAL	H-7 NTC148SSH70624 20120503 NORMAL
SAMPLE DATE	Residential	Industrial	Soil to GW		SO	SO	SO	SO	SO	SO	SO	SO
SAMPLE CODE					0.5	0	0.5	0	0	0.5	0	0.5
MATRIX					2	0.5	2	0.5	0.5	2	0.5	2
TOP DEPTH (FEET)					544031.8263	544031.8263	544031.8263	544031.8263	544031.8263	544031.8263	544031.8263	544031.8263
BOTTOM DEPTH (FEET)					1536064.772	1536039.772	1536039.772	1536014.772	1536014.772	1536014.772	1535989.772	1535989.772
EASTING												
NORTHING												
PESTICIDES (MG/KG)												
4,4'-DDD	4.2	22	5.8	4.2								
4,4'-DDE	2.9	15	18	2.9								
4,4'-DDT	2.9	15	11	2.9								
ALDRIN	0.06	0.3	0.2	0.06								
ALPHA-BHC	0.1	0.6	0.0003	0.0003								
ALPHA-CHLORDANE	NC	NC	NC	NC								
BETA-BHC	0.5	2.4	0.001	0.001								
DELTA-BHC	24	490	0.2	0.2								
DIELDRIN	0.06	0.3	0.002	0.002							0.0023 U	0.0024 U
ENDOSULFAN I	NC	NC	NC	NC								
ENDOSULFAN II	NC	NC	NC	NC								
ENDOSULFAN SULFATE	NC	NC	NC	NC								
ENDRIN	25	510	1	1								
ENDRIN ALDEHYDE	NC	NC	NC	NC								
ENDRIN KETONE	NC	NC	NC	NC								
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009								
GAMMA-CHLORDANE	NC	NC	NC	NC								
HEPTACHLOR	0.2	1	23	0.2								
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1								
ISODRIN	NC	NC	NC	NC								
METHOXYCHLOR	420	8800	160	160								
MIREX	NC	NC	NC	NC								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)												
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.023 U	0.042 U	0.022 U	0.022 U	0.021 U	0.022 U	0.022 U	0.028 J
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.023 U	0.042 U	0.022 U	0.022 U	0.021 U	0.022 U	0.022 U	0.038
ACENAPHTHENE	2400	20000	2.1	2.1	0.024 U	0.044 U	0.023 U	0.037	0.025 J	0.045	0.023 U	0.17
ACENAPHTHYLENE	1800	20000	27	27	0.055	0.11	0.072	0.028 J	0.029 J	0.091	0.02 U	0.046
ANTHRACENE	21000	300000	2500	2500	0.07	0.04 J	0.047	0.091	0.066	0.11	0.027 J	0.31
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.5	0.4	0.4	0.4	0.3	0.6	0.2	1.0
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.37	0.2	0.25	0.28	0.22	0.42	0.14	0.74
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.36	0.26	0.28	0.29	0.23	0.39	0.13	0.7
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.64	0.39	0.46	0.41	0.35	0.58	0.18	1
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.45	0.19	0.17	0.21	0.18	0.35	0.18	0.43
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.15	0.13	0.13	0.14	0.1	0.19	0.07	0.38
CHRYSENE	NC	NC	77	77	0.37	0.23	0.28	0.29	0.22	0.45	0.13	0.72
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.035 J	0.03 J	0.03 J	0.026 J	0.022 J	0.056	0.014 J	0.069
FLUORANTHENE	3200	59000	1200	1200	0.73	0.34	0.46	0.59	0.43	0.86	0.27	1.6
FLUORENE	2600	33000	160	160	0.023 U	0.042 U	0.022 U	0.044	0.031 J	0.063	0.022 U	0.18
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.13	0.14	0.12	0.1	0.08	0.23	0.055	0.27
NAPHTHALENE	55	300	1.2	1.2	0.025 U	0.047 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.1
PHENANTHRENE	2200	36000	250	250	0.32	0.11	0.2	0.36	0.25	0.53	0.093	1.2
PYRENE	2400	45000	880	880	0.63	0.34	0.43	0.48	0.36	0.77	0.24	1.3

Table 3
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	H-8 NTC148SSH80006 20120503 NORMAL	H-8 NTC148SSH80624 20120503 NORMAL	I-4 NTC148SSI40006 20120612 NORMAL	I-4 NTC148SSI40624 20120612 NORMAL	I-6 NTC148SSI60006 20120508 NORMAL	I-6 NTC148SSI60624 20120508 NORMAL	I-7 NTC148SSI70006 20120503 NORMAL	I-7 NTC148SSI70624 20120503 NORMAL
SAMPLE DATE	Residential	Industrial	Soil to GW									
SAMPLE CODE												
MATRIX					SO							
TOP DEPTH (FEET)					0	0.5	0	0.5	0	0.5	0	0.5
BOTTOM DEPTH (FEET)					0.5	2	0.5	2	0.5	2	0.5	2
EASTING					544031.8263	544031.8263	544056.8263	544056.8263	544056.8263	544056.8263	544056.8263	544056.8263
NORTHING					1535964.772	1535964.772	1536064.772	1536064.772	1536014.772	1536014.772	1535989.772	1535989.772
PESTICIDES (MG/KG)												
4,4'-DDD	4.2	22	5.8	4.2								
4,4'-DDE	2.9	15	18	2.9								
4,4'-DDT	2.9	15	11	2.9								
ALDRIN	0.06	0.3	0.2	0.06								
ALPHA-BHC	0.1	0.6	0.0003	0.0003								
ALPHA-CHLORDANE	NC	NC	NC	NC								
BETA-BHC	0.5	2.4	0.001	0.001								
DELTA-BHC	24	490	0.2	0.2								
DIELDRIN	0.06	0.3	0.002	0.002	0.22	0.055	0.005	0.00048 U	0.15	0.043	0.018	0.0024 U
ENDOSULFAN I	NC	NC	NC	NC								
ENDOSULFAN II	NC	NC	NC	NC								
ENDOSULFAN SULFATE	NC	NC	NC	NC								
ENDRIN	25	510	1	1								
ENDRIN ALDEHYDE	NC	NC	NC	NC								
ENDRIN KETONE	NC	NC	NC	NC								
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009								
GAMMA-CHLORDANE	NC	NC	NC	NC								
HEPTACHLOR	0.2	1	23	0.2								
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1								
ISODRIN	NC	NC	NC	NC								
METHOXYCHLOR	420	8800	160	160								
MIREX	NC	NC	NC	NC								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)												
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.022 U	0.024 U	0.023 U	0.022 U	0.022 U	0.022 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.022 U	0.024 U	0.023 U	0.022 U	0.022 U	0.022 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.023 U	0.025 U	0.024 U	0.03 J	0.023 U	0.023 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.021 J	0.02 U	0.022 U	0.02 U	0.037	0.05	0.028 J	0.036
ANTHRACENE	21000	300000	2500	2500	0.038	0.018 J	0.016 U	0.015 U	0.093	0.071	0.03 J	0.064
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.3	0.2	0.1	0.1	0.6	0.5	0.3	0.3
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.19	0.13	0.073	0.077	0.37	0.41	0.22	0.26
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.18	0.12	0.085	0.076	0.42	0.39	0.23	0.24
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.25	0.17	0.14	0.12	0.63	0.61	0.35	0.37
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.14	0.12	0.043	0.08	0.55	0.31	0.18	0.19
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.11	0.073	0.044	0.034 J	0.19	0.18	0.11	0.11
CHRYSENE	NC	NC	77	77	0.19	0.14	0.085	0.083	0.38	0.44	0.22	0.26
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.025 J	0.016 J	0.015 U	0.014 U	0.041	0.036	0.027 J	0.026 J
FLUORANTHENE	3200	59000	1200	1200	0.35	0.23	0.13	0.13	0.69	0.8	0.35	0.53
FLUORENE	2600	33000	160	160	0.022 U	0.022 U	0.024 U	0.023 U	0.036	0.027 J	0.022 U	0.024 J
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.098	0.061	0.037	0.048	0.15	0.13	0.091	0.1
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.024 U	0.026 U	0.025 U	0.024 U	0.024 U	0.024 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.16	0.076	0.04	0.039	0.36	0.39	0.12	0.27
PYRENE	2400	45000	880	880	0.3	0.21	0.12	0.12	0.59	0.69	0.32	0.47

Table 3
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID SAMPLE DATE SAMPLE CODE MATRIX TOP DEPTH (FEET) BOTTOM DEPTH (FEET) EASTING NORTHING	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	I-8 NTC148SSI80624 20120503 NORMAL SO 0.5 2 544056.8263 1535964.772	I-8 NTC148SSI82436 20120802 NORMAL SO 2 3 544056.8263 1535964.772	J-2 NTC148SSJ20006 20120712 NORMAL SO 0 0.5 544081.8263 1536114.772	J-2 NTC148SSJ20624 20120712 NORMAL SO 0.5 2 544081.8263 1536114.772	J-4 NTC148SSJ40006 20120613 NORMAL SO 0 0.5 544081.8263 1536064.772	J-4 NTC148SSJ40624 20120613 NORMAL SO 0.5 2 544081.8263 1536064.772	J-5 NTC148SSJ50006 20120612 NORMAL SO 0 0.5 544081.8263 1536039.772	J-5 NTC148SSJ50624 20120612 NORMAL SO 0.5 2 544081.8263 1536039.772	
PESTICIDES (MG/KG)													
4,4'-DDD	4.2	22	5.8	4.2		0.0032							
4,4'-DDE	2.9	15	18	2.9		0.0016 J							
4,4'-DDT	2.9	15	11	2.9		0.0051							
ALDRIN	0.06	0.3	0.2	0.06		0.0029							
ALPHA-BHC	0.1	0.6	0.0003	0.0003		0.00051 U							
ALPHA-CHLORDANE	NC	NC	NC	NC		0.002							
BETA-BHC	0.5	2.4	0.001	0.001		0.001 U							
DELTA-BHC	24	490	0.2	0.2		0.0005 U							
DIELDRIN	0.06	0.3	0.002	0.002	0.5	0.0054					0.019	0.007	
ENDOSULFAN I	NC	NC	NC	NC		0.00041 U							
ENDOSULFAN II	NC	NC	NC	NC		0.0005 U							
ENDOSULFAN SULFATE	NC	NC	NC	NC		0.00051 U							
ENDRIN	25	510	1	1		0.00077 U							
ENDRIN ALDEHYDE	NC	NC	NC	NC		0.00052 U							
ENDRIN KETONE	NC	NC	NC	NC		0.00047 U							
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009		0.00047 U							
GAMMA-CHLORDANE	NC	NC	NC	NC		0.00096 J							
HEPTACHLOR	0.2	1	23	0.2		0.00055 U							
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1		0.0005 U							
ISODRIN	NC	NC	NC	NC		0.00047 U							
METHOXYCHLOR	420	8800	160	160		0.0009 U							
MIREX	NC	NC	NC	NC		0.00052 U							
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)													
1-METHYLNAPHTHALENE	200	1800	3.1	3.1		0.022 U		0.03 U	0.03 U	0.022 U	0.023 U	0.022 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5		0.022 U		0.03 U	0.03 U	0.022 U	0.023 U	0.022 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1		0.023 U		0.032 U	0.031 U	0.023 U	0.024 U	0.26	0.023 U
ACENAPHTHYLENE	1800	20000	27	27		0.02 U		0.028 U	0.027 U	0.024 J	0.02 U	0.27	0.023 J
ANTHRACENE	21000	300000	2500	2500		0.027 J		0.02 U	0.02 U	0.015 U	0.015 U	1.7	0.047
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1		0.2		0.1	0.0	0.1	0.0	8.5	0.3
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8		0.15		0.049	0.029 J	0.034	0.011 J	10	0.16
BENZO(A)PYRENE	0.1	0.7	8	0.1		0.13		0.064	0.026 J	0.044	0.0079 U	5.6	0.17
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4		0.19		0.13	0.051	0.082	0.014 U	11	0.25
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500		0.19		0.037 J	0.017 U	0.023 J	0.013 U	1.5	0.19
BENZO(K)FLUORANTHENE	NC	NC	24	24		0.065		0.034 J	0.017 U	0.023 J	0.013 U	2.8	0.067
CHRYSENE	NC	NC	77	77		0.15		0.081	0.032 J	0.038	0.013 U	9.8	0.16
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7		0.02 J		0.019 U	0.018 U	0.014 U	0.014 U	0.58	0.029 J
FLUORANTHENE	3200	59000	1200	1200		0.29		0.12	0.053	0.056	0.014 U	21	0.32
FLUORENE	2600	33000	160	160		0.022 U		0.03 U	0.03 U	0.022 U	0.023 U	0.3	0.023 J
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6		0.073		0.034 J	0.017 U	0.018 J	0.013 U	1.7	0.11
NAPHTHALENE	55	300	1.2	1.2		0.024 U		0.033 U	0.033 U	0.024 U	0.025 U	0.024 U	0.024 U
PHENANTHRENE	2200	36000	250	250		0.11		0.049	0.026 U	0.019 J	0.019 U	9.6	0.21
PYRENE	2400	45000	880	880		0.24		0.12	0.051	0.063	0.013 U	17	0.26

Table 3
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	J-5 NTC148SSJ52436 20120802 NORMAL	J-6 NTC148SSJ60006 20120503 NORMAL	J-6 NTC148SSJ60624 20120503 NORMAL	J-7 NTC148SSJ70624 20120503 NORMAL	J-8 NTC148SSJ80006 20120503 NORMAL	J-8 NTC148SSJ80624 20120503 NORMAL	K-3 NTC148SSK30006 20120712 NORMAL	K-3 NTC148SSK30624 20120712 NORMAL
SAMPLE DATE	Residential	Industrial	Soil to GW									
SAMPLE CODE												
MATRIX					SO							
TOP DEPTH (FEET)					2	0	0.5	0.5	0	0.5	0	0.5
BOTTOM DEPTH (FEET)					3	0.5	2	2	0.5	2	0.5	2
EASTING					544081.8263	544081.8263	544081.8263	544081.8263	544081.8263	544081.8263	544106.8263	544106.8263
NORTHING					1536039.772	1536014.772	1536014.772	1535989.772	1535964.772	1535964.772	1536089.772	1536089.772
PESTICIDES (MG/KG)												
4,4'-DDD	4.2	22	5.8	4.2								
4,4'-DDE	2.9	15	18	2.9								
4,4'-DDT	2.9	15	11	2.9								
ALDRIN	0.06	0.3	0.2	0.06								
ALPHA-BHC	0.1	0.6	0.0003	0.0003								
ALPHA-CHLORDANE	NC	NC	NC	NC								
BETA-BHC	0.5	2.4	0.001	0.001								
DELTA-BHC	24	490	0.2	0.2								
DIELDRIN	0.06	0.3	0.002	0.002		0.061	0.016	0.038	0.17	0.15		
ENDOSULFAN I	NC	NC	NC	NC								
ENDOSULFAN II	NC	NC	NC	NC								
ENDOSULFAN SULFATE	NC	NC	NC	NC								
ENDRIN	25	510	1	1								
ENDRIN ALDEHYDE	NC	NC	NC	NC								
ENDRIN KETONE	NC	NC	NC	NC								
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009								
GAMMA-CHLORDANE	NC	NC	NC	NC								
HEPTACHLOR	0.2	1	23	0.2								
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1								
ISODRIN	NC	NC	NC	NC								
METHOXYCHLOR	420	8800	160	160								
MIREX	NC	NC	NC	NC								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)												
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.022 U	0.022 U	0.022 U	0.021 U	0.022 U	0.023 U	0.025 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.022 U	0.022 U	0.022 U	0.021 U	0.022 U	0.023 U	0.025 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.028 J	0.023 U	0.024 U	0.026 U				
ACENAPHTHYLENE	1800	20000	27	27	0.057	0.056	0.023 J	0.02 U	0.025 J	0.02 U	0.02 U	0.022 U
ANTHRACENE	21000	300000	2500	2500	0.11	0.067	0.023 J	0.015 U	0.028 J	0.016 J	0.015 U	0.016 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.7	0.4	0.2	0.1	0.2	0.2	0.0 U	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.57	0.27	0.12	0.061	0.17	0.12	0.01 U	0.032 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.45	0.29	0.13	0.05	0.16	0.11	0.0079 U	0.038 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.73	0.47	0.18	0.076	0.24	0.16	0.014 U	0.068
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.31	0.19	0.065	0.054	0.17	0.12	0.013 U	0.025 J
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.22	0.16	0.076	0.026 J	0.082	0.059	0.013 U	0.019 J
CHRYSENE	NC	NC	77	77	0.6	0.29	0.12	0.052	0.18	0.12	0.013 U	0.041
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.067	0.029 J	0.013 U	0.014 U	0.023 J	0.016 J	0.014 U	0.015 U
FLUORANTHENE	3200	59000	1200	1200	1.2	0.54	0.23	0.09	0.31	0.22	0.014 U	0.063
FLUORENE	2600	33000	160	160	0.033 J	0.028 J	0.022 U	0.022 U	0.021 U	0.022 U	0.023 U	0.025 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.2	0.11	0.045	0.024 J	0.089	0.063	0.013 U	0.023 J
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.025 U	0.027 U					
PHENANTHRENE	2200	36000	250	250	0.58	0.27	0.074	0.041	0.13	0.076	0.019 U	0.021 U
PYRENE	2400	45000	880	880	1	0.48	0.2	0.082	0.27	0.2	0.013 U	0.064

Table 3
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	K-5 NTC148SSK50624 20120613 NORMAL	K-6 NTC148SSK60006 20120612 NORMAL	K-6 NTC148SSK60624 20120612 NORMAL	K-7 NTC148SSK70006 20120503 NORMAL	K-7 NTC148SSK70624 20120503 NORMAL	K-8 NTC148SSK80006 20120612 NORMAL	K-8 NTC148SSK80624 20120612 NORMAL	L-3 NTC148SSL30006 20120712 NORMAL
SAMPLE DATE	Residential	Industrial	Soil to GW		SO							
SAMPLE CODE					0.5	0	0.5	0	0.5	0	0.5	0
MATRIX					2	0.5	2	0.5	2	0.5	2	0.5
TOP DEPTH (FEET)					544106.8263	544106.8263	544106.8263	544106.8263	544106.8263	544106.8263	544106.8263	544131.8263
BOTTOM DEPTH (FEET)					1536039.772	1536014.772	1536014.772	1535989.772	1535989.772	1535964.772	1535964.772	1536089.772
EASTING												
NORTHING												
PESTICIDES (MG/KG)												
4,4'-DDD	4.2	22	5.8	4.2								
4,4'-DDE	2.9	15	18	2.9								
4,4'-DDT	2.9	15	11	2.9								
ALDRIN	0.06	0.3	0.2	0.06								
ALPHA-BHC	0.1	0.6	0.0003	0.0003								
ALPHA-CHLORDANE	NC	NC	NC	NC								
BETA-BHC	0.5	2.4	0.001	0.001								
DELTA-BHC	24	490	0.2	0.2								
DIELDRIN	0.06	0.3	0.002	0.002		0.0018		0.0023 U	0.0023 U	0.00047 U	0.0015 J	
ENDOSULFAN I	NC	NC	NC	NC								
ENDOSULFAN II	NC	NC	NC	NC								
ENDOSULFAN SULFATE	NC	NC	NC	NC								
ENDRIN	25	510	1	1								
ENDRIN ALDEHYDE	NC	NC	NC	NC								
ENDRIN KETONE	NC	NC	NC	NC								
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009								
GAMMA-CHLORDANE	NC	NC	NC	NC								
HEPTACHLOR	0.2	1	23	0.2								
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1								
ISODRIN	NC	NC	NC	NC								
METHOXYCHLOR	420	8800	160	160								
MIREX	NC	NC	NC	NC								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)												
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.023 U	0.021 U	0.022 U	0.021 U	0.021 U	0.022 U	0.022 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.023 U	0.021 U	0.022 U	0.021 U	0.021 U	0.022 U	0.022 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.024 U	0.022 U	0.023 U	0.022 U	0.022 U	0.023 U	0.023 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.17	0.019 U	0.02 U	0.019 U	0.019 U	0.02 U	0.02 U	0.02 U
ANTHRACENE	21000	300000	2500	2500	0.05	0.014 U	0.015 U	0.014 U	0.051	0.015 U	0.015 U	0.015 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.5	0.0	0.1	0.0	0.4	0.1	0.1	0.0 U
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.26	0.037	0.067	0.032 J	0.31	0.042	0.041	0.0099 U
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.36	0.032 J	0.061	0.031 J	0.28	0.046	0.043	0.0079 U
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.68	0.056	0.088	0.066	0.4	0.064	0.071	0.014 U
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.16	0.019 J	0.11	0.03 J	0.3	0.12	0.033 J	0.013 U
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.2	0.017 J	0.025 J	0.02 J	0.17	0.021 J	0.021 J	0.013 U
CHRYSENE	NC	NC	77	77	0.35	0.031 J	0.062	0.039	0.31	0.037	0.041	0.013 U
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.033 J	0.013 U	0.014 U	0.013 U	0.031 J	0.013 U	0.014 U	0.014 U
FLUORANTHENE	3200	59000	1200	1200	0.43	0.071	0.11	0.063	0.62	0.066	0.068	0.014 U
FLUORENE	2600	33000	160	160	0.023 U	0.021 U	0.022 U	0.021 U	0.021 U	0.022 U	0.022 U	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.14	0.014 J	0.037	0.022 J	0.12	0.026 J	0.022 J	0.013 U
NAPHTHALENE	55	300	1.2	1.2	0.025 U	0.023 U	0.024 U	0.023 U	0.023 U	0.024 U	0.024 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.13	0.026 J	0.042	0.019 J	0.24	0.024 J	0.022 J	0.019 U
PYRENE	2400	45000	880	880	0.47	0.058	0.099	0.055	0.53	0.058	0.064	0.013 U

Table 3
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	L-3 NTC148SSL30624 20120712 NORMAL	L-4 NTC148SSL40006 20120712 NORMAL	L-4 NTC148SSL40624 20120712 NORMAL	L-7 NTC148SSL70006 20120612 ORIG	L-7 NTC148SSL70006-D 20120612 DUP	L-7 NTC148SSL70624 20120612 ORIG	L-7 NTC148SSL70624-D 20120612 DUP	L-10 NTC148SSL100006 20120829 NORMAL
SAMPLE DATE	Residential	Industrial	Soil to GW		SO	SO	SO	SO	SO	SO	SO	SO
SAMPLE CODE					0.5	0	0.5	0	0	0.5	0.5	0
MATRIX					2	0.5	2	0.5	0.5	2	2	0.5
TOP DEPTH (FEET)					544131.8263	544131.8263	544131.8263	544131.8263	544131.8263	544131.8263	544131.8263	544131.8263
BOTTOM DEPTH (FEET)					1536089.772	1536064.772	1536064.772	1535989.772	1535989.772	1535989.772	1535989.772	1535914.772
EASTING												
NORTHING												
PESTICIDES (MG/KG)												
4,4'-DDD	4.2	22	5.8	4.2								
4,4'-DDE	2.9	15	18	2.9								
4,4'-DDT	2.9	15	11	2.9								
ALDRIN	0.06	0.3	0.2	0.06								
ALPHA-BHC	0.1	0.6	0.0003	0.0003								
ALPHA-CHLORDANE	NC	NC	NC	NC								
BETA-BHC	0.5	2.4	0.001	0.001								
DELTA-BHC	24	490	0.2	0.2								
DIELDRIN	0.06	0.3	0.002	0.002								
ENDOSULFAN I	NC	NC	NC	NC								
ENDOSULFAN II	NC	NC	NC	NC								
ENDOSULFAN SULFATE	NC	NC	NC	NC								
ENDRIN	25	510	1	1								
ENDRIN ALDEHYDE	NC	NC	NC	NC								
ENDRIN KETONE	NC	NC	NC	NC								
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009								
GAMMA-CHLORDANE	NC	NC	NC	NC								
HEPTACHLOR	0.2	1	23	0.2								
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1								
ISODRIN	NC	NC	NC	NC								
METHOXYCHLOR	420	8800	160	160								
MIREX	NC	NC	NC	NC								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)												
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.024 U	0.024 U	0.023 U	0.023 U	0.022 U	0.022 U	0.022 U	0.023 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.024 U	0.024 U	0.023 U	0.023 U	0.022 U	0.022 U	0.022 U	0.023 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.025 U	0.025 U	0.024 U	0.024 U	0.023 U	0.023 U	0.023 U	0.024 U
ACENAPHTHYLENE	1800	20000	27	27	0.021 U	0.037 J	0.19	0.021 U	0.02 U	0.02 U	0.02 U	0.021 U
ANTHRACENE	21000	300000	2500	2500	0.016 U	0.021 J	0.052	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.0 U	0.2	0.4	0.0	0.0	0.1	0.1	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.01 U	0.11	0.17	0.035 J	0.034 J	0.062	0.044	0.047
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.0083 U	0.13	0.25	0.031 J	0.03 J	0.05	0.038	0.052
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.015 U	0.23	0.45	0.057	0.055	0.076	0.059	0.082
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.013 U	0.087	0.25	0.019 J	0.028 J	0.079 J	0.041 J	0.062
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.013 U	0.063	0.13	0.018 J	0.016 J	0.022 J	0.017 J	0.027 J
CHRYSENE	NC	NC	77	77	0.013 U	0.14	0.36	0.03 J	0.034 J	0.054	0.036	0.05
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.015 U	0.02 J	0.055	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U
FLUORANTHENE	3200	59000	1200	1200	0.015 U	0.21	0.47	0.053	0.059	0.11	0.074	0.085
FLUORENE	2600	33000	160	160	0.024 U	0.024 U	0.023 U	0.023 U	0.022 U	0.022 U	0.022 U	0.023 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.013 U	0.067	0.2	0.017 J	0.021 J	0.022 J	0.023 J	0.036
NAPHTHALENE	55	300	1.2	1.2	0.026 U	0.026 U	0.025 U	0.025 U	0.024 U	0.024 U	0.024 U	0.025 U
PHENANTHRENE	2200	36000	250	250	0.02 U	0.074	0.2	0.019 U	0.022 J	0.041	0.034 J	0.029 J
PYRENE	2400	45000	880	880	0.013 U	0.2	0.52	0.046	0.05	0.092	0.063	0.082

Table 3
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	L-10 NTC148SSL100624 20120829 NORMAL	L-9 NTC148SSL90006 20120829 NORMAL	L-9 NTC148SSL90624 20120829 ORIG	L-9 NTC148SSL90624-D 20120829 DUP	M-3 NTC148SSM30006 20120802 NORMAL	M-3 NTC148SSM30624 20120802 NORMAL	M-4 NTC148SSM40006 20120712 NORMAL	M-4 NTC148SSM40624 20120712 NORMAL
SAMPLE DATE	Residential	Industrial	Soil to GW									
SAMPLE CODE												
MATRIX					SO	SO	SO	SO	SO	SO	SO	SO
TOP DEPTH (FEET)					0.5	0	0.5	0.5	0	0.5	0	0.5
BOTTOM DEPTH (FEET)					2	0.5	2	2	0.5	2	0.5	2
EASTING					544131.8263	544131.8263	544131.8263	544131.8263	544157.0121	544157.0121	544157.0121	544157.0121
NORTHING					1535914.772	1535939.772	1535939.772	1535939.772	1536089.772	1536089.772	1536064.772	1536064.772
PESTICIDES (MG/KG)												
4,4'-DDD	4.2	22	5.8	4.2								
4,4'-DDE	2.9	15	18	2.9								
4,4'-DDT	2.9	15	11	2.9								
ALDRIN	0.06	0.3	0.2	0.06								
ALPHA-BHC	0.1	0.6	0.0003	0.0003								
ALPHA-CHLORDANE	NC	NC	NC	NC								
BETA-BHC	0.5	2.4	0.001	0.001								
DELTA-BHC	24	490	0.2	0.2								
DIELDRIN	0.06	0.3	0.002	0.002								
ENDOSULFAN I	NC	NC	NC	NC								
ENDOSULFAN II	NC	NC	NC	NC								
ENDOSULFAN SULFATE	NC	NC	NC	NC								
ENDRIN	25	510	1	1								
ENDRIN ALDEHYDE	NC	NC	NC	NC								
ENDRIN KETONE	NC	NC	NC	NC								
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009								
GAMMA-CHLORDANE	NC	NC	NC	NC								
HEPTACHLOR	0.2	1	23	0.2								
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1								
ISODRIN	NC	NC	NC	NC								
METHOXYCHLOR	420	8800	160	160								
MIREX	NC	NC	NC	NC								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)												
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.057	0.023 U	0.022 U	0.022 U	0.022 U	0.023 U	0.024 U	0.024 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.067	0.023 U	0.022 U	0.022 U	0.022 U	0.023 U	0.024 U	0.024 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.34	0.024 U	0.023 U	0.023 U	0.023 U	0.024 U	0.025 U	0.025 U
ACENAPHTHYLENE	1800	20000	27	27	0.042	0.021 U	0.02 U	0.02 U	0.024 J	0.095	0.11	0.021 U
ANTHRACENE	21000	300000	2500	2500	0.65	0.021 J	0.015 U	0.015 U	0.015 U	0.026 J	0.028 J	0.016 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	1.8	0.3	0.0 U	0.0 U	0.1	0.1	0.3	0.0
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	1.5	0.21	0.0098 U	0.0098 U	0.028 J	0.054	0.13	0.014 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	1.2	0.22	0.0078 U	0.0078 U	0.04	0.094	0.19	0.0083 U
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	1.7	0.34	0.014 U	0.014 U	0.072	0.17	0.31	0.015 U
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.79	0.17	0.013 U	0.013 U	0.035	0.089	0.14	0.013 U
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.58	0.11	0.013 U	0.013 U	0.019 J	0.043	0.079	0.013 U
CHRYSENE	NC	NC	77	77	1.4	0.24	0.013 U	0.013 U	0.047	0.15	0.22	0.013 U
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.2	0.014 U	0.014 U	0.014 U	0.014 U	0.023 J	0.037 J	0.015 U
FLUORANTHENE	3200	59000	1200	1200	2.8	0.38	0.014 U	0.014 U	0.059	0.19	0.25	0.015 U
FLUORENE	2600	33000	160	160	0.32	0.023 U	0.022 U	0.022 U	0.022 U	0.023 U	0.024 U	0.024 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.7	0.14	0.013 U	0.013 U	0.028 J	0.069	0.12	0.013 U
NAPHTHALENE	55	300	1.2	1.2	0.16	0.025 U	0.024 U	0.024 U	0.024 U	0.026 U	0.027 U	0.026 U
PHENANTHRENE	2200	36000	250	250	2.5	0.088	0.019 U	0.019 U	0.024 J	0.13	0.092	0.02 U
PYRENE	2400	45000	880	880	2.2	0.33	0.013 U	0.013 U	0.071	0.24	0.29	0.013 J

Table 3
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	M-5 NTC148SSM50006 20120712 NORMAL	M-5 NTC148SSM50624 20120712 NORMAL	M-6 NTC148SSM60006 20120712 NORMAL	M-6 NTC148SSM60624 20120712 NORMAL	M-7 NTC148SSM70624 20120802 NORMAL	M-8 NTC148SSM80624 20120802 NORMAL	M-9 NTC148SSM90624 20120829 NORMAL	M-10 NTC148SSM100006 20120829 NORMAL
SAMPLE DATE	Residential	Industrial	Soil to GW									
SAMPLE CODE												
MATRIX					SO							
TOP DEPTH (FEET)					0	0.5	0	0.5	0.5	0.5	0.5	0
BOTTOM DEPTH (FEET)					0.5	2	0.5	2	2	2	2	0.5
EASTING					544157.0121	544157.0121	544157.0121	544157.0121	544157.0121	544157.0121	544157.0121	544157.0121
NORTHING					1536039.772	1536039.772	1536014.772	1536014.772	1535989.772	1535964.772	1535939.772	1535914.772
PESTICIDES (MG/KG)												
4,4'-DDD	4.2	22	5.8	4.2								
4,4'-DDE	2.9	15	18	2.9								
4,4'-DDT	2.9	15	11	2.9								
ALDRIN	0.06	0.3	0.2	0.06								
ALPHA-BHC	0.1	0.6	0.0003	0.0003								
ALPHA-CHLORDANE	NC	NC	NC	NC								
BETA-BHC	0.5	2.4	0.001	0.001								
DELTA-BHC	24	490	0.2	0.2								
DIELDRIN	0.06	0.3	0.002	0.002								
ENDOSULFAN I	NC	NC	NC	NC								
ENDOSULFAN II	NC	NC	NC	NC								
ENDOSULFAN SULFATE	NC	NC	NC	NC								
ENDRIN	25	510	1	1								
ENDRIN ALDEHYDE	NC	NC	NC	NC								
ENDRIN KETONE	NC	NC	NC	NC								
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009								
GAMMA-CHLORDANE	NC	NC	NC	NC								
HEPTACHLOR	0.2	1	23	0.2								
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1								
ISODRIN	NC	NC	NC	NC								
METHOXYCHLOR	420	8800	160	160								
MIREX	NC	NC	NC	NC								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)												
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.023 U	0.022 U	0.022 U	0.022 U	0.066 J	0.022 U	0.022 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.023 U	0.022 U	0.022 U	0.022 U	0.073	0.022 U	0.022 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.024 U	0.043	0.024 U	0.023 U	0.51	0.023 U	0.046	0.061
ACENAPHTHYLENE	1800	20000	27	27	0.025 J	0.046	0.02 U	0.02 U	0.12	0.2	0.03 J	0.023 J
ANTHRACENE	21000	300000	2500	2500	0.09	0.18	0.015 U	0.036	1.1	0.088	0.12	0.16
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.6	1.0	0.1	0.2	3.5	0.8	0.8	0.6
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.52	0.73	0.035	0.2	3	0.32	0.6	0.49
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.39	0.72	0.033 J	0.16	2.4	0.61	0.55	0.42
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.66	1.1	0.052	0.25	3.7	0.77	0.81	0.62
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.24	0.56	0.028 J	0.17	1.4	0.42	0.4	0.33
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.19	0.32	0.019 J	0.082	1.1	0.19	0.26	0.19
CHRYSENE	NC	NC	77	77	0.53	0.76	0.031 J	0.19	2.8	0.4	0.62	0.47
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.061	0.076	0.014 U	0.027 J	0.34	0.088	0.074	0.067
FLUORANTHENE	3200	59000	1200	1200	0.95	1.3	0.054	0.35	5.9	0.53	1.1	1
FLUORENE	2600	33000	160	160	0.023 U	0.048	0.022 U	0.022 U	0.48	0.03 J	0.044	0.061
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.21	0.21	0.023 J	0.091	1.1	0.28	0.27	0.25
NAPHTHALENE	55	300	1.2	1.2	0.025 U	0.024 U	0.025 U	0.024 U	0.16	0.024 U	0.024 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.36	0.68	0.019 U	0.17	4.6	0.24	0.63	0.7
PYRENE	2400	45000	880	880	0.82	1.1	0.048	0.29	4.7	0.76	0.97	0.79

Table 3
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	M-10 NTC148SSM100624 20120829 NORMAL	N-4 NTC148SSN40006 20120802 ORIG	N-2 NTC148SSN20006 20120829 NORMAL	N-3 NTC148SSN30006 20120802 NORMAL	N-3 NTC148SSN30624 20120802 NORMAL	N-4 NTC148SSN40006-D 20120802 DUP	N-4 NTC148SSN40624 20120802 NORMAL	N-5 NTC148SSN50006 20120712 NORMAL
SAMPLE DATE	Residential	Industrial	Soil to GW									
SAMPLE CODE												
MATRIX					SO	SO	SO	SO	SO	SO	SO	SO
TOP DEPTH (FEET)					0.5	0	0	0	0.5	0	0.5	0
BOTTOM DEPTH (FEET)					2	0.5	0.5	0.5	2	0.5	2	0.5
EASTING					544157.0121	544182.0121	544182.0121	544182.0121	544182.0121	544182.0121	544182.0121	544182.0121
NORTHING					1535914.772	1536064.772	1536114.772	1536089.772	1536089.772	1536064.772	1536064.772	1536039.772
PESTICIDES (MG/KG)												
4,4'-DDD	4.2	22	5.8	4.2								
4,4'-DDE	2.9	15	18	2.9								
4,4'-DDT	2.9	15	11	2.9								
ALDRIN	0.06	0.3	0.2	0.06								
ALPHA-BHC	0.1	0.6	0.0003	0.0003								
ALPHA-CHLORDANE	NC	NC	NC	NC								
BETA-BHC	0.5	2.4	0.001	0.001								
DELTA-BHC	24	490	0.2	0.2								
DIELDRIN	0.06	0.3	0.002	0.002								
ENDOSULFAN I	NC	NC	NC	NC								
ENDOSULFAN II	NC	NC	NC	NC								
ENDOSULFAN SULFATE	NC	NC	NC	NC								
ENDRIN	25	510	1	1								
ENDRIN ALDEHYDE	NC	NC	NC	NC								
ENDRIN KETONE	NC	NC	NC	NC								
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009								
GAMMA-CHLORDANE	NC	NC	NC	NC								
HEPTACHLOR	0.2	1	23	0.2								
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1								
ISODRIN	NC	NC	NC	NC								
METHOXYCHLOR	420	8800	160	160								
MIREX	NC	NC	NC	NC								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)												
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.047 U	0.023 U	0.051 U	0.023 U	0.047 U	0.023 U	0.024 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.047 U	0.023 U	0.051 U	0.023 U	0.047 U	0.023 U	0.024 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.05 U	0.024 U	0.054 U	0.024 U	0.049 U	0.024 U	0.055
ACENAPHTHYLENE	1800	20000	27	27	0.079	0.13 J	0.046	0.67	0.075	0.24 J	0.021 U	0.16
ANTHRACENE	21000	300000	2500	2500	0.042	0.051 J	0.015 U	0.23	0.021 J	0.098	0.015 U	0.28
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.3	0.5	0.1	1.4	0.1	0.8	0.1	2.0
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.18	0.28	0.04	0.52	0.06	0.41	0.038	1.5
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.21	0.36	0.067	0.94	0.094	0.53	0.042	1.3
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.29	0.61 J	0.11	1.9	0.18	1.1 J	0.076	2.1
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.28	0.21	0.066	0.56	0.051	0.28	0.027 J	0.7
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.09	0.21	0.033 J	0.49	0.043	0.35	0.026 J	0.73
CHRYSENE	NC	NC	77	77	0.18	0.41	0.085	1.1	0.13	0.62	0.049	1.8
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.035	0.054 J	0.016 J	0.15	0.014 J	0.088	0.014 U	0.24
FLUORANTHENE	3200	59000	1200	1200	0.31	0.53	0.11	1.2	0.17	0.7	0.064	2.6
FLUORENE	2600	33000	160	160	0.022 U	0.047 U	0.023 U	0.071 J	0.023 U	0.047 U	0.023 U	0.077
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.12	0.19	0.049	0.51	0.051	0.26	0.025 J	0.66
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.052 U	0.025 U	0.056 U	0.025 U	0.052 U	0.025 U	0.026 U
PHENANTHRENE	2200	36000	250	250	0.14	0.17	0.052	0.55	0.1	0.22	0.019 J	1.3
PYRENE	2400	45000	880	880	0.26	0.55	0.14	1.6	0.21	0.75	0.069	2.4

Table 3
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	N-5 NTC148SSN50624 20120712 NORMAL	N-6 NTC148SSN60006 20120802 NORMAL	N-6 NTC148SSN600624 20120802 ORIG	N-6 NTC148SSN600624-D 20120802 DUP	N-7 NTC148SSN70006 20120802 NORMAL	N-7 NTC148SSN70624 20120802 NORMAL	N-8 NTC148SSN80006 20120829 NORMAL	N-8 NTC148SSN80624 20120829 NORMAL
SAMPLE DATE	Residential	Industrial	Soil to GW									
SAMPLE CODE												
MATRIX					SO	SO	SO	SO	SO	SO	SO	SO
TOP DEPTH (FEET)					0.5	0	0.5	0.5	0	0.5	0	0.5
BOTTOM DEPTH (FEET)					2	0.5	2	2	0.5	2	0.5	2
EASTING					544182.0121	544182.0121	544182.0121	544182.0121	544182.0121	544182.0121	544182.0121	544182.0121
NORTHING					1536039.772	1536014.772	1536014.772	1536014.772	1535989.772	1535989.772	1535964.772	1535964.772
PESTICIDES (MG/KG)												
4,4'-DDD	4.2	22	5.8	4.2								
4,4'-DDE	2.9	15	18	2.9								
4,4'-DDT	2.9	15	11	2.9								
ALDRIN	0.06	0.3	0.2	0.06								
ALPHA-BHC	0.1	0.6	0.0003	0.0003								
ALPHA-CHLORDANE	NC	NC	NC	NC								
BETA-BHC	0.5	2.4	0.001	0.001								
DELTA-BHC	24	490	0.2	0.2								
DIELDRIN	0.06	0.3	0.002	0.002								
ENDOSULFAN I	NC	NC	NC	NC								
ENDOSULFAN II	NC	NC	NC	NC								
ENDOSULFAN SULFATE	NC	NC	NC	NC								
ENDRIN	25	510	1	1								
ENDRIN ALDEHYDE	NC	NC	NC	NC								
ENDRIN KETONE	NC	NC	NC	NC								
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009								
GAMMA-CHLORDANE	NC	NC	NC	NC								
HEPTACHLOR	0.2	1	23	0.2								
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1								
ISODRIN	NC	NC	NC	NC								
METHOXYCHLOR	420	8800	160	160								
MIREX	NC	NC	NC	NC								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)												
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.023 U	0.022 U	0.022 U	0.022 U	0.036	0.022 U	0.023 U	0.023 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.023 U	0.022 U	0.022 U	0.022 U	0.038	0.022 U	0.023 U	0.023 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.024 U	0.088	0.023 U	0.036	0.087	0.023 U	0.024 U	0.024 U
ACENAPHTHYLENE	1800	20000	27	27	0.045	0.14	0.095 J	0.048 J	0.27	0.1	0.1	0.067
ANTHRACENE	21000	300000	2500	2500	0.04	0.39	0.11	0.17	0.4	0.045	0.17	0.093
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.4	2.3	0.8	1.0	3.7	0.6	1.9	0.9
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.24	2	0.54	0.89	2.9	0.37	1.6	0.73
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.23	1.6	0.59	0.69	2.5	0.44	1.3	0.63
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.4	2.6	0.94	1.2	4.4	0.72	2	1
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.15	0.6	0.22	0.24	0.95	0.17	0.61	0.31
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.12	0.87	0.24	0.33	1.2	0.22	0.72	0.29
CHRYSENE	NC	NC	77	77	0.29	2	0.56	0.87	3.2	0.43	1.6	0.75
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.049	0.19	0.07	0.075	0.33	0.067	0.2	0.098
FLUORANTHENE	3200	59000	1200	1200	0.42	3.3	0.92 J	1.6 J	4.9	0.55	2.4	1.2
FLUORENE	2600	33000	160	160	0.023 U	0.1	0.033 J	0.032 J	0.1	0.022 U	0.031 J	0.023 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.14	0.58	0.22	0.23	0.95	0.18	0.59	0.29
NAPHTHALENE	55	300	1.2	1.2	0.025 U	0.024 U	0.024 U	0.024 U	0.031 J	0.024 U	0.025 U	0.025 U
PHENANTHRENE	2200	36000	250	250	0.15	1.7	0.42	0.67	1.7	0.1	0.78	0.42
PYRENE	2400	45000	880	880	0.39	2.9	0.9	1.3	4.4	0.59	2.2	1.1

Table 3
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	N-9 NTC148SSN90006 20120829 NORMAL	N-9 NTC148SSN90624 20120829 NORMAL	O-2 NTC148SSO20006 20120829 NORMAL	O-2 NTC148SSO20624 20120829 NORMAL	O-3 NTC148SSO30006 20120829 NORMAL	O-3 NTC148SSO30624 20120829 NORMAL	O-4 NTC148SSO40006 20120802 NORMAL	O-4 NTC148SSO40624 20120802 NORMAL
SAMPLE DATE	Residential	Industrial	Soil to GW									
SAMPLE CODE												
MATRIX					SO							
TOP DEPTH (FEET)					0	0.5	0	0.5	0	0.5	0	0.5
BOTTOM DEPTH (FEET)					0.5	2	0.5	2	0.5	2	0.5	2
EASTING					544182.0121	544182.0121	544207.0121	544207.0121	544207.0121	544207.0121	544207.0121	544207.0121
NORTHING					1535939.772	1535939.772	1536114.772	1536114.772	1536089.772	1536089.772	1536064.772	1536064.772
PESTICIDES (MG/KG)												
4,4'-DDD	4.2	22	5.8	4.2								
4,4'-DDE	2.9	15	18	2.9								
4,4'-DDT	2.9	15	11	2.9								
ALDRIN	0.06	0.3	0.2	0.06								
ALPHA-BHC	0.1	0.6	0.0003	0.0003								
ALPHA-CHLORDANE	NC	NC	NC	NC								
BETA-BHC	0.5	2.4	0.001	0.001								
DELTA-BHC	24	490	0.2	0.2								
DIELDRIN	0.06	0.3	0.002	0.002								
ENDOSULFAN I	NC	NC	NC	NC								
ENDOSULFAN II	NC	NC	NC	NC								
ENDOSULFAN SULFATE	NC	NC	NC	NC								
ENDRIN	25	510	1	1								
ENDRIN ALDEHYDE	NC	NC	NC	NC								
ENDRIN KETONE	NC	NC	NC	NC								
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009								
GAMMA-CHLORDANE	NC	NC	NC	NC								
HEPTACHLOR	0.2	1	23	0.2								
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1								
ISODRIN	NC	NC	NC	NC								
METHOXYCHLOR	420	8800	160	160								
MIREX	NC	NC	NC	NC								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)												
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.091		0.025 J	0.025 U	0.047 U	0.022 U	0.045 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.08		0.029 J	0.025 U	0.047 U	0.022 U	0.045 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.81		0.035 J	0.026 U	0.05 U	0.023 U	0.047 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	1.1		1	0.023 U	0.6	0.035	0.3	0.11
ANTHRACENE	21000	300000	2500	2500	3.1		0.015 U	0.017 U	0.14	0.015 U	0.11	0.021 J
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	27.4	0.0	1.3	0.0	1.0	0.1	1.5	0.2
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	25	0.03 J	0.37	0.017 J	0.36	0.026 J	0.65	0.08
BENZO(A)PYRENE	0.1	0.7	8	0.1	19	0.027 J	0.87	0.0088 U	0.71	0.036	1	0.15
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	33	0.05	1.3	0.017 J	1.3	0.067	2	0.2
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	4.4		0.025 J	0.79	0.014 U	0.45	0.027 J	0.51
BENZO(K)FLUORANTHENE	NC	NC	24	24	7.1		0.016 J	0.36	0.014 U	0.39	0.021 J	0.52
CHRYSENE	NC	NC	77	77	25		0.041	0.78	0.014 U	1	0.041	1.2
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	2		0.014 U	0.16	0.015 U	0.095	0.014 U	0.14
FLUORANTHENE	3200	59000	1200	1200	44		0.056	0.83	0.016 J	1.1	0.043	1.6
FLUORENE	2600	33000	160	160	0.84		0.022 U	0.1	0.025 U	0.064 J	0.022 U	0.045 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	4.8		0.021 J	0.61	0.014 U	0.4	0.023 J	0.51
NAPHTHALENE	55	300	1.2	1.2	0.15		0.024 U	0.049	0.027 U	0.052 U	0.024 U	0.049 U
PHENANTHRENE	2200	36000	250	250	17		0.024 J	0.53	0.021 U	0.58	0.023 J	0.42
PYRENE	2400	45000	880	880	35		0.064	1	0.018 J	1.3	0.058	1.5

Table 3
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	O-5 NTC148SSO50006 20120802 NORMAL	O-5 NTC148SSO50624 20120802 NORMAL	O-6 NTC148SSO60006 20120802 NORMAL	O-6 NTC148SSO60624 20120802 NORMAL	O-8 NTC148SSO80006 20120829 NORMAL	O-8 NTC148SSO80624 20120829 NORMAL	O-9 NTC148SSO90624 20120829 NORMAL	Y-5 NTC148SSY50006 20120802 NORMAL
SAMPLE DATE	Residential	Industrial	Soil to GW									
SAMPLE CODE												
MATRIX					SO							
TOP DEPTH (FEET)					0	0.5	0	0.5	0	0.5	0.5	0
BOTTOM DEPTH (FEET)					0.5	2	0.5	2	0.5	2	2	0.5
EASTING					544207.0121	544207.0121	544207.0121	544207.0121	544207.0121	544207.0121	544207.0121	543806.5689
NORTHING					1536039.772	1536039.772	1536014.772	1536014.772	1535964.772	1535964.772	1535939.772	1536039.772
PESTICIDES (MG/KG)												
4,4'-DDD	4.2	22	5.8	4.2								
4,4'-DDE	2.9	15	18	2.9								
4,4'-DDT	2.9	15	11	2.9								
ALDRIN	0.06	0.3	0.2	0.06								
ALPHA-BHC	0.1	0.6	0.0003	0.0003								
ALPHA-CHLORDANE	NC	NC	NC	NC								
BETA-BHC	0.5	2.4	0.001	0.001								
DELTA-BHC	24	490	0.2	0.2								
DIELDRIN	0.06	0.3	0.002	0.002								
ENDOSULFAN I	NC	NC	NC	NC								
ENDOSULFAN II	NC	NC	NC	NC								
ENDOSULFAN SULFATE	NC	NC	NC	NC								
ENDRIN	25	510	1	1								
ENDRIN ALDEHYDE	NC	NC	NC	NC								
ENDRIN KETONE	NC	NC	NC	NC								
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009								
GAMMA-CHLORDANE	NC	NC	NC	NC								
HEPTACHLOR	0.2	1	23	0.2								
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1								
ISODRIN	NC	NC	NC	NC								
METHOXYCHLOR	420	8800	160	160								
MIREX	NC	NC	NC	NC								
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)												
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.045 U	0.022 U	0.24	0.11 U	0.025 U	0.023 U	0.023 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.045 U	0.022 U	0.2	0.11 U	0.025 U	0.023 U	0.023 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.047 U	0.023 U	1.5	0.11 U	0.084	0.024 U	0.024 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.64	0.1	1.3	0.6	0.33	0.021 U	0.68	0.026 J
ANTHRACENE	21000	300000	2500	2500	0.2	0.026 J	5	0.64	0.41	0.015 U	0.23	0.015 J
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	1.0	0.1	20.3	4.9	4.1	0.0	1.7	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.51	0.039	20	4.1	3	0.014 J	1.1	0.065
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.67	0.063	14	3.4	2.8	0.0081 U	1.2	0.082
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	1.4	0.12	25	6.1	4.6	0.016 J	1.7	0.14
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.58	0.073	3.6	1.2	1	0.013 U	0.62	0.083
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.34	0.03 J	7	1.7	1.6	0.013 U	0.47	0.036
CHRYSENE	NC	NC	77	77	0.89	0.07	18	4.1	3.6	0.013 U	1.6	0.099
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.12	0.014 J	1.3	0.37	0.37	0.014 U	0.18	0.015 J
FLUORANTHENE	3200	59000	1200	1200	1.1	0.085	42	6.7	6.3	0.014 J	1.8	0.12
FLUORENE	2600	33000	160	160	0.061 J	0.022 U	1.5	0.12 J	0.1	0.023 U	0.056	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.43	0.05	4	1.1	1.1	0.013 U	0.56	0.067
NAPHTHALENE	55	300	1.2	1.2	0.049 U	0.024 U	0.31	0.12 U	0.027 U	0.025 U	0.025 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.45	0.039	23	2.4	2.5	0.02 U	1.2	0.056
PYRENE	2400	45000	880	880	1.2	0.1	36	6.1	5.4	0.016 J	2.4	0.13

Table 3
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID	FDEP	FDEP	FDEP	Minimum	Y-5 NTC148SSY50624 20120802 NORMAL	Z-4 NTC148SSZ40006 20120802 NORMAL	Z-4 NTC148SSZ40624 20120802 NORMAL	Z-5 NTC148SSZ50006 20120802 NORMAL	Z-5 NTC148SSZ50624 20120802 NORMAL	Z-6 NTC148SSZ60006 20120712 NORMAL	Z-6 NTC148SSZ60624 20120712 NORMAL
SAMPLE DATE	Residential	Industrial	Soil to GW								
SAMPLE CODE											
MATRIX					SO						
TOP DEPTH (FEET)					0.5	0	0.5	0	0.5	0	0.5
BOTTOM DEPTH (FEET)					2	0.5	2	0.5	2	0.5	2
EASTING					543806.5689	543831.5689	543831.5689	543831.5689	543831.5689	543831.5689	543831.5689
NORTHING					1536039.772	1536064.772	1536064.772	1536039.772	1536039.772	1536014.772	1536014.772
PESTICIDES (MG/KG)											
4,4'-DDD	4.2	22	5.8	4.2							
4,4'-DDE	2.9	15	18	2.9							
4,4'-DDT	2.9	15	11	2.9							
ALDRIN	0.06	0.3	0.2	0.06							
ALPHA-BHC	0.1	0.6	0.0003	0.0003							
ALPHA-CHLORDANE	NC	NC	NC	NC							
BETA-BHC	0.5	2.4	0.001	0.001							
DELTA-BHC	24	490	0.2	0.2							
DIELDRIN	0.06	0.3	0.002	0.002							
ENDOSULFAN I	NC	NC	NC	NC							
ENDOSULFAN II	NC	NC	NC	NC							
ENDOSULFAN SULFATE	NC	NC	NC	NC							
ENDRIN	25	510	1	1							
ENDRIN ALDEHYDE	NC	NC	NC	NC							
ENDRIN KETONE	NC	NC	NC	NC							
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009							
GAMMA-CHLORDANE	NC	NC	NC	NC							
HEPTACHLOR	0.2	1	23	0.2							
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1							
ISODRIN	NC	NC	NC	NC							
METHOXYCHLOR	420	8800	160	160							
MIREX	NC	NC	NC	NC							
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)											
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.023 U	0.022 U				
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.023 U	0.022 U				
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.023 U	0.023 U	0.046	0.023 U	0.024 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.025 J	0.02 U	0.02 U	0.02 J	0.02 U	0.02 U	0.02 U
ANTHRACENE	21000	300000	2500	2500	0.015 U	0.014 U	0.015 U	0.096	0.014 U	0.015 U	0.015 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.0	0.0	0.0	0.4	0.1	0.1	0.0
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.017 J	0.018 J	0.026 J	0.27	0.063	0.062	0.024 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.032 J	0.019 J	0.027 J	0.27	0.065	0.066	0.024 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.046	0.033 J	0.046	0.41	0.1	0.11	0.037
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.031 J	0.02 J	0.029 J	0.2	0.055	0.051	0.02 J
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.015 J	0.014 J	0.018 J	0.11	0.032 J	0.034 J	0.013 U
CHRYSENE	NC	NC	77	77	0.019 J	0.017 J	0.027 J	0.29	0.073	0.069	0.02 J
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.013 U	0.013 U	0.014 U	0.047	0.013 J	0.014 U	0.014 U
FLUORANTHENE	3200	59000	1200	1200	0.022 J	0.029 J	0.038	0.61	0.15	0.13	0.014 U
FLUORENE	2600	33000	160	160	0.022 U	0.022 U	0.022 U	0.051	0.022 U	0.023 U	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.026 J	0.015 J	0.02 J	0.17	0.044	0.047	0.017 J
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.024 U	0.024 U	0.039	0.024 U	0.025 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.019 U	0.019 U	0.019 U	0.47	0.11	0.056	0.019 U
PYRENE	2400	45000	880	880	0.028 J	0.027 J	0.035	0.48	0.13	0.11	0.036

Table 4
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID SAMPLE DATE SAMPLE CODE MATRIX TOP DEPTH (FEET) BOTTOM DEPTH (FEET) EASTING NORTHING	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	NTC148SS01 NTC148SS-101- 20110913 NORMAL SO 0 1 544005.9883 1536003.521	NTC148SS01 NTC148SS-134- 20110913 NORMAL SO 3 4 544005.9883 1536003.521	NTC148SP01 NTC148SSSP100060301 20120103 NORMAL SO 0 0.5 544010.075 1536019.955	NTC148SS02 NTC148SS-201- 20110913 NORMAL SO 0 1 544005.828 1535983.637	NTC148SS02 NTC148SS-234- 20110913 NORMAL SO 3 4 544005.828 1535983.637	NTC148SP02 NTC148SSSP200060301 20120103 NORMAL SO 0 0.5 544044.45 1536020.996	NTC148SS03 NTC148SS-301- 20110913 ORIG SO 0 1 544029.0794 1536003.2
PESTICIDES (MG/KG)											
4,4'-DDD	4.2	22	5.8	4.2	0.0097	0.0031	0.0052 J	0.011	0.0045	0.0024 U	0.0042
4,4'-DDE	2.9	15	18	2.9	0.0061	0.0038	0.0027 UJ	0.0035 J	0.0028	0.0034 J	0.0021
4,4'-DDT	2.9	15	11	2.9	0.033	0.019	0.037	0.051	0.021	0.041	0.018
ALDRIN	0.06	0.3	0.2	0.06	0.053	0.06	0.0052 J	0.23	0.053	0.0051 J	0.022
ALPHA-BHC	0.1	0.6	0.0003	0.0003	0.00053 U	0.00052 U	0.0026 U	0.0026 U	0.00051 U	0.0025 U	0.00051 U
ALPHA-CHLORDANE	NC	NC	NC	NC	0.0082	0.0038	0.0023 UJ	0.012	0.0042	0.0085 J	0.014
BETA-BHC	0.5	2.4	0.001	0.001	0.0011 U	0.0011 U	0.0052 UJ	0.0053 U	0.001 U	0.0051 UJ	0.001 U
CHLORDANE	2.8	14	9.6	2.8	0.046 J	0.036 J		0.14 U	0.033 J		0.089
DELTA-BHC	24	490	0.2	0.2	0.00051 U	0.00051 U	0.0025 UJ	0.0025 U	0.0005 U	0.0024 UJ	0.0005 U
DIELDRIN	0.06	0.3	0.002	0.002	0.34	0.56	0.035	0.26	0.38	0.032	0.088
ENDOSULFAN I	NC	NC	NC	NC	0.00042 U	0.00041 U	0.002 U	0.002 U	0.00041 U	0.002 U	0.00041 U
ENDOSULFAN II	NC	NC	NC	NC	0.00051 U	0.00051 U	0.0025 U	0.0025 U	0.0005 U	0.0024 U	0.0005 U
ENDOSULFAN SULFATE	NC	NC	NC	NC	0.00053 U	0.00052 U	0.0026 U	0.0026 U	0.00051 U	0.0025 U	0.00051 U
ENDRIN	25	510	1	1	0.0014 J	0.001 J	0.0039 U	0.0039 U	0.0017 J	0.0038 U	0.00077 U
ENDRIN ALDEHYDE	NC	NC	NC	NC	0.00054 U	0.00053 U	0.0026 U	0.0026 U	0.00052 U	0.0025 U	0.00052 U
ENDRIN KETONE	NC	NC	NC	NC	0.0021	0.0052	0.0023 UJ	0.0053 J	0.0056	0.0023 UJ	0.001 J
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009	0.0014 J	0.00047 U	0.0023 U	0.0024 U	0.001 J	0.0023 U	0.001 J
GAMMA-CHLORDANE	NC	NC	NC	NC	0.0075	0.0031	0.0023 UJ	0.012	0.0035	0.0085 J	0.014
HEPTACHLOR	0.2	1	23	0.2	0.00072 J	0.001 J	0.0028 U	0.0028 U	0.00056 U	0.0027 U	0.0007 J
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1	0.00072 J	0.00051 U	0.0025 U	0.0025 U	0.0005 U	0.0024 U	0.0005 U
ISODRIN	NC	NC	NC	NC	0.0014 J	0.0017 J		0.007 J	0.0035		0.001 J
METHOXYCHLOR	420	8800	160	160	0.00092 U	0.00091 U	0.0045 UJ	0.0045 U	0.0009 U	0.0044 UJ	0.0009 U
MIREX	NC	NC	NC	NC	0.00054 U	0.00053 U		0.0026 U	0.00052 U		0.00052 U
TOXAPHENE	0.9	4.5	31	0.9	0.0086 U	0.0084 U	0.042 U	0.042 U	0.0084 U	0.041 U	0.0084 U
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)											
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.023 U	0.022 U	0.022 U	0.022 U	0.022 U	0.021 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.023 U	0.022 U	0.022 U	0.022 U	0.022 U	0.021 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.024 U	0.023 U	0.023 U	0.023 U	0.059	0.022 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.024 J	0.02 U	0.04	0.041	0.023 J	0.019 J	0.02 U
ANTHRACENE	21000	300000	2500	2500	0.022 J	0.015 U	0.032 J	0.036	0.16	0.016 J	0.035
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.2	0.0	0.4	0.3	0.6	0.1	0.2
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.13	0.042	0.24	0.19	0.45	0.098	0.2 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.15	0.029 J	0.26	0.22	0.42	0.094	0.15 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.2	0.044	0.36	0.29	0.58	0.13	0.23 J
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.13	0.031 J	0.19	0.23	0.22	0.11	0.088 J
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.063	0.014 J	0.13	0.099	0.2	0.05	0.079
CHRYSENE	NC	NC	77	77	0.13	0.031 J	0.23	0.2	0.41	0.092	0.18 J
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.017 J	0.012 U	0.033 J	0.026 J	0.05	0.012 J	0.017 J
FLUORANTHENE	3200	59000	1200	1200	0.24	0.067	0.46	0.38	1	0.19	0.39 J
FLUORENE	2600	33000	160	160	0.023 U	0.022 U	0.022 U	0.022 U	0.064	0.021 U	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.067	0.015 J	0.14	0.1	0.2	0.052	0.067
NAPHTHALENE	55	300	1.2	1.2	0.025 U	0.024 U	0.024 U	0.024 U	0.024 U	0.023 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.081	0.027 J	0.12	0.16	0.59	0.065	0.14 J
PYRENE	2400	45000	880	880	0.22	0.055	0.39	0.31	0.74	0.16	0.33 J

Notes:
Samples labeled with SS (i.e., NTC148SS-134-09132011) were collected from the soil pile. Sample depths are measured from the top of the soil pile, not from ground surface.
Samples labeled with SP (i.e., NTC148SSSP1000603012012) were collected from perimeter of the soil pile.

Table 4
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID SAMPLE DATE SAMPLE CODE MATRIX TOP DEPTH (FEET) BOTTOM DEPTH (FEET) EASTING NORTHING	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	NTC148SS03 NTC148SS-301- 20110913 DUP SO 0 1 544029.0794 1536003.2	NTC148SS03 NTC148SS-334- 20110913 NORMAL SO 3 4 544029.0794 1536003.2	NTC148SP03 NTC148SSSP300060301 20120103 NORMAL SO 0 0.5 544073.9639 1535996.343	NTC148SS04 NTC148SS-401- 20110913 NORMAL SO 0 1 544028.9191 1535983.637	NTC148SS04 NTC148SS-434- 20110913 ORIG SO 3 4 544028.9191 1535983.637	NTC148SS04 NTC148SS-434- 20110913 DUP SO 3 4 544028.9191 1535983.637	NTC148SP04 NTC148SSSP400060301 20120103 NORMAL SO 0 0.5 544051.0472 1535966.482
PESTICIDES (MG/KG)											
4,4'-DDD	4.2	22	5.8	4.2	0.0055	0.05	0.0049 U	0.0039	0.04 J	0.007 J	0.0025 U
4,4'-DDE	2.9	15	18	2.9	0.0014 J	0.044	0.0053 UJ	0.0028	0.0053 J	0.0028 J	0.0027 UJ
4,4'-DDT	2.9	15	11	2.9	0.015	0.26	0.031	0.019	0.11 J	0.021 J	0.059
ALDRIN	0.06	0.3	0.2	0.06	0.034	0.007	0.014 J	0.026	0.026 J	0.0007 J	0.049
ALPHA-BHC	0.1	0.6	0.0003	0.0003	0.00051 U	0.00051 U	0.005 U	0.00051 U	0.00052 U	0.00052 U	0.0025 U
ALPHA-CHLORDANE	NC	NC	NC	NC	0.013	0.02	0.00046 U	0.0035	0.0056	0.0035	0.0085 J
BETA-BHC	0.5	2.4	0.001	0.001	0.001 U	0.001 U	0.01 UJ	0.0011 U	0.0011 U	0.0011 U	0.0051 UJ
CHLORDANE	2.8	14	9.6	2.8	0.094	0.14		0.027 U	0.047 J	0.028 U	
DELTA-BHC	24	490	0.2	0.2	0.0005 U	0.0005 U	0.0049 U	0.0005 U	0.00051 U	0.00051 U	0.0025 UJ
DIELDRIN	0.06	0.3	0.002	0.002	0.093	0.049	0.081	0.075	0.22 J	0.012 J	0.26
ENDOSULFAN I	NC	NC	NC	NC	0.00041 U	0.00041 U	0.004 U	0.00041 U	0.00041 U	0.00041 U	0.002 U
ENDOSULFAN II	NC	NC	NC	NC	0.0005 U	0.0005 U	0.0049 U	0.0005 U	0.00051 U	0.00051 U	0.0025 U
ENDOSULFAN SULFATE	NC	NC	NC	NC	0.00051 U	0.00051 U	0.005 UJ	0.00051 U	0.00052 U	0.00052 U	0.0025 U
ENDRIN	25	510	1	1	0.00077 U	0.00078 U	0.0076 U	0.00078 U	0.0014 J	0.00079 U	0.0038 U
ENDRIN ALDEHYDE	NC	NC	NC	NC	0.00052 U	0.0028	0.0051 U	0.00053 U	0.00053 U	0.00053 U	0.0026 U
ENDRIN KETONE	NC	NC	NC	NC	0.0017 J	0.00047 U	0.0046 UJ	0.0007 J	0.0014 J	0.0014 J	0.0023 UJ
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009	0.00047 U	0.00047 U	0.0046 U	0.00047 U	0.00048 U	0.00048 U	0.0023 U
GAMMA-CHLORDANE	NC	NC	NC	NC	0.013	0.017	0.00046 U	0.0032	0.0049	0.0032	0.0068 J
HEPTACHLOR	0.2	1	23	0.2	0.00055 U	0.00056 U	0.0054 U	0.00056 U	0.0028	0.00056 U	0.0027 U
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1	0.0005 U	0.0005 U	0.0049 U	0.0005 U	0.00051 U	0.00051 U	0.0025 U
ISODRIN	NC	NC	NC	NC	0.0014 J	0.00047 U		0.0014 J	0.0011 J	0.00048 U	
METHOXYCHLOR	420	8800	160	160	0.0009 U	0.0021	0.0088 U	0.0009 U	0.00091 U	0.00091 U	0.0044 UJ
MIREX	NC	NC	NC	NC	0.00052 U	0.0052		0.00053 U	0.00053 U	0.00053 U	
TOXAPHENE	0.9	4.5	31	0.9	0.0083 U	0.0084 U	0.082 U	0.0084 U	0.0085 U	0.0085 U	0.041 U
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)											
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.022 U	0.021 U	0.022 U	0.022 U	0.022 U	0.021 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.022 U	0.021 U	0.022 U	0.022 U	0.022 U	0.021 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.023 U	0.023 U	0.022 U	0.023 U	0.023 U	0.044	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.02 U	0.039	0.019 U	0.02 U	0.02 U	0.027 J	0.028 J
ANTHRACENE	21000	300000	2500	2500	0.015 U	0.024 J	0.037	0.015 U	0.056	0.091	0.092
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	0.1	0.2	0.3	0.1	0.3	0.3	0.5
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	0.06 J	0.14	0.28	0.057	0.25	0.26	0.4
BENZO(A)PYRENE	0.1	0.7	8	0.1	0.061 J	0.16	0.23	0.058	0.19	0.25	0.32
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	0.092 J	0.22	0.34	0.081	0.29	0.36	0.47
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.041 J	0.13	0.18	0.11	0.12	0.14	0.23
BENZO(K)FLUORANTHENE	NC	NC	24	24	0.032 J	0.072	0.14	0.029 J	0.097	0.13	0.18
CHRYSENE	NC	NC	77	77	0.06 J	0.15	0.25	0.054	0.22	0.25	0.35
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.011 U	0.019 J	0.03 J	0.012 U	0.02 J	0.026 J	0.039
FLUORANTHENE	3200	59000	1200	1200	0.11 J	0.24	0.48	0.1	0.48	0.56	0.85
FLUORENE	2600	33000	160	160	0.022 U	0.022 U	0.021 U	0.022 U	0.022 U	0.049	0.023 J
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.026 J	0.078	0.11	0.028 J	0.075	0.099	0.16
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.024 U	0.023 U	0.024 U	0.024 U	0.024 U	0.024 U
PHENANTHRENE	2200	36000	250	250	0.041 J	0.084	0.15	0.037	0.23	0.35	0.38
PYRENE	2400	45000	880	880	0.094 J	0.22	0.38	0.088	0.38	0.42	0.65

Notes:
Samples labeled with SS (i.e., NTC148SS-134-09132011) were collected from the soil pile. Sample depths are measured from the top of the soil pile, not from ground surface.
Samples labeled with SP (i.e., NTC148SSSP1000603012012) were collected from perimeter of the soil pile.

Table 4
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION SAMPLE ID SAMPLE DATE SAMPLE CODE MATRIX TOP DEPTH (FEET) BOTTOM DEPTH (FEET) EASTING NORTHING	FDEP Residential	FDEP Industrial	FDEP Soil to GW	Minimum	NTC148SS05 NTC148SS-501- 20110913 NORMAL SO 0 1 544052.6516 1536003.2	NTC148SS05 NTC148SS-545- 20110913 NORMAL SO 4 5 544052.6516 1536003.2	NTC148SS05 NTC148SS-589- 20110913 NORMAL SO 8 9 544052.6516 1536003.2	NTC148SP05 NTC148SSSP500060301 20120103 NORMAL SO 0 0.5 544010.075 1535969.26	NTC148SS06 NTC148SS-601- 20110913 NORMAL SO 0 1 544052.4912 1535983.797	NTC148SS06 NTC148SS-645- 20110913 NORMAL SO 4 5 544052.4912 1535983.797	NTC148SS06 NTC148SS-689- 20110913 NORMAL SO 8 9 544052.4912 1535983.797
PESTICIDES (MG/KG)											
4,4'-DDD	4.2	22	5.8	4.2	0.0078	0.0042	0.0038	0.01	0.0058	0.0005 U	0.044
4,4'-DDE	2.9	15	18	2.9	0.0025	0.0028	0.0024	0.0027 UJ	0.0034	0.00055 U	0.028
4,4'-DDT	2.9	15	11	2.9	0.018	0.019	0.014	0.041	0.018	0.00069 U	0.23
ALDRIN	0.06	0.3	0.2	0.06	0.04	0.0042	0.042	0.037	0.042	0.026	0.024
ALPHA-BHC	0.1	0.6	0.0003	0.0003	0.00052 U	0.00052 U	0.00051 U	0.0025 U	0.00051 U	0.00051 U	0.00052 U
ALPHA-CHLORDANE	NC	NC	NC	NC	0.011	0.0028	0.0031	0.0023 UJ	0.0027	0.00047 U	0.11
BETA-BHC	0.5	2.4	0.001	0.001	0.0011 U	0.0011 U	0.001 U	0.0051 UJ	0.001 U	0.0011 U	0.0011 U
CHLORDANE	2.8	14	9.6	2.8	0.06	0.027 U	0.027 U		0.029 J	0.027 U	0.69
DELTA-BHC	24	490	0.2	0.2	0.00051 U	0.0005 U	0.0005 U	0.0025 UJ	0.0005 U	0.0005 U	0.00051 U
DIELDRIN	0.06	0.3	0.002	0.002	0.22	0.076	0.4	0.14	0.26	0.046	0.16
ENDOSULFAN I	NC	NC	NC	NC	0.00042 U	0.00041 U	0.00041 U	0.002 U	0.0004 U	0.00041 U	0.00041 U
ENDOSULFAN II	NC	NC	NC	NC	0.00051 U	0.0005 U	0.005 U	0.0025 U	0.0005 U	0.0005 U	0.00051 U
ENDOSULFAN SULFATE	NC	NC	NC	NC	0.00052 U	0.00052 U	0.00051 U	0.0025 U	0.00051 U	0.00051 U	0.00052 U
ENDRIN	25	510	1	1	0.00079 U	0.00078 U	0.0017 J	0.0038 U	0.0014 J	0.00078 U	0.00078 U
ENDRIN ALDEHYDE	NC	NC	NC	NC	0.00053 U	0.00053 U	0.00052 U	0.0026 U	0.00052 U	0.00053 U	0.00053 U
ENDRIN KETONE	NC	NC	NC	NC	0.0021	0.001 J	0.0045	0.0023 UJ	0.0027	0.00047 U	0.0014 J
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009	0.00048 U	0.00047 U	0.00047 U	0.0023 U	0.00047 U	0.00047 U	0.00047 U
GAMMA-CHLORDANE	NC	NC	NC	NC	0.0057	0.0024	0.0021	0.0023 UJ	0.0024	0.00047 U	0.12
HEPTACHLOR	0.2	1	23	0.2	0.00056 U	0.00056 U	0.00055 U	0.0027 U	0.00055 U	0.00056 U	0.008
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1	0.0011 J	0.0005 U	0.0005 U	0.0025 U	0.0005 U	0.0005 U	0.00051 U
ISODRIN	NC	NC	NC	NC	0.0011 J	0.00047 U	0.0024		0.0024	0.00047 U	0.0021
METHOXYCHLOR	420	8800	160	160	0.00092 U	0.0009 U	0.0009 U	0.0044 UJ	0.00089 U	0.0009 U	0.0009 U
MIREX	NC	NC	NC	NC	0.0011 J	0.00053 U	0.00052 U		0.00052 U	0.00053 U	0.00053 U
TOXAPHENE	0.9	4.5	31	0.9	0.0085 U	0.0084 U	0.0084 U	0.041 U	0.0083 U	0.0084 U	0.0084 U
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)											
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	0.022 U	0.022 U	0.022 U	0.022 U	0.022 U	0.022 U	0.022 U
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	0.022 U	0.022 U	0.022 U	0.022 U	0.022 U	0.022 U	0.022 U
ACENAPHTHENE	2400	20000	2.1	2.1	0.043	0.023 U	0.023 U	0.023 U	0.023 U	0.023 U	0.023 U
ACENAPHTHYLENE	1800	20000	27	27	0.026 J	0.02 U	0.02 U	0.019 U	0.02 U	0.02 U	0.02 U
ANTHRACENE	21000	300000	2500	2500	0.47	0.015 U	0.015 U	0.017 J	0.014 U	0.015 U	0.015 U
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	2.6	0.0	0.1	0.2	0.0	0.0 U	0.1
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	2.7	0.032 J	0.062	0.15	0.031 J	0.0098 U	0.067
BENZO(A)PYRENE	0.1	0.7	8	0.1	1.8	0.023 J	0.06	0.15	0.018 J	0.007 U	0.078
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	3	0.034 J	0.082	0.21	0.029 J	0.013 U	0.1
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	0.74	0.057	0.072	0.15	0.012 U	0.013 U	0.16
BENZO(K)FLUORANTHENE	NC	NC	24	24	1	0.013 U	0.029 J	0.08	0.012 U	0.013 U	0.036
CHRYSENE	NC	NC	77	77	2.4	0.02 J	0.056	0.14	0.02 J	0.012 U	0.063
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	0.15	0.012 U	0.012 U	0.018 J	0.011 U	0.012 U	0.012 U
FLUORANTHENE	3200	59000	1200	1200	5	0.036	0.11	0.25	0.043	0.014 U	0.13
FLUORENE	2600	33000	160	160	0.062	0.022 U	0.022 U	0.022 U	0.022 U	0.022 U	0.022 U
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	0.54	0.013 J	0.027 J	0.076	0.012 U	0.013 U	0.026 J
NAPHTHALENE	55	300	1.2	1.2	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U
PHENANTHRENE	2200	36000	250	250	1.9	0.019 U	0.043	0.065	0.019 U	0.019 U	0.053
PYRENE	2400	45000	880	880	4.1	0.031 J	0.096	0.22	0.035	0.013 U	0.11

Notes:
Samples labeled with SS (i.e., NTC148SS-134-09132011) were collected from the soil pile. Sample depths are measured from the top of the soil pile, not from ground surface.
Samples labeled with SP (i.e., NTC148SSSP1000603012012) were collected from perimeter of the soil pile.

Table 4
Pesticide and PAH Concentrations in Building 148
Building 148/SA 56
Former NTC Orlando, Florida

LOCATION					NTC148SP06	NTC148SP06
SAMPLE ID					NTC148SSSP600060301	NTC148SSSP600060301
SAMPLE DATE	FDEP	FDEP	FDEP	Minimum	20120103	20120103
SAMPLE CODE	Residential	Industrial	Soil to GW		ORIG	DUP
MATRIX					SO	SO
TOP DEPTH (FEET)					0	0
BOTTOM DEPTH (FEET)					0.5	0.5
EASTING					543981.95	543981.95
NORTHING					1535996.343	1535996.343
PESTICIDES (MG/KG)						
4,4'-DDD	4.2	22	5.8	4.2	0.005 U	0.0086 J
4,4'-DDE	2.9	15	18	2.9	0.01 J	0.0069 J
4,4'-DDT	2.9	15	11	2.9	0.069	0.071
ALDRIN	0.06	0.3	0.2	0.06	0.024	0.014
ALPHA-BHC	0.1	0.6	0.0003	0.0003	0.0051 U	0.0025 U
ALPHA-CHLORDANE	NC	NC	NC	NC	0.0047 U	0.0023 UJ
BETA-BHC	0.5	2.4	0.001	0.001	0.01 UJ	0.0052 UJ
CHLORDANE	2.8	14	9.6	2.8		
DELTA-BHC	24	490	0.2	0.2	0.005 U	0.0025 UJ
DIELDRIN	0.06	0.3	0.002	0.002	0.097	0.086
ENDOSULFAN I	NC	NC	NC	NC	0.0041 U	0.002 U
ENDOSULFAN II	NC	NC	NC	NC	0.005 U	0.0025 U
ENDOSULFAN SULFATE	NC	NC	NC	NC	0.0051 UJ	0.0025 U
ENDRIN	25	510	1	1	0.0077 U	0.0038 U
ENDRIN ALDEHYDE	NC	NC	NC	NC	0.0052 U	0.0026 U
ENDRIN KETONE	NC	NC	NC	NC	0.0047 UJ	0.0023 UJ
GAMMA-BHC (LINDANE)	0.7	2.5	0.009	0.009	0.0047 U	0.0023 U
GAMMA-CHLORDANE	NC	NC	NC	NC	0.0047 U	0.0023 UJ
HEPTACHLOR	0.2	1	23	0.2	0.0055 U	0.0027 U
HEPTACHLOR EPOXIDE	0.1	0.5	0.6	0.1	0.005 U	0.0025 U
ISODRIN	NC	NC	NC	NC		
METHOXYCHLOR	420	8800	160	160	0.0089 U	0.0045 UJ
MIREX	NC	NC	NC	NC		
TOXAPHENE	0.9	4.5	31	0.9	0.083 U	0.041 U
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)						
1-METHYLNAPHTHALENE	200	1800	3.1	3.1	8.7 J	0.022 UJ
2-METHYLNAPHTHALENE	210	2100	8.5	8.5	15 J	0.022 UJ
ACENAPHTHENE	2400	20000	2.1	2.1	52 J	0.041 J
ACENAPHTHYLENE	1800	20000	27	27	0.99 UJ	0.091 J
ANTHRACENE	21000	300000	2500	2500	89 J	0.11 J
BAP EQUIVALENT-HALFND	0.1	0.7	8	0.1	199.6	1.0
BENZO(A)ANTHRACENE	NC	NC	0.8	0.8	160 J	0.73 J
BENZO(A)PYRENE	0.1	0.7	8	0.1	140 J	0.71 J
BENZO(B)FLUORANTHENE	NC	NC	2.4	2.4	190 J	1.1 J
BENZO(G,H,I)PERYLENE	2500	52000	32000	2500	70 J	0.37 J
BENZO(K)FLUORANTHENE	NC	NC	24	24	67 J	0.31 J
CHRYSENE	NC	NC	77	77	130 J	0.57 J
DIBENZO(A,H)ANTHRACENE	NC	NC	0.7	0.7	17 J	0.076 J
FLUORANTHENE	3200	59000	1200	1200	340 J	1.4 J
FLUORENE	2600	33000	160	160	50 J	0.044 J
INDENO(1,2,3-CD)PYRENE	NC	NC	6.6	6.6	68 J	0.32 J
NAPHTHALENE	55	300	1.2	1.2	56 J	0.041 J
PHENANTHRENE	2200	36000	250	250	270 J	0.43 J
PYRENE	2400	45000	880	880	260 J	1.2 J

Notes:

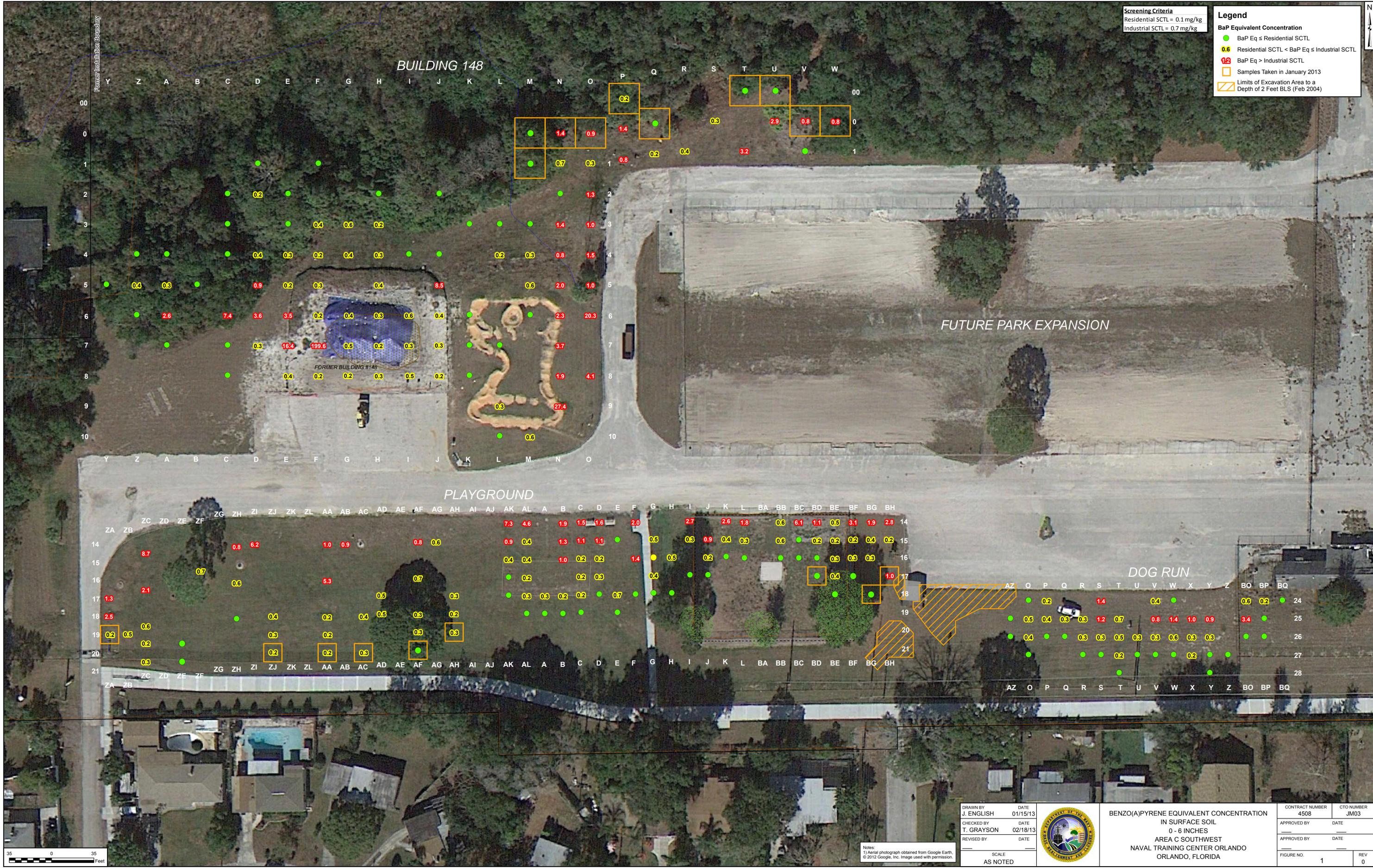
Samples labeled with SS (i.e., NTC148SS-134-09132011) were collected from the soil pile. Sample depths are measured from the top of the soil pile, not from ground surface.

Samples labeled with SP (i.e., NTC148SSSP1000603012012) were collected from perimeter of the soil pile.

Screening Criteria
 Residential SCTL = 0.1 mg/kg
 Industrial SCTL = 0.7 mg/kg

Legend

- BaP Equivalent Concentration
- BaP Eq ≤ Residential SCTL
- 0.6 Residential SCTL < BaP Eq ≤ Industrial SCTL
- 1.2 BaP Eq > Industrial SCTL
- Samples Taken in January 2013
- ▨ Limits of Excavation Area to a Depth of 2 Feet BLS (Feb 2004)



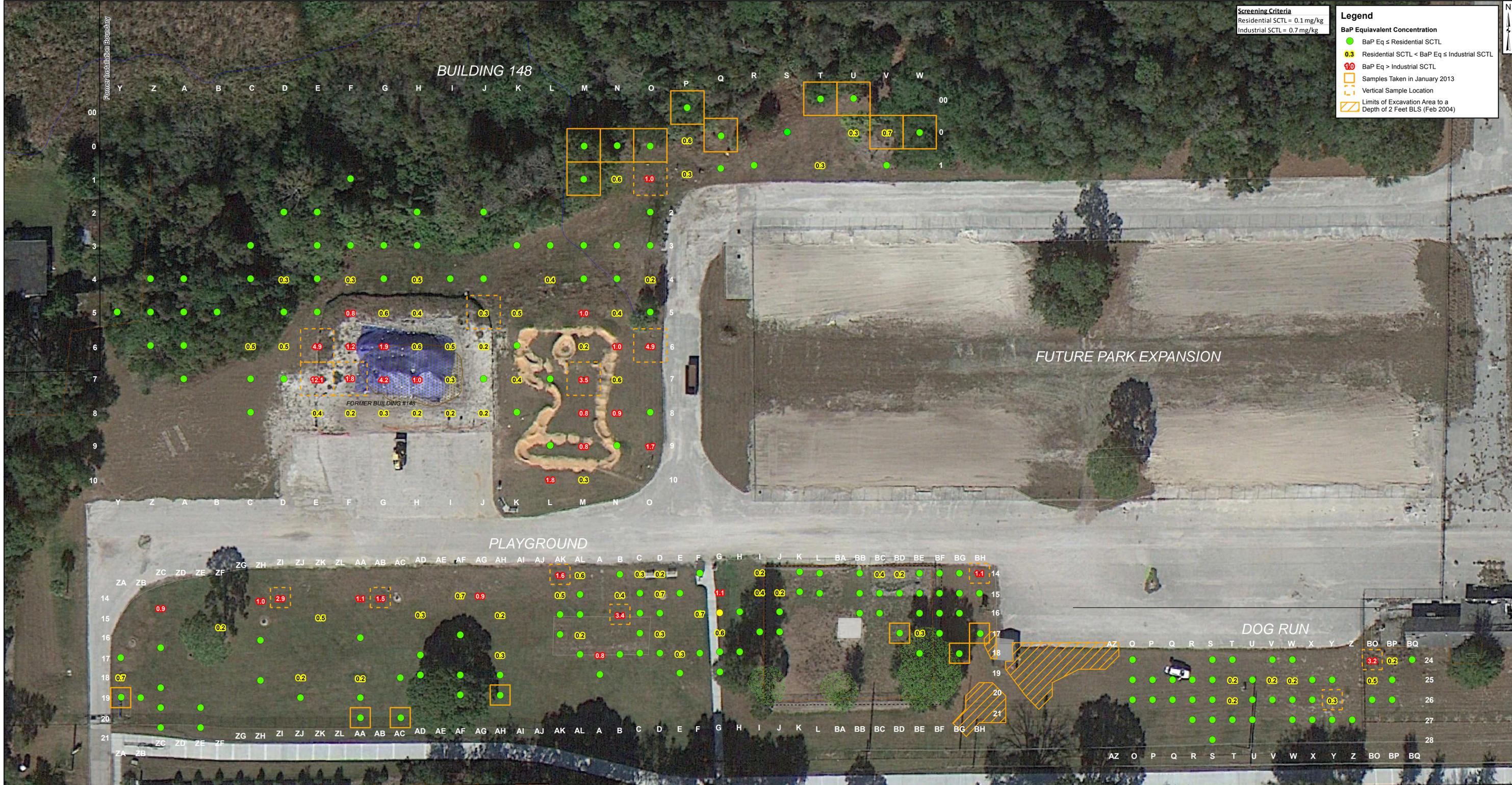
Notes:
 1) Aerial photograph obtained from Google Earth, © 2012 Google, Inc. Image used with permission.

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CHECKED BY T. GRAYSON	DATE 02/18/13
REVISED BY	DATE
SCALE AS NOTED	



BENZO(A)PYRENE EQUIVALENT CONCENTRATION
 IN SURFACE SOIL
 0 - 6 INCHES
 AREA C SOUTHWEST
 NAVAL TRAINING CENTER ORLANDO
 ORLANDO, FLORIDA

CONTRACT NUMBER 4508	CTO NUMBER JM03
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO. 1	REV 0



Screening Criteria
 Residential SCTL = 0.1 mg/kg
 Industrial SCTL = 0.7 mg/kg

Legend

- BaP Eq ≤ Residential SCTL
- Residential SCTL < BaP Eq ≤ Industrial SCTL
- BaP Eq > Industrial SCTL
- Samples Taken in January 2013
- Vertical Sample Location
- Limits of Excavation Area to a Depth of 2 Feet BLS (Feb 2004)

VERTICAL SAMPLE RESULTS			
AREA	SAMPLE LOCATION	SAMPLE DEPTH	BaP Eq (mg/kg)
Bldg 148	E6	2-4'	0.1
	E7	2-4'	0.2
	E7	4-6'	0.0
	F7	2-3'	0.7
	J5	2-3'	0.7
	M7	2-4'	0.1
O1	2-4'	0.0	
O6	2-4'	0.0	

VERTICAL SAMPLE RESULTS			
AREA	SAMPLE LOCATION	SAMPLE DEPTH	BaP Eq (mg/kg)
Playground	ZI15	2-3'	0.1
	AB15	2-3'	0.0
	AK14	2-3'	0.0
	B16	2-3'	0.0
BH14	2-3'	0.0	

VERTICAL SAMPLE RESULTS			
AREA	SAMPLE LOCATION	SAMPLE DEPTH	BaP Eq (mg/kg)
Dog Run	Y26	2-3'	0.1
	BO24	2-3'	0.0

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 CHECKED BY: T. GRAYSON DATE: 02/20/13
 REVISED BY: DATE: _____
 SCALE: AS NOTED



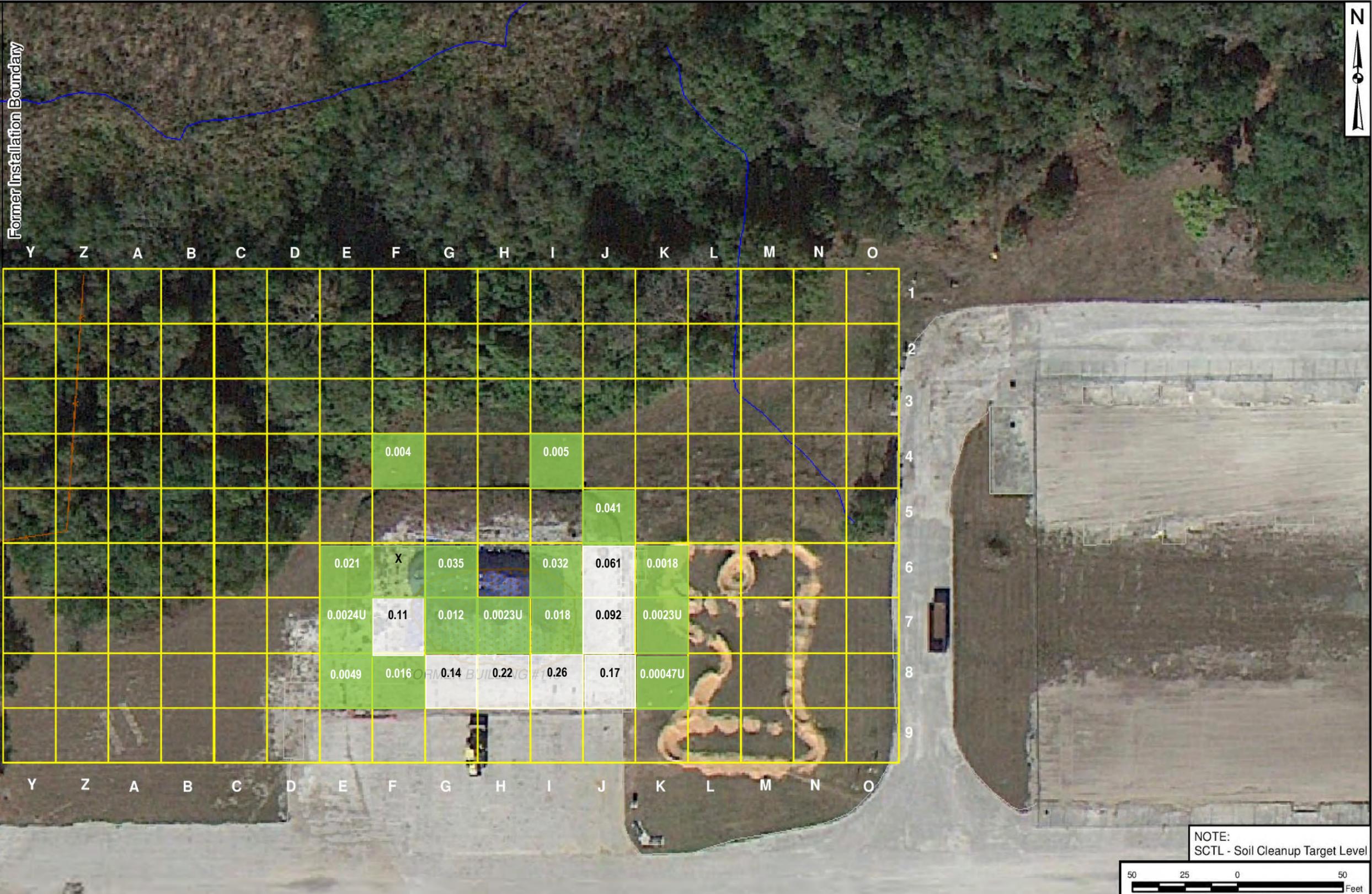
BENZO(A)PYRENE EQUIVALENT CONCENTRATION
 IN SURFACE SOIL
 6 - 24 INCHES
 AREA C SOUTHWEST
 NAVAL TRAINING CENTER ORLANDO
 ORLANDO, FLORIDA

CONTRACT NUMBER	4508	CTO NUMBER	JM03
APPROVED BY	DATE	APPROVED BY	DATE
FIGURE NO.	2	REV	0

Notes:
 1) Aerial photograph obtained from Google Earth, © 2012 Google, Inc. Image used with permission.



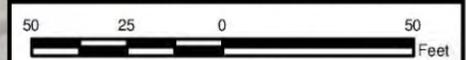
Source Imagery: © 2012 Google, Map Data
© 2012 Google Imagery date: 01/03/2012



Screening Levels	
Residential SCTL = 0.06 mg/kg	
Industrial SCTL = 0.3 mg/kg	
Leachability SCTL (PQL) = 0.003 mg/kg	
0.06 dieldrin < Residential SCTL	
0.07 dieldrin > Residential SCTL	
0.4 dieldrin > Industrial SCTL	
0.004 dieldrin > Leachability PQL	

Legend	
	25 foot Sample Grid

NOTE:
SCTL - Soil Cleanup Target Level



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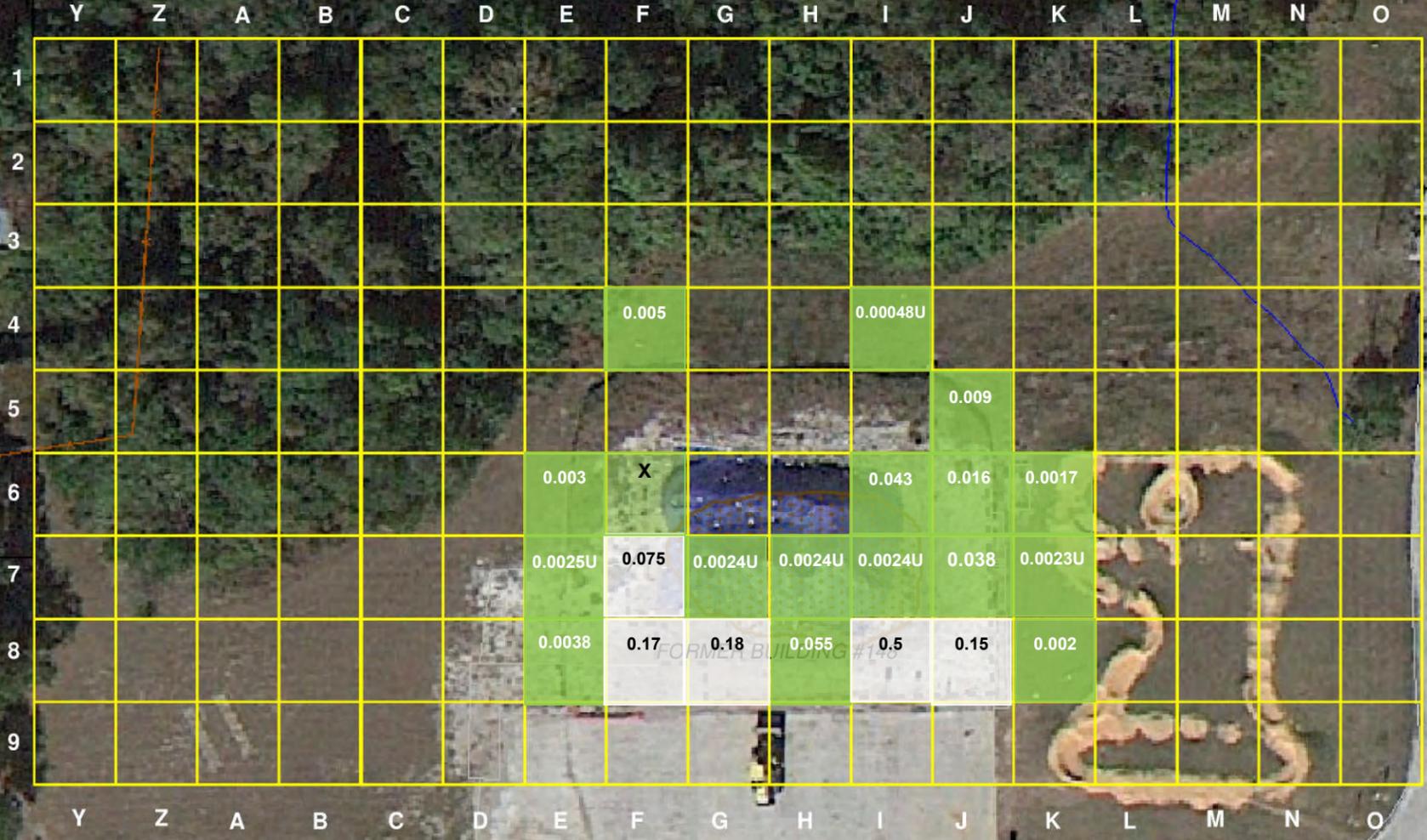


DIELDRIN CONCENTRATION
IN SURFACE SOIL
0 - 6 AND 0 - 12 INCHES
FORMER BUILDING 148 - AREA C
NAVAL TRAINING CENTER ORLANDO
ORLANDO, FLORIDA

CONTRACT NUMBER	CTO NUMBER
112G02581	
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO.	REV
1	0

Source Imagery: © 2012 Google, Map Data
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Former Installation Boundary



Screening Levels	
Residential SCTL = 0.06 mg/kg	
Industrial SCTL = 0.3 mg/kg	
Leachability SCTL (PQL) = 0.003 mg/kg	

0.06 dieldrin < Residential SCTL
0.07 dieldrin > Residential SCTL
0.4 dieldrin > Industrial SCTL
0.004 dieldrin > Leachability PQL

Legend	
	25 foot Sample Grid

NOTE:
SCTL - Soil Cleanup Target Level



DRAWN BY	DATE
S. PAXTON	10/31/12
CHECKED BY	DATE
T. GRAYSON	10/31/12
REVISED BY	DATE
SCALE AS NOTED	



DIELDRIN CONCENTRATION
IN SURFACE SOIL
6 - 24 INCHES
FORMER BUILDING 148 - AREA C
NAVAL TRAINING CENTER ORLANDO
ORLANDO, FLORIDA

CONTRACT NUMBER	CTO NUMBER
112G02581	
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO.	REV
2	0

Subject: **Limited Soil Sampling and Analysis Report**
Building 148, Area C
Naval Training Center Orlando, Orlando, Florida

Prepared for: Art Sanford, BRAC PMO Office Southeast

Prepared by: Ronald J. Kotun, Ph.D., Tetra Tech NUS, Inc.

Date: October 5, 2011

1.0 INTRODUCTION

In January 2009, Area C Southwest (SW), a 19.73-acre parcel of the former Naval Training Center (NTC) Orlando, was transferred to the City of Orlando through the Federal Lands to Parks Program of the United States Department of Interior, National Park Service, for Public Park and public recreation area purposes. In May 2011, in preparation for site development, Building 148, the former Cold Storage Building located at Area C SW, was demolished by the City of Orlando. Following demolition, the soil beneath the building was stockpiled and sampled prior to disposal by the City of Orlando's environmental consultant, Professional Services Industries, Inc. Figure 1 shows the location of Building 148 within Area C SW.

The Navy received a Notice of Environmental Claim letter dated July 22, 2011 from George Schlossberg, City of Orlando legal, officially notifying the Navy of the surface soil sampling results from Building 148 that indicated concentrations of polynuclear aromatic hydrocarbons (PAHs) and dieldrin greater than Florida Department of Environmental Protection (FDEP) cleanup target levels and requesting a reply as to how the Navy intended to address these matters. This technical memorandum describes soil sampling activities performed at Building 148, Area C in response to the City of Orlando's notice and evaluates the suitability for onsite use of the soil.

2.0 SOIL PILE SAMPLING

The Navy contracted Tetra Tech to collect additional soil samples and to evaluate the suitability for spreading the soil on site. The Navy and Tetra Tech developed a sampling strategy, approved by FDEP, based on the soil pile dimensions shown in Figure 2. A sample grid was established and depths determined based on the following information. From site photos and discussions with the City, the Building 148 floor slab was approximately 3 feet above grade. Following demolition of Building 148, perimeter soil was graded and piled onto of foundation soil. The lower 3.5 feet of the stockpile represents undisturbed material that lay directly beneath the former slab and the upper 3 to 9 feet consists of former perimeter soil that has been scraped, mixed, and disturbed and located on top of the pile.

On September 13, 2011, Tetra Tech collected 16 soil samples from the soil stockpile to determine if the stockpile was impacted by previously identified contaminants. The samples were analyzed for PAHs and organochlorine pesticides.

Soil samples were collected at the 0 to 1 foot depth at all locations to monitor the perimeter soil stockpiled on top of the undisturbed soil. At locations 1 through 4 soil samples were also collected at the 3 to 4 foot interval to monitor immediately beneath the former building slab. On the deeper end (East end) of the soil pile, samples were also collected at the 8 to 9 foot depths to provide samples from near the current land surface.

3.0 SOIL PILE SAMPLING RESULTS

Of the 16 samples collected, aldrin, benzo(a)pyrene, benzo[a]pyrene equivalents, and dieldrin were detected in at least one sample at concentrations greater than their respective residential Soil Cleanup Target Levels (SCTLs). Benzo[a]pyrene, benzo[a]pyrene equivalents, and dieldrin were detected at concentrations in at least one sample greater than their respective industrial SCTLs. Aldrin, alpha-BHC, benzo[a]anthracene, benzo[b]fluoranthene, delta-BHC, and dieldrin were detected at concentrations in at least one sample at concentrations greater than their respective leachability SCTLs.

An exposure point concentration is a concentration in a medium that is statistically representative and used to calculate the potential risk for a potential receptor in a given exposure scenario (e.g., incidental ingestion of soil by a resident). Typically, the exposure point concentration for a contaminant in soil is represented by the 95 percent upper confidence limit of the mean (UCL). The UCL is defined as the value that, when calculated repeatedly for randomly drawn sets of site data, equals or exceeds the true mean 95 percent of the time. Use of the UCL ensures that the exposure point concentration is not underestimated when calculating risk.

As the number of samples increases, the UCL begins to approach the true mean. In cases where there is a limited number of samples, the UCL will be greater than the true mean, and may actually be greater than the maximum detected concentration at the site. In this case, the maximum detected concentration is used to represent the exposure point concentration.

EPA's Risk Assessment Guidance for Superfund (1989) states that the UCL should be used to represent the exposure point concentration. Currently, EPA's software, ProUCL, is used to calculate various types of UCLs for EPA-lead risk assessments. ProUCL recommends which UCL is most appropriate to represent the exposure point concentration based on the distribution of the data, the variability of the data, and the number of detections within the data set. Similarly, the Florida Department of Environmental Protection (FDEP) has its own software to calculate UCLs, Florida-UCL. Florida-UCL differs primarily from ProUCL in its sampling requirements and in its algorithms for selecting the most appropriate UCL.

Because we are evaluating a soil pile that would be distributed across an area in lieu of sampling an exposure area, use of the UCL is more appropriate as a basis of comparison to risk-based or leachability soil standards rather than discrete concentrations in individual soil samples. The attached table provides the maximum detected concentrations and the UCLs for the individual parameters. The statistical output from Florida-UCL is provided as an attachment.

The UCLs for aldrin, benzo(a)pyrene, benzo[a]pyrene equivalents, and dieldrin exceed their respective residential SCTLs. The UCLs for dieldrin and benzo[a]pyrene equivalents exceed their industrial SCTLs. The UCLs for alpha-BHC, delta-BHC, and dieldrin exceed their respective leachability SCTLs. However, it is important to note that the exposure concentrations for alpha-BHC and delta-BHC are represented by their maximum detected concentrations; alpha-BHC and delta-BHC were only detected in 1 of the 16 samples, thus rendering Florida-UCL unable to calculate a UCL. Florida-UCL requires a minimum of 10 samples and a minimum of 7 detections to calculate a UCL, or a minimum of 3 detections to calculate a UCL using the bounding method. If there are less than 3 detections, as is the case with alpha-BHC and delta-BHC, the maximum is used. Use of the maximum may overestimate the true average concentration of these contaminants.

It is understood that this soil would be distributed over an area that would not be used for residential use. In accordance with 62-780.650(1)(a)4 F.A.C., evaluation of potential risk requires one to “[d]etermine exposure factors (exposure duration and frequency) based on site-specific characteristics, including consideration of current and plausible projected land uses” The FDEP Technical Report: Development of Cleanup Target Levels (CTLs) for Chapter 62-777, F.A.C. (February 2005) provides the framework for developing site-specific SCTLs using site-specific exposure factors.

If the area where this soil were to be distributed were to be limited to recreational use in the future, one’s exposure frequency would be less than if it were used for residential or industrial purposes. An assumption of an exposure frequency of 200 days per year, rather than 350 days per year for residential exposure, is recommended by FDEP. Assuming that nearby residents would be likely to use this recreational area, FDEP default residential exposure assumptions (e.g., ingestion rate of soil, exposure duration, body weight) would remain unchanged. This of course assumes that all of one’s soil contact is from the recreational area and not from one’s residence, an assumption conservative toward the protection of human health. Risks are directly proportional to exposure and SCTLs are inversely proportional to risk. Assuming an annual recreational exposure frequency of 200 days per year, in lieu of a residential annual exposure frequency of 350 days per year, results in a recreational SCTL 1.75 times greater than the residential SCTL (350 days per year divided by 200 days per year). Benzo[a]pyrene, benzo(a)pyrene equivalents, and dieldrin still have UCL concentrations greater than their respective recreational SCTLs. Therefore, it would not be appropriate to redistribute the soil across the site, even if it is limited to recreational use.



FIGURE 1
BUILDING 148 SITE LOCATION MAP
NAVAL TRAINING CENTER ORLANDO
ORLANDO, FLORIDA

FIGURE 2
SOIL PILE SAMPLING DEPTHS AND LOCATIONS
FORMER BUILDING 148, AREA C
NAVAL TRAINING CENTER ORLANDO
ORLANDO, FLORIDA

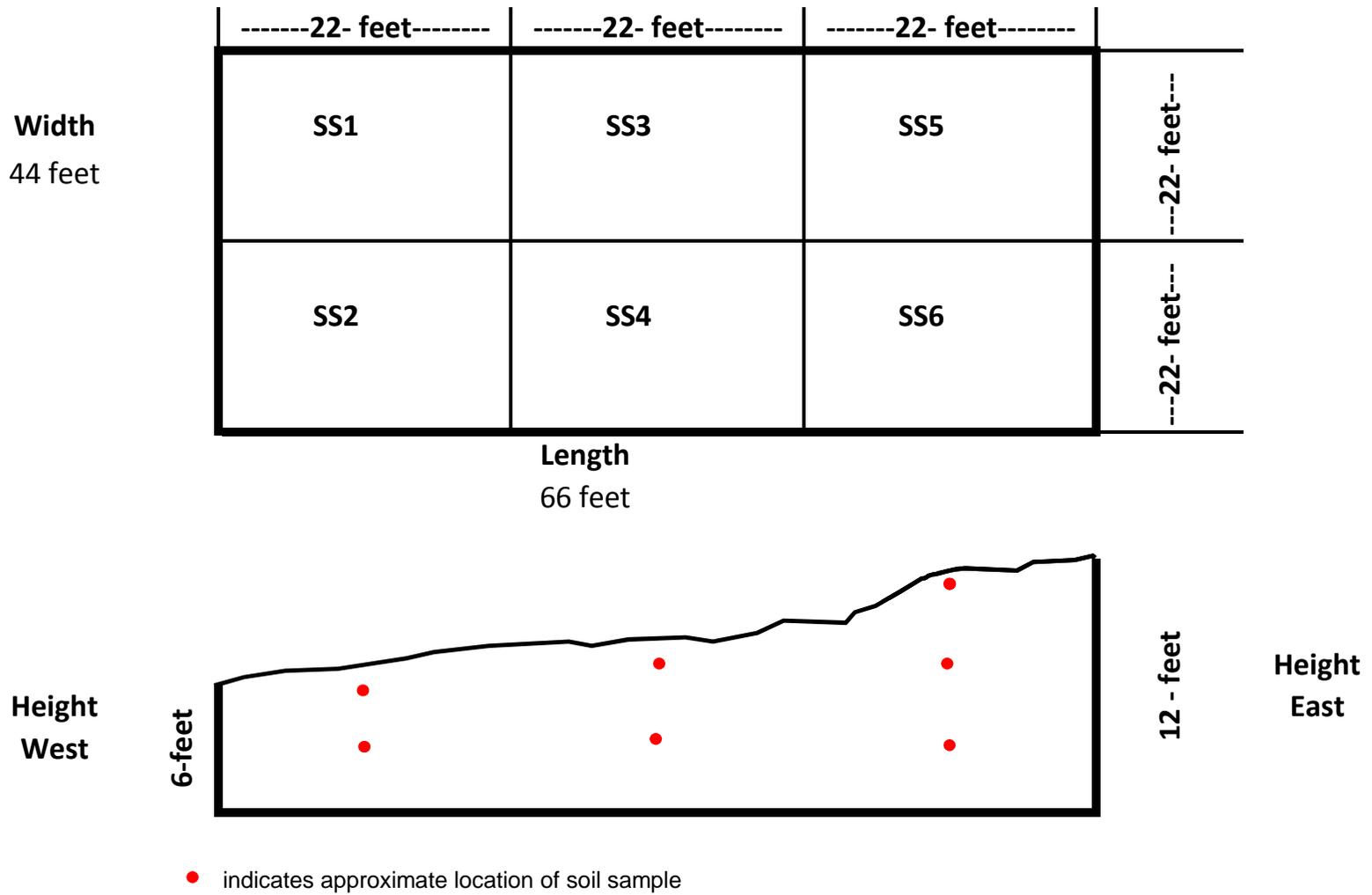


TABLE 1
MAXIMUM CONCENTRATIONS AND UCLs FOR SELECTED PARAMETERS
BUILDING 148, AREA C SURFACE SOIL
NAVAL TRAINING CENTER ORLANDO
ORLANDO, FLORIDA

Analyte	Maximum	UCL ⁽¹⁾	UCL Type	Residential SCTL	Industrial SCTL	Recreational SCTL	Leachability SCTL	C/N
4,4'-DDD	0.05	0.0303	95% Chebyshev (Mean, Std)	4.2	22	7.4	5.8	C
4,4'-DDE	0.044	0.0201	95% Chebyshev (Mean, Std)	2.9	15	5.1	18	C
4,4'-DDT	0.28	0.1696	95% Chebyshev (Mean, Std)	2.9	15	5.1	11	C
Aldrin	0.23	0.1007	95% Chebyshev (Mean, Std)	0.06	0.3	0.11	0.2	C
alpha-BHC	0.0035	0.0035	Maximum (only one detection)	0.1	0.6	0.2	0.0003	C
Benzo(a)anthracene	2.7	0.5606	95% CLT	*	*	*	0.8	C
Benzo(a)pyrene	1.8	0.65	95% Chebyshev (MVUE)	0.1	0.7	0.2	8	C
Benzo(a)pyrene Equivalents	2.6	0.9677	95% Chebyshev (MVUE)	0.1	0.7	0.2	8	C
Benzo(b)fluoranthene	3	0.903	95% Chebyshev (MVUE)	*	*	*	2.4	C
Benzo(k)fluoranthene	1	0.3812	95% Chebyshev (Mean, Std)	*	*	*	24	C
Chlordane (tech)	0.69	0.267	95% Chebyshev (Mean, Std)	2.8	14	4.9	9.6	C
Chlordane-alpha	0.11	0.0318	95% Chebyshev (MVUE)	2.8	14	4.9	9.6	C
Chlordane-gamma	0.12	0.0307	95% Chebyshev (MVUE)	2.8	14	4.9	9.6	C
Chrysene	2.4	0.6387	95% Chebyshev (MVUE)	*	*	*	77	C
delta-BHC	0.0025	0.0025	Maximum (too few detections)	0.06	0.3	0.1	0.002	C
Dibenzo(a,h)anthracene	0.15	0.0624	95% Chebyshev (Mean, Std)	*	*	*	0.7	C
Dieldrin	0.56	0.487	95% H	0.06	0.3	0.1	0.002	C
gamma-BHC	0.0024	0.0013	Bounding (Max)	0.7	2.5	1.2	0.009	C
Heptachlor	0.008	0.0035	Bounding (Max)	0.2	1	0.4	23	C
Heptachlor epoxide	0.0025	0.0025	Maximum (only one detection)	0.1	0.5	0.2	0.6	C
Indeno(1,2,3-cd)pyrene	0.54	0.2098	95% Chebyshev (MVUE)	*	*	*	6.6	C

Acenaphthene	0.0509	0.0407	95% Bounding Max	2400	20000	4200	2.1	N
Acenaphthylene	0.0401	0.0329	95% Bounding Max	1800	20000	3150	27	N
Anthracene	0.47	0.187	95% Chebyshev (Mean, Std)	21000	300000	36750	2500	N
Benzo(g,h,i)perylene	0.74	0.4177	95% Chebyshev (MVUE)	2500	52000	4375	32000	N
Endrin	0.0039	0.0023	Bounding (Max)	25	510	44	1	N
Endrin aldehyde	0.0028	0.0028	Maximum (only two detections)	NA	NA	NA	NA	N
Endrin ketone	0.0056	0.0051	95% H	NA	NA	NA	NA	N
Fluoranthene	5	1.474	95% Chebyshev (MVUE)	3200	58000	5600	1200	N
Fluorene	0.064	0.0456	95% Bounding Max	2600	33000	4550	160	N
Isodrin	0.011	0.0049	95% Chebyshev (Mean, Std)	NA	NA	NA	NA	N
Methoxychlor	0.0091	0.0091	Maximum (only two detections)	NA	NA	NA	NA	N
Mirex	0.012	0.012	Maximum (only two detections)	NA	NA	NA	NA	N
Phenanthrene	1.9	0.7476	95% Chebyshev (Mean, Std)	2200	36000	3850	250	N
Pyrene	4.1	1.168	95% Chebyshev (MVUE)	2400	45000	4200	880	N

1-Methylnaphthalene		NA	None of the samples are detected
2-Methylnaphthalene		NA	None of the samples are detected
beta-BHC		NA	None of the samples are detected
Endosulfan I		NA	None of the samples are detected
Endosulfan II		NA	None of the samples are detected
Endosulfan sulfate		NA	None of the samples are detected
Naphthalene		NA	None of the samples are detected
Toxaphene		NA	None of the samples are detected

Units of mg/kg

(1) UCLs were calculated using FLUCL version 1.0.

* Carcinogenic PAH--Value linked to Benzo[a]pyrene equivalents

Max=Maximum

MVUE = Minimum Variance Unbiased Estimator

Std = Standard Deviation

NA- Not available.

C - Carcinogen

N- Noncarcinogen

Shaded cell indicates that UCL exceeds the criterion

ATTACHMENT

FLORIDA-UCL OUTPUT
BUILDING 148, AREA C SURFACE SOIL PILE

FDEP UCL Calculator Version 1.0

10/5/11

Summary Statistics for Aldrin

Number of Samples	16
Number of Censored Data	0
Minimum	0.0011
Maximum	0.23
Mean	0.043144
Median	0.03
Standard Deviation	0.052774
Variance	0.002785
Coefficient of Variation	1.223203
Skewness	3.275076

95% UCL (Assuming Normal Data)

Student's-t	0.066272
-------------	----------

95% UCL (Adjusted for Skewness)

Adjusted-CLT	0.076391
Modified-t	0.068073

95% Non-parametric UCL

CLT	0.064847
Jackknife	NA
Standard Bootstrap	0.064708
Bootstrap-t	0.089513
Chebyshev (Mean, Std)	0.100654

Summary Statistics for ln(Aldrin)

Minimum	-6.81245
Maximum	-1.46968
Mean	-3.67755
Standard Deviation	1.218028
Variance	1.483593

Goodness-of-Fit Results

Distribution Recommended	Neither
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	0.053091
MLE Standard Deviation	0.09802
MLE Median	0.025285
MLE Coefficient of Variation	1.846282
MVUE Estimate of Mean	0.049386
MVUE Estimate of Std. Dev.	0.072314
MVUE Estimate of SE	0.016943
MVUE Coefficient of Variation	1.464265

UCL Assuming Lognormal Distribution

95% H-UCL	0.143523
95% Chebyshev (MVUE) UCL	0.123237
99% Chebyshev (MVUE) UCL	0.217965

FDEP Recommended UCL to Use:
0.100654

FDEP UCL Calculator Version 1.0

10/5/11

*Note: Too few observations available to compute UCLs - Use Maximum.***Summary Statistics for alpha-BHC**

Number of Samples	16
Number of Censored Data	15
Minimum	0.0035
Maximum	0.0035
Mean	0.000701875
Median	0.000515
Standard Deviation	0.000746192
Variance	
Coefficient of Variation	1.063141227
Skewness	3.999529839

95% UCL (Assuming Normal Data)

Student's-t	NA
-------------	----

95% UCL (Adjusted for Skewness)

Adjusted-CLT	NA
Modified-t	NA

95% Non-parametric UCL

CLT	NA
Jackknife	NA
Standard Bootstrap	NA
Bootstrap-t	NA
Chebyshev (Mean, Std)	NA

Summary Statistics for

Minimum	NA
Maximum	NA
Mean	NA
Standard Deviation	NA
Variance	NA

Goodness-of-Fit Results

Distribution Recommended	NA
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	NA
MLE Standard Deviation	NA
MLE Median	NA
MLE Coefficient of Variation	NA

MVUE Estimate of Mean	NA
MVUE Estimate of Std. Dev.	NA
MVUE Estimate of SE	NA
MVUE Coefficient of Variation	NA

UCL Assuming Lognormal Distribution

95% H-UCL	NA
95% Chebyshev (MVUE) UCL	NA
99% Chebyshev (MVUE) UCL	NA

FDEP Recommended UCL to Use:

0.0035

FDEP UCL Calculator Version 1.0

10/5/11

Note: Too few observations available to compute UCLs - Use Maximum.

Summary Statistics for beta-BHC

Number of Samples	16
Number of Censored Data	16
Minimum	
Maximum	
Mean	
Median	
Standard Deviation	
Variance	
Coefficient of Variation	
Skewness	

95% UCL (Assuming Normal Data)

Student's-t	NA
-------------	----

95% UCL (Adjusted for Skewness)

Adjusted-CLT	NA
Modified-t	NA

95% Non-parametric UCL

CLT	NA
Jackknife	NA
Standard Bootstrap	NA
Bootstrap-t	NA
Chebyshev (Mean, Std)	NA

Summary Statistics for

Minimum	NA
Maximum	NA
Mean	NA
Standard Deviation	NA
Variance	NA

Goodness-of-Fit Results

Distribution Recommended	NA
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	NA
MLE Standard Deviation	NA
MLE Median	NA
MLE Coefficient of Variation	NA

MVUE Estimate of Mean	NA
MVUE Estimate of Std. Dev.	NA
MVUE Estimate of SE	NA
MVUE Coefficient of Variation	NA

UCL Assuming Lognormal Distribution

95% H-UCL	NA
95% Chebyshev (MVUE) UCL	NA
99% Chebyshev (MVUE) UCL	NA

FDEP Recommended UCL to Use:

FDEP UCL Calculator Version 1.0

10/5/11

Note: Too few observations available to compute UCLs - Use Maximum.

Summary Statistics for delta-BHC	
Number of Samples	16
Number of Censored Data	15
Minimum	0.0025
Maximum	0.0025
Mean	0.000641875
Median	0.0005
Standard Deviation	0.000498454
Variance	
Coefficient of Variation	0.776559055
Skewness	3.924276114

95% UCL (Assuming Normal Data)	
Student's-t	NA

95% UCL (Adjusted for Skewness)	
Adjusted-CLT	NA
Modified-t	NA

95% Non-parametric UCL	
CLT	NA
Jackknife	NA
Standard Bootstrap	NA
Bootstrap-t	NA
Chebyshev (Mean, Std)	NA

Summary Statistics for	
Minimum	NA
Maximum	NA
Mean	NA
Standard Deviation	NA
Variance	NA

Goodness-of-Fit Results	
Distribution Recommended	NA
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	NA
MLE Standard Deviation	NA
MLE Median	NA
MLE Coefficient of Variation	NA
MVUE Estimate of Mean	NA
MVUE Estimate of Std. Dev.	NA
MVUE Estimate of SE	NA
MVUE Coefficient of Variation	NA

UCL Assuming Lognormal Distribution

95% H-UCL	NA
95% Chebyshev (MVUE) UCL	NA
99% Chebyshev (MVUE) UCL	NA

FDEP Recommended UCL to Use:	
0.0025	

FDEP UCL Calculator Version 1.0

10/5/11

Note: Bounding estimates are worst case 95% UCLs based on the Chebyshev (mean, std) method.

Summary Statistics for gamma-BHC

Number of Samples	16
Number of Censored Data	13
Minimum	0.001
Maximum	0.0024
Mean	0.000716875
Median	0.00047
Standard Deviation	0.000527683
Variance	
Coefficient of Variation	0.736088216
Skewness	2.57040906

95% UCL (Assuming Normal Data)

Student's-t	NA
-------------	----

95% UCL (Adjusted for Skewness)

Adjusted-CLT	NA
Modified-t	NA

95% Non-parametric UCL

CLT	NA
Jackknife	NA
Standard Bootstrap	NA
Bootstrap-t	NA
Chebyshev (Mean, Std)	NA

95% Bounding Method UCL

Bounding (Max)	0.001292004
Bounding (1/2 DL)	0.000919672

Summary Statistics for

Minimum	NA
Maximum	NA
Mean	NA
Standard Deviation	NA
Variance	NA

Goodness-of-Fit Results

Distribution Recommended	NA
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	NA
MLE Standard Deviation	NA
MLE Median	NA
MLE Coefficient of Variation	NA
MVUE Estimate of Mean	NA
MVUE Estimate of Std. Dev.	NA
MVUE Estimate of SE	NA
MVUE Coefficient of Variation	NA

UCL Assuming Lognormal Distribution

95% H-UCL	NA
95% Chebyshev (MVUE) UCL	NA
99% Chebyshev (MVUE) UCL	NA

FDEP Recommended UCL to Use:
0.001292

Summary Statistics for Chlordane.tech

Number of Samples	16
Number of Censored Data	6
Minimum	0.0135
Maximum	0.689999998
Mean	0.087625
Median	0.041000001
Standard Deviation	0.164637531
Variance	0.027105516
Coefficient of Variation	1.878887662
Skewness	3.688198805

95% UCL (Assuming Normal Data)

Student's-t	0.159779474
-------------	-------------

95% UCL (Adjusted for Skewness)

Adjusted-CLT	0.195889458
Modified-t	0.16610463

95% Non-parametric UCL

CLT	0.155332178
Jackknife	NA
Standard Bootstrap	0.160812736
Bootstrap-t	0.339564323
Chebyshev (Mean, Std)	0.267038763

Summary Statistics for

ln(Chlordane.tech)

Minimum	-4.30507
Maximum	-0.37106
Mean	-3.15594
Standard Deviation	1.079559
Variance	1.165447

Goodness-of-Fit Results

Distribution Recommended	Neither
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	0.07629
MLE Standard Deviation	0.113345
MLE Median	0.042598
MLE Coefficient of Variation	1.485718
MVUE Estimate of Mean	0.070361
MVUE Estimate of Std. Dev.	0.082382
MVUE Estimate of SE	0.025268
MVUE Coefficient of Variation	1.17085

UCL Assuming Lognormal Distribution

95% H-UCL	0.172547
95% Chebyshev (MVUE) UCL	0.180502
99% Chebyshev (MVUE) UCL	0.321777

FDEP Recommended UCL to Use:
0.267039

Summary Statistics for alpha Chlordane

Number of Samples	16
Number of Censored Data	1
Minimum	0.000235
Maximum	0.109999999
Mean	0.013314687
Median	0.0049
Standard Deviation	0.026322919
Variance	0.000692896
Coefficient of Variation	1.976983586
Skewness	3.734618664

95% UCL (Assuming Normal Data)

Student's-t	0.024851037
-------------	-------------

95% UCL (Adjusted for Skewness)

Adjusted-CLT	0.030706065
Modified-t	0.02587506

95% Non-parametric UCL

CLT	0.024139987
Jackknife	NA
Standard Bootstrap	0.02459158
Bootstrap-t	0.055207938
Chebyshev (Mean, Std)	0.042000089

Summary Statistics for ln()

Minimum	-8.35592
Maximum	-2.20727
Mean	-5.15463
Standard Deviation	1.287312
Variance	1.657172

Goodness-of-Fit Results

Distribution Recommended	Lognormal
Distribution Used	Lognormal

Estimates Assuming Lognormal Distribution

MLE Mean	0.01322
MLE Standard Deviation	0.027235
MLE Median	0.005773
MLE Coefficient of Variation	2.060209
MVUE Estimate of Mean	0.012095
MVUE Estimate of Std. Dev.	0.018858
MVUE Estimate of SE	0.004521
MVUE Coefficient of Variation	1.559071

UCL Assuming Lognormal Distribution

95% H-UCL	0.039372
95% Chebyshev (MVUE) UCL	0.031802
99% Chebyshev (MVUE) UCL	0.057079

FDEP Recommended UCL to Use:
0.031802

Summary Statistics for Chlordanegamma

Number of Samples	16
Number of Censored Data	1
Minimum	0.000235
Maximum	0.119999997
Mean	0.013389687
Median	0.0042
Standard Deviation	0.028868131
Variance	0.000833369
Coefficient of Variation	2.155997387
Skewness	3.800174475

95% UCL (Assuming Normal Data)

Student's-t	0.02604151
-------------	------------

95% UCL (Adjusted for Skewness)

Adjusted-CLT	0.03258907
Modified-t	0.027184259

95% Non-parametric UCL

CLT	0.025261706
Jackknife	NA
Standard Bootstrap	0.025712645
Bootstrap-t	0.065585218
Chebyshev (Mean, Std)	0.044848733

Summary Statistics for ln(Chlordanegamma)

Minimum	-8.35592461
Maximum	-2.12026358
Mean	-5.25716811
Standard Deviation	1.327281004
Variance	1.761674863

Goodness-of-Fit Results

Distribution Recommended	Lognormal
Distribution Used	Lognormal

Estimates Assuming Lognormal Distribution

MLE Mean	0.012571403
MLE Standard Deviation	0.027606126
MLE Median	0.005210038
MLE Coefficient of Variation	2.1959464

MVUE Estimate of Mean	0.011414832
MVUE Estimate of Std. Dev.	0.018546399
MVUE Estimate of SE	0.004413261
MVUE Coefficient of Variation	1.624763276

UCL Assuming Lognormal Distribution

95% H-UCL	0.039684799
95% Chebyshev (MVUE) UCL	0.030651797
99% Chebyshev (MVUE) UCL	0.055326343

FDEP Recommended UCL to Use:
0.030652

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Summary Statistics for 4,4'- DDD

Number of Samples	16
Number of Censored Data	1
Minimum	0.00025
Maximum	0.05
Mean	0.012578
Median	0.005
Standard Deviation	0.016219
Variance	0.000263
Coefficient of Variation	1.289483
Skewness	1.729556

95% UCL (Assuming Normal Data)

Student's-t	0.019686
-------------	----------

95% UCL (Adjusted for Skewness)

Adjusted-CLT	0.021122
Modified-t	0.019979

95% Non-parametric UCL

CLT	0.019248
Jackknife	NA
Standard Bootstrap	0.017207
Bootstrap-t	0.053796
Chebyshev (Mean, Std)	0.030253

Summary Statistics for ln (4,4'- DDD)

Minimum	-8.29405
Maximum	-2.99573
Mean	-5.04916
Standard Deviation	1.264964
Variance	1.600133

Goodness-of-Fit Results

Distribution Recommended	Neither
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	0.014277
MLE Standard Deviation	0.028389
MLE Median	0.006415
MLE Coefficient of Variation	1.988389
MVUE Estimate of Mean	0.013116
MVUE Estimate of Std. Dev.	0.019976
MVUE Estimate of SE	0.004808
MVUE Coefficient of Variation	1.523001

UCL Assuming Lognormal Distribution

95% H-UCL	0.041191
95% Chebyshev (MVUE) UCL	0.034075
99% Chebyshev (MVUE) UCL	0.060958

FDEP Recommended UCL to Use:
0.030253

FDEP UCL Calculator Version 1.0

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Summary Statistics for 4,4'- DDE

Number of Samples	16
Number of Censored Data	1
Minimum	0.000275
Maximum	0.044
Mean	0.007385938
Median	0.0028
Standard Deviation	0.011661139
Variance	0.000135982
Coefficient of Variation	1.578829919
Skewness	2.711946964

95% UCL (Assuming Normal Data)

Student's-t	0.012496579
-------------	-------------

95% UCL (Adjusted for Skewness)

Adjusted-CLT	0.014293843
Modified-t	0.012825999

95% Non-parametric UCL

CLT	0.012181581
Jackknife	NA
Standard Bootstrap	0.012517454
Bootstrap-t	0.036973082
Chebyshev (Mean, Std)	0.020093665

Summary Statistics for ln()

Minimum	-8.19874
Maximum	-3.12357
Mean	-5.58274
Standard Deviation	1.12738
Variance	1.270986

Goodness-of-Fit Results

Distribution Recommended	Neither
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	0.007103
MLE Standard Deviation	0.011374
MLE Median	0.003762
MLE Coefficient of Variation	1.601364

MVUE Estimate of Mean	0.006672
MVUE Estimate of Std. Dev.	0.008746
MVUE Estimate of SE	0.002152
MVUE Coefficient of Variation	1.310875

UCL Assuming Lognormal Distribution

95% H-UCL	0.017047
95% Chebyshev (MVUE) UCL	0.01605
99% Chebyshev (MVUE) UCL	0.02808

FDEP Recommended UCL to Use:
0.020094

FDEP UCL Calculator Version 1.0

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Summary Statistics for 4,4'- DDT

Number of Samples	16
Number of Censored Data	1
Minimum	0.000345
Maximum	0.28
Mean	0.064772
Median	0.019
Standard Deviation	0.096202
Variance	0.009255
Coefficient of Variation	1.485251
Skewness	1.763126

95% UCL (Assuming Normal Data)

Student's-t	0.106933
-------------	----------

95% UCL (Adjusted for Skewness)

Adjusted-CLT	0.115664
Modified-t	0.1087

95% Non-parametric UCL

CLT	0.104335
Jackknife	NA
Standard Bootstrap	0.101521
Bootstrap-t	0.480862
Chebyshev (Mean, Std)	0.169608

Summary Statistics for ln()

Minimum	-7.97197
Maximum	-1.27297
Mean	-3.66161
Standard Deviation	1.557166
Variance	2.424766

Goodness-of-Fit Results

Distribution Recommended	Neither
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	0.08636
MLE Standard Deviation	0.277155
MLE Median	0.025691
MLE Coefficient of Variation	3.209297
MVUE Estimate of Mean	0.074347
MVUE Estimate of Std. Dev.	0.15123
MVUE Estimate of SE	0.034205
MVUE Coefficient of Variation	2.034122

UCL Assuming Lognormal Distribution

95% H-UCL	0.393944
95% Chebyshev (MVUE) UCL	0.223443
99% Chebyshev (MVUE) UCL	0.414683

FDEP Recommended UCL to Use:
0.169608

Summary Statistics for Dieldrin

Number of Samples	16
Number of Censored Data	0
Minimum	0.012
Maximum	0.56
Mean	0.201812
Median	0.185
Standard Deviation	0.156823
Variance	0.024593
Coefficient of Variation	0.777073
Skewness	0.816252

95% UCL (Assuming Normal Data)

Student's-t	0.270542
-------------	----------

95% UCL (Adjusted for Skewness)

Adjusted-CLT	0.274856
Modified-t	0.271876

95% Non-parametric UCL

CLT	0.266306
Jackknife	NA
Standard Bootstrap	0.266619
Bootstrap-t	0.277075
Chebyshev (Mean, Std)	0.372711

Summary Statistics for ln(Dieldrin)

Minimum	-4.42285
Maximum	-0.57982
Mean	-1.9783
Standard Deviation	1.016786
Variance	1.033854

Goodness-of-Fit Results

Distribution Recommended	Lognormal
Distribution Used	Lognormal

Estimates Assuming Lognormal Distribution

MLE Mean	0.231918
MLE Standard Deviation	0.312176
MLE Median	0.138304
MLE Coefficient of Variation	1.346062
MVUE Estimate of Mean	0.221655
MVUE Estimate of Std. Dev.	0.257198
MVUE Estimate of SE	0.062045
MVUE Coefficient of Variation	1.16035

UCL Assuming Lognormal Distribution

95% H-UCL	0.486982
95% Chebyshev (MVUE) UCL	0.492102
99% Chebyshev (MVUE) UCL	0.838995

FDEP Recommended UCL to Use:
0.486982

FDEP UCL Calculator Version 1.0

10/5/11

Note: Bounding estimates are worst case 95% UCLs based on the Chebyshev (mean, std) method.

Summary Statistics for Endrin

Number of Samples	16
Number of Censored Data	10
Minimum	0.0014
Maximum	0.0039
Mean	0.001307
Median	0.00079
Standard Deviation	0.000921
Variance	
Coefficient of Variation	0.704107
Skewness	2.138072

95% UCL (Assuming Normal Data)

Student's-t	NA
-------------	----

95% UCL (Adjusted for Skewness)

Adjusted-CLT	NA
Modified-t	NA

95% Non-parametric UCL

CLT	NA
Jackknife	NA
Standard Bootstrap	NA
Bootstrap-t	NA
Chebyshev (Mean, Std)	NA

95% Bounding Method UCL

Bounding (Max)	0.002316
Bounding (1/2 DL)	0.001839

Summary Statistics for

Minimum	NA
Maximum	NA
Mean	NA
Standard Deviation	NA
Variance	NA

Goodness-of-Fit Results

Distribution Recommended	NA
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	NA
MLE Standard Deviation	NA
MLE Median	NA
MLE Coefficient of Variation	NA

MVUE Estimate of Mean	NA
MVUE Estimate of Std. Dev.	NA
MVUE Estimate of SE	NA
MVUE Coefficient of Variation	NA

UCL Assuming Lognormal Distribution

95% H-UCL	NA
95% Chebyshev (MVUE) UCL	NA
99% Chebyshev (MVUE) UCL	NA

FDEP Recommended UCL to Use:
0.002316

FDEP UCL Calculator Version 1.0

10/5/11

*Note: Too few observations available to compute UCLs - Use Maximum.***Summary Statistics for Endrin aldehyde**

Number of Samples	16
Number of Censored Data	14
Minimum	0.0026
Maximum	0.0028
Mean	0.000921875
Median	0.00053
Standard Deviation	0.00085097
Variance	
Coefficient of Variation	0.923085809
Skewness	1.790231347

95% UCL (Assuming Normal Data)

Student's-t	NA
-------------	----

95% UCL (Adjusted for Skewness)

Adjusted-CLT	NA
Modified-t	NA

95% Non-parametric UCL

CLT	NA
Jackknife	NA
Standard Bootstrap	NA
Bootstrap-t	NA
Chebyshev (Mean, Std)	NA

Summary Statistics for

Minimum	NA
Maximum	NA
Mean	NA
Standard Deviation	NA
Variance	NA

Goodness-of-Fit Results

Distribution Recommended	NA
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	NA
MLE Standard Deviation	NA
MLE Median	NA
MLE Coefficient of Variation	NA

MVUE Estimate of Mean	NA
MVUE Estimate of Std. Dev.	NA
MVUE Estimate of SE	NA
MVUE Coefficient of Variation	NA

UCL Assuming Lognormal Distribution

95% H-UCL	NA
95% Chebyshev (MVUE) UCL	NA
99% Chebyshev (MVUE) UCL	NA

FDEP Recommended UCL to Use:

0.0028

Summary Statistics for Endrinetone

Number of Samples	16
Number of Censored Data	2
Minimum	0.000235
Maximum	0.0056
Mean	0.002285625
Median	0.00155
Standard Deviation	0.001837301
Variance	3.37568E-06
Coefficient of Variation	0.803850733
Skewness	0.880820394

95% UCL (Assuming Normal Data)

Student's-t	0.003090845
-------------	-------------

95% UCL (Adjusted for Skewness)

Adjusted-CLT	0.003149307
Modified-t	0.003107703

95% Non-parametric UCL

CLT	0.003041215
Jackknife	NA
Standard Bootstrap	0.00283572
Bootstrap-t	0.003619745
Chebyshev (Mean, Std)	0.004287824

Summary Statistics for ln(Endrinetone)

Minimum	-8.35592
Maximum	-5.18499
Mean	-6.45104
Standard Deviation	0.980559
Variance	0.961497

Goodness-of-Fit Results

Distribution Recommended	Lognormal
Distribution Used	Lognormal

Estimates Assuming Lognormal Distribution

MLE Mean	0.002553
MLE Standard Deviation	0.003246
MLE Median	0.001579
MLE Coefficient of Variation	1.271066

MVUE Estimate of Mean	0.002437
MVUE Estimate of Std. Dev.	0.002665
MVUE Estimate of SE	0.000692
MVUE Coefficient of Variation	1.093633

UCL Assuming Lognormal Distribution

95% H-UCL	0.005146
95% Chebyshev (MVUE) UCL	0.005453
99% Chebyshev (MVUE) UCL	0.009322

FDEP Recommended UCL to Use:
0.005146

FDEP UCL Calculator Version 1.0

10/5/11

Note: Bounding estimates are worst case 95% UCLs based on the Chebyshev (mean, std) method.

Summary Statistics for Heptachlor

Number of Samples	16
Number of Censored Data	10
Minimum	0.00071
Maximum	0.008
Mean	0.00135875
Median	0.00056
Standard Deviation	0.00192254
Variance	
Coefficient of Variation	1.414932609
Skewness	3.145802021

95% UCL (Assuming Normal Data)

Student's-t	NA
-------------	----

95% UCL (Adjusted for Skewness)

Adjusted-CLT	NA
Modified-t	NA

95% Non-parametric UCL

CLT	NA
Jackknife	NA
Standard Bootstrap	NA
Bootstrap-t	NA
Chebyshev (Mean, Std)	NA

95% Bounding Method UCL

Bounding (Max)	0.00345379
Bounding (1/2 DL)	0.003241361

Summary Statistics for

Minimum	NA
Maximum	NA
Mean	NA
Standard Deviation	NA
Variance	NA

Goodness-of-Fit Results

Distribution Recommended	NA
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	NA
MLE Standard Deviation	NA
MLE Median	NA
MLE Coefficient of Variation	NA
MVUE Estimate of Mean	NA
MVUE Estimate of Std. Dev.	NA
MVUE Estimate of SE	NA
MVUE Coefficient of Variation	NA

UCL Assuming Lognormal Distribution

95% H-UCL	NA
95% Chebyshev (MVUE) UCL	NA
99% Chebyshev (MVUE) UCL	NA

FDEP Recommended UCL to Use:
0.003454

FDEP UCL Calculator Version 1.0

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*Note: Too few observations available to compute UCLs - Use Maximum.***Summary Statistics for Heptachlor epoxi**

Number of Samples	16
Number of Censored Data	15
Minimum	0.0025
Maximum	0.0025
Mean	0.000641875
Median	0.0005
Standard Deviation	0.000498454
Variance	
Coefficient of Variation	0.776559055
Skewness	3.924276114

95% UCL (Assuming Normal Data)

Student's-t	NA
-------------	----

95% UCL (Adjusted for Skewness)

Adjusted-CLT	NA
Modified-t	NA

95% Non-parametric UCL

CLT	NA
Jackknife	NA
Standard Bootstrap	NA
Bootstrap-t	NA
Chebyshev (Mean, Std)	NA

Summary Statistics for

Minimum	NA
Maximum	NA
Mean	NA
Standard Deviation	NA
Variance	NA

Goodness-of-Fit Results

Distribution Recommended	NA
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	NA
MLE Standard Deviation	NA
MLE Median	NA
MLE Coefficient of Variation	NA

MVUE Estimate of Mean	NA
MVUE Estimate of Std. Dev.	NA
MVUE Estimate of SE	NA
MVUE Coefficient of Variation	NA

UCL Assuming Lognormal Distribution

95% H-UCL	NA
95% Chebyshev (MVUE) UCL	NA
99% Chebyshev (MVUE) UCL	NA

FDEP Recommended UCL to Use:

0.0025

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Summary Statistics for Isodrin

Number of Samples	16
Number of Censored Data	4
Minimum	0.000235
Maximum	0.011
Mean	0.002147
Median	0.0016
Standard Deviation	0.002571
Variance	6.61E-06
Coefficient of Variation	1.197662
Skewness	2.983592

95% UCL (Assuming Normal Data)

Student's-t	0.003273
-------------	----------

95% UCL (Adjusted for Skewness)

Adjusted-CLT	0.003716
Modified-t	0.003353

95% Non-parametric UCL

CLT	0.003204
Jackknife	NA
Standard Bootstrap	0.003212
Bootstrap-t	0.004153
Chebyshev (Mean, Std)	0.004948

Summary Statistics for ln(Isodrin)

Minimum	-8.35592
Maximum	-4.50986
Mean	-6.67814
Standard Deviation	1.136311
Variance	1.291204

Goodness-of-Fit Results

Distribution Recommended	Neither
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	0.002399
MLE Standard Deviation	0.003896
MLE Median	0.001258
MLE Coefficient of Variation	1.623934
MVUE Estimate of Mean	0.002219
MVUE Estimate of Std. Dev.	0.00284
MVUE Estimate of SE	0.000786
MVUE Coefficient of Variation	1.279786

UCL Assuming Lognormal Distribution

95% H-UCL	0.005824
95% Chebyshev (MVUE) UCL	0.005644
99% Chebyshev (MVUE) UCL	0.010038

FDEP Recommended UCL to Use:
0.004948

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Note: Too few observations available to compute UCLs - Use Maximum.

Summary Statistics for Methoxychlor

Number of Samples	16
Number of Censored Data	14
Minimum	0.0082
Maximum	0.0091
Mean	0.00209625
Median	0.0009
Standard Deviation	0.002715322
Variance	
Coefficient of Variation	1.295323491
Skewness	2.141688585

95% UCL (Assuming Normal Data)

Student's-t	NA
-------------	----

95% UCL (Adjusted for Skewness)

Adjusted-CLT	NA
Modified-t	NA

95% Non-parametric UCL

CLT	NA
Jackknife	NA
Standard Bootstrap	NA
Bootstrap-t	NA
Chebyshev (Mean, Std)	NA

Summary Statistics for

Minimum	NA
Maximum	NA
Mean	NA
Standard Deviation	NA
Variance	NA

Goodness-of-Fit Results

Distribution Recommended	NA
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	NA
MLE Standard Deviation	NA
MLE Median	NA
MLE Coefficient of Variation	NA
MVUE Estimate of Mean	NA
MVUE Estimate of Std. Dev.	NA
MVUE Estimate of SE	NA
MVUE Coefficient of Variation	NA

UCL Assuming Lognormal Distribution

95% H-UCL	NA
95% Chebyshev (MVUE) UCL	NA
99% Chebyshev (MVUE) UCL	NA

FDEP Recommended UCL to Use:
0.0091

FDEP UCL Calculator Version 1.0

10/5/11

Note: Too few observations available to compute UCLs - Use Maximum.

Summary Statistics for Mirex

Number of Samples	16
Number of Censored Data	14
Minimum	0.0052
Maximum	0.012
Mean	0.001666
Median	0.00053
Standard Deviation	0.003022
Variance	
Coefficient of Variation	1.814557
Skewness	3.116975

95% UCL (Assuming Normal Data)

Student's-t	NA
-------------	----

95% UCL (Adjusted for Skewness)

Adjusted-CLT	NA
Modified-t	NA

95% Non-parametric UCL

CLT	NA
Jackknife	NA
Standard Bootstrap	NA
Bootstrap-t	NA
Chebyshev (Mean, Std)	NA

Summary Statistics for

Minimum	NA
Maximum	NA
Mean	NA
Standard Deviation	NA
Variance	NA

Goodness-of-Fit Results

Distribution Recommended	NA
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	NA
MLE Standard Deviation	NA
MLE Median	NA
MLE Coefficient of Variation	NA

MVUE Estimate of Mean	NA
MVUE Estimate of Std. Dev.	NA
MVUE Estimate of SE	NA
MVUE Coefficient of Variation	NA

UCL Assuming Lognormal Distribution

95% H-UCL	NA
95% Chebyshev (MVUE) UCL	NA
99% Chebyshev (MVUE) UCL	NA

FDEP Recommended UCL to Use:
0.012

FDEP UCL Calculator Version 1.0

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*Note: Too few observations available to compute UCLs - Use Maximum.***Summary Statistics for Toxaphene**

Number of Samples	16
Number of Censored Data	16
Minimum	
Maximum	
Mean	
Median	
Standard Deviation	
Variance	
Coefficient of Variation	
Skewness	

95% UCL (Assuming Normal Data)

Student's-t	NA
-------------	----

95% UCL (Adjusted for Skewness)

Adjusted-CLT	NA
Modified-t	NA

95% Non-parametric UCL

CLT	NA
Jackknife	NA
Standard Bootstrap	NA
Bootstrap-t	NA
Chebyshev (Mean, Std)	NA

Summary Statistics for

Minimum	NA
Maximum	NA
Mean	NA
Standard Deviation	NA
Variance	NA

Goodness-of-Fit Results

Distribution Recommended	NA
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	NA
MLE Standard Deviation	NA
MLE Median	NA
MLE Coefficient of Variation	NA

MVUE Estimate of Mean	NA
MVUE Estimate of Std. Dev.	NA
MVUE Estimate of SE	NA
MVUE Coefficient of Variation	NA

UCL Assuming Lognormal Distribution

95% H-UCL	NA
95% Chebyshev (MVUE) UCL	NA
99% Chebyshev (MVUE) UCL	NA

FDEP Recommended UCL to Use:

Summary Statistics for BAPEquivalent

Number of Samples	16
Number of Censored Data	1
Minimum	0.0035
Maximum	2.586400032
Mean	0.326666813
Median	0.155591503
Standard Deviation	0.621956475
Variance	0.386829857
Coefficient of Variation	1.903947539
Skewness	3.608056545

95% UCL (Assuming Normal Data)

Student's-t	0.599247038
-------------	-------------

95% UCL (Adjusted for Skewness)

Adjusted-CLT	0.732331693
Modified-t	0.622622609

95% Non-parametric UCL

CLT	0.582446396
Jackknife	NA
Standard Bootstrap	0.545967698
Bootstrap-t	1.59339726
Chebyshev (Mean, Std)	1.004443884

Summary Statistics for ln(BAPEquivalent)

Minimum	-5.65499
Maximum	0.950267
Mean	-2.06134
Standard Deviation	1.479477
Variance	2.188851

Goodness-of-Fit Results

Distribution Recommended	Lognormal
Distribution Used	Lognormal

Estimates Assuming Lognormal Distribution

MLE Mean	0.380255
MLE Standard Deviation	1.070468
MLE Median	0.127284
MLE Coefficient of Variation	2.815129
MVUE Estimate of Mean	0.333935
MVUE Estimate of Std. Dev.	0.630973
MVUE Estimate of SE	0.145397
MVUE Coefficient of Variation	1.889507

UCL Assuming Lognormal Distribution

95% H-UCL	1.521911
95% Chebyshev (MVUE) UCL	0.967707
99% Chebyshev (MVUE) UCL	1.780623

FDEP Recommended UCL to Use:
0.967707

FDEP UCL Calculator Version 1.0**10/5/11***Note: Bounding estimates are worst case 95% UCLs based on the Chebyshev (mean, std) method.***Summary Statistics for Acenaphthene**

Number of Samples	16
Number of Censored Data	13
Minimum	0.043000001
Maximum	0.059
Mean	0.027875001
Median	0.023
Standard Deviation	0.010825126
Variance	
Coefficient of Variation	0.388345301
Skewness	2.183696032

95% UCL (Assuming Normal Data)

Student's-t	NA
-------------	----

95% UCL (Adjusted for Skewness)

Adjusted-CLT	NA
Modified-t	NA

95% Non-parametric UCL

CLT	NA
Jackknife	NA
Standard Bootstrap	NA
Bootstrap-t	NA
Chebyshev (Mean, Std)	NA

95% Bounding Method UCL

Bounding (Max)	0.040746432
Bounding (1/2 DL)	0.035195686

Summary Statistics for

Minimum	NA
Maximum	NA
Mean	NA
Standard Deviation	NA
Variance	NA

Goodness-of-Fit Results

Distribution Recommended	NA
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	NA
MLE Standard Deviation	NA
MLE Median	NA
MLE Coefficient of Variation	NA

MVUE Estimate of Mean	NA
MVUE Estimate of Std. Dev.	NA
MVUE Estimate of SE	NA
MVUE Coefficient of Variation	NA

UCL Assuming Lognormal Distribution

95% H-UCL	NA
95% Chebyshev (MVUE) UCL	NA
99% Chebyshev (MVUE) UCL	NA

FDEP Recommended UCL to Use:
0.040746

FDEP UCL Calculator Version 1.0**10/5/11***Note: Bounding estimates are worst case 95% UCLs based on the Chebyshev (mean, std) method.***Summary Statistics for Acenaphthylene**

Number of Samples	16
Number of Censored Data	10
Minimum	0.023
Maximum	0.041000001
Mean	0.02375
Median	0.02
Standard Deviation	0.00676757
Variance	
Coefficient of Variation	0.284950316
Skewness	2.015040874

95% UCL (Assuming Normal Data)

Student's-t	NA
-------------	----

95% UCL (Adjusted for Skewness)

Adjusted-CLT	NA
Modified-t	NA

95% Non-parametric UCL

CLT	NA
Jackknife	NA
Standard Bootstrap	NA
Bootstrap-t	NA
Chebyshev (Mean, Std)	NA

95% Bounding Method UCL

Bounding (Max)	0.032930586
Bounding (1/2 DL)	0.029477065

Summary Statistics for

Minimum	NA
Maximum	NA
Mean	NA
Standard Deviation	NA
Variance	NA

Goodness-of-Fit Results

Distribution Recommended	NA
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	NA
MLE Standard Deviation	NA
MLE Median	NA
MLE Coefficient of Variation	NA

MVUE Estimate of Mean	NA
MVUE Estimate of Std. Dev.	NA
MVUE Estimate of SE	NA
MVUE Coefficient of Variation	NA

UCL Assuming Lognormal Distribution

95% H-UCL	NA
95% Chebyshev (MVUE) UCL	NA
99% Chebyshev (MVUE) UCL	NA

FDEP Recommended UCL to Use:
0.032931

Summary Statistics for Anthracene

Number of Samples	16
Number of Censored Data	8
Minimum	0.007
Maximum	0.469999999
Mean	0.05959375
Median	0.01475
Standard Deviation	0.116938191
Variance	0.013674541
Coefficient of Variation	1.962255973
Skewness	3.28322649

95% UCL (Assuming Normal Data)

Student's-t	0.110843383
-------------	-------------

95% UCL (Adjusted for Skewness)

Adjusted-CLT	0.133328408
Modified-t	0.114842698

95% Non-parametric UCL

CLT	0.107684582
Jackknife	NA
Standard Bootstrap	0.100907147
Bootstrap-t	0.352080256
Chebyshev (Mean, Std)	0.187027141

Summary Statistics for In(Anthracene)

Minimum	-4.96184
Maximum	-0.75502
Mean	-3.83136
Standard Deviation	1.318576
Variance	1.738643

Goodness-of-Fit Results

Distribution Recommended	Neither
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	0.051713
MLE Standard Deviation	0.111988
MLE Median	0.02168
MLE Coefficient of Variation	2.165553
MVUE Estimate of Mean	0.043923
MVUE Estimate of Std. Dev.	0.06159
MVUE Estimate of SE	0.020795
MVUE Coefficient of Variation	1.402227

UCL Assuming Lognormal Distribution

95% H-UCL	0.161167
95% Chebyshev (MVUE) UCL	0.134567
99% Chebyshev (MVUE) UCL	0.250831

FDEP Recommended UCL to Use:
0.187027

Summary Statistics for Benzoanthracene

Number of Samples	16
Number of Censored Data	1
Minimum	0.0049
Maximum	2.700000048
Mean	0.292243751
Median	0.098499998
Standard Deviation	0.652566864
Variance	0.425843512
Coefficient of Variation	2.232954037
Skewness	3.791436434

95% UCL (Assuming Normal Data)

Student's-t	0.578239381
-------------	-------------

95% UCL (Adjusted for Skewness)

Adjusted-CLT	0.725866795
Modified-t	0.604011953

95% Non-parametric UCL

CLT	0.560611844
Jackknife	NA
Standard Bootstrap	0.567071021
Bootstrap-t	1.539620996
Chebyshev (Mean, Std)	1.00337851

Summary Statistics for ln(Benzoanthracene)

Minimum	-5.31852
Maximum	0.9932518
Mean	-2.273832
Standard Deviation	1.400544
Variance	1.9615235

Goodness-of-Fit Results

Distribution Recommended	Lognormal
Distribution Used	Lognormal

Estimates Assuming Lognormal Distribution

MLE Mean	0.2744268
MLE Standard Deviation	0.678348
MLE Median	0.102917
MLE Coefficient of Variation	2.4718719
MVUE Estimate of Mean	0.2454241
MVUE Estimate of Std. Dev.	0.429306
MVUE Estimate of SE	0.1006624
MVUE Coefficient of Variation	1.7492412

UCL Assuming Lognormal Distribution

95% H-UCL	0.9681225
95% Chebyshev (MVUE) UCL	0.6842014
99% Chebyshev (MVUE) UCL	1.2470047

FDEP Recommended UCL to Use:
0.560612

Summary Statistics for Benzoapyrene

Number of Samples	16
Number of Censored Data	1
Minimum	0.0035
Maximum	1.799999952
Mean	0.229406246
Median	0.114000008
Standard Deviation	0.432854052
Variance	0.18736263
Coefficient of Variation	1.8868451
Skewness	3.5923419

95% UCL (Assuming Normal Data)

Student's-t	0.41910997
-------------	------------

95% UCL (Adjusted for Skewness)

Adjusted-CLT	0.511276603
Modified-t	0.435307473

95% Non-parametric UCL

CLT	0.407417476
Jackknife	NA
Standard Bootstrap	0.413223028
Bootstrap-t	0.936953664
Chebyshev (Mean, Std)	0.701108932

Summary Statistics for ln(Benzoapyrene)

Minimum	-5.65499
Maximum	0.587787
Mean	-2.40384
Standard Deviation	1.447015
Variance	2.093853

Goodness-of-Fit Results

Distribution Recommended	Lognormal
Distribution Used	Lognormal

Estimates Assuming Lognormal Distribution

MLE Mean	0.257454
MLE Standard Deviation	0.686787
MLE Median	0.09037
MLE Coefficient of Variation	2.667607

MVUE Estimate of Mean	0.227846
MVUE Estimate of Std. Dev.	0.417192
MVUE Estimate of SE	0.096844
MVUE Coefficient of Variation	1.831028

UCL Assuming Lognormal Distribution

95% H-UCL	0.977505
95% Chebyshev (MVUE) UCL	0.649977
99% Chebyshev (MVUE) UCL	1.19143

FDEP Recommended UCL to Use:
0.649977

Summary Statistics for Benzobfluoranthene

Number of Samples	16
Number of Censored Data	1
Minimum	0.0065
Maximum	3
Mean	0.352406249
Median	0.150000006
Standard Deviation	0.722227185
Variance	0.521612107
Coefficient of Variation	2.049416507
Skewness	3.711663485

95% UCL (Assuming Normal Data)

Student's-t	0.668931425
-------------	-------------

95% UCL (Adjusted for Skewness)

Adjusted-CLT	0.828469634
Modified-t	0.696855009

95% Non-parametric UCL

CLT	0.649422169
Jackknife	NA
Standard Bootstrap	0.621071398
Bootstrap-t	1.967619538
Chebyshev (Mean, Std)	1.139453292

Summary Statistics for In(Benzobfluoranthene)

Minimum	-5.035953045
Maximum	1.098612309
Mean	-2.020063944
Standard Deviation	1.414618748
Variance	2.001146202

Goodness-of-Fit Results

Distribution Recommended	Lognormal
Distribution Used	Lognormal

Estimates Assuming Lognormal Distribution

MLE Mean	0.360778586
MLE Standard Deviation	0.912529532
MLE Median	0.132646983
MLE Coefficient of Variation	2.529333965

MVUE Estimate of Mean	0.321650535
MVUE Estimate of Std. Dev.	0.570535851
MVUE Estimate of SE	0.133378541
MVUE Coefficient of Variation	1.77377554

UCL Assuming Lognormal Distribution

95% H-UCL	1.301079512
95% Chebyshev (MVUE) UCL	0.90303427
99% Chebyshev (MVUE) UCL	1.648753643

FDEP Recommended UCL to Use:
0.903034

Summary Statistics for Benzoghiperylene

Number of Samples	16
Number of Censored Data	2
Minimum	0.006
Maximum	0.74000001
Mean	0.14259375
Median	0.114999995
Standard Deviation	0.172813893
Variance	0.029864641
Coefficient of Variation	1.21193175
Skewness	3.035918713

95% UCL (Assuming Normal Data)

Student's-t	0.218331605
-------------	-------------

95% UCL (Adjusted for Skewness)

Adjusted-CLT	0.248705909
Modified-t	0.22379671

95% Non-parametric UCL

CLT	0.213663459
Jackknife	NA
Standard Bootstrap	0.216740847
Bootstrap-t	0.311589837
Chebyshev (Mean, Std)	0.330917686

Summary Statistics for In(Benzoghiperylene)

Minimum	-5.115995884
Maximum	-0.301105082
Mean	-2.514855947
Standard Deviation	1.241180224
Variance	1.540528347

Goodness-of-Fit Results

Distribution Recommended	Lognormal
Distribution Used	Lognormal

Estimates Assuming Lognormal Distribution

MLE Mean	0.174716298
MLE Standard Deviation	0.334573976
MLE Median	0.080874562
MLE Coefficient of Variation	1.91495573
MVUE Estimate of Mean	0.160354733
MVUE Estimate of Std. Dev.	0.235260768
MVUE Estimate of SE	0.059037681
MVUE Coefficient of Variation	1.467127055

UCL Assuming Lognormal Distribution

95% H-UCL	0.487579882
95% Chebyshev (MVUE) UCL	0.417694092
99% Chebyshev (MVUE) UCL	0.747773767

FDEP Recommended UCL to Use:
0.417694

Summary Statistics for Benzokfluoranthene

Number of Samples	16
Number of Censored Data	3
Minimum	0.006
Maximum	1
Mean	0.1186875
Median	0.0495
Standard Deviation	0.240892083
Variance	0.058028996
Coefficient of Variation	2.02963314
Skewness	3.688042879

95% UCL (Assuming Normal Data)

Student's-t	0.224261492
-------------	-------------

95% UCL (Adjusted for Skewness)

Adjusted-CLT	0.277093917
Modified-t	0.233515859

95% Non-parametric UCL

CLT	0.217754364
Jackknife	NA
Standard Bootstrap	0.211726949
Bootstrap-t	0.537123322
Chebyshev (Mean, Std)	0.381199658

Summary Statistics for ln(Benzokfluoranthene)

Minimum	-5.115995884
Maximum	0
Mean	-3.095820621
Standard Deviation	1.373361737
Variance	1.88612246

Goodness-of-Fit Results

Distribution Recommended	Neither
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	0.116163176
MLE Standard Deviation	0.27473884
MLE Median	0.045237874
MLE Coefficient of Variation	2.365111311
MVUE Estimate of Mean	0.103024118
MVUE Estimate of Std. Dev.	0.169950192
MVUE Estimate of SE	0.043431981
MVUE Coefficient of Variation	1.649615607

UCL Assuming Lognormal Distribution

95% H-UCL	0.392982274
95% Chebyshev (MVUE) UCL	0.292339772
99% Chebyshev (MVUE) UCL	0.535167992

FDEP Recommended UCL to Use:
0.3812

Summary Statistics for Chrysene

Number of Samples	16
Number of Censored Data	1
Minimum	0.006
Maximum	2.4
Mean	0.265625
Median	0.0965
Standard Deviation	0.5795
Variance	0.335821
Coefficient of Variation	2.181649
Skewness	3.768437

95% UCL (Assuming Normal Data)

Student's-t	0.519598
-------------	----------

95% UCL (Adjusted for Skewness)

Adjusted-CLT	0.649806
Modified-t	0.542346

95% Non-parametric UCL

CLT	0.503945
Jackknife	NA
Standard Bootstrap	0.46639
Bootstrap-t	1.704996
Chebyshev (Mean, Std)	0.897136

Summary Statistics for ln(Chrysene)

Minimum	-5.116
Maximum	0.875469
Mean	-2.3732
Standard Deviation	1.418671
Variance	2.012626

Goodness-of-Fit Results

Distribution Recommended	Lognormal
Distribution Used	Lognormal

Estimates Assuming Lognormal Distribution

MLE Mean	0.2549
MLE Standard Deviation	0.649017
MLE Median	0.093182
MLE Coefficient of Variation	2.546163

MVUE Estimate of Mean	0.22705
MVUE Estimate of Std. Dev.	0.404347
MVUE Estimate of SE	0.094445
MVUE Coefficient of Variation	1.780877

UCL Assuming Lognormal Distribution

95% H-UCL	0.925129
95% Chebyshev (MVUE) UCL	0.638727
99% Chebyshev (MVUE) UCL	1.166771

FDEP Recommended UCL to Use:
0.638727

Summary Statistics for Dibenzoanthracene

Number of Samples	16
Number of Censored Data	8
Minimum	0.0055
Maximum	0.15000006
Mean	0.023250001
Median	0.011500001
Standard Deviation	0.035887325
Variance	0.0012879
Coefficient of Variation	1.543540828
Skewness	3.318196297

95% UCL (Assuming Normal Data)

Student's-t	0.038978074
-------------	-------------

95% UCL (Adjusted for Skewness)

Adjusted-CLT	0.045962356
Modified-t	0.040218502

95% Non-parametric UCL

CLT	0.038008664
Jackknife	NA
Standard Bootstrap	0.035414468
Bootstrap-t	0.078549616
Chebyshev (Mean, Std)	0.062358212

Summary Statistics for ln(Dibenzoanthracene)

Minimum	-5.20300722
Maximum	-1.89712
Mean	-4.33241144
Standard Deviation	0.976234618
Variance	0.953034029

Goodness-of-Fit Results

Distribution Recommended	Neither
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	0.021154674
MLE Standard Deviation	0.02670493
MLE Median	0.013135833
MLE Coefficient of Variation	1.262365514
MVUE Estimate of Mean	0.019584069
MVUE Estimate of Std. Dev.	0.01986298
MVUE Estimate of SE	0.006901796
MVUE Coefficient of Variation	1.014241706

UCL Assuming Lognormal Distribution

95% H-UCL	0.042430241
95% Chebyshev (MVUE) UCL	0.049668308
99% Chebyshev (MVUE) UCL	0.088256247

FDEP Recommended UCL to Use:
0.0624

Summary Statistics for Fluoranthene

Number of Samples	16
Number of Censored Data	1
Minimum	0.007
Maximum	5
Mean	0.555812497
Median	0.185000002
Standard Deviation	1.213030433
Variance	1.47144283
Coefficient of Variation	2.182445408
Skewness	3.708729744

95% UCL (Assuming Normal Data)

Student's-t	1.087438345
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95% UCL (Adjusted for Skewness)

Adjusted-CLT	1.355156064
Modified-t	1.134300828

95% Non-parametric UCL

CLT	1.054671288
Jackknife	NA
Standard Bootstrap	1.042251825
Bootstrap-t	3.018934011
Chebyshev (Mean, Std)	1.877712369

Summary Statistics for In(Fluoranthene)

Minimum	-4.961844921
Maximum	1.609437943
Mean	-1.710051879
Standard Deviation	1.520071357
Variance	2.310616932

Goodness-of-Fit Results

Distribution Recommended	Lognormal
Distribution Used	Lognormal

Estimates Assuming Lognormal Distribution

MLE Mean	0.574219579
MLE Standard Deviation	1.730359211
MLE Median	0.18085641
MLE Coefficient of Variation	3.013410328
MVUE Estimate of Mean	0.49918431
MVUE Estimate of Std. Dev.	0.980517443
MVUE Estimate of SE	0.223795786
MVUE Coefficient of Variation	1.964239305

UCL Assuming Lognormal Distribution

95% H-UCL	2.458787203
95% Chebyshev (MVUE) UCL	1.474687815
99% Chebyshev (MVUE) UCL	2.725929976

FDEP Recommended UCL to Use:
1.47469

FDEP UCL Calculator Version 1.0**10/5/11***Note: Bounding estimates are worst case 95% UCLs based on the Chebyshev (mean, std) method.***Summary Statistics for Fluorene**

Number of Samples	16
Number of Censored Data	13
Minimum	0.049
Maximum	0.064
Mean	0.028875
Median	0.022
Standard Deviation	0.014917
Variance	
Coefficient of Variation	0.516606
Skewness	1.92197

95% UCL (Assuming Normal Data)

Student's-t	NA
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95% UCL (Adjusted for Skewness)

Adjusted-CLT	NA
Modified-t	NA

95% Non-parametric UCL

CLT	NA
Jackknife	NA
Standard Bootstrap	NA
Bootstrap-t	NA
Chebyshev (Mean, Std)	NA

95% Bounding Method UCL

Bounding (Max)	0.045598
Bounding (1/2 DL)	0.040934

Summary Statistics for

Minimum	NA
Maximum	NA
Mean	NA
Standard Deviation	NA
Variance	NA

Goodness-of-Fit Results

Distribution Recommended	NA
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	NA
MLE Standard Deviation	NA
MLE Median	NA
MLE Coefficient of Variation	NA

MVUE Estimate of Mean	NA
MVUE Estimate of Std. Dev.	NA
MVUE Estimate of SE	NA
MVUE Coefficient of Variation	NA

UCL Assuming Lognormal Distribution

95% H-UCL	NA
95% Chebyshev (MVUE) UCL	NA
99% Chebyshev (MVUE) UCL	NA

FDEP Recommended UCL to Use:
0.045598

Summary Statistics for Indeno123cdpyrene

Number of Samples	16
Number of Censored Data	2
Minimum	0.006
Maximum	0.54000021
Mean	0.085843752
Median	0.047499999
Standard Deviation	0.13102643
Variance	0.017167925
Coefficient of Variation	1.526336235
Skewness	3.13555932

95% UCL (Assuming Normal Data)

Student's-t	0.143267736
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95% UCL (Adjusted for Skewness)

Adjusted-CLT	0.167169347
Modified-t	0.147547334

95% Non-parametric UCL

CLT	0.139728367
Jackknife	NA
Standard Bootstrap	0.131870911
Bootstrap-t	0.244666561
Chebyshev (Mean, Std)	0.228629798

Summary Statistics for ln(Indeno123cdpyrene)

Minimum	-5.116
Maximum	-0.61619
Mean	-3.1606
Standard Deviation	1.214441
Variance	1.474866

Goodness-of-Fit Results

Distribution Recommended	Lognormal
Distribution Used	Lognormal

Estimates Assuming Lognormal Distribution

MLE Mean	0.088641
MLE Standard Deviation	0.162734
MLE Median	0.0424
MLE Coefficient of Variation	1.835879
MVUE Estimate of Mean	0.081746
MVUE Estimate of Std. Dev.	0.116604
MVUE Estimate of SE	0.029386
MVUE Coefficient of Variation	1.426426

UCL Assuming Lognormal Distribution

95% H-UCL	0.238463
95% Chebyshev (MVUE) UCL	0.209834
99% Chebyshev (MVUE) UCL	0.374129

FDEP Recommended UCL to Use:
0.209834

Summary Statistics for Phenanthrene

Number of Samples	16
Number of Censored Data	3
Minimum	0.0095
Maximum	1.899999976
Mean	0.235281247
Median	0.067000002
Standard Deviation	0.470128237
Variance	0.221020559
Coefficient of Variation	1.998154309
Skewness	3.357748985

95% UCL (Assuming Normal Data)

Student's-t	0.441320866
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95% UCL (Adjusted for Skewness)

Adjusted-CLT	0.534057796
Modified-t	0.457764328

95% Non-parametric UCL

CLT	0.428621471
Jackknife	NA
Standard Bootstrap	0.400052071
Bootstrap-t	1.172819495
Chebyshev (Mean, Std)	0.747603476

Summary Statistics for In(Phenanthrene)

Minimum	-4.65646
Maximum	0.641854
Mean	-2.58441
Standard Deviation	1.515627
Variance	2.297125

Goodness-of-Fit Results

Distribution Recommended	Neither
Distribution Used	Neither

Estimates Assuming Lognormal Distribution

MLE Mean	0.237914
MLE Standard Deviation	0.711578
MLE Median	0.075441
MLE Coefficient of Variation	2.99091
MVUE Estimate of Mean	0.20334
MVUE Estimate of Std. Dev.	0.382748
MVUE Estimate of SE	0.095091
MVUE Coefficient of Variation	1.882306

UCL Assuming Lognormal Distribution

95% H-UCL	1.011144
95% Chebyshev (MVUE) UCL	0.617834
99% Chebyshev (MVUE) UCL	1.14949

FDEP Recommended UCL to Use:
0.747603

Summary Statistics for Pyrene

Number of Samples	16
Number of Censored Data	1
Minimum	0.0065
Maximum	4.1
Mean	0.452219
Median	0.165
Standard Deviation	0.991676
Variance	0.983421
Coefficient of Variation	2.192912
Skewness	3.754231

95% UCL (Assuming Normal Data)

Student's-t	0.886833
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95% UCL (Adjusted for Skewness)

Adjusted-CLT	1.108712
Modified-t	0.925614

95% Non-parametric UCL

CLT	0.860045
Jackknife	NA
Standard Bootstrap	0.813927
Bootstrap-t	2.799906
Chebyshev (Mean, Std)	1.532898

Summary Statistics for ln(Pyrene)

Minimum	-5.03595
Maximum	1.410987
Mean	-1.88384
Standard Deviation	1.48582
Variance	2.207662

Goodness-of-Fit Results

Distribution Recommended	Lognormal
Distribution Used	Lognormal

Estimates Assuming Lognormal Distribution

MLE Mean	0.458403
MLE Standard Deviation	1.304188
MLE Median	0.152006
MLE Coefficient of Variation	2.845071

MVUE Estimate of Mean	0.40194
MVUE Estimate of Std. Dev.	0.764115
MVUE Estimate of SE	0.17582
MVUE Coefficient of Variation	1.901067

UCL Assuming Lognormal Distribution

95% H-UCL	1.85393
95% Chebyshev (MVUE) UCL	1.168321
99% Chebyshev (MVUE) UCL	2.151328

FDEP Recommended UCL to Use:
1.168321

ORGANOCHLORINE PESTICIDE DATA

AREA C SURFACE SOIL PILE

Laboratory: ENCO Orlando
 Client: Tetra Tech NUS, Inc. (TE013)
 Project: NTC ORLANDO CTO 143

		Lab Sample ID		Date Collected		Leachability	
SpecificMethod	Analyte	RptUnits	Groundwater (mg/kg)	NTC 148SS 101 09132011	NTC 148SS 134 09132011	NTC 148SS 201 09132011	
EPA 8081B	4,4'-DDD	mg/kg dry	5.8				
EPA 8081B	4,4'-DDD [2C]	mg/kg dry	5.8	0.0097	0.0031	0.011	
EPA 8081B	4,4'-DDE	mg/kg dry	18	0.0061	0.0038	0.0070	
EPA 8081B	4,4'-DDT	mg/kg dry	11	0.033	0.019	0.051	
EPA 8081B	Aldrin	mg/kg dry	0.2	0.053	0.060	0.23	
EPA 8081B	alpha-BHC	mg/kg dry	0.0003	<0.00053	<0.00052	0.0035	
EPA 8081B	beta-BHC	mg/kg dry	0.001	<0.0011	<0.0011	<0.0053	
EPA 8081B	Chlordane (tech)	mg/kg dry	????	0.046	0.036	<0.14	
EPA 8081B	Chlordane-alpha	mg/kg dry	????				
EPA 8081B	Chlordane-alpha [2C]	mg/kg dry	????	0.0082	0.0038	0.012	
EPA 8081B	Chlordane-gamma	mg/kg dry	????	0.0075	0.0031	0.012	
EPA 8081B	delta-BHC	mg/kg dry	0.2	0.00072	<0.00051	<0.0025	
EPA 8081B	Dieldrin	mg/kg dry	0.002	0.34	0.56	0.26	
EPA 8081B	Endosulfan I	mg/kg dry	????	<0.00042	<0.00041	<0.0020	
EPA 8081B	Endosulfan II	mg/kg dry	????	<0.00051	<0.00051	<0.0025	
EPA 8081B	Endosulfan sulfate	mg/kg dry	????	<0.00053	<0.00052	<0.0026	
EPA 8081B	Endrin	mg/kg dry	1	0.0014	0.0010	<0.0039	
EPA 8081B	Endrin aldehyde	mg/kg dry	????	<0.00054	<0.00053	<0.0026	
EPA 8081B	Endrin ketone	mg/kg dry	????	0.0021	0.0052	0.0053	
EPA 8081B	gamma-BHC	mg/kg dry	0.009	0.0014	<0.00047	<0.0024	
EPA 8081B	Heptachlor	mg/kg dry	23	0.00072		<0.0028	
EPA 8081B	Heptachlor [2C]	mg/kg dry	23		0.0010		
EPA 8081B	Heptachlor epoxide	mg/kg dry	0.6	0.00072	<0.00051	<0.0025	
EPA 8081B	Isodrin	mg/kg dry	????	0.0025	0.0028	0.011	
EPA 8081B	Methoxychlor	mg/kg dry	160	<0.00092	<0.00091	<0.0045	
EPA 8081B	Mirex	mg/kg dry	????	<0.00054	<0.00053	<0.0026	
EPA 8081B	Toxaphene	mg/kg dry	31	<0.0086	<0.0084	<0.042	

Laboratory: ENCO Orlando
Client: Tetra Tech NUS, Inc. (TE013)
Project: NTC ORLANDO CTO 143

SpecificMethod	Analyte	RptUnits	Lab Sample ID		Date Collected	Leachability	NTC 148SS 234 09132011	NTC 148SS 301 09132011	NTC 148SS 334 09132011
			A104730-04	A104730-06					
EPA 8081B	4,4'-DDD	mg/kg dry	5.8		9/13/2011 10:30	Groundwater (mg/kg)			9/13/2011 10:50
EPA 8081B	4,4'-DDD [2C]	mg/kg dry	5.8				0.0042		
EPA 8081B	4,4'-DDE	mg/kg dry	18				0.0021		0.044
EPA 8081B	4,4'-DDT	mg/kg dry	11				0.018		0.26
EPA 8081B	Aldrin	mg/kg dry	0.2				0.022		0.0070
EPA 8081B	alpha-BHC	mg/kg dry	0.0003				<0.00051		<0.00051
EPA 8081B	beta-BHC	mg/kg dry	0.001				<0.0010		<0.0010
EPA 8081B	Chlordane (tech)	mg/kg dry	????				0.089		0.14
EPA 8081B	Chlordane-alpha	mg/kg dry	????						
EPA 8081B	Chlordane-alpha [2C]	mg/kg dry	????				0.014		0.020
EPA 8081B	Chlordane-gamma	mg/kg dry	????				0.014		0.017
EPA 8081B	delta-BHC	mg/kg dry	0.2				<0.00050		<0.00050
EPA 8081B	Dieldrin	mg/kg dry	0.002				0.38		0.049
EPA 8081B	Endosulfan I	mg/kg dry	????				<0.00041		<0.00041
EPA 8081B	Endosulfan II	mg/kg dry	????				<0.00050		<0.00050
EPA 8081B	Endosulfan sulfate	mg/kg dry	????				<0.00051		<0.00051
EPA 8081B	Endrin	mg/kg dry	1				0.0031		<0.00078
EPA 8081B	Endrin aldehyde	mg/kg dry	????				<0.00052		0.0028
EPA 8081B	Endrin ketone	mg/kg dry	????				0.0056		<0.00047
EPA 8081B	gamma-BHC	mg/kg dry	0.009				0.0010		<0.00047
EPA 8081B	Heptachlor	mg/kg dry	23				<0.00056		<0.00056
EPA 8081B	Heptachlor [2C]	mg/kg dry	23				0.00070		
EPA 8081B	Heptachlor epoxide	mg/kg dry	0.6				<0.00050		<0.00050
EPA 8081B	Isodrin	mg/kg dry	????				0.0035		<0.00047
EPA 8081B	Methoxychlor	mg/kg dry	160				<0.00090		0.0091
EPA 8081B	Mirex	mg/kg dry	????				<0.00052		0.0052
EPA 8081B	Toxaphene	mg/kg dry	31				<0.0084		<0.0084

Laboratory: ENCO Orlando
 Client: Tetra Tech NUS, Inc. (TE013)
 Project: NTC ORLANDO CTO 143

SpecificMethod	Analyte	RptUnits	Lab Sample ID		Date Collected	Leachability	Groundwater (mg/kg)	NTC 148SS 401 09132011	NTC 148SS 434 09132011	NTC 148SS 501 09132011
			A104730-07	A104730-08						
EPA 8081B	4,4'-DDD	mg/kg dry			9/13/2011 11:00					A104730-09 9/13/2011 11:20
EPA 8081B	4,4'-DDD [2C]	mg/kg dry				5.8				
EPA 8081B	4,4'-DDE	mg/kg dry				18	0.0039	0.040		0.0043
EPA 8081B	4,4'-DDT	mg/kg dry				1.1	0.0028	0.0053		0.0025
EPA 8081B	Aldrin	mg/kg dry				0.2	0.019	0.28		0.018
EPA 8081B	alpha-BHC	mg/kg dry				0.0003	0.026	0.026		0.040
EPA 8081B	beta-BHC	mg/kg dry				0.001	<0.00051	<0.00052		<0.00052
EPA 8081B	Chlordane (tech)	mg/kg dry				???	<0.0011	<0.0011		<0.0011
EPA 8081B	Chlordane-alpha	mg/kg dry				???	<0.027	0.047		0.060
EPA 8081B	Chlordane-alpha [2C]	mg/kg dry				???				
EPA 8081B	Chlordane-gamma	mg/kg dry				???	0.0035	0.0056		0.0064
EPA 8081B	delta-BHC	mg/kg dry				0.2	0.0032	0.0049		0.0057
EPA 8081B	Dieldrin	mg/kg dry				0.002	<0.00050	<0.00051		<0.00051
EPA 8081B	Endosulfan I	mg/kg dry				???	0.075	0.22		0.22
EPA 8081B	Endosulfan II	mg/kg dry				???	<0.00041	<0.00041		<0.00042
EPA 8081B	Endosulfan sulfate	mg/kg dry				???	<0.00050	<0.00051		<0.00051
EPA 8081B	Endrin	mg/kg dry				1	<0.00051	<0.00052		<0.00052
EPA 8081B	Endrin aldehyde	mg/kg dry				???	<0.00078	0.0014		<0.00079
EPA 8081B	Endrin ketone	mg/kg dry				???	<0.00053	<0.00053		0.0025
EPA 8081B	gamma-BHC	mg/kg dry				0.009	0.00070	0.0014		0.0021
EPA 8081B	Heptachlor	mg/kg dry				23	<0.00047	<0.00048		<0.00048
EPA 8081B	Heptachlor [2C]	mg/kg dry				23	<0.00056	0.0028		0.00071
EPA 8081B	Heptachlor epoxide	mg/kg dry				0.6	<0.00050	<0.00051		<0.00051
EPA 8081B	Isodrin	mg/kg dry				???	0.0014	0.0011		0.0018
EPA 8081B	Methoxychlor	mg/kg dry				160	<0.00090	<0.00091		0.0082
EPA 8081B	Mirex	mg/kg dry				???	<0.00053	<0.00053		0.012
EPA 8081B	Toxaphene	mg/kg dry				31	<0.0084	<0.0085		<0.0085

Laboratory: ENCO Orlando
Client: Tetra Tech NUS, Inc. (TE013)
Project: NTC ORLANDO CTO 143

SpecificMethod	Analyte	RptUnits	Lab Sample ID		Leachability	Date Collected	A104730-10	A104730-11	A104730-12
			Groundwater (mg/kg)						
EPA 8081B	4,4'-DDD	mg/kg dry	5.8			9/13/2011 11:25	9/13/2011 11:35	9/13/2011 11:45	
EPA 8081B	4,4'-DDD [2C]	mg/kg dry	5.8						
EPA 8081B	4,4'-DDE	mg/kg dry	18						
EPA 8081B	4,4'-DDT	mg/kg dry	11						
EPA 8081B	Aldrin	mg/kg dry	0.2						
EPA 8081B	alpha-BHC	mg/kg dry	0.0003						
EPA 8081B	beta-BHC	mg/kg dry	0.001						
EPA 8081B	Chlordane (tech)	mg/kg dry	???						
EPA 8081B	Chlordane-alpha	mg/kg dry	???						
EPA 8081B	Chlordane-alpha [2C]	mg/kg dry	???						
EPA 8081B	Chlordane-gamma	mg/kg dry	???						
EPA 8081B	delta-BHC	mg/kg dry	0.2						
EPA 8081B	Dieldrin	mg/kg dry	0.002						
EPA 8081B	Endosulfan I	mg/kg dry	???						
EPA 8081B	Endosulfan II	mg/kg dry	???						
EPA 8081B	Endosulfan sulfate	mg/kg dry	???						
EPA 8081B	Endrin	mg/kg dry	1						
EPA 8081B	Endrin aldehyde	mg/kg dry	???						
EPA 8081B	Endrin ketone	mg/kg dry	???						
EPA 8081B	gamma-BHC	mg/kg dry	0.009						
EPA 8081B	Heptachlor	mg/kg dry	23						
EPA 8081B	Heptachlor [2C]	mg/kg dry	23						
EPA 8081B	Heptachlor epoxide	mg/kg dry	0.6						
EPA 8081B	Isodrin	mg/kg dry	???						
EPA 8081B	Methoxychlor	mg/kg dry	160						
EPA 8081B	Mirex	mg/kg dry	???						
EPA 8081B	Toxaphene	mg/kg dry	31						

Laboratory: ENCO Orlando
 Client: Tetra Tech NUS, Inc. (TE013)
 Project: NTC ORLANDO CTO 143

		Lab Sample ID		Date Collected		Leachability	
Specific/Method	Analyte	RptUnits	Groundwater (mg/kg)	NTC 148SS 645 09132011	NTC 148SS 689 09132011	NTC 148SS FD1 09132011	
EPA 8081B	4,4'-DDD	mg/kg dry	5.8	<0.00050	0.044		A104730-15 9/13/2011 10:48
EPA 8081B	4,4'-DDD [2C]	mg/kg dry	5.8				0.0055
EPA 8081B	4,4'-DDE	mg/kg dry	18	<0.00055	0.028		0.0021
EPA 8081B	4,4'-DDT	mg/kg dry	11	<0.00069	0.23		0.015
EPA 8081B	Aldrin	mg/kg dry	0.2	0.026	0.024		0.034
EPA 8081B	alpha-BHC	mg/kg dry	0.0003	<0.00051	<0.00052		<0.00051
EPA 8081B	beta-BHC	mg/kg dry	0.001	<0.0011	<0.0011		<0.0010
EPA 8081B	Chlordane (tech)	mg/kg dry	????	<0.027	0.69		0.094
EPA 8081B	Chlordane-alpha	mg/kg dry	????	<0.00047			
EPA 8081B	Chlordane-alpha [2C]	mg/kg dry	????		0.11		0.013
EPA 8081B	Chlordane-gamma	mg/kg dry	????	<0.00047	0.12		0.013
EPA 8081B	delta-BHC	mg/kg dry	0.2	<0.00050	<0.00051		<0.00050
EPA 8081B	Dieldrin	mg/kg dry	0.002	0.046	0.15		0.093
EPA 8081B	Endosulfan I	mg/kg dry	????	<0.00041	<0.00041		<0.00041
EPA 8081B	Endosulfan II	mg/kg dry	????	<0.00050	<0.00051		<0.00050
EPA 8081B	Endosulfan sulfate	mg/kg dry	????	<0.00051	<0.00052		<0.00051
EPA 8081B	Endrin	mg/kg dry	1	<0.00078	<0.00078		<0.00077
EPA 8081B	Endrin aldehyde	mg/kg dry	????	<0.00053	<0.00053		<0.00052
EPA 8081B	Endrin ketone	mg/kg dry	????	<0.00047	0.014		0.0017
EPA 8081B	gamma-BHC	mg/kg dry	0.009	<0.00047	<0.00047		<0.00047
EPA 8081B	Heptachlor	mg/kg dry	23	<0.00056	0.0080		<0.00055
EPA 8081B	Heptachlor [2C]	mg/kg dry	23				
EPA 8081B	Heptachlor epoxide	mg/kg dry	0.6	<0.00050	<0.00051		<0.00050
EPA 8081B	Isodrin	mg/kg dry	????	<0.00047	0.0021		0.0014
EPA 8081B	Methoxychlor	mg/kg dry	160	<0.00090	<0.00090		<0.00090
EPA 8081B	Mirex	mg/kg dry	????	<0.00053	<0.00053		<0.00052
EPA 8081B	Toxaphene	mg/kg dry	31	<0.0084	<0.0084		<0.0083

Laboratory: ENCO Orlando
 Client: Tetra Tech NUS, Inc. (TE013)
 Project: NTC ORLANDO CTO 143

		Lab Sample ID	
		Date Collected	A104730-16 9/13/2011 11:13
Specific/Method	Analyte	RptUnits	Leachability Groundwater (mg/kg)
EPA 8081B	4,4'-DDD	mg/kg dry	5.8
EPA 8081B	4,4'-DDD [2C]	mg/kg dry	5.8
EPA 8081B	4,4'-DDE	mg/kg dry	18
EPA 8081B	4,4'-DDT	mg/kg dry	.11
EPA 8081B	Aldrin	mg/kg dry	0.2
EPA 8081B	alpha-BHC	mg/kg dry	0.0003
EPA 8081B	beta-BHC	mg/kg dry	0.001
EPA 8081B	Chlordane (tech)	mg/kg dry	????
EPA 8081B	Chlordane-alpha	mg/kg dry	????
EPA 8081B	Chlordane-alpha [2C]	mg/kg dry	????
EPA 8081B	Chlordane-gamma	mg/kg dry	????
EPA 8081B	delta-BHC	mg/kg dry	0.2
EPA 8081B	Dieldrin	mg/kg dry	0.002
EPA 8081B	Endosulfan I	mg/kg dry	????
EPA 8081B	Endosulfan II	mg/kg dry	????
EPA 8081B	Endosulfan sulfate	mg/kg dry	????
EPA 8081B	Endrin	mg/kg dry	1
EPA 8081B	Endrin aldehyde	mg/kg dry	????
EPA 8081B	Endrin ketone	mg/kg dry	????
EPA 8081B	gamma-BHC	mg/kg dry	0.009
EPA 8081B	Heptachlor	mg/kg dry	23
EPA 8081B	Heptachlor [2C]	mg/kg dry	23
EPA 8081B	Heptachlor epoxide	mg/kg dry	0.6
EPA 8081B	Isodrin	mg/kg dry	????
EPA 8081B	Methoxychlor	mg/kg dry	160
EPA 8081B	Mirex	mg/kg dry	????
EPA 8081B	Toxaphene	mg/kg dry	31
			0.0070
			0.0028
			0.021
			0.0011
			<0.00052
			<0.0011
			<0.028
			0.0035
			0.0032
			<0.00051
			0.012
			<0.00041
			<0.00051
			<0.00052
			<0.00079
			<0.00053
			0.0014
			<0.00048
			<0.00056
			<0.00051
			<0.00048
			<0.00091
			<0.00053
			<0.0085

SEMIVOLATILE ORGANIC COMPOUND DATA

AREA C SURFACE SOIL PILE

Laboratory: ENCO Orlando
Client: Tetra Tech NUS, Inc. (TE013)
Project: NTC ORLANDO CTO 143

Specific Method	Analyte	Rpt Units	Lab Sample ID		Date Collected	Leachability	Groundwater (mg/kg)	NTC 148SS 101 09132011	NTC 148SS 134 09132011	NTC 148SS 201 09132011
			A104730-01	A104730-02						
EPA 8270D	1-Methylnaphthalene	mg/kg dry	9/13/2011 10:00	A104730-01	9/13/2011 10:15	3.1	<0.023	<0.022	<0.022	9/13/2011 10:20
EPA 8270D	2-Methylnaphthalene	mg/kg dry				8.5	<0.023	<0.022	<0.022	
EPA 8270D	Acenaphthene	mg/kg dry				2.1	<0.024	<0.023	<0.023	
EPA 8270D	Acenaphthylene	mg/kg dry				27	0.024	<0.020	0.041	
EPA 8270D	Anthracene	mg/kg dry				2500	0.022	<0.015	0.036	
EPA 8270D	Benzo(a)anthracene	mg/kg dry				0.8	0.13	0.042	0.19	
EPA 8270D	Benzo(a)pyrene	mg/kg dry				8	0.15	0.029	0.22	
EPA 8270D	Benzo(b)fluoranthene	mg/kg dry				2.4	0.20	0.044	0.29	
EPA 8270D	Benzo(g,h,i)perylene	mg/kg dry				32000	0.13	0.031	0.23	
EPA 8270D	Benzo(k)fluoranthene	mg/kg dry				24	0.063	0.014	0.099	
EPA 8270D	Chrysene	mg/kg dry				77	0.13	0.031	0.20	
EPA 8270D	Dibenzo(a,h)anthracene	mg/kg dry				0.7	0.017	<0.012	0.026	
EPA 8270D	Fluoranthene	mg/kg dry				1200	0.24	0.067	0.38	
EPA 8270D	Fluorene	mg/kg dry				160	<0.023	<0.022	<0.022	
EPA 8270D	Indeno(1,2,3-cd)pyrene	mg/kg dry				6.6	0.067	0.015	0.10	
EPA 8270D	Naphthalene	mg/kg dry				1.2	<0.025	<0.024	<0.024	
EPA 8270D	Phenanthrene	mg/kg dry				250	0.081	0.027	0.16	
EPA 8270D	Pyrene	mg/kg dry				880	0.22	0.055	0.31	

Laboratory: ENCO Orlando
Client: Tetra Tech NUS, Inc. (TE013)
Project: NTC ORLANDO CTO 143

Specific Method	Analyte	Rpt Units	Lab Sample ID		Date Collected	Leachability	Groundwater (mg/kg)	Leachability
EPA 8270D	1-Methylnaphthalene	mg/kg dry	A104730-04	A104730-05	9/13/2011 10:30	9/13/2011 10:45	A104730-06	9/13/2011 10:50
EPA 8270D	2-Methylnaphthalene	mg/kg dry	NTC 148SS 234 09132011	NTC 148SS 301 09132011	<0.022	<0.022	NTC 148SS 334 09132011	<0.022
EPA 8270D	Acenaphthene	mg/kg dry	0.059	<0.023	0.059	<0.023	<0.023	<0.023
EPA 8270D	Acenaphthylene	mg/kg dry	0.023	<0.020	0.023	<0.020	0.039	0.039
EPA 8270D	Anthracene	mg/kg dry	0.16	0.035	0.16	0.035	0.024	0.024
EPA 8270D	Benzo(a)anthracene	mg/kg dry	0.45	0.20	0.45	0.20	0.14	0.14
EPA 8270D	Benzo(a)pyrene	mg/kg dry	0.42	0.15	0.42	0.15	0.16	0.16
EPA 8270D	Benzo(b)fluoranthene	mg/kg dry	0.58	0.23	0.58	0.23	0.22	0.22
EPA 8270D	Benzo(g,h,i)perylene	mg/kg dry	0.22	0.088	0.22	0.088	0.13	0.13
EPA 8270D	Benzo(k)fluoranthene	mg/kg dry	0.20	0.079	0.20	0.079	0.072	0.072
EPA 8270D	Chrysene	mg/kg dry	0.41	0.18	0.41	0.18	0.15	0.15
EPA 8270D	Dibenzo(a,h)anthracene	mg/kg dry	0.7	0.017	0.7	0.017	0.019	0.019
EPA 8270D	Fluoranthene	mg/kg dry	1.0	0.39	1.0	0.39	0.24	0.24
EPA 8270D	Fluorene	mg/kg dry	0.064	<0.022	0.064	<0.022	<0.022	<0.022
EPA 8270D	Indeno(1,2,3-cd)pyrene	mg/kg dry	0.20	0.067	0.20	0.067	0.078	0.078
EPA 8270D	Naphthalene	mg/kg dry	<0.024	<0.024	<0.024	<0.024	<0.024	<0.024
EPA 8270D	Phenanthrene	mg/kg dry	0.59	0.14	0.59	0.14	0.084	0.084
EPA 8270D	Pyrene	mg/kg dry	0.74	0.33	0.74	0.33	0.22	0.22

Laboratory: ENCO Orlando
 Client: Tetra Tech NUS, Inc. (TE013)
 Project: NTC ORLANDO CTO 143

Specific Method	Analyte	Rpt Units	Lab Sample ID		Leachability	Date Collected	Groundwater (mg/kg)	NTC 148SS 401 09132011	NTC 148SS 434 09132011	NTC 148SS 501 09132011
			A104730-07	A104730-08						
EPA 8270D	1-Methylnaphthalene	mg/kg dry	3.1	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022
EPA 8270D	2-Methylnaphthalene	mg/kg dry	8.5	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022
EPA 8270D	Acenaphthene	mg/kg dry	2.1	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	0.043
EPA 8270D	Acenaphthylene	mg/kg dry	27	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.026
EPA 8270D	Anthracene	mg/kg dry	2500	<0.015	<0.015	0.056	0.056	0.056	0.056	0.47
EPA 8270D	Benzo(a)anthracene	mg/kg dry	0.8	0.057	0.057	0.25	0.25	0.25	0.25	2.7
EPA 8270D	Benzo(a)pyrene	mg/kg dry	8	0.058	0.058	0.19	0.19	0.19	0.19	1.8
EPA 8270D	Benzo(b)fluoranthene	mg/kg dry	2.4	0.081	0.081	0.29	0.29	0.29	0.29	3.0
EPA 8270D	Benzo(g,h,i)perylene	mg/kg dry	32000	0.11	0.11	0.12	0.12	0.12	0.12	0.74
EPA 8270D	Benzo(k)fluoranthene	mg/kg dry	24	0.029	0.029	0.097	0.097	0.097	0.097	1.0
EPA 8270D	Chrysene	mg/kg dry	77	0.054	0.054	0.22	0.22	0.22	0.22	2.4
EPA 8270D	Dibenzo(a,h)anthracene	mg/kg dry	0.7	<0.012	<0.012	0.020	0.020	0.020	0.020	0.15
EPA 8270D	Fluoranthene	mg/kg dry	1200	0.10	0.10	0.48	0.48	0.48	0.48	5.0
EPA 8270D	Fluorene	mg/kg dry	160	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	0.062
EPA 8270D	Indeno(1,2,3-cd)pyrene	mg/kg dry	6.6	0.028	0.028	0.075	0.075	0.075	0.075	0.54
EPA 8270D	Naphthalene	mg/kg dry	1.2	<0.024	<0.024	<0.024	<0.024	<0.024	<0.024	<0.024
EPA 8270D	Phenanthrene	mg/kg dry	250	0.037	0.037	0.23	0.23	0.23	0.23	1.9
EPA 8270D	Pyrene	mg/kg dry	880	0.088	0.088	0.38	0.38	0.38	0.38	4.1

Laboratory: ENCO Orlando
 Client: Tetra Tech NUS, Inc. (TE013)
 Project: NTC ORLANDO CTO 143

		Lab Sample ID		Date Collected	
		A104730-13	A104730-14	A104730-15	
		9/13/2011 11:50	9/13/2011 12:00	9/13/2011 10:48	
		NTC 148SS 645 09132011			
		NTC 148SS 689 09132011			
		NTC 148SS FDT 09132011			
Specific Method	Analyte	Rpt Units	Leachability	Groundwater (mg/kg)	
EPA 8270D	1-Methylnaphthalene	mg/kg dry	3.1	<0.022	<0.022
EPA 8270D	2-Methylnaphthalene	mg/kg dry	8.5	<0.022	<0.022
EPA 8270D	Acenaphthene	mg/kg dry	2.1	<0.023	<0.023
EPA 8270D	Acenaphthylene	mg/kg dry	27	<0.020	<0.020
EPA 8270D	Anthracene	mg/kg dry	2500	<0.015	<0.015
EPA 8270D	Benzo(a)anthracene	mg/kg dry	0.8	<0.0098	0.067
EPA 8270D	Benzo(a)pyrene	mg/kg dry	8	<0.0070	0.078
EPA 8270D	Benzo(b)fluoranthene	mg/kg dry	2.4	<0.013	0.10
EPA 8270D	Benzo(g,h,i)perylene	mg/kg dry	32000	<0.013	0.16
EPA 8270D	Benzo(k)fluoranthene	mg/kg dry	24	<0.013	0.036
EPA 8270D	Chrysene	mg/kg dry	77	<0.012	0.063
EPA 8270D	Dibenzo(a,h)anthracene	mg/kg dry	0.7	<0.012	<0.012
EPA 8270D	Fluoranthene	mg/kg dry	1200	<0.014	0.13
EPA 8270D	Fluorene	mg/kg dry	160	<0.022	<0.022
EPA 8270D	Indeno(1,2,3-cd)pyrene	mg/kg dry	6.6	<0.013	0.026
EPA 8270D	Naphthalene	mg/kg dry	1.2	<0.024	<0.024
EPA 8270D	Phenanthrene	mg/kg dry	260	<0.019	0.053
EPA 8270D	Pyrene	mg/kg dry	880	<0.013	0.11
					0.094

Laboratory: ENCO Orlando
Client: Tetra Tech NUS, Inc. (TE013)
Project: NTC ORLANDO CTO 143

		Lab Sample ID	
		Date Collected	A104730-16 9/13/2011 11:13
Specific Method	Analyte	Rpt Units	Leachability
EPA 8270D	1-Methylnaphthalene	mg/kg dry	Groundwater (mg/kg) NTC 148SS FD2 09132011 3.1 <0.022
EPA 8270D	2-Methylnaphthalene	mg/kg dry	8.5 <0.022
EPA 8270D	Acenaphthene	mg/kg dry	2.1 0.044
EPA 8270D	Acenaphthylene	mg/kg dry	27 0.027
EPA 8270D	Anthracene	mg/kg dry	2500 0.091
EPA 8270D	Benzo(a)anthracene	mg/kg dry	0.8 0.26
EPA 8270D	Benzo(a)pyrene	mg/kg dry	8 0.25
EPA 8270D	Benzo(b)fluoranthene	mg/kg dry	2.4 0.36
EPA 8270D	Benzo(g,h,i)perylene	mg/kg dry	32000 0.14
EPA 8270D	Benzo(k)fluoranthene	mg/kg dry	24 0.13
EPA 8270D	Chrysene	mg/kg dry	77 0.25
EPA 8270D	Dibenzo(a,h)anthracene	mg/kg dry	0.7 0.026
EPA 8270D	Fluoranthene	mg/kg dry	1200 0.56
EPA 8270D	Fluorene	mg/kg dry	160 0.049
EPA 8270D	Indeno(1,2,3-cd)pyrene	mg/kg dry	6.6 0.099
EPA 8270D	Naphthalene	mg/kg dry	1.2 <0.024
EPA 8270D	Phenanthrene	mg/kg dry	250 0.35
EPA 8270D	Pyrene	mg/kg dry	880 0.42

APPENDIX E
STANDARD OPERATING PROCEDURES AND FORMS
(PROVIDED ON CD ONLY)

FC 1000. CLEANING / DECONTAMINATION PROCEDURES

1. PERFORMANCE CRITERIA

- 1.1. The cleaning/decontamination procedures must ensure that all equipment that contacts a sample during sample collection is free from the analytes of interest and constituents that would interfere with the analytes of interest.
- 1.2. The detergents and other cleaning supplies cannot contribute analytes of interest or interfering constituents unless these are effectively removed during a subsequent step in the cleaning procedure.
- 1.3. The effectiveness of any cleaning procedure (including all cleaning reagents) must be supported by equipment blanks with reported non-detected values.

The cleaning procedures outlined in this SOP are designed to meet the above-mentioned performance criteria. Alternative cleaning reagents or procedures may be used. However, the organization must be prepared to demonstrate through documentation (i.e., company-written protocols and analytical records) and historical data (i.e., absence of analytes of interest in equipment blanks) that it consistently meets these performance criteria. Field quality control measures (see FQ 1210) must support the use of alternative reagents or procedures.

FC 1001. *Cleaning Reagents*

Recommendations for the types and grades of various cleaning supplies are outlined below. The recommended reagent types or grades were selected to ensure that the cleaned equipment is free from any detectable contamination.

1. DETERGENTS: Use Luminox (or a non-phosphate solvent based equivalent), Liqui-Nox (or a non-phosphate equivalent) or Alconox (or equivalent). EPA recommends Luminox (or equivalent) since solvent rinses can be eliminated from the cleaning process. Liquinox (or equivalent) may be substituted (solvent rinses, when applicable, must be performed), and Alconox (or equivalent) may be substituted if the sampling equipment will not be used to collect phosphorus or phosphorus-containing compounds.
2. SOLVENTS

Note: If the detergent Luminox (or equivalent) is used, solvent rinses are not required.

- 2.1. Use pesticide grade isopropanol as the rinse solvent in routine equipment cleaning procedures. This grade of alcohol must be purchased from a laboratory supply vendor.
- 2.2. Other solvents, such as acetone or methanol, may be used as the final rinse solvent if they are pesticide grade. However, methanol is more toxic to the environment and acetone may be an analyte of interest for volatile organics.
 - 2.2.1. **Do not use** acetone if volatile organics are of interest.
- 2.3. Properly dispose of all wastes according to applicable regulations. Containerize all solvents (including rinsates) for on-site remediation or off-site disposal, as required.
- 2.4. Pre-clean equipment that is heavily contaminated (see FC 1120, section 3) with organic analytes with reagent grade acetone and hexane or other suitable solvents.
- 2.5. Use pesticide grade methylene chloride when cleaning sample containers.

2.6. Store all solvents away from potential sources of contamination (gas, copier supplies, etc.).

3. ANALYTE-FREE WATER SOURCES

3.1. Analyte-free water is water in which all analytes of interest and all interferences are below method detection limits.

3.2. Maintain documentation (such as results from equipment blanks) to demonstrate the reliability and purity of analyte-free water source(s).

3.3. The source of the water must meet the requirements of the analytical method and must be free from the analytes of interest. In general, the following water types are associated with specific analyte groups:

- Milli-Q (or equivalent polished water): suitable for all analyses.
- Organic-free: suitable for volatile and extractable organics.
- Deionized water: not suitable for volatile and extractable organics if the analytes of interest are present in concentrations that affect the result.
- Distilled water: not suitable for volatile and extractable organics, metals or ultra-trace metals.

3.4. Use analyte-free water for blank preparation and the final decontamination water rinse.

3.5. In order to minimize long-term storage and potential leaching problems, obtain or purchase analyte-free water just prior to the sampling event. If obtained from a source (such as a laboratory), fill the transport containers and use the contents for a single sampling event. Empty the transport container(s) at the end of the sampling event.

3.6. Discard any analyte-free water that is transferred to a dispensing container (such as a wash bottle) at the end of each sampling day.

4. ACIDS

4.1. Reagent Grade Nitric Acid: 10 - 15% (one volume concentrated nitric acid and five volumes deionized water).

4.1.1. Use for the acid rinse unless nitrogen components (e.g., nitrate, nitrite, etc.) are to be sampled.

4.1.2. If sampling for ultra-trace levels of metals, use an ultra-pure grade acid.

4.2. Reagent Grade Hydrochloric Acid: 10% hydrochloric acid (one volume concentrated hydrochloric and three volumes deionized water).

4.2.1. Use when nitrogen components are to be sampled.

4.3. If samples for both metals and the nitrogen-containing components (see FC 1001, section 4.1.1 above) are collected with the equipment, use the hydrochloric acid rinse, or thoroughly rinse with hydrochloric acid after a nitric acid rinse.

4.4. If sampling for ultra trace levels of metals, use an ultra-pure grade acid.

4.5. Freshly prepared acid solutions may be recycled during the sampling event or cleaning process. Dispose appropriately at the end of the sampling event, cleaning process or if acid is discolored or appears otherwise contaminated (e.g., floating particulates).

4.5.1. Transport only the quantity necessary to complete the sampling event.

- 4.6. Dispose of any unused acids according to FDEP and local ordinances.

FC 1002. *Reagent Storage Containers*

The contents of all containers must be clearly marked.

1. DETERGENTS: Store in the original container or in a high density polyethylene (HDPE) or polypropylene (PP) container.
2. SOLVENTS
 - 2.1. Store solvents to be used for cleaning or decontamination in the original container until use in the field. If transferred to another container for field use, the container must be either glass or Teflon.
 - 2.2. Use dispensing containers constructed of glass, Teflon, or stainless steel. Note: if stainless steel sprayers are used, any components (including gaskets and transfer lines) that contact the solvents must be constructed of inert materials.
3. ANALYTE-FREE WATER: Transport in containers appropriate to the type of water to be stored. If the water is commercially purchased (e.g., grocery store), use the original containers when transporting the water to the field. Containers made of glass, Teflon, polypropylene, or Polyethylene (PE) are acceptable.
 - 3.1. Use glass, Teflon, polypropylene or PE to transport organic-free sources of water on-site.
 - 3.2. Dispense water from containers made of glass, Teflon, PE or polypropylene.
 - 3.3. Do not store water in transport containers for more than three days before beginning a sampling event.
 - 3.4. Store and dispense acids using containers made of glass, Teflon, PE or polypropylene.

FC 1003. *General Requirements*

1. Before using any equipment, clean/decontaminate all sampling equipment (pumps, tubing, lanyards, split spoons, etc.) that are exposed to the sample.
 - 1.1. Before installing, clean (or obtain as certified precleaned) all equipment that is dedicated to a single sampling point and remains in contact with the sample medium (e.g., permanently installed groundwater pump (see FS 2220, section 3.3.4)).
 - 1.2. Clean this equipment any time it is removed for maintenance or repair.
 - 1.3. Replace dedicated tubing if discolored or damaged.
2. Clean all equipment in a designated area having a controlled environment (house, laboratory, or base of field operations) and transport to the field precleaned and ready to use, unless otherwise justified.
3. Rinse all equipment with water after use, even if it is to be field-cleaned for other sites. Rinse equipment used at contaminated sites or used to collect in-process (e.g., untreated or partially treated wastewater) samples immediately with water.
4. Whenever possible, transport sufficient clean equipment to the field so that an entire sampling event can be conducted without the need for cleaning equipment in the field.

5. Segregate equipment that is only used once (i.e., not cleaned in the field) from clean equipment and return to the in-house cleaning facility to be cleaned in a controlled environment.
6. Protect decontaminated field equipment (including well sounders) from environmental contamination by securely wrapping and sealing with one of the following:
 - 6.1. Aluminum foil (commercial grade is acceptable);
 - 6.2. Untreated butcher paper; or
 - 6.3. Clean, untreated, disposable plastic bags. Plastic bags may be used:
 - For all analyte groups except volatile and extractable organics;
 - For volatile and extractable organics, if the equipment is first wrapped in foil or butcher paper or if the equipment is completely dry.
7. Containerize all solvent rinsing wastes, detergent wastes and other chemical wastes requiring off-site or regulated disposal. Dispose of all wastes in conformance with applicable regulations.

FC 1100. Cleaning Sample Collection Equipment

FC 1110. ON-SITE/IN-FIELD CLEANING

1. Cleaning equipment on-site is not recommended because:
 - 1.1. Environmental conditions cannot be controlled.
 - 1.2. Wastes (solvents and acids) must be containerized for proper disposal.
2. If performed, follow the appropriate cleaning procedure as outlined in FC 1130. Ambient temperature water may be substituted in the hot, sudsy water bath, and hot water rinses.

Note: Properly dispose of all solvents and acids.

3. Rinse all equipment with water after use, even if it is to be field-cleaned for other sites. Rinse equipment used at contaminated sites or used to collect in-process (e.g., untreated or partially treated wastewater) samples immediately with water.

FC 1120. HEAVILY CONTAMINATED EQUIPMENT

In order to avoid contaminating other samples, isolate heavily contaminated equipment from other equipment and thoroughly decontaminate the equipment before further use. Equipment is considered heavily contaminated if it:

- Has been used to collect samples from a source known to contain significantly higher levels than background;
 - Has been used to collect free product; or
 - Has been used to collect industrial products (e.g., pesticides or solvents) or their by-products.
1. Cleaning heavily contaminated equipment in the field is not recommended.
 2. ON-SITE PROCEDURES
 - 2.1. Protect all other equipment, personnel and samples from exposure by isolating the equipment immediately after use.

- 2.2. At a minimum, place the equipment in a tightly sealed untreated plastic bag.
 - 2.3. Do not store or ship the contaminated equipment next to clean, decontaminated equipment, unused sample containers, or filled sample containers.
 - 2.4. Transport the equipment back to the base of operations for thorough decontamination.
 - 2.5. If cleaning must occur in the field, and in order to document the effectiveness of the procedure, collect and analyze blanks on the cleaned equipment (see FQ 1000).
3. CLEANING PROCEDURES
- 3.1. If organic contamination cannot be readily removed with scrubbing and a detergent solution, prerinse equipment by thoroughly rinsing or soaking the equipment in acetone.
 - 3.1.1. Do not use solvent soaks or rinses if the material is clear acrylic.
 - 3.1.2. Use hexane only if preceded and followed by acetone.
 - 3.2. In extreme cases, it may be necessary to steam clean the field equipment before proceeding with routine cleaning procedures.
 - 3.3. After the solvent rinses (and/or steam cleaning), use the appropriate cleaning procedure (see FC 1130).
 - 3.3.1. Scrub, rather than soak all equipment with sudsy water.
 - 3.3.2. If high levels of metals are suspected and the equipment cannot be cleaned without acid rinsing, soak the equipment in the appropriate acid. Do not use stainless steel equipment when heavy metal contamination is suspected or present, since stainless steel cannot be exposed to prolonged acid soaks.
 - 3.4. If the field equipment cannot be cleaned utilizing these procedures, discard unless further cleaning with stronger solvents and/or oxidizing solutions is effective as evidenced by visual observation and blanks.
 - 3.5. Clearly mark or disable all discarded equipment to discourage use.

FC 1130. GENERAL CLEANING

Follow these procedures when cleaning equipment under controlled conditions. See FC 1110 for modifications if cleaning is performed on-site. Check manufacturer's instructions for cleaning restrictions and/or recommendations.

FC 1131. Procedure for Teflon, Stainless Steel and Glass Sampling Equipment

This procedure must be used when sampling for **ALL** analyte groups: extractable organics, metals, nutrients, etc. or if a single decontamination protocol is desired to clean all Teflon, stainless steel and glass equipment.

1. Rinse equipment with hot tap water.
2. Soak equipment in a hot, sudsy water solution (Liqui-Nox or equivalent - see FC 1001, section 1).
3. If necessary, use a brush to remove particulate matter or surface film.
4. Rinse thoroughly with hot tap water.

5. If samples for trace metals or inorganic analytes will be collected with the equipment and the equipment **is not** stainless steel, thoroughly rinse (wet all surfaces) with the appropriate acid solution (see FC 1001, section 4).
6. Rinse thoroughly with analyte-free water. Use enough water to ensure that all equipment surfaces are thoroughly flushed with water.
7. If samples for volatile or extractable organics will be collected, rinse with isopropanol. Wet equipment surfaces thoroughly with free-flowing solvent. Rinse thoroughly with analyte-free water (see FC 1001, section 3).
8. Allow to air dry. Wrap and seal according to FC 1003, section 6 as soon as the equipment is air-dried.
9. If isopropanol is used, the equipment may be air-dried without the final analyte-free water rinse (see FC 1131, section 8 above); however, **the equipment must be completely dry before wrapping or use.**
10. Wrap clean sampling equipment according to the procedure described in FC 1003, section 6.

FC 1132. *General Cleaning Procedure for Plastic Sampling Equipment*

1. Rinse equipment with hot tap water.
2. Soak equipment in a hot, sudsy water solution (Liqui-Nox or equivalent - see FC 1001, section 1).
3. If necessary, use a brush to remove particulate matter or surface film.
4. Rinse thoroughly with hot tap water.
5. Thoroughly rinse (wet all surfaces) with the appropriate acid solution (see FC 1001, section 4).
- 4). Check manufacturer's instructions for cleaning restrictions and/or recommendations.
6. Rinse thoroughly with analyte-free water. Use enough water to ensure that all equipment surfaces are thoroughly flushed with water. Allow to air dry as long as possible.
7. Wrap clean sampling equipment according to the procedure described in FC 1003, section 6.

FC 1133. *Cleaning Procedure by Analyte Group*

See Table FC 1000-1 for the procedures to be used to decontaminate equipment based on construction of sampling equipment, and analyte groups to be sampled.

FC 1140. **AUTOMATIC SAMPLERS, SAMPLING TRAINS AND BOTTLES**

1. When automatic samplers are deployed for extended time periods, clean the sampler using the following procedures when routine maintenance is performed. Inspect deployed samplers prior to each use. At a minimum, change the tubing if it has become discolored or has lost elasticity (FC 1140, section 2.3 below).
2. Clean all automatic samplers (such as ISCO) as follows:
 - 2.1. Wash the exterior and accessible interior portions of the automatic samplers (excluding the waterproof timing mechanisms) with laboratory detergent (see FC 1001, section 1) and rinse with tap water.

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FC 1000 Cleaning / Decontamination Procedures

- 2.2. Clean the face of the timing case mechanisms with a clean, damp cloth.
- 2.3. Check all tubing (sample intake and pump tubing). Change the tubing every six months (if used frequently) or if it has become discolored (i.e., affected by mold and algae) or if it has lost its elasticity.
- 2.4. See FC 1160, section 4 for the procedures associated with cleaning the tubing in the pump head.
3. AUTOMATIC SAMPLER ROTARY FUNNEL AND DISTRIBUTOR
 - 3.1. Clean with hot sudsy water and a brush (see FC 1001, section 1 for appropriate detergent type).
 - 3.2. Rinse thoroughly with analyte-free water.
 - 3.3. Air dry.
 - 3.4. Replace in sampler.
4. SAMPLER METAL TUBE: Clean as outlined in FC 1160, section 5.
5. REUSABLE GLASS COMPOSITE SAMPLE CONTAINERS
 - 5.1. If containers are used to collect samples that contain oil, grease or other hard to remove materials, it may be necessary to rinse the container several times with reagent-grade acetone before the detergent wash. If material cannot be removed with acetone, discard the container.
 - 5.2. Wash containers following the procedure outlined in FC 1131 above. End with a final solvent rinse if organics are to be sampled.
 - 5.3. Invert containers to drain and air dry for at least 24 hours.
 - 5.4. Cap with aluminum foil, Teflon film or the decontaminated Teflon-lined lid.
 - 5.5. After use, rinse with water in the field, seal with aluminum foil to keep the interior of the container wet, and return to the laboratory or base of operations.
 - 5.6. **Do not recycle or reuse containers if:**
 - 5.6.1. They were used to collect in-process (i.e., untreated or partially treated) wastewater samples at industrial facilities;
 - 5.6.2. A visible film, scale or discoloration remains in the container after the cleaning procedures have been used; or
 - 5.6.3. The containers were used to collect samples at pesticide, herbicide or other chemical manufacturing facilities that produce toxic or noxious compounds. Such containers must be properly disposed of (preferably at the facility) at the conclusion of the sampling activities.
 - 5.6.4. If the containers described above are reused, check no less than 10% of the cleaned containers for the analytes of interest **before** use. If found to be contaminated, (i.e., constituents of interest are found at method detection levels or higher), then **discard the containers.**
6. REUSABLE PLASTIC COMPOSITE SAMPLE CONTAINERS
 - 6.1. Follow FC 1132.

- 6.2. Inspect the containers. Determine if the containers can be reused by the criteria in FC 1140, section 5 above.
7. GLASS SEQUENTIAL SAMPLE BOTTLES FOR AUTOMATIC SAMPLER BASED FOR SEQUENTIAL MODE
 - 7.1. Clean glass sequential sample bottles to be used for collecting inorganic samples by using a laboratory dishwasher (see FC 1140, sections 7.1.1 through 7.1.3 below) or manually following the procedures in FC 1131.
 - 7.1.1. Rinse with appropriate acid solution (see FC 1001, section 4).
 - 7.1.2. Rinse thoroughly with tap water.
 - 7.1.3. Wash in dishwasher at wash cycle, using laboratory detergent cycle, followed by tap and analyte-free water rinse cycles.
 - 7.2. Replace bottles in covered, automatic sampler base; cover with aluminum foil for storage.
 - 7.3. Rinse bottles in the field with water as soon as possible after sampling event.
8. Glass Sequential Sample Bottles (Automatic Sampler based for Sequential Mode) to be used for Collecting Samples for Organic Compounds
 - 8.1. Use cleaning procedures outlined in FC 1131. Allow containers to thoroughly air dry before use.
 - 8.2. Replace bottles in covered, automatic sampler base; cover with aluminum foil for storage.
9. BOTTLE SIPHONS USED TO TRANSFER SAMPLES FROM COMPOSITE CONTAINERS
 - 9.1. Rinse tubing with solvent and dry overnight in a drying oven.
 - 9.2. Cap ends with aluminum foil and/or Teflon film for storage.
 - 9.3. Seal in plastic for storage and transport.
 - 9.4. Flush siphon thoroughly with sample before use.
10. REUSABLE TEFLON COMPOSITE MIXER RODS
 - 10.1. Follow procedures outlined in FC 1131.
 - 10.2. Wrap in aluminum foil for storage.

FC 1150. FILTRATION EQUIPMENT

1. Dissolved Constituents using in-line, Molded and Disposable Filter Units
 - 1.1. Peristaltic Pump
 - 1.1.1. Clean the pump following procedures in FC 1170, section 2.2.
 - 1.1.2. Clean the pump head tubing following FC 1160, section 4.
 - 1.1.3. If Teflon tubing is used, clean following the procedures in FC 1160, section 3.
 - 1.1.4. Clean other tubing types such as polyethylene according to the appropriate procedures listed in FC 1160, section 7.
 - 1.2. Other Equipment Types (e.g., pressurized Teflon bailer)

- 1.2.1. Follow the appropriate cleaning regimen specified in FC 1131 through FC 1132 for other types of equipment that utilize in-line, molded and disposable filters.
2. Dissolved Constituents using Non-disposable Filtration Units (e.g., syringes, "tripod assembly")
 - 2.1. Stainless Steel or Glass Units
 - 2.1.1. Follow FC 1131, assembling and applying pressure to the apparatus after each rinse step (water and acid) to drive rinsing solution through the porous filter holder in the bottom of the apparatus.
 - 2.1.2. Remove and clean any transfer tubing according to the appropriate cleaning procedures (see FC 1160).
 - 2.1.3. Assemble the unit and cap both the pressure inlet and sample discharge lines (or whole unit if a syringe) with aluminum foil to prevent contamination during storage.
 - 2.1.4. If the unit will **not** be used to filter volatile or extractable organics, seal the unit in an untreated plastic bag to prevent contamination.
 - 2.2. Reusable In-Line Filter Holders
 - 2.2.1. Clean, using FC 1131, (if Teflon, glass or stainless steel) or FC 1132 (if plastic) assembling and applying pressure to the apparatus after each rinse step (water and acid) to drive rinsing solution through the porous filter holder in the bottom of the apparatus.
 - 2.2.2. Assemble the unit and wrap with aluminum foil to prevent contamination during storage.
 - 2.2.3. If the unit will **not** be used to filter volatile or extractable organics, seal the unit in an untreated plastic bag to prevent contamination.
3. FILTERS
 - 3.1. Do not clean filters. Instructions for rinsing the filters prior to use are discussed in the applicable sampling SOPs (FS 2000 - FS 8000).

FC 1160. SAMPLE TUBING DECONTAMINATION

1. Check tubing:
 - 1.1. For discoloration: Remove discolored tubing from use until it can be cleaned. If the discoloration cannot be removed, discard the tubing.
 - 1.2. For elasticity (if used in a peristaltic-type pump): Discard any tubing that has lost its elasticity.
2. Transport all tubing to the field in precut, **precleaned** sections.
3. TEFLON, POLYETHYLENE AND POLYPROPYLENE TUBING
 - 3.1. New Tubing: Follow this procedure unless the manufacturer/supplier provides certification that the tubing is clean.
 - 3.1.1. Teflon
 - 3.1.1.1. Rinse outside of tubing with pesticide-grade solvent (see FC 1001, section 2).

- 3.1.1.2. Flush inside of tubing with pesticide-grade solvent.
- 3.1.1.3. Dry overnight in drying oven or equivalent (zero air, nitrogen, etc.).

3.1.2. Polyethylene and Polypropylene

- 3.1.2.1. Clean the exterior and interior of the tubing by soaking in hot, sudsy water.
- 3.1.2.2. Thoroughly rinse the exterior and interior of the tubing with tap water, followed by analyte-free water.

3.2. Reused Tubing

Use the following procedure for in-lab cleaning. **Field cleaning is not recommended:**

- 3.2.1. Clean the exterior of the tubing by soaking in hot, sudsy water (see FC 1001, section 1) in a stainless steel sink (or equivalent non-contaminating material). Use a brush to remove any particulates, if necessary.
- 3.2.2. Use a small bottle brush and clean the inside of the tubing ends where the barbs are to be inserted or cut 1-2 inches from the ends of the tubing after cleaning.
- 3.2.3. Rinse tubing exterior and ends liberally with tap water.
- 3.2.4. Rinse tubing surfaces and ends with the appropriate acid solution (see FC 1001, section 4), tap water, isopropanol (see FC 1001, section 2), and finally analyte-free water.
 - 3.2.4.1. Note: Eliminate the isopropanol rinse for polyethylene or polypropylene tubing.
- 3.2.5. Place tubing on fresh aluminum foil or clean polyethylene sheeting. Connect all of the precut lengths of tubing with Teflon inserts or barbs.
- 3.2.6. Cleaning configuration:
 - 3.2.6.1. Place cleaning reagents: [sudsy water (see FC 1001, section 1); acid (see FC 1001, section 4); isopropanol (see FC 1001, section 2)] in an appropriately cleaned container (2-liter glass jar is recommended).
 - 3.2.6.2. Place one end of the Teflon tubing into the cleaning solution.
 - 3.2.6.3. Attach the other end of the Teflon tubing set to the influent end of a pump.
 - 3.2.6.4. Recycle the effluent from the pump by connecting a length of Teflon tubing from the effluent to the glass jar with the cleaning reagents.
 - 3.2.6.5. Recycling as described above may be done for all reagents listed in FC 1160, section 3.2.6.1 above, **except** the final isopropanol rinse and the final analyte-free water rinse. Disconnect the tubing between the effluent end of the pump and the jar of cleaning reagents.
 - 3.2.6.6. Containerize isopropanol in a waste container for proper disposal.
 - 3.2.6.7. Analyte-free water may be discarded down the drain.
- 3.2.7. Using the above configuration described in FS 1160, section 3.2.6 above:
 - 3.2.7.1. Pump hot, sudsy water through the connected lengths. Allow the pump to run long enough to pump at least three complete tubing volumes through the tubing set.

3.2.7.2. Using the same procedure, successively pump tap water, the acid solution(s), tap water, isopropanol, and finally analyte-free water through the system.

3.2.7.3. Leave the Teflon inserts or barbs between the precut lengths and cap or connect the remaining ends.

3.2.8. After the interior has been cleaned as described in FC 1160, section 3.2.7 above, rinse the exterior of the tubing with analyte-free water.

3.2.9. Wrap the connected lengths in aluminum foil or untreated butcher paper and store in a clean, dry area until use.

4. Flexible Tubing used in Pump Heads of Automatic Samplers and other Peristaltic Pumps

Replace tubing after each sampling point if samples are collected through the tubing. Unless the pump is deployed to collect samples from the same location over a long period of time, remove and wash the tubing after each sampling event (see FC 1140, section 1).

4.1. Flush tubing with hot tap water then sudsy water (see FC 1001, section 1).

4.2. Rinse thoroughly with hot tap water.

4.3. Rinse thoroughly with analyte-free water.

4.4. If used to collect metals samples, flush the tubing with an appropriate acid solution (see FC 1001, section 4), followed by thorough rinsing with analyte-free water. If used to collect both metals and nitrogen components use hydrochloric acid (see FC 1001, section 4.1.1).

4.5. Install tubing in peristaltic pump or automatic sampler.

4.6. Cap both ends with aluminum foil or equivalent.

Note: Change tubing at specified frequencies as part of routine preventative maintenance.

5. STAINLESS STEEL TUBING

Clean the exterior and interior of stainless steel tubing as follows:

5.1. Using sudsy water (see FC 1001, section 1), scrub the interior and exterior surfaces.

5.2. Rinse with hot tap water.

5.3. Rinse with analyte-free water.

5.4. If volatile or extractable organics are to be sampled, rinse all surfaces with isopropanol (see FC 1001, section 2). Use enough solvent to wet all surfaces with free flowing solvent.

5.5. Allow to air dry or thoroughly rinse with analyte-free water.

6. GLASS TUBING

6.1. Use new glass tubing.

6.2. If volatile or extractable organics are to be sampled, rinse with isopropanol (see FC 1001, section 2).

6.3. Air dry for at least 24 hours.

6.4. Wrap in aluminum foil or untreated butcher paper to prevent contamination during storage.

6.5. Discard tubing after use.

7. MISCELLANEOUS NON-INERT TUBING TYPES (TYGON, RUBBER, PVC, ETC.)

7.1. New Tubing

7.1.1. As a general rule, new tubing may be used without preliminary cleaning.

7.1.2. Protect new tubing from potential environmental contamination by wrapping in aluminum foil and sealing in untreated plastic bags or keep in the original sealed packaging until use.

7.1.3. If new tubing is exposed to potential contamination, rinse the exterior and interior tubing surfaces with hot tap water followed by a thorough rinse with analyte-free water.

7.1.4. If new tubing is to be used to collect samples, thoroughly rinse the tubing with sample water (i.e., pump sample water through the tubing) before collecting samples.

7.2. Reused Tubing

7.2.1. Flush tubing with sudsy solution of hot tap water and laboratory detergent (see FC 1001, section 1).

7.2.2. Rinse exterior and interior thoroughly with hot tap water.

7.2.3. Rinse exterior and interior thoroughly with analyte-free water.

7.2.4. If used to collect only metals samples, flush the tubing with nitric acid (see FC 1001, section 4.1), followed by a thorough rinse with analyte-free water.

7.2.5. If used to collect metals and nitrogen-containing compounds, see FC 1001, section 4.3.

7.2.6. Cap ends in aluminum foil and store in clean, untreated plastic bags to prevent contamination during storage and transport.

FC 1170. PUMPS

1. SUBMERSIBLE PUMPS

1.1. Pumps used for Purging and Sampling Metals and/or Volatile and Extractable Organics

1.1.1. Construction of pump body and internal mechanisms (bladders, impellers, etc.), including seals and connections, must follow Tables FS 1000-1, FS 1000-2 and FS 1000-3.

1.1.2. Tubing material must follow Tables FS 1000-1, FS 1000-2 and FS 1000-3.

1.1.3. Clean pump exterior following FC 1132. Note: omit the solvent rinse if the pump body is constructed of plastic (e.g., ABS, PVC, etc.).

1.1.4. Clean the pump internal cavity and mechanism as follows:

1.1.4.1. If used only for purging, thoroughly flush the pump with water before purging the next well.

1.1.4.2. When used for purging and sampling, completely disassemble the pump (if practical) and decontaminate between each well.

1.1.4.3. When used for purging and sampling and the pump cannot be (practicably) disassembled, then clean the internal cavity/mechanism by pumping

several gallons of sudsy water (see FC 1001, section 1), followed by several gallons of tap water, and finally, several gallons of analyte-free water.

1.1.4.4. If multiple sampling points are located in an area that is not accessible by a vehicle, and it is difficult to return to the vehicle for cleaning or to transport all cleaning materials to the staging location, at a minimum thoroughly rinse the pump with water.

1.1.5. Refer to FC 1160, section 3 to clean Teflon tubing.

1.1.6. Refer to FC 1160, section 5 for stainless steel tubing.

1.1.7. Clean other types of tubing according to FC 1160, sections 6 and 7.

1.2. Pumps used for Purging and Sampling all Analytes except Metals, Volatile and Extractable Organics

1.2.1. Pump construction: no restrictions.

1.2.2. Pump tubing material: no restrictions.

1.2.3. Scrub the exterior of the pump with appropriate metal-free, phosphate-free or ammonia-free detergent solution.

1.2.4. Rinse the exterior with tap water and analyte-free water.

1.2.5. Rinse the interior of the pump and tubing by pumping tap or analyte-free water through the system using a clean bucket or drum.

2. ABOVE-GROUND PUMPS USED FOR PURGING AND SAMPLING

2.1. Pumps used only for Purging

2.1.1. The exterior of the pump must be free of oil and grease.

2.1.2. Select tubing according to Tables FS 1000-1, FS 1000-2 and FS 1000-3.

2.1.3. Clean the tubing that contacts the formation water according to the appropriate protocol for construction materials specified in FC 1160.

2.2. Pumps used for Sampling

2.2.1. Clean the exterior of the pump with a detergent solution followed by a tap water rinse. Use clean cloths or unbleached paper towels that have been moistened with the appropriate solution to wipe down the pump.

2.2.2. Select tubing according to Tables FS 1000-1, FS 1000-2 and FS 1000-3.

2.2.3. Clean the tubing that contacts the formation water according to the appropriate protocol for construction materials specified in FC 1160.

FC 1180. ANALYTE-FREE WATER CONTAINERS

This section pertains to containers that are purchased to transport, store and dispense analyte-free water. It does not apply to water that has been purchased in containers. See FC 1002, section 3 for appropriate construction materials.

1. NEW CONTAINERS

1.1. Wash containers and caps according to FC 1131, omitting the solvent rinse if plastic (polyethylene or polypropylene) containers are being cleaned.

1.2. Cap with Teflon film or the bottle cap. The bottle cap must be composed of the same material as the container and cannot be lined.

2. REUSED CONTAINERS

2.1. Immediately after emptying, cap with aluminum foil, Teflon film or the container cap.

2.2. Wash the exterior of the container with lab-grade detergent solution (see FC 1001, section 1) and rinse with analyte-free water.

2.3. Rinse the interior thoroughly with analyte-free water.

2.4. Invert and allow to drain and dry.

FC 1190. ICE CHESTS AND SHIPPING CONTAINERS

1. Wash the exterior and interior of all ice chests with laboratory detergent (see FC 1001, section 1) after each use.

2. Rinse with tap water and air dry before storing.

3. If the ice chest becomes severely contaminated with concentrated waste or other toxic or hazardous materials clean as thoroughly as possible, render unusable, and properly dispose.

FC 1200. Field Instruments and Drilling Equipment

FC 1210. FIELD INSTRUMENTS (TAPES, METERS, ETC.)

Follow manufacturer's recommendations for cleaning instruments. At a minimum:

1. Wipe down equipment body, probes, and cables with lab-grade detergent solution (see FC 1001, section 1). Check manufacturer's instructions for recommendations and/or restrictions on cleaning.

2. Rinse thoroughly with tap water.

3. Rinse thoroughly with analyte-free water.

4. Store equipment according to the manufacturer's recommendation or wrap equipment in aluminum foil, untreated butcher paper or untreated plastic bags to eliminate potential environmental contamination.

FC 1220. SOIL BORING EQUIPMENT

This section pertains only to equipment that is not used to collect samples. Clean split spoons, bucket augers and other sampling devices according to FC 1131.

1. Remove oil, grease, and hydraulic fluid from the exterior of the engine and power head, auger stems, bits and other associated equipment with a power washer or steam jenny or wash by hand with a brush and sudsy waster (no degreasers).

2. Rinse thoroughly with tap water.

FC 1230. WELL CASING CLEANING

These are recommended procedures for cleaning well casing and riser pipes. Use procedures specified by a FDEP contract, order, permit, or rule, if different or more stringent than the procedures outlined below.

1. FDEP recommends only using casing that is designed for subsurface environmental groundwater monitoring.
2. Casing that has been contaminated with grease, hydraulic fluid, petroleum fuel, etc. may require additional cleaning or deemed unusable.
3. All casings and riser pipes should be cleaned before installation, unless the casing is received wrapped and ready for installation:
 - 3.1. Steam clean all casings and riser pipes except PVC. Steam cleaning criteria shall meet the following: water pressure - 2500 psi; water temperature - 200°F.
 - 3.2. Rinse thoroughly with tap (potable) water. This tap water must be free of the analytes of interest.

FC 1300. Sample Containers

FC 1310. OBTAINING CLEAN CONTAINERS

1. Obtain clean sample containers in one of three ways:
 - 1.1. From commercial vendors as precleaned containers. The cleaning grades must meet EPA analyte specific requirements. Keep all records for these containers (lot numbers, certification statements, date of receipt, etc.) and document the container's intended uses;
 - 1.2. From internal groups within the organization that are responsible for cleaning and maintaining containers according to the procedures outlined in FC 1320; or
 - 1.3. From a subcontracted laboratory that is accredited under the National Environmental Laboratory Accreditation Program (NELAP).
 - 1.3.1. The contractor must verify that the laboratory follows the container cleaning procedures outlined in FC 1320.
 - 1.3.2. If the laboratory cleaning procedures are different, the contractor must require that the laboratory use the following cleaning procedures or provide documentation and historical records to show that their in-house procedure produces containers that are free from the analytes of interest.

FC 1320. CONTAINER CLEANING PROCEDURES

1. Refer to Table FC 1000-2. Follow the cleaning steps in the order specified in the chart.
2. Cleaning procedures that are different from those outlined in FC 1320 may be used as long as blanks collected in the containers are free from the analytes of interest and any analytical interferences and the cleaning procedures are supported by historical and continuing documentation.
3. Inspect all containers before cleaning.
 - 3.1. **Do not recycle or reuse containers if:**
 - 3.1.1. Containers were used to collect in-process (i.e., untreated or partially treated) wastewater samples at industrial facilities;
 - 3.1.2. A visible film, scale or discoloration remains in the container after the cleaning procedures have been used; or

3.1.3. Containers were used to collect samples at pesticide, herbicide or other chemical manufacturing facilities that produce toxic or noxious compounds. Such containers shall be properly disposed of (preferably at the facility) at the conclusion of the sampling activities.

3.1.4. If the containers described above are reused, check no less than 10% of the cleaned containers for the analytes of interest before use. If found to be contaminated (i.e., analytes of interest are found at MDL levels or higher), discard the containers.

FC 1400. Documentation

Document cleaning procedures described below for the indicated activities. See FD 1000 for additional information about required records and retention of documents.

FC 1410. FIELD EQUIPMENT

1. IN-FIELD CLEANING

1.1. Initially identify the procedures that are used to clean equipment in the field by SOP numbers and dates of usage.

1.2. Record the date and time that equipment was cleaned.

2. IN-HOUSE CLEANING

2.1. Retain any cleaning certificates, whether from a laboratory or commercial vendor.

2.2. Identify the procedure(s) that are used to clean equipment by the SOP number and dates of usage.

2.3. Record the date that the equipment was cleaned.

FC 1420. SAMPLE CONTAINERS

1. Organizations that order precleaned containers must retain the packing slips, and lot numbers of each shipment, any certification statements provided by the vendor and the vendor cleaning procedures.

2. Organizations that clean containers must maintain permanent records of the following:

2.1. Procedure(s) used to clean containers by SOP number and dates of usage.

2.2. If containers are certified clean by the laboratory the laboratory must record:

- Type of container;
- Date cleaned;
- SOP used;
- Person responsible for cleaning;
- Lot number (date of cleaning may be used) of the batch of containers that were cleaned using the same reagent lots and the same procedure;
- The results of quality control tests that were run on lot numbers; and
- Any additional cleaning or problems that were encountered with a specific lot.

FC 1430. REAGENTS AND OTHER CLEANING SUPPLIES

Maintain a record of the lot number with the inclusive dates of use for all acids, solvents, and other cleaning supplies.

Appendix FC 1000
Tables, Figures and Forms

Table FC 1000-1 Procedures for Decontamination at the Base of Operations or On-site

Table FC 1000-2 Container Cleaning Procedures

Table FC 1000-1
Procedures for Decontamination at the Base of Operations or On-Site

Construction Material	Analyte Group Sampled	SOP Reference	Base of Operations	On-Site
Teflon or Glass	All	FC 1131	Follow as written	May substitute ambient temperature water for the hot water rinses and hot detergent solution
	Extractable & Volatile Organics Petroleum Hydrocarbons		May omit acid rinse	May substitute ambient temperature water for the hot water rinses and hot detergent solution May omit acid rinse
	Metals ¹ Radionuclides For ultra trace metals, refer to FS 8200		May omit solvent rinse	May substitute ambient temperature water for the hot water rinses and hot detergent solution May omit solvent rinse
	Inorganic Nonmetallics Physical & Aggregate Properties Aggregate Organics Biologicals Volatile Inorganics		May omit solvent rinse	Rinse several times with water Rinse several times with sample water from the next sampling location
	Microbiological – Viruses Microbiological - Bacteria		Omit solvent and acid rinses	Rinse several times with water Rinse several times with sample water from the next sampling location
Metallic (stainless steel, brass, etc.)	All Extractable & Volatile Organics Petroleum Hydrocarbons	FC 1131	Omit the acid rinse	May substitute ambient temperature water for the hot water rinses and hot detergent solution Omit the acid rinse
	Metals Radionuclides		Omit the acid rinse May omit the solvent rinse	May substitute ambient temperature water for the hot water rinses and hot detergent solution Omit the acid rinse May omit the solvent rinse
	Inorganic Nonmetallics Physical & Aggregate Properties Aggregate Organics Biologicals Volatile Inorganics		Omit solvent rinse May omit the acid rinse	Rinse several times with water Rinse several times with sample water from the next sampling location

Table FC 1000-1
Procedures for Decontamination at the Base of Operations or On-Site

Construction Material	Analyte Group Sampled	SOP Reference	Base of Operations	On-Site
	Microbiological – Viruses Microbiological - Bacteria		Omit solvent and acid rinses	Rinse several times with water Rinse several times with sample water from the next sampling location
Plastic (Polyethylene, polypropylene, PVC, silicone, acrylic)	Volatile and Extractable Organics;	FC 1132	Follow as written.	May substitute ambient temperature water for the hot water rinses and hot detergent solution
	Inorganic Nonmetallics Physical & Aggregate Properties Aggregate Organics Biologicals Volatile Inorganics		May omit the acid rinse	Rinse several times with water Rinse several times with sample water from the next sampling location
	Microbiological – Viruses Microbiological - Bacteria		Omit acid rinse	Rinse several times with water Rinse several times with sample water from the next sampling location

ⁱ Do not use glass if collecting samples for boron or silica.

Table FC 1000-2
Container Cleaning Procedures

ANALYSIS / ANALYTE GROUP	CLEANING STEPS See Description Below
Extractable Organics	1, 2, 4, 6 (not required if Luminox (or equivalent is used), (5 and 7 optional), 11
Volatile Organics	1, 2, 4, (6 optional, methanol only), 7
Metals	1, 2, 3, 4, 8, 11 ** **Procedures to clean containers for ultra-trace metals are found in FS 8200
Inorganic Nonmetallics, Radionuclides, Physical and Aggregate Properties, Aggregate Inorganics, and Volatile Inorganics	1, 2, 3*, 4, 8, 11 * For nutrients, replace nitric acid with hydrochloric acid, or use a hydrochloric acid rinse after the nitric acid rinse. See FC 1001, section 4
Petroleum Hydrocarbons, and Oil and Grease	1, 2, 3, 4, (5, 6, 7 optional), 11
Microbiological (all)	1, 2, 4, 8, 9, 11
Toxicity Tests (Includes Bioassays)	1, 2, 10, 2, 4, 6.1, (10 optional), 11

NOTE: Steps 1 and 2 may be omitted when cleaning new, uncertified containers.

1. Wash with hot tap water and a brush using a suitable laboratory-grade detergent:
 - 1.1. Volatile and Extractable Organics, Petroleum Hydrocarbon, Oil and Grease: Luminox, Liqui-Nox, Alconox or equivalent;
 - 1.2. Inorganic nonmetallics: Liqui-Nox or equivalent;
 - 1.3. Metals: Liqui-Nox, Acationox, Micro or equivalents;
 - 1.4. Microbiologicals (all): Must pass an inhibitory residue test.
2. Rinse thoroughly with hot tap water.
3. Rinse with 10% nitric acid solution.
4. Rinse thoroughly with analyte-free water (deionized or better).
5. Rinse thoroughly with pesticide-grade methylene chloride.
6. Rinse thoroughly with pesticide-grade isopropanol, acetone or methanol.
 - 6.1. For bioassays, use only acetone, and only when containers are glass.
7. Oven dry at 103°C to 125°C for at least 1 hour.

Table FC 1000-2
Container Cleaning Procedures

- 7.1. VOC vials and containers must remain in the oven in a contaminant-free environment until needed. They should be capped in a contaminant-free environment just prior to dispatch to the field.
8. Invert and air-dry in a contaminant-free environment.
9. Sterilize containers:
 - 9.1. Plastic: 60 min at 170°C, loosen caps to prevent distortion.
 - 9.2. Glass: 15 min at 121°C.
10. Rinse with 10% hydrochloric acid followed by a sodium bicarbonate solution.
11. Cap tightly and store in a contaminant-free environment until use. Do not use glass if collecting samples for boron or silica.

FD 1000. DOCUMENTATION PROCEDURES

1. INTRODUCTION:

1.1. For the creation of clear, accurate and methodical records to document all field activities affecting sample data, implement the following standard operating procedures for sample collection, sample handling and field-testing activities.

2. SCOPE AND APPLICABILITY

2.1. This SOP provides a detailed listing of the information required for documentation of all sampling procedures and field testing.

2.2. Refer to the associated sampling or field testing SOP for any requirements for the chronological or sequential documentation of data.

3. QUALITY ASSURANCE

3.1. Implement review procedures to monitor and verify accurate manual and automated data entry and recordkeeping for all documentation tasks outlined in this SOP.

FD 1100. Universal Documentation Requirements

Incorporate efficient archival design and concise documentation schemes for all record systems. Ensure that the history of a sample is clearly evident in the retained records and documentation and can be independently reconstructed.

1. CRITERIA FOR ALL DOCUMENTS

1.1. Keep all applicable documentation available for inspection. Keep all original data and records as well as reduced or manipulated forms of the original data or records.

1.1.1. Authorized representatives of DEP have the legal right to inspect and request copies of any records using paper, electronic media, or other media during any DEP audit of physical facilities or on-site sampling events, and for any data validations conducted for applicable project data submitted to DEP.

1.2. Record enough information so that clarifications, interpretations, or explanations of the data are not required from the originator of the documentation.

1.3. Clearly indicate the nature and intent of all documentation and all record entries.

1.4. Link citations to SOPs and other documents by the complete name, reference or publication number, revision number, and revision date for the cited document, when applicable. Also assign this information to internally generated SOPs.

1.5. Retain copies of all revisions of all cited documents as part of the documentation archives.

2. PROCEDURES

2.1. Sign, initial or encode all documentation entries made to paper, electronic or other records with a link indicating the name and responsibility of the author making the data entry, clearly indicating the reason for the signature, initials or code (e.g., "sampled by"; "released by"; "prepared by"; "reviewed by").

2.2. In order to abbreviate record entries, make references to procedures written in internal SOPs or methodology and procedures promulgated by external sources.

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2.2.1. Document the intent to use SOPs other than the DEP SOPs, or to use allowable modifications to the DEP SOPs by recording the effective date of use for all such SOPs or modifications.

2.2.1.1. Retain any correspondence with DEP regarding approval to use alternative procedures for any projects.

2.2.2. Authorize all internal SOPs with the signatures of the quality assurance officer(s) and manager(s) responsible for implementation of the SOPs. Record the dates of signature.

2.3. Employ straightforward archiving of records to facilitate documentation tracking and retrieval of all current and archived records for purposes of inspection, verification, and historical reconstruction of all procedures and measurement data.

2.4. Keep copies or originals of all documentation, including documentation sent to or received from external parties.

2.5. Use waterproof ink for all paper documentation.

2.6. Do not erase or obliterate entry errors on paper records. Make corrections by marking a line through the error so that it is still legible. Initial or sign the marked error and its correction.

2.7. Maintain electronic audit trails for all edited electronic records, if possible. Utilize software that allows tracking of users and data edits, if available. Software that prompts the user to double-check edits before execution is also preferred. See FD 1200.

2.8. Clearly link all documentation associated with a sample or measurement. Make cross-references to specific documentation when necessary.

2.9. Link final reports, data summaries, or other condensed versions of data to the original sample data, including those prepared by external parties.

3. RETENTION REQUIREMENTS

3.1. Per the DEP QA Rule, 62-160.220 & .340, F.A.C., keep all documentation archives for a minimum of 5 years after the date of project completion or permit cycle unless otherwise specified in a Department contract, order, permit, or Title 62 rules.

FD 1200. Electronic Documentation

Handle electronic (digital) data as with any data according to applicable provisions of FD 1100.

1. RETENTION OF AUTOMATIC DATA RECORDING PRODUCTS

1.1. For data not directly read from the instrument display and manually recorded, retain all products or outputs from automatic data recording devices, such as strip chart recorders, integrators, data loggers, field measurement devices, computers, etc. Store records in electronic, magnetic, optical, or paper form, as necessary.

1.1.1. Retain all original, raw output data. Ensure archiving of these data prior to subsequent reduction or other manipulation of the data.

1.2. Identify output records as to purpose, analysis date and time, field sample identification number, etc. Maintain clear linkage with the associated sample, other data source or measured medium and specific instrument used to make the measurement.

2. ELECTRONIC DATA SECURITY

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- 2.1. Control levels of access to electronic data systems as required to maintain system security and to prevent unauthorized editing of data.
 - 2.2. Do not alter raw instrumentation data or original manual data records in any fashion without retention of the original raw data.
 - 2.3. Maintain secure computer networks and appropriate virus protection as warranted for each system design.
3. ELECTRONIC DATA STORAGE AND DOCUMENTATION
- 3.1. Store all electronic, magnetic, and optical media for easy retrieval of records.
 - 3.1.1. Ensure that all records can be printed to paper if needed for audit or verification purposes.
 - 3.1.2. If it is anticipated that the documentation archive will become unreadable due to obsolescence of a particular storage technology, retain a paper archive of the data or transfer to other suitable media.
 - 3.2. For easy retrieval of records, link all stored data to the associated sample data or other data source.
 - 3.3. Back up all data at a copy rate commensurate with the level of vulnerability of the data. Consider replicating all original data as soon as possible after origination.
4. SOFTWARE VERIFICATION
- 4.1. Ensure that any software used to perform automatic calculations conforms to required formulas or protocols.
 - 4.2. Document all software problems and their resolution in detail, where these problems have irretrievably affected data records or linkage. Record the calendar date, time, responsible personnel, and relevant technical details of all affected data and software files. Note all software changes, updates, installations, etc. per the above concerns. File and link all associated service records supplied by vendors or other service personnel.
5. PROTECTION OF EQUIPMENT AND STORAGE MEDIA
- 5.1. Place stationary computers, instrumentation, and peripheral devices in locations of controlled temperature and humidity and away from areas where the potential for fluid leaks, fire, falling objects, or other hazards may exist. In the field, protect portable equipment from weather, excess heat or freezing, storage in closed vehicles, spillage from reagents and samples, etc.
 - 5.2. Protect storage media from deteriorating conditions such as temperature, humidity, magnetic fields, or other environmental hazards as above.
6. ELECTRONIC SIGNATURES – Documents signed with electronic signatures must be consistent with the requirements of 62-160.405, F.A.C.:
- 6.1. the integrity of the electronic signature can be assured;
 - 6.2. the signature is unique to the individual;
 - 6.3. the organization using electronic signatures has written policies for the generation and use of electronic signatures; and
 - 6.4. the organization using electronic signatures has written procedures for ensuring the security, confidentiality, integrity and auditability of each signature.

FD 1300. Documentation Using Other Media

1. UNIVERSAL REQUIREMENTS

1.1. Handle documentation prepared using other media according to FD 1100.

2. PROTECTION OF STORED MEDIA

2.1. Store media such as photographs, photographic negatives, microfilm, videotape, etc. under conditions generally prescribed for these media by manufacturers and conducive to long-term storage and protection from deterioration. See also FD 1200, section 5, above.

FD 2000. DOCUMENTATION OF CLEANED EQUIPMENT, SAMPLE CONTAINERS, REAGENTS AND SUPPLIES

When providing sample containers, preservation reagents, analyte-free water or sampling equipment, document certain aspects of these preparations.

1. EQUIPMENT CLEANING DOCUMENTATION

1.1. Document all cleaning procedures by stepwise description in an internal SOP if cleaning procedures in the DEP SOP have been modified for use. Alternatively, cite the DEP SOP procedures in the cleaning record for the applicable equipment.

1.2. Record the date of cleaning.

1.2.1. If items are cleaned in the field during sampling activities for a site, document the date and time when the affected equipment was cleaned. Link this information with the site and the cleaning location at the site.

1.3. Retain or make accessible any certificates of cleanliness issued by vendors supplying cleaned equipment or sample containers.

1.3.1. Retain from the vendor or document for internal cleaning the following information for sample containers, as applicable:

- Packing slip and cleanliness certificates from vendors
- Container types and intended uses
- Lot numbers or other designations for groups of containers cleaned together using the same reagents and procedures
- Dates of cleaning
- Cleaning procedures or reference to internal cleaning SOPs or DEP SOPs
- Cleaning personnel names
- Results of quality control analyses associated with container lots
- Comments about problems or other information associated with container lots

2. SAMPLING KIT DOCUMENTATION

If supplied to a party other than internal staff, transmit to the recipient the following information pertaining to sampling equipment or other implements, sample containers, reagent containers, analyte-free water containers, reagents or analyte-free water supplied to the recipient.

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- Quantity, description and material composition of all containers, container caps or closures or liners for caps or closures
 - Intended application for each sample container type indicated by approved analytical method or analyte group(s)
 - Type, lot number, amount and concentration of preservative added to clean sample containers and/or shipped as additional preservative
 - Intended use for any additional preservatives or reagents provided
 - Description of any analyte-free water (i.e., deionized, organic-free, etc.)
 - Date of analyte-free water containerization
 - Date of sampling kit preparation
 - Description and material composition of all reagent transfer implements (e.g., pipets) shipped in the sampling kit and the analyte groups for which the implements have been cleaned or supplied
 - Quantity, description and material composition of all sampling equipment and pump tubing (including equipment supplied for filtration) and the analyte groups for which the equipment has been cleaned or supplied
 - Tare weight of VOC vials, as applicable (this item is necessary when EPA 5035 VOC sample vials are provided for soil samples)
3. DOCUMENTATION FOR REAGENTS AND OTHER CHEMICALS
- 3.1. Keep a record of the lot numbers and inclusive dates of use for all reagents, detergents, solvents and other chemicals used for cleaning and sample preservation.
- 3.1.1. See FD 4000 below for documentation requirements for reagents used for field testing.

FD 3000. DOCUMENTATION OF EQUIPMENT MAINTENANCE

1. Log all maintenance and repair performed for each instrument unit, including routine cleaning procedures, corrective actions performed during calibrations or verifications, and solution or parts replacement for instrument probes.
 - 1.1. Include the calendar date for the procedures performed.
 - 1.2. Record names of personnel performing the maintenance or repair tasks.
 - 1.2.1. Describe any malfunctions necessitating repair or service.
2. Designate the identity of specific instrumentation in the documentation with a unique description or code for each instrument unit employed. This identifier may include a manufacturer name, model number, serial number, inventory number, or other unique identification.
3. Retain vendor service records for all affected instruments.
4. Record the following for rented equipment:

- Rental date(s)
 - Equipment type and model or inventory number or other description
5. Retain the manufacturer's operating and maintenance instructions.

FD 4000. DOCUMENTATION FOR CALIBRATION OF FIELD-TESTING INSTRUMENTS AND FIELD ANALYSES

Document acceptable instrument or measuring system calibration for each field test or analysis of a sample or other measurement medium.

FD 4100. General Documentation for all Field Testing

1. STANDARD AND REAGENT DOCUMENTATION: Document information about standards and reagents used for calibrations, verifications, and sample measurements.
 - 1.1. Note the date of receipt, the expiration date and the date of first use for all standards and reagents.
 - 1.1.1. Document acceptable verification of any standard used after its expiration date.
 - 1.2. Record the concentration or other value for the standard in the appropriate measurement units.
 - 1.2.1. Note vendor catalog number and description for preformulated solutions as well as for neat liquids and powdered standards.
 - 1.2.2. Retain vendor assay specifications for standards as part of the calibration record.
 - 1.2.2.1. Record the grade of standard or reagent used.
 - 1.3. When formulated in-house, document all calculations used to formulate calibration standards.
 - 1.3.1. Record the date of preparation for all in-house formulations.
 - 1.4. Describe or cite the procedure(s) used to prepare any standards in-house (DEP SOP or internal SOP).
2. FIELD INSTRUMENT CALIBRATION DOCUMENTATION: Document acceptable calibration and calibration verification for each instrument unit and field test or analysis, linking this record with affected sample measurements.
 - 2.1. Retain vendor certifications of all factory-calibrated instrumentation.
 - 2.2. Designate the identity of specific instrumentation in the documentation with a unique description or code for each instrument unit used.
 - 2.2.1. Record manufacturer name, model number, and identifying number such as a serial number for each instrument unit.
 - 2.3. Record the time and date of all initial calibrations and all calibration verifications.
 - 2.4. Record the instrument reading (value in appropriate measurement units) of all calibration verifications.
 - 2.5. Record the name of the analyst(s) performing the calibration or verification.

2.6. Document the specific standards used to calibrate or verify the instrument or field test with the following information:

- Type of standard or standard name (e.g., pH buffer)
- Value of standard, including correct units (e.g., pH = 7.0 SU)
- Link to information recorded according to section 1 above

2.7. Retain manufacturers' instrument specifications.

2.8. Document whether successful initial calibration occurred.

2.9. Document whether each calibration verification passed or failed.

2.10. Document, according to records requirements of FD 3000, any corrective actions taken to modify instrument performance.

2.10.1. Document date and time of any corrective actions.

2.10.2. Note any incidence of discontinuation of use of the instrument due to calibration failure.

2.11. Describe or cite the specific calibration or verification procedure performed (DEP SOP or internal SOP).

3. Record all field-testing measurement data, to include the following:

- Project name
- Date and time of measurement or test (including time zone, if applicable)
- Source and location of the measurement or test sample (e.g., monitoring well identification number, outfall number, station number or other description)
- Latitude and longitude of sampling source location (if required)
- Analyte or parameter measured
- Measurement or test sample value
- "J" data qualifier code for estimated measurement or test sample value
- Reporting units for the measurement
- Initials or name of analyst performing the measurement
- Unique identification of the specific instrument unit used for the test (see 2.2 above)

FD 5000. DOCUMENTATION OF SAMPLE COLLECTION, PRESERVATION AND TRANSPORT

Follow these procedures for all samples. See FD 5100 - FD 5427 below for additional documentation for specific sampling activities. See example Forms in FD 9000 below for example formats for documenting specific sampling and testing procedures.

1. SAMPLE IDENTIFICATION REQUIREMENTS

1.1. Ensure that labels are waterproof and will not disintegrate or detach from the sample container when wet, especially under conditions of extended submersion in ice water typically accumulating in ice chests or other transport containers.

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1.2. Label or tag each sample container with a unique field identification code that adequately distinguishes each sample according to the following criteria. The code must adequately link the sample container with all of the information about the sample contained in the permanent field record.

1.2.1. Link the unique field identification code to the sample source or sampling point identification, the date of sample collection, the time of sample collection (for maximum holding times equal to or less than 48 hours), the analytes of interest and the preservation technique.

1.2.2. Label or tag each sample container for the following types of samples with a unique field identification code:

- Quality control samples such as duplicate samples, other replicate samples or split samples collected for the same analyte or group of analytes
- Field samples or quality control samples collected using a different sample collection technique for the same analyte or group of analytes (for example, if both a bailer and a pump are used to collect samples for metals analysis, label the bailer sample to distinguish it from the pump sample)

1.2.3. The color, size, shape, or material composition of sample containers and caps cannot substitute for the information required in 1.2.1. – 1.2.2. Above.

1.2.4. The unique field identification code and any other information included on the container label or tag must allow the analyzing laboratory to independently determine the sample collection date, the sample collection time (for maximum holding times \leq 48 hours), the sample preservation and the analytical tests to be performed on each container or group of containers.

1.3. Attach the label or tag so that it does not contact any portion of the sample that is removed or poured from the container.

1.4. Record the unique field identification code on all other documentation associated with the specific sample container or group of containers.

2. GENERAL REQUIREMENTS FOR SAMPLING DOCUMENTATION: Record the following information for all sampling:

2.1. Names of all sampling team personnel on site during sampling

2.2. Date and time of sample collection (indicate hours and minutes)

2.2.1. Use 24-hour clock time or indicate A.M. and P.M.

2.2.2. Note the exact time of collection for individual sample containers for time-sensitive analyses with a maximum holding time of 48 hours or less.

2.3. Ambient field conditions, to include, but not limited to information such as weather, tides, etc.

2.4. Comments about samples or conditions associated with the sample source (e.g., turbidity, sulfide odor, insufficient amount of sample collected)

2.5. Specific description of sample location, including site name and address

2.5.1. Describe the specific sampling point (e.g., monitoring well identification number, outfall number, station number, etc.).

2.5.2. Determine latitude and longitude of sampling source location (if required).

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- 2.5.3. Locate sampling points on scaled maps or drawings where applicable.
 - 2.6. Record the unique field identification code for each sample container and parameters to be analyzed, per section 1 above. The code must adequately link the sample container or group of containers with all of the information about the sample contained in the permanent field record.
 - 2.7. Number of containers collected for each unique field identification code
 - 2.8. Matrix sampled
 - 2.9. Type of field sample collected, such as grab, composite or other applicable designation.
 - 2.10. Field-testing measurement data:
 - 2.10.1. See FD 4000 above for specific details.
 - 2.11. Calibration records for field-testing equipment
 - 2.11.1. See FD 4000 above for specific details.
 - 2.12. Preservation for each container
 - 2.12.1. Indicate whether samples are chemically preserved on-site by the sampling team or, alternatively, were collected in prepreserved (predosed) containers.
 - 2.12.2. Indication of any tests performed in the field to determine the presence of analytical interferences in the sample.
 - 2.12.3. Indication of any treatments of samples performed in the field to eliminate or minimize analytical interferences in the sample.
 - 2.12.4. See FD 5100, section 1.
 - 2.13. Purging and sampling equipment used, including the material composition of the equipment and any expendable items such as tubing.
 - 2.14. Types, number, collection location and collection sequence of quality control samples
 - 2.14.1. Include a list of equipment that was rinsed to collect any equipment blanks.
 - 2.15. Use of fuel powered vehicles and equipment
 - 2.16. Number of subsamples and amount of each subsample in any composite samples
 - 2.16.1. Include sufficient location information for the composite subsamples per 2.4 above.
 - 2.17. Depth of all samples or subsamples
 - 2.18. Signature(s) or initials of sampler(s)
3. **SAMPLE TRANSMITTAL RECORDS:** Transmit the following information to the analytical laboratory or other receiving party. Link transmittal records with a given project and retain all transmittal records.
- Site name and address – Note: Client code is acceptable if samples are considered sensitive information and if the field records clearly trace the code to a specified site and address.
 - Date and time of sample collection

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- Name of sampler responsible for sample transmittal
- Unique field identification codes for each sample container
- Total number of samples
- Required analyses
- Preservation protocol
- Comments about sample or sample conditions
- Identification of common carrier (if used)

4. SAMPLE TRANSPORT

4.1. If shipping transmittal forms in the transport containers with the samples, place the forms in a waterproof enclosure and seal.

4.2. For common carrier shipping, seal transport containers securely with strapping tape or other means to prevent lids from accidentally opening.

4.2.1. Keep all shipping bills from common carriers with archived transmittal records.

5. ANCILLARY FIELD RECORDS: Link any miscellaneous or ancillary records (photographs, videotapes, maps, etc.) to specific sampling events such that these records are easily traceable in the data archives associated with the project, sampling date and sample source(s).

FD 5100. Documentation Specific To Aqueous Chemistry Sampling

1. SAMPLE PRESERVATION: Document preservation of all samples according to the following instructions.

1.1. List the chemical preservatives added to the sample.

1.2. Record the results of pH verification performed in the field, including the pH value of the sample (if applicable). Note any observations about changes in the sample as a result of adding preservative to the sample or mixing the sample with the preservative.

1.3. Record the amount of preservative added to samples and the amount of any additional preservative added. The amount dosed into sample containers supplied with premeasured preservatives must also be recorded.

1.3.1. For documentation of procedures for preservation for routine samples, cite DEP SOPs or internal SOPs for this information.

1.3.2. Record instances of deviation from preservation protocols found in SOPs when non-routine or problematic samples are collected.

1.4. Record the use of ice or other cooling method, when applicable.

2. GROUNDWATER SAMPLING

2.1. Record or establish a documentation link to the following information for all samples. See section 3 below for in-place plumbing:

- Well casing composition and diameter of well casing
- A description of the process and the data used to design the well

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- The equipment and procedure used to install the well
 - The well development procedure
 - Pertinent lithologic or hydrogeologic information
 - Ambient conditions at the wellhead or sampling point that are potential sources of unrepresentative sample contamination
 - Water table depth and well depth
 - Calculations used to determine purge volume
 - Total amount of water purged
 - Date well was purged
 - Purging equipment used
 - Sampling equipment used
 - Well diameter
 - Total depth of well
 - Depth to groundwater
 - Volume of water in the well
 - Purging method
 - Placement depth of tubing or pump intake
 - Depth and length of screened interval
 - Times for beginning and ending of purging
 - Total volume purged
 - Times of stabilization parameter measurements
 - Purging rate, including any changes in rate
 - Temperature measurements
 - pH measurements
 - Specific conductance measurements
 - Dissolved oxygen measurements
 - Turbidity measurements
 - Site or monitoring well conditions impacting observed dissolved oxygen and turbidity measurements
 - Color of groundwater
 - Odor of groundwater
- 2.2. Record the following for Water Level and Purge Volume Determination (FS 2211):
- Depth to groundwater
 - Total depth of well

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- Length of water column
- Well diameter
- Volume of water in the well
- Volume of pump
- Tubing diameter
- Length of tubing
- Volume of flow cell
- Volume in the pumping system

2.3. Record the following for Well Purging (FS 2212)

- Calculations for pumping rates, including any changes in rates
- Flow meter readings
- Volume of water purged
- Placement depth of tubing or pump intake
- Depth and length of screened interval
- Time needed to purge one (1) well volume or purging equipment volume
- Well volumes or purging equipment volumes purged
- Temperature measurements
- pH measurements
- Specific conductance measurements
- Dissolved oxygen measurements
- Turbidity measurements
- Purging rate, including any changes in rate
- Drawdown in the well

3. IN-PLACE PLUMBING SOURCES INCLUDING DRINKING WATER SYSTEMS

3.1. Record the following for all samples:

- Plumbing and tap material construction (if known)
- Flow rate at which well was purged
- Amount of time well was allowed to purge
- Flow rate at time of sample collection
- Public water system identification number (if applicable)
- Name and address of water supply system and an emergency phone number for notification of sample results (if applicable)

4. SURFACE WATER SAMPLING

- Sample collection depth

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- Beginning and ending times (24 hr) for timed composite sampling
- Type of composite (e.g., flow-proportioned, continuous, etc.)

5. WASTEWATER SAMPLING

- Beginning and ending times (24 hr) for timed composite sampling
- Type of composite (e.g. flow-proportioned, continuous, etc.)

FD 5120. RECORDS FOR NON-AQUEOUS ENVIRONMENTAL SAMPLES

Document the following information for all samples when using the indicated procedures.

FD 5130. DOCUMENTATION SPECIFIC TO SOIL SAMPLING (FS 3000)

1. GENERAL SOIL SAMPLING

- Sample collection depth
- Areal location of sample
- Sample collection device

2. Sampling for Volatile Organic Compounds (VOC) per EPA Method 5035

- Tare weight of VOC sample vial (if applicable)
- Weight of sample (if applicable)

FD 5140. DOCUMENTATION SPECIFIC TO SEDIMENT SAMPLING (FS 4000)

1. General Sediment Sampling

- Sample collection depth
- Areal location of sample
- Sample collection device

2. Sampling for Volatile Organic Compounds (VOC) per EPA Method 5035

- Tare weight of VOC sample vial (if applicable)
- Weight of sample (if applicable)

FD 5200. Documentation Specific to Waste Sampling (FS 5000)

1. DRUM SAMPLING

1.1. Record the following information for each drum:

- Type of drum and description of contents
- Drum number, if applicable
- Terrain and drainage condition
- Shape, size and dimensions of drum
- Label wording or other markings

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- Dimensional extent of leaks or spills associated with the drum
- Drum location (or location map)

1.2. Record the following information for the drum sample(s):

- Description of phases, colors, crystals, powders, sludges, etc.
- Stratified layers sampled, including aliquot amounts for composites, if applicable

1.3. Record the following for field testing results on opened drums and drum samples:

- Background readings for OVA meters
- Sample readings for OVA meters
- Type of OVA probe
- Radiation background reading and sample radiation reading
- Type of radiation monitor used
- Oxygen and LEL readings from container opening
- Water reactivity results
- Specific gravity
- PCB test results
- Water solubility results
- pH of aqueous wastes
- Results of chemical test strips
- Ignitability results
- Results of other chemical hazard test kits
- Miscellaneous comments for any tests

2. Documentation for Tanks

2.1. Record the following information for the tank:

- Type of tank, tank design and material of construction of tank
- Description of tank contents and markings
- Tank number or other designation, if applicable
- Terrain and drainage condition
- Shape, size and dimensions of tank
- Label or placard wording or other markings
- Dimensional extent of leaks or spills associated with the tank
- Tank location (or location map)

2.2. Record the following information for the tank sample(s):

- Description of phases, colors, crystals, powders, sludges, etc.

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- Stratified layers sampled, including aliquot amounts for composites, if applicable
- 2.3. Record the following for field testing results on opened tanks and tank samples:

- Background readings for OVA meters
- Sample readings for OVA meters
- Type of OVA probe
- Radiation background reading and sample radiation reading
- Type of radiation monitor used
- Oxygen and LEL level from container opening
- Water reactivity results
- Specific gravity
- PCB test results
- Water solubility results
- pH of aqueous wastes
- Results of chemical test strips
- Ignitability results
- Results of other chemical hazard test kits
- Miscellaneous comments for any tests

3. DOCUMENTATION FOR WASTE LEACHATE AND WASTE SUMP SAMPLES

3.1. Document information specific to leachate and sump sampling according to the documentation requirements for the respective DEP SOPs employed to collect samples (FS 2100, FS 2200, FS 4000, FS 5100 and FS 5200).

4. DOCUMENTATION FOR WASTE PILE SAMPLES

4.1. Document information specific to waste pile sampling according to associated regulatory requirements for the project.

5. DOCUMENTATION FOR WASTE IMPOUNDMENT AND WASTE LAGOON SAMPLES

5.1. Document information specific to impoundment and lagoon sampling according to the documentation requirements for the respective DEP SOPs employed to collect samples (FS 2100, FS 4000, FS 5100, and FS 5200).

FD 5300. Documentation for Biological Sampling

The following SOP sections list required documentation items for specific biological sampling procedures, as indicated.

FD 5310. DOCUMENTATION FOR BIOLOGICAL AQUATIC HABITAT CHARACTERIZATION

Minimum documentation required for biological habitat characterization and sampling is listed below according to requirements as specified in the indicated sampling and field-testing DEP SOPs.

FD 5311. *Physical/Chemical Characterization for Biological Sampling (FT 3001)*

1. Record the following information or use the Physical/Chemical Characterization Field Sheet (Form FD 9000-3):

- Submitting agency code
- Submitting agency name
- STORET station number
- Sample date
- Sample location including county
- Field identification
- Receiving body of water
- Time of sampling
- Percentage of land-use types in the watershed that drain to the site
- Potential for erosion within the portion of the watershed that affects the site
- Local non-point-source pollution potential and obvious sources
- Typical width of 100-meter section of river or stream
- Size of the system or the size of the sample area within the system (lake, wetland, or estuary)
- Three measurements of water depth across the typical width transect
- Three measurements of water velocity, one at each of the locations where water depth was measured
- Vegetated riparian buffer zone width on each side of the stream or river or at the least buffered point of the lake, wetland or estuary
- Presence of artificial channelization in the vicinity of the sampling location (stream or river)
- Description of state of recovery from artificial channelization
- Presence or absence of impoundments in the area of the sampling location
- Vertical distance from the current water level to the peak overflow level
- Distance of the high water mark above the stream bed
- Observed water depth at high water mark location
- Percentage range that best describes the degree of shading in the sampling area
- Any odors associated with the bottom sediments
- Presence or absence of oils in the sediment
- Any deposits in the area, including the degree of smothering by sand or silt
- Depth of each water quality measurement
- Temperature

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- pH
- Dissolved oxygen
- Specific conductance
- Salinity
- Secchi depth
- Type of aquatic system sampled
- Stream magnitude (order designation)
- Description of any noticeable water odors
- Term that best describes the relative coverage of any oil on the water surface
- Term that best describes the amount of turbidity in the water
- Term that best describes the color of the water
- Weather conditions during the time of sampling
- Any other conditions/observations that are helpful in characterizing the site
- Relative abundances of periphyton, fish, aquatic macrophytes and iron/sulfur bacteria
- List and map of dominant vegetation observed
- Sampling team designation
- Signature(s) of sampler(s)
- Signature date

2. For streams and rivers, draw a grid sketch of the site (optionally use Form FD 9000-4), showing the location and amount of each substrate type (as observed by sight or touch). Using the grid sketch, count the number of grid spaces for each substrate type. Divide each of these numbers by the total number of grid spaces contained within the site sketch. Record this percent coverage value for each substrate type. If the substrates are sampled, record the number of times each substrate is sampled by an indicated method.

3. For lakes, divide the site map into twelve sections and note visual markers that will assist in distinguishing those sections.

4. Photographs of the sampling area are also useful tools for documenting habitat conditions and identifying station location.

FD 5312. *Stream and River Biological Habitat Assessment Records (FT 3100)*

1. Record the following information or use Form FD 9000-5, Stream/River Habitat Assessment Field Sheet:

- Submitting organization name and/or code
- STORET station number
- Assessment date
- Sampling location including county
- Field identification

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- Receiving body of water
 - Time of sampling upon arrival at the site
2. Additionally record the following:
- Substrate diversity score
 - Substrate availability score
 - Water velocity score
 - Habitat smothering score
 - Artificial channelization score
 - Bank stability score for each bank
 - Riparian buffer zone width score for each bank
 - Riparian zone vegetation quality score for each bank
 - Primary habitat components score
 - Secondary habitat components score
 - Habitat assessment total score
 - Additional comments and observations
 - Signatures
3. Record the following information or use Form FD 9000-4, Stream/River Habitat Sketch Sheet for each 100-meter segment assessed.
- Link to the waterbody name, location of 100-meter segment, analyst name(s) and date of the assessment
 - Code, symbol or icon used to map each substrate observed in the segment
 - Proportionate sketch or map of the abundance of each habitat (substrate) observed in the 100-meter segment, oriented to the direction of flow
 - Location of velocity measurements taken within the segment
 - Location of habitats smothered by sand or silt
 - Location of unstable, eroding banks
 - Locations along the segment where the natural, riparian vegetation is altered or eliminated
 - Plant taxa observed
 - Additional notes and observations

FD 5313. *Lake Biological Habitat Assessment Records (FT 3200)*

1. Document the following information or use the Lake Habitat Assessment Field Sheet (Form FD 9000-6):
- STORET station number

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- Sampling date
- Sampling location including lake name
- Eco-region
- Field identification number
- County name
- Lake size
- Features observed
- Description of the hydrology of the system (water residence time)
- Lake water color
- Secchi depth score
- Vegetation quality score
- Stormwater inputs score
- Bottom substrate quality score
- Lakeside adverse human alterations score
- Upland buffer zone score
- Adverse watershed land use score
- Habitat assessment total score
- Additional comments and observations
- Name and Signature of analyst

FD 5320. BIOLOGICAL AQUATIC COMMUNITY SAMPLING RECORDS (FS 7000)

Minimum documentation required for biological sampling for procedures described in FS 7000 is listed below according to requirements as specified in the indicated sampling DEP SOPs.

FD 5321. *Periphyton Sampling Records (FS 7200)*

For each sample, record the following:

- Station sampled
- Date collected

FD 5322. *Qualitative Periphyton Sampling Records (FS 7220)*

Complete the Physical/Chemical Characterization Field Sheet (Form FD 9000-3), Stream/River Habitat Sketch Sheet (Form FD 9000-4) or site map and Stream/River Habitat Assessment Field Sheet (Form FD 9000-5), as appropriate for the water body sampled (see FT 3000 – FT 3100). Other customized formats may be used to record the information prompted on the above forms.

FD 5323. *Rapid Periphyton Survey Records (FS 7230)*

For each 100-meter reach surveyed, record the following information or use Form FD 9000-8, Rapid Periphyton Survey Field Sheet:

- Site or waterbody name
- Survey date
- Name(s) of analyst(s)
- Transect mark number (10-meter segment within the 100-meter reach)
- Transect point (1 – 9)
- Algae sample collected
- Algal thickness rank (per FS 7230 procedure)
- Algae type
- Canopy cover (per FS 7230 procedure)
- Bottom visibility
- Water color
- Additional comments or observations

FD 5324. *Lake Vegetation Index Records (FS 7310)*

Record the following information or use Form FD 9000-7, Lake Vegetation Index Data Field Sheet:

- Waterbody name
- Assessment or sampling date
- County name
- Name of analyst(s)
- STORET station number
- Signature(s) of analyst(s)
- Lake water level
- Presence of algal mats
- Lake units sampled (12-sector procedure per FS 7310)
- Taxa observed in each selected unit
- Dominant and co-dominant taxa in each unit
- Taxa collected for further identification
- Approximate water depth for each taxon collected

FD 5325. *Rapid Bioassessment (Biorecon) Records (FS 7410)*

Record the following information or use the Biorecon Field Sheet (Form FD 9000-1).

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- STORET station number
- Location, including latitude and longitude
- Watershed or basin name
- Family or genus of all organisms from all material in all four dipnet sweeps
- Total taxa tallies
- Taxa richness, Ephemeroptera taxa, Trichoptera taxa, Long-lived taxa, Clinger taxa, and Sensitive taxa
- Abundance code for each taxon
- Name(s) of analysts collecting and sorting samples
- Habitat types (substrates) sampled
- Name(s) of analyst(s) performing quality control
- Signatures
- Collection date and time

FD 5326. *Stream Condition Index (D-frame Dipnet) Sampling Records (FS 7420)*

1. Complete the Physical/Chemical Characterization Field Sheet (Form FD 9000-3), Stream/River Habitat Sketch Sheet (Form FD 9000-4) or site map and Stream/River Habitat Assessment Field Sheet (Form FD 9000-5) forms appropriate for the water body sampled (see FT 3000 – FT 3400). Other customized formats may be used to record the information prompted on the above forms.
2. Record the following for each sample:
 - Number of sweeps for each habitat
 - Number of containers per sample

FD 5327. *Sediment Core Biological Grab Sampling Records (FS 7440)*

Record the sampling location of site grab core samples.

FD 5328. *Sediment Dredge Biological Grab Sampling Records (FS 7450)*

Record the sampling location of site grab dredge samples.

FD 5329. *Lake Condition Index (Lake Composite) Sediment Dredge Biological Grab Sampling Records (FS 7460)*

Record the following or use DEP Form FD 9000-2 (Composite Lake Sampling Sheet):

- Sampling date
- Lake name
- Sampling equipment used
- Comments and observations

- Dredge drop number (1 – 12)
- Sampling depth for each drop number
- Sampling location of site grab dredge sample for each drop (include lake sector map)
- Sediment type(s) in grab dredge sample for each drop
- Location of any water quality measurements

FD 6000. QUALITY CONTROL DOCUMENTATION

1. Document all field quality control samples in the permanent field records.
2. At a minimum, record the following information:
 - The type, time and date that the quality control sample was collected; and
 - The preservative(s) (premeasured or added amount) and preservation checks performed.
3. If blanks are collected/prepared by the field organization, maintain records of the following:
 - Type of analyte-free water used;
 - Source of analyte-free water (include lot number if commercially purchased);
 - A list of the sampling equipment used to prepare the blank.

If items above are specified in an internal SOP, you may reference the SOP number and revision date in the field notes. Note any deviations to the procedure in the field notes.

4. For trip blanks, record the following:
 - Date and time of preparation
 - Storage conditions prior to release to the sample collecting organization
 - Type of analyte-free water used
 - Source and lot number (if applicable) of analyte-free water
 - 4.1. Include trip blank information in the sampling kit documentation per FD 2000, section 2.
5. For duplicates, record the technique that was used to collect the sample.
6. For split samples, identify the method used to collect the samples and the source(s) of the sample containers and preservatives.

FD 7000. LEGAL OR EVIDENTIARY DOCUMENTATION

1. Scope: The use of legal or evidentiary Chain-of-Custody (COC) protocols is not usually required by DEP, except for cases involving civil or criminal enforcement. Do not use these procedures for routine sampling for compliance, for example, unless evidentiary custody protocols are specifically mandated in a permit or other legal order or when required for enforcement actions.
2. General Procedural Instructions
 - 2.1. Follow applicable requirements in FD 1000 – FD 5000 for all evidence samples.

2.2. Establish and maintain the evidentiary integrity of samples and/or sample containers. Demonstrate that the samples and/or sample containers were handled and transferred in such a manner as to eliminate possible tampering.

2.2.1. Document and track all time periods and the physical possession and storage of sample containers and samples from point of origin through the final analytical result and sample disposal.

FD 7100. General Requirements for Evidentiary Documentation

1. CHAIN OF CUSTODY RECORDS: Use the Chain-of-Custody (COC) records to establish an intact, contiguous record of the physical possession, storage, and disposal of sample containers, collected samples, sample aliquots, and sample extracts or digestates. For ease of discussion, the above-mentioned items are referred to as "samples".

1.1. Account for all time periods associated with the physical samples.

1.2. Include signatures of all individuals who physically handle the samples.

1.2.1. The signature of any individual on any record that is designated as part of the Chain-of-Custody is their assertion that they personally handled or processed the samples identified on the record.

1.2.2. Denote each signature with a short statement that describes the activity of the signatory (e.g., "sampled by", "received by", "relinquished by", etc.).

1.2.3. In order to simplify recordkeeping, minimize the number of people who physically handle the samples.

2. CONSOLIDATION OF RECORDS: The COC records need not be limited to a single form or document. However, limit the number of documents required to establish COC, where practical, by grouping information for related activities in a single record. For example, a sample transmittal form may contain both certain field information and the necessary transfer information and signatures for establishing delivery and receipt at the laboratory.

3. LIABILITY FOR CUSTODY DOCUMENTATION: Ensure appropriate personnel initiate and maintain sample chain-of-custody at specified times.

3.1. Begin legal chain-of-custody when the precleaned sample containers are dispatched to the field.

3.1.1. Omit the transmittal record for precleaned sample containers if the same party provides the containers and collects the samples.

3.2. Sign the COC record upon relinquishing the prepared sample kits or containers.

3.3. Sign the COC record upon receipt of the sample kits or containers.

3.4. Thereafter, ensure that all parties handling the samples maintain sample custody (i.e., relinquishing and receiving) and documentation until the samples or sampling kits are relinquished to a common carrier.

3.4.1. The common carrier should not sign COC forms.

3.4.2. Indicate the name of the common carrier in the COC record, when used. Retain shipping bills and related documents as part of the record.

3.4.3. Ensure that all other transferors and transferees releasing or accepting materials from the common carrier sign the custody record.

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3.5. Chain-of-custody is relinquished by the party who seals the shipping container and is accepted by the party who opens it.

3.5.1. Indicate the date and time of sealing of the transport container for shipment.

3.5.2. See FD 7200, section 3 below regarding the use of custody seals.

4. SAMPLE SHIPPING OR TRANSPORTING

4.1. Affix tamper-indicating custody seals or evidence tape before shipping samples.

4.1.1. Seal sample container caps with tamper-indicating custody seals or evidence tape before packing for shipping or transport.

4.1.2. Seal sample transport or shipping containers with strapping tape and tamper-indicating custody seals or evidence tape.

4.1.3. If the same party collects then possesses (or securely stores), packs and transports the samples from time of collection, omit any use of custody seals or evidence tape.

4.2. Keep the COC forms with the samples during transport or shipment. Place the COC records in a waterproof closure inside the sealed ice chest or shipping container.

FD 7200. Required Documentation for Evidentiary Custody

1. GENERAL CONTENT REQUIREMENTS: Document the following in COC tracking records by direct entry or linkage to other records:

- Time of day and calendar date of each transfer or handling procedure
- Signatures of transferors, transferees and other personnel handling samples
- Location of samples (if stored in a secured area)
- Description of all handling procedures performed on the samples for each time and date entry recorded above
- Storage conditions for the samples, including chemical preservation and refrigeration or other cooling
- Unique identification for all samples
- Final disposition of the physical samples
- Common carrier identity and related shipping documents

2. DOCUMENTATION CONTENT FOR SAMPLE TRANSMITTAL

Provide a Chain-of-Custody record for all evidentiary samples and subsamples that are transmitted or received by any party. Include the following information in the COC record of transmittal:

- Sampling site name and address
- Date and time of sample collection
- Unique field identification code for each sample source and each sample container
- Names of personnel collecting samples
- Signatures of all transferors and transferees

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- Time of day and calendar date of all custody transfers
- Clear indication of number of sample containers
- Required analyses by approved method number or other description
- Common carrier usage
- Sample container/preservation kit documentation, if applicable

3. CHAIN-OF-CUSTODY SEALS: If required, affix tamper-indicating evidence tape or seals to all sample, storage and shipping container closures when transferring or shipping sample container kits or samples to another party.

- 3.1. Place the seal so that the closure cannot be opened without breaking the seal.
- 3.2. Record the time, calendar date, and signatures of responsible personnel affixing and breaking all seals for each sample container and shipping container.
- 3.3. Affix new seals every time a seal is broken until continuation of evidentiary custody is no longer required.

FD 7300. Documenting Controlled Access to Evidence Samples

Control and document access to all evidentiary samples and subsamples with adequate tracking. Documentation must include records about each of the activities and situations listed below, when applicable to sample evidence, and must track the location and physical handling of all samples by all persons at all times. See FS 1000 for additional discussion about procedures for handling evidence samples.

1. Limit the number of individuals who physically handle the samples as much as practicable.
2. When storing samples and subsamples, place samples in locked storage (e.g., locked vehicle, locked storeroom, etc.) at all times when not in the possession or view of authorized personnel.
3. Alternatively, maintain restricted access to facilities where samples are stored. Ensure that unauthorized personnel are not able to gain access to the samples at any time.
4. Do not leave samples in unoccupied motel or hotel rooms or other areas where access cannot be controlled by the person(s) responsible for custody without first securing samples and shipping or storage containers with tamper-indicating evidence tape or custody seals.

FD 7400. Documenting Disposal of Evidence Samples

1. Dispose of the physical samples only with the concurrence of the affected legal authority, sample data user, and/or submitter/owner of the samples.
2. Record all conditions of disposal and retain correspondence between all parties concerning the final disposition of the physical samples.
3. Record the date of disposal, the nature of disposal (i.e., sample depleted, sample flushed into sewer, sample returned to client, etc.), and the name of the individual who performed the disposal. If samples are transferred to another party, document custody transfer in the same manner as other transfers (see FD 7000 – FD 7200).

FD 8000. (RESERVED)

FD 9000. FORMS

Forms to facilitate documentation of sampling, field-testing, and biological laboratory calculation activities are available on the Department's website. These forms are for unrestricted public use and are presented in example formats. *The use of these forms is not mandatory. However, **some** of the data elements and other information denoted by the form prompts comprise **required documentation** items. Not all required documentation is illustrated in the form examples.* Customize these forms as needed. These forms are available as separate document files. The following forms are incorporated into the indicated SOPs for convenience of use:

- Form FD 9000-1 Biorecon Field Sheet (FS 7000)
- Form FD 9000-2 Composite Lake Sampling Sheet for <1000 Acres (FS 7000)
- Form FD 9000-3 Physical/Chemical Characterization Field Sheet (FT 3000)
- Form FD 9000-4 Stream/River Habitat Sketch Sheet (FT 3000)
- Form FD 9000-5 Stream/River Habitat Assessment Field Sheet (FT 3000)
- Form FD 9000-6 Lake Habitat Assessment Field Sheet (FT 3000)
- Form FD 9000-7 Lake Vegetation Index Data Field Sheet (FS 7000)
- Form FD 9000-8 Rapid Periphyton Survey Field Sheet (FS 7000)

FQ 1000. FIELD QUALITY CONTROL REQUIREMENTS

Field quality control measures monitor the sampling event to ensure that the collected samples are representative of the sample source.

Field-collected blanks must demonstrate that the collected samples have not been contaminated by:

- The sampling environment
- The sampling equipment
- The sample container
- The sampling preservatives
- Sample transport
- Sample storage

FQ 1100. Sample Containers

Sample containers must be free from contamination by the analytes of interest or any interfering constituents and must be compatible with the sample type.

FQ 1200. Sampling Operations

1. When collected, analyze all quality control samples for the same parameters as the associated samples.

1.1. When collected, collect blanks for the following parameter groups and tests:

- Volatile Organics
- Extractable Organics
- Metals
- Ultratrace Metals
- Inorganic Nonmetallics
- Radionuclides
- Petroleum Hydrocarbons and Oil & Grease
- Volatile Inorganics
- Aggregate Organics except Biochemical Oxygen Demand

1.2. Blanks are not required for:

- Microbiological (all types)
- Toxicity
- Field parameters such as pH, Specific Conductance, Residual Chlorine, Temperature, Light Penetration, Dissolved Oxygen, ORP and Salinity
- Radon

- Algal Growth Potential
 - Biological Community
 - Physical and Aggregate Properties
 - Biochemical Oxygen Demand
2. Preserve, transport, document and handle all quality control samples as if they were samples. Once collected, they must remain with the sample set until the laboratory has received them.
 3. Except for trip blanks, prepare all quality control samples **on-site in the field**.
 - 3.1. Do not prepare precleaned equipment blanks in advance at the base of operations.
 - 3.2. Do not prepare field-cleaned equipment blanks after leaving the sampling site.
 4. Perform and document any field QC measures specified by the analytical method (such as trip blanks for volatile organics).

FQ 1210. QUALITY CONTROL BLANKS

FQ 1211. *Precleaned Equipment Blanks*

1. USE: Monitors on-site sampling environment, sampling equipment decontamination, sample container cleaning, the suitability of sample preservatives and analyte-free water, and sample transport and storage conditions for water, waste, soil, or sediment samples.
2. Collect these blanks using sampling equipment that has been brought to the site precleaned and ready for use. The cleaning procedures used for the blank collection must be identical to those used for the field sample collection.
3. Collect these blanks before the equipment set has been used.
4. Prepare equipment blanks by rinsing the sampling equipment set with the appropriate type of analyte-free water and collecting the rinse water in appropriate sample containers (see FQ 1100).

FQ 1212. *Field-Cleaned Equipment Blanks*

1. USE: Monitors on-site sampling environment, sampling equipment decontamination, sample container cleaning, the suitability of sample preservatives and analyte-free water, and sample transport and storage conditions.
2. Collect these blanks using sampling equipment that has been cleaned in the field (i.e., between sampling points). The cleaning procedures used for the blank collection must be identical to those used for the field sample collection.
3. Prepare field-cleaned equipment blanks immediately after the equipment is cleaned in the field and before leaving the sampling site.
4. Prepare equipment blanks by rinsing the sampling equipment set with the appropriate type of analyte-free water and collecting the rinse water in appropriate sample containers (see FQ 1100).
 - 4.1. For intermediate sampling devices or equipment, site-water rinsing is defined as the decontamination step, if this is the only cleaning that will be performed on the equipment prior to collecting the sample.

- 4.1.1. In this case, collect the equipment blank after rinsing the intermediate device 3 times with site water
- 4.1.2. Follow the site-water rinses with 3 rinses using analyte-free water.
- 4.1.3. Collect the equipment blank with a subsequent rinse of the device using additional analyte-free water to collect sufficient blank volume.

FQ 1213. *Trip Blanks*

1. USE: Monitors sample container cleaning, the suitability of sample preservatives and analyte-free water, and sample transport and storage conditions.
2. The organization that is providing the VOC vials must provide the trip blanks by filling two or more VOC vials with analyte-free water and preservatives (if needed).
 - 2.1. To prevent degradation of the trip blank, long-term storage of prepared trip blanks is not recommended.
3. These blanks are applicable if samples are to be analyzed for volatile constituents (volatile organics, methyl mercury, etc.) in water, waste, soils, or sediments.
4. Place a set of trip blanks in each transport container used to ship/store empty VOC vials. They must remain with the VOC vials during the sampling episode and must be transported to the analyzing laboratory in the same shipping or transport container(s) as the VOC samples.
5. Trip blanks must be opened **only** by the laboratory after the blank and associated samples have been received for analysis.

FQ 1214. *Field Blanks*

1. USE: Monitors on-site sampling environment, sample container cleaning, the suitability of sample preservatives and analyte-free water, and sample transport and storage conditions for water, waste, soil or sediment samples.
2. Prepare field blanks by pouring analyte-free water into sample containers for each parameter set to be collected.
3. Field blanks are not required if equipment blanks (FQ 1211 or FQ 1212) are collected.

FQ 1220. **FIELD DUPLICATES**

1. USE: Designed to measure the variability in the sampling process.
2. GENERAL CONSIDERATIONS:
 - 2.1. Collect duplicates by **repeating** (simultaneously or in rapid succession) the entire sample acquisition technique that was used to obtain the first sample.
 - 2.1.1. Collect, preserve, transport and document duplicates in the same manner as the samples. **These samples are not considered laboratory duplicates.**
 - 2.2. When collected, analyze field duplicates for the same parameters as the associated samples.
 - 2.3. If possible, collect duplicate samples from sampling locations where contamination is present.

2.4. Field duplicates must be collected if required by the analytical method and as required by a DEP program.

FQ 1221. *Water Duplicates*

Collect water duplicates by sampling from successively collected volumes (i.e., samples from the next volume of sample water).

FQ 1222. *Soil Duplicates*

Collect soil duplicates from the same sample source (i.e., soil from the same soil sampling device).

FQ 1230. MANDATORY FIELD QUALITY CONTROLS

1. The respondent, permittee or contractor and the sampling organization are responsible for ensuring that blanks (excluding trip blanks) are collected at a minimum of 5% of each reported test result/matrix combination for the life of a project.

1.1. Collect at least one blank for each reported test result/matrix combination each year for each project.

1.2. If a party wishes to claim that a positive result is due to external contamination sources during sample collection, transport or analysis, then at least one field collected blank (excludes trip blanks) must have been collected at the same time the samples were collected and analyzed with the same sample set.

1.3. A project will be defined by the organization responsible for collecting the samples for the project.

1.3.1. When applicable, define the scope of the project in conjunction with the appropriate DEP authority.

2. When collecting a set of blanks, use the following criteria:

2.1. Equipment Blanks:

2.1.1. Collect field-cleaned equipment blanks if any sample equipment decontamination is performed in the field.

2.1.2. If no decontamination is performed in the field, collect precleaned equipment blanks if the equipment is not certified clean by the vendor or the laboratory providing the equipment.

2.1.3. Equipment blanks are not required for volatile organic compounds.

2.2. Field Blanks:

2.2.1. Collect field blanks if no equipment except the sample container is used to collect the samples or if the sampling equipment is certified clean by the vendor or the laboratory providing the equipment.

2.2.1.1. If a sample container is used as an intermediate sample collection device, collect an equipment blank by rinsing the decontaminated collection container as the substitute for the field blank.

2.2.2. Field blanks are not required for volatile organic compounds.

2.3. Trip Blanks:

2.3.1. These blanks are applicable if samples are to be analyzed for volatile organic compounds. See FQ 1213 for frequency, preparation and handling requirements.

3. OPTIONAL QUALITY CONTROL MEASURES

3.1. The method or project may require collection of additional quality control measures as outlined in FQ 1210 (Blanks), FQ 1220 (Duplicates) and FQ 1240 (Split Samples).

FQ 1240. SPLIT SAMPLES

The DEP or the client may require split samples as a means of determining compliance or as an added measure of quality control. Unlike duplicate samples that measure the variability of both the sample collection and laboratory procedures, split samples measure only the variability **between** laboratories. Therefore, the laboratory samples must be subsamples of the same parent sample and every attempt must be made to ensure sample homogeneity.

Collect, preserve, transport and document split samples using the same protocols as the related samples. In addition, attempt to use the same preservatives (if required).

If split samples are incorporated as an added quality control measure, the DEP recommends that all involved parties agree on the logistics of collecting the samples, the supplier(s) of the preservatives and containers, the analytical method(s), and the statistics that will be used to evaluate the data.

FQ 1241. Soils, Sediments, Chemical Wastes and Sludges

Collecting split samples for these matrices is not recommended because a true split sample in these matrices is not possible.

FQ 1242. Water

Collect split samples for water in one of two ways:

1. Mix the sample in a large, appropriately precleaned, intermediate vessel (a churn splitter is recommended). This method shall not be used if volatile or extractable organics, oil and grease or total petroleum hydrocarbons are of interest. While continuing to thoroughly mix the sample, pour aliquots of the sample into the appropriate sample containers. Alternatively:

2. Fill the sample containers from consecutive sample volumes **from the same sampling device**. If the sampling device does not hold enough sample to fill the sample containers, use the following procedure:

2.1. Fill the first container with half of the sample, and pour the remaining sample into the second container.

2.2. Obtain an additional sample, pour the first half into the **second** container, and pour the remaining portion into the first container.

2.3. Continue with steps described in sections 2.1 and 2.2 above until both containers are filled.

FQ 1250. QUALITY CONTROL DOCUMENTATION

1. Document all field quality control samples in the permanent field records.
2. At a minimum, record the following information:

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- The type, time and date that the quality control sample was collected; and
 - The preservative(s) (premeasured or added amount) and preservation checks performed.
3. If blanks are collected/prepared by the field organization, maintain records of the following:
- Type of analyte-free water used;
 - Source of analyte-free water (include lot number if commercially purchased);
 - A list of the sampling equipment used to prepare the blank.

If items above are specified in an internal SOP, you may reference the SOP number and revision date in the field notes. Note any deviations to the procedure in the field notes.

4. For trip blanks, record the following:
- Date and time of preparation
 - Storage conditions prior to release to the sample collecting organization
 - Type of analyte-free water used
 - Source and lot number (if applicable) of analyte-free water
- 4.1. Include trip blank information in the sampling kit documentation per FD 2000, section 2.
5. For duplicates, record the technique that was used to collect the sample.
6. For split samples, identify the method used to collect the samples and the source(s) of the sample containers and preservatives.

FS 1000. GENERAL SAMPLING PROCEDURES

See also the following Standard Operating Procedures:

- FA 1000 and 2000 Administrative Procedures
- FC 1000 Cleaning/Decontamination Procedures
- FD 1000-9000 Documentation Procedures
- FM 1000 Field Planning and Mobilization
- FQ 1000 Field Quality Control Requirements

FS 1001. Preliminary Activities

1. Begin each sampling trip with some planning and coordination. Refer to FM 1000 for recommendations and suggestions on laboratory selection and communication, and field mobilization.

1.1. DEP recommends that a minimum of two people be assigned to a field team. In addition to safety concerns, the process of collecting the samples, labeling the containers and completing the field records is much easier if more than one person is present.

1.2. If responding to incidents involving hazardous substances, DEP recommends that four or five people be assigned to the team.

2. EQUIPMENT

2.1. Select appropriate equipment based on the sampling source (see FS 2000 to FS 8200), the analytes of interest and the sampling procedure.

2.1.1. If properly cleaned, sample containers may be used as collection devices or intermediate containers.

2.2. The equipment construction must be consistent with the analytes or analyte groups to be collected (see Tables FS 1000-1 and FS 1000-2).

2.3. Bring precleaned equipment to the field or use equipment that has been certified clean by the vendor or laboratory.

3. DEDICATED EQUIPMENT STORAGE

3.1. Store all dedicated equipment (except dedicated pump systems or dedicated drop pipes) in a controlled environment.

3.2. If possible, store equipment in an area that is located away from the sampling site. If equipment other than dedicated pumps or dedicated drop pipes is stored in monitoring wells, suspend the equipment above the formation water.

3.3. Securely seal the monitoring well in order to prevent tampering between sampling events.

3.4. Decontaminate all equipment (except dedicated pumps or drop pipes) before use according to the applicable procedures in FC 1000.

4. SAMPLE CONTAINERS

4.1. The analyses to be performed on the sample determine the construction of sample containers.

4.2. Inspect all containers and lids for flaws (cracks, chips, etc.) before use. Do not use any container with visible defects or discoloration.

FS 1002. *Contamination Prevention and Sample Collection Order*

1. CONTAMINATION PREVENTION

1.1. Take special effort to prevent cross contamination and contamination of the environment when collecting samples. Protect equipment, sample containers and supplies from accidental contamination.

1.1.1. Do not insert pump tubing, measurement probes, other implements, fingers, etc. into sample containers or into samples that have been collected for laboratory analysis.

1.1.1.1. If it is necessary to insert an item into the container or sample, ensure that the item is adequately decontaminated for the analytes of interest to be analyzed in the sample.

1.1.2. If possible, collect samples from the least contaminated sampling location (or background sampling location) to the most contaminated sampling location.

1.1.2.1. Collect the ambient or background samples first and store them in separate ice chests or shipping containers.

1.1.3. Collect samples in flowing water from downstream to upstream.

1.1.4. Do not store or ship highly contaminated samples (concentrated wastes, free product, etc.) or samples suspected of containing high concentrations of contaminants in the same ice chest or shipping container with other environmental samples.

1.1.4.1. Isolate these sample containers by sealing them in separate, untreated plastic bags immediately after collecting, preserving, labeling, etc.

1.1.4.2. Use a clean, untreated plastic bag to line the ice chest or shipping container.

2. SAMPLE COLLECTION ORDER

2.1. Sampling order is a recommendation to be modified depending on site circumstances. Unless field conditions justify other sampling regimens, collect samples in the following order:

- Volatile Organics and Volatile Inorganics
- Extractable Organics, Petroleum Hydrocarbons, Aggregate Organics and Oil & Grease
- Total Metals
- Dissolved Metals
- Inorganic Nonmetallics, Physical and Aggregate Properties, and Biologicals
- Radionuclides
- Microbiological

Note: If the pump used to collect groundwater samples cannot be used to collect volatile or extractable organics, then collect all other parameters, withdraw the pump and tubing, and collect the volatile and extractable organics.

3. COMPOSITE SAMPLES

- 3.1. Do not collect composite samples unless required by permit or DEP program.
- 3.2. If compositing is required, use the following procedure:
 - 3.2.1. Select sampling points from which to collect each aliquot.
 - 3.2.2. Using the appropriate sampling technique, collect equal aliquots (same sample size) from each location and place in a properly cleaned container.
 - 3.2.3. Record the approximate amount of each aliquot (volume or weight).
 - 3.2.4. Add preservative(s), if required.
 - 3.2.5. Label container and make appropriate field notes (see FD 1000-9000).
 - 3.2.6. Notify the laboratory that the sample is a composite sample.
 - 3.2.7. When collecting soil or sediment samples, combine the aliquots of the sample directly in the sample container with no pre-mixing. Notify the laboratory that the sample is an unmixed composite sample, and request that the laboratory thoroughly mix the sample before sample preparation or analysis.
 - 3.2.8. When collecting water composites see FS 2000, section 1.3 or pertinent sections of other water matrix SOPs for specific details on collection.

FS 1003. *Protective Gloves*

1. Gloves serve a dual purpose to:
 - Protect the sample collector from potential exposure to sample constituents
 - Minimize accidental contamination of samples by the collector
2. The DEP recommends wearing protective gloves when conducting all sampling activities. They must be worn except when:
 - The sample source is considered to be non-hazardous
 - The samples will not be analyzed for trace constituents
 - The part of the sampling equipment that is handled without gloves does not contact the sample source
3. Do not let gloves come into contact with the sample or with the interior or lip of the sample container.
4. Use clean, new, unpowdered and disposable gloves.
 - 4.1. DEP recommends latex gloves, however, other types of gloves may be used as long as the construction materials do not contaminate the sample or if internal safety protocols require greater protection.
 - 4.2. Note that certain materials (as might be potentially present in concentrated effluent) may pass through certain glove types and be absorbed in the skin. Many vendor catalogs provide information about the permeability of different gloves and the circumstances under which the glove material might be applicable.
 - 4.3. The powder in powdered gloves can contribute significant contamination and DEP does not recommend wearing powdered gloves unless it can be demonstrated that the powder does not interfere with the sample analysis.

5. If gloves are used, change:
 - After preliminary activities such as pump placement;
 - After collecting all the samples at a single sampling point; or
 - If torn, or used to handle extremely dirty or highly contaminated surfaces.
6. Properly dispose of all used gloves.

FS 1004. *Container and Equipment Rinsing*

When collecting aqueous samples, rinse the sample collection equipment with a portion of the sample water before taking the actual sample. Sample containers do not need to be rinsed. In the case of petroleum hydrocarbons, oil & grease or containers with premeasured preservatives, the sample containers cannot be rinsed.

FS 1005. *Fuel-Powered Equipment and Related Activities*

1. Place all fuel-powered equipment away from, and downwind of, any site activities (e.g., purging, sampling, decontamination). If field conditions preclude such placement (i.e., the wind is from the upstream direction in a boat), place the fuel source(s) as far away as possible from the sampling activities and describe the conditions in the field notes.
2. Handle fuel (i.e., filling vehicles and equipment) prior to the sampling day. If such activities must be performed during sampling, the personnel must wear disposable gloves. Dispense all fuels, dispose of gloves downwind, and well away from the sampling activities.
3. If sampling at active gas stations, stop sample collection activities during fuel deliveries.

FS 1006. *Preservation, Holding Times and Container Types*

1. Preserve all samples according to the requirements specified in Tables FS 1000-4 through FS 1000-10.
 - 1.1. The information listed in the above-referenced tables supersedes any preservation techniques, holding time or container type that might be discussed in individual analytical methods.
 - 1.2. If samples are collected only for total phosphorus and are not for NPDES compliance, thermal preservation (ice) is not required if the sample containers are pre-preserved with acid.
2. The preservation procedures in the referenced tables specify immediate preservation. "Immediate" is defined as "within 15 minutes of sample collection." Perform all preservation on-site (in the field).
 - 2.1. Preservation is not required if samples can be transported back to the laboratory within 15 minutes of collecting the sample and
 - 2.1.1. The laboratory begins sample analysis within the 15-minute window and documents the exact time the analysis began, or
 - 2.1.2. The laboratory adds the appropriate preservatives (including thermal preservation) within 15 minutes of sample collection and documents the exact time that the preservation was done.

3. PRESERVING COMPOSITE WATER SAMPLES

3.1. If the sample preservation requires thermal preservation (e.g., $<6^{\circ}\text{C}$), the samples must be cooled to the specified temperature.

3.1.1. Manually collected samples to be composited must be refrigerated at a temperature equal to or less than the required temperature.

3.1.2. Automatic samplers must be able to maintain the required temperature by packed ice or refrigeration.

3.2. When chemical preservation is also required, begin the preservation process within 15 minutes of the last collected sample.

3.3. Holding Times for Automatic Samplers:

3.3.1. If the collection period is 24 hours or less, the holding time begins at the last scheduled sample collection;

3.3.2. If the collection period exceeds 24 hours, the holding time begins with the time that the first sample is collected.

4. PH ADJUSTED PRESERVATION - Check the pH of pH-adjusted samples according to these frequencies:

4.1. During the first sampling event at a particular site, check **all** samples (includes each groundwater monitoring well, surface water location, or influent/effluent sampling location) that are pH-adjusted except volatile organics.

4.2. During subsequent visits to a particular site, check at least one sample per parameter group that must be pH-adjusted.

4.3. If the frequency of sample collection at a specified location is greater than once per month (i.e., weekly or daily), check the pH of at least one sample per parameter group (except volatile organics) according to the following schedule:

4.3.1. Weekly sampling: 1 pH check per month

4.3.2. Daily sampling: 1 pH check per week

4.4. If the frequency of sample collection at a specified location is once per month, check the pH of at least one sample per parameter group (except volatile organics) quarterly.

4.5. If site conditions vary from sampling event to sampling event, perform pH checks at increased intervals.

5. THERMAL PRESERVATION

5.1. When preservation requirements indicate cooling to a specific temperature, samples must be placed in wet ice within 15 minutes of sample collection (see 1006, section 2 above). Unless specified, do not freeze samples.

5.2. All supplies (ice, dry ice, etc.) necessary to meet a thermal preservation requirement must be onsite for immediate use.

5.3. Ship samples in wet ice. If samples are cooled to the required temperature before shipment, samples may be shipped with frozen ice packs if the specified temperature is maintained during shipment. The sample temperature must not exceed the specified temperature.

5.4. If immediate freezing is required, dry ice must be available in the field to begin the freezing process.

FS 1007. *Preventive and Routine Maintenance*

Preventive maintenance activities are necessary to ensure that the equipment can be used to obtain the expected results and to avoid unusable or broken equipment while in the field.

Equipment is properly maintained when:

- It functions as expected during mobilization; and
- It is not a source of sample contamination (e.g., dust).

1. Follow the manufacturer's suggested maintenance activities and document all maintenance. At a minimum, DEP recommends the activities listed on Table FS 1000-12.

2. Maintain documentation for the following information for each piece of equipment or instrumentation. See FD 3000 also.

2.1. Designate the identity of specific instrumentation in the documentation with a unique description or code for each instrument unit employed. This identifier may include a manufacturer name, model number, serial number, inventory number or other unique identification.

2.2. Log all maintenance and repair performed for each instrument unit, including routine cleaning procedures and solution or parts replacement for instrument probes.

2.3. Include the calendar date for the procedures performed.

2.4. Record names of personnel performing the maintenance or repair tasks.

2.5. Describe any malfunctions necessitating repair or service.

2.6. Retain vendor service records for all affected instruments.

2.7. Record the following for rented equipment:

- Rental date(s)
- Equipment type and model or inventory number or other description

2.8. Retain the manufacturer's operating and maintenance instructions.

FS 1008. *Documentation and References*

1. REFERENCES: All sampling references must be available for consultation in the field. These include:

- DEP SOPs;
- Internal SOPs;
- Sampling and analysis plans; and/or
- Quality Assurance Project Plans.

2. DOCUMENTATION: Complete and sign all documentation (see FD 1000).

FS 1009. *Sample Documentation and Evidentiary Custody*

1. SAMPLE DOCUMENTATION

1.1. Document all activities related to a sampling event, including sample collection, equipment calibration, equipment cleaning and sample transport.

1.2. The required documentation related to each sampling or other field activity is specified in the associated SOPs; i.e., FQ 1000, FC 1000, the FS series, and the FT series.

1.3. The documentation requirements are also summarized in FD 1000, Field Documentation. FD 1000 additionally contains a list of example forms published with the SOPs that may be used to document various activities or as templates for creating customized forms.

2. LEGAL CHAIN OF CUSTODY (COC)

The use of legal or evidentiary Chain-of-Custody (COC) protocols is not usually required by DEP, except for cases involving civil or criminal enforcement. Do not use these procedures for routine sampling for compliance unless evidentiary custody protocols are specifically mandated in a permit or other legal order or when required for enforcement actions.

Evidentiary sample custody protocols are used to demonstrate that the samples and/or sample containers were handled and transferred in such a manner as to eliminate possible tampering.

When a client or situation requires legal COC, use the procedures in FD 7000 to document and track all time periods associated with the physical possession and storage of sample containers, samples, and subsamples from point of origin through the final analytical result and sample disposal.

When legal or evidentiary COC is required, samples must be:

- In the actual possession of a person who is authorized to handle the samples (e.g., sample collector, laboratory technician);
- In the view of the same person after being in their physical possession;
- Secured by the same person to prevent tampering; or
- Stored in a designated secure area.

2.1. Control and document access to all evidentiary samples and subsamples with adequate tracking. Documentation must include records about each of the activities and situations listed below, when applicable to sample evidence, and must track the location and physical handling of all samples by all persons at all times.

2.1.1. Limit the number of individuals who physically handle the samples as much as practicable.

2.1.2. When storing samples and subsamples, place samples in locked storage (e.g., locked vehicle, locked storeroom, etc.) at all times when not in the possession or view of authorized personnel.

2.1.3. Alternatively, maintain restricted access to facilities where samples are stored. Ensure that unauthorized personnel are not able to gain access to the samples at any time.

2.1.4. Do not leave samples in unoccupied motel or hotel rooms or other areas where access cannot be controlled by the person(s) responsible for custody without first securing samples and shipping or storage containers with tamper-indicating evidence tape or custody seals. Ice chests or other storage containers used to store sample containers in hotel rooms may be sealed instead of sealing each sample container stored within.

2.2. Use a Chain of Custody form or other transmittal record to document sample transfers to other parties. Other records and forms may be used to document internal activities if they meet the requirements for legal chain of custody.

2.3. Legal COC begins when the precleaned sample containers are dispatched to the field.

2.3.1. The person who relinquishes the prepared sample kits or containers and the individual who receives the sample kits or containers must sign the COC form unless the same party provides the containers and collects the samples.

2.3.2. All parties handling the empty sample containers and samples are responsible for documenting sample custody, including relinquishing and receiving samples, except commercial common carriers.

2.4. Shipping Samples under Legal COC

2.4.1. Complete all relevant information on the COC transmittal form or record (see FD 7200, section 2).

2.4.2. Internal records must document the handling of the samples and shipping containers in preparation for shipment. The names of all persons who have prepared the shipment must be recorded. All time intervals associated with handling and preparation must be accounted for.

2.4.3. Place the forms in a sealed waterproof bag and place in the shipping container with the samples.

2.4.4. Seal the shipping container with tamper-proof seals (see 2.6 below) so that any tampering can be clearly seen by the individual who receives the samples.

2.4.5. Note: The common carrier does not sign COC records. However, the common carrier (when used) must be identified.

2.5. Delivering Samples to the Laboratory

2.5.1. All individuals who handle and relinquish the sample containers must sign the transmittal form. The legal custody responsibilities of the field operations end when the samples are relinquished to the laboratory.

2.6. Chain of Custody Seals: If required, affix tamper-indicating evidence tape or seals to all sample, storage and shipping container closures when transferring or shipping sample container kits or samples to another party.

2.6.1. Place the seal so that the closure cannot be opened without breaking the seal.

2.6.2. Record the time, calendar date and signatures of responsible personnel affixing and breaking all seals for each sample container and shipping container.

2.6.3. Affix new seals every time a seal is broken until continuation of evidentiary custody is no longer required.

FS 1010. *Health and Safety*

Implement all local, state and federal requirements relating the health and safety.

FS 1011. *Hazardous Wastes*

Follow all local, state and federal requirements pertaining to the storage and disposal of any hazardous or investigation-derived wastes.

1. Properly manage all investigation-derived waste (IDW) so contamination is not spread into previously uncontaminated areas.
 - 1.1. IDW includes all water, soil, drilling mud, decontamination wastes, discarded personal protective equipment (PPE), etc. from site investigations, exploratory borings, piezometer and monitoring well installation, refurbishment, and abandonment, and other investigative activities. Containerize the IDW at the time it is generated.
 - 1.2. Determine if the IDW must be managed as Resource Conservation and Recovery Act (RCRA) regulated hazardous waste through appropriate testing or generator knowledge. Manage all IDW that is determined to be RCRA regulated hazardous waste according to the local state and federal requirements.
 - 1.3. Properly dispose of IDW that is not a RCRA-regulated hazardous waste but is contaminated above the Department's Soil Cleanup Target Levels or the state standards and/or minimum criteria for ground water quality.
 - 1.4. IDW that is not contaminated or contains contaminants below the Department's Soil Cleanup Target Levels or the state standards and/or minimum criteria for ground water quality may be disposed of onsite as long as the IDW will not cause a surface water violation.
 - 1.5. Maintain all containers holding IDW in good condition:
 - 1.5.1. Periodically inspect the containers for damage
 - 1.5.2. Ensure that all required labeling (DOT, RCRA, etc.) are clearly visible.

Appendix FS 1000
Tables, Figures and Forms

- Table FS 1000-1 Equipment Construction Materials
- Table FS 1000-2 Construction Material Selection for Equipment and Sample Containers
- Table FS 1000-3 Equipment Use and Construction
- Table FS 1000-4 40 CFR Part 136 Table II: Required Containers, Preservation Techniques, and Holding Times (Water/Wastewater Samples)
- Table FS 1000-5 Approved Water and Wastewater Procedures, Containers, Preservation and Holding Times for Analytes not found in 40 CFR Part 136
- Table FS 1000-6 Recommended Sample Containers, Sample Volumes, Preservation Techniques and Holding Times for Residuals, Soil and Sediment Samples.
- Table FS 1000-7 Sample Handling, Preservation and Holding Time Table for SW 846 Method 5035
- Table FS 1000-8 Preservation Methods and Holding Times for Drinking Water Samples that Differ from 40 CFR Part 136, Table II
- Table FS 1000-9 Containers, Preservation and Holding Times for Biosolids Samples and Protozoans
- Table FS 1000-10 Container Materials, Preservation, and Holding Times for Fish and Shellfish
- Table FS 1000-11 Holding Times for SPLP or TCLP Extraction, Sample Preparation and Determinative Analysis
- Table FS 1000-12 Preventive Maintenance Tasks
- Figure FS 1000-1 Organic Trap Configuration for Collecting Extractable Organics with a Peristaltic Pump

DEP-SOP-001/01
 FS 1000 General Sampling Procedures
Table FS 1000-1
Equipment Construction Materials

Construction Material ¹	Acceptable Analyte Groups	Precautions
Metals		
316 Stainless Steel	All analyte groups. Recommended for inorganic nonmetallics, metals, volatile and extractable organics.	Do not use if weathered, corroded or pitted. ²
300-Series Stainless Steel (304, 303, 302)	Suitable for all analyte groups (if used, check for corrosion before use). Recommended for inorganic nonmetallics, metals, volatile and extractable organics.	Do not use if weathered, corroded or pitted. ² If corroded, there is a potential for samples to be contaminated with iron, chromium, copper or nickel. Check for compatibility with water chemistry for dedicated applications. Do not use in low pH, high chloride, or high TDS waters.
Low Carbon Steel Galvanized Steel Carbon Steel	Inorganic nonmetallics only.	Coring devices are acceptable for all analyte groups if appropriate liners are used. Use Teflon liners for organics. Use plastic or Teflon liners for metals. Do not use if weathered, corroded or pitted. ² If corroded, there is a potential for samples to be contaminated with iron and manganese. Galvanized equipment will also contaminate with zinc and cadmium. If used to collect large samples (e.g., dredges), collect organic and metal samples may be collected from portions of the interior of the collected material.
Brass	Inorganic nonmetallics only.	Do not use if weathered, corroded or pitted. ²
Plastics ³		
Teflon and other fluorocarbon polymers	All analyte groups. Especially recommended for trace metals and organics.	Easily scratched. Do not use if scratched or discolored.
Polypropylene Polyethylene (All Types)	All analyte groups.	Easily scratched. Do not use if scratched or discolored.
Polyvinyl chloride (PVC)	All analyte groups except extractable and volatile organics.	Do not use when collecting extractable or volatile organics samples.

DEP-SOP-001/01
 FS 1000 General Sampling Procedures
Table FS 1000-1
Equipment Construction Materials

Construction Material¹	Acceptable Analyte Groups	Precautions
Tygon, Silicone, Neoprene	All analyte groups except extractable and volatile organics.	Do not use when collecting extractable or volatile organic samples. Do not use silicone if sampling for silica.
Viton	All analyte groups except extractable and volatile organics. ⁴	Minimize contact with sample. Use only if no alternative material exists.
Glass		
Glass, borosilicate	All analyte groups except silica and boron.	

Adapted from USGS Field Manual, Chapter 2, January 2000.

¹ Refers to construction material of the portions of the sampling equipment that come in contact with the sample (e.g., housing of variable speed submersible pump must be stainless steel if extractable organics are sampled; the housing of a variable speed submersible pump used to sample metals may be plastic.)

² Corroded/weathered surfaces are active sorption sites for organic compounds.

³ Plastics used in connection with inorganic trace element samples (including metals) must be uncolored or white.

⁴ May be allowable for specialized parts where no alternative material exists (e.g., Viton seals are the best available seal for some dedicated pump systems), however, contact with the sample must be minimized.

Table FS 1000-2
Construction Material Selection for Equipment and Sample Containers

Analyte Group	Acceptable Materials
Extractable Organics	Teflon Stainless steel Glass Polypropylene (All types) Polyethylene (All types) All parts of the system including connectors and gaskets must be considered – Viton may be used if no other material is acceptable.
Volatile Organics	Teflon Stainless steel Glass Polypropylene (All types) Polyethylene (All types) All parts of the system including connectors and gaskets must be considered – Viton may be used if no other material is acceptable.
Metals	Teflon Stainless steel Polyethylene (All types) Polypropylene (All types) Tygon, Viton, Silicone, Neoprene PVC Glass (except silica and boron)
Ultratrace Metals	Teflon Polyethylene (All types) Polypropylene (All types) Polycarbonate Mercury must be in glass or Teflon
Inorganic Nonmetallics	Teflon Stainless steel Low carbon, Galvanized or Carbon steel Polyethylene (All types) Polypropylene (All types) Tygon, Viton, Silicone, Neoprene PVC Glass Brass

Table FS 1000-2
Construction Material Selection for Equipment and Sample Containers

Analyte Group	Acceptable Materials
Microbiological samples	Teflon Stainless steel Polyethylene (All types) Polypropylene (All types) Tygon, Viton, Silicone, Neoprene PVC Glass Sterilize all sample containers. Thoroughly clean sampling equipment and rinse several times with sample water before collection. Sampling equipment does not require sterilization Do not rinse sample containers

**Table FS 1000-3
 Equipment Use and Construction**

<u>EQUIPMENT</u>	<u>CONSTRUCTION</u>		<u>USE</u>	<u>PERMISSIBLE ANALYTE GROUPS</u>	<u>RESTRICTIONS AND PRECAUTIONS</u>
	<u>HOUSING</u> ¹	<u>TUBING</u>			
WATER SAMPLING					
GROUNDWATER					
1 Positive displacement pumps ²					
a. Submersible (turbine, helical rotor, gear driven)	SS, Teflon	SS, Teflon, PE, PP	Purging	All analyte groups	^{3,4,5} ; must be variable speed
			Sampling	All analyte groups	^{3,4,5} must be variable speed
	SS, Teflon	Non-inert ⁶	Purging	All analyte groups	^{3,4,5} must be variable speed; polishing required ⁷
			Sampling	All analyte groups <u>except</u> volatile and extractable organics	Must be variable speed If sampling for metals, the tubing must be non-metallic if not SS
	Non-inert ⁶	Non-inert ⁶	Purging	All analyte groups	^{3,4,5} must be variable speed; polishing required ⁷
			Sampling	All analyte groups <u>except</u> volatile and extractable organics	Must be variable speed If sampling for metals, the tubing must be non-metallic if not SS
b. Bladder pump (no gas contact)	SS, Teflon, PE, PP or PVC if permanently installed	SS, Teflon, PE, PP	Purging	All analyte groups	^{3,4,5} must be variable speed
			Sampling	All analyte groups	^{3,4} must be variable speed Bladder must be Teflon if sampling for volatile or extractable organics or PE or PP if used in portable pumps
	SS, Teflon, PE, PP	Non-inert ⁶	Purging	All analyte groups	^{3,4} must be variable speed; polishing required ⁷
			Sampling	All analyte groups <u>except</u> volatile and extractable organics	This configuration is not recommended ^{3,4} must be variable speed If sampling for metals, the tubing must be non-metallic if not SS
	Non-inert ⁶	Non-inert ⁶	Purging	All analyte groups	^{3,4} must be variable speed; polishing required ⁷
			Sampling	All analyte groups <u>except</u> volatile and extractable organics	^{3,4} must be variable speed; polishing required ⁷ If sampling for metals, the tubing must be non-metallic if not SS

**Table FS 1000-3
Equipment Use and Construction**

<u>EQUIPMENT</u>	<u>CONSTRUCTION</u>		<u>USE</u>	<u>PERMISSIBLE ANALYTE GROUPS</u>	<u>RESTRICTIONS AND PRECAUTIONS</u>
	<u>HOUSING</u> ¹	<u>TUBING</u>			
2. Suction lift pumps					
a. Centrifugal	N/A	SS, Teflon, PE, PP	Purging	All analyte groups	⁴ foot-valve required Must be variable speed
	N/A	Non-inert ⁶	Purging	All analyte groups	⁴ foot-valve required; polishing required Must be variable speed
b. Peristaltic	N/A	SS, Teflon, PE, PP	Purging	All analyte groups	⁴ foot-valve required; polishing required or continuous pumping required Must be variable speed
			Sampling	All analyte groups <u>except</u> volatile organics	⁴ Silicone tubing in pump head Must be variable speed
	N/A	Non-inert ⁶	Purging	All analyte groups	⁴ foot-valve required Must be variable speed
			Sampling	All analyte groups <u>except</u> volatile and extractable organics	⁴ Silicone tubing in pump head Must be variable speed
3. Bailers					
	SS, Teflon, PE, PP	N/A	Purging	All analyte groups	None; not recommended
		N/A	Sampling	All analyte groups	None; not recommended
	Non-inert ⁶	N/A	Purging	All analyte groups <u>except</u> volatile and extractable organics	None; not recommended If sampling for metals, the tubing must be non-metallic if not SS
			Sampling	All analyte groups <u>except</u> volatile and extractable organics	None; not recommended If sampling for metals, the tubing must be non-metallic if not SS
<u>SURFACE WATER</u>					
1. Intermediate containers such as pond sampler, scoops, beakers, buckets, and dippers	SS, Teflon, Teflon-coated, PE, PP	N/A	Grab sampling	All analyte groups	None
	Glass	N/A		All analyte groups except boron and fluoride	None
	Non-inert ⁶	N/A		All analyte groups <u>except</u> volatile and extractable organics	None

**Table FS 1000-3
 Equipment Use and Construction**

<u>EQUIPMENT</u>	<u>CONSTRUCTION</u>		<u>USE</u>	<u>PERMISSIBLE ANALYTE GROUPS</u>	<u>RESTRICTIONS AND PRECAUTIONS</u>
	<u>HOUSING</u> ¹	<u>TUBING</u>			
2. Nansen, Kemmerer, Van Dorn, Alpha and Beta Samplers, Niskin (or equivalent)	SS, Teflon, Teflon-coated, PE, PP	N/A	Specific depth grab sampling	All analyte groups	None
	Non-inert ⁶	N/A		All analyte groups <u>except</u> volatile and extractable organics	None
3. DO Dunker	SS, Teflon, glass, PE, PP	N/A	Water column composite sampling	All analyte groups	None
4. Bailers – double valve	SS, Teflon, PE, PP	N/A	Grab sampling	All analyte groups	None
	Non-inert ⁶	N/A	Grab sampling	All analyte groups <u>except</u> volatile and extractable organics	None If sampling for metals, the tubing must be non-metallic if not SS
5. Peristaltic pump	N/A	SS, Teflon, PE, PP	Specific depth sampling	All analyte groups <u>except</u> volatile organics	Silicone tubing in pump head Must be variable speed
	N/A	Non-inert ⁶		All analyte groups <u>except</u> volatile and extractable organics	Silicone tubing in pump head Must be variable speed
<u>FIELD FILTRATION UNITS</u>	N/A		Dissolved constituents	Inorganic nonmetallics and metals in surface water Inorganic nonmetallics in groundwater Metals in groundwater and static wastewater and surface water Metals in moving surface water (i.e., river/stream)	Must use a 0.45 µm filter Must use a 0.45 µm filter Must use in-line, high capacity, one-piece molded filter that is connected to the outlet of a pump; no intermediate vessels; positive pressure PE, PP & Teflon bailers acceptable Must use a 1 µm filter in groundwater, a 0.45 µm filter in surface water Must use positive pressure device, but an intermediate vessel may be used. Use a 0.45 µm filter

**Table FS 1000-3
 Equipment Use and Construction**

<u>EQUIPMENT</u>	<u>CONSTRUCTION</u>		<u>USE</u>	<u>PERMISSIBLE ANALYTE GROUPS</u>	<u>RESTRICTIONS AND PRECAUTIONS</u>
	<u>HOUSING</u> ¹	<u>TUBING</u>			
SOLID SAMPLING					
SOILS					
1. Core barrel (or liner)	SS, Teflon, glass, Teflon-coated, aluminum, PE, PP	N/A	Sampling	All analyte groups ⁸	9, 10, 11
	Non-inert ⁶ nonmetallics	N/A	Sampling	All analyte groups	12
	Non-inert ⁶ metals	N/A	Sampling	All analyte groups	12
2. Trowel, scoop, spoon or spatula	SS, Teflon, Teflon-coated, PE, PP	N/A	Sampling	All analyte groups ⁸	
			Compositing	All analyte groups except volatile organics	Samples for volatile organics must grab samples
	Plastic	N/A	Sampling and compositing	All analyte groups <u>except</u> volatile and extractable organics	None Must be nonmetallic if not SS
3. Mixing tray (pan)	SS, Teflon, glass, Teflon-coated, aluminum, PE, PP	N/A	Sampling	All analyte groups ⁸	11
			Compositing or homogenizing	All analyte groups except volatile organics	11
	Non-inert ⁶	N/A	Compositing or homogenizing	All analyte groups	10,11,12 must be nonmetallic if not SS
4. Shovel, bucket auger	SS	N/A	Sampling	All analyte groups ⁸	None
	Non-SS	N/A	Sampling	All analyte groups ⁸	10,11,12
5. Split spoon	SS or carbon steel w/ Teflon insert	N/A	Sampling	All analyte groups ⁸	10,11,12
6. Shelby tube	SS	N/A	Sampling	All analyte groups ⁸	9
	Carbon steel	N/A	Sampling	All analyte groups	9,10,12
SEDIMENT					
1. Coring devices	SS, Teflon, glass, Teflon-coated, aluminum, PE, PP	N/A	Sampling	All analyte groups ⁸	9,10,11

**Table FS 1000-3
Equipment Use and Construction**

<u>EQUIPMENT</u>	<u>CONSTRUCTION</u>		<u>USE</u>	<u>PERMISSIBLE ANALYTE GROUPS</u>	<u>RESTRICTIONS AND PRECAUTIONS</u>
	<u>HOUSING</u> ¹	<u>TUBING</u>			
	Non-inert ⁶ nonmetallics	N/A	Sampling	All analyte groups	¹²
	Non-inert ⁶ metals	N/A	Sampling	All analyte groups	^{9,10,11}
2. Grab – Young, Petersen, Shipek	Teflon, Teflon-lined, SS	N/A	Sampling	All analyte groups ⁸	None
	Carbon steel	N/A	Sampling	All analyte groups	^{10,11}
3. Dredges – Eckman, Ponar, Petit Ponar Van Veen	SS	N/A	Sampling	All analyte groups ⁸	None
	Carbon steel, brass	N/A	Sampling	All analyte groups	^{10,11}
4. Trowel, scoop, spoon or spatula	SS, Teflon, Teflon-coated, PE, PP	N/A	Sampling Compositing	All analyte groups ⁸ All analyte groups except volatile organics	Samples for volatile organics be grab samples
	Plastic	N/A	Sampling and compositing	All analyte groups <u>except</u> volatile and extractable organics	None must be nonmetallic if not SS
5. Mixing tray (pan)	SS, Teflon, glass, Teflon-coated, aluminum, PE, PP	N/A	Sampling Compositing or homogenizing	All analyte groups ⁸ All analyte groups except volatile organics	¹¹ ¹¹
	Non-inert ⁶	N/A	Compositing or homogenizing	All analyte groups <u>except</u> volatile and extractable organics	none ¹¹ must be nonmetallic if not SS
WASTE ¹³					
Scoop	SS	N/A	Liquids, solids & sludges	All analyte groups ⁸	Cannot collect deeper phases
Spoon	SS	N/A	Solids, sludges	All analyte groups ⁸	Cannot collect deeper phases
Push tube	SS	N/A	Solids, sludges	All analyte groups ⁸	Cannot collect deeper phases
Auger	SS	N/A	Solids	All analyte groups ⁸	None

**Table FS 1000-3
 Equipment Use and Construction**

<u>EQUIPMENT</u>	<u>CONSTRUCTION</u>		<u>USE</u>	<u>PERMISSIBLE ANALYTE GROUPS</u>	<u>RESTRICTIONS AND PRECAUTIONS</u>
	<u>HOUSING</u> ¹	<u>TUBING</u>			
Sediment sampler	SS	N/A	Impoundments, piles	All analyte groups ⁸	None
Ponar dredge	SS	N/A	Solids, sludges & sediments	All analyte groups ⁸	None
Coliwasa, Drum thief	Glass	N/A	Liquids, sludges	All analyte groups	None
Mucksucker, Dipstick	Teflon		Liquids, sludges	All analyte groups	Not recommended for tanks > 11 feet deep
Bacon bomb	SS	N/A	Liquids	All analyte groups ⁸	Not recommended for viscous wastes
Bailer	SS, Teflon	N/A	Liquids	All analyte groups ⁸	Do not use with heterogeneous wastes Not recommended for viscous wastes
Peristaltic pump	N/A	Teflon, Glass	Liquids	All analyte groups except volatile organics	Do not use in flammable atmosphere Not recommended for viscous wastes
Backhoe bucket	Steel	N/A	Solids, Sludges		Difficult to clean Volatiles and metals must be taken from the interior part of the sample
Split spoon	SS	N/A	Solids	All analyte groups ⁸	
Roto-Hammer	Steel	N/A	Solids	All analyte groups ⁸	Physically breaks up sample Not for flammable atmospheres

Acronyms:

N/A not applicable
 SS stainless steel
 HDPE high-density polyethylene
 PE polyethylene
 PVC polyvinyl chloride
 PP polypropylene

Table FS 1000-3
Equipment Use and Construction

- ¹ Refers to tubing and pump housings/internal parts that are in contact with purged or sampled water (interior and exterior of delivery tube, inner lining of the discharge tube, etc.).
- ² If used to collect volatile or extractable organics, all power cords and other tubing must be encased in Teflon, PE or PP.
- ³ If used as a non-dedicated system, pump must be completely disassembled, if practical, and cleaned between wells.
- ⁴ Delivery tubing must be precleaned and precut at the base of operations or laboratory. If the same tubing is used during the sampling event, it must be cleaned and decontaminated between uses.
- ⁵ In-line check valve required.
- ⁶ "Non-inert" pertains to materials that are reactive (adsorb, absorb, etc.) to the analytes being sampled. For organics, materials include rubber, plastics (except PE and PP), and PVC. For metals, materials include brass, galvanized, and carbon steel.
- ⁷ "Polishing": When purging for volatile or extractable organics, the entire length of tubing or the portion which comes in contact with the formation water must be constructed of Teflon, SS, PE or PP. If other materials (e.g., PVC, garden hoses, etc.) are used, the following protocols must be followed: 1) slowly withdraw the pump from the water column during the last phase of purging, to remove any water from the well that may have contacted the exterior of the pump and/or tubing; 2) remove a single well volume with the sampling device before sampling begins. **Do not use Tygon** for purging if purgeable or extractable organics are of interest. Polishing **is not recommended**; use of sampling equipment constructed of appropriate materials is preferred.
- ⁸ Do not use if collecting for hexavalent chromium (Chromium⁺⁶)
- ⁹ If samples are sealed in the liner for transport to the laboratory, the sample for VOC analysis must be taken from the interior part of the core.
- ¹⁰ If a non-stainless steel (carbon steel, aluminum) liner, core barrel or implement is used, take the samples for metals, purgeable organics and organics from the interior part of the core sample.
- ¹¹ Aluminum foil, trays or liners may be used only if aluminum is not an analyte of interest.
- ¹² If non-inert-liner, core barrel or implement is used, take samples from the interior part of the collected sample.
- ¹³ If disposable equipment of alternative construction materials is used, the construction material must be compatible with the chemical composition of the waste, cannot alter the characteristics of the waste sample in any way, and cannot contribute analytes of interest or any interfering components.

Table FS1000-4

40 CFR Part 136 TABLE II: Required Containers, Preservation Techniques, and Holding Times
Applicable to **all** Non-Potable Water Samples (includes wastewater, surface water, and groundwater)

Parameter No./Name (refers to parameter number on Tables IA,B, C, D,E, F, G & H as noted)	Container ¹	Preservation ^{2, 3}	Maximum holding time ⁴
Table IA—Bacterial Tests:			
1–5. Coliform, total, fecal, and <i>E. coli</i>	PA, G	Cool, <10 °C, 0.0008% Na ₂ S ₂ O ₃ ⁵	6 hours ^{6, 7}
6. Fecal streptococci	PA, G	Cool, <10 °C, 0.0008% Na ₂ S ₂ O ₃ ⁵	6 hours ⁶
7. Enterococci	PA, G	Cool, <10 °C, 0.0008% Na ₂ S ₂ O ₃ ⁵	6 hours ⁶
8. Salmonella	PA, G	Cool, <10 °C, 0.0008% Na ₂ S ₂ O ₃ ⁵	6 hours ⁶
Table IA— Aquatic Toxicity Tests:			
9–11. Toxicity, acute and chronic	P, FP, G	Cool, ≤6 °C ⁸	36 hours
Table IB—Inorganic Tests:			
1. Acidity	P, FP, G	Cool, ≤6 °C ⁹	14 days
2. Alkalinity	P, FP, G	Cool, ≤6 °C ⁹	14 days
4. Ammonia	P, FP, G	Cool, ≤6 °C ⁹ , H ₂ SO ₄ to pH<2	28 days
9. Biochemical oxygen demand	P, FP, G	Cool, ≤6 °C ⁹	48 hours
10. Boron	P, FP, or Quartz	HNO ₃ to pH<2	6 months
11. Bromide	P, FP, G	None required	28 days
14. Biochemical oxygen demand, carbonaceous	P, FP, G	Cool, ≤6 °C ⁹	48 hours
15. Chemical oxygen demand	P, FP, G	Cool, ≤6 °C ⁹ , H ₂ SO ₄ to pH<2	28 days
16. Chloride	P, FP, G	None required	28 days
17. Chlorine, total residual	P, G	None required	Analyze within 15 minutes
21. Color	P, FP, G	Cool, ≤6 °C ⁹	48 hours
23–24. Cyanide, total or available (or CATC)	P, FP, G	Cool, ≤6 °C ⁹ , NaOH to pH>12 ¹⁰ , reducing agent ⁵	14 days
25. Fluoride	P	None required	28 days
27. Hardness	P, FP, G	HNO ₃ or H ₂ SO ₄ to pH<2	6 months
28. Hydrogen ion (pH)	P, FP, G	None required	Analyze within 15 minutes
31, 43. Kjeldahl and organic N	P, FP, G	Cool, ≤6 °C ⁹ , H ₂ SO ₄ to pH<2	28 days
Table IB—Metals:			
7 18. Chromium VI	P, FP, G	Cool, ≤6 °C ⁹ , pH = 9.3–9.7 ¹²	28 days
35. Mercury (CVAA)	P, FP, G	HNO ₃ to pH<2	28 days

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Applicable to **all** Non-Potable Water Samples (includes wastewater, surface water, and groundwater)

Parameter No./Name (refers to parameter number on Tables IA,B, C, D,E, F, G & H as noted)	Container ¹	Preservation ^{2, 3}	Maximum holding time ⁴
35. Mercury (CVAFS)	FP, G; and FP-lined cap ¹³	5 mL/L 12N HCl or 5 mL/L BrCl ¹³	90 days ¹³
3, 5–8, 12, 13, 19, 20, 22, 26, 29, 30, 32–34, 36, 37, 45, 47, 51, 52, 58–60, 62, 63, 70– 72, 74, 75. Metals, except boron, chromium VI, and mercury.	P, FP, G	HNO ₃ to pH<2, or at least 24 hours prior to analysis ¹⁴	6 months
38. Nitrate	P, FP, G	Cool, ≤6 °C ⁹	48 hours
39. Nitrate-nitrite	P, FP, G	Cool, ≤6 °C ⁹ , H ₂ SO ₄ to pH<2	28 days
40. Nitrite	P, FP, G	Cool, ≤6 °C ⁹	48 hours
41. Oil and grease	G	Cool, ≤6 °C ⁹ , HCl or H ₂ SO ₄ to pH<2	28 days
42. Organic Carbon	P, FP, G	Cool, ≤6 °C ⁹ , HCl, H ₂ SO ₄ , or H ₃ PO ₄ to pH<2.	28 days
44. Orthophosphate	P, FP, G	Cool, ≤6 °C ⁹	Filter within 15 minutes; Analyze within 48 hours
46. Oxygen, Dissolved Probe	G, Bottle and top	None required	Analyze within 15 minutes
47. Winkler	G, Bottle and top	Fix on site and store in dark	8 hours
48. Phenols	G	Cool, ≤6 °C ⁹ , H ₂ SO ₄ to pH<2	28 days
49. Phosphorous (elemental)	G	Cool, ≤6 °C ⁹	48 hours
50. Phosphorous, total	P, FP, G	Cool, ≤6 °C ⁹ , H ₂ SO ₄ to pH<2	28 days
53. Residue, total	P, FP, G	Cool, ≤6 °C ⁹	7 days
54. Residue, Filterable	P, FP, G	Cool, ≤6 °C ⁹	7 days
55. Residue, Nonfilterable (TSS)	P, FP, G	Cool, ≤6 °C ⁹	7 days
56. Residue, Settleable	P, FP, G	Cool, ≤6 °C ⁹	48 hours
57. Residue, Volatile	P, FP, G	Cool, ≤6 °C ⁹	7 days
61. Silica	P or Quartz	Cool, ≤6 °C ⁹	28 days
64. Specific conductance	P, FP, G	Cool, ≤6 °C ⁹	28 days
65. Sulfate	P, FP, G	Cool, ≤6 °C ⁹	28 days
66. Sulfide	P, FP, G	Cool, ≤6 °C ⁹ , add zinc acetate plus sodium hydroxide to pH>9	7 days
67. Sulfite	P, FP, G	None required	Analyze within 15 minutes
68. Surfactants	P, FP, G	Cool, ≤6 °C ⁹	48 hours

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40 CFR Part 136 TABLE II: Required Containers, Preservation Techniques, and Holding Times
Applicable to **all** Non-Potable Water Samples (includes wastewater, surface water, and groundwater)

Parameter No./Name (refers to parameter number on Tables IA,B, C, D,E, F, G & H as noted)	Container ¹	Preservation ^{2, 3}	Maximum holding time ⁴
69. Temperature	P, FP, G	None required	Analyze
73. Turbidity	P, FP, G	Cool, ≤6 °C ⁹	48 hours

Table IC—Organic Tests 8			
13, 18–20, 22, 24–28, 34–37, 39–43, 45–47, 56, 76, 104, 105, 108–111, 113. Purgeable Halocarbons	G, FP-lined septum	Cool, ≤6 °C ⁹ , 0.008% Na ₂ S ₂ O ₃ ⁵	14 days
6, 57, 106. Purgeable aromatic hydrocarbons	G, FP-lined septum	Cool, ≤6 °C ⁹ , 0.008% Na ₂ S ₂ O ₃ ⁵ , HCl to pH 2 ¹⁶	14 days ¹⁶
3, 4. Acrolein and acrylonitrile	G, FP-lined septum	Cool, ≤6 °C ⁹ , 0.008% Na ₂ S ₂ O ₃ ⁵ , pH to 4–5 ¹⁷	14 days ¹⁷
23, 30, 44, 49, 53, 77, 80, 81, 98, 100, 112. Phenols ¹⁸	G, FP-lined cap	Cool, ≤6 °C ⁹ , 0.008% Na ₂ S ₂ O ₃ ⁵	7 days until extraction, 40 days after extraction
7, 38. Benzidines ^{18,19}	G, FP-lined cap	Cool, ≤6 °C ⁹ , 0.008% Na ₂ S ₂ O ₃ ⁵	7 days until extraction ²⁰
14, 17, 48, 50–52. Phthalate esters ¹⁸	G, FP-lined cap	Cool, ≤6 °C ⁹	7 days until extraction, 40 days after extraction
82–84. Nitrosamines ^{18,21}	G, FP-lined cap	Cool, ≤6 °C ⁹ , store in dark, 0.008% Na ₂ S ₂ O ₃ ⁵	7 days until extraction, 40 days after extraction
88–94. PCBs ¹⁸	G, FP-lined cap	Cool, ≤6 °C ⁹	1 year until extraction, 1 year after extraction
54, 55, 75, 79. Nitroaromatics and isophorone ¹⁸	G, FP-lined cap	Cool, ≤6 °C ⁹ , store in dark, 0.008% Na ₂ S ₂ O ₃ ⁵	7 days until extraction, 40 days after extraction
1, 2, 5, 8–12, 32, 33, 58, 59, 74, 78, 99, 101. Polynuclear aromatic hydrocarbons ¹⁸	G, FP-lined cap	Cool, ≤6 °C ⁹ , store in dark, 0.008% Na ₂ S ₂ O ₃ ⁵	7 days until extraction, 40 days after extraction
15, 16, 21, 31, 87. Haloethers ¹⁸	G, FP-lined cap	Cool, ≤6 °C ⁹ , 0.008% Na ₂ S ₂ O ₃ ⁵	7 days until extraction, 40 days after extraction
29, 35–37, 63–65, 107. Chlorinated hydrocarbons ¹⁸	G, FP-lined cap	Cool, ≤6 °C ⁹	7 days until extraction, 40 days after extraction
60–62, 66–72, 85, 86, 95–97, 102, 103. CDDs/CDFs ¹⁸			
Aqueous Samples: Field and Lab Preservation	G	Cool, ≤6 °C ⁹ , 0.008% Na ₂ S ₂ O ₃ ⁵ , pH<9	1 year

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Parameter No./Name (refers to parameter number on Tables IA,B, C, D,E, F, G & H as noted)	Container ¹	Preservation ^{2, 3}	Maximum holding time ⁴
Solids and Mixed-Phase Samples: Field Preservation	G	Cool, ≤6 °C ⁹	7 days
Tissue Samples: Field Preservation	G	Cool, ≤6 °C ⁹	24 hours
Solids, Mixed-Phase, and Tissue Samples: Lab Preservation	G	Freeze, ≤-10 °C	1 year
Table ID—Pesticides			
Tests: 1–70. Pesticides ¹⁸	G, FP-lined cap	Cool, ≤6 °C ⁹ , pH 5–9 ²²	7 days until extraction, 40 days after extraction
Table IE—Radiological Tests:			
1–5. Alpha, beta, and radium	P, FP, G	HNO ₃ to pH<2	6 months
Table IH—Bacterial Tests:			
1. <i>E. coli</i>			
2. Enterococci	PA, G	Cool, <10 °C, 0.008% Na ₂ S ₂ O ₃ ⁵	6 hours ⁶
Table II—Protozoan Tests:			
8. Cryptosporidium	LDPE; field filtration	0–8 °C	96 hours. ²³
9. Giardia	LDPE; field filtration	0–8 °C	96 hours ²³

Reference: This table is adapted from Table II, 40 CFR Part 136, 2007

¹ “P” is polyethylene; “FP” is fluoropolymer (polytetrafluoroethylene (PTFE; Teflon®), or other fluoropolymer, unless stated otherwise in this Table II; “G” is glass; “PA” is any plastic that is made of a sterilizable material (polypropylene or other autoclavable plastic); “LDPE” is low density polyethylene.

² Except where noted in this Table II and the method for the parameter, preserve each grab sample within 15 minutes of collection. For a composite sample collected with an automated sampler (e.g., using a 24-hour composite sampler; see 40 CFR 122.21(g)(7)(i) or 40 CFR Part 403, Appendix E), refrigerate the sample at ≤6 °C during collection unless specified otherwise in this Table II or in the method(s). For a composite sample to be split into separate aliquots for preservation and/or analysis, maintain the sample at ≤6 °C, unless specified otherwise in this Table II or in the method(s), until collection, splitting, and preservation is completed. Add the preservative to the sample container prior to sample collection when the preservative will not compromise the integrity of a grab sample, a composite sample, or an aliquot split from a composite sample; otherwise, preserve the grab sample, composite sample,

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or aliquot split from a composite sample within 15 minutes of collection. If a composite measurement is required but a composite sample would compromise sample integrity, individual grab samples must be collected at prescribed time intervals (e.g., 4 samples over the course of a day, at 6-hour intervals). Grab samples must be analyzed separately and the concentrations averaged. Alternatively, grab samples may be collected in the field and composited in the laboratory if the compositing procedure produces results equivalent to results produced by arithmetic averaging of the results of analysis of individual grab samples. For examples of laboratory compositing procedures, see EPA Method 1664A (oil and grease) and the procedures at 40 CFR 141.34(f)(14)(iv) and (v) (volatile organics).

³ When any sample is to be shipped by common carrier or sent via the U.S. Postal Service, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements of Table II, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid (HCl) in water solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO₃) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H₂SO₄) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).

⁴ Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before the start of analysis and still be considered valid (e.g., samples analyzed for fecal coliforms may be held up to 6 hours prior to commencing analysis). Samples may be held for longer periods only if the permittee or monitoring laboratory has data on file to show that, for the specific types of samples under study, the analytes are stable for the longer time, and has received a variance from the Regional Administrator under § 136.3(e). For a grab sample, the holding time begins at the time of collection. For a composite sample collected with an automated sampler (e.g., using a 24-hour composite sampler; see 40 CFR 122.21(g)(7)(i) or 40 CFR Part 403, Appendix E), the holding time begins at the time of the end of collection of the composite sample. For a set of grab samples composited in the field or laboratory, the holding time begins at the time of collection of the last grab sample in the set. Some samples may not be stable for the maximum time period given in the table. A permittee or monitoring laboratory is obligated to hold the sample for a shorter time if it knows that a shorter time is necessary to maintain sample stability. See § 136.3(e) for details. The date and time of collection of an individual grab sample is the date and time at which the sample is collected. For a set of grab samples to be composited, and that are all collected on the same calendar date, the date of collection is the date on which the samples are collected. For a set of grab samples to be composited, and that are collected across two calendar dates, the date of collection is the dates of the two days; e.g., November 14–15. For a composite sample collected automatically on a given date, the

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date of collection is the date on which the sample is collected. For a composite sample collected automatically, and that is collected across two calendar dates, the date of collection is the dates of the two days; e.g., November 14–15.

⁵ Add a reducing agent only if an oxidant (e.g., chlorine) is present. Reducing agents shown to be effective are sodium thiosulfate ($\text{Na}_2\text{S}_2\text{O}_3$), ascorbic acid, sodium arsenite (NaAsO_2), or sodium borohydride (NaBH_4). However, some of these agents have been shown to produce a positive or negative cyanide bias, depending on other substances in the sample and the analytical method used. Therefore, do not add an excess of reducing agent. Methods recommending ascorbic acid (e.g., EPA Method 335.4) specify adding ascorbic acid crystals, 0.1–0.6 g, until a drop of sample produces no color on potassium iodide (KI) starch paper, then adding 0.06 g (60 mg) for each liter of sample volume. If NaBH_4 or NaAsO_2 is used, 25 mg/L NaBH_4 or 100 mg/L NaAsO_2 will reduce more than 50 mg/L of chlorine (see method “Kelada-01” and/or Standard Method

4500–CN⁻ for more information). After adding reducing agent, test the sample using KI paper, a test strip (e.g. for chlorine, SenSafe™ Total Chlorine Water Check 480010) moistened with acetate buffer solution (see Standard Method 4500–Cl.C.3e), or a chlorine/oxidant test method (e.g., EPA Method 330.4 or 330.5), to make sure all oxidant is removed. If oxidant remains, add more reducing agent. Whatever agent is used, it should be tested to assure that cyanide results are not affected adversely.

⁶ Samples analysis should begin immediately, preferably within 2 hours of collection. The maximum transport time to the laboratory is 6 hours, and samples should be processed within 2 hours of receipt at the laboratory.

⁷ For fecal coliform samples for sewage sludge (biosolids) only, the holding time is extended to 24 hours for the following sample types using either EPA Method 1680 (LTB–EC) or 1681 (A–1): Class A composted, Class B aerobically digested, and Class B anaerobically digested.

⁸ Sufficient ice should be placed with the samples in the shipping container to ensure that ice is still present when the samples arrive at the laboratory. However, even if ice is present when the samples arrive, it is necessary to immediately measure the temperature of the samples and confirm that the preservation temperature maximum has not been exceeded. In the isolated cases where it can be documented that this holding temperature cannot be met, the permittee can be given the option of on-site testing or can request a variance. The request for a variance should include supportive data which show that the toxicity of the effluent samples is not reduced because of the increased holding temperature.

⁹ Aqueous samples must be preserved at ≤ 6 °C, and should not be frozen unless data demonstrating that sample freezing does not adversely impact sample integrity is maintained on file and accepted as valid by the regulatory authority. Also, for purposes of NPDES monitoring, the specification of “ ≤ 6 °C” is used in place of the “4 °C” and “ < 4 °C” sample temperature requirements listed in some methods. It is not necessary to measure the sample temperature to three significant figures ($1/100^{\text{th}}$ of 1 degree); rather, three

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significant figures are specified so that rounding down to 6 °C may not be used to meet the ≤6 °C requirement. The preservation temperature does not apply to samples that are analyzed immediately (less than 15 minutes).

¹⁰ Sample collection and preservation: Collect a volume of sample appropriate to the analytical method in a bottle of the material specified. If the sample can be analyzed within 48 hours and sulfide is not present, adjust the pH to > 12 with sodium hydroxide solution (e.g., 5% w/v), refrigerate as specified, and analyze within 48 hours. Otherwise, to extend the holding time to 14 days and mitigate interferences, treat the sample immediately using any or all of the following techniques, as necessary, followed by adjustment of the sample pH to > 12 and refrigeration as specified. There may be interferences that are not mitigated by approved procedures. Any procedure for removal or suppression of an interference may be employed, provided the laboratory demonstrates that it more accurately measures cyanide. Particulate cyanide (e.g., ferric ferrocyanide) or a strong cyanide complex (e.g., cobalt cyanide) are more accurately measured if the laboratory holds the sample at room temperature and pH > 12 for a minimum of 4 hours prior to analysis, and performs UV digestion or dissolution under alkaline (pH=12) conditions, if necessary.

(1) SULFUR: To remove elemental sulfur (S₈), filter the sample immediately. If the filtration time will exceed 15 minutes, use a larger filter or a method that requires a smaller sample volume (e.g., EPA Method 335.4 or Lachat Method 01). Adjust the pH of the filtrate to > 12 with NaOH, refrigerate the filter and filtrate, and ship or transport to the laboratory. In the laboratory, extract the filter with 100 mL of 5% NaOH solution for a minimum of 2 hours. Filter the extract and discard the solids. Combine the 5% NaOH-extracted filtrate with the initial filtrate, lower the pH to approximately 12 with concentrated hydrochloric or sulfuric acid, and analyze the combined filtrate. Because the detection limit for cyanide will be increased by dilution by the filtrate from the solids, test the sample with and without the solids procedure if a low detection limit for cyanide is necessary. Do not use the solids procedure if a higher cyanide concentration is obtained without it. Alternatively, analyze the filtrates from the sample and the solids separately, add the amounts determined (in µg or mg), and divide by the original sample volume to obtain the cyanide concentration.

(2) SULFIDE: If the sample contains sulfide as determined by lead acetate paper, or if sulfide is known or suspected to be present, immediately conduct one of the volatilization treatments or the precipitation treatment as follows: Volatilization—Headspace expelling. In a fume hood or well-ventilated area, transfer 0.75 liter of sample to a 4.4 L collapsible container (e.g., Cubitainer™). Acidify with concentrated hydrochloric acid to pH

< 2. Cap the container and shake vigorously for 30 seconds. Remove the cap and expel the headspace into the fume hood or open area by collapsing the container without expelling the sample. Refill the headspace by expanding the container. Repeat expelling a total of five headspace volumes. Adjust the pH to > 12, refrigerate, and ship or transport to the laboratory. Scaling to a smaller or larger sample volume must maintain the air to sample volume ratio. A larger volume of air will result in too great a loss of cyanide (> 10%). Dynamic stripping: In a fume hood or well-ventilated area, transfer 0.75 liter of sample to a container of the material specified and acidify with concentrated hydrochloric acid to pH < 2. Using a calibrated air sampling pump or flowmeter, purge the acidified sample into the fume hood or open area through a fritted glass aerator at a flow rate of 2.25 L/min for 4 minutes. Adjust the pH to >

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12, refrigerate, and ship or transport to the laboratory. Scaling to a smaller or larger sample volume must maintain the air to sample volume ratio. A larger volume of air will result in too great a loss of cyanide (> 10%). Precipitation: If the sample contains particulate matter that would be removed by filtration, filter the sample prior to treatment to assure that cyanide associated with the particulate matter is included in the measurement. Ship or transport the filter to the laboratory. In the laboratory, extract the filter with 100 mL of 5% NaOH solution for a minimum of 2 hours. Filter the extract and discard the solids. Combine the 5% NaOH-extracted filtrate with the initial filtrate, lower the pH to approximately 12 with concentrated hydrochloric or sulfuric acid, and analyze the combined filtrate. Because the detection limit for cyanide will be increased by dilution by the filtrate from the solids, test the sample with and without the solids procedure if a low detection limit for cyanide is necessary. Do not use the solids procedure if a higher cyanide concentration is obtained without it. Alternatively, analyze the filtrates from the sample and the solids separately, add the amounts determined (in μg or mg), and divide by the original sample volume to obtain the cyanide concentration. For removal of sulfide by precipitation, raise the pH of the sample to > 12 with NaOH solution, then add approximately 1 mg of powdered cadmium chloride for each mL of sample. For example, add approximately 500 mg to a 500-mL sample. Cap and shake the container to mix. Allow the precipitate to settle and test the sample with lead acetate paper. If necessary, add cadmium chloride but avoid adding an excess. Finally, filter through 0.45 micron filter. Cool the sample as specified and ship or transport the filtrate and filter to the laboratory. In the laboratory, extract the filter with 100 mL of 5% NaOH solution for a minimum of 2 hours. Filter the extract and discard the solids. Combine the 5% NaOH-extracted filtrate with the initial filtrate, lower the pH to approximately 12 with concentrated hydrochloric or sulfuric acid, and analyze the combined filtrate. Because the detection limit for cyanide will be increased by dilution by the filtrate from the solids, test the sample with and without the solids procedure if a low detection limit for cyanide is necessary. Do not use the solids procedure if a higher cyanide concentration is obtained without it. Alternatively, analyze the filtrates from the sample and the solids separately, add the amounts determined (in μg or mg), and divide by the original sample volume to obtain the cyanide concentration. If a ligand-exchange method is used (e.g., ASTM D6888), it may be necessary to increase the ligand-exchange reagent to offset any excess of cadmium chloride.

(3) SULFITE, THIOSULFATE, OR THIOCYANATE: If sulfite, thiosulfate, or thiocyanate is known or suspected to be present, use UV digestion with a glass coil (Method Kelada-01) or ligand exchange (Method OIA-1677) to preclude cyanide loss or positive interference.

(4) ALDEHYDE: If formaldehyde, acetaldehyde, or another water-soluble aldehyde is known or suspected to be present, treat the sample with 20 mL of 3.5% ethylenediamine solution per liter of sample.

(5) CARBONATE: Carbonate interference is evidenced by noticeable effervescence upon acidification in the distillation flask, a reduction in the pH of the absorber solution, and incomplete cyanide spike recovery. When significant carbonate is present, adjust the pH to ≥ 12 using calcium hydroxide instead of sodium hydroxide. Allow the precipitate to settle and decant or filter the sample prior to analysis (also see Standard Method 4500-CN.B.3.d).

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40 CFR Part 136 TABLE II: Required Containers, Preservation Techniques, and Holding Times
Applicable to **all** Non-Potable Water Samples (includes wastewater, surface water, and groundwater)

(6) CHLORINE, HYPOCHLORITE, OR OTHER OXIDANT: Treat a sample known or suspected to contain chlorine, hypochlorite, or other oxidant as directed in footnote 5.

¹¹ For dissolved metals, filter grab samples within 15 minutes of collection and before adding preservatives. For a composite sample collected with an automated sampler (e.g., using a 24-hour composite sampler; see 40 CFR 122.21(g)(7)(i) or 40 CFR Part 403, Appendix E), filter the sample within 15 minutes after completion of collection and before adding preservatives. If it is known or suspected that dissolved sample integrity will be compromised during collection of a composite sample collected automatically over time (e.g., by interchange of a metal between dissolved and suspended forms), collect and filter grab samples to be composited (footnote 2) in place of a composite sample collected automatically.

¹² To achieve the 28-day holding time, use the ammonium sulfate buffer solution specified in EPA Method 218.6. The allowance in this footnote supersedes preservation and holding time requirements in the approved hexavalent chromium methods, unless this supersession would compromise the measurement, in which case requirements in the method must be followed.

¹³ Samples collected for the determination of trace level mercury (<100 ng/L) using EPA Method 1631 must be collected in tightly-capped fluoropolymer or glass bottles and preserved with BrCl or HCl solution within 48 hours of sample collection. The time to preservation may be extended to 28 days if a sample is oxidized in the sample bottle. A sample collected for dissolved trace level mercury should be filtered in the laboratory within 24 hours of the time of collection. However, if circumstances preclude overnight shipment, the sample should be filtered in a designated clean area in the field in accordance with procedures given in Method 1669. If sample integrity will not be maintained by shipment to and filtration in the laboratory, the sample must be filtered in a designated clean area in the field within the time period necessary to maintain sample integrity. A sample that has been collected for determination of total or dissolved trace level mercury must be analyzed within 90 days of sample collection.

¹⁴ An aqueous sample may be collected and shipped without acid preservation. However, acid must be added at least 24 hours before analysis to dissolve any metals that adsorb to the container walls. If the sample must be analyzed within 24 hours of collection, add the acid immediately (see footnote 2). Soil and sediment samples do not need to be preserved with acid. The allowances in this footnote supersede the preservation and holding time requirements in the approved metals methods.

¹⁵ Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.

¹⁶ If the sample is not adjusted to pH 2, then the sample must be analyzed within seven days of sampling.

¹⁷ The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.

Table FS1000-4

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¹⁸ When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity (i.e., use all necessary preservatives and hold for the shortest time listed). When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to ≤ 6 °C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6–9; samples preserved in this manner may be held for seven days before extraction and for forty days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (regarding the requirement for thiosulfate reduction), and footnotes 19, 20 (regarding the analysis of benzidine).

¹⁹ If 1,2-diphenylhydrazine is likely to be present, adjust the pH of the sample to 4.0 ± 0.2 to prevent rearrangement to benzidine.

²⁰ Extracts may be stored up to 30 days at < 0 °C.

²¹ For the analysis of diphenylnitrosamine, add 0.008% $\text{Na}_2\text{S}_2\text{O}_3$ and adjust pH to 7–10 with NaOH within 24 hours of sampling

²² The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $\text{Na}_2\text{S}_2\text{O}_3$.

²³ Holding time is calculated from time of sample collection to elution for samples shipped to the laboratory in bulk and calculated from the time of sample filtration to elution for samples filtered in the field

Table FS 1000-5
Approved Water and Wastewater Procedures, Containers, Preservation and Holding Times
For Analytes not Found in 40 CFR 136

Analyte	Methods	Reference ¹	Container ²	Preservation ³	Maximum Holding Time ⁴
Bromine	DPD Colorimetric ⁵	SM 4500-CI-G	P, G	None required	Analyze immediately
Bromates	Ion Chromatography	EPA 300.0 ⁶	P, G	Cool 4°C	30 days
Chlorophylls	Spectrophotometric	SM 10200 H	P, G ⁷	Dark 4°C Filtered, dark, 20°C	48 hours chilled until filtration ⁸ , and analyze immediately or 48 hours chilled until filtration ⁸ , and 28 days (frozen) after filtration
Corrosivity	Calculated (CaCO ₃ Stability, Langelier Index)	SM 2330 ASTM D513-92	P, G	Cool 4°C ⁹	7 days ⁹
FL-PRO	Gas Chromatography	DEP (11/1/95)	G only	Cool 4°C, H ₂ SO ₄ or HCl to pH<2	7 days until extraction, 40 days after extraction
Odor	Human Panel	SM 2150	G only	Cool 4°C	6 hours
Salinity	Electrometric ¹⁰ Hydrometric ¹⁰	SM 2520 B SM 2520 C	G, wax seal	Analyze immediately or use wax seal	30 days ¹⁰
Taste	Human Panel	SM 2160 B, C, D ASTM E679-91	G only	Cool 4°C	24 hours
Total Dissolved Gases	Direct-sensing Membrane-diffusion	SM 2810	_____	_____	Analyze in-situ
Total Petroleum Hydrocarbons	Gravimetry	EPA 1664	G only	Cool 4°C, H ₂ SO ₄ or HCl to pH<2	28 days
Transparency	Irradiometric ¹¹	62-302.200(6), FAC	_____	_____	Analyze in-situ
Un-ionized Ammonia	Calculated ¹²	DEP-SOP ¹³	P, G	Cool 4°C Na ₂ S ₂ O ₃ ¹²	8 hours unpreserved 28 days preserved ¹²
Organic Pesticides ¹⁴	GC and HPLC	EPA (600-series) ¹⁴	¹⁵	¹⁵	¹⁵

¹ SM XXXX = procedures from "Standard Methods for the Examination of Water and Wastewater", APHA-AWWA-WPCF, 20th edition, 1998 and Standard Methods Online.

ASTM XXXX-YY = procedure from "Annual Book of ASTM Standards", Volumes 11.01 and 11.02 (Water I and II), 1999.

² P = plastic, G = glass.

³ When specified, sample preservation should be performed immediately upon sample collection.

⁴ The times listed are the maximum times that samples may be held before analysis and still be considered valid.

Table FS 1000-5
Approved Water and Wastewater Procedures, Containers, Preservation and Holding Times
For Analytes not Found in 40 CFR 136

- ⁵ The approved procedure is for residual chlorine. However, in the absence of chlorine, the DPD colorimetric procedure can be adapted to measure bromine content of the sample. In such case, the validity of this assumption must be verified by using another procedure for chlorine which is not affected by the presence of bromine (i.e., negligible interference).
- ⁶ The Determination of Inorganic Anions in Water by Ion Chromatography", EPA Method 300.0, Revised August 1993, by John D. Pfaff, U. S. EPA Cincinnati, Ohio 45268.
- ⁷ Collect samples in opaque bottles and process under reduced light.
- ⁸ Samples must be filtered within 48 hours of collection. Add magnesium carbonate to the filter while the last of the sample passes through the filter..
- ⁹ Temperature and pH must be measured on site at the time of sample collection. 7 days is the maximum time for laboratory analysis of total alkalinity, calcium ion and total solids.
- ¹⁰ The electrometric and hydrometric analytical methods are suited for field use. The argentometric method is suited for laboratory use. Samples collected for laboratory analysis, when properly sealed with paraffin waxed stopper, may be held indefinitely. The maximum holding time of 30 days is recommended as a practical regulatory limit.
- ¹¹ Transparency in surface waters is defined as a compensation point for photosynthetic activity, i.e., the depth at which one percent of the light intensity entering at the water surface remains unabsorbed. The DEP Chapter 62-302, FAC requires that the light intensities at the surface and subsurface be measured simultaneously by irradiance meters such as the Kahlsico Underwater Irradiometer, Model No. 268 WA 310, or an equivalent device having a comparable spectral response.
- ¹² The results of the measurements of pH, temperature, salinity (if applicable) and the ammonium ion concentration in the sample are used to calculate the concentration of ammonia in the unionized state. Temperature, pH and salinity must be measured on-site at the time of sample collection. Laboratory analysis of the ammonium ion concentration should be conducted within eight hours of sample collection. If prompt analysis of ammonia is impossible, preserve samples with H₂SO₄ to pH between 1.5 and 2. Acid-preserved samples, stored at 4°C, may be held up to 28 days for ammonia determination. Sodium thiosulfate should only be used if fresh samples contain residual chlorine.
- ¹³ DEP Central Analytical Laboratory, Tallahassee, FL, Revision No. 2, 2-12-2001. The document is available from the DEP Standards & Assessment Section..
- ¹⁴ Other pesticides listed in approved EPA methods (608.1, 608.2, 614, 614.1, 615, 617, 618, 619, 622, 622.1, 627, 629, 631, 632, 632.1, 633, 642, 643, 644 and 645) that are not included in Table ID of 40 CFR Part 136 (July 2007).
- ¹⁵ Container, preservation and holding time as specified in each individual method must be followed.

Table FS 1000-6
Recommended Sample Containers, Sample Volumes, Preservation Techniques and Holding Times for Residuals, Soil and Sediment Samples

Analyte	Methods	References	Container	Preservation	Maximum Holding Times
Volatile Organics	Purge-and-Trap GC and GC-MS	8015, 8260, 8021, 5035	See Table 1000-7		
Semivolatile Organics	GC, HPLC, and GC-MS	8041, 8061, 8070, 8081, 8082, 8091, 8111, 8121, 8131, 8141, 8151, 8270, 8275, 8280, 8290, 8310, 8315, 8316, 8318, 8321, 8325, 8330, 8331, 8332, 8410, 8430, 8440, FL-PRO	Glass, 8 oz widemouth with Teflon® -Lined lid	Cool 4°C ¹	14 days until extraction, 40 days after extraction
Dioxins		8290	Amber Glass, 8 oz widemouth with Teflon® -Lined lid	Cool 4°C ¹ in dark	30 days until extraction, 45 days after extraction
Total Metals-except mercury and chromium VI methods	Flame AA, Furnace AA, Hydride and ICP	All 7000-series (except 7195, 7196, 7197, 7198, 7470 and 7471), and 6010 (ICP)	Glass or plastic 8 oz widemouth (200 grams sample)	None	6 months
Chromium VI	Colorimetric, Chelation with Flame AA (200 gram sample)	7196 and 7197 (prep 3060)	Glass or plastic, 8 oz widemouth (200 gram sample)	Cool 4°± 2°C ¹	1 month until extraction, 4 days after extraction ²
Mercury	Manual Cold Vapor AA	7471	Glass or plastic 8 oz widemouth (200 grams sample)	Cool 4°± 2°C ¹	28 days
Microbiology (MPN)		MPN	Sterile glass or plastic	Cool 4°C ¹	24 hours
Aggregate Properties			Glass or plastic	Cool 4°C ¹	14 days
Inorganic nonmetallics all except:			Glass or plastic		28 days
Sulfite, Nitrate,			Glass or plastic	Cool 4°C ¹	48 hours
Nitrite & o-phosphate					
Elemental Phosphorus			Glass		48 hours

Table FS 1000-6

Recommended Sample Containers, Sample Volumes, Preservation Techniques and Holding Times for Residuals, Soil and Sediment Samples

The term "residuals" include: (1) sludges of domestic origin having no specific requirements in Tables FS-1000-4 or FS-1000-9; (2) sludges of industrial origin; and (3) concentrated waste samples.

¹ Keep soils, sediments and sludges cool at 4°C from collection time until analysis. No preservation is required for concentrated waste samples.

² Storage Temperature is 4°C, ±2°C

Table FS 1000-7

Sample Handling, Preservation and Holding Time Table for SW 846 Method 5035

Conc. Level	Sampling Device	Collection Procedure	Sample Container		Preservation	Sample Preparation	Max HT ^①	Determinative Procedure
			Type	Vial Preparation				
≤200 ug/kg	Coring Device	5035 - Section 6.2.1	Glass Vial w/ PTFE-silicone Septum	5035 - 6.1.1	NaHSO ₄ / 4°C	5035 - Section 7.2	14 D	Any recognized VOC Method
				5035 - 6.1.1 ^②	4°C	5035 - Section 7.2	48 H	Any recognized VOC Method
				5035 - 6.1.1 ^②	4°C / -10°C ^{③,④}	5035 - Section 7.2	48 H / 14 D ^⑤	Any recognized VOC Method
	EnCore or equivalent	5035 - Section 6.2.1	EnCore or equivalent	5035 - 6.1.1 ^{②,⑥,⑦}	4°C	5035 - Section 7.2	48 H	Any recognized VOC Method
		5035 - Section 6.2.1	EnCore or equivalent	5035 - 6.1.1 ^{⑥,⑦}	NaHSO ₄ / 4°C	5035 - Section 7.2 ^⑤	48 H / 14 D ^⑤	Any recognized VOC Method
		5035 - Section 6.2.1	EnCore or equivalent	5035-6.1.1 ^{②⑥⑦}	4°C / -10°C ^{③,④}	5035 - Section 7.2 ^⑤	48 H / 14 D ^⑤	Any recognized VOC Method
>200 ug/kg	EnCore or equivalent	5035 - Section 6.2.2.3 ^⑥	EnCore or equivalent	5035 - 6.1.3 ^{⑥,⑦}	4°C	5035 - Sections 7.3.2 & 7.3.3 ^⑥	48 H / 14 D ^⑤	Any recognized VOC Method
>200 ug/kg ^⑧	Coring Device	5035 - Section 6.2.2.3 ^⑧	Glass Vial w/ PTFE-silicone Septum	6.1.3 ^⑧	Methanol/PEG + 4°C	5035 - Section 7.3.4	14 D	Any recognized VOC Method
	Conventional Devices	DEP SOP - Section 4.3	Glass w/ PTFE-silicone Septum	6.1.2	4°C	5035 - Sections 7.3.1 - 7.3.3	14 D	Any recognized VOC Method
Oily Waste	Conventional Devices	5035 - Section 6.2.4.2	Glass w/ PTFE-silicone Septum	6.1.4	4°C	5035 - Sections 7.4.1 - 7.4.2	14 D	Any recognized VOC Method
	Conventional Devices	5035 - Section 6.2.4.1	Glass w/ PTFE-silicone Septum	6.1.4	Methanol/PEG + 4°C	5035 - Sections 7.4.3	14 D	Any recognized VOC Method
Dry Wt.	Conventional Devices		Glass with Teflon liner		4°C	5035 - Section 7.5		
Soil Screen	Conventional Devices	DEP SOP - Section 4.3	Glass w/ PTFE-silicone Septum		4°C	5035 - Section 7.1	14 D	Any recognized VOC Method

Table FS 1000-7

Sample Handling, Preservation and Holding Time Table for SW 846 Method 5035

- ① Maximum time allowable from time/date of collection to sample analysis.
- ② Eliminate 6.1.1.2; use only organic-free water.
- ③ Contents of sampling device must be transported to the laboratory at 4°C and stored at -10°C.
- ④ In order to ensure that vials do not break during freezing, they should be stored on their side or at a slanted angle to maximize surface area.
- ⑤ Maximum allowable time at 4°C is 48 hours; maximum allowable time to sample analysis is 14 days (from time of sample collection).
- ⑥ Conducted in the laboratory.
- ⑦ Entire contents of sampling device are extruded into the sample analysis vial containing the appropriate solvent.
- ⑧ Procedures are limited only to those situations or programs in which the maximum contamination level does not exceed 200 ug/kg.
- ⑨ Methanolic preservation in the field is not recommended, but may be used if approved by an DEP program.

FS 1000-8
Preservation Methods and Holding Times for Drinking Water Samples that Differ from 40 CFR Part 136, Table II

Analyte	Preservation ¹	Holding Time ²	Holding Time for Extract ³	Container ⁴
MICROBIOLOGICAL-BACTERIA	Cool < 10°C, Na ₂ S ₂ O ₃ ⁵			P or G
Total Coliforms, fecal coliforms & <i>E. coli</i> in drinking water	Cool < 10°C ⁶ , Na ₂ S ₂ O ₃ ⁵	30 Hours ⁷		P or G
Total coliforms and fecal coliforms in source water Heterotrophic bacteria in drinking water	Cool < 10°C, Na ₂ S ₂ O ₃ ⁵	8 hours		P or G
Gross Alpha	Conc. HCl or HNO ₃ to pH <2 ^{8,9}	6 mo		P or G
Gross beta	Conc. HCl or HNO to pH <2 ^{8,9}	6 mo		P or G
Strontium-89	Conc. HCl or HNO to pH <2 ^{8,9}	6 mo		P or G
Strontium-90	Conc. HCl or HNO to pH <2 ^{8,9}	6 mo		P or G
Radium-226	Conc. HCl or HNO to pH <2 ^{8,9}	6 mo		P or G
Radium-228	Conc. HCl or HNO to pH <2 ^{8,9}	6 mo		P or G
Cesium-134	Concentrated HCl to pH <<2 ^{8,9}	6 mo		P or G
Iodine-131	None	8 da		P or G
Tritium	None	6 months		G
Uranium	Conc. HCl or HNO ₃ to pH <2 ^{8,9}	6 mo		P or G
Photon emitters	Conc. HCl or HNO ₃ to pH <2 ^{8,9}	6 mo		P or G
Asbestos	Cool 4°C	48 hours		P or G
Bromate	Ethylenediamine (50mg/L)	28 days		P or G
Cyanide	Cool, 4C, Ascorbic acid (if chlorinated), NaOH pH>12	14 days		P or G
Nitrate	Cool, 4°C	48 hours		P or G
Nitrate (chlorinated source)	Cool, 4°C	14 days		P or G
Odor	Cool 4°C	24 hours		G
502.2	Sodium Thiosulfate or Ascorbic Acid, 4°C HCl pH<2 if Ascorbic Acid is used	14 days		Glass with PTFE Lined Septum

FS 1000-8

Preservation Methods and Holding Times for Drinking Water Samples that Differ from 40 CFR Part 136, Table II

Analyte	Preservation ¹	Holding Time ²	Holding Time for Extract ³	Container ⁴
504.1	Sodium Thiosulfate Cool, 4°C,	14 days	4°C, 24 hours	Glass with PFTE-Lined Septum
505	Sodium Thiosulfate Cool, 4°C	14 days (7 days for Heptachlor)	4°C, 24 hours	Glass with PFTE-Lined Septum
506	Sodium Thiosulfate Cool, 4°C, Dark	14 days	4°C, dark, 14 days	Amber Glass with PFTE-lined Cap
507	Sodium Thiosulfate Cool, 4°C, Dark	14 days (see method for exceptions)	4°C, dark, 14 days	Amber Glass with PFTE-lined Cap
508	Sodium Thiosulfate Cool, 4°C, Dark	7 days (see method for exceptions)	4°C, dark, 14 days	Glass with PFTE-lined Cap
508A	Cool, 4°C	14 days	30 days	Glass with PFTE-lined Cap
508.1	Sodium Sulfite, HCl pH<2, Cool, 4°C	14 days (see method for exceptions)	30 days	Glass with PFTE-lined Cap
515.1	Sodium Thiosulfate Cool, 4°C, Dark	14 days	4°C, dark, 28 days	Amber Glass with PFTE-lined Cap
515.2	Sodium Thiosulfate HCl pH<2, Cool, 4°C, Dark	14 days	≤ 4°C, dark, 14 days	Amber Glass with PFTE-lined Cap
515.3	Sodium Thiosulfate HCl pH<2, Cool, 4°C, Dark	14 days	≤ 4°C, dark, 14 days	Amber Glass with PFTE-lined Cap
515.4	Sodium Sulfite, HCl pH<2, Cool, ≤10°C for first 48 hours ≤6°C thereafter, Dark	14 days	≤0°C, 21 days	
524.2	Ascorbic Acid, HCl pH<2, Cool 4°C	14 days		Glass with PFTE-lined Septum
525.2	Sodium Sulfite, Dark, Cool, 4°C, HCl pH<2	14 days (see method for exceptions)	≤ 4°C, 30 days from collection	Amber Glass with PFTE-lined Cap
531.1, 6610	Sodium Thiosulfate Monochloroacetic acid, pH<3, Cool, 4°C	Cool 4°C, 28 days		Glass with PFTE-lined Septum
531.2	Sodium Thiosulfate, Potassium Dihydrogen Citrate buffer to pH 4,	28 days		

FS 1000-8

Preservation Methods and Holding Times for Drinking Water Samples that Differ from 40 CFR Part 136, Table II

Analyte	Preservation ¹	Holding Time ²	Holding Time for Extract ³	Container ⁴
	dark, ≤10°C for first 48 hr, ≤6°C thereafter			
547	Sodium Thiosulfate Cool, 4°C	14 days (18 mo. frozen)		Glass with PTFE-lined Septum
548.1	Sodium Thiosulfate (HCl pH 1.5-2 if high biological activity), Cool, 4°C, Dark	7 days	≤4°C 14 days	Amber Glass with PTFE-lined Septum
549.2	Sodium Thiosulfate (H ₂ SO ₄ pH<2 if biologically active), Cool, 4°C, Dark	7 days	21 days	High Density Amber Plastic or Silanized Amber Glass
550, 550.1	Sodium Thiosulfate Cool, 4°C, HCl pH<2	7 days	550, 30 days 550.1, 40 days Dark, 4°C	Amber Glass with PTFE-lined Cap
551.1	Sodium Thiosulfate, Sodium Sulfite, Ammonium Chloride, pH 4.5-5.0 with phosphate buffer, Cool, 4°C	14 days		Glass with PTFE-lined Septum
552.1	Ammonium chloride, Cool, 4°C, Dark	14 days	≤4°C, dark 48 hours	Amber Glass with PTFE-lined cap
552.2	Ammonium chloride, Cool, 4°C, Dark	14 days	≤4°C, dark 7 days ≤-10°C 14 days	Amber Glass with PTFE-lined cap
555	Sodium Sulfite, HCl, pH ≤ 2, Dark, Cool 4°C	14 days		Glass with PTFE-lined cap
1613B	Sodium Thiosulfate, Cool, 0-4°C, Dark		Recommend 40 days	Amber Glass with PTFE-lined Cap

¹ Preservation, when required, must be done immediately upon sample collection.

² Stated values are the maximum regulatory holding times. Sample processing must begin by the stated time.

³ Stated time is the maximum time a prepared sample extract may be held before analysis.

⁴ (P) polyethylene or (G) or glass. For microbiology, plastic sample containers must be made of sterilizable materials (poly-propylene or other autoclavable plastic).

⁵ Addition of sodium thiosulfate is only required if the sample has a detectable amount of residual chlorine, as indicated by a field test using EPA Method 330.4 or 330.2 or equivalent.

FS 1000-8

Preservation Methods and Holding Times for Drinking Water Samples that Differ from 40 CFR Part 136, Table II

- ⁶ Temperature requirement applies only to source water samples, however once received by the laboratory, if sample processing does not begin on the same working day, samples must be refrigerated.
- ⁷ If samples are analyzed after 30 hours, but within 48 hours of collection, the laboratory is to indicate in the analytical report that the data may be invalid because of excessive delay in sample processing. No samples received after 48 hours are to be accepted or analyzed for compliance with the regulations of the Department of Environmental Protection or the Department of Health.
- ⁸ It is recommended that the preservative be added at the time of collection unless suspended solids activity is to be measured. It is also recommended that samples be filtered, if suspended or settleable solids are present, prior to adding preservative, at the time of collection. However, if the sample has to be shipped to a laboratory or storage area, acidification of the sample (in its original container) may be delayed for a period not to exceed 5 days. A minimum of 16 hours must elapse between acidification and analysis.
- ⁹ If HCl is used to acidify samples, which are to be analyzed for gross alpha or gross beta activities, the acid salts must be converted to nitrate salts before transfer of the samples to planchets.

Table FS 1000-9
Containers, Preservation and Holding Times for Biosolids Samples and Protozoans

<i>ANALYTE NAME</i>	<i>CONTAINER</i>	<i>PRESERVATION</i>	<i>MAX HOLDING TIME</i>
Fecal Coliform	Plastic or Glass	Cool 4°C	24 hours
Salmonella	Plastic or Glass	< 10°C	24 hours
Enteric Viruses	Plastic or Glass	Up to 25°C	2 hours
Enteric Viruses	Plastic or Glass	2 to 10°C	48 hours
Specific Oxygen Uptake Rate	Plastic or Glass	None	As Soon As Possible
Helminth OVA	Plastic or Glass	< 4°C (Do not Freeze)	24 hours
Cryptosporidium/Giardia	Plastic or Glass	0 - 8°C (Do not Freeze)*	96 Hours
Total Solids	Plastic or Glass	≤6°C (Do not Freeze)	7 days
Metallics	Plastic or Glass	See Tables FS 1000-4, FS 1000-5 and FS 1000-6	
Other Inorganic Pollutants	Plastic or Glass	See Tables FS 1000-4, FS 1000-5 and FS 1000-6	

***Dechlorinate bulk samples when applicable**

Table FS 1000-10
Container Materials, Preservation, and Holding Times for Fish and Shellfish

Analyte	Matrix	Sample Container	Field (Transport to Lab)		Laboratory	
			Preservation	Maximum Shipping Time	Storage	Holding Time
	Whole Organism (Fish, shellfish, etc.)	Foil-wrap each organism (or composite for shellfish) and transport in waterproof plastic bag	Cool in wet ice or: ----- Freeze on dry ice	24 hours ----- 48 hours		
Mercury	Tissue (fillets and edible portions, homogenates)	Plastic, borosilicate glass, quartz, PTFE			Freeze at <-20°C	28 days
Other metals	Tissue (fillets and edible portions, homogenates)	Plastic, borosilicate glass, quartz, PTFE			Freeze at <-20°C	6 months
Organics	Tissue (fillets and edible portions, homogenates)	Borosilicate glass, PTFE, quartz, aluminum foil			Freeze at <-20°C	1 year
Dioxin	Tissue (fillets and edible portions, homogenates)	Amber containers: Borosilicate glass, PTFE, quartz, aluminum foil			Freeze at <-20°C	30 days until extraction, 15 days after extraction
Lipids	Tissue (fillets and edible portions, homogenates)	Plastic, borosilicate glass, quartz, PTFE			Freeze at <-20°C	1 year

PTFE = Polytetrafluoroethylene (Teflon)

Table FS 1000-11
Holding Times for SPLP or TCLP Extraction, Sample Preparation and Determinative Analysis

Holding Time (Days)				
	From: Field Collection	From: SPLP or TCLP Extraction	From: Preparative Extraction	Total Elapsed Time
	To: SPLP or TCLP Extraction	To: Preparative Extraction	To: Determinative Analysis	
Volatiles	14	NA	14	28
Semi-Volatiles	14	7	40	61
Mercury	28	NA	28	56
Metals, except Mercury	180	NA	180	360

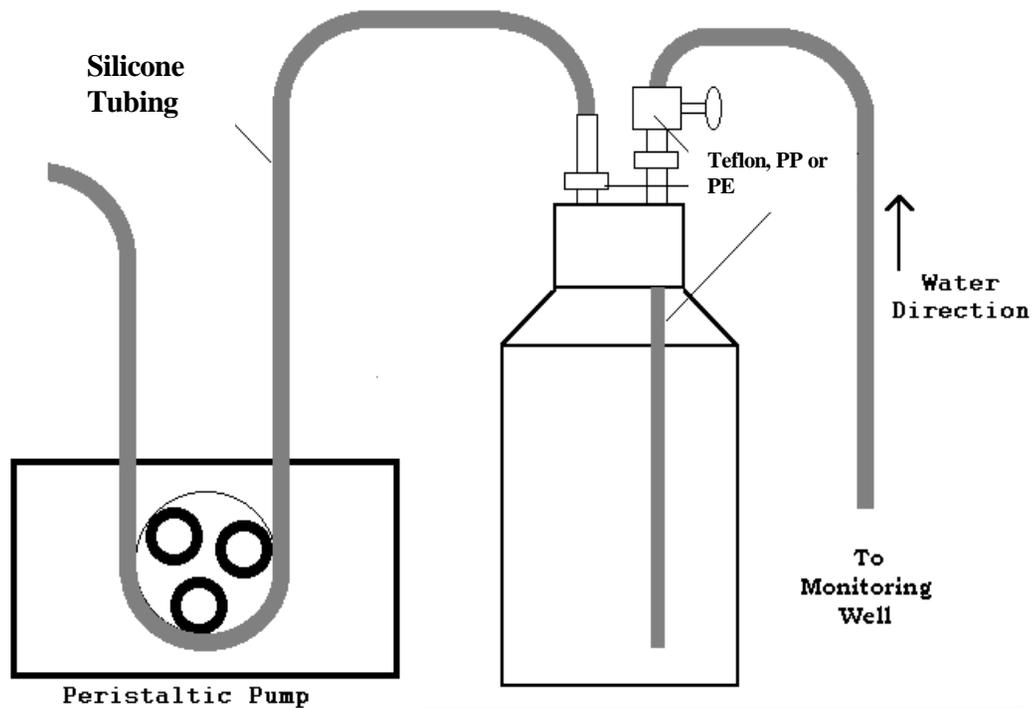
NA – Not Applicable

**Table FS 1000-12
 Preventive Maintenance Tasks**

INSTRUMENT/ACTIVITY	FREQUENCY
REFRIGERATORS, INCUBATORS, OVENS	
Clean interior	Monthly
Check thermometer temperature against certified thermometer or equivalent	Annually
ANYTICAL BALANCES	
Clean pan and compartment	Daily ¹
Check with Class S weights	Monthly
Manufacturer cleaning and calibration	Annually
pH AND ION SELECTIVE ELECTRODES	
PROBE	
Check probe for cracks and proper levels of filling solution; check reference junction; clean electrode	Daily, Replace as necessary
Check response time	Daily ¹
METER	
Check batteries and electronics for loose connections and cracked leads	Daily ¹ , Replace as necessary
TURBIDIMETER	
Clean instrument housing	Monthly
Clean cells	Daily ¹
CONDUCTIVITY METER	
Check batteries and probe cables	Daily ¹
Replatinize Probe	Per manufacturer's recommendations
DISSOLVED OXYGEN METERS	
PROBE	
Check membrane for deterioration; check filling solution	Daily ¹ , Replace as necessary
METER	
Battery level and electronics checked	Daily ¹ , Replace as necessary
THERMOMETERS	
Check for cracks and gaps in the mercury	Daily ¹ , Replace as necessary
TEMPERATURE PROBE	
Check connections, cables	Daily ¹
Check against calibrated thermometer	Daily ¹
AUTOMATIC SAMPLE COLLECTION SYSTEMS (e.g., ISCO, Sigma)	
Check sampler operation (forward, reverse, automatic through three cycles of the purge-pump-purge cycle)	Daily ¹ Prior to Sampling Event
Check purge-pump-purge cycle when sampler is installed	Daily ¹ Prior to Sampling Event
Check the flow pacer that activates the sampler to assure proper operation	Daily ¹ Prior to Sampling Event
Check desiccant	Daily ¹ , Replace as Necessary
Check batteries	Daily ¹ , Replace as Necessary
Check pumping rate against manufacturer's specifications	Daily ¹ , Replace as Necessary

¹Daily is defined as prior to use or a 12-hour period if equipment is run continuously

Figure FS 1000-1
Organic Trap Configuration for Collecting Extractable Organics with a Peristaltic Pump



The glass sample bottle must be threaded to use a reusable sampling cap lined and installed with fittings made of Teflon, polypropylene or polyethylene, similar to the design shown.

FS 2200. Groundwater Sampling

1. INTRODUCTION AND SCOPE

1.1 Use these Standard Operating Procedures to collect groundwater samples. They are designed to ensure that the collected samples will be representative of water in the aquifer or target formation and that the samples have not been altered or contaminated by the sampling and handling procedures. These procedures apply to permanently and temporarily installed monitoring wells, wells constructed using "direct-push" techniques, wells with installed plumbing, remedial groundwater treatment systems and excavations where groundwater is present. Use of alternative, DEP-approved and properly documented procedures (e.g., Corporate SOP, ASTM Standards, alternative equipment, etc.) is acceptable if they meet the intent (e.g., sample representativeness and integrity) of this standard (see FA 1000).

1.2 The topics in this SOP include equipment and supply selection, equipment construction materials, and purging and sampling techniques.

1.3 Use the following DEP SOPs in conjunction with FS 2200:

- FA 1000 Regulatory Scope and Administrative Procedures for Use of DEP SOPs
- FC 1000 Cleaning/Decontamination Procedures
- FD 1000 Documentation Procedures
- FQ 1000 Field Quality Control Requirements
- FS 1000 General Sampling Procedures
- FS 2000 General Aqueous Sampling
- FT 1000 Field Testing and Measurement
- FT 1100 Field pH
- FT 1200 Field Specific Conductance
- FT 1400 Field Temperature
- FT 1500 Field Dissolved Oxygen
- FT 1600 Field Turbidity

2. Groundwater samples may be collected from a number of different configurations. Each configuration is associated with a unique set of sampling equipment requirements and techniques:

3. Wells without Plumbing: These wells require that equipment be brought to the well to purge and sample unless dedicated equipment is placed in the well.

4. Wells with In-Place Plumbing: Wells with in-place plumbing do not require that equipment be brought to the well to purge and sample. In-place plumbing is generally considered permanent equipment routinely used for purposes other than purging and sampling, such as for water supply. They are generally found at wellfields, industrial facilities, and private residences. See FS 2300 for procedures to sample potable water wells. Air Strippers or Remedial Systems: These types of systems are installed as remediation devices. Sample these wells like drinking water wells (see FS 2300).

FS 2201 *Equipment and Supplies*

Use groundwater purging and sampling equipment constructed of only non-reactive, non-leachable materials that are compatible with the environment and the selected analytes. In selecting groundwater purging and sampling equipment, give consideration to the depth of the well, the depth to groundwater, the volume of water to be evacuated, the sampling and purging technique, and the analytes of interest. Refer to Tables FS 1000-1, FS 1000-2, FS 1000-3 and FS 2200-1 for selection of appropriate equipment.

Additional supplies such as reagents, preservatives, and field measurement equipment are often necessary.

1. **FLOW CONTAINER:** DEP recommends using a flow-through cell or container when collecting measurements for purging stabilization. The design must ensure that fresh formation water continuously contacts the measuring devices and does not aerate the sample or otherwise affect the groundwater properties.
2. **PUMPS:** All pumps or pump tubing must be lowered and retrieved from the well slowly and carefully to minimize disturbance to the formation water. This is especially critical at the air/water interface. Avoid the resuspension of sediment particles (turbidity) at the bottom of the well or adhered to the well casing during positioning of the pump or tubing.

2.1 Above-Ground Pumps

2.1.1 Variable Speed Peristaltic Pump: Use a variable speed peristaltic pump to purge groundwater from wells when the static water level in the well is no greater than 20-25 feet below land surface (BLS). If the water levels are deeper than 18-20 feet BLS, the pumping velocity will decrease.

2.1.1.1 A variable speed peristaltic pump can be used for normal purging and sampling (see FS 2213 and FS 2221), sampling low permeability aquifers or formations (see FS 2222) and collecting filtered groundwater samples (see FS 2225, section 1).

2.1.1.2 Most analyte groups can be sampled with a peristaltic pump if the tubing and pump configurations are appropriate. See Table FS 1000-3 for proper tubing selection and pump configurations.

2.1.2 Variable Speed Centrifugal Pump: A variable speed centrifugal pump can be used to purge groundwater from 2-inch and larger internal diameter wells. Do not use this type of pump to collect groundwater samples.

2.1.2.1 When purging is complete, do not allow the water that remains in the tubing to fall back into the well. Install a check valve at the end of the purge tubing, and withdraw the tubing slowly from the well while the pump is still running.

2.1.2.2 See Table FS 1000-3 for proper tubing selection and allowable analyte groups.

2.2 Submersible Pumps

2.2.1 Variable Speed Electric Submersible Pump: A variable speed submersible pump can be used to purge and sample groundwater from 2-inch and larger internal diameter wells.

2.2.1.1 A variable speed submersible pump can be used for normal purging and sampling (see FS 2213 and FS 2221), sampling low permeability aquifers or

formations (see FS 2222) and collecting filtered groundwater samples (see FS 2225, section 1).

2.2.1.2 Make sure that the pump housing, fittings, check valves and associated hardware are constructed of stainless steel. Make sure that any other materials are compatible with the analytes of interest. See Table FS 1000-3 for restrictions.

2.2.1.3 Install a check valve at the output side of the pump to prevent backflow.

2.2.1.4 If purging and sampling for organics:

- The entire length of the delivery tube must be Teflon, Polyethylene or Polypropylene (PP) tubing.
- The electrical cord must be sealed in Teflon, Polyethylene or PP and any cabling must be sealed in Teflon, Polyethylene or PP, or be constructed of stainless steel.
- All interior components that contact the sample water (impeller, seals, gaskets, etc.) must be constructed of stainless steel or Teflon.

2.2.2 Variable Speed Bladder Pump: A variable speed positive displacement bladder pump (no-gas contact) can be used to purge and sample groundwater from 3/4-inch and larger internal diameter wells.

2.2.2.1 A variable speed bladder pump can be used for normal purging and sampling (see FS 2213 and FS 2221), sampling low permeability aquifers or formations (see FS 2222) and collecting filtered groundwater samples (see FS 2225, section 1).

2.2.2.2 The bladder pump system is composed of the pump, the compressed air tubing, the water discharge tubing, the controller and a compressor or compressed gas supply.

2.2.2.3 The pump consists of a bladder and an exterior casing or pump body that surrounds the bladder and two (2) check valves. These parts can be composed of various materials, usually combinations of polyvinyl chloride (PVC), Teflon, Polyethylene, PP and stainless steel. Other materials must be compatible with the analytes of interest. See Table FS 1000-3 for restrictions.

2.2.2.4 If purging and sampling for organics:

- The pump body must be constructed of stainless steel and the valves and bladder must be Teflon, Polyethylene or PP.
- The entire length of the delivery tube must be Teflon, Polyethylene or PP.
- Any cabling must be sealed in Teflon, Polyethylene or PP, or be constructed of stainless steel.
- Permanently installed pumps may have a PVC pump body as long as the pump remains in contact with the water in the well.

3. BAILERS:

3.1 Purging: DEP does not recommend using bailers for purging unless no other equipment can be used or purging with a bailer has been specifically authorized by a DEP program, permit, contract or order (see Table FS 2200-3). Use a bailer if there is non-aqueous phase liquid (free product) in the well or non-aqueous phase liquid is suspected to

be in the well. If in doubt about the appropriateness of using a bailer at a site or during a particular sampling event, contact the appropriate DEP program or project manager. If a bailer is used, follow FS 2213, section 4, with no deviations.

3.2 Sampling: Bailers may be used to routinely collect some analyte groups or under specific circumstances for other analyte groups (see Table FS 2200-3).

3.3 Construction and Type:

3.3.1 Bailers must be constructed of materials compatible with the analytes of interest. See Table FS 1000-3 for restrictions.

3.3.2 Stainless steel, Teflon, Polyethylene and PP bailers may be used to sample all analytes.

3.3.3 Use disposable bailers when sampling grossly contaminated sample sources.

3.3.4 DEP recommends using dual check valve bailers when collecting samples.

3.3.5 Use bailers with a controlled flow bottom when collecting volatile organic samples.

3.3.6 Use bailers that can be pressurized when collecting filtered samples for metals.

3.4 Contamination Prevention:

3.4.1 Keep the bailer wrapped (foil, butcher paper, etc.) until just before use.

3.4.2 Use protective gloves to handle the bailer once it is removed from its wrapping.

3.4.3 Handle the bailer by the lanyard to minimize contact with the bailer surface.

4. LANYARDS

4.1 Lanyards must be made of non-reactive, non-leachable material such as cotton twine, nylon, or stainless steel; or, coated with Teflon, Polyethylene or PP.

4.1.1 Evaluate the appropriateness of the lanyard material with analyses of equipment blanks for the analytes of interest, as necessary.

4.2 Discard cotton twine, nylon, and non-stainless steel braided lanyards after sampling each monitoring well.

4.3 Decontaminate stainless steel, coated Teflon, Polyethylene and PP lanyards between monitoring wells (see FC 1003). They do not need to be decontaminated between purging and sampling operations.

4.4 Securely fasten lanyards to downhole equipment (bailers, pumps, etc.).

4.5 Do not allow lanyards used for downhole equipment to touch the ground surface.

FS 2210. GROUNDWATER PURGING

Perform procedures in the following sections to calculate purging parameters and to purge groundwater from monitoring wells, wells with installed plumbing, high-volume wells, air stripper systems and other remedial treatment systems.

FS 2211 *Water Level and Purge Volume Determination*

Collect representative groundwater samples from the aquifer. The amount of water that must be purged from a well is determined by the volume of water and/or field parameter stabilization.

1. GENERAL EQUIPMENT CONSIDERATIONS

1.1 Selection of appropriate purging equipment depends on the analytes of interest, the well diameter, transmissivity of the aquifer, the depth to groundwater and other site conditions.

1.2 Use a pump to purge the well.

1.3 Use a bailer if there is non-aqueous phase liquid in the well or non-aqueous phase liquid is suspected to be in the well.

1.4 Bailers may be used if approved by a DEP program, or if bailer use is specified in a permit, contract or DEP order (see Table FS 2200-3). If used, bailers must be of appropriate type and construction, and the user must follow the procedure outlined in FS 2213, section 4, with no deviations. If in doubt about the appropriateness of using a bailer at a site or during a particular sampling event, contact the appropriate DEP program or project manager. DEP does not recommend using bailers because improper bailing:

1.4.1 Introduces atmospheric oxygen which precipitates metals (i.e., iron) or causes other changes in the chemistry of the water in the sample (i.e., pH)

1.4.2 Agitates groundwater which biases volatile and semi-volatile organic analyses due to volatilization

1.4.3 Agitates the water in the aquifer and resuspends fine particulate matter

1.4.4 Surges the well, loosening particulate matter in the annular space around the well screen

1.4.5 Introduces dirt into the water column if the sides of the casing wall are scraped

2. INITIAL INSPECTION

2.1 Verify the identification of the monitoring well by examining markings, sign plates, placards or other designations.

2.2 Remove the well cover and remove all standing water around the top of the well casing (manhole) before opening the well cap.

2.3 Inspect the exterior protective casing of the monitoring well for damage and document the results of the inspection if there is a problem.

2.4 It is recommended that you place a protective covering around the well head. Replace the covering if it becomes soiled or ripped.

2.5 Inspect the well lock and determine whether the cap fits tightly. Replace the cap if necessary.

3. WATER LEVEL MEASUREMENTS: Use an electronic probe or chalked tape to determine the water level.

3.1 General Procedures

Perform these steps using either the electronic probe or chalked tape method.

3.1.1 Decontaminate all equipment that will contact the groundwater in the well before use.

3.1.2 Measure the depth to groundwater from the top of well casing to the nearest 0.01 foot and always measure from the same reference point or survey mark on the well casing. If there is no reference mark, measure from the north side of the casing.

3.1.3 Record the measurement and the reference point.

3.2 Electronic Probe

3.2.1 Follow the manufacturer's instructions for use.

3.2.2 Record the measurement.

3.3 Chalked Line Method: This method is not recommended if collecting samples for organic or inorganic parameters.

3.3.1 Lower chalked tape into the well until the lower end is in the water (usually determined by the sound of the weight hitting the water).

3.3.2 Record the length of the tape relative to the reference point (see section 3.2 above).

3.3.3 Quickly remove the tape from the well.

3.3.4 Record the length of the wetted portion to the nearest 0.01 foot.

3.3.5 Determine the depth to water by subtracting the length of the wetted portion (see section 3.5.3 above) from the total length (see section 3.5.2 above). Record the result.

4. WATER COLUMN DETERMINATION

4.1 Do not determine the total depth of the well by lowering the probe to the bottom of the well immediately before purging and sampling. If the well must be sounded, delay purging and sampling activities for at least 24 hours after the well was sounded or for a time sufficient to meet the purge stabilization criterion for turbidity. Alternatively, collect samples before sounding the well.

4.2 Subtract the depth to the top of the water column from the total well depth to determine the length of the water column.

4.3 The total well depth depends on the well construction. Some wells may be drilled in areas of sinkhole or karst formations or rock leaving an open borehole. Attempt to find the total borehole depth in cases where there is an open borehole below the cased portion.

5. WELL WATER VOLUME

5.1 Calculate the total volume of water in gallons in the well using the following equation:

$$V = (0.041)d \times d \times h$$

Where: V = volume in gallons

d = well diameter in inches

h = height of the water column in feet

5.2 The total volume of water in the well may also be determined with the following equation by using a casing volume per foot factor (Gallons per Foot of Water) for the appropriate diameter well:

$$V = [\text{Gallons per Foot of Water}] \times h$$

Where: V = volume in gallons

h = height of the water column in feet

Casing Internal Diameter	Approximate Gallons per Foot of Water
0.75"	0.02
1"	0.04
1.25"	0.06
2"	0.16
3"	0.37
4"	0.65
5"	1.02
6"	1.47
12"	5.88

5.3 Record all measurements and calculations in the field records.

6. Purging Equipment Volume

Calculate the total volume of the pump, associated tubing and container that is used for in situ measurements (flow container), if used, using the following equation:

$$V = p + ((0.041)d \times d \times l) + fc$$

- Where:
- V = volume in gallons
 - p = volume of pump in gallons
 - d = tubing diameter in inches
 - l = length of tubing in feet
 - fc = volume of flow cell in gallons

7. When collecting samples from multiple wells on a site, if the groundwater elevation data are to be used to construct groundwater elevation contour maps, all water level measurements must be taken within the same 24-hour time interval unless a shorter time period is required by a DEP program. If the site is tidally influenced, complete the water level measurements within the time frame of an incoming or outgoing tide.

FS 2212 *Well Purging Techniques*

The selection of the purging technique and equipment is dependent on the hydrogeologic properties of the aquifer, especially depth to groundwater and hydraulic conductivity. The intent of proper purging is to stabilize the water level in the well and minimize the hydraulic stress to the hydrogeologic formation.

Every attempt must be made to match the pumping rate with the recharge rate of the well before evaluating the purging completion criteria.

A flowchart which summarizes purging procedure options is presented in Figure FS 2200-2.

Select equipment using the construction and configuration requirements specified in Table FS 2200-1. See the discussions in FS 2201.

1. MEASURING THE PURGE VOLUME: The volume of water that is removed during purging must be recorded. Measure the volume during the purging operation.

1.1 Collect the water in a graduated container and multiply the number of times the container was emptied by the volume of the container, or

1.2 Estimate the volume based on pumping rate. Use this technique only if the pumping rate is constant. Determine the pumping rate by measuring the amount of water that is pumped for a fixed period of time or use a flow meter.

1.2.1 Calculate the amount of water that is discharged per minute:

$$D = \frac{\text{Measured amount}}{\text{Total time in minutes}}$$

1.2.2 Calculate the time needed to purge one (1) well volume or one (1) purging equipment volume:

$$\text{Time} = \frac{V}{D}$$

Where: V = well volume determined from FS 2211, section 5, or purging equipment volume

D = discharge rate calculated in section 1.2.1. above

1.2.3 Make new measurements (see section 1.2.1 above) each time the pumping rate is changed, or

1.3 Use a totalizing flow meter.

1.3.1 Record the reading on the totalizer prior to purging.

1.3.2 Record the reading on the totalizer at the end of purging.

1.3.3 Subtract the reading on the totalizer prior to purging from the reading on the totalizer at the end of purging to obtain the volume purged.

1.4 Record in the field records the times that purging begins and ends.

2. Stabilization Measurement Frequency

2.1 Begin to record stabilization measurements after pumping the minimum volume as prescribed in options 2.3 – 2.5 below. Every attempt must be made to match the pumping rate with the recharge rate of the well before evaluating the purging criteria.

2.2 If the well screened interval is not known, use option 2.3, below.

2.3 Wells with Fully Submerged Screen and Pump or Intake Tubing Placed at the Top of the Water Column (conventional purge): Purge until the water level has stabilized (well recovery rate equals the purge rate), then purge a minimum of one (1) well volume prior to collecting measurements of the stabilization parameters. Allow at least one quarter (1/4) well volume to purge between subsequent measurements.

2.4 Wells with Fully Submerged Screen and Pump or Intake Tubing Placed Within the Screened Interval (minimizing purge volume): Purge until the water level has stabilized (well recovery rate equals the purge rate), then purge a minimum of one (1) volume of the pump, associated tubing and flow container (if used) prior to collecting measurements of the stabilization parameters. Take measurements of the stabilization parameters no sooner

than two (2) minutes apart. Purge at least three (3) volumes of the pump, associated tubing and flow container, if used, prior to collecting a sample.

If the water level drops into the screened interval during purging, lower the pump or tubing intake as in FS 2213, section 1.3 below and follow purging procedures for partially submerged well screens (2.5 below).

2.5 Wells with a Partially Submerged Well Screen: Purge until the water level has stabilized (well recovery rate equals the purge rate), then purge a minimum of one (1) well volume prior to collecting measurements of the stabilization parameters. Take measurements of the stabilization parameters no sooner than two (2) minutes apart.

3. PURGING COMPLETION: DEP recommends the use of a flow-through container to measure the stabilization parameters discussed below. Alternatively, measure all parameters *in situ* by inserting measurement probes into the well at the depth appropriate for the purging option. Purging is considered complete if the criteria in section 3.1, 3.2 or 3.3 below are satisfied. Make every attempt to satisfy the criteria in section 3.1. Every attempt must be made to match the pumping rate with the recharge rate of the well before evaluating the purging criteria.

3.1 Three (3) consecutive measurements of the five (5) parameters listed below must be within the stated limits. The measurements evaluated must be the last three consecutive measurements taken before purging is stopped. The range between the highest and the lowest values for the last three measurements of temperature, pH and specific conductance cannot exceed the stated limits. The last three consecutive measurements of dissolved oxygen and turbidity must all be at or below the listed thresholds.

- Temperature: $\pm 0.2^{\circ} \text{C}$
- pH: ± 0.2 Standard Units
- Specific Conductance: $\pm 5.0\%$ of reading
- Dissolved Oxygen: $\leq 20\%$ Saturation
- Turbidity: ≤ 20 NTU

3.2 Naturally occurring conditions may prevent attaining the $\leq 20\%$ saturation criterion for dissolved oxygen, typically in surficial aquifers. See section 3.5, below.

3.3 Naturally occurring conditions may prevent attaining the ≤ 20 NTU criterion for turbidity. However, when collecting groundwater samples for metals or certain inorganic (e.g., phosphorus forms) or extractable organic (e.g. polynuclear aromatic hydrocarbons) chemicals, make every attempt to reduce turbidity to ≤ 20 NTU to avoid a potential turbidity-associated bias for these analytes. See section 3.5, below.

3.4 Document and report the following, as applicable, except that the last four (4) items only need to be submitted once:

- Purging rate.
- Drawdown in the well, if any.
- Pump or tubing intake placement.
- Length and location of the screened interval.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.

- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

3.5 If the criteria in section 3.1 above for dissolved oxygen and/or turbidity cannot be met, then three (3) consecutive measurements of the five (5) parameters listed below must be within the stated limits.

3.5.1 The measurements evaluated must be the last three consecutive measurements taken before purging is stopped. The range between the highest and the lowest values for the last three measurements cannot exceed the stated limits.

- Temperature: $\pm 0.2^{\circ} \text{C}$
- pH: ± 0.2 Standard Units
- Specific Conductance: $\pm 5.0\%$ of reading
- Dissolved Oxygen: $\pm 0.2 \text{ mg/L}$ or 10%, whichever is greater
- Turbidity: $\pm 5 \text{ NTUs}$ or 10%, whichever is greater

3.5.2 Additionally, document and report the following, as applicable, except that the last four (4) items only need to be submitted once:

- Purging rate.
- Drawdown in the well, if any.
- Pump or tubing intake placement.
- Length and location of the screened interval.
- A description of conditions at the site that cause the dissolved oxygen to be high and/or dissolved oxygen measurements made within the screened or open borehole portion of the well with a downhole dissolved oxygen probe.
- A description of conditions at the site that cause the turbidity to be high and any procedures that will be used to minimize turbidity in the future.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.
- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

3.5.3 If from review of the submitted data the Department determines that both the elevated Dissolved Oxygen and Turbidity measurements are due to naturally occurring conditions, then only the first four (4) items are required to be submitted in future reports. However, if the Department cannot determine if the Dissolved Oxygen or Turbidity is elevated due to naturally occurring conditions, then in addition to the first four (4) items, a description of the conditions at the site that caused the affected parameter(s) to be high is required to be submitted in future reports.

3.6 If the stabilization parameters in either section 3.1 or 3.2 cannot be met, and all attempts have been made to minimize the drawdown, check the instrument condition and calibration, purging flow rate and all tubing connections to determine if they might be affecting the ability to achieve stable measurements. All measurements that were made during the attempt must be documented. The sampling team leader may decide whether or

not to collect a sample or to continue purging after five (5) well volumes (conventional purge section 2.1 or 2.3 above) or five (5) volumes of the screened interval (minimizing purge volumes in section 2.2 above).

Further, the report in which the data are submitted must include the following, as applicable, except that the last four (4) items only need to be submitted once:

- Purging rate.
- Pump or tubing intake placement.
- Length and location of the screened interval.
- Drawdown in the well, if any.
- A description of conditions at the site that caused the dissolved oxygen to be high and/or dissolved oxygen measurements made within the screened or open borehole portion of the well with a downhole dissolved oxygen probe.
- A description of conditions at the site that caused the turbidity to be high and any procedures that will be used to minimize turbidity in the future.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.
- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

If from review of the submitted data the DEP determines that both the elevated Dissolved Oxygen and Turbidity measurements are due to naturally occurring conditions, then only the first four (4) items are required to be submitted in future reports. However, if the DEP cannot determine if the Dissolved Oxygen or Turbidity is elevated due to naturally occurring conditions, then in addition to the first four (4) items, a description of the conditions at the site that caused the affected parameter(s) to be high is required to be submitted in future reports.

3.7 One fully dry purge (not recommended). This criterion applies only if purging was attempted per FS 2212, FS 2213, and section 3.4.1 below, and if it is impossible to balance the pumping rate with the rate of recharge at very low pumping rates (< 100 mL/minute).

3.7.1 If wells have previously and consistently purged dry, when purged according to FS 2212 and FS 2213, and the current depth to groundwater indicates that the well will purge dry during the current sampling event, minimize the amount of water removed from the well by using the same pump to purge and collect the sample:

- 3.7.1.1 Place the pump or tubing intake within the well screened interval.
- 3.7.1.2 Use very small diameter Teflon, Polyethylene or PP tubing and the smallest possible pump chamber volume to minimize the total volume of water pumped from the well and to reduce drawdown.
- 3.7.1.3 Select tubing that is thick enough to minimize oxygen transfer through the tubing walls while pumping.
- 3.7.1.4 Pump at the lowest possible rate (100 mL/minute or less) to reduce drawdown to a minimum.

- 3.7.1.5 Purge at least two (2) volumes of the pumping system (pump, tubing and flow cell, if used).
- 3.7.1.6 Measure pH, Specific Conductance, Temperature, Dissolved Oxygen and Turbidity and begin to collect the samples (see FS 2222).
4. Collect samples immediately after purging is complete.
- 4.1 The time period between completing the purge and sampling cannot exceed six (6) hours.
- 4.2 If sample collection does not occur within one (1) hour of purging completion, re-measure the five (5) field parameters Temperature, pH, Specific Conductance, Dissolved Oxygen and Turbidity just prior to collecting the sample.
- 4.2.1 If the measured values are not within 10 percent of the previous measurements, re-purge the well.
- 4.2.2 See section 3.4 above when collecting samples from wells that have purged dry.

FS 2213 *Purging Wells Without Plumbing (Monitoring Wells)*

1. TUBING/PUMP PLACEMENT

- 1.1 Do not lower the pump or intake hose (tubing) to the bottom of the well. Pump or tubing placement procedures will be determined by the purging option selected in FS 2212, section 2 above or FS 2214 below.
- 1.1.1 Minimizing Purge Volume: If the following conditions can be met, position the intake hose (tubing) or pump in the screened or open borehole interval.
- The same pump must be used for both purging and sampling,
 - The well screen or borehole interval must be less than or equal to 10 feet, and
 - The well screen or borehole must be fully submerged.
- 1.1.2 If the position or length of the screened interval or open borehole is unknown or estimated, place the intake hose (tubing) or pump to perform conventional purging in 1.2 below.
- 1.1.3 Position the pump or intake hose when purging large-diameter deep wells with open boreholes using the procedure in FS 2214 below.
- 1.2 Conventional Purging: Position the pump or intake tubing in the top one foot of the water column or no deeper than necessary for the type of pump.
- 1.2.1 If purging with a bailer, see section 4 below.
- 1.3 Partially Submerged Screened Interval: If the well screen or open borehole is partially submerged, and the pump will be used for both purging and sampling, position the pump or intake hose (tubing) in the portion of the water column within the submerged screened or open borehole interval.
- 1.3.1 If the position or length of the screened interval or open borehole is unknown or estimated, place the intake hose (tubing) or pump to perform conventional purging in 1.2 above.
- 1.3.2 Purge large-volume, high-recharge wells as in FS 2214 below.
- 1.3.3 If purging with a bailer, see section 4 below.

2. NON-DEDICATED (PORTABLE) PUMPS

2.1 Variable Speed Peristaltic Pump

- 2.1.1 Install a new, 1-foot maximum length of silicone tubing in the peristaltic pump head.
- 2.1.2 Attach a short section of tubing to the discharge side of the pump-head silicone tubing and into a graduated container.
- 2.1.3 Attach one end of a length of new or precleaned transport tubing to the intake side of the pump head silicone tubing.
- 2.1.4 Place the transport tubing in the monitoring well per one of the options in FS 2213, section 1 above.
- 2.1.5 Measure the depth to groundwater at frequent intervals.
- 2.1.6 Record these measurements.
- 2.1.7 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.
- 2.1.8 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.
- 2.1.9 If the water table continues to drop during pumping, lower the tubing at the approximate rate of drawdown so that the water is removed from the top of the water column.
- 2.1.10 Record the purging rate each time the rate changes.
- 2.1.11 Measure the purge volume by one of the methods outlined in FS 2212, section 1.
- 2.1.12 Record this measurement.
- 2.1.13 Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

2.2 Variable Speed Centrifugal Pump

- 2.2.1 Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.
- 2.2.2 Place the decontaminated suction hose so that water is always pumped from the top of the water column.
- 2.2.3 Equip the suction hose with a foot valve to prevent purge water from re-entering the well.
- 2.2.4 Measure the depth to groundwater at frequent intervals.
- 2.2.5 Record these measurements.
- 2.2.6 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.
- 2.2.7 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.
- 2.2.8 If the water table continues to drop during pumping, lower the tubing at the approximate rate of drawdown so that the water is removed from the top of the water column.

- 2.2.9 Record the purging rate each time the rate changes.
- 2.2.10 Measure the purge volume by one of the methods outlined in FS 2212, section 1.
- 2.2.11 Record this measurement.
- 2.2.12 Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

2.3 Variable Speed Electric Submersible Pump

- 2.3.1 Position fuel powered equipment downwind and at least 10 feet from the well head. Make sure that the exhaust faces downwind.
- 2.3.2 Carefully position the decontaminated pump per one of the options in FS 2213, section 1 above.
- 2.3.3 Measure the depth to groundwater at frequent intervals.
- 2.3.4 Record these measurements.
- 2.3.5 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.
- 2.3.6 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.
- 2.3.7 If the water table continues to drop during pumping, lower the tubing or pump at the approximate rate of drawdown so that the water is removed from the top of the water column.
- 2.3.8 Record the purging rate each time the rate changes.
- 2.3.9 Measure the purge volume by one of the methods outlined in FS 2212, section 1.
- 2.3.10 Record this measurement.
- 2.3.11 Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

2.4 Variable Speed Bladder Pump

- 2.4.1 Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.
- 2.4.2 Attach the tubing and carefully position the pump per one of the options in FS 2213, section 1 above.
- 2.4.3 Measure the depth to groundwater at frequent intervals.
- 2.4.4 Record these measurements.
- 2.4.5 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.
- 2.4.6 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.
- 2.4.7 If the water table continues to drop during pumping, lower the tubing or pump at the approximate rate of drawdown so that the water is removed from the top of the water column.
- 2.4.8 Record the purging rate each time the rate changes.

2.4.9 Measure the purge volume by one of the methods outlined in FS 2212, section 1.

2.4.10 Record this measurement.

2.4.11 Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

3. DEDICATED PORTABLE PUMPS: Place dedicated pumps per one of the options in FS 2213, section 1 above.

3.1 Variable Speed Electric Submersible Pump

3.1.1 Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

3.1.2 Measure the depth to groundwater at frequent intervals.

3.1.3 Record these measurements.

3.1.4 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

3.1.5 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal with the recharge rate.

3.1.6 Record the purging rate each time the rate changes.

3.1.7 Measure the purge volume by one of the methods outlined in FS 2212, section 1.

3.1.8 Record this measurement.

3.2 Variable Speed Bladder Pump

3.2.1 Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

3.2.2 Measure the depth to groundwater at frequent intervals.

3.2.3 Record these measurements.

3.2.4 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

3.2.5 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal with the recharge rate.

3.2.6 Record the purging rate each time the rate changes.

3.2.7 Measure the purge volume by one of the methods outlined in FS 2212, section 1.

3.2.8 Record this measurement.

4. BAILERS: DEP recommends against using bailers for purging except as a last contingency, or if free product is present in the well or suspected to be in the well. However, they may be used if approved by a DEP program, or specified in a permit, contract or DEP order (see Table FS 2200-3 and FS 2211, section 1.3). If in doubt about the appropriateness of using a bailer at a site or during a particular sampling event, contact the appropriate DEP program or project manager.

4.1 Minimize handling the bailer as much as possible.

4.1.1 Remove the bailer from its protective wrapping just before use.

4.1.2 Attach a lanyard of appropriate material (see FS 2201, section 4).

- 4.1.3 Use the lanyard to move and position the bailer.
- 4.2 Lower and retrieve the bailer slowly and smoothly.
- 4.3 Lower the bailer carefully into the well to a depth approximately a foot above the water column.
 - 4.3.1 Do not lower the top of the bailer more than one (1) foot below the top of the water table so that water is removed from the top of the water column. Ensure that the length of the bailer does not exceed the length of the water column.
 - 4.3.2 Allow time for the bailer to fill with aquifer water as it descends into the water column.
- 4.4 Carefully raise the bailer.
 - 4.4.1 Retrieve the bailer at the same rate of 2 cm/sec until the bottom of the bailer has cleared to top of the water column.
- 4.5 Measure the purge volume by one of the methods outlined in FS 2212, section 1.
 - 4.5.1 Record the volume of the bailer.
- 4.6 Continue to carefully lower and retrieve the bailer as described above until the purging completion conditions specified in FS 2212, section 3, have been satisfied.
 - 4.6.1 Remove at least one (1) well volume before collecting measurements of the field parameters. Take each subsequent set of measurements after removing at least one quarter (1/4) well volume between measurements.

FS 2214 *Purging Large-Volume, High-Recharge Wells With Portable Pumps*

If a well originally constructed for high-flow-rate pumping will be sampled as a monitoring well, use these guidelines to develop a purging procedure applicable to the specific details of the well construction. Typical wells constructed for this purpose may be deep, large-diameter wells with a section of open borehole. Evaluate each well on a case-by-case basis and consider any available information on the construction and hydraulic performance of the well.

1. PURGING PROCEDURE

- 1.1 Place the pump at the top of the open borehole segment of the well.
- 1.2 Start purging while monitoring stabilization parameters as in FS 2212, section 3 above.
- 1.3 Purge at least one equipment volume before measuring stabilization parameters.
- 1.4 If the well is being purged for the first time using these guidelines, monitor stabilization parameters for an extended period until confident that sufficient volume has been pumped from the open borehole to draw fresh formation water into the pump tubing and flow-through container. Use the information obtained from the first-time purging of the well to determine the pumping rate and duration of purging required for future sampling events at the well.
- 1.5 Purge at least three equipment volumes before evaluating purging completion.

2. PURGING COMPLETION

2.1 Complete the purging of the well when the last three consecutive measurements of the purge stabilization parameters have met the applicable criteria specified in FS 2212, section 3 above.

3. Collect samples from the well using the procedures in FS 2221, section 1 below.

FS 2215. *Purging Wells With Plumbing (production wells or permanently installed pumps equipped with sampling ports or sampling spigots)*

Wells with in-place plumbing are commonly found at municipal water treatment plants, industrial water supplies, private residences, etc. Depending on the sampling objective for collecting samples using installed plumbing, purge the system and collect samples closest to the point of consumption, or, as close to the source well as possible. When purging is required and the purge volume of the plumbing system is not known, purge the system until the purging completion criteria in FS 2212, section 3, have been met.

1. CONTINUOUSLY RUNNING PUMPS

1.1 Select the spigot that is closest to the pump and before any storage tanks (if possible).

1.2 Remove all hoses, aerators and filters (if possible).

1.3 Open the spigot and purge at maximum flow.

1.4 If a storage tank is located between the pump and the spigot, purge the volume of the tank, lines and spigot.

1.5 If the spigot is before any storage tank, purge until sufficient volume is removed to flush the stagnant water from the spigot and the tap line to the spigot.

1.6 Reduce the flow rate to ≤ 500 mL/minute (a 1/8" stream) or approximately 0.1 gal/minute before collecting samples. When sampling for volatile organic compounds, reduce the flow to ≤ 100 mL/minute before collecting the samples.

2. INTERMITTENTLY RUNNING PUMPS

2.1 Select the spigot that is closest to the pump and before any storage tanks (if possible).

2.2 Remove all hoses, aerators and filters (if possible).

2.3 Open the spigot and purge sufficient volume at a maximum, practical flow rate to flush the spigot and lines and until the purging completion criteria in FS 2212, section 3, have been met.

2.4 If a storage tank is located between the pump and the spigot, purge the volume of the tank, lines and spigot.

2.5 Ensure that the purge stabilization measurement of dissolved oxygen is not biased with aeration of the sample by a high flow rate in the flow-through container.

2.6 Reduce the flow rate to ≤ 500 mL/minute (a 1/8" stream) or approximately 0.1 gal/minute before collecting samples. When sampling for volatile organic compounds, reduce the flow to ≤ 100 mL/minute before collecting the samples.

FS 2216. *Purging Airstrippers and Remedial Treatment Systems*

If collecting samples for groundwater contamination monitoring, follow FS 2215 above.

FS 2220. GROUNDWATER SAMPLING TECHNIQUES

1. Purge wells using the techniques outlined in FS 2210.
2. Replace the protective covering around the well if it is soiled or torn after completing the purging operations.
3. EQUIPMENT CONSIDERATIONS

Follow all notes and restrictions as indicated in Table FS 2200-1 and as discussed in FS 2201.

NOTE: The only pumps that are currently approved for use in collecting volatile organic samples through the pump are stainless steel and Teflon variable speed submersible pumps, stainless steel and Teflon or Polyethylene variable speed bladder pumps, and permanently installed PVC bodied pumps (variable speed bladder or submersible pumps) as long as the pump remains in contact with the water in the well at all times.

- 3.1 Collect the sample into the sample container from the sampling device. **Do not** use intermediate containers.
- 3.2 In order to avoid contaminating the sample or loss of analytes from the sample:
- 3.3 Handle the sampling equipment as little as possible.
 - 3.3.1 Minimize the equipment that is exposed to the sample.
 - 3.3.2 Minimize aeration of samples collected for VOC analysis.
 - 3.3.3 Reduce sampling pump flow rates to ≤ 100 mL/minute when collecting VOC samples.
- 3.4 Dedicated Sampling Equipment
 - 3.4.1 Whenever possible, use dedicated equipment because it significantly reduces the chance of cross-contamination.
 - 3.4.2 Dedicated is defined as equipment that is to be used solely for one location for the life of that equipment (e.g., permanently mounted pump).
 - 3.4.3 All material construction and restrictions from Table FS 2200-1 also apply to dedicated equipment. Purchase equipment with the most sensitive analyte of interest in mind.
- 3.5 Cleaning/Decontamination
 - 3.5.1 Clean or ensure dedicated pumps are clean before installation. They do not need to be cleaned prior to each use but must be cleaned if they are withdrawn for repair or servicing.
 - 3.5.2 Clean or make sure any permanently mounted tubing is clean before installation.
 - 3.5.3 Change or clean tubing when the pump is withdrawn for servicing.
 - 3.5.4 Clean any replaceable or temporary parts as specified in FC 1000.
 - 3.5.5 Collect equipment blanks on dedicated pumping systems when the tubing is cleaned or replaced.
 - 3.5.6 Clean or ensure dedicated bailers are clean before placing them into the well.
 - 3.5.7 Collect an equipment blank on dedicated bailers before introducing them into the water column.

3.5.8 Suspend dedicated bailers above the water column if they are stored in the well.

FS 2221. *Sampling Wells Without Plumbing*

1. SAMPLING WITH PUMPS: Variable speed stainless steel and Teflon submersible pumps and stainless steel, Teflon or Polyethylene bladder pumps, and permanently installed PVC-bodied variable speed submersible or bladder pumps, as long as the pump remains in contact with the water in the well at all times, may be used to sample for all organics. The delivery tubing must be Teflon, Polyethylene or PP. **Extractable organics** may be collected through a peristaltic pump if ≤ 1 foot of silicone tubing is used in the pump head or a vacuum trap is used (see Figure FS 2200-1 for specific configuration). Follow all notes and restrictions as defined in Table FS 2200-1 and discussed in Equipment and Supplies (FS 2201) when using pumps to collect samples.

Do not lower the pump or tubing to the bottom of the well.

1.1 Peristaltic Pump

1.1.1 Volatile Organics Using Manual Fill and Drain Method: Collect volatile organics last. If the pump tubing is placed within the screened interval, the tubing cannot be reinserted into the well, and steps 1.1.1.3 through 1.1.1.6 below are prohibited.

- 1.1.1.1 Ensure that there is sufficient tubing volume to fill the requisite number of VOC vials.
- 1.1.1.2 Remove the drop tubing from the inlet side of the pump.
- 1.1.1.3 Submerge the drop tubing into the water column and allow it fill.
- 1.1.1.4 Remove the drop tubing from the well.
- 1.1.1.5 Prevent the water in the tubing from flowing back into the well.
- 1.1.1.6 Carefully allow the groundwater to drain by gravity into the sample vials. Avoid turbulence. Do not aerate the sample. The flow rate must be ≤ 100 mL/minute.
- 1.1.1.7 Repeat steps 1.1.1.3 - 1.1.1.6 until enough vials are filled.

1.1.2 Volatile Organics Using the Pump to Fill and Drain the Tubing: Collect volatile organics last. If the pump tubing is placed within the screened interval, the tubing cannot be reinserted into the well, and steps 1.1.2.2 through 1.1.2.8 below are prohibited.

- 1.1.2.1 Ensure that there is sufficient tubing volume to fill the requisite number of VOC vials.
- 1.1.2.2 Submerge the drop tubing into the water column.
- 1.1.2.3 Use the pump to fill the drop tubing.
- 1.1.2.4 Quickly remove the tubing from the pump.
- 1.1.2.5 Prevent the water in the tubing from flowing back into the well.
- 1.1.2.6 Remove the drop tubing from the well and fill the vials using the pump or gravity-drain methods in steps 1.1.2.7 or 1.1.2.8 below.
- 1.1.2.7 Reverse the flow on the peristaltic pump to deliver the sample into the vials at a slow, steady rate. The flow rate must be ≤ 100 mL/minute.

1.1.2.8 Or, remove the drop tubing from the inlet side of the pump and carefully allow the groundwater to drain into the sample vials. Avoid turbulence. Do not aerate the sample. The flow rate must be ≤ 100 mL/minute.

1.1.2.9 Repeat steps 1.1.2.2 through 1.1.2.8 until enough vials are filled.

1.1.3 Extractable Organics Collected Through Silicone Pump-Head Tubing:

1.1.3.1 Ensure that a 1-foot maximum length of new silicone tubing was installed in the peristaltic pump head assembly before the well was purged if the same pump is being used to purge and sample the well. Otherwise, install a new length of tubing as described above.

1.1.3.2 Collect extractable organic samples directly from the effluent delivery tubing (attached to discharge side of the silicone pump head tubing) into the sample container.

1.1.3.3 If there is a concern that sample analytes are absorbed, adsorbed, leached or otherwise affected or lost by pumping through the silicone pump-head tubing, sample the well using the organic trap assembly in 1.1.4 below.

1.1.4 Extractable Organics Using an Optional Organic Trap Assembly

1.1.4.1 Assemble the components of the pump and trap according to Figure FS 2200-1.

1.1.4.2 The sample container should be the trap bottle.

1.1.4.3 All equipment that contacts the groundwater **before** the sample container must be constructed of Teflon, Polyethylene, PP, stainless steel or glass, including the transport tubing to and from the sample container, the interior liner of the container cap and all fittings. **Do not use a rubber stopper as a cap.**

1.1.4.4 Connect the outflow tubing from the container to the influent side of the peristaltic pump.

1.1.4.5 Prevent the water in the down-hole delivery tubing from flowing back into the well while performing this connection.

1.1.4.6 Turn the pump on and reduce the flow rate to a smooth and even flow.

1.1.4.7 Discard a small portion of the sample to allow an air space.

1.1.4.8 Preserve (if required), label and complete the field notes.

1.1.5 Inorganics

1.1.5.1 Inorganic samples may be collected from the effluent tubing.

1.1.5.2 If samples are collected from the pump, decontaminate all tubing (including the tubing in the head) or change it between wells.

1.1.5.3 Preserve (if required), label and complete field notes.

1.2 Variable Speed Bladder Pump

1.2.1 If sampling for organics the pump body must be constructed of stainless steel and the valves and bladder must be Teflon. All tubing must be Teflon, Polyethylene, or PP and any cabling must be sealed in Teflon, Polyethylene or PP, or made of stainless steel.

1.2.2 After purging to a smooth even flow, reduce the flow rate.

1.2.3 When sampling for volatile organic compounds, reduce the flow rate to 100 mL/minute or less, if possible.

1.3 Variable Speed Submersible Pump

1.3.1 The housing must be stainless steel.

1.3.2 If sampling for organics, the internal impellers, seals and gaskets must be constructed of stainless steel, Teflon, Polyethylene or PP. The delivery tubing must be Teflon, Polyethylene or PP and the electrical cord must be sealed in Teflon and any cabling must be sealed in Teflon or constructed of stainless steel.

1.3.3 After purging to a smooth even flow, reduce the flow rate.

1.3.4 When sampling for volatile organic compounds, reduce the flow rate to 100 mL/minute or less, if possible.

2. SAMPLING WITH BAILERS: A high degree of skill and coordination are necessary to collect representative samples with a bailer. When properly used, bailers may be used to collect samples for certain analyte groups and under specific conditions (see Table FS 2200-3). They must be of an appropriate type and construction (see FS 2201, section 3), and must be used as outlined below. If in doubt about the appropriateness of using a bailer at a site or during a particular sampling event, contact the appropriate DEP program or project manager.

2.1 General Considerations

2.1.1 Minimize handling the bailer as much as possible.

2.1.1.1 Wear sampling gloves.

2.1.1.2 Remove the bailer from its protective wrapping just before use.

2.1.1.3 Attach a lanyard of appropriate material (see FS 2201, section 4).

2.1.1.4 Use the lanyard to move and position the bailers.

2.1.2 Do not allow the bailer or lanyard to touch the ground.

2.1.3 Rinsing

2.1.3.1 If the bailer is certified precleaned, no rinsing is necessary.

2.1.3.2 If both a pump and a bailer are to be used to collect samples, rinse the exterior and interior of the bailer with sample water from the pump before removing the pump.

2.1.3.3 If the purge pump is not appropriate for collecting samples (e.g., non-inert components), rinse the bailer with by collecting a single bailer of the groundwater to be sampled. Use the technique described in section 2.2, Bailing Technique, below.

2.1.3.4 Discard the water appropriately.

2.1.3.5 **Do not** rinse the bailer if Oil & Grease, TRPHs, etc., (see FS 2006) are to be collected.

2.2 Bailing Technique

2.2.1 Collect all samples that are required to be collected with a pump before collecting samples with the bailer.

2.2.2 Raise and lower the bailer gently to minimize stirring up particulate matter in the well and the water column which can increase sample turbidity.

2.2.3 Lower the bailer carefully into the well to a depth approximately a foot above the water column. Ensure that the length of the bailer does not exceed the length of the water column.

2.2.3.1 When the bailer is in position, lower the bailer into the water column at a rate of 2 cm/sec until the desired depth is reached (see section 2.2.3 above).

2.2.4 Do not lower the top of the bailer more than one (1) foot below the top of the water table so that water is removed from the top of the water column.

2.2.5 Allow time for the bailer to fill with aquifer water as it descends into the water column.

2.2.6 Do not allow the bailer to touch the bottom of the well or particulate matter will be incorporated into the sample.

2.2.6.1 Carefully raise the bailer (see section 2.2.2 above). Retrieve the bailer at the same rate of 2 cm/sec until the bottom of the bailer has cleared to top of the water column.

2.2.7 Lower the bailer to approximately the same depth each time.

2.2.8 Collect the sample.

2.2.8.1 Install a device to control the flow from the bottom of the bailer and discard the first few inches of water. Reduce the flow to ≤ 100 mL/minute when collecting VOC samples.

2.2.8.2 Fill the appropriate sample containers by allowing the sample to slowly flow down the side of the container. Minimize aeration of VOC samples.

2.2.8.3 Discard the last few inches of water in the bailer.

2.2.9 Repeat steps 2.2.1 through 2.2.8.3 for additional samples.

2.2.10 Measure the DO, pH, temperature, turbidity and specific conductance after the final sample has been collected.

2.2.10.1 Record all measurements and note the time that sampling was completed.

3. SAMPLING WELLS WITH FLOATING NON-AQUEOUS PHASE LIQUID: DEP does not recommend the sampling of wells with floating non-aqueous phase liquid for trace contaminants. This concerns primarily petroleum related sites, but includes any chemical product (e.g., solvent) that floats on the water table. Sampling is acceptable if the information is to be used for the purpose of remedial design.

Sample data from such wells cannot provide useful information regarding the level of contamination. Furthermore, these wells typically do not provide legitimate data because of permanent chemical contamination from product contact with the well casing for an extended period of time.

DEP does reserve the right to require sampling of these wells, not for levels of trace contaminants, but for confirmation of an appropriate remediation technique. This type of sampling is performed **below** the non-aqueous phase layer (see section 3.2 below).

3.1 Non-Aqueous Phase Liquid Sampling: Non-aqueous phase liquid may be evident in a cased monitoring well or in an open excavation.

3.1.1 Non-aqueous phase liquid is normally sampled for two reasons:

- Documentation for its existence and thickness; and
- Determination of the type of product so that the proper analyses can be performed to determine extent. This is only feasible for relatively recent releases as it may not be possible to identify weathered product.

3.1.2 Disposable plastic (acrylic, clear PVC) bailers are recommended for sampling. Disposable Polyethylene and PP bailers are also acceptable. Other wide mouth vessels may be used for sampling non-aqueous phase liquid in an excavation.

3.1.3 Monitoring Well

3.1.3.1 If a non-aqueous phase liquid is identified in a monitoring well during the water level measurement, measure its thickness in the well. If the thickness of the non-aqueous phase liquid is greater than 0.01 foot or product globules are present, collect a sample using a precleaned disposable bailer.

3.1.3.2 Measure the product thickness to the nearest 0.01 foot after withdrawing the bailer.

3.1.3.3 Pour a portion of the product into a glass sample container.

3.1.3.4 This sample is considered a concentrated waste. Therefore, package the container in protective wrapping to prevent breakage, isolate from other samples, and ice to 4°C.

3.1.4 Excavation

3.1.4.1 If non-aqueous phase liquid is observed in an open excavation, a glass sample container or a precleaned intermediate vessel may be used to collect the sample.

3.1.4.2 Securely tie a lanyard to the container and lower it into the excavation.

3.1.4.3 Gently lower and retrieve the container so that no solid material is released or collected.

3.1.4.4 If sufficient water is available, a bailer can be used.

3.1.4.5 Although not recommended, screened casing can be placed (or augered and placed) in the bottom of the excavation and the product sampled with a bailer.

3.1.4.6 Avoid dangerous situations, such as standing too close to the edge of an excavation, riding in the backhoe bucket, or entering a trench or excavation that may collapse.

3.1.4.7 Follow all applicable OSHA regulations.

3.2 Sampling Below Product

3.2.1 This type of depth-specific sampling to attempt to sample the dissolved constituents in the water column below the product layer is performed only at the request of DEP or its designee.

3.2.2 These data provide information that helps define adequate groundwater treatment. Without these data, incorrect (and sometimes unnecessarily expensive) remediation techniques may be designed for a situation where they are not required.

3.2.3 There are some substantial logistical problems involved with sending a sampler through non-aqueous phase liquid to sample the groundwater below. Although there are some products designed specifically for this type of sampling, they are expensive and the results may not be commensurate with their cost. The use of "self-engineered" equipment or coverings may be the best option.

3.2.4 These data are only to be used for qualitative use and will aid in deciding on an appropriate remediation technique.

3.2.5 Wrapping bailers and tubing in plastic seems to be the most popular technique in getting past the product layer.

3.2.6 Although not recommended, some have wrapped submersible pumps in several layers of plastic and retrieved each layer by a separate lanyard. One suggestion would be to use a rigid piece of stainless steel tubing wrapped in plastic.

3.2.6.1 Once the covered tubing is past the layer, pull up on the plastic, piercing the plastic and exposing the (somewhat) clean tubing inlet.

3.2.6.2 Introduce the wrapped hose slowly to not entrain any more product into the dissolved layer located below.

3.2.6.3 Also, perform this procedure with a peristaltic pump or a vacuum pump linked to a trap bottle. To use this setup, the water table must be no deeper than 15-20 feet, realizing that actual sampling may be occurring several feet below the product layer.

FS 2222. *Sampling Low Permeability Aquifers or Wells That Have Purged Dry*

1. Collect the sample(s) after the well has been purged according to FS 2212, section 3.4. Minimize the amount of water removed from the well by using the same pump to purge and collect the sample. If the well has purged dry, collect samples as soon as sufficient sample water is available.
2. Measure the five (5) field parameters Temperature, pH, Specific Conductance, Dissolved Oxygen and Turbidity at the time of sample collection.
3. Advise the analytical laboratory and the client that the usual amount of sample for analysis may not be available.

FS 2223. *Sampling Wells With In-Place Plumbing*

1. If a storage tank is present, locate a cold water spigot, valve or other sampling point close to the well head between the pump and the storage tank. If there is no sampling location between the pump and the storage tank, locate the spigot, valve or other sampling point closest to the tank.
 - 1.1 Depending on the sampling objective for collecting samples using installed plumbing, purge the system and collect samples closest to the point of consumption, or, as close to the source well as possible.
2. Remove all screens or aerators and reduce the flow rate to no more than 500 mL/minute. If collecting samples for volatile organic compounds, reduce the flow rate to 100 mL/minute or less. Collect the samples directly into the appropriate containers.

FS 2224. *Sampling Airstripper and Remedial Treatment System Sampling*

1. Reduce the flow rate to less than 500 mL/minute and begin sample collection.
2. If collecting samples for volatile organic compounds, reduce the flow rate to 100 mL/minute or less.
3. Collect the samples directly into the appropriate containers.

FS 2225. *Filtering Groundwater Samples*

Filtered groundwater samples can only be collected after approval from the DEP program or project manager. If filtering is approved, the DEP program or permit condition may require both filtered and unfiltered samples to be collected, analyzed and reported.

1. FILTERING GROUNDWATER FOR METALS:

1.1 Unless specified otherwise by the DEP program, use a new, disposable, high capacity, 1- μ m in-line filter.

1.2 Use a variable speed peristaltic, bladder or submersible pump with the in-line filter fitted on the outlet end.

1.2.1 Peristaltic pumps, bladder pumps or submersible pumps can be used when water levels are no greater than 20 to 25 feet deep.

1.2.2 Bladder pumps or submersible pumps must be used when water levels are greater than 20 to 25 feet deep.

1.3 Ensure that a 1-foot maximum length of new, silicone tubing was installed in the peristaltic pump head assembly before the well was purged if the same pump is being used to purge and sample the well. Otherwise, install a new length of tubing as described above.

1.4 Ensure that new or precleaned delivery tubing was assembled with the peristaltic pump before the well was purged if the same pump is being used to purge and sample the well. Otherwise, assemble the pump with new or precleaned delivery tubing and the new filter.

1.5 Insert the filter on the high pressure side (i.e., on the delivery side) of the pump.

1.5.1 Flush the filter before attaching to the pump tubing assembly with 30-50 mL of analyte free water or an inert gas (nitrogen) to remove atmospheric oxygen;

1.5.2 Or, with the filter attached to the pump tubing assembly, hold the filter upright with the inlet and outlet in the vertical position and pump water from the aquifer through the filter until all atmospheric oxygen has been removed.

1.6 Collect the filtered samples directly into the sample container from the high-pressure (delivery) side of the pump tubing assembly.

1.6.1 Collect filtered samples by either of the methods in 1.6.1.3 or 1.6.1.4 below if the static water level in the well is too deep for a variable speed peristaltic pump and a variable speed electric submersible pump or variable speed bladder pump is not available.

1.6.1.1 Do not agitate the sample or expose it to atmospheric oxygen.

1.6.1.2 **Do not** pour the sample into any intermediate vessel for subsequent filtration.

1.6.1.3 Collect the sample in a Polyethylene, Teflon or PP bailer that can be pressurized. When the bailer has been retrieved, immediately connect the filter and begin to pressurize the bailer;

1.6.1.4 Or, collect the sample with a bailer and immediately place the intake tube of the peristaltic pump into the full bailer and begin pumping the water through the filter as described in section 1.2 above.

1.7 **Do not** use the following equipment for filtering groundwater samples for metals:

1.7.1 Any pump and apparatus combination in which the filter is on the vacuum (suction) side of the pump.

1.7.2 Any type of syringe or barrel filtration apparatus.

1.7.3 Any filter that is not encased in a one-piece, molded unit.

2. Filtering groundwater for non-metallic analytes

2.1 The following analytes cannot be filtered:

- Oil and Grease
- Total Recoverable Petroleum Hydrocarbons (TRPH)
- FL-PRO
- Volatile Organic Compounds (VOC)
- Microbiological Analytes
- Volatile Inorganic Compounds (e.g., Hydrogen Sulfide)

2.2 Unless specified otherwise by the regulatory program, use a new, disposable, high capacity, 0.45 µm in-line filter.

2.3 Assemble the pump, tubing and filter as in 1.2 – 1.5 above.

2.4 Flush the filter as in 1.5.1 or 1.5.2 above.

2.5 Collect the samples as in 1.6 – 1.6.1.4 above.

Appendix FS 2200
Tables, Figures and Forms

Table FS 2200-1 Equipment for Collecting Groundwater Samples

Table FS 2200-2 Dissolved Oxygen Saturation

Table FS 2200-3 Allowable Uses for Bailers

Figure FS 2200-1 Pump and Trap for Extractable Organics

Figure FS 2200-2 Groundwater Purging Procedure

Form FD 9000-24 Groundwater Sampling Log

**Table FS 2200-1
 Equipment for Collecting Groundwater Samples**

Activity	Equipment Type
Well Purging	Variable speed centrifugal pump Variable speed submersible pump Variable speed bladder pump Variable speed peristaltic pump Bailer with lanyard: Not Recommended
Well Stabilization	pH meter DO meter Conductivity meter Thermometer/Thermistor Turbidimeter Flow-through cell Multi-function meters
Sample Collection	Variable speed peristaltic pump Variable speed submersible pump Variable speed bladder pump Bailer with lanyard (See Table FS 2200-3)
Filtration	Variable speed peristaltic pump Variable speed submersible pump Variable speed bladder pump Pressurized bailer 1.0 µm high capacity molded filter 0.45 µm high capacity molded filter
Groundwater Level	Electronic sensor Chalked tape

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Table FS 2200-2
Dissolved Oxygen Saturation

TEMP	D.O.	mg/L	TEMP	D.O.	mg/L	TEMP	D.O.	mg/L	TEMP	D.O.	mg/L
deg C	SAT.	20%	deg C	SAT.	20%	deg C	SAT.	20%	deg C	SAT.	20%
15.0	10.084	2.017	19.0	9.276	1.855	23.0	8.578	1.716	27.0	7.968	1.594
15.1	10.062	2.012	19.1	9.258	1.852	23.1	8.562	1.712	27.1	7.954	1.591
15.2	10.040	2.008	19.2	9.239	1.848	23.2	8.546	1.709	27.2	7.940	1.588
15.3	10.019	2.004	19.3	9.220	1.844	23.3	8.530	1.706	27.3	7.926	1.585
15.4	9.997	1.999	19.4	9.202	1.840	23.4	8.514	1.703	27.4	7.912	1.582
15.5	9.976	1.995	19.5	9.184	1.837	23.5	8.498	1.700	27.5	7.898	1.580
15.6	9.955	1.991	19.6	9.165	1.833	23.6	8.482	1.696	27.6	7.884	1.577
15.7	9.934	1.987	19.7	9.147	1.829	23.7	8.466	1.693	27.7	7.870	1.574
15.8	9.912	1.982	19.8	9.129	1.826	23.8	8.450	1.690	27.8	7.856	1.571
15.9	9.891	1.978	19.9	9.111	1.822	23.9	8.434	1.687	27.9	7.842	1.568
16.0	9.870	1.974	20.0	9.092	1.818	24.0	8.418	1.684	28.0	7.828	1.566
16.1	9.849	1.970	20.1	9.074	1.815	24.1	8.403	1.681	28.1	7.814	1.563
16.2	9.829	1.966	20.2	9.056	1.811	24.2	8.387	1.677	28.2	7.800	1.560
16.3	9.808	1.962	20.3	9.039	1.808	24.3	8.371	1.674	28.3	7.786	1.557
16.4	9.787	1.957	20.4	9.021	1.804	24.4	8.356	1.671	28.4	7.773	1.555
16.5	9.767	1.953	20.5	9.003	1.801	24.5	8.340	1.668	28.5	7.759	1.552
16.6	9.746	1.949	20.6	8.985	1.797	24.6	8.325	1.665	28.6	7.745	1.549
16.7	9.726	1.945	20.7	8.968	1.794	24.7	8.309	1.662	28.7	7.732	1.546
16.8	9.705	1.941	20.8	8.950	1.790	24.8	8.294	1.659	28.8	7.718	1.544
16.9	9.685	1.937	20.9	8.932	1.786	24.9	8.279	1.656	28.9	7.705	1.541
17.0	9.665	1.933	21.0	8.915	1.783	25.0	8.263	1.653	29.0	7.691	1.538
17.1	9.645	1.929	21.1	8.898	1.780	25.1	8.248	1.650	29.1	7.678	1.536
17.2	9.625	1.925	21.2	8.880	1.776	25.2	8.233	1.647	29.2	7.664	1.533
17.3	9.605	1.921	21.3	8.863	1.773	25.3	8.218	1.644	29.3	7.651	1.530
17.4	9.585	1.917	21.4	8.846	1.769	25.4	8.203	1.641	29.4	7.638	1.528
17.5	9.565	1.913	21.5	8.829	1.766	25.5	8.188	1.638	29.5	7.625	1.525
17.6	9.545	1.909	21.6	8.812	1.762	25.6	8.173	1.635	29.6	7.611	1.522
17.7	9.526	1.905	21.7	8.794	1.759	25.7	8.158	1.632	29.7	7.598	1.520
17.8	9.506	1.901	21.8	8.777	1.755	25.8	8.143	1.629	29.8	7.585	1.517
17.9	9.486	1.897	21.9	8.761	1.752	25.9	8.128	1.626	29.9	7.572	1.514
18.0	9.467	1.893	22.0	8.744	1.749	26.0	8.114	1.623	30.0	7.559	1.512
18.1	9.448	1.890	22.1	8.727	1.745	26.1	8.099	1.620	30.1	7.546	1.509
18.2	9.428	1.886	22.2	8.710	1.742	26.2	8.084	1.617	30.2	7.533	1.507
18.3	9.409	1.882	22.3	8.693	1.739	26.3	8.070	1.614	30.3	7.520	1.504
18.4	9.390	1.878	22.4	8.677	1.735	26.4	8.055	1.611	30.4	7.507	1.501
18.5	9.371	1.874	22.5	8.660	1.732	26.5	8.040	1.608	30.5	7.494	1.499
18.6	9.352	1.870	22.6	8.644	1.729	26.6	8.026	1.605	30.6	7.481	1.496
18.7	9.333	1.867	22.7	8.627	1.725	26.7	8.012	1.602	30.7	7.468	1.494
18.8	9.314	1.863	22.8	8.611	1.722	26.8	7.997	1.599	30.8	7.456	1.491
18.9	9.295	1.859	22.9	8.595	1.719	26.9	7.983	1.597	30.9	7.443	1.489

Derived using the formula in Standard Methods for the Examination of Water and Wastewater, Page 4-101, 18th Edition, 1992

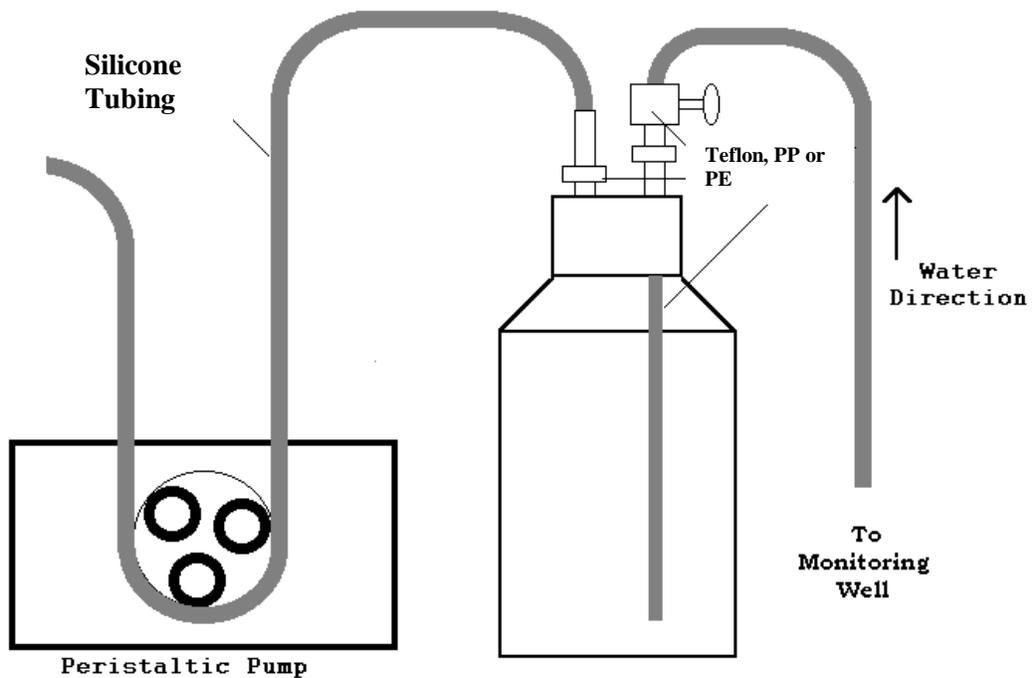
**Table FS 2200-3
 Allowable Uses for Bailers**

• ANALYTE GROUP(S)	• PURGING (Not Recommended)	• SAMPLING	
	Use:	Use:	Not Recommended:
Volatile Organics Extractable Organics Radionuclides, including Radon Metals Volatile Sulfides	If allowed by permit, program, contract or order or If operated by a skilled individual with documented training in proper techniques. Field documentation must demonstrate that the procedure in FS 2213, section 4 was followed without deviation.	If concentrations exceed action levels, the purpose is to monitor effective treatment, and the DEP program allows the use of bailers; or If specified by DEP permit, program, contract or order. or If operated by a skilled individual with documented training in proper techniques and using appropriate equipment. Field documentation must demonstrate that the procedure in FS 2221, section 2 was followed without deviation.	If concentrations are near or below the stated action levels; or If a critical decision (e.g., clean closure) will be made based on the data; or If data are to demonstrate compliance with a permit or order.
Petroleum Hydrocarbons (TRPH) & Oil & Grease	If allowed by permit, program, contract or order or If operated by a skilled individual with documented training in proper techniques. Field documentation must demonstrate that the procedure in FS 2213, section 4 was followed without deviation.	Only if allowed by permit, program, contract or order as samples should be collected into the container without intermediate devices.	Unless allowed by permit, program, contract or order.

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• ANALYTE GROUP(S)	• PURGING (Not Recommended)	• SAMPLING	
	Use:	Use:	Not Recommended:
Biologicals Inorganic Non-Metallics Aggregate Organics Microbiological Physical and Aggregate Properties	If allowed by permit, program, contract or order or If operated by a skilled individual with documented training in proper techniques. Field documentation must demonstrate that the procedure in FS 2213, section 4 was followed without deviation.	If all analytes collected from the well can be collected with a bailer; or If collected <u>after</u> collecting all analytes that require the use of a pump.	Before collecting any analytes that must be collected with a pump.
Ultra-Trace Metals	Never	Never	

Figure 2200-1
Pump and Trap for Extractable Organics



The glass sample bottle must be threaded to use a reusable sampling cap lined and installed with fittings made of Teflon, polypropylene or polyethylene, similar to the design shown.

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Scenario 1: WELL SCREEN COMPLETELY SUBMERGED

Scenario 2: WELL SCREEN PARTIALLY SUBMERGED

Option 1a: Minimal Purge Volume: Pump or tubing is placed within the middle of the screen interval. The following conditions must be met to use this option:

1. The well screen interval is ≤ 10 feet.
2. Although drawdown may occur in the well when purging is initiated, the drawdown has to stabilize (Aquifer Recovery Rate = Purge Rate).
3. The samples will be obtained with the same equipment that was used to purge the well. Therefore, centrifugal pumps and bailers are not suitable for use in Option 1a.

If one or more of these conditions do not apply, use Option 1b.

Option 1b: Conventional Purge: Pump, tubing, or bailer¹ is placed above the screen at the top of the water column.

¹ DEP does not recommend the use of a bailer for purging; however, if a bailer is used it shall be lowered and raised at the rate of 2 cm/sec in the top of the water column.

Option 2a: A bailer¹ is placed at the top of the water column and is used to purge and sample the well.

Option 2b: Pump or tubing is placed within the middle of the saturated portion of the screen interval.

If the pump or tubing that was used for purging will not be used to obtain the sample, then position the pump or tubing at the top of the water column for purging.

Purging Procedure #1

1. After the drawdown in the well stabilizes, purge at least one equipment volume then collect the first set of stabilization parameters.
2. Thereafter, collect stabilization parameters ≥ 2 to 3 minutes apart.
3. Purge at least three equipment volumes before sampling.

Purging Procedure #2

1. Purge at least one well volume then collect first set of stabilization parameters.
2. Thereafter, collect stabilization parameters \geq every 1/4 well volume.

Purging Procedure #3

1. Purge at least one well volume then collect first set of stabilization parameters.
2. Thereafter, collect stabilization parameters ≥ 2 to 3 minutes apart.

Purging Completion

If Dissolved Oxygen is $\leq 20\%$ of saturation for the measured temperature and Turbidity is ≤ 20 NTUs, then purging is complete when **three** consecutive readings of the parameters listed below are within the following ranges:

Temperature $\pm 0.2^\circ\text{C}$
pH ± 0.2 Standard Units
Specific Conductance $\pm 5.0\%$ of reading

If Dissolved Oxygen (DO) is $> 20\%$ of saturation for the measured temperature and/or Turbidity is > 20 NTUs after every attempt has been made to reduce DO and/or turbidity, then purging is complete when **three** consecutive readings of the parameters listed below are within the following ranges:

Temperature $\pm 0.2^\circ\text{C}$
pH ± 0.2 Standard Units
Specific Conductance $\pm 5.0\%$ of reading
Dissolved Oxygen ± 0.2 mg/L or readings are within 10% (whichever is greater).
Turbidity ± 5 NTUs or readings are within 10% (whichever is greater).

If the well is expected to purge dry, position the pump or tubing within the screened interval and purge at ≤ 100 mL/minute until two equipment volumes are removed. Use the same pump for purging and sampling.

If the well purges dry at the lowest achievable flow rate (pumping at 100 mL/minute or less), then after a sufficient amount of water recharges in the well, collect the samples.

In either case listed above, before samples are collected, measure (once) pH, temperature, specific conductance, dissolved oxygen, and turbidity.

If one or more parameters do not stabilize after 5 volumes of the screened interval (purging procedure #1) or 5 well volumes (purging procedure #s 2 & 3) are removed, purging may be discontinued at the discretion of the sampling team leader.

FS 3000. SOIL

See also the following Standard Operating Procedures:

- FA 1000 Administrative Procedures
- FC 1000 Cleaning/Decontamination Procedures
- FD 1000 Documentation Procedures
- FM 1000 Field Planning and Mobilization
- FQ 1000 Field Quality Control Requirements
- FS 1000 General Sampling Procedures
- FT 1000 – FT 2000 Field Testing and Calibration

1. Introduction and Scope

1.1. Use these SOPs during field investigations to collect soil samples that are representative of current site conditions. It is very important to ensure that the collected samples are neither altered nor contaminated by sampling and handling techniques.

1.2. The following topics include: equipment choice, equipment construction materials, grab and areal or depth composite sampling techniques. Sample collection methods fall into three general depth classifications: surface, shallow subsurface, and deep subsurface. Once the samples are acquired, the handling procedures are very similar and are described below.

2. GENERAL

2.1. Select sampling equipment based on the type of sample to be collected and the analytes of interest. Choose soil sampling locations such that a representative portion of the soil is collected with minimal disturbance. Locations where natural vegetation is stressed or dead and/or areas that have surficial soil staining may be indicative of improper waste disposal practices.

2.2. If background and/or quality control sampling is warranted and feasible as determined in the site's work plan or by the project manager, select an up gradient, undisturbed location for obtaining the background and/or quality control samples. Be aware that differences in soil types may affect these background samples (e.g., sands vs. clays).

2.3. **Do not collect** samples for chemical analysis from auger flights or cuttings from hollow stem auger flights, except for waste characterization purposes for disposal.

2.4. Do not use samples that are collected for geological/lithological or vapor meter determinations for chemical analyses.

3. EQUIPMENT AND SUPPLIES

3.1. All equipment must be constructed of materials consistent with the analytes of interest. Refer to FS 1000, Tables FS 1000-1, FS 1000-2 and FS 1000-3 for selection of appropriate equipment and materials.

3.2. For information on sample container size and construction, see FS 1000, Table FS 1000-6.

3.3. For information on sampling equipment cleaning requirements, see FC 1000.

3.4. For information on preservation and holding time requirements, see FS 1000, Table FS 1000-6.

3.5. For information on documentation requirements, see FD 1000.

4. PROCEDURES FOR COMPOSITING

4.1. The following is not a complete discussion regarding all available sampling protocols nor the appropriateness or inappropriateness of compositing soil samples. The appropriateness of compositing soil samples will depend on the data quality objectives of the project. However, it is sometimes advantageous to composite soil samples to minimize the number of samples to be analyzed when sampling highly contaminated areas. Obtain permission from the DEP program.

4.1.1. Select sampling points from which to collect each aliquot.

4.1.2. Using the appropriate sampling technique, collect equal aliquots (same sample size) from each location and place in a properly cleaned container.

4.1.3. **Combine the aliquots of the sample directly in the sample container with no pre-mixing.**

4.1.4. Record the amount of each aliquot (volume or weight).

4.1.5. Label container, preserve on wet ice to 4°C and complete field notes.

4.1.6. Notify the laboratory that the sample is an unmixed composite sample, and request that the sample be thoroughly mixed before sample preparation or analysis.

5. SPECIFIC PROCEDURES FOR VOLATILE ORGANIC COMPOUNDS

Follow the procedures specified in EPA Method 5035 for sample collection and sample preparation. The protocols listed below **do not replace Method 5035** but clarify and/or modify certain method procedures. Therefore, it is essential that all organizations have a copy of Method 5035 as a reference document.

5.1. Container Preparation

5.1.1. All containers must be cleaned according to the FC 1000 sample container cleaning procedures for volatile organics.

5.1.2. Sample Vials: If sample vials are filled in the field, they must be provided with all reagents, stirring devices, label **and vial cap** to be used during sample analysis. These vials must be preweighed by the laboratory and records must be maintained so that there is an unambiguous link between the tare weight and the filled sample vial.

5.2. Collection Procedure

5.2.1. The sample vials (when used) will contain a premeasured amount of liquid. The laboratory must weigh the vials before sending into the field, and must weigh them again after receipt. Therefore:

- Do not lose any of the liquid either through evaporation or spillage
- Do not use a vial if some of the contents has spilled, or if it appears that some has leaked during transport
- Use the laboratory-supplied container label for identification information. **DO NOT apply any additional labels to the container**

- Do not interchange vial caps or septa
- 5.2.2. Minimize exposure to air by obtaining the sample directly from the sample source, using a coring device or a commercially designed sampling tool.
- 5.2.2.1. The sample collection device must be designed to fit tightly against the mouth of the vial or be small enough to be inserted into the vial. Use:
- EnCore or equivalent sampling devices or
 - Disposable plastic syringes with the syringe end cut off prior to sampling (use **once** per sampling location).
- 5.2.2.2. Extrude the sample directly into the sample container.
- 5.2.3. Follow the method procedures for field transfer into the vial.
- 5.2.4. Procedures for determining the sample weight in the field are not required unless the project manager requires an accurate determination of the 5-gram sample size.
- 5.2.4.1. If the vials are returned to the laboratory for weighing, the sampler must be proficient in estimating the requisite 5-gram weight necessary for each sample.
- 5.2.4.2. If an accurate estimate of the 5-gram sample size is desired prior to starting sample collection activities, use a balance with a sensitivity of 0.1 gram. Check the balance calibration before each day's use with a set of weights that have been calibrated against NIST-traceable weights at least annually.
- 5.2.5. If the sampling device is transported to the laboratory with a sample, make sure the seals are intact, especially if collecting samples from sandy soils.
- 5.2.6. Collect at least two replicate samples from the same soil stratum and within close proximity to the original sample location.
- 5.2.7. Collect an additional aliquot of sample for screening and dry weight determinations.
- 5.3. Preservation (see FS 1000, Table FS 1000-7)
- 5.3.1. Low Level ($\leq 200 \mu\text{g}/\text{kg}$ volatile organics)
- 5.3.1.1. Method 5035 discusses the use of sodium bisulfate, which is an acid. Since Florida soils contain significant amounts of calcium carbonate that reacts with acids, DEP does not recommend using this preservative.
- 5.3.1.2. Properly pack the samples (see FS 2004, section 5), and place all samples on wet ice.
- 5.3.1.3. Analyze unpreserved samples (no acid) within 48 hours.
- 5.3.1.4. Analyze acid-preserved samples within the specified 14-day holding time.
- 5.3.1.5. Analyze unpreserved samples that have been collected in a septum vial with premeasured analyte-free water within 48 hours.
- 5.3.1.6. If unpreserved samples collected in a septum vial with premeasured analyte-free water are frozen to -10°C at the laboratory within 48 hours of sample collection, analyze the samples within 14 days.
- 5.3.1.7. Analyze samples that have been collected with and transported in a sealed coring device within 48 hours.

5.3.1.8. If unpreserved samples collected in a sealed coring device are extruded from the corer into an appropriate liquid and frozen to -10°C at the laboratory within 48 hours of sample collection, analyze the samples within 14 days.

5.3.2. High Level (> 200 µg/kg volatile organics)

5.3.2.1. Properly pack the samples (see FS 2004, section 5), and place all samples on wet ice.

5.3.2.2. Analyze samples that have been collected with and transported in a sealed coring device within 48 hours.

5.3.2.3. If unpreserved samples collected in a sealed coring device are extruded from the corer into an appropriate liquid and stored at 4°C at the laboratory within 48 hours of sample collection, analyze the samples within 14 days.

5.3.2.4. Analyze samples that that have been preserved in methanol in the field within 14-days.

6. BULK SAMPLES: The collection of bulk samples will depend on the data quality objectives of the project.

6.1. Do not composite or mix VOC samples unless required by the DEP program or if mandated by a formal DEP document (permit, order or contract).

6.2. Select sampling points from which to collect each aliquot.

6.3. Using the appropriate sampling technique, collect equal aliquots (same sample size) from each location and place in a properly cleaned container.

6.3.1. **Combine the aliquots of the sample directly in the sample container with no pre-mixing..**

6.3.2. Pack soil tightly minimizing as much headspace as possible in the sample container.

6.3.3. Cap container tightly with Teflon side facing sample.

6.4. Record the amount of each aliquot (volume or weight) in the field notes.

6.5. Label container. Refer to FS 1000, Table FS 1000-7 for preservation and holding time requirements.

6.6. Notify the laboratory that the sample is an unmixed composite sample, and request that the sample be thoroughly mixed before sample preparation or analysis.

FS 3100. Surface Soil Sampling

Surface soil is generally classified as soil between the ground surface and 6-12 inches below ground surface.

1. Remove leaves, grass and surface debris from the area to be sampled.
2. Collect samples for volatile organic analyses as described in FS 3000, section 5.
3. Select an appropriate precleaned sampling device and collect the sample.
4. Transfer the sample to the appropriate sample container.
5. Clean the outside of the sample container to remove excess soil.

6. Label the sample container, place on wet ice to preserve to 4°C and complete the field notes.

FS 3200. Subsurface Soil Sampling

Interval begins at approximately 12 inches below ground surface.

FS 3210. SAMPLE COLLECTION PROCEDURE

Use the following after the desired depth has been reached by one of the methods outlined in FS 3220.

1. Collect samples for volatile organic analyses as described in FS 3000, section 5.
2. For other analyses, select an appropriate precleaned sampling device and collect the sample.
3. Transfer the sample to the appropriate sample container.
4. Clean the outside of the sample container to remove excess soil.
5. Label the sample container, place on wet ice to preserve to 4°C and complete the field notes.

FS 3220. REACHING THE APPROPRIATE DEPTH

1. **SHOVELS AND DIGGERS:** Used for soils from approximately 12 inches to a point when using the implement becomes impractical.
 - 1.1. Dig a hole or trench to the required depth.
 - 1.2. Follow the sample collection procedures outlined in FS 3210.
2. **BACKHOE:** Used for soils from approximately 12 inches to a point when using the implement becomes impractical.
 - 2.1. Dig a trench to the appropriate depth.
 - 2.2. Expose the sample, in the trench, by using a precleaned spoon, spatula or equivalent to clean away the soil that came in contact with the backhoe bucket.
 - 2.3. Use a **second** precleaned utensil to actually collect the sample from the trench.
 - 2.4. Follow the procedures outlined in FS 3210 to collect the sample.
3. **BUCKET AUGERS AND HOLLOW CORERS:** Suitable to reach soils from approximately 12 inches to a point when using the implement becomes impractical.
 - 3.1. Push and rotate the auger into the soil until the bucket is filled.
 - 3.2. Addition of a non-contaminating sleeve may allow an undisturbed soil sample to be obtained.
 - 3.2.1. The device consists of a standard auger head with a removable sleeve, which is inserted into the auger barrel. In this case it is the sleeve, which fills with soil.
 - 3.2.2. Remove the sleeve from the auger and cap.
 - 3.3. If the auger hole is prone to collapse due to low cohesion in some soils, DEP recommends inserting a temporary rigid PVC casing into the hole. The casing prevents hole collapse and minimizes cross-contamination between soil zones as the auger is advanced.

- 3.4. Remove the sample from the sampler by pushing or scraping the soil with an appropriate precleaned utensil into an appropriately precleaned tray or aluminum foil.
- 3.5. Remove any portion of the sample that has been disturbed and discard.
- 3.6. Follow the sample collection procedures outlined in FS 3210.

NOTE: If a confining layer has been breached during sampling, grout the hole to land surface with Type-1 Portland cement. This requirement may be different throughout Florida; contact the local Water Management District office for local requirements.

4. SPLIT SPOON SAMPLER: Suitable for reaching soils from approximately 12 inches to depths greater than 10 feet.

- 4.1. A split spoon sampler, useful for sampling unconsolidated soil, consists of two half cylinders (spoons) that fit together to form a tube approximately two feet in length and two inches in diameter.
 - 4.1.1. The cylindrical arrangement is maintained by a retaining head and bit rings that screw on at each end of the split spoon.
 - 4.1.2. The bit ring has beveled edges to facilitate sampling as the split spoon is forced into the ground.
 - 4.1.3. Advance the sampler using the weight of the drilling stem and rods or a mechanical hammer.
 - 4.1.4. Insert a catcher device in the head ring to prevent loss of unconsolidated sample during recovery.
- 4.2. After retrieving the split spoon sampler, expose the soil by unscrewing the bit and head rings and splitting the barrel.
- 4.3. If the recovery is enough to accommodate discarding a portion of the sample, discard the top and bottom two to three inches of the sample.
- 4.4. For volatile organic compounds collect the sample immediately from the **center portion of the split spoon** using the procedures described in FS 3000, section 5.
- 4.5. For other analyses, slice the sample from the center portion of the split spoon using a clean, decontaminated utensil.
- 4.6. Select an appropriate precleaned sampling device and collect the sample.
- 4.7. Transfer the sample to the appropriate sample container.
- 4.8. Clean the outside of the sample container to remove excess soil.
- 4.9. Label the sample container, place on wet ice to preserve to 4°C and complete the field notes.

5. DIRECT PUSH RIGS: May be used for depths greater than 10 feet below ground surface.

- 5.1. Liners: The clear liners are used with direct push rigs. This method is appropriate only for unconsolidated materials. The sampling depth that can be achieved varies depending on the rig and the lithologies that are encountered. Typically, the rig operator will:

- Place the liner inside the metal probe rod
- Select a point holder with an opening appropriate for the site lithology and screw it on the probe rod
- Advance the rod a full rod length
- Retrieve the rod
- Remove the point holder
- Remove the liner, and
- Slice the liner to expose the soil.

5.2. After the liner has been sliced, follow the procedures outlined in FS 3210, collecting volatile organic samples (if needed) immediately after the liner is sliced.

5.3. If samples for organic vapor analysis screening are required, collect them by slicing the sample(s) using a clean, decontaminated utensil and place them in 8-ounce (preferred) or 16-ounce jars, immediately cover the opening with aluminum foil and screw on the lid ring. If the contamination is derived from petroleum products, it is acceptable to use a clean gloved hand to transfer the sample(s) to the sample container(s).

5.4. For other analyses, slice the sample from the center portion of the split spoon using a clean, decontaminated utensil.

5.5. Select an appropriate precleaned sampling device and collect the sample.

5.6. Transfer the sample to the appropriate sample container.

5.7. Clean the outside of the sample container to remove excess soil.

5.8. Label the sample container, place on wet ice to preserve to 4°C and complete the field notes.

6. SHELBY TUBE SAMPLER

6.1. The Shelby tube sampler is used to sample unconsolidated soil and consists of a tube approximately 30 inches long and two inches (or larger) in diameter.

6.2. One end of the tube has edges beveled into a cutting edge. The other end can be mounted to an adapter, which allows attachment to the drilling rig assembly.

6.3. After drilling to the required depth with an auger or rotary drill bit, a soil sample is obtained through the auger or directly in the borehole.

6.4. Push the Shelby tube into the soil using the drilling rig's hydraulic ram or manually with a sledge hammer.

6.5. Remove the tube from the sampler head.

6.6. Extrude the sample from the Shelby tube.

6.7. Use a decontaminated utensil to remove any portion of the sample that has been disturbed.

6.8. Collect samples for volatile organics immediately from the center portion of the Shelby tube using the procedures described in FS 3000, section 5.

6.9. For other analyses, slice the sample from the center portion of the Shelby tube using a clean, decontaminated utensil.

- 6.10. Transfer the sample to the appropriate sample container.
- 6.11. Clean the outside of the sample container to remove excess soil.
- 6.12. Label the sample container, place on wet ice to preserve to 4°C and complete the field notes.

7. CORE BARREL

- 7.1. A standard core barrel is utilized when consolidated samples (such as limestone or dolomite) are to be sampled.
 - 7.1.1. The core barrel is a cylinder approximately three feet long and two inches in diameter.
 - 7.1.2. The barrel has a removable head ring with small embedded diamonds which allow the device to cut through rock or consolidated soil as the drilling rods are rotated.
- 7.2. Retrieve the sample core by unscrewing the head ring and sliding the sample into a precleaned container.
- 7.3. Use a decontaminated utensil to remove any portion of the sample that has been disturbed.
- 7.4. Remove the sample from the sampler (corer) with a precleaned tool.
- 7.5. Transfer the sample to the appropriate sample container.
- 7.6. Clean the outside of the sample container to remove excess soil.
- 7.7. Label the sample container, place on wet ice to preserve to 4°C and complete the field notes.

FS 5000. WASTE SAMPLING

1. INTRODUCTION: Use the procedures in FS 5000 to sample media and matrices of industrial origin.

1.1. Use the following DEP SOPs in conjunction with FS 5000:

- FA 1000 Regulatory Scope and Administrative Procedures for Use of DEP SOPs
- FC 1000 Cleaning / Decontamination Procedures
- FD 1000 Documentation Procedures
- FM 1000 Field Planning and Mobilization
- FQ 1000 Field Quality Control Requirements
- FS 1000 General Sampling Procedures
- FT 1000 – FT 2000 General Field Testing and Measurement

1.1.1. Use additional DEP SOPs as required for specific applications.

2. EQUIPMENT AND SUPPLIES: Refer to Table FS 5000-1 for approved waste sampling equipment.

3. PRESERVATION, TRANSPORT AND HANDLING OF WASTE SAMPLES

3.1. Do not preserve waste samples with chemical preservatives or cool waste samples where the potential for an inadvertent chemical reaction of samples with the preservative might occur, or where cooling might otherwise alter the original sample characteristics. Protect samples from sunlight in order to minimize any potential reaction due to possible light sensitivity of samples. Appropriate handling and storage precautions should be taken if samples have the potential to be shock sensitive.

3.2. After the samples have been collected and containerized, clean the outside of the containers with water, paper towels or other absorbent materials to remove any spilled sample from the exterior of the container.

3.3. Place each labeled container in a separate, resealable plastic bag and then repackage in a second resealable plastic bag. Apply an evidentiary custody seal to container closure before bagging, if applicable. If transporting the samples presents a possibility for breaking glass sample containers, pack the sample containers with non-combustible, absorbent cushioning material and place in a shipping container that has been lined with plastic. Waste samples that are suspected of being acutely toxic or extremely hazardous must be packed in paint cans or other suitable containers and filled with absorbent materials prior to being placed in a cooler.

3.4. See Table FS 1000-6 for preservation procedures.

4. DOCUMENTATION

4.1. See FD 5300 for a complete listing of documentation requirements specific to waste sampling.

4.2. Additional guidance on documentation requirements specific to each type of waste sampling is included in the associated DEP SOPs below.

FS 5010. SAMPLING HAZARDS AND PERSONNEL SAFETY

Waste sampling requires specialized training, safety protocols and personal protective equipment (PPE). The degree and type of safety measures and PPE required depends on the unique characteristics of the waste to be sampled.

1. REFERENCE FOR REQUIRED SAFETY PROTOCOLS, TRAINING AND PPE: As applicable, adhere to safety procedures, training requirements and prescribed PPE described in Occupational Safety and Health Administration (OSHA) Rule 29 CFR 1910.120 (Hazardous Waste Operations and Emergency Response).
2. MINIMUM SAFETY PLANNING AND PROCEDURES: It is beyond the scope of this field sampling SOP to describe safety protocols for every contingency. Follow the listed minimum safety procedures below, where applicable:
 - 2.1. Ensure that all personnel are appropriately trained and qualified per OSHA requirements.
 - 2.2. Ensure that sampling personnel meet employer and OSHA medical requirements.
 - 2.3. Conduct site reconnaissance and identify hazards.
 - 2.4. Produce a written site safety plan and review with all personnel.
 - 2.5. Designate a site safety and health officer.
 - 2.6. Produce a written sampling plan and review with all personnel.
 - 2.7. Provide appropriate PPE and sampling equipment to all samplers.
 - 2.8. Establish site control (exclusion zones, access corridors, etc.).
 - 2.9. Conduct preliminary and continuous on-site air monitoring (combustible gases, oxygen deficiency, toxic gases, radiation).
 - 2.10. Establish decontamination areas for samplers.
 - 2.11. Prepare for emergencies (backup personnel, spill containment, fire equipment, first aid, evacuations, etc.).
 - 2.12. Follow additional health and safety procedures developed by the facility owner, as applicable.

FS 5020. PRELIMINARY WASTE CHARACTERIZATION

1. Conduct a preliminary waste characterization prior to collecting samples for laboratory analysis. Use the waste characterizations to establish proper safety protocols and protections for sampling personnel, to make decisions regarding staging, bulking, compositing, segregation, shipping and disposal of wastes and to refine the selection of appropriate laboratory analyses for collected waste samples.
2. Classify the wastes into the following general categories: reactive wastes, explosives, acids, bases, ignitable wastes, heavy metals, pesticides, halogenated compounds, cyanides and oxidizers. In cases where sufficient information is not available, conduct further analyses to identify the material.
3. The field waste characterization tests listed below are designed to gain a quick, preliminary assessment of the types and levels of chemicals in the wastes. Perform the field methods below according to the manufacturers' instructions.

- HazCat Chemical Identification System
 - Dräger Tubes
 - Clor-N-Oil Test Kit
 - Spill-fyter Chemical Classifier Strips
 - Setaflash (ignitability)
4. Record the results of the preliminary characterization, including the results of any field waste characterization tests performed.

FS 5100. Drum Sampling

1. PRECAUTIONS FOR DRUM SAMPLING

1.1. Opening closed containers and drums of unknown content is a hazardous activity. Give maximum attention to sampling team safety by establishing and following clear and proper procedure and wearing appropriate personal protection equipment. *Remote sampling technique may be required for some situations. **Conduct all sampling activities using appropriate personal protective equipment (PPE) for the level of hazard encountered. See FS 5010. If the contents of drums or their hazards are unknown, use Level B protection at a minimum.***

1.2. Exercise caution when excavating, inspecting, staging and sampling drums because of the potential presence of explosive or flammable gases, toxic vapors or other hazardous materials. Assume that labeled drums are mislabeled. In general, assume that all drums contain hazardous material until the contents have been independently characterized.

1.3. Refer to 29 CFR Part 1910.120(j) for OSHA standards required for drum and container handling.

2. DRUM EXCAVATION: **All excavation activities must include appropriate personal protective equipment for the level of hazard encountered. See FS 5010. If the contents of drums or their hazards are unknown, wear Level B protection, at a minimum.**

2.1. Utilize geophysical techniques to approximate buried drum locations and depths.

2.2. Locate all utility lines, poles and pipes above and below ground. Ensure adequate clearance between all utilities or structures and the drum excavation area.

2.3. Use heavy equipment and equipment operators with drum removal experience to excavate, remove or handle drums. Avoid digging directly into drums. Final excavation must be done manually, using non-sparking hand tools.

2.4. Monitor the area around exposed drums for volatile organic compounds, explosives or radioactive materials before proceeding.

2.5. Identify each drum that will be opened. Use paint sticks, spray paint, traffic cones, etc.

3. DRUM INSPECTION: **All inspection activities must include appropriate personal protective equipment for the level of hazard encountered. See FS 5010. If the contents of drums or their hazards are unknown, wear Level B protection, at a minimum.**

3.1. Visually inspect all drums that are being considered for sampling for the following:

- Pressurization (bulging/dimples)
- Crystals around the drum opening
- Leaks, holes, stains
- Labels, markings, hazard warnings
- Composition and type (steel/plastic and open/bung)
- Dead vegetation around drum
- Condition, age, rust, potential shock sensitivity
- Sampling accessibility

3.1.1. Drums showing evidence of pressurization and crystals must be furthered assessed to determine if remote drum opening is needed. Do not tap or knock the drums to determine drum contents or volume.

3.2. Uniquely identify each drum with a tag, label, bands, spray paint or other means. Indicate drum category, as determined by visual inspection. Use color-coding as needed to distinguish categories of drums.

3.3. Record all observations made during drum inspection.

4. DRUM STAGING: ***All staging activities must include appropriate personal protective equipment for the level of hazard encountered. See FS 5010. If the contents of drums or their hazards are unknown, wear Level B protection, at a minimum.***

4.1. Use heavy equipment and qualified equipment operators with drum handling experience to stage drums, if necessary.

4.2. If ignitable, explosive or reactive characteristics are indicated by initial characterization of drum contents, locate the staging area away from the drum-opening area to prevent chain reaction should an opened drum explode or ignite.

4.3. The procedures for handling and sampling drums differ by drum category. Separate drums into the following categories, based on determination of contents:

- Liquids
- Lab packs
- Solids
- Empty

4.3.1. Segregate drums containing radioactive, explosive or shock-sensitive material from other drums and the drum-opening area. Place drums containing these hazards in a diked and fenced area where practical.

4.3.2. Separate drums containing acids or bases from each other. Similarly separate drums containing other wastes known to react with each other.

4.4. Move drums from the staging area to the opening area one at a time using forklift trucks equipped with drum grabbers or barrel grapples or, move by roller conveyor or other means.

5. DRUM OPENING PROCEDURES:

5.1. General Considerations:

5.1.1. ***Wear personal protective equipment (PPE) as prescribed in the reference cited in FS 5010 for the level of hazard encountered with each drum.***

5.1.2. Use remote drum-opening procedures when possible to maximize personnel safety.

5.1.3. Use manual bung wrench or deheader drum-opening procedures only with structurally sound drums that are capable of withstanding the forces applied during bung opening or deheading.

5.1.4. Do not attempt to use a manual bung wrench or deheader on drums that contain shock-sensitive, reactive, explosive or flammable materials.

5.2. Procedures Required Prior to Drum Opening: Before opening, ground each metal drum that is not in direct contact with the earth using grounding wires, alligator clips and a grounding rod or metal structure. If a metal drum is in an overpack drum, ensure the metal drum is grounded.

5.2.1. Touch the drum opening equipment to the bung or lid and allow an electrically conductive path to form. Slowly remove the bung or drum ring and/or lid with spark resistant tools (brass/beryllium).

5.2.2. Screen drums for explosive gases and toxic vapor with air monitoring instruments as bung or drum lid is removed.

5.2.3. Record the results of all monitoring of drums.

5.3. Tools for Opening Drums: See specific instructions below for use of various drum opening tools.

All manual procedures require appropriate personal protective equipment (PPE) for all personnel working with the drum. The puncture or deheading of any drum may present a chemical splash hazard. The level of protection required is described in the reference cited in FS 5010 for the type of hazards encountered with each drum. If drum contents or hazards are unknown, wear Level B protection, at a minimum.

5.3.1. Manual Bung Wrench

5.3.1.1. ***Wear appropriate protective gear per FS 5010.***

5.3.1.2. Position top or side mounted bungs in upright position.

5.3.1.3. Pull slowly and steadily across the drum.

5.3.1.4. Use a handle extension for increased wrench leverage where necessary.

5.3.1.5. Watch for sparking even when using non-sparking bung wrenches.

5.3.2. Manual Drum Deheader

5.3.2.1. Position the cutting edge of the deheader just inside the top chime and tighten the deheader adjustment screw to hold the device tight against the side of the drum.

5.3.2.2. Slowly make an initial cut into the drumhead to release pressure (or use remote techniques to relieve pressure prior to deheading procedures).

5.3.2.3. Move the deheader handle up and down while sliding the device along the chime.

5.3.2.4. Decontaminate the drum deheader between drums, if contact between the deheader and drum contents have occurred. See FC 1000.

5.3.3. Hand Pick, Pickaxe and Hand Spike

5.3.3.1. Anticipate potential splashing with the use of these tools. ***Wear proper personal protective gear per FS 5010.***

5.3.3.2. Use these devices where the bung cannot be opened or the drumhead cannot be removed.

5.3.3.3. Decontaminate hand tools between drums. See FC 1000.

5.3.4. Remote Opening Using a Backhoe Spike: Use this procedure for greater personal safety. Mount a splash shield in front of the backhoe operator cage. ***The operator must wear appropriate personal protection gear per FS 5010.*** Provide air supply gear to the operator, if applicable.

5.3.4.1. Place drums in rows such that the backhoe can be maneuvered between them.

5.3.4.2. Punch a hole in the drumhead with the backhoe spike.

5.3.4.3. Decontaminate the backhoe spike between drums. See FC 1220.

5.3.5. Remote Opening Using Hydraulic Devices

5.3.5.1. Follow manufacturer's instructions to puncture the drum.

5.3.5.2. ***This procedure presents a splash hazard. Wear personal protective gear per FS 5010, as applicable.***

5.3.6. Remote Bung Opening Using Pneumatic Devices: ***This procedure does not allow slow release of accumulated pressure in the drum. Wear personal protective gear per FS 5010 and take safety precautions during this procedure, as applicable.***

5.3.6.1. Do not attempt to remove rusted bungs with this device.

5.3.6.2. Place drums in level, upright position.

5.3.6.3. Follow manufacturer's instructions to fit the opener to the bung, remotely remove the bung and detach the device.

5.4. Inspecting Drum Contents

5.4.1. Note the state, quantity, phases, and color of the drum contents.

5.4.2. Review the screening results with any pre-existing data to determine which drums will be sampled.

5.4.3. Monitor headspace gases from opened drums. Use an oxygen meter and explosimeter first, followed by organic vapor analyzer (OVA) monitoring.

5.4.4. Record all results from the inspection of drums.

5.5. General Instructions for Drum Sampling

5.5.1. If applicable for the sampling plan, account for any stratification of drum contents by appropriate choice of sampling tools and techniques. If the entire depth of the drum must be represented by the sample(s), collect all phases and strata of the drum either as a composite or as discrete phase and stratum samples, as required. Only profiling

samplers such as COLIWASA (COMPOSITE LIQUID WASTE SAMPLER), thieves, sludge judges, etc. allow proportional sampling of strata and phases.

5.5.1.1. Filling Multiple Sample Containers Where Strata or Phases are Composited: Using a proportional sampler, dispense an entire sampler volume of waste into each required sample container in succession until all containers are adequately filled.

5.5.1.2. Filling Multiple Sample Containers Where Discrete Stratum or Phase Samples are Required: Fill the required number of containers in succession using a discrete sampler to collect samples from the appropriate phase or stratum.

5.5.2. Account for sludge depth in the drum by measuring depth to apparent bottom and subtracting from drum total depth (height).

5.5.3. Select the appropriate sampling equipment based on the physical state of the material and the type of container. Sampling equipment must be made of non-reactive materials that will not alter the chemical or physical properties of the material that is to be sampled.

5.5.4. Place absorbent pads, sampling equipment and sample containers near drum(s) to be sampled.

5.5.5. Record all observations made during sampling. Document sampling per FD 5300.

CONDUCT AIR MONITORING FOR TOXIC VAPORS, EXPLOSIVE GASES AND OXYGEN-DEFICIENT ATMOSPHERES DURING DRUM SAMPLING.

FS 5110. SAMPLING LIQUIDS FROM DRUMS

1. GLASS THIEF (TUBE)

1.1. General Considerations for Glass Thief

1.1.1. Use disposable glass tubes only.

1.1.2. Typical dimension for the glass thief is 6mm-16mm I.D. and 48 inches long.

1.2. Sampling Procedure for Glass Thief

1.2.1. Remove cap from sample container.

1.2.2. Insert thief into drum almost to bottom or until solid layer is reached. Allow one foot of tubing to extend out of the top of the drum.

1.2.3. Let the waste in the drum rise to its natural level in the thief.

1.2.4. Cap the top of the thief with a stopper or gloved thumb. Do not let waste liquid contact the stopper or thumb.

1.2.5. Withdraw the thief from the drum.

1.2.6. Insert open end of thief into the sample container and allow thief contents to drain into the container. Fill container 2/3 full.

1.2.7. When finished with the thief, break the thief into pieces and insert into the drum (if permitted by the sampling and disposal plans).

2. COLIWASA (COMPOSITE LIQUID WASTE SAMPLER)

2.1. General Considerations for COLIWASA Sampling

2.1.1. Use the COLIWASA to collect representative multiphase samples from the full depth of a drum, as applicable.

2.1.1.1. If it is not a disposable model, the COLIWASA may be too expensive for some applications and cannot be easily decontaminated in the field.

2.1.1.2. Variations in design of this sampling device may be available from different vendors but the operational principle is the same.

2.2. Sampling Procedure for COLIWASA

Follow manufacturer's directions for use if different from the following:

2.2.1. Configure the COLIWASA in the open position by lifting the stopper rod several inches above the closed position.

2.2.2. Slowly lower the sampler into the liquid waste at a rate that permits the levels of liquid inside and outside the sampler tube to rise to about the same heights. Failure to maintain equal heights inside and outside the tube will affect the representativeness of the sample. If the liquid level inside the tube is lower than the waste level outside the tube, the sampling rate is too fast.

2.2.3. When the sampler stopper hits the bottom of the drum, push the stopper rod to the closed position.

2.2.4. Slowly withdraw the sample from the waste liquid and simultaneously wipe the outside of the device with a disposable wipe.

2.2.5. Position the lower end of the COLIWASA in the sample container. Lift the stopper rod and carefully drain the waste liquid into the container.

2.3. Sampling Procedures for Other Devices: (Reserved)

FS 5120. SAMPLING SOLIDS AND SLUDGES FROM DRUMS

1. GENERAL CONSIDERATIONS

1.1. Use a long-handled dipper, push tube or other coring device, scoop, spoon, bucket auger, screw auger or, if conditions necessitate, a pneumatic hammer/drill to obtain samples of solids in drums.

1.2. If necessary for the sampling plan, take multiple samples from different areas of the drum.

2. PROCEDURE FOR CORING DEVICE OR PUSH TUBE

2.1. Insert device to bottom of drum. T-handle and extension attachments, where applicable, must extend above the top of the drum.

2.2. Rotate the corer or push the sampling tube to cut a core of material.

2.3. Slowly withdraw the device to retain the sample.

2.4. Use stainless steel laboratory spatulas or scoops to transfer the sample to containers.

3. PROCEDURES FOR OTHER SAMPLING DEVICES: (Reserved)

FS 5130. CLOSING DRUMS AND SEGREGATION OF EQUIPMENT AND WASTES AFTER SAMPLING

1. Close each drum when sampling of the drum is complete.
2. Segregate contaminated sampling equipment and investigation-derived wastes (IDW) containing incompatible materials as determined by the drum screening procedure.
3. Handle and dispose of IDW and contaminated disposable equipment according to local, state and federal regulations.
4. As required, wrap or bag contaminated reusable equipment in protective material or store in containers until cleaned.

FS 5200. Tank, Sump and Leachate Sampling

1. INTRODUCTION: Some procedures for tank, sump and leachate sampling will be identical to those for drum sampling. The depth or physical configuration of some waste units will prevent the use of some equipment or techniques, depending on the unit to be sampled.
2. EQUIPMENT AND SUPPLIES: See Table FS 5000-1 for approved sampling equipment.

FS 5201. *Presampling Considerations and Procedures for Tanks*

1. PRESAMPLING CONSIDERATIONS FOR TANKS

1.1. Sampling tanks is considered hazardous due to the potential for tanks to contain large volumes of hazardous materials. Follow appropriate safety protocols. Some tank sampling requires physical agility and manual dexterity in order to access the tank sampling points, carry equipment and supplies, open tank hatches and collect and containerize samples while wearing personal protective equipment. Personnel must be able to perform the appropriate procedures under these conditions.

1.1.1. *Wear personal protective equipment (PPE) as prescribed in the reference cited in FS 5010 for the level of hazard encountered with each tank. If the contents of a tank or its hazards are unknown, wear Level B protection while working in proximity to the tank.*

1.2. Unlike drums, tanks may be compartmentalized or have complex designs. Review preliminary information about the tank contents and configuration prior to the sampling operation to ensure the safety of sampling personnel and to ensure that study design objectives can be achieved.

1.3. In addition to having discharge valves near the bottom, most tanks and bulk storage units have hatches at the top. Collect samples from the top hatch because of the potential for tank contents to be stratified. *Do not collect samples from valves unless necessary and only if part of the sampling plan. See section 1.4 below.*

1.4. When sampling from the discharge valve, there is a possibility of a stuck or broken valve that could cause an uncontrolled release. Do not utilize valves on tanks or bulk storage devices unless the owner or operator of the facility operates them, or a containment plan is in place should the valve stick or break. If a tank must be sampled from a discharge valve, clearly understand the valving arrangement of the particular tank to ensure that the compartment of interest is sampled. Make sure that sampling from valves is specified in the sampling plan. *Valve sampling will not allow sampling of individual strata in the tank.*

1.5. If stratification of tank contents must be accounted for, choose appropriate sampling tools and techniques so that the entire depth of the tank is represented by the sample(s) collected. Sample all phases and strata of the tank either as a composite or as discrete phase and stratum samples, as required by the sampling plan. Only profiling samplers such as COLIWASA, thieves, sludge judges, etc. allow proportional composite sampling of strata and phases. If proportional composite sampling of a tank is not practical, collect discrete samples from each phase or stratum in order to characterize the entire contents of the tank. If the sampling plan requires only approximate sampling or screening, collect a simple grab sample from the contents of the tank.

2. PRESAMPLING PROCEDURES FOR TANKS

2.1. Perform a structural integrity survey of the tank. Inspect the ladder, stairs, and catwalk that will be used to access the top hatch of larger tanks to ensure that they will support the combined weight of personnel and equipment.

2.2. Evaluate tank sampling points for safety, accessibility and sample quality.

2.3. Before opening, ground each metal tank using grounding wires, alligator clips and a grounding rod or metal structure.

2.4. Remove all sources of ignition from the immediate area.

2.5. Open any vents or pressure release valves slowly to allow the unit to vent to atmospheric pressure.

2.5.1. Monitor for explosive or flammable gases and toxic vapors during venting. If dangerous concentrations of gases evolve from the vent or the pressure is too great, close the system and leave the area immediately.

2.6. Touch tank opening equipment to the bolts in the hatch lid and allow an electrically conductive path to form. Slowly remove bolts and/or hatch with spark resistant tools (brass/beryllium).

2.6.1. If a pressure build up is encountered or detected, cease opening activities and leave the area.

2.7. Screen the interior of tanks for explosive or flammable gases and toxic vapors with air monitoring instruments.

2.8. Depending on the study objectives and site conditions, conduct characteristic screening (e.g., pH, halogen, etc.) as required. Collect a small volume of sample for flash point testing, if warranted.

2.8.1. Note the state, quantity, number of phases and color of the tank contents.

2.8.2. Compare the screening results with any pre-existing data to determine if the tank should be sampled.

2.9. Determine depth of any and all liquids, solids and liquid/solid interfaces. Measure depth of any sludge. Use weighted tape measures, probe lines, sludge judges or other appropriate equipment to characterize tank stratification with depth.

2.10. Determine the inside diameter of the tank and calculate the volume of wastes in the tank using the depth measurements above. Do not assume that the external diameter of the tank approximates the inside diameter, since the tank construction may have insulation or support structures hidden under the external surface.

2.11. Record all observations, measurements and calculations made at the time of tank inspection. See FD 5300.

FS 5210. GENERAL SAMPLING INSTRUCTIONS FOR TANKS

1. GENERAL CONSIDERATIONS: Because of the many different types of designs and materials that may be encountered, only general sampling procedures that outline sampling a tank from the top hatch are listed below:

CONDUCT CONTINUOUS AIR MONITORING FOR TOXIC VAPORS, EXPLOSIVE GASES AND OXYGEN DEFICIENT ATMOSPHERES DURING TANK SAMPLING

1.1. Select the appropriate sampling equipment based on the physical state of the material and the type of tank. Use sampling equipment constructed of non-reactive materials that will not alter the chemical or physical properties of the material that is to be sampled. See Table FS 5000-1.

1.2. ***Wear required personal protective equipment (PPE) as prescribed in the reference cited in FS 5010 for the level of hazard encountered with each tank. If tank contents or hazards are unknown, wear Level B protection, at a minimum.***

1.3. Where tanks are compartmented, collect at least one sample from each compartment.

1.4. Place absorbent pads, sampling equipment and sample containers near tanks(s) to be sampled.

1.5. Document all observations and procedures associated with sample collection per FD 5300.

2. SAMPLING LIQUIDS FROM TANKS

2.1. Collect liquid samples according to the objectives of the sampling plan, using appropriate samplers.

2.2. Slowly lower the bailer, bacon bomb, Dipstick™, COLIWASA, or Teflon® tubing to the desired sampling depth. ***In work areas where explosive or flammable atmospheres could occur, do not use peristaltic pumps powered by batteries.***

2.2.1. Close the sampling device or start pump.

2.2.2. Slowly remove the sampling device from the tank.

2.2.3. Release or pump the sample from the device into the sample container(s).

2.2.4. Repeat the procedure until a sufficient sample volume is obtained.

2.3. Inspect samples for phase differences or stratification.

2.3.1. If separate phases or strata are observed in any sample container, perform repeated iterative sampling, if discrete phase or stratum sampling is required by the sampling plan. Systematically collect additional samples by halving the depth between two discreet sampling points to determine the next sampling depth. Repeat this procedure until no phase difference or stratification is noted in the sample. Calculate phase and stratum boundary depths from these samplings.

2.3.2. If discrete phase or stratum sampling is not required by the sampling plan, collect composite samples using appropriate profiling samplers or collect simple grab samples, depending on sampling plan objectives.

2.4. If additional sampling ports are available, verify phase and stratum information with additional samples from the other ports, if practical.

2.5. If more than one sample container will be used to collect for the analytes of interest, use the following procedures for filling multiple sample containers.

2.5.1. Filling Multiple Sample Containers Where Strata or Phases are Composited: Using a proportional sampler, dispense an entire sampler volume of waste into each required sample container in succession until all containers are adequately filled.

2.5.2. Filling Multiple Sample Containers Where Discrete Stratum or Phase Samples are Required: Fill the required number of containers in succession using a discrete sampler to collect samples from the appropriate phase or stratum.

3. SAMPLING SOLIDS/SEMI-SOLIDS FROM TANKS

3.1. Use a long-handled dipper, push tube, bucket auger, screw auger, Mucksucker™, or if conditions permit, a pneumatic hammer/drill to obtain the sample. See specific instructions for each applicable sampling device in FS 5211 below.

3.2. Carefully extrude the sample from the sampling device or use a clean stainless steel spoon to place the sample into containers for analyses.

3.3. Close the tank when sampling is complete.

4. WASTE DISPOSAL AND CONTAMINATED EQUIPMENT

4.1. Segregate contaminated sampling equipment and investigation-derived wastes containing incompatible materials.

4.2. Manage all waste according to applicable local, state and federal regulations.

FS 5211. *Tank Sampling Instructions for Specific Sampling Devices*

Select the equipment described below for use based on the specific sampling requirements of the tank.

1. BACON BOMB SAMPLER: Use the bacon bomb sampler for discrete depth sampling in a tank.

1.1. Attach sampler retrieval line and plunger line, if necessary. The sampling line must be measured and marked for the predetermined collection depth required.

1.2. Slowly lower the bacon bomb to the required depth in the tank and pull and hold the plunger line to actuate filling of the sampler. Release the plunger line to stop filling and seal the sampler closed.

1.3. Retrieve the sampler by the sample line. Do not pull on the plunger line, or the sample will be lost or exchanged with the contents of the tank or a different phase or stratum. Wipe or rinse the exterior of the sampler before filling sample containers. Collect any rinsate for proper disposal.

1.4. Release contents into the sample container by pulling on the plunger line.

2. SLUDGE JUDGE: Use the sludge judge to obtain an accurate reading of the depth of settleable solids in any liquid and for collection of the sample for laboratory analysis.

2.1. Lower the sludge judge to the bottom of the tank and allow the sampler to fill to surface level and seat the check valve on the sampler.

- 2.2. Retrieve the sludge judge and raise it completely out of the tank liquid for determination of sludge depth.
- 2.3. Actuate release pin at the bottom of the sampler to release contents or fill a sample container.
3. SUBSURFACE GRAB SAMPLER: Use the subsurface grab sampler to collect samples at discreet depths in the tank.
 - 3.1. Screw sample bottle onto the sampler head assembly.
 - 3.2. Lower the sampler to the required depth and actuate the plunger mechanism.
 - 3.3. Release the plunger to close the sampling head after filling the sample bottle and retrieve the sampler from the tank.
 - 3.4. Remove and cap the sample bottle.
 - 3.5. Decontaminate the exterior of the sample bottle.
4. GLASS THIEF (TUBE)
 - 4.1. General Considerations for Glass Thief
 - 4.1.1. Use disposable glass tubes only.
 - 4.1.2. Typical dimension for the glass thief is 6mm - 16mm I.D. and 48 inches long.
 - 4.1.3. Tanks greater than about 3 feet in depth cannot be sampled with a glass thief.
 - 4.2. Sampling Procedure for Glass Thief
 - 4.2.1. Remove cap from sample container.
 - 4.2.2. Insert thief into tank almost to bottom or until solid layer is reached. Allow one foot of tubing to extend out of the top of the tank.
 - 4.2.3. Let the waste in the tank rise to its natural level in the thief.
 - 4.2.4. Cap the top of the thief with a stopper or gloved thumb. Do not let waste liquid contact the stopper or thumb.
 - 4.2.5. Withdraw the thief from the tank.
 - 4.2.6. Insert open end of thief into the sample container and allow thief contents to drain into the container. Fill container 2/3 full.
 - 4.2.7. When finished with the thief, break the thief into pieces and insert into the tank (if permitted by the sampling and disposal plans).
 - 4.2.8. Close tank cover.
5. BAILER
 - 5.1. Slowly lower bailer into tank contents using non-reactive bailer line. Do not splash bailer into the liquid.
 - 5.2. Retrieve the bailer after the bailer fills completely.
 - 5.3. Slowly pour bailer contents into the sample container.
 - 5.4. Close tank cover.
6. COLIWASA:

Follow manufacturer's directions for use if different from the following:

- 6.1. Configure the COLIWASA in the open position by lifting the stopper rod several inches above the closed position.
- 6.2. Slowly lower the sampler into the liquid waste at a rate that permits the levels of liquid inside and outside the sampler tube to rise to about the same heights. Failure to maintain equal heights inside and outside the tube will affect the representativeness of the sample. If the liquid level inside the tube is lower than the waste level outside the tube, the sampling rate is too fast.
- 6.3. When the sampler stopper hits the bottom of the drum, push the stopper rod to the closed position.
- 6.4. Slowly withdraw the sample from the waste liquid and simultaneously wipe the outside of the device with a disposable wipe.
- 6.5. Position the lower end of the COLIWASA in the sample container. Lift the stopper rod and carefully drain the waste liquid into the container.

7. ADDITIONAL SAMPLING DEVICES: Reserved

FS 5220. LEACHATE AND SUMP SAMPLING

1. As applicable, follow DEP SOP procedures for tank, drum, groundwater, surface water and sediment sampling. See FS 5100 and FS 5200 above, as well as FS 2100, FS 2200 and FS 4000.
2. Document leachate and sump sampling according to the documentation requirements for the respective DEP SOPs employed to collect samples, per the above. Document additional items per FD 1000.

FS 5300. Waste Pile Sampling

1. The number of samples, the type of sample(s) and the sample location(s) or sampling point(s) for waste pile sampling will be based on sampling plan objectives as determined by permitting or other regulatory criteria and according to the size, shape, material composition, compactness or other characteristics of the pile and the distribution of analytes, analyte concentrations and strata in the waste pile.
2. Follow directives of the sampling plan specific to the project.
3. Document waste pile sampling according to associated regulatory requirements for the project. Document additional items per FD 1000, as applicable.
4. Refer to FS 3000 for soil sampling procedures applicable to waste pile sampling.

FS 5400. Impoundment and Lagoon Sampling

1. Surface impoundments vary in size, shape, and waste content, and may vary in distribution of hazardous constituents and characteristics (strata). The number of samples, the type of sample(s), and the sample location(s) will be based on the sampling design objectives.
2. Commonly used equipment to collect samples from surface impoundments are listed in Table FS 5000-1. All equipment must be compatible with the waste to prevent any alteration of the sample.

- 3. *Because of the potential danger of sampling waste units suspected of containing elevated levels of hazardous constituents, do not attempt to sample surface hazardous waste impoundments from a boat. Conduct all sampling from the banks or piers of surface impoundments. Any exception must be approved per specific provisions in the applicable health & safety plans and sampling plans.***
4. Refer to FS 2100 and FS 4000 for general surface water and sediment sampling procedures applicable to waste impoundment sampling.
 - 4.1. Additionally, some procedures and equipment applicable to drum and tank sampling may be useful for waste impoundment sampling. See FS 5100 and FS 5200 above.
5. Document impoundment and lagoon sampling procedures and observations per FD 1000 for the applicable procedures employed.

Appendix FS 5000
Tables, Figures and Forms

Table FS 5000-1 Waste Sampling Equipment

Table FS 5000-1 Waste Sampling Equipment

Equipment	Construction Material ¹	Phases	Waste Units or Sources	Limitations
Scoop with bracket and handle	Stainless Steel	Liquids, Solids, Sludges	Impoundments, Piles, Drums and Containers, Tanks	Depth constraint. Cannot collect deeper phase or stratum in stratified waste
Spoon	Stainless Steel	Solids, Sludges	Impoundments, Piles, Drums and Containers, Tanks	Depth constraint. Cannot collect deeper strata
Push Tube	Stainless Steel	Cohesive Solids, Sludges	Impoundments, Piles, Drums and Containers, Tanks	Depth constraints. Do not use to sample solids with dimensions >½ the diameter of the tube
Auger	Stainless Steel	Solids	Piles	Unusable for solidified wastes
Sediment Sampler	Stainless Steel	Solids, Sludges, Sediment	Impoundments, Piles	Do not use to sample solids with dimensions >½ the diameter of the tube
Ponar Dredge	Stainless Steel	Solids, Sludges, Sediments	Impoundments	Deployment constraints. Must have means to position equipment to desired sampling location. Difficult to decontaminate
COLIWASA, Drum Thief	Glass	Liquids, Sludges	Impoundments, Drums and Containers, Tanks	Depth constrained to length of sampling device. Not effective with viscous wastes
Mucksucker™ Dipstick™	Teflon	Liquids Sludges	Impoundments, Drums and Containers, Tanks	Not recommended for tanks >11 feet deep
Bacon Bomb	Stainless Steel	Liquids	Impoundments, Tanks	Not effective with viscous wastes
Bailer	Stainless Steel Teflon	Liquids	Impoundments, Tanks	Do not use with heterogeneous wastes. Not effective with viscous wastes
Peristaltic Pump with Vacuum Trap Assembly ²	Teflon Glass	Liquids	Impoundments, Drums and Containers, Tanks	Do not use in flammable atmospheres. Not effective with viscous wastes
Backhoe Bucket	Steel	Solids Sludges	Piles	May be difficult to access desired sampling location. Difficult to clean. Loss of VOCs possible
Split Spoon	Stainless Steel	Solids	Piles	Requires drill rig
Roto-Hammer	Steel	Solids	Piles, Drums, Containers	Physically breaks up sample. May release volatiles. Not for flammable atmospheres

¹ If disposable equipment of alternative material construction is used, ensure that the equipment is compatible with the chemical composition of the waste and will not alter the characteristics of the waste sample in any way.

² A peristaltic pump may be used without an optional vacuum trap assembly if the flexible tubing used in the pump head is one foot or less in length. Do not pump samples for VOCs through the pump head or into a vacuum trap.

FT 1000. GENERAL FIELD TESTING AND MEASUREMENT

Use the following SOPs in conjunction with FT 1000:

- FD 1000 Documentation Procedures
- FM 1000 Field Planning and Mobilization
- FS 1000 General Sampling Procedures
- FT 1100 through FT 3000 Specific Field Testing Procedures

1. INTRODUCTION

1.1. **Scope and Applicability:** SOPs FT 1100 to FT 3000 outline procedures to conduct field testing measurements and observations. They include the parameters that are measured *in-situ* or in a field-collected sample. Additionally some samples with allowable extended holding times may be collected for laboratory measurement, as described in the specific FT-series SOPs. Included in SOPs FT 1100 to FT 3000 are:

- FT 1100 Field Measurement of Hydrogen Ion Activity (pH)
- FT 1200 Field Measurement of Specific Conductance (Conductivity)
- FT 1300 Field Measurement of Salinity
- FT 1400 Field Measurement of Temperature
- FT 1500 Field Measurement of Dissolved Oxygen (DO)
- FT 1600 Field Measurement of Turbidity
- FT 1700 Field Measurement of Light Penetration (Secchi Depth and Transparency)
- FT 1800 Field Measurement of Water Flow and Velocity
- FT 1900 Continuous Monitoring with Installed Meters
- FT 2000 Field Measurement of Residual Chlorine
- FT 3000 Aquatic Habitat Characterization

1.2. **Exclusions:** **If proposed for experimental purposes, field-screening procedures employing techniques not addressed in these SOPs** must be submitted to the DEP site or project manager. Such procedures must be addressed for each program or project dealing specifically with the planning and design of sampling events. Data quality objectives for quantitative assessment preclude the use of field-screening procedures for regulatory purposes.

1.3. Expectations and Requirements:

1.3.1. In some cases, specific instruments are identified in the SOP, with detailed instruction provided on their use. If you are using a different instrument from that identified in the SOP, follow the manufacturer's instructions for assembly, operation, and maintenance.

1.3.2. When required, the FT-series SOPs outline the instrument specifications. A field instrument must meet the stated requirements.

1.3.3. The FT-Series SOPs specify the calibration requirements for each method. Although instruments may vary in configuration or operation, the specified calibration requirements must be met.

1.3.3.1. Where applicable to the FT-series SOP, use the minimum number of calibration standards specified.

1.3.3.2. Do not establish the lower limit of the quantitative calibration bracket with "zero" solutions, quality control blanks or reagent dilution water.

1.3.4. Ensure that all equipment is in proper working condition, calibrated, and that batteries are properly charged before using the equipment for field testing measurements.

1.3.5. If reagents or standards are prepared from stock chemicals, they must be analytical reagent grade or better. Some procedures may specify a higher grade or assay of reagent or standard.

1.4. Recommendations for Use of Grab Samples or *in situ* Field Testing Measurements:

1.4.1. Use *in situ* readings where practical for field measurements in surface water and wastewater.

1.4.2. Use *in situ* readings or flow-through containers for field measurements for groundwater stabilization during purging and for other applications where groundwater monitoring measurements are required.

1.4.3. If grab samples are collected for measurement where allowed in the individual FT-series SOP, measure samples within fifteen (15) minutes of collection when immediate analysis is specified per Table FS 1000-4 and FS 1000-5. Otherwise, analyze grab samples within the applicable holding times specified in Table FS 1000-4 and FS 1000-5.

2. MINIMUM CALIBRATION REQUIREMENTS:

2.1. Calibration Definitions: This section outlines the essential calibration concepts that must be applied to each field test. Specific requirements for calibration are addressed in the individual SOPs.

2.1.1. Initial Calibration (IC): The instrument or meter electronics are adjusted (manually or automatically) to a theoretical value (e.g., dissolved oxygen saturation) or a known value of a calibration standard.

2.1.2. Initial Calibration Verification (ICV): The instrument or meter calibration is checked or verified directly following initial calibration by measuring a calibration standard of known value as if it were a sample and comparing the measured result to the calibration acceptance criteria listed in the SOP.

2.1.3. Continuing Calibration Verification (CCV): The instrument or meter calibration is checked or verified by measuring a calibration standard of known value as if it were a sample and comparing the measured result to the calibration acceptance criteria listed in the SOP.

2.1.4. Chronological Calibration Bracket: The interval of time between verifications within which environmental sample measurements must occur. The instrument or meter

is calibrated or verified before and verified after the time of environmental sample measurement(s).

2.1.5. Quantitative Calibration Bracket: The instrument or meter is calibrated or verified at two known values that encompass the range of observed environmental sample measurement(s).

2.1.6. Acceptance Criteria: The numerical limits within which calibration verifications are acceptable.

2.2. Calibration Activities: Specific calibration procedures are given in the individual SOPs.

2.2.1. Chronological Calibration Bracket:

2.2.1.1. Ensure that the field test result is preceded by an acceptable ICV or CCV and followed by an acceptable CCV.

2.2.1.2. Specific requirements for chronological bracketing are addressed in the individual FT-series SOPs.

2.2.2. Quantitative Calibration Bracket:

2.2.2.1. Choose two standards that bracket the range of sample measurements. These standards may be used for initial calibrations or for verifications.

2.2.2.2. Specific requirements for quantitative bracketing are addressed in the individual FT-series SOPs.

2.2.3. Initial Calibration: Calibrate if no initial calibration has been performed or if a calibration verification does not meet acceptance criteria. Do not reuse standards for initial calibrations.

Table FT 1000-1: Field Testing Acceptance Criteria	
Parameter	Acceptance Criteria
pH (FT 1100)	± 0.2 Standard pH Units of buffer or more stringent program criteria
Specific Conductance (FT 1200)	± 5% of standard value
Temperature (FT 1400)	± 0.2°C of NIST-traceable value (with correction factors) Verification over range of applicable values
Dissolved Oxygen (FT 1500)	± 0.3 mg/L of theoretical value (see Table FT 1500-1)
Turbidity (FT 1600)	0.1-10 NTU: ± 10% of standard value 11-40 NTU: ± 8% of standard value 41-100 NTU: ± 6.5% of standard value > 100 NTU: ± 5% of standard value
Total Residual Chlorine (FT 2000)	0.995 calibration curve correlation coefficient ± 10% of primary standard value ± 10% of secondary standard value Color comparator acceptance criterion: ± 10% of primary standard value

2.2.4. Initial Calibration Verification:

2.2.4.1. Perform an ICV immediately after calibration. All ICVs must meet the calibration acceptance criteria specified in the applicable FT-series SOP. See Table FT 1000-1 for a list of acceptance criteria for the most common field testing procedures.

2.2.4.2. If an ICV fails to meet acceptance criteria, immediately recalibrate the instrument using the applicable initial calibration procedure or remove it from service.

2.2.5. Continuing Calibration Verification: Perform a CCV at no more than 24-hour intervals from previous verification, except where noted for individual FT-series SOPs.

2.2.5.1. If historically generated data demonstrate that a specific instrument remains stable for longer periods of time, the time interval between calibration verifications may be increased.

2.2.5.2. Base the selected time interval on the shortest interval that the instrument maintains stability. If CCVs consistently fail, shorten the time period between verifications or replace/repair the instrument.

2.2.5.3. All CCVs must meet the calibration acceptance criteria specified in the applicable FT-series SOP. See Table FT 1000-1 for a list of acceptance criteria for the most common field testing procedures.

2.2.5.4. If a CCV fails to meet acceptance criteria perform one or more of the following procedures as necessary:

- Reattempt the CCV again within the chronological bracket time interval without changing the instrument calibration. Do not perform maintenance, repair, or cleaning of the instrument or probe. Probes may be rinsed with analyte-free water or fresh verification standard. The CCV may be reattempted with a fresh aliquot of verification standard.
- Perform the initial calibration, perform an ICV, re-analyze the sample(s), and perform a CCV.
- Report all results between the last acceptable calibration verification and the failed calibration verification as estimated (report the value with a "J"). Include a narrative description of the problem in the field notes.

2.2.5.5. For installed instruments that are deployed for extended periods of time or used for continuous monitoring, see FT 1900.

2.2.5.6. Shorten the time period between verification checks or replace/repair the instrument.

2.2.6. Determining the Values of Secondary Standards: Use only those standards recommended by the manufacturer for a specific instrument. Only use secondary standards for continuing calibration verifications. See the individual FT-series SOPs for specific procedures for use of secondary standards. At documented intervals, determine or verify the values of secondary standards immediately after performing an initial calibration or after verifying the calibration with primary standards. Read each secondary standard as a sample. This result must be within the manufacturer's stated tolerance range and +/- 10% of the stated standard value. If the +/- 10% criterion is not

met, assign this reading as the value of the standard. If the reading is outside the manufacturer's stated tolerance range, discard the secondary standard.

2.2.7. More frequent calibration verifications may be required for discharge permit compliance measurements or other regulatory requirements.

3. PREVENTIVE MAINTENANCE: Record all maintenance and repair notes in the maintenance logbook for each meter (see FS 1007). If rental equipment is used, a log is not required. However, the origin (i.e., rental company), rental date, equipment type, model number, and identification number (if applicable) must be entered into the field notes or a rental equipment notebook.

4. DOCUMENTATION

4.1. Standard and Reagent Documentation: Document information about standards and reagents used for calibrations, verifications, and sample measurements.

4.1.1. Note the date of receipt, the expiration date and the date of first use for all standards and reagents.

4.1.1.1. Document acceptable verification of any standard used after its expiration date.

4.1.2. Record the concentration or other value for the standard in the appropriate measurement units.

4.1.2.1. Note vendor catalog number and description for pre-formulated solutions as well as for neat liquids and powdered standards.

4.1.2.2. Retain vendor assay specifications for standards as part of the calibration record.

4.1.3. Record the grade of standard or reagent used.

4.1.4. When formulated in-house, document all calculations used to formulate calibration standards.

4.1.4.1. Record the date of preparation for all in-house formulations.

4.1.5. Describe or cite the procedure(s) used to prepare any standards in-house (DEP SOP or internal SOP).

4.2. Field Instrument Calibration Documentation: Document acceptable calibration and calibration verification for each instrument unit and field test or analysis, linking this record with affected sample measurements.

4.2.1. Retain vendor certifications of all factory-calibrated instrumentation.

4.2.2. Designate the identity of specific instrumentation in the documentation with a unique description or code for each instrument unit used.

4.2.2.1. Record the manufacturer name, model number, and identifying number such as a serial number for each instrument unit.

4.2.3. Record the time and date of all initial calibrations and all calibration verifications.

4.2.4. Record the instrument reading (value in appropriate measurement units) of all calibration verifications.

4.2.5. Record the name of the analyst(s) performing the calibration.

4.2.6. Document the specific standards used to calibrate or verify the instrument or field test with the following information:

- Type of standard or standard name (e.g., pH buffer)
- Value of standard, including correct units (e.g., pH = 7.0 SU)
- Manufacturer's tolerance range for secondary standards
- Link to information recorded according to section 4.1 above

4.2.7. Retain manufacturers' instrument specifications.

4.2.8. Document whether successful initial calibration occurred.

4.2.9. Document whether each calibration verification passed or failed.

4.2.10. Document any corrective actions taken to correct instrument performance according to records requirements of FD 3000.

4.2.10.1. Document the date and time of any corrective actions.

4.2.10.2. Note any incidence of discontinuation of use of the instrument due to calibration failure.

4.2.11. Describe or cite the specific calibration or verification procedure performed (DEP SOP or internal SOP).

4.3. Record all field-testing measurement data, to include the following:

- Project name
- Date and time of measurement or test (including time zone, if applicable)
- Source and location of the measurement or test sample (e.g., monitoring well identification number, outfall number, station number or other description)
- Latitude and longitude of sampling source location (if required)
- Analyte or parameter measured
- Measurement or test sample value
- Reporting units
- Initials or name of analyst performing the measurement
- Unique identification of the specific instrument unit(s) used for the test(s)

Appendix FT 1000
Tables, Figures and Forms

Table FT 1000-1 Field Testing Acceptance Criteria

Table FT 1000-1: Field Testing Acceptance Criteria	
Parameter	Acceptance Criteria
pH (FT 1100)	± 0.2 Standard pH Units of buffer or more stringent program criteria
Specific Conductance (FT 1200)	$\pm 5\%$ of standard value
Temperature (FT 1400)	$\pm 0.2^{\circ}\text{C}$ of NIST-traceable value (with correction factors) Verification over range of applicable values
Dissolved Oxygen (FT 1500)	± 0.3 mg/L of theoretical value (see Table FT 1500-1)
Turbidity (FT 1600)	0.1-10 NTU: $\pm 10\%$ of standard value 11-40 NTU: $\pm 8\%$ of standard value 41-100 NTU: $\pm 6.5\%$ of standard value > 100 NTU: $\pm 5\%$ of standard value
Total Residual Chlorine (FT 2000)	0.995 calibration curve correlation coefficient $\pm 10\%$ of primary standard value $\pm 10\%$ of secondary standard value Color comparator acceptance criterion: $\pm 10\%$ of primary standard value

FT 1100. Field Measurement of Hydrogen Ion Activity (pH)

Use in conjunction with:

- FT 1000 General Field Testing and Measurement
- FQ 1000 Field Quality Control Requirements
- FS 1000 General Sampling Procedures
- FD 1000 Documentation Procedures

1. Equipment and Supplies

1.1. Field Instrument: Use any pH meter consisting of a potentiometer, a glass electrode, a reference electrode, and a temperature-compensating device.

1.1.1. For routine fieldwork use a pH meter accurate and reproducible to at least 0.2-unit in the range of 0.0 to 14.0 units, and equipped with temperature-compensation adjustment. Record the pH value in pH units to one decimal place.

1.1.2. Advanced silicon chip pH sensors (with digital meters) may be used if demonstrated to yield equivalent performance to glass electrode sensors for the intended application.

1.2. Standards: Purchased or laboratory-prepared standard buffer solutions of pH values that bracket the expected sample pH range. Use buffers with nominal values of 4.0, 7.0 and 10.0 units for most situations. If the sample pH is outside the range of 4.0 to 10.0, then use two buffers that bracket the expected range with the pH 7 buffer being one of the two buffers. Alternatively, prepare appropriate standards per table I in method SM4500-H⁺-B.

1.3. Recordkeeping and Documentation Supplies:

- Field notebook (w/ waterproof paper is recommended) or forms
- Indelible pens

2. Calibration and Use

2.1. General Concerns

2.1.1. The acceptance criterion for the initial calibration or the calibration verification is a reading of the standard within +/- 0.2-unit of the expected value.

2.1.2. On a weekly basis, check the calibration to ensure the % theoretical slope is greater than 90% (if applicable to your instrument type).

2.1.2.1. Note the % slope in the calibration records.

2.1.2.2. A % slope of less than 90% indicates a bad electrode that must be changed or repaired.

2.1.2.3. If % slope cannot be determined on your meter, or the manufacturer's optimum specifications are different, follow the manufacturer's recommendation for maintaining optimum meter performance.

2.2. Interferences

2.2.1. Sodium at pH \geq 10.0 units can be reduced or eliminated by using a low sodium error electrode.

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- 2.2.2. Coatings of oils, greases, and particles may impair the electrode's response. Pat the electrode bulb dry with lint-free paper or cloth and rinse with de-ionized water. For cleaning hard-to-remove films, use acetone very sparingly so that the electronic surface is not damaged.
- 2.2.3. Temperature effects on the electrometric measurement of pH are controlled by using instruments having temperature compensation or by calibrating the meter at the temperature of the samples.
- 2.2.4. Poorly buffered solutions with low specific conductance ($< 200 \mu\text{mhos/cm}$) may cause fluctuations in the pH readings. Equilibrate electrode by immersing in several aliquots of sample before taking pH.
- 2.2.5. Ensure stable sample and sensor temperature before calibrating or taking sample readings. Drifting sensor or sample temperature may produce erroneous sample measurements, calibrations, or verifications.
- 2.2.6. Thoroughly rinse the pH sensor with deionized water or fresh buffer standard when calibrating or verifying the calibration or when taking sample measurements. For in-situ measurements, ensure adequate flushing of the sensor with fresh sample water prior to taking measurements. Any residual standard, sample or deionized water remaining on the sensor may affect the measurement of the subsequent standard or sample. This is especially true when samples or standards of widely different pH value are successively measured.
- 2.2.7. Drifting readings or an inability to calibrate the sensor may also indicate a fouled electrode. Clean the electrode per the manufacturer's instructions or replace.
- 2.3. Calibration: Follow the manufacturer's calibration instructions specific to your meter. Most instruments allow for a two-point calibration and a few models can perform a three-point calibration. Use the appropriate number of standard buffer solutions for calibration. Do not reuse buffers for initial calibrations.
 - 2.3.1. Rinse the probe with de-ionized water (DI) before and between each standard buffer solution.
 - 2.3.2. Follow the calibration activities specified in FT 1000, section 2.2.
 - 2.3.2.1. Perform an initial calibration using at least two buffers. Always use a pH 7 buffer first.
 - 2.3.2.2. If the pH sample range is expected to be wider than the range established by a two-point calibration (e.g., some samples at pH 4 and others at pH 8), then add a third calibration point. If the instrument cannot be calibrated with three buffers, the third buffer may be used as the initial calibration verification to extend the range.
 - 2.3.2.3. After initial calibration, immediately perform an initial calibration verification (ICV). Read a buffer as a sample. To be acceptable, a calibration verification must be within ± 0.2 pH units of the stated buffer value. For example, if reading the pH 4.0 buffer, the result must be in the 3.8 to 4.2 range. Certain regulatory programs may have more stringent acceptance criteria.
 - 2.3.2.4. After sample measurement(s), perform a continuing calibration verification (CCV). Read a buffer as a sample. To be acceptable, a

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calibration verification must be within +/- 0.2 pH units of the stated buffer value. This CCV (if within acceptance criteria) can be used as the beginning of the chronological bracket. Certain regulatory programs may have more stringent acceptance criteria.

- 2.4. Measuring pH *in situ*: After calibrating the multi-probe sensors as outlined in 2.3 above, follow the meter's instructions to select the display for reading the pH of the sample. Immerse the probe at the desired depth in the water and wait for stabilization of the reading before recording the measurement.
- 2.5. Measuring pH in Flow-through Cells: When using a flow-through cell, the procedure described above in section 2.4 is applicable.
- 2.6. Measuring pH in Samples: After an acceptable initial calibration or calibration verification, follow these procedures to take a pH reading of a freshly collected sample (within 15 minutes of collection).
 - 2.6.1. Pour enough of the fresh sample into a clean cup to take the reading.
 - 2.6.2. Place the pH electrode in the sample (in the cup) and swirl the electrode.
 - 2.6.3. Wait for stabilization, and read the pH value.
 - 2.6.4. Turn the meter off after the last sample reading, rinse the electrode thoroughly with de-ionized water and replace the electrode's cap.
3. PREVENTIVE MAINTENANCE: Refer to FT 1000, section 3.
4. DOCUMENTATION
 - 4.1. Standard and Reagent Documentation: Document information about standards and reagents used for calibrations, verifications, and sample measurements.
 - 4.1.1. Note the date of receipt, the expiration date and the date of first use for all standards and reagents.
 - 4.1.1.1. Document acceptable verification of any standard used after its expiration date.
 - 4.1.2. Record the concentration or other value for the standard in the appropriate measurement units.
 - 4.1.2.1. Note vendor catalog number and description for preformulated solutions as well as for neat liquids and powdered standards.
 - 4.1.2.2. Retain vendor assay specifications for standards as part of the calibration record.
 - 4.1.3. Record the grade of standard or reagent used.
 - 4.1.4. When formulated in-house, document all calculations used to formulate calibration standards.
 - 4.1.4.1. Record the date of preparation for all in-house formulations.
 - 4.1.5. Describe or cite the procedure(s) used to prepare any standards in-house (DEP SOP or internal SOP).
 - 4.2. Field Instrument Calibration Documentation: Document acceptable calibration and calibration verification for each instrument unit and field test or analysis, linking this record with affected sample measurements.

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- 4.2.1. Retain vendor certifications of all factory-calibrated instrumentation.
- 4.2.2. Designate the identity of specific instrumentation in the documentation with a unique description or code for each instrument unit used.
 - 4.2.2.1. Record manufacturer name, model number, and identifying number such as a serial number for each instrument unit.
- 4.2.3. Record the time and date of all initial calibrations and all calibration verifications.
- 4.2.4. Record the instrument reading (value in appropriate measurement units) of all calibration verifications.
- 4.2.5. Record the name of the analyst(s) performing the calibration.
- 4.2.6. Document the specific standards used to calibrate or verify the instrument or field test with the following information:
 - Type of standard or standard name (e.g., pH buffer)
 - Value of standard, including correct units (e.g., pH = 7.0 SU)
 - Link to information recorded according to section 4.1 above
- 4.2.7. Retain manufacturers' instrument specifications.
- 4.2.8. Document whether successful initial calibration occurred.
- 4.2.9. Document whether each calibration verification passed or failed.
- 4.2.10. Document any corrective actions taken to correct instrument performance according to records requirements of FD 3000.
 - 4.2.10.1. Document date and time of any corrective action.
 - 4.2.10.2. Note any incidence of discontinuation of use of the instrument due to calibration failure.
- 4.2.11. Describe or cite the specific calibration or verification procedure performed (DEP SOP or internal SOP).
- 4.3. Record all field-testing measurement data, to include the following:
 - Project name
 - Date and time of measurement or test (including time zone, if applicable)
 - Source and location of the measurement or test sample (e.g., monitoring well identification number, outfall number, station number or other description)
 - Latitude and longitude of sampling source location (if required)
 - Analyte or parameter measured
 - Measurement or test sample value
 - Reporting units
 - Initials or name of analyst performing the measurement
 - Unique identification of the specific instrument unit(s) used for the test(s)

FT 1200. Field Measurement of Specific Conductance (Conductivity)

Use in conjunction with:

- FT 1000 General Field Testing and Measurement
- FQ 1000 Field Quality Control Requirements
- FS 1000 General Sampling
- FD 1000 Documentation Procedures

1. INTRODUCTION: Specific conductance is a useful method to approximate the total amount of inorganic dissolved solids.

1.1. Conductivity varies with temperature. For example, the conductivity of salt water increases 3%/degree C at 0°C, and only 2%/degree C at 25°C.

1.2. Record the sample temperature or adjust the temperature of the samples prior to measuring specific conductance if the conductivity instrument does not employ automatic temperature compensation and correction of the instrument display value.

2. EQUIPMENT AND SUPPLIES

2.1. Field Instrument: Any self-contained conductivity instrument suitable for field work, accurate and reproducible to 5% or better over the operational range of the instrument, and preferably equipped with temperature-compensation adjustment. See references in FT 1210 below for additional information about instruments.

2.2. Standards: Purchased or laboratory-prepared standard potassium chloride (KCl) solutions with conductivity values that bracket the expected samples' range. In the laboratory, prepare standards of appropriate conductivities per SM2510 (Conductivity, in *Standard Methods for the Examination of Water and Wastewater, American Public Health Association*). Do not reuse standards for initial calibrations.

2.3. Recordkeeping and Documentation Supplies:

- Field notebook (w/ waterproof paper is recommended) or forms
- Indelible pens

3. CALIBRATION AND USE

3.1. General Concerns

3.1.1. Follow the instrument manufacturer's instructions for the details of operating the instrument.

3.1.2. For instruments without automatic temperature compensation, attempt to adjust the temperature of the samples to 25°C. If the temperature cannot be adjusted, measure the temperature with a calibrated device (see FT 1400), record the temperature, correct for temperature (per section 3.4 below) and report the results corrected to 25°C. See references in FT 1210 below for further information about temperature correction.

3.1.3. Ensure stable sample and sensor temperature before calibrating or taking sample readings. Drifting sensor or sample temperature may produce erroneous sample measurements, calibrations or verifications.

3.1.4. Thoroughly rinse the conductivity sensor with deionized water and fresh standard when calibrating or verifying the calibration or when taking sample measurements. For in-situ measurements, ensure adequate flushing of the sensor with fresh sample water prior to taking measurements. Any residual standard, sample or deionized water remaining on the sensor may affect the measurement of the subsequent standard or sample. This is especially true when samples or low-concentration standards are measured subsequent to measuring high-concentration standards.

3.1.5. Drifting readings or an inability to calibrate the sensor may also indicate a fouled electrode. Clean the electrodes per the manufacturer's instructions.

3.1.6. When successful calibration and verification cannot be achieved after ensuring that temperatures have stabilized and the sensor electrodes are clean and free of residual sample or standard from the previous measurement, suspect opened containers of standards, especially after repeated openings, when near the manufacturer's expiration date or when little standard volume remains in the container. Low-concentration conductivity standards are seldom stable for an extended period after opening.

3.2. Calibration and Calibration Verification:

3.2.1. Follow the calibration activities specified in FT 1000, section 2.2.

3.2.2. Initial Calibration: Calibrate the meter prior to use according to the following steps:

3.2.2.1. **Do not "zero" in the meter using analyte-free water or air.**

3.2.2.2. When the sample measurements are expected to be 100 $\mu\text{mhos/cm}$ or greater, use two standard potassium chloride solutions that bracket the range of expected sample conductivities. A single standard at 100 $\mu\text{mhos/cm}$ standard potassium chloride solution is acceptable for situations in which all sample measurements are expected to be less than 100 $\mu\text{mhos/cm}$.

3.2.2.3. Calibrate the instrument with one of the two standards to create an upper or lower boundary for the quantitative bracket.

3.2.2.4. Verify the calibration of the instrument with the second standard, quantitatively bracketing the range of expected sample values.

3.2.2.5. If the instrument can be calibrated with more than one standard, choose additional calibration standards within the range of expected sample values. The second standard in section 3.2.2.3 above may be used as an additional calibration standard.

3.2.2.6. Note: If all samples are expected to be less than 100 $\mu\text{mhos/cm}$, only one standard at 100 $\mu\text{mhos/cm}$ standard potassium chloride solution is required.

3.2.3. Acceptability: Accept the calibration if the meter reads within +/- 5% of the value of any calibration standard used to verify the calibration. For example, the acceptance range for a 100 $\mu\text{mhos/cm}$ standard is 95 to 105 $\mu\text{mhos/cm}$. If the meter does not read within +/- 5% of each calibration verification standard, determine the cause of the problem and correct before proceeding.

3.2.4. Temperature Correction: Most field instruments read conductivity directly. If the meter does not automatically correct values to 25°C, calculate correction factors using

the procedure in section 3.4 below. Record all readings and calculations in the calibration records.

3.2.5. Continuing Calibration Verification: Check the meter in read mode with at least one KCl standard with a specific conductance which quantitatively brackets the conductivity measured in environmental samples. The reading for the calibration verification must also be within +/- 5% of the standard value (see 3.2.3 above).

3.2.5.1. If new environmental samples are encountered outside the range of the initial calibration in 3.2.2 above, verify the instrument calibration with an additional standard that brackets the range of new sample values. If these calibration verifications fail, recalibrate the instrument as in 3.2.2.

3.2.5.2. **More frequent calibration verifications may be required for discharge permit compliance measurements or other regulatory requirements.**

3.3. Measuring Specific Conductance of Samples:

3.3.1. Follow manufacturer's instructions for sample measurement.

3.3.2. Immerse or place the conductivity probe or sensor in situ at a measuring location representative of the sampling source.

3.3.3. Allow the conductivity instrument to stabilize.

3.3.4. Measure the water temperature (if necessary for manual temperature compensation) and record the temperature. See FT 1400 for temperature measurement procedures.

3.3.5. If the meter is equipped with manual temperature compensation, adjust the conductivity meter to the water temperature per manufacturer's instructions.

3.3.6. If the conductivity meter has a set of positions that multiply the reading by powers of ten in order to measure the full range of potential conductivities, set this dial to the correct range in order to take a reading.

3.3.7. Record the sample conductivity measurement reading within 15 minutes of water sample collection.

3.3.8. Rinse off the probe with de-ionized water. Follow manufacturer's instructions for probe storage between use.

3.4 Calculations for Temperature Compensation

If the meter does not automatically correct for temperature (manual or automatic adjustment), or if a probe with a cell constant other than 1 is used, the following formula must be used to normalize the data to 25°C:

$$K = \frac{(K_m)(C)}{1 + 0.0191(T-25)}$$

Where: K = conductivity in $\mu\text{mhos/cm}$ at 25°C

K_m = measured conductivity in $\mu\text{mhos/cm}$ at T degrees C

C = cell constant

T = measured temperature of the sample in degrees C

If the cell constant is 1, the formula for determining conductivity becomes:

$$K = \frac{(K_m)}{1 + 0.0191(T-25)}$$

Refer to SM2510B, 20th edition, if other calculations (i.e., determining cell constant, etc.) are required. See FT 1210 below.

3.5 *In situ* Measurements at Depth or With Flow-through Cells: After calibrating the instrument as outlined in 3.2 above, follow the manufacturer's instructions to measure the conductivity of the sample.

3.5.1. For *in situ* measurements immerse the probe at the desired depth and wait for stabilization of the reading and record its value. Follow a similar procedure when using a flow-through cell.

3.5.1.1 Preferably measure groundwater sample conductivity *in situ* with a downhole probe or in a flow-through system.

4. PREVENTATIVE MAINTENANCE: Refer to FT 1000, section 3.

5. DOCUMENTATION

5.1. Standard and Reagent Documentation: Document information about standards and reagents used for calibrations, verifications and sample measurements.

5.1.1. Note the date of receipt, the expiration date and the date of first use for all standards and reagents.

5.1.1.1. Document acceptable verification of any standard used after its expiration date.

5.1.2. Record the concentration or other value for the standard in the appropriate measurement units.

5.1.2.1. Note vendor catalog number and description for preformulated solutions as well as for neat liquids and powdered standards.

5.1.2.2. Retain vendor assay specifications for standards as part of the calibration record.

5.1.3. Record the grade of standard or reagent used.

5.1.4. When formulated in-house, document all calculations used to formulate calibration standards.

5.1.4.1. Record the date of preparation for all in-house formulations.

5.1.5. Describe or cite the procedure(s) used to prepare any standards in-house (DEP SOP or internal SOP).

5.2. Field Instrument Calibration Documentation: Document acceptable calibration and calibration verification for each instrument unit and field test or analysis, linking this record with affected sample measurements.

5.2.1. Retain vendor certifications of all factory-calibrated instrumentation.

5.2.2. Designate the identity of specific instrumentation in the documentation with a unique description or code for each instrument unit used.

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- 5.2.2.1. Record manufacturer name, model number, and identifying number such as a serial number for each instrument unit.
- 5.2.3. Record the time and date of all initial calibrations and all calibration verifications.
- 5.2.4. Record the instrument reading (value in appropriate measurement units) of all calibration verifications.
- 5.2.5. Record the name of the analyst(s) performing the calibration.
- 5.2.6. Document the specific standards used to calibrate or verify the instrument or field test with the following information:
- Type of standard or standard name (e.g., conductivity standard)
 - Value of standard, including correct units (e.g., conductivity = 100 μ mhos/cm)
 - Link to information recorded according to section 5.1 above
- 5.2.7. Retain manufacturers' instrument specifications.
- 5.2.8. Document whether successful initial calibration occurred.
- 5.2.9. Document whether each calibration verification passed or failed.
- 5.2.10. Document any corrective actions taken to correct instrument performance according to records requirements of FD 3000.
- 5.2.10.1. Document date and time of any corrective action.
- 5.2.10.2. Note any incidence of discontinuation of use of the instrument due to calibration failure.
- 5.2.11. Describe or cite the specific calibration or verification procedure performed (DEP SOP or internal SOP).
- 5.3. Record all field-testing measurement data, to include the following:
- Project name
 - Date and time of measurement or test (including time zone, if applicable)
 - Source and location of the measurement or test sample (e.g., monitoring well identification number, outfall number, station number or other description)
 - Latitude and longitude of sampling source location (if required)
 - Analyte or parameter measured
 - Measurement or test sample value
 - Reporting units
 - Initials or name of analyst performing the measurement
 - Unique identification of the specific instrument unit(s) used for the test(s)

FT 1400. Field Measurement of Temperature

The use of this SOP is not required when using field temperature measurement devices to monitor groundwater stabilization during the purging of groundwater monitoring wells. Field temperature measurement devices used for temperature compensation (correction) for other measurements such as dissolved oxygen, specific conductance or pH are also exempted from the requirements of this SOP. FT 1400 must be used for all other field temperature measurements required by DEP.

Use this SOP in conjunction with the following DEP SOPs:

- FT 1000 General Field Testing and Measurement
- FQ 1000 Field Quality Control Requirements
- FS 1000 General Sampling Procedures
- FD 1000 Documentation Procedures

1. EQUIPMENT AND SUPPLIES

1.1. Field Instruments: Use any of the following instrument types for performing field measurements:

- Digital thermistor (thermocouple type) and meter typical of field instruments
- Glass bulb, mercury-filled thermometer (not recommended for field ruggedness)
- Glass bulb, alcohol-filled thermometer with protective case
- Bi-metal strip/dial-type thermometer
- Advanced silicon chip temperature sensor and digital meter

1.1.1. Field instruments must be capable of measuring temperature in 0.1°C increments.

1.2. Standard Thermometer: NIST-traceable Celsius certified thermometer with scale marks for every 0.1°C increment, a range of 0°C to 100°C (or a range bracketing expected sample temperatures) and correction chart supplied with certification. The standard thermometer must have a valid certification for the period of measurement.

1.3. Recordkeeping and Documentation Supplies:

- Field notebook or forms \
- Indelible pens

2. CALIBRATION AND USE

2.1. General Concerns

2.1.1. Select a temperature measuring device meeting the requirements of section 1.1 above.

2.1.2. Dial-type and thermocouple-type devices with meters are preferred over the glass thermometers for fieldwork because of their durability and ease of reading.

2.1.2.1. Transport glass thermometers in protective cases.

2.1.2.2. Inspect glass thermometers for liquid separation. Do not use a thermometer if the liquid has separated.

2.1.2.3. Most instruments with digital display will provide more decimal figures than are significant. Record the temperature reading with only one rounded decimal figure (e.g., 25.9 instead of 25.86°C).

2.2. Calibration

2.2.1. Follow the calibration activities specified in FT 1000, section 2.2.

2.2.2. Verify all thermistor (meter) devices and field thermometers against the NIST-traceable standard thermometer at several temperatures in the expected sample measurement range, using any correction factor indicated by the certificate supplied with the NIST-traceable thermometer.

2.2.2.1. See the US Geological Survey, National Field Manual for the Collection of Water-Quality Data, Book 9, Chapter A6, Field Measurements, Section 6.1, Temperature, Techniques of Water-Resources Investigations, 4/98 for additional guidance about making temperature comparisons with the standard thermometer.

2.2.2.2. Make note of the calibration in the calibration records. See section 4 below.

2.2.2.3. The field measurement device may be used with a linear correction factor provided that the observed temperature difference with the standard thermometer is documented at incremental temperatures over the range of expected sample temperatures.

2.2.2.4. Use the resulting correction factor when making temperature measurements of samples with the field measurement device.

2.2.2.5. Prominently display the correction factor on the field measurement device, with the date last verified. A calibration correction curve or plot may also be used.

2.2.2.6. To be acceptable, a calibration verification must be within +/- 0.5°C of the corrected reading of the NIST-traceable thermometer.

2.2.2.7. Properly dispose of glass-bulb thermometers that do not meet the above calibration acceptance criteria.

2.2.3. Continuing Calibration Verifications:

2.2.3.1. Determine the maximum time between continuing calibration verifications for the specific field temperature measurement device based on instrument stability.

2.2.3.2. Verify the field measurement device against the standard NIST-traceable thermometer as in section 2.2.2 above.

2.2.4. Refer to additional calibration requirements in FT 1000, section 2.2.

2.2.5. More frequent calibration verifications may be required for discharge permit compliance measurements or other regulatory requirements.

2.3. Measuring Sample Temperature

2.3.1. Insert or place the thermometer or sensor *in situ* at a measuring location representative of the sampling source.

2.3.2. Allow the thermometer or temperature sensor to equilibrate to ambient *in situ* temperature.

2.3.2.1. Groundwater samples must be measured *in situ* with a downhole probe or in a flow-through container. Do not measure bailed or pumped samples in an intermediate container containing static sample.

2.3.3. Record the temperature to the nearest 0.1°C after the reading stabilizes and remains constant.

3. PREVENTIVE MAINTENANCE: Refer to FT 1000, section 3.

4. DOCUMENTATION

4.1. Standards Documentation: Document information about the NIST-traceable standard thermometer in the calibration record, including:

- Unique identification for the thermometer
- Vendor certificate of calibration, including any correction factor
- Vendor's expiration date for the certificate of calibration

4.2. Field Instrument Calibration Documentation: Document acceptable calibration and calibration verification for each instrument unit and field test or analysis, linking this record with affected sample measurements.

4.2.1. Retain vendor certifications of all factory-calibrated instrumentation.

4.2.2. Designate the identity of specific instrumentation in the documentation with a unique description or code for each instrument unit used.

4.2.2.1. Record manufacturer name, model number, and identifying number such as a serial number for each instrument unit.

4.2.3. Record the time and date of all initial calibrations and all calibration verifications.

4.2.4. Record the instrument reading (value in appropriate measurement units) of all calibration verifications.

4.2.5. Record the name of the analyst(s) performing the calibration.

4.2.6. Document the following information about initial calibration and calibration verifications and link to information recorded according to section 4.1 above:

- Details of the method used to compare the field measurement device to the NIST-traceable standard thermometer.
- Results of each calibration verification, including the expected reading (per the NIST-traceable standard thermometer)
- The actual reading of the field measurement device, using any established correction factors and correct units.

4.2.7. Retain manufacturers' instrument specifications.

4.2.8. Document whether successful initial calibration occurred.

4.2.9. Document whether each calibration verification passed or failed.

4.2.10. Document any corrective actions taken to correct instrument performance (such as a new correction factor) according to records requirements of FD 3000.

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4.2.10.1. Document date and time of any corrective action.

4.2.10.2. Note any incidence of discontinuation of use of the instrument due to calibration failure.

4.2.11. Describe or cite the specific calibration or verification procedure performed (DEP SOP or internal SOP).

4.3. Record all field-testing measurement data, to include the following:

- Project name
- Date and time of measurement or test (including time zone, if applicable)
- Source and location of the measurement or test sample (e.g., monitoring well identification number, outfall number, station number or other description)
- Latitude and longitude of sampling source location (if required)
- Analyte or parameter measured
- Measurement or test sample value
- Reporting units
- Initials or name of analyst performing the measurement
- Unique identification of the specific instrument unit(s) used for the test(s)

FT 1500. Field Measurement of Dissolved Oxygen (DO)

Use in conjunction with:

- FT 1000 General Field Testing and Measurement
- FS 1000 General Sampling Procedures
- FD 1000 Documentation Procedures

1. EQUIPMENT AND SUPPLIES

1.1. Field Instruments

1.1.1. Membrane-type polarographic or galvanic electrode DO sensor with dedicated meter or configured with multi-parameter sonde

1.1.2. Luminescence-based DO sensor with dedicated meter or configured with multi-parameter sonde (see American Society for Testing and Materials, *Standard Test Methods for Dissolved Oxygen in Water*, Test Method C-Luminescence-based Sensor, D 888-05).

1.1.3. Select instrument assemblies that provide minimum precision of +/- 0.2 mg DO/L and a minimum accuracy of +/- 0.2 mg DO/L.

1.1.4. Compensate for temperature dependence of DO measurements by using instruments employing automatic temperature compensation or by manually correcting measurements in accordance with SM 4500-O G (see *Standard Methods for the Examination of Water and Wastewater*, American Public Health Association, American Water Works Association, Water Pollution Control Federation).

1.1.4.1. Calibrate on-board temperature sensors as described in FT 1400.

1.2. Standards

1.2.1. NIST-traceable Celsius thermometer with a scale marked for every 0.1°C and a range of 0 to 100°C.

1.2.2. Access to an organization with capability to perform the Winkler titration procedure is recommended but not mandatory.

1.2.3. A “zero-DO standard”, prepared on-site with an aliquot of the sample water, is optional. Prepare by adding excess sodium sulfite and a trace of cobalt chloride to bring the DO to zero.

1.3. Recordkeeping and Documentation Supplies:

- Field notebook (w/ waterproof paper is recommended) or forms
- Indelible pens

2. CALIBRATION AND USE: the electrode method is predominantly used in-situ for dissolved oxygen determinations.

2.1. General Concerns

2.1.1. Turbulence is necessary to keep a constant flow of water across the membrane-sample interface. Make sure the appropriate mechanism is working before using the probe.

2.1.2. Follow instrument manufacturer's instructions for probe storage. For example, store the probe with a cover that creates a saturated atmosphere. A cap, with a wet sponge in it, will suffice for single-parameter probes. If the sensor is in a multi-probe device, keep the protective cap chamber moist during storage.

2.1.3. Before mobilizing, check to make sure there are no bubbles beneath the probe membrane, or any wrinkles or tears in the probe membrane. If so, replace the membrane and KCL solution. Check the leads, contacts, etc. for corrosion and/or shorts if meter pointer remains off-scale, does not calibrate, or drifts.

2.1.4. Dissolved inorganic salts interfere with the performance of DO probes. For example, DO readings in salt water are affected by the salinity and must be corrected. The DO meter may adjust automatically based on readings taken from the specific conductivity/salinity probe. If corrections are not automatic the appropriate calculations must be used to correct for salinity. If automatic adjustments are used the specific conductivity/salinity probe calibration must be verified or calibrated in accordance with FT1200.

2.1.5. Reactive gases, which pass through the membrane, may interfere. For example, chlorine will depolarize the cathode and cause a high probe output. Long-term exposures to chlorine will coat the anode with the chloride of the anode metal and eventually desensitize the probe. Sulfide (from H₂S) will undergo oxidation if high enough potential (voltage) is applied, creating current flow, yielding faulty readings. If such interferences are suspected, change the membrane electrode more frequently and calibrate at more frequent intervals.

2.1.6. Ensure that the temperature of the sensor and sample are stable. Unstable temperatures will produce erroneous calibrations, verifications or sample measurements.

2.1.7. Erroneous calibrations or verifications may result if the saturated air chamber is not vented to atmospheric pressure, properly humidified and protected from temperature fluctuations produced by common field conditions such as evaporation or fluctuation in sunlight intensity.

2.2. Follow the quality control requirements for calibration (see activities in FT 1000, section 2.2).

2.3. Initial Calibration and Initial Calibration Verification

2.3.1. Air Calibration and Initial Calibration Verification (ICV): Calibrate the meter at 100% saturation. Before use, verify the meter calibration in water-saturated air to make sure it is properly calibrated and operating correctly. Make a similar verification at the end of the day or sampling event. Follow the manufacturer's instructions for your specific instrument.

2.3.1.1. Allow an appropriate warm up period before initial field calibration.

2.3.1.2. Wet the inside of the calibration chamber with water, pour out the excess water (leave a few drops), wipe any droplets off the membrane/sensor and insert the sensor into the chamber (this ensures 100% humidity).

2.3.1.3. Allow adequate time for the DO sensor and the air inside the calibration chamber to equilibrate.

2.3.1.4. Once the probe/calibration chamber is stable at ambient temperature, check the air temperature and determine, from the DO versus temperature table, what the DO saturation value should be at the observed temperature (see Table FT

1500-1, below). A stable and accurate temperature is required for a valid calibration. The acceptance criterion for DO calibration verification is +/- 0.3 mg DO/L at the observed temperature of the verification.

2.4. Continuous Calibration Verification

2.4.1. Air-Calibration Verification: DO sensor or instrument is calibrated against air that is saturated with water at a known temperature and ambient atmospheric pressure. Use Table FT 1500-1 below to verify calibration at specified temperature.

2.4.1.1. Wet the inside of the calibration chamber with water, pour out the excess water (leave a few drops) and insert the sensor into the chamber (this ensures 100-percent humidity)

2.4.1.2. Allow adequate time for the DO sensor and the air inside the calibration chamber to equilibrate.

2.4.1.3. Measure the temperature in the calibration chamber and observe the readings until the instrument stabilizes.

2.4.1.4. Use the oxygen solubility Table FT 1500-1 below to determine the DO saturation at a measured temperature and atmospheric pressure. Calculate values to the nearest tenth degree by interpolation or use an expanded version of this table found in FS 2200, which provides saturation data in 0.1 °C increments for a selected temperature range (see Table FS 2200-2).

2.4.1.5. Compare DO meter reading with value obtained from Table FT 1500-1 below to verify continuous calibration.

2.5. Additional Verifications: The following methods may be used as additional checks to verify calibration. These additional checks may be required as part of a specific permit.

2.5.1. Winkler method: This check is useful to assess the condition of the DO sensor (i.e., its degradation with time/use) and that the instrument can still maintain a valid calibration (see SM 4500-O C).

2.5.1.1. **Perform the Winkler method when required by permit or other regulation at the required calendar frequency.**

2.5.1.2. For an accuracy calibration verification using the Winkler method, follow SM 4500-O C.

2.5.1.3. Fill a clean bucket with uncontaminated or de-ionized water and place the probe into the bucket (with stirrer or equivalent mechanism turned off). Fill at least two biological oxygen demand (BOD) bottles without entraining atmospheric oxygen into the bottles. Carefully submerge the bottom of the bottle (one at a time) into the water and allow the water to fill the bottle. Place the bottle on the bottom of the bucket and carefully place stopper into it without adding atmospheric oxygen. Retrieve the bottles and determine their DO by the Winkler method (see SM4500-O-C for more details). Turn the stirrer or equivalent mechanism on and read the DO of the water in the bucket.

2.5.1.4. Adjust the DO meter according to manufacturer's instructions. Be sure to adjust the meter to the temperature of water in the bucket, and then calibrate the DO meter to read the average DO concentration of the two samples determined by the Winkler test.

2.5.2. Zero-DO Verification: The air calibration and the interfering effects of the sample can be further checked in the field by means of a "zero-DO standard"(SM 4500-O G).

2.5.2.1. Prepare this standard on-site with an aliquot of the sample by adding excess sodium sulfite and a trace of cobalt chloride to bring the DO to zero. Prepare this zero-DO standard in a beaker or a large-mouth sample container of appropriate size to insert the DO probe.

2.5.2.2. After adding the chemicals, gently swirl the water and let it sit for about 30 seconds before inserting the probe.

2.5.2.3. Read the DO of the sample. If the reading is outside the acceptance interval, the instrument must be recalibrated and/or zero-adjusted if the meter allows for this adjustment.

2.5.3. Air-Saturated Water: The DO sensor or instrument system is calibrated against water that is saturated with oxygen at a known temperature and ambient atmospheric pressure.

2.5.3.1. The temperature and conductivity of water used for calibration should be about the same as the temperature and conductivity of the water to be measured.

2.5.3.2. Place DO sensor and calibration water in a large beaker or open-mouth container.

2.5.3.3. Aerate the water for an adequate amount of time.

2.5.3.4. Determine if the water is 100 percent saturated with oxygen, and take a temperature reading. Temperature must be calibrated or verified for accuracy before DO calibration verification.

2.5.3.5. Use Table FT 1500-1 above to determine the DO saturation value at the measured water temperature. Compare DO meter reading with value obtained from Table FT 1500-1 to ensure continuous calibration.

2.6. Measuring DO in Samples:

2.6.1. Insert or place the DO probe *in situ* at a measuring location representative of the sampling source:

2.6.1.1. Take the DO of an effluent just before it enters the receiving water. If the effluent aerated prior to entering the surface water, take the DO reading in the receiving water right where it enters.

2.6.1.2. For well mixed surface waters, e.g., fast flowing streams, take the DO reading at approximately 1-2 feet below the surface or at mid-depth.

2.6.1.3. For still or sluggish surface waters, take a reading at one foot below the surface, one foot above the bottom, and at mid-depth.

2.6.1.4. If it is shallow surface waters, (less than two feet) take the reading at mid-depth.

2.6.1.5. Do not take a reading in frothy or aerated water unless required by the sampling plan.

2.6.1.6. Groundwater samples must be measured *in situ* with a downhole probe or in a flow-through container. Do not measure bailed or pumped samples in an intermediate container containing static sample.

2.6.2. Rinse probe with de-ionized water and keep the probe in the saturated atmosphere (see 2.1.2 above) between sites and events.

2.6.3. If the readings show distinct, unexplainable changes in DO levels, or when the probe has been in waters with high sulfides, recalibrate or perform maintenance per manufacturer's instructions. While taking a reading, if it is very low (e.g., below 1.0 mg/L), allow the meter to stabilize, record it and then, remove and rinse the probe, as the environment is very likely anoxic and may contain hydrogen sulfide, which can damage the probe.

2.6.4. Salinity and Temperature corrections may be necessary. Follow manufacturer instructions for automatic corrections or perform manual calculations (SM 4500-O G).

3. PREVENTIVE MAINTENANCE: Refer to FT 1000, section 3.

4. DOCUMENTATION

4.1. Standard and Reagent Documentation: Document information about standards and reagents used for verifications.

4.1.1. Note the date of receipt, the expiration date and the date of first use for all standards and reagents.

4.1.1.1. Document acceptable verification of any standard used after its expiration date.

4.1.2. Record the concentration or other value for the standard in the appropriate measurement units.

4.1.2.1. Note vendor catalog number and description for pre-formulated solutions as well as for neat liquids and powdered standards.

4.1.2.2. Retain vendor assay specifications for standards as part of the calibration record.

4.1.3. Record the grade of standard or reagent used.

4.1.4. When formulated in-house, document all calculations used to formulate calibration standards.

4.1.4.1. Record the date of preparation for all in-house formulations.

4.1.5. Describe or cite the procedure(s) used to prepare any standards in-house (DEP SOP or internal SOP).

4.2. Field Instrument Calibration Documentation: Document acceptable calibration and calibration verification for each instrument unit and field test or analysis, linking this record with affected sample measurements.

4.2.1. Retain vendor certifications of all factory-calibrated instrumentation.

4.2.2. Designate the identity of specific instrumentation in the documentation with a unique description or code for each instrument unit used.

4.2.2.1. Record the manufacturer name, model number and identifying number such as a serial number for each instrument unit.

4.2.3. Record the time and date of all initial calibrations and all calibration verifications.

4.2.4. Record the instrument reading (value in appropriate measurement units) of all calibration verifications.

- 4.2.5. Record the temperature associated with all calibration verifications.
- 4.2.6. Record the name of the analyst(s) performing the calibration.
- 4.2.7. Document the specific standards used to calibrate or verify the instrument or field test with the following information:
 - Type of standard or standard name (e.g., saturation)
 - Value of standard, including correct units (e.g., mg/L at °C)
 - Link to information recorded according to section 4.1 above
- 4.2.8. Retain manufacturers' instrument specifications.
- 4.2.9. Document whether successful initial calibration occurred.
- 4.2.10. Document whether each calibration verification passed or failed.
- 4.2.11. Document any corrective actions taken to correct instrument performance according to records requirements of FD 3000.
 - 4.2.11.1. Document the date and time of any corrective action.
 - 4.2.11.2. Note any incidence of discontinuation of use of the instrument due to calibration failure.
- 4.2.12. Describe or cite the specific calibration or verification procedure performed (DEP SOP or internal SOP).
- 4.3. Record all field-testing measurement data, to include the following:
 - Project name
 - Date and time of measurement or test (including time zone, if applicable)
 - Source and location of the measurement or test sample (e.g., monitoring well identification number, outfall number, station number or other description)
 - Latitude and longitude of sampling source location (if required)
 - Analyte or parameter measured
 - Measurement or test sample value
 - Reporting units
 - Initials or name of analyst performing the measurement
 - Unique identification of the specific instrument unit(s) used for the test(s)

Appendix FT 1500
Tables, Figures and Forms

Table FT 1500-1 Solubility of Oxygen in Water

Table FT 1500-1: Solubility of Oxygen in Water			
at Atmospheric Pressure^{1,2}			
Temperature	Oxygen Solubility	Temperature	Oxygen Solubility
°C	mg/L	°C	mg/L
0.0	14.621	26.0	8.113
1.0	14.216	27.0	7.968
2.0	13.829	28.0	7.827
3.0	13.460	29.0	7.691
4.0	13.107	30.0	7.559
5.0	12.770	31.0	7.430
6.0	12.447	32.0	7.305
7.0	12.139	33.0	7.183
8.0	11.843	34.0	7.065
9.0	11.559	35.0	6.950
10.0	11.288	36.0	6.837
11.0	11.027	37.0	6.727
12.0	10.777	38.0	6.620
13.0	10.537	39.0	6.515
14.0	10.306	40.0	6.412
15.0	10.084	41.0	6.312
16.0	9.870	42.0	6.213
17.0	9.665	43.0	6.116
18.0	9.467	44.0	6.021
19.0	9.276	45.0	5.927
20.0	9.092	46.0	5.835
21.0	8.915	47.0	5.744
22.0	8.743	48.0	5.654
23.0	8.578	49.0	5.565
24.0	8.418	50.0	5.477
25.0	8.263		

1. The table provides three decimal places to aid interpolation
2. Under equilibrium conditions, the partial pressure of oxygen in air-saturated water is equal to that of the oxygen in water-saturated

FT 1600. Field Measurement of Turbidity

Use in conjunction with:

- FT 1000 General Field Testing and Measurement
- FS 1000 General Sampling Procedures
- FD 1000 Documentation Procedures

1. INTRODUCTION: Turbidity measures the scattering effect that suspended solids have on the propagation of light through a body of water (surface or ground waters). The higher the effect (i.e., intensity of scattered light), the higher the turbidity value. Suspended and colloidal matter such as clay, silt, finely divided organic and inorganic matter, and plankton and other microscopic organisms cause turbidity in water.

This SOP describes the use of true nephelometric measurement using instruments meeting the specifications outlined in 2.1.

Exceptions to the requirements specified in 2.1 below include:

- 1.1. In situ probes with turbidity sensors used for screening purposes (e.g., groundwater purge stabilization measurements).
- 1.2. Non standard light sources, detectors or other turbidity measuring devices may be proposed for use in studies that entail comparison measurements (dredge and fill) or unattended deployment for monitoring purposes.
- 1.3. **Do not report results from “non standard” sensors or configurations for regulatory purposes such as permit compliance unless the Department has approved the use for the specific project.**
- 1.4. All “non standard” instrument must be calibrated/check according to the principles outlined in this SOP.

2. EQUIPMENT AND SUPPLIES

- 2.1. Field Instrument: Use a turbidimeter (nephelometer) or a spectrophotometer consisting of a light source and one or more photoelectric detectors with a readout device to indicate the intensity of light. The instrument must meet these specifications:
 - 2.1.1. The light source must have a tungsten-filament lamp operated at a color temperature between 2000 and 3000 K.
 - 2.1.2. The distance traversed by the incident light and scattered light within the sample tube must not exceed 10 cm.
 - 2.1.3. The light detector, positioned at 90° to the incident light, must have an acceptance angle that does not exceed $\pm 30^\circ$ from 90°.
 - 2.1.4. The detector and any filter system must have a spectral peak response between 400 and 600 nanometers.
 - 2.1.5. The instrument sensitivity must permit detection of a turbidity difference of 0.02 NTU at the 0 – 1.0 NTU scale.

2.1.6. Note: using the appropriate equipment and following the procedures in this SOP, the field accuracy of this measurement is close to $\%R = 100 \pm 10\%$ for turbidities in the range of 1 to 100 NTU.

2.2. Sample Cells (cuvettes): Use sample cells or tubes of clear, colorless glass or plastic.

2.2.1. Keep cells clean, both inside and out, and discard if scratched or etched.

2.2.1.1. Never handle them where the light beam strikes the sample.

2.2.1.2. Clean sample cells by thorough washing with laboratory soap (inside and out) followed by multiple rinses with distilled or de-ionized water, and let air-dry.

2.2.2. Use a very thin layer of silicone oil on the outside surfaces to mask minor imperfections or scratches in the cells.

2.2.2.1. Use silicone oil with the same refractive index of the glass; making sure the cell appear to be nearly dry with little or no visible signs of oil.

2.2.3. Because small differences between cells significantly impact measurement, use either matched pairs or the same cell for standardization and sample measurement.

2.3. Standards:

2.3.1. Primary standards: Use these standards for initial calibration.

2.3.1.1. Formazin standards can be either obtained commercially or prepared according to method SM 2130B, section 3.b. See *Standard Methods for the Examination of Water and Wastewater* (American Public Health Association, American Water Works Association, Water Pollution Control Federation).

2.3.1.2. Some instruments may require the use of styrene divinylbenzene (SDVB) standards for calibration.

2.3.2. Secondary Standards: Use only those certified by the manufacturer for a specific instrument. Secondary standards must only be used for continuing calibration verifications according to the procedures in section 3.4 below. Determine or verify the values of secondary standards according to the procedure in section 3.3 below.

2.3.3. Turbidity-free water: Use filtered, laboratory reagent water demonstrated to be free of measurable turbidity (<0.01 NTU) or purchase commercially prepared turbidity-free water.

3. CALIBRATION AND USE

3.1. General Concerns

3.1.1. Light absorption by dissolved and suspended matter may cause a negative bias on the turbidity measurement. When present in significant concentrations, particles of light-absorbing materials such as activated carbon will cause a negative interference. Likewise, the presence of dissolved, color-causing substances that absorb light may also cause a negative interference. Some commercial instruments may have the capability of either correcting for slight color interference or optically blanking out the color effect.

3.1.2. Handle samples with natural effervescence as described in 3.5.5.1 below.

3.2. Calibration and Initial Calibration Verification

3.2.1. Follow the calibration activities in FT 1000, section 2.2.

3.2.2. Perform an initial calibration using at least two primary standards.

3.2.2.1. If the instrument cannot be calibrated with two standards, calibrate the instrument with one standard and verify with a second standard per 3.2.3 below.

3.2.2.2. For measurement of samples of very low turbidity, select the lowest standard commercially available for bracketing the lower end of the anticipated sample turbidity range or dilute higher turbidity standards with turbidity-free water.

3.2.2.3. Do not use turbidity-free water as a calibration verification standard.

3.2.3. Perform an initial calibration verification by reading at least one primary standard as a sample. The acceptance criterion for the initial calibration verification depends on the range of turbidity of the standard value:

- Standard Value = 0.1-10 NTU: the response must be within 10% of the standard;
- Standard Value = 11-40 NTU: the response must be within 8% of the standard;
- Standard Value = 41-100 NTU: the response must be within 6.5% of the standard; and
- Standard Value > 100 NTU: the response must be within 5% of the standard.

3.3. Determining the Values of Secondary Standards

3.3.1. Use only those standards certified by the manufacturer for a specific instrument.

3.3.2. Use verified secondary standards only for continuing calibration verifications.

3.3.3. Determining the initial value(s) of secondary standard(s):

3.3.3.1. Calibrate or verify the instrument with primary standards. Select primary standards that bracket the range of the secondary standards.

3.3.3.2. Immediately after the an initial calibration with primary standards or verification with a primary standard, read each secondary standard as a sample use the reading from the instrument as the first assigned value.

3.3.4. Verifying Secondary Standards

3.3.4.1. At least once per quarter or at other documented intervals (see 3.3.5 below), determine or verify the values of secondary standards immediately after the instrument has been calibrated or verified with primary standards.

3.3.4.2. Read each secondary standard as a sample. This reading must be within the manufacturer's stated tolerance range and within the acceptance ranges of the assigned standard value as listed in 3.2.3., above. If the criteria in section 3.2.3., above are not met, assign this reading as the value of the standard. If the reading is outside the manufacturer's stated tolerance range, discard the secondary standard.

3.3.5. More frequent calibration verifications may be required for discharge permit compliance measurements or other regulatory requirements.

3.4. Continuing Calibration Verification: Perform a continuing calibration verification using at least one primary or secondary standard. The calibration acceptance criteria are the same as those listed in section 3.2.3 above.

3.5. Measuring Turbidity in Samples

3.5.1. Gently agitate the sample and wait until air bubbles disappear.

- 3.5.2. Double-rinse the sample cell or cuvette with a small amount of the sample. Discard, and pour an aliquot into the sample cell or cuvette.
 - 3.5.3. Gently dry out its external surface with lint-free paper.
 - 3.5.4. Insert the cell in the instrument and read the turbidity directly from the meter display.
 - 3.5.5. Do not use vacuum degassing, ultrasonic bath or other devices to remove bubbles from the sample. If the sample contains visible bubbles or if it effervesces (as in groundwater, with changes in pressure and temperature), make a note of this in the field records and collect a sample for laboratory measurement.
 - 3.5.5.1. If effervescing samples are collected for laboratory analysis collect the sample without leaving headspace in the container and ship it as soon as possible to the laboratory (the holding time for this measurement is only 48 hrs). Ship this sample in wet ice at 4°C.
 - 3.5.6. Pour out the sample, double-rinse the cuvette with de-ionized water in preparation for the next sample.
4. PREVENTIVE MAINTENANCE: Refer to FT 1000, section 3.
 5. DOCUMENTATION
 - 5.1. Standard and Reagent Documentation: Document information about standards and reagents used for calibrations, verifications, and sample measurements.
 - 5.1.1. Note the date of receipt, the expiration date and the date of first use for all standards and reagents.
 - 5.1.1.1. Document acceptable verification of any standard used after its expiration date.
 - 5.1.2. Record the concentration or other value for the standard in the appropriate measurement units.
 - 5.1.2.1. Note vendor catalog number and description for preformulated solutions as well as for neat liquids and powdered standards.
 - 5.1.2.2. Retain vendor assay specifications for standards as part of the calibration record.
 - 5.1.3. Record the grade of standard or reagent used.
 - 5.1.4. When formulated in-house, document all calculations used to formulate calibration standards.
 - 5.1.4.1. Record the date of preparation for all in-house formulations.
 - 5.1.5. Describe or cite the procedure(s) used to prepare any standards in-house (DEP SOP or internal SOP).
 - 5.2. Field Instrument Calibration Documentation: Document acceptable calibration and calibration verification for each instrument unit and field test or analysis, linking this record with affected sample measurements.
 - 5.2.1. Retain vendor certifications of all factory-calibrated instrumentation.
 - 5.2.2. Designate the identity of specific instrumentation in the documentation with a unique description or code for each instrument unit used.

DEP-SOP-001/01
FT 1600 Field Measurement of Turbidity

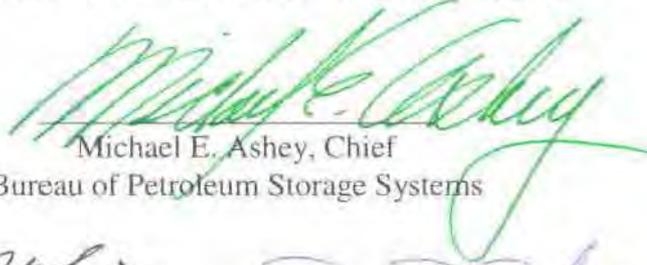
- 5.2.2.1. Record manufacturer name, model number, and identifying number (such as a serial number) for each instrument unit.
- 5.2.3. Record the time and date of all initial calibrations and all calibration verifications.
- 5.2.4. Record the instrument reading (value in appropriate measurement units) of all calibration verifications.
- 5.2.5. Record the name of the analyst(s) performing the calibration.
- 5.2.6. Document the specific standards used to calibrate or verify the instrument or field test with the following information:
 - Type of standard or standard name (e.g., formazin)
 - Value of standard, including correct units (e.g., 20 NTU)
 - Link to information recorded according to section 5.1 above
- 5.2.7. Retain manufacturers' instrument specifications.
- 5.2.8. Document whether successful initial calibration occurred.
- 5.2.9. Document whether each calibration verification passed or failed.
- 5.2.10. Document any corrective actions taken to correct instrument performance according to records requirements of FD 3000.
 - 5.2.10.1. Document date and time of any corrective action.
 - 5.2.10.2. Note any incidence of discontinuation of use of the instrument due to calibration failure.
- 5.2.11. Describe or cite the specific calibration or verification procedure performed (DEP SOP or internal SOP).
- 5.3. Record all field-testing measurement data, to include the following:
 - Project name
 - Date and time of measurement or test (including time zone, if applicable)
 - Source and location of the measurement or test sample (e.g., monitoring well identification number, outfall number, station number or other description)
 - Latitude and longitude of sampling source location (if required)
 - Analyte or parameter measured
 - Measurement or test sample value
 - Reporting units
 - Initials or name of analyst performing the measurement
 - Unique identification of the specific instrument unit(s) used for the test(s)

DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF PETROLEUM STORAGE SYSTEMS
PETROLEUM CLEANUP PROGRAM

STANDARD OPERATING PROCEDURES PCS-004

SOIL ASSESSMENT AND SAMPLING METHODS
FOR
FLORIDA BUREAU OF PETROLEUM STORAGE SYSTEM SITES

HISTORY: New and Effective October 1, 2001



Michael E. Ashey, Chief
Bureau of Petroleum Storage Systems



Michael J. Bland, P.G.
Chief Geologist



Diane D. Pickett, P.G.
Assistant Chief Geologist

EXECUTIVE SUMMARY

Proper soil sampling and analytical procedures are critical to obtaining data necessary for fully assessing and remediating petroleum contaminated sites. Because of this, the Bureau of Petroleum Storage Systems (BPSS) is clarifying the procedures necessary to obtain reliable and usable soil data. This memo clarifies proper field collection and preservation practices, phases out the use of EnCore™ samplers, discusses strategies for the collection of representative volatile organic soil samples, and clarifies when Soil Cleanup Target Levels apply. This memo also clarifies the soil classification system that should be used to describe the lithologies on a boring log (the Unified Soil Classification System), and some issues concerning Synthetic Precipitation Leaching Procedure (SPLP) testing and speciation of Total Recoverable Petroleum Hydrocarbons (TRPHs).

This memo is intended as procedural guidance to be followed for all petroleum contaminated sites, regardless of whether the site is eligible for cleanup funding assistance from the Inland Protection Trust Fund (IPTF). However, inclusion of some considerations of IPTF funded cleanups was unavoidable. Therefore, certain provisions of this guidance are concerned with the appropriate scope of activities that should be conducted at a cleanup site.

Soil Assessment and Sampling

October 1, 2001

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INTRODUCTION

The soil assessment requirements and procedures mandated by the United States Environmental Protection Agency (EPA) and the 1997 revision of Chapter 62-770, Florida Administrative Code (F.A.C.) have sometimes been confusing or misinterpreted. In the past three years, there have been additional changes or clarifications as to where to collect samples, the number of samples to be collected, how samples are to be collected, preserved, and analyzed, and how to interpret the data. Consultants and contractors working on petroleum projects must be familiar with the following three guidance documents related to soil assessment which are available on the BPSS web site (www.dep.state.fl.us/dwm/programs/pcp/default.htm).

1. "Guidelines for Assessment and Source Removal of Petroleum Contaminated Soil," dated May 1998.
2. "Chapter 62-770, F.A.C. Table IV Interpretation," dated July 13, 1998.
3. "New Soil Sampling Procedures and Recommended EPA Methods (per changes to USEPA SW-846) and other Quality Assurance Issues for the Division of Waste Management," dated July 15, 1998.

This memorandum does not replace or supersede the above guidance documents but is intended to enhance and better clarify the procedures.

One of the most commonly misunderstood procedures relates to collecting the soil samples for laboratory analyses. Chapter 62-770, F.A.C. mandates the collection of confirmatory soil lab analyses for a minimum of three vadose zone soil samples per source area representing high, medium, and low screening results for Gasoline Analytical Group (GAG) and/or Kerosene Analytical Group (KAG) discharges. The establishment of Method 5035 during the revision of EPA's SW846, which changed the way soil samples should be collected, prepared, and analyzed to reduce volatilization, caused some degree of confusion because it requires a high level and/or low level laboratory analysis (depending on the concentration of contaminants in the sample) of each sample collected. Assessments at petroleum impacted sites in Florida must satisfy both of these regulatory documents whether there are one or multiple source areas, whether the water table is shallow or deep, whether the discharge is old or new, and in a variety of lithologies. Soil sampling may also be necessary in the smear zone and/or saturated zone to obtain further data to assist in remedial decisions.

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DEFINITIONS OF VADOSE ZONE, SMEAR ZONE, CAPILLARY FRINGE, AND SATURATED ZONES FOR BPSS SITES

When screening a petroleum contaminated site with an Organic Vapor Analyzer (OVA), certain observations must be made as soil is collected to differentiate between vadose zone soil contamination, smear zone contamination, volatilization from the water table, and capillary fringe effects. For the purpose of describing soil sampling strategy in Florida's petroleum cleanup program, the following definitions for the different soil zones should be used.

The **vadose zone** is the area between the land surface and the water table. Since the water table fluctuates, the thickness of the vadose zone varies with the water table. Due to the nature of contamination migration in the soil matrix, soil contamination in the vadose zone is generally restricted to the source area locations.

The **saturated zone** is defined as the area below the water table. The top of the saturated zone will vary depending upon the seasons and is sometimes difficult to distinguish from the capillary zone during the drilling event. For this reason, soil borings should be completed to a depth of at least one to two feet into the water table to ensure that the borings are completed into the saturated zone (unless a variance to this policy has been approved by the BPSS).

The **capillary fringe** is described as the area directly above the water table where moisture "wicks" upward due to capillary forces, leaving small amounts of water in the pore spaces above the water table. The thickness of the capillary fringe zone is dependent primarily on the type of soils.

The **smear zone** is the area of soil contamination that may exist, at varying extents, within the zone of water table fluctuations that have occurred since the time of the petroleum release. Petroleum product floating on top of the water table can become sorbed onto the soils within this zone as the water table fluctuates, potentially leaving a large amount of petroleum product mass that has adhered to the soil grains. This product can remain trapped below the water table as the water table rises. Soil Cleanup Target Levels (soil CTLs) generally apply to the vadose zone (above the water table), but due to water table fluctuations the soil CTLs may or may not apply to the smear zone samples and a case-by-case determination is necessary (for a detailed discussion, see the Smear Zone Sampling Strategy section on pages 12 and 13). It is important to determine whether there is a smear zone and to define the smear zone boundaries as part of a site assessment to allow proper decisions regarding the need for, and scope of, remedial action and the proper placement of the top of well screens (because apparent smear zones, as indicated by elevated OVA readings as the water table is approached, can help estimate historical water table fluctuations at a site).

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CHAPTER 62-770, F.A.C. REQUIREMENTS, INTERPRETATIONS, AND ACCEPTABLE ALTERNATIVES

All petroleum site assessments must have laboratory analyses performed on representative vadose zone soil samples from areas suspected of being contaminated by petroleum products. Chapter 62-770, F.A.C. allows field soil screening techniques for soil assessment to complement limited soil lab data, and the soil laboratory analytical results from the vadose zone need to be compared to soil CTLs for each site. Soil samples obtained for the purpose of comparison with soil CTLs must be:

1. Grab samples (not composited) which are collected during field soil screening activities;
2. Collected in the vadose zone above the seasonal high water table; and
3. Collected at least once during the site assessment (although additional sampling may be required depending on the age of the soil screening and OVA data and on the horizontal and vertical extent of soil contamination).

The criteria to determine which subsamples of the field-screened samples should be collected for laboratory analyses are listed below.

1. At each GAG or KAG source area, when there are positive corrected hydrocarbon measurements (above background) during soil screening activities, at least three vadose zone soil samples for laboratory analyses should be collected as follows:
 - a. One sample should be taken at a soil screening location with a relatively **high** corrected hydrocarbon measurement compared to other measurements taken at the site. If several screening results exceed the instrument's detection capability, the sample should be collected close to the suspected source area. It should be noted that if the corrected hydrocarbon measurements are undetermined due to a high methane content, then subsequent sampling events must utilize a screening instrument that has a measuring limit of at least 5,000 ppm;
 - b. One sample should be taken at a soil screening location with a **medium** range corrected hydrocarbon measurement; and
 - c. One sample should be taken at a soil screening location with a relatively **low** positive corrected hydrocarbon measurement (the value should be above background, generally above 10 to 20 ppm).

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2. At each GAG or KAG source area, when there are no positive responses above background during soil screening activities, only one soil sample for laboratory analyses should be collected from the suspected source area. If information is not available regarding the depth of the suspected discharge, or if there was a suspected surface spillage (based on the eligibility information), then the sample should be collected from within two feet of the ground surface. In the case of aboveground storage tanks, the sample should be collected next to the tank if a containment area is not present, or at the location where the containment area drain valve discharges if a containment area is present. However, if the discharge is suspected to have occurred at depth (such as a ruptured line or fuel tank), then the soil sample should be collected at the depth suspected of having been most impacted. If laboratory analyses indicate that there is petroleum contamination in the soil, then soil assessment should proceed on the assumption that the screening method may not be able to resolve the extent of the soil contamination (see 3, below).
3. At sites where soil contamination has been confirmed from laboratory results, but it has been demonstrated that soil contamination is not detected by field soil screening devices, then the extent of the soil contamination will need to be defined by laboratory analyzed samples. The sampling locations and the number of samples needed to define the extent of soil contamination exclusively with laboratory analyses should be determined on a site-by-site basis. Consideration can also be given to the use of field screening methods other than the OVA. A proposal for an alternative method should be made to the BPSS prior to using the technique. If TRPHs are the only contaminants detected (a common situation for old diesel fuel discharges) and the area of contamination is expected to be large, it may be desirable to complement the lab analytical data with a field testing kit (it also may be appropriate to speciate the TRPHs, as discussed later in this guidance).
4. Laboratory soil samples should be obtained from the perimeter of new excavation areas, during or immediately after excavation, to confirm that the contaminated soil has been removed (usually a minimum of one soil sample collected from the north, south, east and west sides of the excavation). The samples should be collected at the depth where the soil was most impacted. At least one soil sample should also be obtained from the bottom of the excavation if the water table was not intersected.
5. Additional laboratory samples may be required or recommended in cases where:
 - a. There are large areas of soil contamination (to ensure that at least 5% of the positive soil screening readings are analyzed as appropriate, see "Guidelines for Assessment and Source Removal of Petroleum Contaminated Soil," dated May 1998);

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- b. There is a deep water table that requires the use of a rig and the cost of completing additional borings later to obtain more samples for lab analyses greatly exceeds the cost of collecting and analyzing extra samples during the initial boring event;
- c. Contamination is located in complex lithologies which could result in heterogeneous distribution of contamination that might easily be missed with only three samples per source area;
- d. There is poor correspondence between soil screening results and laboratory results;
- e. The age of the spill suggests that any contamination remaining may consist of non-volatile contaminants;
- f. The site is suspected to have been impacted by different types of petroleum products; or
- g. A substantial remediation activity (e.g.-excavation) is anticipated that could greatly benefit in terms of scope and cost of the activity by better defining the extent and degree of soil CTL exceedances.

The selection of sample locations for lab analyses does not need to be based on any particular exact percentage of the range of field screening results. The objective is to obtain a sample that represents a high screening result, one with a low screening result that is above background, and one with a result as close to the midpoint of screening results as possible. The goal should be to collect the high from within 10% of the highest screening result, the low from within 10% of the lowest screening result, and the medium from approximately halfway between these. However, this goal can be adjusted based on the need for the data and the appropriateness of the sampling strategy. In many cases, obtaining a high in the top 25% and a low in the bottom 25% may be sufficient and more practical. For subsequent sampling events, the goal of the soil sampling event may be to obtain one or more high, medium, or low soil samples that better determine the OVA threshold value indicating the soils are contaminated above the Soil CTLs, or one or more extra high soil samples to assist in making remedial decisions. The high, medium, and low soil samples should normally be obtained from separate borings, but on rare occasions (such as when the water table is deep) from different depths in the same boring depending on the nature and extent of the soil contamination. The best strategy is to vary the depths and locations of soil samples as appropriate to obtain data representative of the extent of contamination.

The following describes the laboratory analytical procedures to utilize and how the results are to be applied:

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1. For GAG and KAG discharges, each sample should be analyzed for BTEX plus MTBE and Polycyclic Aromatic Hydrocarbons (PAHs) using appropriate approved EPA methods, and TRPHs using FL-PRO. Unless a different source area is identified during the initial sampling event, subsequent soil sampling events should be restricted to the contaminants identified during the initial sampling event. For used oil discharges, generally only one soil sample is collected from the most visibly stained area and the sample should be analyzed for the contaminants of concern listed in Table C of Chapter 62-770, F.A.C.
2. Vadose zone laboratory analytical results should be compared to the soil CTLs (Direct Exposure Residential and Leachability Based on Groundwater Criteria columns) specified in Table II of Chapter 62-777, F.A.C. For a detailed description of how to use the soil lab data obtained to make cleanup decisions, see the memo titled "Chapter 62-770, F.A.C., Table IV Interpretation," dated July 13, 1998.
3. Owners of petroleum contaminated sites with Remedial Action Plans or Monitoring Only Plans that have been approved and implemented have the option to adhere to the site rehabilitation completion requirements stipulated in the version of Chapter 62-770, F.A.C. that was in effect at the time of the plan approval (as long as the approved active remediation or monitoring is continued to present or completion). If they elect to use a pre-September 23, 1997 version of Chapter 62-770, F.A.C., these sites are not required to have soil samples collected for laboratory analyses. If the site owner chooses not to utilize the current version of Chapter 62-770, F.A.C., the reports that are submitted to the Department should clearly state which version of Chapter 62-770, F.A.C. is being used for the assessment and remediation of the site. The versions of Chapter 62-770, F.A.C. where Cleanup Target Levels for soil and/or groundwater have changed are:
 - a. Chapter 17-70, F.A.C., new 11-1-87,
 - b. Chapter 17-70, F.A.C., amended 2-21-90,
 - c. Chapter 62-770, F.A.C., amended 9-23-97,
 - d. Chapter 62-770, F.A.C., amended 8-5-99.

Tabular summaries of soil analytical results should be presented along with the screening results in reports submitted to the BPSS. The contaminant concentrations should be listed adjacent to the filtered, unfiltered and corrected hydrocarbon screening measurements.

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EPA's SW846 REVISION and PROPER FIELD COLLECTION TECHNIQUES

The EPA determined that a significant percentage of VOCs might be lost (mainly by volatilization) from soil samples during traditional sampling and analysis procedures. In the last SW846 revision, the EPA established Method 5035, which was created, for the most part, to reduce volatilization of a soil sample from the time it is collected in a sample container through the time it is analyzed. A new "closed loop" analytical method was created to help reduce volatilization in the lab, and new field preservation methods were established. The field preservation is aimed at minimizing biodegradation and volatilization of constituents between the time the soil is put into a sample container in the field until the time the sample is prepared for analysis. However, a large part of the volatilization is taking place from the time the soil is taken from its natural setting to the time it is preserved in a sample container. Transfer of the sample into the container requires proper field collection techniques to minimize losses by volatilization.

Proper soil sampling and analyses have been discussed previously in the guidance memo "New Soil Sampling Procedures and Recommended EPA Methods (per changes to USEPA SW-846) and other Quality Assurance Issues for the Division of Waste Management," dated July 15, 1998. However, the following modification to that procedure is now a requirement by the BPSS:

1. Effective six months from the date of issuance of this guidance (April 1, 2002), EnCore™ samplers (or equivalent) will no longer be an allowable device for transporting samples to the laboratory.
2. Soil samples (approximately 5 g or 3 cm³) must be collected with a coring device such as a disposable plastic syringe (or other appropriate coring device) and immediately transferred into three VOC vials having a Teflon-lined lid which were prepared and weighed at the laboratory with approximately 5 mL of an appropriate preservative. The appropriate preservative for one of the vials (on which the lab will run their high level analyses to detect VOCs above approximately 200 ug/kg) is methanol and/or polyethylene glycol. The appropriate preservative for two of the vials (on which the laboratory will run a low level analysis if VOCs were not detected on the high level analysis) is organic-free reagent-grade water. (NOTE: Do not confuse the Chapter 62-770, F.A.C. requirement for sample collection from the high, medium, and low screening results with EPA's high and low level laboratory procedures. They are not related.)

It is imperative that the soil from the collection device (e.g., hand extraction tools, split spoon samplers, Direct Push Technology [DPT] sampling liners) be transferred using the coring device (i.e., syringe) into the VOC vial and other lab and/or screening containers as fast as possible (within 1 minute), with as

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little disturbance and disaggregation of the sample as possible. Disturbing and disaggregating the soil while extracting it from its natural setting and transferring it to laboratory and/or screening containers causes increased volatilization and therefore should be kept to a minimum. Of the allowable sample collection methods, hand extraction causes the most disturbance of the sample, but since it is a requirement for at least the top four feet of a boring, care must be taken to keep the sample as undisturbed as is practical before collecting it with a corer and while transferring the soil into the lab vials and/or screening jars quickly. When transferring the soil sample from the coring device into the VOC vial, care should be taken to prevent splashing the preservative out of the VOC vial. The order of sample collection should be VOC vials first, followed by filling OVA unfiltered and filtered screening jars, and then filling the soil bulk jar last.

Some of the field procedures currently in use today for soil collection and transfer to the laboratory and screening containers are improper. The following are examples of inappropriate soil sampling procedures:

1. It is not appropriate to open a sampling device, half fill and cover the OVA sampling jar, wait the required 5-15 minutes for the sample to equilibrate with the jar headspace, obtain the OVA results, and then decide whether or not to fill the lab sample containers from soil left in the sampler device or soil screening jar.
2. It is improper to fill a jar (or plastic bag) with soil, place it (or the sampling device) in a sample cooler on ice, and wait until later to decide whether or not to collect the lab samples from the jar, plastic bag, or sampling device.
3. Obtaining soil samples from auger flights is also not permitted due to mixing of soils and volatilization of the contaminants due to excessive exposure to air.

For split spoon or direct push soil tube sampling, the sample collection device must be immediately opened after the soil has been retrieved, and the soil must be immediately transferred to the sample containers. When using a coring device, this means that as the sample collection tool is opened, the coring devices must be immediately filled with soil and the soil transferred to the VOC vials and other containers (within 1 minute), before the OVA screening results are obtained. Hypothetically, the previous discussion would indicate that you were collecting soil lab samples before you knew from where to collect them (since your goal is to obtain soils from the high, medium, and low screening results to send to the lab), however, in many cases enough is known about a site to make good estimates as to the locations of the source areas and the extent of soil contamination. Often, previous investigations or the nature of the discharge will indicate the best locations and depths to collect the lab samples. However, the BPSS encourages the collection of extra soil samples while in the field when there are not enough data to estimate the optimum soil lab sampling points. The strategy for collecting the high, medium, and low screening samples for lab analyses is discussed in the next section.

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VADOSE ZONE SOIL SAMPLING STRATEGIES

The rationale for where and how to collect the soil analytical samples and how many to collect is discussed below. Each site will have its own strategy based on its site-specific characteristics, but a few generalities are inherent.

Two different strategies that may be used to collect the soil samples are described below:

Strategy 1: The consultant should bring to the site extra sample containers for all sample parameters (for example, bring double the amount of sample containers that are required for that field event). This way extra samples can be collected at the time the soil borings are advanced. The consultant should utilize their best judgment and knowledge about the location(s) of the source area(s) in the placement of soil borings and should collect extra high, medium, and low soil samples during the screening process. This way, when the screening event has been completed, a good selection of samples will be available from which to select those samples corresponding to high, medium, and low screening results to send to the lab without the need for additional borings. Once appropriate samples are selected to send to the laboratory, the extra samples will be discarded. Since it is not necessary for samples corresponding to any particular numeric value representing exact high, medium, and low soil screening samples to be submitted to the lab, it is not necessary or cost-effective to collect “continuous” soil lab samples, just a representative number. Below are examples of when Strategy 1 may be appropriate:

- For sites with a deep water table where there are insufficient data to preselect soil lab sampling locations, and because of the cost associated with installing deep soil borings, Strategy 1 may be the most cost-effective approach.
- For sites that have a shallow water table but have excessively thick or reinforced concrete that must be removed with a core drill prior to hand augering, this may add to the time necessary to obtain a sample and simply collecting extra soil lab samples during the soil screening process may be more cost-effective.
- If borings are being completed in the vicinity of a gasoline distribution line or some other hazard, then the sampling strategy of collecting extra soil samples at the time of the advancement of the borings would be preferred so that another boring does not have to be completed in the area to collect the sample for lab analyses.

Strategy 2: After the extent of soil contamination has been sufficiently delineated through soil screening, the depths and locations to collect the high, medium, and low soil samples can be determined. Then, additional soil borings can be located adjacent to the original borings to

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obtain the lab samples. It is important to also collect samples for OVA screening to confirm the previous OVA readings at this interval. Below are examples of when Strategy 2 may be appropriate:

- This option may be considered for sites which have a shallow water table (and do not have excessively thick or reinforced concrete) because they are generally quick to hand auger, and don't require a drilling rig to collect soil samples above the water table.
- This option may be considered for some DPT investigations with an intermediate depth to water where difficult drilling conditions are not present. In such areas where the depth to water and lithology allow for efficient DPT boring advancement, Strategy 2 may be the most cost-effective approach.
- This strategy may also be appropriate for sites where the source areas are not known. However, if enough information is available to estimate the locations of the tanks, integral piping, and dispensers, Strategy 1 may be more appropriate.

The two strategies given above are not mutually exclusive and there can be an overlap of methods on a site-specific basis. The cost-effectiveness of installing additional borings versus collecting extra soil sample containers must be considered for each site, and for preapproval sites must be agreed to by the consultant and FDEP site manager prior to field activities.

For sites where the general extent of soil contamination has already been determined (for example, sites where assessment work was halted in March 1995), it is usually not necessary to reassess the entire site. Rather, a few new borings should be placed around each source area and the soil plume perimeter at locations and depths predetermined (using historical data) to obtain approximate high, medium, and low samples. If the previous soil screening and/or lab data are old, samples should be collected for field screening and lab analyses to reevaluate the extent of soil contamination that still exists by comparing the new data with previous results. That procedure will help determine if any redistribution or natural attenuation of petroleum in the soils has occurred.

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SMEAR ZONE SAMPLING STRATEGY

The previous discussion on sampling strategy has focused mainly on vadose zone sampling for general assessment considerations. Other sampling procedures must be considered for determining the distribution of petroleum products in the smear and saturated zones.

While collecting and screening soil in the field, attention must be paid to the changes in OVA responses as the boring depth approaches the water table. An elevated OVA response just above the water table may indicate product in the smear zone, or simply lesser amounts of dissolved petroleum from the capillary fringe and/or vapors from petroleum present in the groundwater. This may help explain why there is often poor correlation between field screening and laboratory analyses. Determinations of the distribution of petroleum mass and the development of remedial decisions can be affected by determining which of these phenomena is present. To evaluate which is present, a combination of field observations and lab analyses of the soil is necessary.

A boring placed in a source area where a discharge occurred close to the surface might result in high OVA responses from the surface down to below the water table. A boring placed outside of the area where a surface discharge occurred may result in negligible OVA responses in the vadose zone, but increased OVA responses as the water table is approached and reached, indicating smear zone, capillary fringe, and/or volatilization off the water table. As the distance from the source is increased, soil screening in borings may result in elevated OVA responses only in the saturated zone, indicating groundwater contamination. Fluctuations in the water table complicate this evaluation. During a high water table, the smear zone may be completely below the current water table. Lab analyses of soil samples collected at various locations and depths will help clarify this situation. Collection of vadose zone samples from above the smear zone was discussed earlier in this document, but collection of soil samples near the water table may be necessary to determine the amount of contamination present and whether it is smear zone product or just a consequence of the dissolved or volatized component in the groundwater. During a low stand of the water table, such as in the drought in effect prior to the issuance of this guidance, samples just above the water table are often sufficient to characterize the smear zone. However, during a higher stand of the water table, samples above and below the water table may be appropriate.

Typically, lab analyses of soil samples collected in the vadose, smear, or saturated zones are used for determining the distribution of petroleum products and for making remedial decisions, whereas lab analyses of soil samples collected above the water table are also used to compare to soil CTLs. It is necessary to consider the factors described above and apply judgement on a case-by-case basis in determining whether to collect soil samples from the smear zone for lab analyses and how many samples to collect. At the time that Site Rehabilitation Completion is proposed, the soil CTLs will not apply to smear zone samples unless the smear zone is also part of the vadose zone. However, the smear zone can have a profound effect on the duration of time and cost to achieve site rehabilitation completion,

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either by active remedial action or natural attenuation monitoring. Lines of evidence of the likely significance of the smear zone need to be considered and the additional cost of soil sample collection and analysis from the smear zone weighed against the possible implications of the smear zone source mass to the cleanup time and cost if it is not assessed and addressed effectively by the remediation strategy.

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BORING LOG REQUIREMENTS

A boring log must be completed for all borings to document, at a minimum, the following:

1. lithologies;
2. moisture content;
3. depth to groundwater;
4. OVA measurements;
5. presence of odors (if observed);
6. soil discoloration;
7. free product;
8. the start and finish date(s) and time(s) of the boring;
9. the name of the person (preferably a geologist) completing the log;
10. sampling information, including the sampling interval and percent of sample recovered, and;
11. boring completion method (hand auger, direct push, etc.).

For each soil boring that is completed or each well that is installed, a separate soil boring log should be prepared and submitted to the Department.

The lithologies must be described and then classified according to the Unified Soil Classification System (USCS). This is a change from previous guidance (October 1998 SAR Guidance Preparation memorandum) which only recommended the use of the USCS. Mandating the use of the USCS will standardize the lithology descriptions. (Note: Field personnel must be cautious as to the use of the “grading” concept used in the USCS, which is the opposite of the “sorting” concept that many geologists are accustomed to. Grading refers to the degree of mixing, whereas sorting refers to the degree of similarity.)

Moisture content (typically categorized as dry, moist or damp, wet, or saturated) must be included for every sample collected (for example, at one to two foot intervals). Detailed logging of even slight lithologic variations and/or moisture content may help locate potential seasonal perched zones which

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may be inhibiting the movement of groundwater and/or petroleum products, and may assist in development of an appropriate remedial strategy.

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SPLP SOIL SAMPLING

Synthetic Precipitation Leaching Procedure (SPLP, USEPA Test Method 1312) extractions and analyses of the leachates are performed when there is a question of whether the contamination in the soil at a site will leach to the groundwater at concentrations in excess of groundwater CTLs. The SPLP should only be considered in situations where Direct Exposure soil CTLs are not exceeded but one or more leachability soil CTLs are exceeded. A description of the SPLP testing procedure is outlined in the Department's May 1998 "Guidelines for Assessment and Source Removal of Petroleum Contaminated Soil."

SPLP tests should not be performed routinely at every site if the leachability-based soil CTLs are exceeded for a soil sample. For example, if the site has a shallow water table and the groundwater is impacted by petroleum hydrocarbons at levels above the groundwater CTLs then it stands to reason that the contamination in the soil is leaching to the water table (the exception would be when soil contamination sufficient to leach to the groundwater existed in the past, but the soils have since naturally attenuated to a point they are no longer contributing to groundwater contamination). SPLP tests should generally be performed for sites where the groundwater is not impacted at levels above the groundwater CTLs, but the leachability-based soil CTLs are exceeded.

When costing in the SPLP analyses in a work order, two separate costs for the SPLP analyses should be included for each SPLP sampling location. The first cost that should be included is for the extraction of the leachate from the soil (EPA Method 1312) and the second cost is for analysis of the leachate by the laboratory (EPA Method 602, 8310, etc., depending on which contaminants were previously detected in the soil above leachability-based soil CTLs). It is important that the laboratory uses a water analysis method capable of achieving the groundwater CTLs for the SPLP leachate test. The results of the SPLP analyses should be compared to the groundwater CTLs and not the leachability-based soil CTLs for each constituent analyzed.

As discussed in the Executive Summary, this guidance document is intended to be followed for all petroleum contaminated sites, regardless of whether the site is eligible for cleanup funding assistance or not. This section discusses a provision that SPLP analysis of soil samples should not be conducted unless direct exposure soil CTLs are not exceeded but leachability soil CTLs are exceeded in the soils at the site, which can only be ascertained after sending soil samples for laboratory analyses. This is a required procedure for IPTF funded site assessments and is good advice for any site. However, if a responsible party for a non-eligible site or his consultant wishes to do a greater scope of activities than suggested by this guidance (e.g., performing SPLP analysis prior to knowing whether either of the Leachability or Direct Exposure Soil CTLs are exceeded) they should have that level of discretion.

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SPECIATION OF TRPHs

In Section IV (D) of the Technical Report entitled “Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C.” (available on the BPSS web site) it is stated that if the default soil CTLs are exceeded for TRPHs, then alternative soil CTLs may be established by performing an additional laboratory analysis that identifies the TRPH class (aromatic or aliphatic), the fractions present for each class, and the concentrations measured for each class. This additional analysis should only be performed if TRPHs are the only contaminant of concern detected above the soil CTLs.

If this analysis is to be performed, then two (split) soil samples should be collected from the previous sampling location and depth interval that indicated the TRPH exceedance. One sample should be analyzed using FL-PRO. The second (split) sample should be analyzed for TRPHs using either the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG) method or the Massachusetts Department of Environmental Protection (MADEP) method. [Note: Although we are currently including both the Extractable Petroleum Hydrocarbons (EPH) and the Volatile Petroleum Hydrocarbons (VPH) portions of the MADEP method, it is anticipated that data will show that volatile organics will not be a concern; if that is the case, in the future the FDEP will restrict MADEP analyses to the EPH portion]. The purpose of collecting split samples is so that the laboratory can first analyze the samples for TRPHs using the FL-PRO method to verify the samples collected are representative of the location of previous TRPH exceedance. Based on the concentration of TRPHs detected during the FL-PRO analysis, a decision can then be made as to whether it is necessary to run the more expensive TPHCWG or MADEP methods.

The concentrations obtained during FL-PRO analyses should be compared to the direct exposure and leachability-based soil CTLs. The concentrations for the TPHCWG method should be compared to each of the TRPH classes and fractions that are listed in Table C4 of the Technical Report “Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C.” A revision to this document is expected next year and will also include a table with which to compare the concentrations for the MADEP method (until then, a copy of the table can be obtained from the BPSS).

Utility Clearance

Procedure 3-01

1.0 Purpose and Scope

- 1.1 This standard operating procedure (SOP) describes the process for determining the presence of subsurface utilities and other cultural features at locations where planned site activities involve the physical disturbance of subsurface materials.
- 1.2 This procedure is the Program-approved professional guidance for work performed by Resolution Consultants under the Comprehensive Long-Term Environmental Action Navy (CLEAN) contract (Contract Number N62470-11-D-8013).
- 1.3 The procedure applies to the following activities: soil gas surveying, excavating, trenching, drilling of borings and installation of monitoring and extraction wells, use of soil recovery or slide-hammer hand augers, and all other intrusive sampling activities.
- 1.4 The primary purpose of the procedure is to minimize the potential for damage to underground utilities and other subsurface features, which could result in physical injury, disruption of utility service, or disturbance of other subsurface cultural features.
- 1.5 If there are procedures, whether it be from Resolution Consultants, state, and/or federal, that are not addressed in this SOP and are applicable to utility clearance, those procedures should be added as an appendix to the project specific SAP.
- 1.6 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

2.0 Safety

- 2.1 Field and subcontractor personnel shall adhere to a site-specific health and safety plan (HASP).

3.0 Terms and Definitions

3.1 Utility

For the purposes of this SOP, a utility is defined as a manmade underground line or conduit, cable, pipe, vault or tank that is, or was, used for the transmission of material or energy (e.g., gas, electrical, telephone, steam, water or sewage, product transfer lines, or underground storage tanks).

3.2 As-Built Plans

As-built plans are plans or blueprints depicting the locations of structures and associated utilities on a property.

3.3 One-Call

The Utility Notification Center is the one-call agency for nationwide call before you dig. The Utility Notification Center is open 24 hours a day, and accepts calls from anyone planning to dig. The phone number 811 is the designated call before you dig phone number that directly connects you to your local one-call center. Additional information can be found at www.call811.com.

Calling before you dig ensures that any publicly owned underground lines will be marked so that you can dig around them safely. Having the utility lines marked not only prevents accidental damage to the lines, but prevents property damage and personal injuries that could result in breaking a line.

The following information will need to be provided when a call is placed to One-Call:

- Your name, phone number, company name (if applicable), and mailing address.
- What type of work is being done.
- Who the work is being done for.
- The county and city the work is taking place in.
- The address or the street where the work is taking place.
- Marking instructions, (specific instructions as to where the work is taking place).

Under normal circumstances it takes between 2 to 5 days from the time you call (not counting weekends or holidays) to have the underground lines marked. Because these laws vary from state to state, exactly how long it will take depends on where your worksite is located. You will be given an exact start time and date when your locate request is completed, which will comply with the laws in your area.

In the event of an emergency (any situation causing damage to life or property, or a service outage), lines can be marked sooner than the original given time if requested.

3.4 **Toning**

Toning is the process of surveying an area utilizing one or more surface geophysical methods to determine the presence or absence of underground utilities. Typically, toning is conducted after identifying the general location of utilities and carefully examining all available site utility plans. Each location is marked according to the type of utility being identified. In addition, areas cleared by toning are flagged or staked to indicate that all identified utilities in a given area have been toned.

4.0 **Training and Qualifications**

- 4.1 The **Contract Task Order (CTO) Manager** is responsible for verifying that these utility locating procedures are performed prior to the initiation of active subsurface exploration.
- 4.2 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.
- 4.3 The **Field Manager** is responsible for ensuring that all utility locating activities are performed in accordance with this procedure.
- 4.4 All **Field Personnel** are responsible for the implementation of this procedure.

5.0 **Equipment and Supplies**

- 5.1 Equipment and supplies necessary for locating subsurface utilities will be provided by the subcontractor; however, the project **Field Manager/Field Personnel** will provide any additional equipment and supplies as needed as well as maintain information regarding the utility clearance activities in the field logbook.

6.0 **Procedure**

Proceed with the following steps where subsurface exploration will include excavations, drilling, or any other subsurface investigative method that could damage utilities at a site. In addition to the steps outlined below, always exercise caution while conducting subsurface exploratory work.

6.1 **Prepare Preliminary Site Plan**

- Prepare a preliminary, scaled site plan depicting the proposed exploratory locations as part of the project specific Sampling and Analysis Plan (SAP) or Work Plan. Include as many of the cultural and natural features as practical in this plan.

6.2 **Review Background Information**

- Search existing plan files to review the as-built plans to identify the known location of utilities at the site. Plot the locations of utilities identified onto a preliminary, scaled site plan. Inform the CTO Manager if utilities lie within close proximity to a proposed exploration or excavation location. The CTO Manager will determine if it is necessary to relocate proposed sampling or excavation locations.
- Include the utility location information gathered during previous investigations (e.g., remedial investigation or remedial site evaluation) in the project design documents for removal or remedial actions. In this manner, information regarding utility locations collected during implementation of a CTO can be shared with the subcontractor during implementation of a particular task order. In many instances, this will help to reduce the amount of additional geophysical surveying work the subcontractor may have to perform.
- Conduct interviews with onsite and facility personnel familiar with the site to obtain additional information regarding the known and suspected locations of underground utilities. In addition, if appropriate, contact shall be made with local utility companies to request their help in locating underground lines. Pencil in the dimensions, orientation, and depth of utilities, other than those identified on the as-built plans, at their approximate locations on the preliminary plans. Enter the type of utility, the personnel who provided the information, and the date the information was provided into the field log.
- During the pre-field work interviewing process, the interviewer will determine which site personnel should be notified in the event of an incident involving damage to existing utilities. Record this information in the field logbook with the corresponding telephone numbers and addresses.

6.3 **Site Visit/Locate Utilities/Toning**

- Prior to the initiation of field activities, the Field Task Manager or similarly qualified field personnel shall visit the site and note existing structures and evidence of associated utilities, such as fire hydrants, irrigation systems, manhole and vault box covers, standpipes, telephone switch boxes, free-standing light poles, gas or electric meters, pavement cuts, and linear depression. Compare notes of the actual site configuration to the preliminary site plan. Note deviations in the field logbook and on the preliminary site plan. Accurately locate or survey and clearly mark with stakes, pins, flags, paint, or other suitable devices all areas where subsurface exploration is proposed. These areas shall correspond with the locations drawn on the preliminary site plan.
- Following the initial site visit by the Field Task Manager, a trained utility locating subcontractor will locate, identify, and tone all utilities depicted on the preliminary site plan. The Field Task Manager or similarly qualified field personnel shall visit the site and identify the areas of subsurface disturbance with white spray paint, chalk, white pin flags or some other easily identifiable marking. The utility locator should utilize appropriate sensing equipment to attempt to locate utilities that might not have appeared on the as-built plans. At a minimum, the utility subcontractor should utilize a metal detector and/or magnetometer; however, it is important to consider the possibility that non-metallic utilities or tanks might be present at the site. Use other appropriate surface geophysical methods such as Ground Penetrating Radar, Radiodetection, etc. as appropriate. Clear proposed exploration areas of all utilities in the immediate area where subsurface exploration is proposed. Clearly tone all anomalous areas. Clearly identify all toned areas on the preliminary site plan. All utilities near the area of subsurface disturbance should also be marked out by the utility subcontractor using the universal colors for subsurface utilities (i.e., red – electric; blue – water; green – sewer; yellow – gas; etc.). After toning the site and plotting all known or suspected buried utilities on the preliminary site plan, the utility locator shall provide the Field Task Manager with a copy of the completed preliminary

site plan. Alternatively, the Field Task Manager or designee shall document the results of the survey on the preliminary site plan.

- Report to the Field Task Manager anomalous areas detected and toned that are in close proximity to the exploration or excavation areas. The Field Task Manager shall determine the safe distance to maintain from the known or suspected utility. It may be necessary to relocate the proposed exploration or excavation areas. If this is required, the Field Task Manager or designee shall relocate them and clearly mark them using the methods described above. Completely remove the markings at the prior location. Plot the new locations on the site plan and delete the prior locations from the plan. In some instances, such as in areas extremely congested with subsurface utilities, it may be necessary to dig by hand or use techniques such as air knife to determine the location of the utilities.

6.4 **Prepare Site Plan**

- Prior to the initiation of field activities, draft a final site plan that indicates the location of subsurface exploration areas and all known or suspected utilities present at the site. Provide copies of this site plan to the Navy Technical Representative (NTR), the CTO Manager, and the subcontractor who is to conduct the subsurface exploration/excavation work. Review the site plan with the NTR to verify its accuracy prior to initiating subsurface sampling activities.

7.0 **Quality Control and Assurance**

7.1 Utility locating must incorporate quality control measures to ensure conformance to these and the project requirements.

8.0 **Records, Data Analysis, Calculations**

8.1 A bound field logbook will be kept detailing all activities conducted during the utility locating procedure.

8.2 The logbook will describe any changes and modifications made to the original exploration plan. The trained utility locator shall prepare a report and keep it in the project file. Also, a copy of the final site plan will be kept in the project file.

9.0 **Attachments or References**

Department of Defense, United States (DoD). 2005. [Uniform Federal Policy for Quality Assurance Project Plans, Part 1: UFP-QAPP Manual](http://www.epa.gov/fedfac/pdf/ufp_qapp_v1_0305.pdf). Final Version 1. DoD: DTIC ADA 427785, EPA-505-B-04-900A. In conjunction with the U. S. Environmental Protection Agency and the Department of Energy. Washington: Intergovernmental Data Quality Task Force. March. On-line updates available at: http://www.epa.gov/fedfac/pdf/ufp_qapp_v1_0305.pdf.

Author	Reviewer	Revisions (Technical or Editorial)
Caryn DeJesus Senior Scientist	Bob Shoemaker Senior Scientist	Rev 0 – Initial Issue (June 2012)

Logbooks

Procedure 3-02

1.0 Purpose and Scope

- 1.1 This standard operating procedure (SOP) describes the activities and responsibilities pertaining to the identification, use, and control of logbooks and associated field data records.
- 1.2 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

2.0 Safety

- 2.1 In order to keep the logbook clean, store it in a clean location and use it only when outer gloves used for PPE have been removed.

3.0 Terms and Definitions

3.1 Logbook

A logbook is a bound field notebook with consecutively numbered, water-repellent pages that is clearly identified with the name of the relevant activity, the person assigned responsibility for maintenance of the logbook, and the beginning and ending dates of the entries.

3.2 Data Form

A data form is a predetermined format utilized for recording field data that may become, by reference, a part of the logbook (e.g., soil boring logs, trenching logs, surface soil sampling logs, groundwater sample logs, and well construction logs are data forms).

4.0 Training and Qualifications

- 4.1 The **Contract Task Order (CTO) Manager** or **designee** is responsible for determining which team members shall record information in field logbooks and for obtaining and maintaining control of the required logbooks. The **CTO Manager** shall review the field logbook on at least a monthly basis. The **CTO Manager** or **designee** is responsible for reviewing logbook entries to determine compliance with this procedure and to ensure that the entries meet the project requirements.
- 4.2 A knowledgeable individual such as the **Field Manager**, **CTO Manager**, or **Program Quality Manager** shall perform a technical review of each logbook at a frequency commensurate with the level of activity (weekly is suggested, or, at a minimum, monthly). Document these reviews by the dated signature of the reviewer on the last page or page immediately following the material reviewed.
- 4.3 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.
- 4.4 The **Field Manager** is responsible for ensuring that all **field personnel** follow these procedures and that the logbook is completed properly and daily. The **Field Manager** is also responsible for submitting copies to the **CTO Manager**, who is responsible for filing them and submitting a copy (if required by the CTO Statement of Work).
- 4.5 The **logbook user** is responsible for recording pertinent data into the logbook to satisfy project requirements and for attesting to the accuracy of the entries by dated signature. The **logbook user** is also responsible for safeguarding the logbook while having custody of it.

4.6 All **field personnel** are responsible for the implementation of this procedure.

5.0 Equipment and Supplies

5.1 Field logbooks shall be bound field notebooks with water-repellent pages.

5.2 Pens shall have indelible black ink.

6.0 Procedure

6.1 The field logbook serves as the primary record of field activities. Make entries chronologically and in sufficient detail to allow the writer or a knowledgeable reviewer to reconstruct the applicable events. Store the logbook in a clean location and use it only when outer gloves used for personal protective equipment (PPE) have been removed.

6.2 Individual data forms may be generated to provide systematic data collection documentation. Entries on these forms shall meet the same requirements as entries in the logbook and shall be referenced in the applicable logbook entry. Individual data forms shall reference the applicable logbook and page number. At a minimum, include names of all samples collected in the logbook even if they are recorded elsewhere.

6.3 Enter field descriptions and observations into the logbook, as described in Attachment 1, using indelible black ink.

6.4 Typical information to be entered includes the following:

- Dates (month/day/year) and times (military) of all on-site activities and entries made in logbooks/forms;
- Site name and description;
- Site location by longitude and latitude, if known;
- Weather conditions, including temperature and relative humidity;
- Fieldwork documentation, including site entry and exit times;
- Descriptions of, and rationale for, approved deviations from the work plan (WP) or field sampling plan;
- Field instrumentation readings;
- Names, job functions, and organizational affiliations of on-site personnel;
- Photograph references;
- Site sketches and diagrams made on site;
- Identification and description of sample morphology, collection locations, and sample numbers;
- Sample collection information, including dates (month/day/year) and times (military) of sample collections, sample collection methods and devices, station location numbers, sample collection depths/heights, sample preservation information, sample pH (if applicable), analysis requested (analytical groups), etc., as well as chain-of-custody (COC) information such as sample identification numbers cross-referenced to COC sample numbers;
- Sample naming convention;
- Field quality control (QC) sample information;
- Site observations, field descriptions, equipment used, and field activities accomplished to reconstruct field operations;

- Meeting information;
- Important times and dates of telephone conversations, correspondence, or deliverables;
- Field calculations;
- PPE level;
- Calibration records;
- Contractor and subcontractor information (address, names of personnel, job functions, organizational affiliations, contract number, contract name, and work assignment number);
- Equipment decontamination procedures and effectiveness;
- Laboratories receiving samples and shipping information, such as carrier, shipment time, number of sample containers shipped, and analyses requested; and
- User signatures.

6.5 The logbook shall reference data maintained in other logs, forms, etc. Correct entry errors by drawing a single line through the incorrect entry, then initialing and dating this change. Enter an explanation for the correction if the correction is more than for a mistake.

6.6 At least at the end of each day, the person making the entry shall sign or initial each entry or group of entries.

6.7 Enter logbook page numbers on each page to facilitate identification of photocopies.

6.8 If a person's initials are used for identification, or if uncommon acronyms are used, identify these on a page at the beginning of the logbook.

6.9 At least weekly and preferably daily, the **preparer** shall photocopy and retain the pages completed during that session for backup. This will prevent loss of a large amount of information if the logbook is lost.

7.0 Quality Control and Assurance

7.1 Review per Section 4.2 shall be recorded.

8.0 Records, Data Analysis, Calculations

8.1 Retain the field logbook as a permanent project record. If a particular CTO requires submittal of photocopies of logbooks, perform this as required.

8.2 Deviations from this procedure shall be documented in field records. Significant changes shall be approved by the **Program Quality Manager**.

9.0 Attachments or References

9.1 Attachment 1 – Description of Logbook Entries

9.2 Department of Defense, United States (DoD). 2005. *Uniform Federal Policy for Quality Assurance Project Plans, Part 1: UFP-QAPP Manual*. Final Version 1. DoD: DTIC ADA 427785, EPA-505-B-04-900A. In conjunction with the U. S. Environmental Protection Agency and the Department of Energy. Washington: Intergovernmental Data Quality Task Force. March. On-line updates available at: http://www.epa.gov/fedfac/pdf/ufp_qapp_v1_0305.pdf.

Author	Reviewer	Revisions (Technical or Editorial)
Mark Kromis Program Chemist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue

Attachment 1

Description of Logbook Entries

Logbook entries shall be consistent with Section A.1.4 *Field Documentation SOPs* of the UFP-QAPP Manual (DoD 2005) and contain the following information, as applicable, for each activity recorded. Some of these details may be entered on data forms, as described previously.

Name of Activity	For example, Asbestos Bulk Sampling, Charcoal Canister Sampling, Aquifer Testing.
Task Team Members and Equipment	Name all members on the field team involved in the specified activity. List equipment used by serial number or other unique identification, including calibration information.
Activity Location	Indicate location of sampling area as indicated in the field sampling plan.
Weather	Indicate general weather and precipitation conditions.
Level of PPE	Record the level of PPE (e.g., Level D).
Methods	Indicate method or procedure number employed for the activity.
Sample Numbers	Indicate the unique numbers associated with the physical samples. Identify QC samples.
Sample Type and Volume	Indicate the medium, container type, preservative, and the volume for each sample.
Time and Date	Record the time and date when the activity was performed (e.g., 0830/08/OCT/89). Use the 24-hour clock for recording the time and two digits for recording the day of the month and the year.
Analyses	Indicate the appropriate code for analyses to be performed on each sample, as specified in the WP.
Field Measurements	Indicate measurements and field instrument readings taken during the activity.
Chain of Custody and Distribution	Indicate chain-of-custody for each sample collected and indicate to whom the samples are transferred and the destination.
References	If appropriate, indicate references to other logs or forms, drawings, or photographs employed in the activity.
Narrative (including time and location)	<p>Create a factual, chronological record of the team's activities throughout the day including the time and location of each activity. Include descriptions of general problems encountered and their resolution. Provide the names and affiliations of non-field team personnel who visit the site, request changes in activity, impact the work schedule, request information, or observe team activities. Record any visual or other observations relevant to the activity, the contamination source, or the sample itself.</p> <p>It should be emphasized that logbook entries are for recording data and chronologies of events. The logbook author must include observations and descriptive notations, taking care to be objective and recording no opinions or subjective comments unless appropriate.</p>
Recorded by	Include the signature of the individual responsible for the entries contained in the logbook and referenced forms.
Checked by	Include the signature of the individual who performs the review of the completed entries.

Recordkeeping, Sample Labeling, and Chain-of-Custody

Procedure 3-03

1.0 Purpose and Scope

- 1.1 The purpose of this standard operating procedure is to establish standard protocols for all field personnel for use in maintaining field and sampling activity records, writing sample logs, labeling samples, ensuring that proper sample custody procedures are utilized, and completing chain-of-custody/analytical request forms.
- 1.2 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

2.0 Safety

Not applicable.

3.0 Terms and Definitions

3.1 Logbook

A logbook is a bound field notebook with consecutively numbered, water-repellent pages that is clearly identified with the name of the relevant activity, the person responsible for maintenance of the logbook, and the beginning and ending dates of the entries.

3.2 Chain-of-Custody

Chain-of-custody (COC) is documentation of the process of custody control. Custody control includes possession of a sample from the time of its collection in the field to its receipt by the analytical laboratory, and through analysis and storage prior to disposal.

4.0 Training and Qualifications

- 4.1 The **CTO Manager** is responsible for determining which team members shall record information in the field logbook and for checking sample logbooks and COC forms to ensure compliance with these procedures. The **CTO Manager** shall review COC forms on a monthly basis at a minimum.
- 4.2 The **CTO Manager** and **Program Quality Manager** are responsible for evaluating project compliance with the Project Procedures Manual.
- 4.3 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.
- 4.4 The **Laboratory Project Manager** or **Sample Control Department Manager** is responsible for reporting any sample documentation or COC problems to the **CTO Manager** or **CTO Laboratory Coordinator** within 24 hours of sample receipt.
- 4.5 The **Field Manager** is responsible for ensuring that all **field personnel** follow these procedures. The **CTO Laboratory Coordinator** is responsible for verifying that the COC/analytical request forms have been completed properly and match the sampling and analysis plan. The **CTO Manager** or **CTO Laboratory Coordinator** is responsible for notifying the **laboratory, data managers, and data validators** in writing if analytical request changes are required as a corrective action. These small changes are different from change orders, which involve changes to the scope of the subcontract with

the laboratory and must be made in accordance with a respective contract (e.g., CLEAN remedial action contract).

- 4.6 All **field personnel** are responsible for following these procedures while conducting sampling activities. **Field personnel** are responsible for recording pertinent data into the logbook to satisfy project requirements and for attesting to the accuracy of the entries by dated signature.

5.0 Procedure

This procedure provides standards for documenting field activities, labeling the samples, documenting sample custody, and completing COC/analytical request forms. The standards presented in this section shall be followed to ensure that samples collected are maintained for their intended purpose and that the conditions encountered during field activities are documented.

5.1 Recordkeeping

The field logbook serves as the primary record of field activities. Make entries chronologically and in sufficient detail to allow the writer or a knowledgeable reviewer to reconstruct each day's events. Field logs such as soil boring logs and ground-water sampling logs will also be used. These procedures are described in Procedure 3-02, *Logbooks*.

5.2 Sample Labeling

Affix a sample label with adhesive backing to each individual sample container. Place clear tape over each label (preferably prior to sampling) to prevent the labels from tearing off, falling off, being smeared, and to prevent loss of information on the label. Record the following information with a waterproof marker on each label:

- Project name or number (optional);
- COC sample number;
- Date and time of collection;
- Sampler's initials;
- Matrix (optional);
- Sample preservatives (if applicable); and
- Analysis to be performed on sample (this shall be identified by the method number or name identified in the subcontract with the laboratory).

These labels may be obtained from the analytical laboratory or printed from a computer file onto adhesive labels.

5.3 Custody Procedures

For samples intended for chemical analysis, sample custody procedures shall be followed through collection, transfer, analysis, and disposal to ensure that the integrity of the samples is maintained. Maintain custody of samples in accordance with the U.S. Environmental Protection Agency (EPA) COC guidelines prescribed in EPA *NEIC Policies and Procedures*, National Enforcement Investigations Center, Denver, Colorado, revised May 1986; EPA *RCRA Ground Water Monitoring Technical Enforcement Guidance Document (TEGD)*; *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA OSWER Directive 9355 3-01); Appendix 2 of the *Technical Guidance Manual for Solid Waste Water Quality Assessment Test (SWAT) Proposals and Reports*; and *Test Methods for Evaluating Solid Waste* (EPA SW-846)

A description of sample custody procedures is provided below.

5.3.1 Sample Collection Custody Procedures

According to the U.S. EPA guidelines, a sample is considered to be in custody if one of the following conditions is met:

- It is in one's actual physical possession or view;
- It is in one's physical possession and has not been tampered with (i.e., it is under lock or official seal);
- It is retained in a secured area with restricted access; and
- It is placed in a container and secured with an official seal such that the sample cannot be reached without breaking the seal.

Place custody seals on sample containers immediately after sample collection and on shipping coolers if the cooler is to be removed from the sampler's custody. Place custody seals in such a manner that they must be broken to open the containers or coolers. Label the custody seals with the following information:

- Sampler's name or initials; and
- Date and time that the sample/cooler was sealed.

These seals are designed to enable detection of sample tampering. An example of a custody seal is shown in Attachment 1.

Field personnel shall also log individual samples onto COC forms (carbon copy or computer generated) when a sample is collected. These forms may also serve as the request for analyses. Procedures for completing these forms are discussed in Section 7.4, indicating sample identification number, matrix, date and time of collection, number of containers, analytical methods to be performed on the sample, and preservatives added (if any). The **samplers** will also sign the COC form signifying that they were the personnel who collected the samples. The COC form shall accompany the samples from the field to the laboratory. When a cooler is ready for shipment to the analytical laboratory, the **person delivering the samples for transport** will sign and indicate the date and time on the accompanying COC form. One copy of the COC form will be retained by the **sampler** and the remaining copies of the COC form shall be placed inside a self-sealing bag and taped to the inside of the cooler. Each cooler must be associated with a unique COC form. Whenever a transfer of custody takes place, **both parties** shall sign and date the accompanying carbon copy COC forms, and the **individual relinquishing the samples** shall retain a copy of each form. One exception is when the samples are shipped; the **delivery service personnel** will not sign or receive a copy because they do not open the coolers. The **laboratory** shall attach copies of the completed COC forms to the reports containing the results of the analytical tests. An example COC form is provided in Attachment 2.

5.3.2 Laboratory Custody Procedures

The following custody procedures are to be followed by an **independent laboratory** receiving samples for chemical analysis; the procedures in their Naval Facilities Engineering Service Center-evaluated Laboratory Quality Assurance Plan must follow these same procedures. A **designated sample custodian** shall take custody of all samples upon their arrival at the analytical laboratory. The **custodian** shall inspect all sample labels and COC forms to ensure that the information is consistent, and that each is properly completed. The **custodian** will also measure the temperature of the temperature blank in the coolers upon arrival using either a National Institute for Standards and Technology calibrated thermometer or an infra-red temperature gun. The **custodian** shall note the condition of the samples including:

- If the samples show signs of damage or tampering;
- If the containers are broken or leaking;
- If headspace is present in sample vials;
- If proper preservation of samples has occurred (made by pH measurement, except volatile organic compounds [VOCs] and purgeable total petroleum hydrocarbons [TPH] and temperature). The pH of VOC and purgeable TPH samples will be checked by the **laboratory analyst** after the sample aliquot has been removed from the vial for analysis; and
- If any sample holding times have been exceeded.

All of the above information shall be documented on a sample receipt sheet by the **custodian**.

Discrepancies or improper preservation shall be noted by the **laboratory** as an out-of-control event and shall be documented on an out-of-control form with corrective action taken. The out-of-control form shall be signed and dated by the **sample control custodian** and **any other persons** responsible for corrective action. An example of an out-of-control form is included as Attachment 4.

The **custodian** shall then assign a unique laboratory number to each sample and distribute the samples to secured storage areas maintained at 4 degrees Celsius (soil samples for VOC analysis are to be stored in a frozen state until analysis). The unique laboratory number for each sample, COC sample number, client name, date and time received, analysis due date, and storage shall also be manually logged onto a sample receipt record and later entered into the laboratory's computerized data management system. The **custodian** shall sign the shipping bill and maintain a copy.

Laboratory personnel shall be responsible for the care and custody of samples from the time of their receipt at the laboratory through their exhaustion or disposal. Samples should be logged in and out on internal laboratory COC forms each time they are removed from storage for extraction or analysis.

5.4 **Completing COC/Analytical Request Forms**

COC form/analytical request form completion procedures are crucial in properly transferring the custody and responsibility of samples from field personnel to the laboratory. This form is important for accurately and concisely requesting analyses for each sample; it is essentially a release order from the analysis subcontract.

Attachment 2 is an example of a generic COC/analytical request form that may be used by **field personnel**. Multiple copies may be tailored to each project so that much of the information described below need not be handwritten each time. Attachment 3 is an example of a completed site-specific COC/analytical request form, with box numbers identified and discussed in text below.

COC forms tailored to each CTO can be drafted and printed onto multi-ply forms. This eliminates the need to rewrite the analytical methods column headers each time. It also eliminates the need to write the project manager, name, and number; QC Level; TAT; and the same general comments each time.

Complete one COC form per cooler. Whenever possible, place all VOC analyte vials into one cooler in order to reduce the number of trip blanks. Complete all sections and be sure to sign and date the COC form. One copy of the COC form must remain with the field personnel.

Box 2 **Bill To:** List the name and address of the person/company to bill only if it is not in the subcontract with the laboratory.

Box 3 **Sample Disposal Instructions:** These instructions will be stated in the Master Service Agreement or each CTO statement of work with each laboratory.

Shipment Method: State the method of shipment (e.g., hand carry or air courier via FedEx or DHL).

Comments: This area shall be used by the field team to communicate observations, potential hazards, or limitations that may have occurred in the field or additional information regarding analysis (e.g., a specific metals list, samples expected to contain high analyte concentrations).

Box 4 **Cooler No.:** This will be written on the inside or outside of the cooler and shall be included on the COC. Some laboratories attach this number to the trip blank identification, which helps track samples for VOC analysis. If a number is not on the cooler, field personnel shall assign a number, write it on the cooler, and write it on the COC.

QC Level: Enter the reporting quality control (QC) requirements (e.g., Full Data Package, Summary Data Package).

Turnaround time (TAT): TAT will be determined by a sample delivery group (SDG), which may be formed over a 14-day period, not to exceed 20 samples. Once the SDG has been completed, standard TAT is 21 calendar days from receipt of the last sample in the SDG. Entering NORMAL or STANDARD in this field will be acceptable. If quicker TAT is required, it shall be in the subcontract with the laboratory and reiterated on each COC to remind the laboratory.

Box 5 **Type of Containers:** Write the type of container used (e.g., 1-liter glass amber, for a given parameter in that column).

Preservatives: Field personnel must indicate on the COC the correct preservative used for the analysis requested. Indicate the pH of the sample (if tested) in case there are buffering conditions found in the sample matrix.

Box 6 **Sample Identification (ID) Number:** This is typically a five-character alphanumeric identifier used by the contractor to identify samples. The use of this identifier is important since the laboratories are restricted to the number of characters they are able to use. Sample numbering shall be in accordance with the project-specific sampling and analysis plan.

Description (Sample ID): This name will be determined by the location and description of the sample, as described in the project-specific sampling and analysis plan. This sample identification should not be submitted to the laboratory, but should be left blank. If a computer COC version is used, the sample identification can be input, but printed with this block black. A cross-referenced list of the COC Sample Number and sample identification must be maintained separately.

Date Collected: Record the collection date in order to track the holding time of the sample. Note: For trip blanks, record the date it was placed in company with samples.

Time Collected: When collecting samples, record the time the sample is first collected. Use of the 24-hour military clock will avoid a.m. or p.m. designations (e.g., 1815 instead of 6:15 p.m.). Record local time; the laboratory is responsible for calculating holding times to local time.

Lab ID: This is for laboratory use only.

-
- Box 7 **Matrix/QC:** Identify the matrix (e.g., water, soil, air, tissue, fresh water sediment, marine sediment, or product). If a sample is expected to contain high analyte concentrations (e.g., a tank bottom sludge or distinct product layer), notify the laboratory in the comment section. Mark an "X" for the sample(s) that have extra volume for laboratory QC matrix spike/matrix spike duplicate (MS/MSD) purposes. The sample provided for MS/MSD purposes is usually a field duplicate.
- Box 8 **Analytical Parameters:** Enter the parameter by descriptor and the method number desired (e.g., BTEX 8260B, PAHs 8270C, etc.). Whenever practicable, list the parameters as they appear in the laboratory subcontract to maintain consistency and avoid confusion.
- If the COC does not have a specific box for number of sample containers, use the boxes below the analytical parameter, to indicate the number of containers collected for each parameter.
- Box 9 **Sampler's Signature:** The person who collected samples must sign here.
- Relinquished By:** The person who turned over the custody of the samples to a second party other than an express mail carrier, such as FedEx or DHL, must sign and date here.
- Received By:** Typically, a representative of the receiving laboratory signs and dates here. Or, a field crew member who delivered the samples in person from the field to the laboratory might sign here. A courier, such as FedEx or DHL, does not sign here because they do not open the coolers. It must also be used by the prime contracting laboratory when samples are to be sent to a subcontractor.
- Relinquished By:** In the case of subcontracting, the primary laboratory will sign and date the Relinquished By space and fill out an additional COC to accompany the samples being subcontracted.
- Received By (Laboratory):** This space is for the final destination (e.g., at a subcontracted laboratory). A representative of the final destination (e.g., subcontracted laboratory) must sign and date here.
- Box 10 **Lab No. and Questions:** This box is to be filled in by the laboratory only.
- Box 11 **Control Number:** This number is the "COC" followed by the first contractor identification number in that cooler, or contained on that COC. This control number must be unique (i.e., never used twice). Record the date the COC is completed. It should be the same date the samples are collected.
- Box 12 **Total # of Containers:** Sum the number of containers in that row.
- Box 13 **Totals:** Sum the number of containers in each column. Because COC forms contain different formats depending on who produced the form, not all of the information listed in items 1 to 13 may be recorded; however, as much of this information as possible shall be included.
-

6.0 Quality Control and Assurance

- 6.1 Recordkeeping, sample labeling, and chain-of-custody activities must incorporate quality control measures to ensure accuracy and completeness.
- 6.2 Deviations from this procedure or the project-specific CTO work plan shall be documented in field records. Significant changes shall be approved by the **Program Quality Manager**.

7.0 Records, Data Analysis, Calculations

- 7.1 The COC/analytical request form shall be faxed approximately daily to the **CTO Laboratory Coordinator** for verification of accuracy. Following the completion of sampling activities, the sample

logbook and COC forms will be transmitted to the **CTO Manager** for storage in project files. The **data validators** shall receive a copy also. The original COC/analytical request form shall be submitted by the **laboratory** along with the data delivered. Any changes to the analytical requests that are required shall be made in writing to the laboratory. A copy of this written change shall be sent to the data validators and placed in the project files. The reason for the change shall be included in the project files so that recurring problems can be easily identified.

- 7.2 Deviations from this procedure or the project-specific sampling and analysis plan shall be documented in the records. Significant changes shall be approved by the **Program Quality Manager**.

8.0 Attachments or References

- 8.1 Attachment 1 – Chain-of-Custody Seal
- 8.2 Attachment 2 – Generic Chain-of-Custody/Analytical Request Form
- 8.3 Attachment 3 – Sample Completed Chain-of-Custody
- 8.4 Attachment 4 – Sample Out-of-Control Form
- 8.5 Environmental Protection Agency, United States (EPA). 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*. Interim Final. EPA/540/G-89/004. Office of Emergency and Remedial Response. October.
- 8.6 EPA. 1992. *RCRA Groundwater Monitoring Draft Technical Guidance*. EPA/530/R-93/001. Office of Solid Waste. November.
- 8.7 EPA. 1997. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846. 3rd ed., Final Update IIIA. Office of Solid Waste.
- 8.8 Water Resources Control Board, State of California. 1988. *Technical Guidance Manual for Solid Waste Water Quality Assessment Test (SWAT) Proposals and Reports*. August.
- 8.9 Procedure 3-02, *Logbooks*.

Author	Reviewer	Revisions (Technical or Editorial)
Mark Kromis Program Chemist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue

Attachment 1 Chain-of-Custody Seal

CHAIN-OF-CUSTODY SEAL

<i>[LABORATORY]</i>	SAMPLE NO.	DATE	SEAL BROKEN BY
	SIGNATURE		DATE
	PRINT NAME AND TITLE (<i>Inspector, Analyst or Technician</i>)		

Attachment 2 Generic Chain-of-Custody/Analytical Request Form

680178

CHAIN OF CUSTODY RECORD												Page ____ of ____		
Client/Project Name:				Project Location:				Analysis Requested						
Project Number:				Field Logbook No.:										
Sampler: (Print Name)/Affiliation:				Chain of Custody Tape No.:										
Signature:				Send Results/Report to:										
Field Sample No./Identification	Date	Time	Obs	Comp	Sample Container (Size/Mat)	Sample Type (Liquid, Sludge, Etc.)	Preservative	Field Filtered					Lab I.D.	Remarks
Reinquished by: (Print Name)			Date:		Received by: (Print Name)			Date:		Analytical Laboratory (Destination):				
Signature:			Time:		Signature:			Time:						
Reinquished by: (Print Name)			Date:		Received by: (Print Name)			Date:						
Signature:			Time:		Signature:			Time:		Serial No.				
Reinquished by: (Print Name)			Date:		Received by: (Print Name)			Date:						
Signature:			Time:		Signature:			Time:						

Attachment 3 Sample Completed Chain-of-Custody

Chain-of-Custody					Control Number: 96H0HC205																																																																																																																																																	
1 CTO/DO Manager: Joe Smith CTO/DO Name: Former Navy Landfill CTO/DO Number: CTO 0250 <i>Deliver results to the address above or as stated in contract</i>			2 Bill To: CLEANRAC Contractor Company: company name Address: Oahu, Hawaii		3 Date: 9 / 3 / 00 Page 1 of 1 Sample Disposal: by lab Shipment Method: Express Courier Comments: PACDIV Level D, Measure Cooler Temperature at Lab:																																																																																																																																																	
4 Cooler No: 413 QC Level: PACDIV Level D TAT: Normal - per contract			5 container # (water): 1 2 2 1 2 1																																																																																																																																																			
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			7 Matrix/QC <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Soil</th> <th>Water</th> <th>Other (drum, sludge, etc.)</th> <th>Field Duplicate (MS/MSD)</th> <th>TPH 00158</th> <th>CLP VOAs</th> <th>CLP SVOAs</th> <th>CLP Pesticides</th> <th>CLP Metals</th> <th>EPA 8080 (PCBs only)</th> <th>EPA 8240</th> <th>EPA 8270</th> <th>Total Lead by EPA 6010</th> <th>Extra Volume MS/MSD</th> <th>HOLD</th> <th>Total # of Containers</th> </tr> </thead> <tbody> <tr><td>X</td><td></td><td></td><td></td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr> <tr><td>X</td><td></td><td></td><td></td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr> <tr><td>X</td><td></td><td></td><td></td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr> <tr><td>X</td><td></td><td></td><td></td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr> <tr><td>X</td><td></td><td></td><td></td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr> <tr><td></td><td>X</td><td></td><td>X</td><td></td><td>X</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2</td></tr> <tr><td></td><td>X</td><td></td><td></td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td><td></td><td></td><td></td><td></td><td>8</td></tr> <tr><td colspan="4">13 TOTALS:</td><td>8</td><td>8</td><td>7</td><td>8</td><td>7</td><td>8</td><td></td><td></td><td></td><td></td><td></td><td>16</td></tr> </tbody> </table>				Soil	Water	Other (drum, sludge, etc.)	Field Duplicate (MS/MSD)	TPH 00158	CLP VOAs	CLP SVOAs	CLP Pesticides	CLP Metals	EPA 8080 (PCBs only)	EPA 8240	EPA 8270	Total Lead by EPA 6010	Extra Volume MS/MSD	HOLD	Total # of Containers	X				X	X	X	X	X	X						1	X				X	X	X	X	X	X						1	X				X	X	X	X	X	X						1	X				X	X	X	X	X	X						1	X				X	X	X	X	X	X						1		X		X		X										2		X			X	X	X	X	X	X						8	13 TOTALS:				8	8	7	8	7	8						16
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Original (white), Lab Copy (yellow), Field Copy (pink)

Attachment 4 Sample Out-of-Control Form

OUT OF CONTROL FORM	Status	Date	Initial
	Noted OOC		
	Submit for CA*		
	Resubmit for CA*		
	Completed		

Date Recognized:	By:	Samples Affected (List by Accession AND Sample No.)
Dated Occurred:	Matrix	
Parameter (Test Code):	Method:	
Analyst:	Supervisor:	
1. Type of Event (Check all that apply)	2. Corrective Action (CA)* (Check all that apply)	
<input type="checkbox"/> Calibration Corr. Coefficient <0.995	<input type="checkbox"/> Repeat calibration	
<input type="checkbox"/> %RSD>20%	<input type="checkbox"/> Made new standards	
<input type="checkbox"/> Blank >MDL	<input type="checkbox"/> Reran analysis	
<input type="checkbox"/> Does not meet criteria:	<input type="checkbox"/> Sample(s) redigested and rerun	
<input type="checkbox"/> Spike	<input type="checkbox"/> Sample(s) reextracted and rerun	
<input type="checkbox"/> Duplicate	<input type="checkbox"/> Recalculated	
<input type="checkbox"/> LCS	<input type="checkbox"/> Cleaned system	
<input type="checkbox"/> Calibration Verification	<input type="checkbox"/> Ran standard additions	
<input type="checkbox"/> Standard Additions	<input type="checkbox"/> Notified	
<input type="checkbox"/> MS/MSD	<input type="checkbox"/> Other (please explain)	
<input type="checkbox"/> BS/BSD		
<input type="checkbox"/> Surrogate Recovery		
<input type="checkbox"/> Calculations Error		
<input type="checkbox"/> Holding Times Missed		
<input type="checkbox"/> Other (Please explain)	Comments:	

3. Results of Corrective Action	
<input type="checkbox"/>	Return to Control (indicated with)
<input type="checkbox"/>	Corrective Actions Not Successful - DATA IS TO BE FLAGGED with _____.

Analyst:	Date:
Supervisor:	Date:
QA Department:	Date:

Region 4
U.S. Environmental Protection Agency
Science and Ecosystem Support Division
Athens, Georgia

OPERATING PROCEDURE

Title: Global Positioning System

Effective Date: April 20, 2011

Number: SESDPROC-110-R3

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4/14/2011

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4/14/11

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Date:

4/18/11

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Date:

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Date:

4/14/11

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Title: Field Quality Manager, Science and Ecosystem Support Division

Signature:

Date:

4/14/11

Revision History

This table shows changes to this controlled document over time. The most recent version is presented in the top row of the table. Previous versions of the document are maintained by the SESD Document Control Coordinator.

History	Effective Date
<p>SESDPROC-110-R3, <i>Global Positioning System</i>, replaces SESDPROC-110-R2</p> <p>Cover Page: The EIB Branch Chief was changed from Antonio Quinones to Archie Lee. The FQM was changed from Laura Ackerman to Liza Montalvo.</p> <p>Revision History: Changed Field Quality Manager to Document Control Coordinator.</p> <p>Section 1.2: Added the following statement: Mention of trade names or commercial products in this operating procedure does not constitute endorsement or recommendation for use.</p> <p>Section 1.3: Omitted the reference to the H: drive of the LAN. Changed Field Quality Manager to Document Control Coordinator.</p>	<p>April 20, 2011</p>
<p>SESDPROC-110-R2, <i>Global Positioning System</i>, replaces SESDPROC-110-R01</p> <p>Title Page Changed title for Antonio Quinones from Environmental Investigations Branch to Enforcement and Investigations Branch. Changed Bill Cosgrove's title from Acting Chief to Chief.</p> <p>Section 1.4 Alphabetized and added a reference.</p>	<p>November 1, 2007</p>
<p>SESDPROC-110-R1, <i>Global Positioning System</i>, replaces SESDPROC-110-R0</p> <p>This revision reflects the following changes:</p> <p>General Extensive rewrite with additional information added to most sections. Brian Striggow added as coauthor.</p> <p>Section 2.1 Rewritten description of GPS system. Descriptions of "GPS Accuracy Factors" and "Differential GPS" isolated as separate subsections.</p>	<p>October 1, 2007</p>

<p>Section 2.2 This Section, titled “Requirements for Locational Information” inserted. Supplies guidance on accuracy requirements for various study types and potential means used to obtain requisite accuracy. Subsection on datums and data formats included.</p> <p>Section 2.3 “Quality Control Procedures”, previously numbered as Section 2.2. Most information in this section moved to Section 2.1 discussion of Accuracy Factors and Section 2.4 discussion of specific receivers. Explicit statement added that no specific GPS quality control procedures are required for most SESD studies.</p> <p>Section 2.4 Information added to sections on Trimble and Garmin receivers.</p> <p>Section 2.5 Issue of electronic data-logging addressed. Storage of electronic data records addressed.</p>	
<p>SESDPROC-110-R0, Global Positioning System, Original Issue</p>	<p>March 22, 2007</p>

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Contents

1 General Information

1.1 Purpose

This document describes the Global Positioning System (GPS) and procedures, methods and considerations to be used and observed when using GPS to record location data in the field. Guidance is provided on accuracy requirements for various uses of location data and potential means to obtain the requisite accuracy. This document contains direction developed solely to provide internal guidance to SESD employees.

1.2 Scope/Application

The procedures contained in this document are to be used by SESD field investigators when using the Global Positioning System to obtain the geographical coordinates of sampling locations and/or measurements during field investigations. In SESD investigations, GPS is the preferred means of collecting horizontal location information. In most cases the accuracy of GPS is unsuitable for collection of elevation data.

On the occasion that SESD field personnel determine that any of the procedures described in this section cannot be used to obtain the required coordinate information and alternate procedures are employed, the alternate procedure will be documented in the field log book, along with a description of the circumstances requiring its use. GPS users must be currently qualified as proficient in the operation of the specific GPS equipment to be used. The manufacturer's operation manuals should be used for detailed information on the use of specific GPS equipment. Mention of trade names or commercial products in this operating procedure does not constitute endorsement or recommendation for use.

1.3 Documentation/Verification

This procedure was prepared by persons deemed technically competent by SESD management, based on their knowledge, skills and abilities and has been tested in practice and reviewed in print by a subject matter expert. The official copy of this procedure resides on the SESD local area network (LAN). The Document Control Coordinator is responsible for ensuring the most recent version of the procedure is placed on the LAN and for maintaining records of review conducted prior to its issuance.

1.4 References

Rand Corporation, The Global Positioning System, Assessing National Policies, Appendix B, GPS History, Chronology, and Budgets, 1995.

SESD Operating Procedure for Control of Records, SESDPROC-002, Most Recent Version.

Trimble® Navigation Limited, Mapping Systems General Reference, Revision B, 1996.

USEPA, Global Position Systems – Technical Implementation Guidance, Office of Environmental Information (EPA/250/R-03/001), 2003.

USEPA, GIS Technical Memorandum 3. Global Positioning Systems – Technology and It's Application in Environmental Programs, Research and Development (PM-225). EPA/600/R-92/036, 1992.

USEPA, Locational Data Policy, Office of Information Resources Management, IRM Policy Manual 2100 Chapter 13, 1991.

2 Methodology

2.1 General

2.1.1 GPS Description

The Navigation Satellite Time and Ranging (NAVSTAR) Global Positioning System (GPS) is a worldwide radio-navigation system created by the U. S. Department of Defense (DOD) to provide navigation, location, and timing information for military operations. System testing using a limited number of satellites began in 1978 with the system being declared fully operational in 1995. The system was declared available for civilian uses in the 1980s and has seen burgeoning civilian application for navigation and mapping.

The GPS system consists of three basic elements: the space segment, control segment, and user segment. The space segment consists of the constellation of up to 24 active NAVSTAR satellites in six orbital tracks. The satellites are not in geo-synchronous orbit and are in constant motion relative to a ground user. The control segment consists of several ground stations that serve as uplinks to the satellites and that make adjustments to satellite orbits and clocks when necessary. The user segment consists of the GPS receiver which will typically consist of an antenna, multi-channel receiver, and processing unit.

For the purposes of this document, the user segment GPS receivers may be loosely grouped into Recreational and Navigational receivers (henceforth referred to as General Use receivers), Mapping Grade receivers, and Survey Grade receivers.

- Most General Use grade receivers are available on the retail market to consumers for a variety of applications including boating, hiking, and automotive navigation. They display an instantaneous reading of position and are generally not optimized for data collection. Waypoints containing instantaneous position fixes can often be stored and downloaded. The accuracy of these receivers is adequate for many environmental applications.
- Mapping Grade receivers are used for applications such as resource management and Geographical Information System (GIS) feature collection. The receivers are capable of averaging multiple position fixes for greater accuracy and then data-logging the results with sufficient information to post-correct the positions as described below. The potential accuracy that can be achieved may be better than one meter.

- Survey Grade receivers can provide accuracy at the centimeter level by using long occupation times and special techniques for receiver use and data processing. Survey Grade receivers are not used by SESD in field investigations.

GPS receivers derive positions by simultaneously measuring the distance (range) to several satellites in precisely known orbits, and using triangulation of the ranges to calculate a unique position for the receiver. The range to each satellite is determined by precisely measuring the transit time of radio signals broadcast from the satellites.

2.1.2 GPS Accuracy Factors

The accuracy of the basic GPS system is approximately 15m. GPS accuracy can be affected by a number of factors including the Selective Availability feature, atmospheric delays, satellite clock and orbit errors, multipath signals, signal strength, and satellite geometry relative to the user.

In the early GPS implementation, the DOD used a feature known as Selective Availability (SA) to degrade the quality and subsequent accuracy of the GPS signals to non-DOD users. With Selective Availability enabled, accuracy of position fixes could be as poor as 100m without the use of differential correction techniques described below. Currently there is no SA limitation in accuracy in place with a stated Executive Branch intention to not return to the use of the SA signal degradation.

As satellites move in their orbits and some signals are blocked by obstructions, the geometry of the available satellite signals relative to the user will constantly change. When the satellites with available signals are clustered closely together in the sky, small errors in range will result in large errors in reported position. Conversely, when the satellites are distributed more broadly across the sky, the resultant position errors will be at their minimum. The general measure of this phenomenon is Dilution of Precision (DOP), which may be represented as Position Dilution of Precision (PDOP), or more specifically for geographical coordinate collection, Horizontal Dilution of Precision (HDOP). Mapping and Survey Grade receivers generally can calculate and display DOP and allow the user to limit logging to times when the higher potential accuracy conditions of low DOP prevail. General Use receivers may display DOP and use DOP with other factors to estimate a general accuracy figure. DOP may range from approximately 2 to 50, with high quality work usually requiring a HDOP of less than 4-6.

Signal strength and multipath signals relate to the strength and quality of the signal reaching the receiver antenna. Signal attenuation by the atmosphere, buildings, and tree cover limit the accuracy of the ranges obtained. The measure of signal strength is Signal to Noise Ratio (SNR), generally measured in decibels(db). Most receivers of any grade will display the SNR of the satellite signals in a bar graph or table. Mapping Grade Receivers generally allow the user to specify a minimum signal strength for the use of a satellite signal (commonly 2-15db). Poor signal strength can be resolved by waiting for satellite locations to change or moving the receiver location. Multipath signals result

from portions of the satellite signal bouncing off terrain, structures, or atmospheric disturbances, resulting in a degraded total signal. Higher quality Mapping Grade receivers may be capable of rejecting the stray multipath signals, such as Trimble® receivers using Everest™ technology.

2.1.3 Differential GPS

Selective Availability, clock errors, and orbital errors affect all GPS users and atmospheric delays affect all users over a relatively wide region. A second GPS receiver in the same general area as the user will experience the same errors from these sources as the user's receiver. Consequently, correction factors from a remote station at a known location can be applied to the user's receiver in a process known as Differential GPS (DGPS). DGPS can be applied in real-time using additional radio signals, or after the collection event by a method called post-correction.

Real-time DGPS uses established networks of base stations at precisely surveyed locations. The US Coast Guard operates a system of 80 base stations which became fully operational in 1999. The range corrections are broadcast on marine radiobeacon frequencies, with redundant coverage of most of the US coastline and the Mississippi River. There is near complete single beacon coverage of most of the internal US, but there are known gaps in coverage in both EPA Region 4 and the US as a whole. The system is sometimes referred to using the more general term DGPS or in nomenclature referring to the beacon-based nature of the system. Beacon-based DGPS is implemented primarily in Navigational and Mapping Grade receivers.

Real-time DGPS can also be implemented with a Space Based Augmentation System (SBAS). The most common SBAS currently used in the United States is the Wide Area Augmentation System (WAAS), developed by the Federal Aviation Administration to meet the additional demands on GPS for aircraft navigation. The WAAS network of base stations collects information on satellite clock errors, orbital errors, and atmospheric conditions. The error information is transferred to satellites in geo-synchronous orbits and subsequently broadcast to suitably equipped GPS receivers on frequencies compatible with the GPS range signals. While beacon-based DGPS passes range corrections to the receivers, WAAS communicates a model for the errors which is capable of providing more accurate corrections. Current Mapping Grade receivers will likely use WAAS with or without the option of beacon-based DGPS. All but the least expensive General Use receivers are generally equipped with WAAS differential correction capability.

Post-Corrected DGPS is generally accomplished by downloading the receiver survey files to a desktop or laptop computer and then retrieving correction files for the same time period (generally via the internet) from an established base station in the area of the survey. Post-processed accuracy improves with proximity of the base station to the surveyed locations and base station data should be used from a station within 300km of the site surveyed. The survey positions are processed by application software and a new

set of positions is generated using the correction data. The capability for post-processed differential correction is generally limited to Mapping Grade and Survey Grade receivers.

Various factors limit GPS accuracy in the vertical plane to approximately half of that obtainable in the horizontal plane, i.e., if a location fix is accurate to 3 m in the horizontal plane, it may only be accurate to 6 m in the vertical plane. Since relatively high accuracy is usually required for the uses of elevation data, GPS is rarely used to obtain and report elevations.

2.2 Requirements for Locational Information

2.2.1 Data Uses

Locational information can serve many purposes in an environmental investigation, a few of which are listed below:

1. Providing an unambiguous means to identify facilities or sampling plats.
2. Providing locational information to key analytical data in a GIS based data archiving system to the original sampling locations.
3. Differentiating watersheds.
4. Providing information to calculate extents and volumes of contamination.
5. Providing a means to relocate the media represented by samples for removal or treatment.
6. Providing information to prepare presentation graphics of sampling locations.

Depending on the specific uses for the data and the type of work being performed, there will be different needs for the accuracy of the locational data. Studies where a sample represents a large area of relatively homogeneous material would not require the same accuracy as the location of a permanent monitoring well. Below are broad guidelines for the accuracy that might be required for different applications.

Desired Accuracy	Application
100 m	Open ocean work where sample is presumed to be representative of a large area
20 m	Open water work (lakes or estuaries) where sample is presumed to be representative of a large area
10 m	Stream and river work where samples are presumed to be broadly representative of a reach
5-3 m	Stream work where samples are representative of a specific narrowly defined section

10 m	Air Monitoring Stations
10 - 3 m	Microscale air monitoring
3 - 1 m	Permanent monitoring wells
1 m	Locations of 'Hot Spots' destined for removal of limited areal extent
3 - 1 m	Locations of Temporary groundwater wells in plumes requiring narrow delineation
3 m	Locations of Temporary groundwater wells in broad plumes
3 m	Locations of environmental samples with sample spacing >20 m
5 m	Locations of environmental samples with sample spacing >60 m
200 - 20 m	Coordinates describing a facility where mobile waste units are sampled
30 - 3 m	Locations of industrial process areas or NPDES permitted facilities where the sampling locations are described in field notes relative to the process or site features

Specific demands of a study may drive increased or decreased requirements for accuracy. The preferred means of locational data collection for most studies will be GPS, although alternate means are permissible if they meet accuracy requirements. The following table indicates the accuracy that may be expected from various means of establishing coordinates.

Accuracy	Description
200 - 50 m	Map Derived, coarse work
40 - 20 m	Map Derived, fine work or using GIS with digital imagery
15 m	General Use Grade GPS, w/o WAAS
5 m	General Use Grade GPS, w/ WAAS or beacon corrections
10 m	Mapping Grade GPS, no corrections, averaged readings,
3 m	Mapping Grade GPS w/ differential correction, averaged readings
1 m	Mapping Grade GPS w/ differential correction, controlled DOP and SNR, averaged readings
10 cm	Surveying Grade GPS or optical surveying (dependent on baseline length)

Accuracy is a term used to describe the degree of conformity of a measurement. In GPS, accuracy is usually specified as an estimate of the radius from the measured coordinates that is likely to include the actual coordinates. The estimate is based on several standard deviations probability of including the actual point in the measurement. As such, it is recognized that some measurements will fall outside of the specified accuracy. For the purposes of SESD GPS work, the nominal accuracy figures derived from manufacturer's literature for specific operating conditions, displayed by the receiver at the time of feature collection, or output from processing software will be taken at face value.

2.2.2 Datums and Data formats

In general, a datum is a reference from which other measurements are taken. In the development of surveying systems by civil entities, different datums were used as base references that will result in differing coordinates for the same location. A GPS receiver will generally display coordinates in a number of different user-selected datums. **Unless there are specific requirements on a project, all SESD work should be conducted using the WGS84 datum.** Alternatively, the nearly equivalent NAD83 datum may be used if WGS84 is unavailable as a receiver option. If an alternate coordinate system is used where coordinates are obtained and recorded in field logbooks, the use of the alternate coordinate system should also be noted in the logbook.

The SESD Data Archival and Retrieval System (DART) requires that coordinates for sample locations be entered in the WGS84 datum and dd.ddddd format. Unless specific project requirements dictate otherwise, all coordinates explicitly stated in reports will be in WGS84 format and in all cases the datum used will be specified.

There is no SESD policy on significant digits for GPS information, and accuracy should not be implied from the presence of significant digits in reported coordinates. However, good scientific practice should be followed in the presentation of locational information in order that useful information not be truncated or a higher degree of accuracy implied. The following table shows the incremental distance in latitude represented by the least significant digit for various coordinate formats:

dd.ddddd°	Approximately 4" or 10 cm
dd.ddddd°	Approximately 44" or 1.1 m
dd.dddd°	Approximately 36' or 11 m
dd°mm'ss"	Approximately 100' or 30 m
dd°mm'ss.x"	Approximately 10' or 3 m
dd°mm'ss.xx"	Approximately 1' or 30 cm
dd°mm.xxxx'	Approximately 7" or 18 cm
dd°mm.xxx'	Approximately 6' or 1.8 m
dd°mm.xx'	Approximately 60' or 18 m

2.3 Quality Control Procedures

By nature of its origin in the DOD and recent application to aircraft navigation, the GPS is designed for high reliability. GPS failures resulting in an incorrect reading beyond the bounds of known errors are so rare that the possibility can be ignored for most SESD studies. If a study requires the verification of receiver function, this can be accomplished by verifying that a receiver displays the correct position while occupying a known benchmark.

2.4 Special Considerations

The application will dictate the type of receiver used. There are several specific considerations for the use of the various receiver types.

2.4.1 Special considerations for the use of Trimble® Mapping Grade Receivers

The suggested settings for Trimble® receivers are:

1. Position mode: Overdetermined 3D (or manual 3D if only 4 satellites are visible)
2. Elevation mask: 15 degrees
3. PDOP: 6
4. Signal to noise ratio (SNR) mask: 6
5. Dynamics code: Land
6. Logging interval: 1 second for points, 5 seconds for lines and areas
7. Audible click: Yes
8. Log DOP data: Yes
9. Coordinate System: Geographic Datum WGS84

When using Trimble® Geoexplorer receivers, the option of using the accuracy „slider bar’ display may be used to consolidate many of the above parameters. The slider bar position must be positioned at midscale or towards the „Precision’ end of the scale to achieve 1m accuracy work. When conducting work requiring less accuracy, the slider should be initially positioned midscale and may be adjusted toward the Production’ end of the scale if the higher level of accuracy can not be maintained.

The receivers may be configured to force real-time position correction. The use of real-time correction reduces the risk of being unable to obtain appropriate post-correction files, but may limit productivity when differential signals cannot be

received or are intermittent. The use of forced real-time vs. post-correction is an operator decision. If the positions are not to be downloaded and the accuracy of differential correction is required, it will be necessary to force real-time correction.

Trimble® receivers at SESD contain a data dictionary that can facilitate the management of GIS data. If the COC_GIS dictionary is selected at the time of file creation, SESD standard media codes can be assigned to features at the time of logging that will accompany the data through the download process. The use of the COC_GIS data dictionary can simplify the management of the data when processed in a GIS system or when entered into the DART system.

The logging interval of most Trimble® GPS receivers defaults to a 5 second interval. This may be changed to a 1 second interval to expedite feature collection. A point feature should have a minimum of 36 positions logged to obtain the additional accuracy afforded by averaging positions. After a minimum of 36 positions are logged and the feature is closed, the averaged position can be obtained by selecting the feature on the „Map’ screen. The averaged position should always be the one entered into field notebooks.

Some Trimble® receivers may only display data in dd°mm’ss.sss” format. If the coordinates are downloaded and processed through Pathfinder Office software, they can be output in the dd.dddddd (or any other) format. If the coordinates were only recorded in field logbooks, they can be converted to decimal degrees as follows:

Converting to decimal degrees (dd.dddddd) from degrees°minutes’sseconds” (dd°mm’ss.sss”):

$$dd.dddddd = dd + (mm/60) + (ss.sss/3600)$$

Example: Convert 33°28’45.241” to decimal degrees

$$33 + (28/60) + (45.241/3600) = 33.479236$$

The reverse conversion is accomplished as follows:

Converting to degrees°minutes’sseconds” from decimal degrees

Starting with dd.dddddd

Multiply .dddddd by 60 to obtain mm.mmmm

Multiply .mmmm by 60 to obtain ss.sss

Then dd°mm’ss.sss” = dd & mm & ss.sss

Example: Convert 33.479236 to dd°mm'ss.sss" format

Multiply .479236 by 60 to obtain 28.7540 (mm.mmmm)

Multiply .7540 by 60 to obtain 45.241 (ss.sss)

Dd°mm'ss.sss" = 33° & 28' & 45.241" = 33°28'45.241"

2.4.2 Special considerations for the use of Garmin® General Use Grade Receivers

The standard format for navigational purposes is decimal minutes (dd°mm.mmm'). This format is utilized due to the fact that nautical navigation charts are set up in this format. However, location information must be converted to a decimal degree (dd.ddddd°) format in order for GIS software to properly interpret the information. The conversion is accomplished by dividing the minutes portion of the coordinates by 60.

Converting to decimal degrees from decimal minutes:

$dd.ddddd^{\circ} = dd + (mm.mmm/60)$

Example: Convert 81°49.386 degrees to decimal degrees

$81 + (49.386/60) = 81.8231$ degrees

The reverse conversion is accomplished as follows:

$dd^{\circ}mm.mmm' = dd \& (.dddd*60)$

Example: Convert 81.8231 degrees to decimal minutes (dd°mm.mmm')

Multiply .8231 by 60 to obtain 49.386 (mm.mmm)

$81^{\circ} \& 49.386' = 81^{\circ}49.386'$

GPS users need to familiarize themselves with the differences between the two formats, as they appear similar. Spreadsheets can automate the conversion process.

2.5 Records

The GPS coordinates and the SESD equipment identification number of the GPS receiver should be recorded in field logbooks at the time of GPS coordinate collection. The data logging capability of receivers may be used in lieu of the requirement to record the coordinates in logbooks when the following conditions can be met:

1. The location can easily be found later if it needs to be resurveyed prior to demobilization. A permanent monitoring well can easily be resurveyed, while most open-water work would not afford this opportunity.
2. The data is downloaded and ascertained to meet the accuracy requirements for the project prior to demobilization from the site.
3. The data is stored in at least two separate locations for transport, such as a laptop hard drive and a flash drive or compact disc.

In all cases where positions are electronically recorded, the provisions of the Electronic Records section of the SESD Operating Procedure for Control of Records (SESDPROC-002) should be followed.

Where locational data is collected and processed electronically, but not reported explicitly in the final report, a copy of the coordinates in text format should be output and entered into the project file in paper or electronic form. The output should include:

1. Latitude, generally in dd.dddddd format.
2. Longitude, generally in dd.dddddd format.
3. Date of collection.
4. DOP information where it supports the accuracy requirements.
5. Correction status of each point where it supports the accuracy requirements.
6. The datum used for the export.

Trimble® Pathfinder Office will create files with this information by exporting to a text file. The information will be contained in the .pos and .inf files.

APPENDIX F
SITE SAFETY AND HEALTH PLAN
(PROVIDED ON CD ONLY)

SITE HEALTH AND SAFETY PLAN

Former Naval Training Center
Orlando, FL

Revision: 1

Resolution Consultants Job Number:
60270384

Prepared for:



Department of the Navy
Naval Facilities Engineering Command Southeast
Bldg. 135 N, P.O. Box 30
Jacksonville, Florida 32212-0030

Prepared by:



Resolution Consultants
A Joint Venture of AECOM & EnSafe
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Contract Number: N62470-11-D-8013
Delivery Order Number: JM22

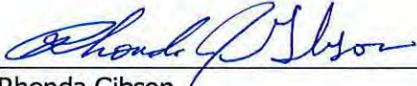
March 2013

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SITE HEALTH AND SAFETY PLAN

This Site Health and Safety Plan (HASP) was prepared for employees performing a specific, limited scope of work. It was prepared based on the best available information regarding the physical and chemical hazards known or suspected to be present on the project site. While it is not possible to discover, evaluate, and protect in advance against all possible hazards that may be encountered during the completion of this project, adherence to the requirements of the HASP will significantly reduce the potential for occupational injury. By signing below, I acknowledge that I have reviewed and hereby approve the HASP for the Insert Base and Site Name. This HASP has been written for the exclusive use of Resolution Consultants, their employees, and subcontractors. The plan is written for specified site conditions, dates, and personnel, and must be amended if these conditions change.

Prepared by:



Rhonda Gibson
Site Manager
(407) 304-4411

March 8, 2013

Date



Russ Reynolds
AECOM H&S Specialist
(864) 234-3042

March 8, 2013

Date

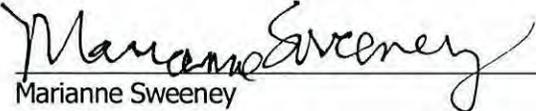
Concurrence by:



John Knopf, CSP
Resolution Consultants H&S Manager
(901) 372-7962

March 8, 2013

Date



Marianne Sweeney
CTO Manager
(407) 304-4446

March 8, 2013

Date

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EXECUTIVE SUMMARY

The purpose of this Site Health and Safety Plan (HASP) is to address health and safety concerns related to Resolution Consultants managed activities at the project site. The document is intended to identify known potential hazards and facilitate communication and control measures to prevent injury or harm. Additionally, provisions to control the potential for environmental impact from these activities are included where applicable.

SUMMARY TABLE					
Resolution Consultants SOW		Resolution Consultants will be performing well abandonment, well installation, pump replacement and system piping to support the RA effort on the site. Soil and groundwater sampling will also be conducted by Resolution Consultants' personnel.			
Subcontractor A Drilling		Subcontractor A will be performing well abandonment and well installation			
Subcontractor B IDW		Subcontractor B will be picking up 55-gallon drums of soil cuttings from drilling activities			
Subcontractor C Lab		Subcontractor C will be performing laboratory analysis at an off-site lab on samples collected from the site.			
Subcontractor D Drilling		Subcontractor D will be performing groundwater monitoring well installation.			
PRIMARY PHYSICAL HAZARDS					
	Underground Utilities		Traffic Control	x	Electrical Hazards
	Overhead Utilities	x	Slips, Trips/Walking Surface	x	Excavation & Trenching
x	Drill Rig Operations	x	Manual Lifting		Working adjacent to Railway
CHEMICAL HAZARDS, MONITORING, ACTION LEVELS					
COC		MONITORING		ACTION LEVELS	
Chlorinated VOCs (tetrachloroethene, trichloroethene, cis-1,2-dichloroethene, vinyl chloride)		PID (min. 10.2 eV bulb)		OSHA: 1 ppm, TWA ₈ 5 ppm, ceiling ACGIH: 1 ppm, TWA ₈	
Polynuclear Aromatic Hydrocarbons (benzo[a]pyrene)		TVA 1000		OSHA: 0.2 mg/m ³ TWA NIOSH: 0.1 mg/m ³ TWA	
Pesticides (dieldrin)		PID (min. 10.2 eV bulb)		OSHA: 0.25 mg/m ³ TWA NIOSH: 0.25 mg/m ³ TWA	

All staff is bound by the provisions of this HASP and are required to participate in a preliminary project safety meeting to familiarize them with the anticipated hazards and respective onsite controls. The discussion will cover the entire HASP subject matter, putting emphasis on critical elements of the plan; such as the emergency response procedures, personal protective equipment, site control strategies, and monitoring requirements. In addition, daily tailgate safety meetings will be held to discuss: the anticipated scope of work, required controls, identified new hazards and controls, incident reporting, the results of inspections, any lessons learned or concerns from the previous day.

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Attachment 6	Incident Investigation and Reporting Forms
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Attachment 8	State Spill Response Procedures/Spill Reporting Card

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Acronyms and Abbreviations

ACGIH	American Conference of Governmental Industrial Hygienists
ANSI	American National Standards Institute
APR	Air Purifying Respirator
°C	Degrees Celsius
CAS	Chemical Abstracts Service
CFR	Code of Federal Regulations
CGI	Combustible Gas Indicator
CIH	Certified Industrial Hygienist
CO	Carbon Monoxide
COC	Contaminant of Concern
CRZ	Contaminant Reduction Zone
CSP	Certified Safety Professional
CVOC	Chlorinated Volatile Organic Compound
dBA	Decibels on the A-weighted scale
DOT	Department of Transportation
EAP	Emergency Action Plan
EC	Emergency Coordinator
eV	electron-volt
EZ	Exclusion Zone
FSP	Field Sampling Plan
GFCI	Ground Fault Circuit Interrupter
H ₂ S	Hydrogen Sulfide
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSA	Hollow-Stem Auger
IDLH	Immediately Dangerous to Life or Health
IDW	Investigative-Derived Waste
mg/kg	Milligrams per kilogram
mg/m ³	Milligrams per cubic meter
MSDS	Material Safety Data Sheet
MUTCD	Manual of Uniform Traffic Control Devices

NCR	Nonconformance Report
NFA	No Further Action
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
O ₂	Oxygen
OSHA	Occupational Safety and Health Administration
PE	Performance Evaluation
PEL	Permissible Exposure L
PID	Photo Ionization Detector
PM	Project Manager
POL	Petroleum, Oil, and Lubricant
PPE	Personal Protective Equipment
ppm	Parts per million
PHSP	Programmatic Health and Safety Plan
REL	Recommended Exposure Limit
RTECS	Registry of Toxic Effects of Chemical Substances
SCBA	Self Contained Breathing Apparatus
SH&E	Safety, Health, and Environmental
SOP	Standard Operating Procedure
SOW	Statement of Work
HASP	Health and Safety Plan
SSHO	Site Safety Health Officer
STEL	Short Term Exposure Limit
THA	Task Hazard Analysis
ug/l	Micrograms per liter
UN	United Nations
USCG	US Coast Guard
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOC	Volatile Organic Compound

1.0 INTRODUCTION

This project Health and Safety Plan (HASP) (including Attachments 1-8) provides a general description of the levels of personal protection and safe operating guidelines expected of each employee or subcontractor associated with the environmental services being conducted at the project site. This HASP also identifies chemical and physical hazards known to be associated with the Resolution Consultants-managed activities addressed in this document.

A cross-reference table is provided in Attachment 1 which provides information concerning the corresponding elements between this HASP and the Accident Prevention Plan (APP) requirements of the United States Army Corps of Engineers (USACE) *Safety and Health Requirements Manual*, EM-385-1-1, 2008.

This HASP may be modified as necessary to address any additional activities or changes in site conditions, which may occur during field operations. All changes to the HASP must be approved by the Resolution Consultants Health and Safety Manager or designee in advance of the execution of respective work.

1.1 General

The provisions of this HASP are mandatory for all Resolution Consultants personnel (including both AECOM and EnSafe employees, as applicable) engaged in fieldwork associated with the environmental services being conducted at the subject site. For the purposes of this HASP, the term "Resolution Consultants" means an employee of either of the firms. A copy of this HASP and any applicable HASP supplements shall be accessible on site and available for review at all times. Recordkeeping will be maintained in accordance with this HASP and the applicable Standard Operating Procedures (SOPs). In the event of a conflict between this HASP, the SOPs and federal, provincial, state, and local regulations, workers shall follow the most stringent/protective requirements. Concurrence with the provisions of this HASP is mandatory for all personnel at the site covered by this HASP and must be signed on the acknowledgement page (Section 11.0).

1.2 Project Policy Statement

Resolution Consultants is committed to protecting the safety and health of our employees and meeting our obligations with respect to the protection of others affected by our activities. We are also committed to protecting and preserving the natural environment and communities in which we operate. The safety of persons and property is of vital importance to the success of this project and accident prevention measures shall be taken toward the avoidance of needless

waste and loss. It shall be the policy of this project that all operations be conducted safely. Onsite supervisors are responsible for those they supervise by maintaining a safe and healthy working environment in their areas of responsibility, and by fairly and uniformly enforcing safety and health rules and requirements for all project personnel. Subcontractors shall comply with the requirements of this HASP, provisions contained within the contract document and all applicable rules, requirements and health, safety and environmental regulations. All practical measures shall be taken to promote safety and maintain a safe place to work. Contractors are wholly responsible for the prevention of accidents on work under their direction and shall be responsible for thorough safety and loss control programs and the execution of their own safety plans for the protection of workers.

1.3 References

This HASP conforms to the regulatory requirements and guidelines established in the following documents:

- Department of Labor. Occupational Safety and Health Administration. (2012). Title 29, Part 1910 of the Code of Federal Regulations (29 CFR 1910), Occupational Safety and Health Standards (with special attention to Section 120, Hazardous Waste Operations and Emergency Response). Washington D.C: US Government Printing Office.
- Department of Labor. Occupational Safety and Health Administration. (2012). Title 29, Part 1926 of the Code of Federal Regulations (29 CFR 1926), Safety and Health Regulations for Construction (Chapter XVII). Washington D.C: US Government Printing Office.
- National Institute for Occupational Safety and Health (NIOSH). Occupational Safety and Health Administration.
- Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (Publication No. 85-115).
- U.S. Army Corps of Engineers. (2008). Safety and Health Requirements Manual (Publication No. EM 385-1-1).
- Resolution Consultants, Programmatic Health and Safety Plan.

2.0 SITE INFORMATION AND SCOPE OF WORK

Resolution Consultants will conduct environmental services at the project site. Work will be performed in accordance with the applicable Statement of Work (SOW) and associated Project Work Plan developed for project site. Deviations from the listed SOW will require that the Resolution Consultants Health and Safety Manager or designee review and approve changes made to this HASP to ensure adequate protection of personnel and other property. All changes to this HASP must be documented in Attachment 2.

The following is a summary of relevant data concerning the project site and the work procedures to be performed. The Project Work Plan prepared by Resolution Consultants as a companion document to this HASP provides more detail concerning both site history and planned work operations.

2.1 Site Information

This section provides a general description and historical information associated with the site.

2.1.1 General Description

The former Naval Training Center was comprised of four non-contiguous facilities in the heart of Orlando: the Main Base (1,095 acres), Area C (46 acres), Herndon Annex (54 acres, and the McCoy Annex (877 acres). Operable Unit (OU) 4 is located in Area C and the NE portion is now owned by Orlando Heights LLC and utilized as warehouse storage while the NW portion is owned by the City of Orlando and proposed for recreational purposes. Study Area (SA) 39 is located in the southwest corner of the Former Main Base and encompasses a 12 acre parcel of land which is now a residential community in Baldwin Park.

2.1.2 Site Background/History

OU 4: Construction of Area C, including OU 4, began in 1942 to provide support services for the Army Air Corps Orlando Air Base. OU 4 is located in the northern portion of Area C and includes a former Defense Reutilization and Marketing Office (DRMO) warehouses and salvage yard (SA 12) and storage area (SA 14), and base laundry and dry cleaning facility (Building 1100, SA 13). OU 4 borders Lake Druid, with residential, trespasser and recreational user exposure risks. Three distinct zones of groundwater are located in the northwest portion of OU 4. The groundwater flow direction in the upper surficial aquifer (0-60 feet below land surface) is toward the west to Lake Druid.

Building 1100 has been demolished and the site is currently undeveloped. Soil, groundwater and surface water are impacted by chlorinated solvents. Remedial activities have been on-going for several years and include soil removal, in situ air stripping via recirculation wells, in situ chemical oxidation using potassium permanganate, phytoremediation, and enhanced biodegradation using Emulsified Oil Substrate (EOS). The recirculation wells were converted to conventional pump and treat recovery wells. One of the wells has become compromised and the well and pump will be replaced.

SA 39: The former Main Base, which includes SA 39, was initially constructed in 1942 as the Army Air Corps Orlando Air Base. Building 137, the Hazardous Materials Storage Facility, was located in the southeast corner of SA 39. The southeast corner was undeveloped and covered with grass; however, this area was once utilized as a coal staging area before disposition to the various steam generating boilers located throughout the facility. All facilities were removed prior to the redevelopment of the property for residential area in 2001.

The SA 39 site is located in the area of Fox Street and Fern Avenue in the Baldwin Park residential district. Historically, COCs in groundwater included chlorinated solvents; however, recent groundwater data indicates all COCs have fallen below risk-based FDEP GCTLs. Therefore, all wells at this site will be abandoned.

Building 148/SA 56 at Area C Southwest: Construction of Area C began in 1942 to provide support services for the Army Air Corps Orlando Air Base. The Navy acquired the property on July 1, 1998 when it was commissioned and functioned as a Naval training facility for recruits, enlisted personnel, and officers until it was decommissioned in the mid-1990s. The southwest portion of Area C included Building 148, the Cold Storage Warehouse, which stored and distributed all of the frozen or chilled food used by the galleys at NTC, Orlando. In January 2009, the Area C southwest parcel was transferred to the City of Orlando for use as a recreational park facility. Upon demolition of Building 148 for site development, soil samples were analyzed and found to contain concentrations of pesticides (dieldrin) and carcinogenic polynuclear aromatic hydrocarbons (PAHs), including benzo[a]pyrene, above FDEP Residential SCTLs. In addition, soil sampling by the City's consultant in the southern portion of the Area C southwest parcel (SA 56) where a playground, community garden, and dog park are planned, indicated elevated concentrations of carcinogenic PAHs above FDEP Residential SCTLs.

2.1.3 Previous Investigations

OU 4: COCs in groundwater and surface water at OU 4 include the chlorinated volatile organic compounds (CVOCs) tetrachloroethene (PCE) and its daughter products trichlorethene (TCE), cis-

1,2-dichloroethene (cis-DCE), and vinyl chloride (VC). Antimony is also a groundwater COC in a limited area. Soil contamination includes CVOCs, polynuclear aromatic hydrocarbons (PAHs) and arsenic at concentrations exceeding FDEP Residential SCTLs.

SA 39: Historically, COCs in groundwater at SA 39 included chlorinated solvents (CVOCs); however, recent groundwater data indicates all COCs have fallen below risk-based FDEP GCTLs.

Building 148/SA 56 at Area C Southwest: Soil contamination includes carcinogenic PAHs and dieldrin present at concentrations exceeding FDEP Residential SCTLs. Groundwater sampling has been limited, with collection of one sample from one microwell. There were no detections in the sample exceeding respective GCTLs; however, detection limits for benzo(a)pyrene and dieldrin were above the GCTLs.

Remedial activities have been on-going at OU 4 and SA 39 for several years. Contaminant concentrations at OU4 have been reduced significantly, and contaminants are below regulatory criteria (risk levels) at SA 39. Building 148/SA 56 is in the remedial investigation phase and soil sampling is being conducted to determine the extent of the soil contamination at the site. Current contaminant levels at OU 4 and Building 148/SA 56 are listed in Table 2-1:

Table 2-1 Previous Investigation Data			
Site	Contaminants	Soil (mg/kg)	Groundwater (ug/l)
OU 4	tetrachloroethene	490	26,600
OU 4	trichlorethene	--	697
OU 4	cis-1,2-dichloroethene	--	23,600
OU 4	vinyl chloride	--	1,070
OU 4	antimony	--	18.3
OU 4	benzo(a)pyrene	0.203	--
OU 4	arsenic	0.74	--
Building 148/SA 56 at Area C SW	dieldrin	0.5	0.05 U
Building 148/SA 56 at Area C SW	benzo(a)pyrene	199.6	10 U

U = Analyte included in the analysis, but not detected above reporting limit indicated.

2.2 Scope of Work

Resolution Consultants will be completing recovery well replacement along with trenching and piping the new recovery well to the treatment system at OU 4. Well abandonment will be completed at OU 4 and SA 39.

The warehouse at OU 4 will be abandoned. This task includes coordinating the removal of previous Navy contractors' supplies and equipment and the removal of the former OU 4 injection system.

Resolution Consultants will be conducting soil and groundwater sampling and well installation at Building 148/SA 56 at Area C Southwest.

2.2.1 Mobilization/Demobilization

Mobilization and demobilization represent limited pre and post-task activities. These activities include driving to and from the site; initial site preparations, and post-work activities, such as staging drums and general housekeeping. This activity does not represent any intrusive activities.

2.2.2 Site Preparation

Site preparation activities at OU 4 include decontamination area setup, removal of the chain-link fence surrounding the work area, and coring through the existing concrete. Utility clearance will not be required because OU 4 is a remote, undeveloped area where extensive intrusive activities including soil borings and trenching have occurred in the recent past. All existing structures have been or will be abandoned and replaced. Well abandonment activities at SA 39 do not require utility location services. Site preparation at Building 148/SA 56 at Area C Southwest may require clearing and grubbing in the areas to be sampled.

2.2.3 Well Abandonment Oversight

Resolution Consultants personnel will be performing the oversight for well abandonment of one recovery well (10-inch PVC with 6-inch insert) at OU 4 to be performed by the drilling subcontractor [Groundwater Protection]. Additionally, 26 monitoring wells (2-inch PVC) will be abandoned at SA 39.

Well abandonment will also occur for monitoring wells at OU 3 and SA 2. Additional wells at OU 4 to be abandoned consist of monitoring wells, injection and extraction wells, piezometers, and temporary wells. The numbers and locations of the additional wells to be abandoned are included in the Well Abandonment Work Plan.

The major activities involved with abandoning a well are:

- Set up for well abandonment
- Remove stick-up or flushmount casing, including concrete pad
- Pull well casing from ground with drill rig or over-drill
- Fill well with grout

Additional information on boring and well abandonment operations can be found in *SH&E 716, Drilling & Boring*.

2.2.4 Well Installation Oversight

Resolution Consultants personnel will be performing oversight for the replacement installation of one new groundwater recovery well at OU 4 using hollow-stem auger (HSA) or sonic drilling methods. A drilling subcontractor (Groundwater Protection) will be utilized for the installation of the recovery well (4-inch PVC) to a depth of 46 feet utilizing a HSA drill and/or sonic drill rig. The major activities involved with installation of a recovery well are as follows:

- Set-up for boring/well installation
- Monitor air quality in the workers breathing zone
- Log soils and screen with a PID
- Sample collection using encore or bulk sampling
- Administrative activities

2.2.5 Repair of GW Treatment System

Resolution Consultants personnel will conduct maintenance activities at the OU 4 groundwater recovery/air stripping treatment system. Activities include submersible pump replacement and influent piping to the existing treatment system. The submersible pump will be wired to the existing disconnect panel. The existing influent piping will be jetted clear of sand and reused if possible. Alternately, new 2-inch PVC piping will be installed at a depth of approximately 6 inches below grade. A minimum of two technicians will be on-site during maintenance activities.

2.2.6 Warehouse Abandonment

The warehouse previously used by the Navy and its contractors for storage and field offices will be abandoned. Resolution Consultants will coordinate with the Navy and contractors to remove equipment and supplies. The abandoned injection system on the north side of the OU 4 property will be dismantled and disposed offsite.

2.2.7 Investigative-Derived Waste (IDW) Management

COCs in the project work area are below hazardous levels, and Investigative-Derived Waste (IDW) is expected to be non-hazardous. All IDW [soil cuttings and development water] will be collected and containerized for disposal. Waste characterization samples will be collected from the drummed soil cuttings for waste profiling. IDW waste will be staged onsite, and then delivered to an IDW storage facility for processing within 90 calendar days of completing the field activities. Development water and decontamination fluids will be transferred to the on-site tray stripper treatment system for processing and disposal. Non-hazardous IDW (normal trash) will be disposed of in a timely fashion during fieldwork.

2.2.8 Equipment Decontamination

Resolution Consultants and subcontractor personnel will perform decontamination of equipment used to perform work within controlled work areas.

Before any drilling begins, and at the completion of drilling, the drilling subcontractor shall decontaminate the drill rig, casing, samplers, and all other drilling equipment that will be used

onsite. The drilling subcontractor shall provide a high-pressure steam cleaner for decontamination of all downhole drilling equipment. Soil sampling equipment shall be decontaminated between each use, using a phosphate free detergent and potable water in accordance with ASTM D 5088. The drilling subcontractor shall construct a temporary decontamination pad to contain all decontamination water generated during decontamination of drill rigs and tools.

2.2.9 Site Restoration

Site restoration will involve the removal of IDW staging areas, final grading of the site, replacement of fencing, and the disposal of construction debris.

2.2.10 Soil Sampling

Soil samples will be collected from hand-augered points. The major activities involved with collecting samples from the site and surrounding properties include the following:

- Pre-sampling event notifications and approval
- Set-up for sampling activities
- Samples to be collected from hand augered points up to 7 feet below grade.
- Sample prep and sample shipping
- Administrative activities

2.2.11 Groundwater Sampling

Groundwater samples will be collected from monitor wells. When groundwater sampling the following should be observed:

- Groundwater sampling should be performed such that exposure to vapors is avoided by standing upwind from the well head and allowing sufficient time for the formation to equilibrate before purging
- Air monitoring should be performed as necessary, including during sampling, if determined to be necessary
- In addition to the default PPE, chemical resistant gloves should be worn during all sampling operations
- Use "closed" pumping systems for purging and sample collection whenever possible; use of bailers should be the last resort when no other means of sample collection is possible
- Use caution when acid preservatives are added to sample containers
- For water levels or sampling in high traffic areas where there is no solid barrier between traffic, one person should function as a lookout for oncoming traffic.

2.2.12 Additional Work Operations

Operations at the site may require additional tasks not identified in this section or addressed in Attachment 3, THAs. A THA must be prepared, and approved by the Safety Professional before performing any task not covered in this HASP.

3.0 HAZARD ASSESSMENT (SAFETY)

3.1 Physical Hazards

The following physical hazards are anticipated to be present on the site. Additional hazards may be noted on the THAs developed for the individual tasks.

3.1.1 Slips, Trips, Falls, and Protruding Objects

A variety of conditions may exist that may result in injury from slips, trips, falls, and protruding objects. Slips and trips may occur as a result of wet, slippery, or uneven walking surfaces. To prevent injuries from slips and trips, always keep work areas clean; keep walkways free of objects and debris; and report/clean up liquid spills. Serious injuries may occur as a result of falls from elevated heights. Always wear fall protection while working at heights of 6 feet or greater above the next lower level. Protruding objects are any object that extends into the path of travel or working area that may cause injury when contacted by personnel. Always be aware of protruding objects and when feasible remove or label the protruding object with an appropriate warning.

Slippery, uneven footing and tripping hazards will likely be present at the site. Be vigilant, avoid puddles, and wear footwear with slip resistant soles. In addition, tall ground cover (high grass) can make it difficult to detect holes and depressions in the ground. Remain vigilant and travel slowly through areas with tall ground cover.

Walk around, not over or on top of debris or trash piles. When carrying equipment, identify a path that is clear of any obstructions. It might be necessary to remove obstacles to create a smooth, unobstructed access point to the work areas on site.

Maintaining a work environment that is free from accumulated debris is the key to preventing slip, trip, and fall hazards at construction sites. Essential elements of good housekeeping include:

- Orderly placement of materials, tools and equipment out of walkways
- Placing trash receptacles at appropriate locations for the disposal of miscellaneous rubbish
- Prompt removal and secure storage of items that are not needed to perform the immediate task at hand

3.1.2 Housekeeping

During site activities, work areas will be continuously policed for identification of excess trash and unnecessary debris. Excess debris and trash will be collected and stored in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) prior to disposal. At no time will debris

or trash be intermingled with waste PPE or contaminated materials. Additional information on the requirements of housekeeping can be found in *5-307-Housekeeping, Worksite*.

3.1.3 Manual Lifting

Most materials associated with investigation and remedial activities are moved by hand. The human body is subject to severe damage in the forms of back injury, muscle strains, and hernia if caution is not observed in the handling process. Whenever possible, use mechanical assistance to lift or move materials and at a minimum, use at least two people to lift, or roll/lift with your arms as close to the body as possible. For additional requirements and guidance, refer to *5-308-Manual Lifting*.

3.1.4 Utilities

A utility clearance is not required for this project, because there are no active underground utilities in the work area of OU 4, and the scope of work (well abandonment) for SA 39 does not require utility clearances.

Ensure backhoe operator, truck drivers, etc. and signal person are aware of overhead power lines when working around overhead power lines. Overhead power and utility lines may be present on, or adjacent to, the site and represent a potential hazard during the mobilization/demobilization of equipment and supplies. Maintain a minimum of 15 feet between overhead power lines and the bucket and/or arm of the backhoe bed/cab of trucks, etc. Any deviation must be approved by the Resolution Consultants Health and Safety Manager or designee. Additional information on working adjacent to overhead power and utility lines can be found in *5-406-Electrical Lines, Overhead*.

3.1.5 Electrical hazards

Electrical and powered equipment may be used during a variety of site activities. Injuries associated with electrical and powered equipment include electric shock, cuts/lacerations, eye damage (from flying debris), and burns. To reduce the potential of injury from the hazards associated with electrical and powered equipment, always comply with the following:

- Use ground fault circuit interrupters (GFCIs) when using electrical powered tools/equipment. GFCIs prevent electrical shock by detecting the loss of electricity from a power cord and/or electrical device.
- Ensure generators are properly grounded, including the use of a grounding rod, driven to a depth of 3-feet.
- Wear ANSI-approved (Z87.1) safety glasses. Face shields may be required to provide additional face protection from flying debris.

- Wear appropriate work gloves. Work gloves may reduce the severity of burns and cuts/lacerations.

All temporary electric installations (site trailer, subpanels) will comply with OSHA (29 CFR 1926, Subpart K, and 29 CFR 1910, Subpart S) guidelines. Only qualified and competent individuals (licensed electrician) will provide electrical service/servicing. Refer to *5-410-Hazardous Energy Control*, for additional requirements and information.

3.1.6 Lock-Out/Tag-Out Procedures

Use lockout/tagout procedures when performing maintenance or repairs on equipment. It is the responsibility of Resolution Consultants employees to verify that all remediation equipment is locked out before Resolution Consultants employees perform any maintenance or repair work on the system. The source must be **locked out**; it is not enough to push the power switch to off and disconnect the breaker. Anyone can re-engage power under these circumstances. Locking out the power source is the only way to guarantee that the power will not be inadvertently reactivated.

A lock-out/tag-out kit will be carried with the technicians involved in project work. The kit includes standard locks, keys and lock-out notices. The site specific lock-out/tag-out information must be completed for the groundwater treatment system. These forms will then be placed on the entrance gate to the treatment system compound so all field technicians performing operations and maintenance work on the system are familiar with how to lock-out the system when necessary. Refer to *5-410-Hazardous Energy Control*, for additional information and requirements.

3.1.7 Heavy Equipment and Vehicle Operations

Heavy equipment and site vehicles present serious hazards for site personnel. Blind spots, failure to yield, and other situations may cause heavy equipment/vehicles to come into contact with personnel. To reduce the possibility of contact between equipment/traffic and personnel, always adhere to the following:

- Personnel must wear a high visibility, reflective safety vest or clothing at all times when working near heavy equipment and/or other vehicle traffic.
- Personnel must always yield to equipment/vehicle traffic and stay as far as possible from all equipment/vehicle traffic. Always maintain eye contact with operators.
- Never enter the travel path or swing radius of heavy equipment unless positive contact and clearance has been given with the equipment operator. Tracked or wheeled equipment must come to a complete stop and excavation buckets must be placed on the ground before any employee enters the hazard zone.

- When feasible, place barriers between work areas and equipment/vehicle traffic.
- Always ensure reverse warning alarms are working and louder than surrounding noise. Personnel must report inoperative reverse warning alarms.
- Ensure Daily Equipment Safety Inspections are being performed and documentation filed at the site.

The use of forklifts presents a unique set of hazards to employees using, and working around the equipment. Proper training on the safe usage of the specific type of forklift being utilized is essential to the safe execution of work tasks with the equipment. Besides the daily inspections and safe usage of the equipment, there are numerous other safety related issues that need to be assessed during their use, to include safe working surfaces, and overhead power lines. Refer to *5-409-Forklifts*, for additional requirements regarding forklifts.

The loading and unloading of equipment will utilize cranes and forklifts. All cranes will have documentation of a current annual inspection and be operated by a licensed crane operator. Certification will be verified ahead of time, and prior to beginning operations on the site. Swing radius barricades will be assembled and outriggers positioned in their full out positions prior to initiating lifts. At no time will personnel stand under suspended loads.

For additional requirements, refer to *5-309-Mobile or Heavy Equipment*, and *5-310-Cranes, Hoists, and mobile Lifting Devices*.

3.1.8 Drilling Operations

Drilling operations, including hollow-stem, rotary, sonic and/or direct push drilling, present their own set of hazards. Several basic precautions that should be taken include, but are not limited to, confirming locations of underground and overhead utilities, wearing of appropriate PPE and the avoidance of loose clothing or jewelry, staying clear of moving parts, knowing the locations of emergency shut-off switches. Other operational safety precautions regarding moving the drilling equipment, raising and lowering the derrick (mast), and drilling can be found in *5-405-Drilling and Boring*.

3.1.9 Excavations and Trenches

Excavations and trenches present workers with a variety of hazards. If the piping is replaced, it will be buried at a depth of approximately 6 inches below grade. This piping will be in an area where there are no active utilities, and significant intrusive activities have already been performed. Refer to *5-303-Excavation & Trenching* for additional requirements.

3.1.10 Spill Prevention

Work activities may involve the use of hazardous materials (e.g., fuels, solvents) or work involving drums or other containers. The following procedures will be used to prevent or contain spills:

- All hazardous material will be stored in appropriate containers
- Tops/lids will be placed back on containers after use
- Containers of hazardous materials will be stored appropriately away from moving equipment

At least one spill response kit, to include an appropriate empty container, materials to allow for booming or diking the area to minimize the size of the spill, and appropriate clean-up material (e.g., speedy dri) shall be available at each work site with the potential for a chemical spill (more as needed).

- All hazardous commodities in use (e.g., fuels) shall be properly labeled
- Containers shall only be lifted using equipment specifically manufactured for that purpose
- For drums/containers, follow the procedures in *5-308-Manual Lifting Safe Work Practices*, to minimize spillage

3.1.11 Noise Exposure Monitoring

When heavy equipment is in operation or high noise producing equipment is in use, it will be necessary to ensure that each exclusion zone fully encompasses all areas where hazardous noise levels are present (85decibels on the A-weighted scale [dBA] or greater). If the sound pressure level exceeds 85 dBA at any location along the site perimeter, the exclusion zone boundary will then be adjusted to fully encompass this region. During this project, all personnel working inside the exclusion zone will be required to use hearing protection. Refer to *5-510-Hearing Conservation Program*, for additional information and requirements.

3.1.12 Traffic Control

General traffic control precautions include placing a work vehicle between your worksite and oncoming traffic whenever possible. Not only is it a large, visible warning sign, but also if an oncoming car should fail to yield or deviate, the parked vehicle rather than your body would absorb the first impact of a crash. Turn the vehicle wheels so that if it was struck, it would swing away from the worksite. When using cones or other devices to modify traffic flow, ensure use of the proper taper length and device spacing to provide adequate warning distance to on-coming motor vehicles. In addition, proper PPE is to be worn during traffic operations, to include hardhat and high-visibility vests. Refer to *5-306-Highway and Road Work*, for additional requirements.

3.1.13 Hand Augering

Care should be taken to prevent injuries when using hand augers.

- When practical, work as a team of two to advance borings with a hand auger.
- Do not apply excessive force to turn the auger or twist & turn your back in an effort to advance the auger.
- Wear cotton or leather gloves when rotating the auger.
- Avoid putting pressure on the palms of your hands; use a good grip to spread the pressure over the entire hand.
- Take frequent stretch breaks to stretch and relax your back, arms and hands.
- Use caution when transporting or decontaminating auger, as they can be bulky and have an irregular length and shape.

3.1.14 Hand Safety

Glove Selection

Gloves should be selected to afford protection from a variety of hazards to protect onsite workers from hand injuries, the following gloves will be used for when performing a specific duty:

- Leather gloves for general protection, cushioning, or abrasion/laceration protection
- Nitril gloves for dermal protection from general chemical hazards
- Insulated gloves or Thermax glove liners as appropriate in cold weather
- Insulated gloves when working w/ electrical hazards
- Vibration dampening gloves when utilizing vibrating/gyrating saws, hammers, or other equipment
- Specialty gloves as appropriate: Rubber/Chemical Specific, Waterproof, added grip, filet gloves, etc.

Wear the right gloves or combination of gloves for the hazard and be sure to get the proper size gloves for all employees. Be sure to remove jewelry prior to work to avoid catching on equipment or creating pinch points. Pinch points are found between a moving object and a stationary object, or between two continuously moving objects. Yellow hand stickers will be placed on equipment to remind workers of pinch points.

Hand Tools

Rules for the safe use of hand tools:

- Select the right size tool for the job. Don't use "cheaters" and avoid pulling old tools from the waste stream. There's a reason why they were thrown away!

- All hand tools must be in safe condition.
- Handles must be sound, straight and tight-fitting.
- Always inspect tools before use and replace or repair worn or damaged tools.
- Always keep the cutting edges sharp and never test a cutting edge with your finger.
- When working on an elevated surface (ladder, truck, scaffold), ensure your tools are secure. Falling tools can cause serious injury.
- Always carry your tools correctly and never put sharp or pointed tools in your pocket.
- When carrying hand tools, always point the cutting edge to the ground.
- Always keep your tools in a dry place to prevent rust.
- Cutting tools must be kept sharp and properly shaped.
- Secure work pieces prior to cutting or drilling.
- Keep the unused hand and other people away from the tool.

3.2 Biological Hazards

It is anticipated that numerous biological hazards will be present on the project site. Poisonous plants may be found along the tree lines and adjacent to monitoring wells, along with ticks and other biting insects. Stinging insects, such as bees and wasps, may build nests inside of monitoring wells or be within proximity of the work zone. Below is a discussion of the most common biological hazards found on project sites, and those anticipated to be of concern here.

3.2.1 Small Mammals

Working in the field either directly or indirectly with small mammals has inherent risks of injury or exposure to zoonotic diseases (infectious diseases that can be transmitted from animals to humans) that all field staff need to protect themselves against. The risks are usually higher when there is direct contact with a wild animal, either through a break in the skin (blood), saliva, or excrement; however, there are also risks through air-borne diseases (e.g., Hantavirus). Should you encounter any small mammals please avoid contact with them.

3.2.2 Venomous Animals

Some animals have the ability to inject venom. These include: rattlesnakes, black widow spiders, and scorpions. These all have limited distributions, so in most areas you are unlikely to encounter them. Other spiders possess venom but they are not harmful to humans. Shrews have poisonous saliva but the chance of being envenomed by them is extremely unlikely unless they are handled. Should you encounter any potentially venomous animals please avoid contact with them.

If bitten by any of these animals special care should be taken to treat the wound as it may lead to complications due to the toxin. A bite from a venomous snakes or animals, which may expose varying degrees of toxic venom, is rarely fatal but should always be considered a medical emergency.

3.2.3 Poisonous Plants

Sensitivity to toxins generated by plants, insects, and animals varies according to dosage and the ability of the victim to process the toxin; therefore, it is difficult to predict whether a reaction will occur, or how severe the reaction will be. Staff should be aware that there are a large number of organisms capable of causing serious irritations and allergic reactions. Some reactions will only erupt if a secondary exposure to sunlight occurs. Depending on the severity of the reaction, the result can result in severe scarring, blindness or even death.

Plants that field staff should recognize and take precautions to avoid include: Poison Sumac, Poison Ivy (terrestrial and climbing), Poison Oak, Giant Hogweed (or Giant Cow Parsnip), Wild Parsnip, Devil's Club and Stinging Nettle. Many others are extremely poisonous to eat (e.g., Poison Hemlock, Water Parsnip) — do not eat anything that has not been identified.

A large number of plants are not harmful to touch but may contain poisonous berries or foliage that could cause serious complications or death if they are ingested. It goes without saying not to eat any berries or plants that you are not absolutely sure of their identity. Examples of common poisonous or irritating plant species, common to the United States, are shown in Table 3-1.

Care should be taken to avoid contact with poisonous vegetation by personnel who are allergic to the affects and those that are not. However, if you come into contact with poisonous plants accidentally, you can use cleansing agents such as 'Ivy-X wipes' or 'Technu' cream to lift the poisonous oils from the skin. It is recommended that you have cleansing agents available in the field for post exposure hygienic activities.

**Table 3-1
Hazardous Plant Identification Guide**

<p>Poison Ivy</p> <ul style="list-style-type: none"> • Grows in West, Midwest, Texas, East • Several forms — vine, trailing shrub, or shrub • Three leaflets (can vary 3-9) • Leaves green in summer, red in fall • Yellow or green flowers • White berries 	
<p>Poison Oak</p> <ul style="list-style-type: none"> • Grows in the East (NJ to Texas), Pacific Coast • 6-foot tall shrubs or long vines • Oak-like leaves, clusters of three • Yellow berries 	

3.2.4 Insects

Insects for which precautionary measures should be taken include: mosquitoes (potential carriers of disease aside from dermatitis), black flies, wasps, bees, ticks, and Fire Ant.

Wasps and bees will cause a painful sting to anyone if they are harassed. They are of most concern for individuals with allergic reactions who can go into anaphylactic shock. Also instances where an individual is exposed to multiple stings can cause a serious health concern for anyone. These insects are most likely to sting when their hive or nest is threatened.

Ticks can be encountered when walking in tall grass or shrubs. They crawl up clothing searching for exposed skin where they will insert mouthparts to drink blood. Most serious concern is possibility of contracting Lyme disease which is spread by the Black-legged or Deer Tick. Occasionally a tick can cause Tick Paralysis if it is able to remain feeding for several days. Full recovery usually occurs shortly after the tick is removed.

The Fire Ant is spreading and often very abundant where it is established. It is very aggressive and commonly climbs up clothing and stings unprovoked when it comes into contact with skin. Painful irritations will persist for an hour or more.

Precautionary measures such as the use of insect repellent containing DEET should be utilized to help minimize the likelihood of bites from insects.

3.3 Ultraviolet Hazards

Workers performing field work outdoors may be susceptible to sunburn if not properly protected with sunscreen or protective clothing and hats. Skin can burn in minutes when the UV Index is VERY HIGH. Protective measures, to include ≥ 30 SPF sunscreen and UVA/UVB protective clothing/safety glasses, are advisable year round.

3.4 Weather Hazards

The Site Safety Health Officer (SSHO) will be attentive to daily weather forecasts for the project area each morning. Predicted weather conditions of potential field impact are to be included in safety briefings and the SWAP for that day. Weather changes should initiate a review and updates SWAP as necessary. Weather-related hazards will directly correlate to the type of weather involved. Hot, dry weather may cause greater dust emissions, particularly during intrusive activities. Rain may increase slip/trip hazards, particularly for ground workers.

Severe weather can occur with little warning. Employees will be vigilant for the potentials for storms, lightning, high winds, and flash flood events. Additionally, lightning strikes during electrical storms could also be a potential hazard. The following procedures will be implemented once thunder is heard or lightning spotted:

- 1) If thunder is heard, all site personnel are to be alert of any visible lightning flashes. The SSHO will observe the storm front and track the direction it is moving. The SSHO will continue to observe the storm front until it passes or until the prevailing direction is determined to be away from the site.
- 2) If lightning is observed, the SS or SSHO are to be notified. When the next lightning flash is observed, a "second" count shall be initiated from the time the lightning is observed until the thunder from the strike is heard.
- 3) The following action guidelines shall be implemented once the "second" count is ≤ 30 seconds:
 - a) "second" count > 30 , the SS or SSHO will continually observe the storm front. If the front is moving away, work will continue. If the front is moving towards the site, the SS will initially place workers on alert for potential evacuation.

- b) "second" count ≤ 30 , the SS will issue the evacuation command and all workers are to report to the break/lunch trailer. Work can be re-initiated once the front has passed by and thunder has not been heard for 30 minutes.
- 4) If lightning is observed and the storm front is moving away from or around the site and is > 20 miles away, work will be permitted to continue. The location of the storm can be confirmed via internet access to a local weather website that has a Doppler radar tracking system.

3.5 Hazard Analysis

Task Hazard Analyses (THAs) have been completed for all tasks identified in the Scope of Work (Attachment 3):

- Mobilization/Demobilization
- Well Abandonment
- Groundwater Well Installation
- Soil Sampling
- Groundwater Sampling

As a result of unanticipated work activities or changing conditions, additional THAs may be required. All additional THAs will be reviewed and approved by the Resolution Consultants Health and Safety Manager or designee.

3.6 Task Specific SH&E Procedures

Personnel may be exposed to a variety of chemical, physical, and radiological hazards resulting from task or equipment-specific activities. The controls for many of these hazards are discussed in the Resolution Consultants SH&E SOPs. Copies of applicable SOPs are located in Attachment 4.

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4.0 SH&E REQUIREMENTS (SAFETY)

4.1 HAZWOPER Qualifications

Personnel performing work at the job site must be qualified as HAZWOPER workers (unless otherwise noted in specific THAs or by the SSHO), and must meet the medical monitoring and training requirements specified in the Resolution Consultants' SH&E Standard Operating Procedures.

If site monitoring procedures indicate that a possible exposure has occurred above the OSHA permissible exposure limit (PEL), employees may be required to receive supplemental medical testing to document any symptoms that may be specific to the particular materials present.

4.2 Site-Specific Safety Training

All Resolution Consultants personnel performing activities at the site will be trained in accordance with *5-003-SH&E Training*. All personnel are required to remain current in all of their required training and evaluate their need for additional training when there is a change in work. In addition to the general health and safety training programs, personnel will be required to complete any supplemental task specific training developed for the tasks to be performed. Administration and compliance with the requirements for additional task-specific training will be the responsibility of the project or lead manager. Any additional required training that is completed will be documented and tracked in the project files.

4.2.1 Competent Person Training Requirements

To complete the planned scope of work, a competent person (per OSHA definition) must be designated to perform the required daily on-site inspections of operations and/or equipment. The competent person may be a Resolution Consultants (if responsible for supervising that activity) or the subcontractor's employee. Designated competent person(s) for this project are shown in Table 4-1.

Table 4-1 Task-Specific Competent Persons		
Employee Name	Organization	Area of Competency
Chris Evans	Resolution Consultants	Excavation & Trenching
Chris Evans	Resolution Consultants	Heavy Equipment

Note:

The training requirements for competent persons are specified in the indicated SOPs and/or *RC-202, Competent Person Designation*. By identifying an employee as a "competent person", that person has now been authorized to take prompt corrective measures to eliminate hazards.

4.3 Tailgate Meetings (SWAP)

Prior to the start of daily project activities, a tailgate meeting will be conducted by the SSHO. The meeting is to review the specific requirements of this HASP, applicable THA, and relevant risks and mitigative strategies for the planned scope of services. Attendance at the daily tailgate meeting is mandatory for all employees at the site covered by this HASP and must be documented on the SWAP form (Attachment 5). All safety training documentation is to be maintained in the project file by the SSHO.

4.4 Hazard Communication

Hazardous materials that may be encountered as existing on-site environmental or physical/health contaminants during the work activities are addressed in this HASP and their properties, hazards and associated required controls will be communicated to all affected staff and subcontractors.

Any employee or organization (contractor or subcontractor) intending to bring any hazardous material onto this Resolution Consultants-controlled work site must first provide a copy of the item's Material Safety Data Sheet (MSDS) to the SSHO for review and filing (the SSHO will maintain copies of all MSDS on site). MSDS may not be available for locally-obtained products, in which case some alternate form of product hazard documentation will be acceptable in accordance with the requirements of *5-507-Hazardous Materials Communication/WHMIS*.

All personnel shall be briefed on the hazards of any chemical product they use, and shall be aware of and have access to all MSDS. All containers on site shall be properly labeled to indicate their contents. Labeling on any containers not intended for single-day, individual use shall contain additional information indicating potential health and safety hazards (flammability, reactivity, etc.) In addition, any specific spill response planning or notification requirements are the responsibility of the contractor controlling and managing the materials at the site.

Attachment 7 contains copies of MSDS for hazardous contaminants of concern and hazardous chemicals planned to be brought onsite at the time this HASP is prepared. This information will be updated as required during site operations.

4.5 Confined Space Entry

Confined space entry is not anticipated for this site. If confined spaces are identified, the SSHO/site supervisor will inform all employees of the location of confined spaces and prevent

unauthorized entry. Confined space entry procedures and training requirements are listed in 5-301-*Confined Spaces*.

4.7 General Safety Rules

All site personnel shall conduct themselves in a safe manner and maintain a working environment that is free of additional hazards, in adherence to 5-001-*Safe Work Standards and Rules* and 5-307-*Housekeeping, Worksite*.

4.7.1 Housekeeping

During site activities, work areas will be continuously policed for identification of excess trash and unnecessary debris. Excess debris and trash will be collected and stored in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) prior to disposal. At no time will debris or trash be intermingled with waste PPE or contaminated materials.

4.7.2 Smoking, Eating, or Drinking

Smoking, eating and drinking will not be permitted inside any controlled work area at any time. Field workers will first wash hands and face immediately after leaving controlled work areas (and always prior to eating or drinking). Consumption of alcoholic beverages is prohibited at any Resolution Consultants site. Smoking, eating, or drinking must be in an approved area.

4.7.3 Personal Hygiene

The following personal hygiene requirements will be observed:

Water Supply: A water supply meeting the following requirements will be utilized:

Potable Water — An adequate supply of potable water will be available for field personnel consumption. Potable water can be provided in the form of water bottles, canteens, water coolers, or drinking fountains. Where drinking fountains are not available, individual-use cups will be provided as well as adequate disposal containers. Staff sharing a potables cooler shall not introduce individually opened containers into the team cooler in an effort to minimize concerns for indirect contamination. Additionally, each potable cooler will be sealed to protect the water quality.

Potable water containers will be properly identified in order to distinguish them from non-potable water sources. All containers of potable water will be marked with a label stating:

***Potable Water ONLY
Not Intended for Sample Storage***

Non-Potable Water — Non-potable water may be used for hand washing and cleaning activities. Non-potable water will not be used for drinking purposes. All containers of non-potable water will be marked with a label stating:

***Non-Potable Water
Not Intended for Drinking Water Consumption***

Toilet Facilities: A minimum of one toilet will be provided for every 20 personnel on site, with separate toilets maintained for each sex except where there are less than 5 total personnel on site. For mobile crews where work activities and locations permit transportation to nearby toilet facilities on-site facilities are not required.

Washing Facilities: Employees will be provided washing facilities (e.g., buckets with water and Alconox) at each work location. The use of water and hand soap (or similar substance) will be required by all employees following exit from the Exclusion Zone, prior to breaks, and at the end of daily work activities.

4.7.4 Buddy System

All field personnel will use the buddy system when working within any controlled work area. Personnel belonging to another organization on site can serve as "buddies" for Resolution Consultants personnel. Under no circumstances will any employee be present alone in a controlled work area.

4.8 Stop Work Authority

All employees have the right and duty to stop work when conditions are unsafe, and to assist in correcting these conditions as outlined in 5-002- *Stop Work Authority*. Whenever the SSHO determines that workplace conditions present an uncontrolled risk of injury or illness to employees, immediate resolution with the appropriate supervisor shall be sought. Should the supervisor be unable or unwilling to correct the unsafe conditions, the SSHO is authorized and required to stop work, which shall be immediately binding on all affected Resolution Consultants employees and subcontractors.

Upon issuing the stop work order, the SHSO shall implement corrective actions so that operations may be safely resumed. Resumption of safe operations is the primary objective; however, operations shall not resume until the Resolution Consultants Health and Safety Manager or designee has concurred that workplace conditions meet acceptable safety standards.

4.9 Client Specific Safety Requirements

The client has specified no additional health and safety requirements at this time.

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5.0 EXPOSURE MONITORING PROCEDURES (HEALTH)

5.1 Contaminant Exposure Hazards

The following is a discussion of the potential hazards presented to worker personnel during this project from on-site chemical hazards known, suspected, or anticipated to be present on site.

Exposure symptoms and applicable first aid information for each suspected site contaminant identified in the Scope of Work are located in the following subsections.

5.1.1 Tetrachloroethene

The largest use for tetrachloroethene is in dry cleaning and textile operations, accounting for an estimated 60 percent of all tetrachloroethene use in the US in 1991. It is also used in the production of chlorofluorocarbons; in vapor degreasing and metal cleaning operations; in aerosol formulations; as a carrier for rubber coatings, solvent soaps, printing inks, adhesives, sealants, polishes, lubricants, and silicones; and as a solvent in various consumer products, such as typewriter correction fluid and shoe polishes.

PCE is a noncombustible liquid, but decomposes in a fire to hydrogen chloride and phosgene. It has a mild, sweet odor resembling that of chloroform. The odor threshold in air is 1 ppm. The boiling point is 250°C. Synonyms are Perchlorethylene, Perchloroethylene, Perchloroethene and Perk.

PCE is a potential human carcinogen. Prolonged skin contact with PCE and/or excessive inhalation of its vapor may cause Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage. Target organs of the body are the eyes, skin, respiratory system, liver, kidneys, central nervous system.

The CAL OSHA PEL is 25 ppm, with an action level of 12 ppm and a short-term exposure limit of 100 ppm. The CAL OSHA IDLH is 150 ppm.

5.1.2 Trichloroethene

Trichloroethene is a colorless, nonflammable, noncorrosive liquid with a "sweet" odor characteristic of some chlorinated hydrocarbons. Its boiling point is 86° to 87°C. The LEL is 8.0%, and the UEL is 10.5% at 25°C. At 100°C the LEL is 7.8% and UEL is 52%. The odor threshold is 25 to 50 ppm. Synonyms are ethylene trichloride, ethinyl trichloride, trichloroethylene, tri and TCE.

Trichloroethene is primarily used as a solvent in vapor degreasing. It is also used for extracting caffeine from coffee, as a dry-cleaning agent, and as a chemical intermediate in the production of pesticides, waxes, gums, resins, tars, paints, varnishes, and specific chemicals such as chloroacetic acid.

The transitional limit PEL is 100 ppm. The final rule limit PEL and 1998 ACGIH TLV are 50 ppm (270 mg/m³) with a STEL of 100 ppm. The IDLH level is 1,000 ppm.

Routes of entry are through inhalation, percutaneous absorption, ingestion, skin and eye contact. Harmful effects and symptoms of short-term exposure are as follows:

Inhalation - Headache, sleepiness, nausea, vomiting, dizziness and coughing have been felt around 100 ppm. Unconsciousness can result at 3,000 ppm. Exposure to 8,000 ppm can cause death.

Skin – Can be absorbed through skin. May cause irritation, burning or redness.

Eyes – May cause irritation, burning or watering.

Ingestion - Can cause drunkenness, vomiting, diarrhea or abdominal pain. Unconsciousness, liver or kidney damage, vision distortion and death have been reported at large doses.

Long term exposure with vapor levels near 100 ppm can cause giddiness, nervous exhaustion, increased sensitivity to alcohol including redness in the face (trichloroethene blush), the ability to become addicted to the vapor, as well as effects of acute exposure listed above. Higher levels can alter one's heart rate. Repeated contact with hands can cause excessive dryness, cracking, burning, loss of sense of touch or temporary paralysis of fingers. Most of these effects seem to go away after exposure has stopped. Trichloroethene is considered a suspect cancer agent, because high levels cause liver cancer in mice. Whether it causes cancer in humans is unknown.

Level B is required above the PEL. Determination in air is via adsorption on charcoal adhering to NIOSH Method 1022.

5.1.3 Cis-1,2 Dichloroethene and trans-1,2 Dichloroethene

1,2-Dichloroethene (1,2-DCE) is a synthetic chemical with no known natural sources. It occurs in two forms known as cis- and trans- isomers that have similar properties. 1,2-DCE is a colorless, flammable liquid with a harsh odor. It is used as a chemical intermediate in the production of other chlorinated solvents. 1,2-DCE has also been used as a solvent in the extraction of rubber, to remove fats from meat and fish, and to decaffeinate coffee. 1,2-DCE may be released to the environment from manufacturing plants or from landfills where it had been disposed. It can be

released to the air from the burning of vinyl. Because the 1,2-DCE isomers are environmental breakdown products of the widely used chlorinated solvents trichloroethene (TCE) and tetrachloroethene (PCE), 1,2-DCE's detection in groundwater may often be due to the release of the parent compounds into the environment

The odor threshold for 1,2-DCE (trans-) in water is reported to be 0.26 parts per million (ppm); the reported odor threshold in air is 0.08 ppm. Evidence indicates that 1,2-DCE is eliminated by the body fairly rapidly so that it does not accumulate in tissues.

Routes of entry are through inhalation of vapor. 1,2-Dichloroethene can affect personnel when breathed in and by passing through skin. 1,1-Dichloroethene is not a listed carcinogen. Exposure can irritate the eyes, nose and throat. Contact can irritate and burn the eyes and skin. High levels cause a drunken feeling that can go on to unconsciousness. Repeated exposures may damage the liver and blood. It is a highly flammable and reactive chemical, and a dangerous fire and explosion hazard.

The OSHA PEL is 200 ppm, with an action level of 100 ppm and an IDLH of 1000 ppm.

5.1.4 Vinyl chloride

Vinyl chloride is a flammable gas at room temperature (boils at -14°C), and is usually encountered as a cooled liquid. The colorless liquid forms a vapor which has a pleasant, ethereal odor. The LEL is 3.6%, and the UEL is 33.0%. The odor threshold is variously given as 260 ppm, 3000 ppm, and 4000 ppm in air and 3.4 ppm in water. Synonyms are chloroethylene, chloroethene, monochloroethylene.

Vinyl chloride is used as a vinyl monomer in the manufacture of polyvinyl chloride and other resins. It is also used as a chemical intermediate and as a solvent.

Geo-Con follows the OSHA PEL, established in 29 CFR 1910.1017, of 1 ppm. The OSHA action level is 0.5 ppm. The TLV is 5 ppm ($13\text{ mg}/\text{m}^3$).

The primary route of entry is inhalation. There is some evidence that absorption through the skin is possible. Harmful effects and symptoms related to short-term exposure are as follows:

Inhalation – Exposure at 8,000 ppm for 5 minutes can cause a feeling of intoxication, tiredness, drowsiness, abdominal pain, numbness and tingling in fingers and toes, pain in joints, coughing, sneezing, irritability and loss of appetite and weight.

Skin – Contact with liquid may cause frostbite; contact with vapor may cause irritation and rash. Absorption is possible through the skin.

Eyes – Can cause severe and immediate irritation.

Ingestion – None found.

Long term exposure may cause club-like swelling and shortening of finger tips. Skin may become thickened and stiff with coarse, whitish patches. Bones and joints of arms and legs may suffer damage. Liver and spleen damage may occur. Not all symptoms disappear after exposure stops. Vinyl chloride has caused liver cancer in occupationally exposed individuals.

5.1.5 Benzo(a)pyrene

Benzo(a)pyrene is a yellow to brown powder. Benzo(a)pyrene is a polynuclear aromatic hydrocarbon found in coal tar. It is also found in automobile exhaust fumes (especially from diesel engines) and in all smoke resulting from the combustion of organic material.

The principal route of entry is through the skin. Harmful effects and symptoms related to short-term exposure are as follows:

Inhalation – May be harmful if inhaled. May cause respiratory tract irritation. Can cause a burning sensation, cough, wheezing, laryngitis, shortness of breath, headache, nausea, vomiting

Skin – May be harmful if absorbed through skin. May cause mild skin irritation. Can cause a burning sensation, cough, wheezing, laryngitis, shortness of breath, headache, nausea, vomiting

Eyes – May cause eye irritation.

Ingestion – may be harmful if swallowed.

The OSHA PEL (permissible exposure levels) for PAHs in the workplace is 0.2 mg/m³ for 8-hour TWA (time-weighted average). The National Institute for Occupational Safety and Health (NIOSH) has recommended that the workplace exposure limit for PAHs be set at the lowest detectable concentration, which was 0.1 mg/m³ (REL=recommended exposure limit) for coal tar pitch volatile agents for a 10-hour workday, 40-hour workweek.

Selected LD50s and LC50s

Subcutaneous LD50 Rat : 50 mg/kg

Chronic exposure may cause dermatitis to the skin. In vivo tests have showed mutagenic effects and may cause congenital malformation in a fetus. Benzo(a)pyrene has been linked to cancer in numerous studies.

5.1.6 Dieldrin

Dieldrin is a white crystalline solid or light brown dry flakes and it is odorless or mild chemical odor. It is most likely encountered in solid form but decomposes upon boiling.

Dieldrin is a chlorinated hydrocarbon originally produced in 1948 by J. Hyman & Co, Denver, as an insecticide. From 1950 to 1974, dieldrin was widely used to control insects as well as control locusts and mosquitoes, as a wood preserve, and for termite control. Most uses of dieldrin were banned in 1987, due to its harmful effects on humans, fish, and wildlife.

The principal route of entry is through the skin. Specific effects include moderate to severe erythema (redness) and moderate edema (raised skin), nausea, vomiting, headache. Health effects related to short-term exposure are as follows:

Inhalation – Harmful: possible risk of irreversible effects through inhalation.

Skin – Very Toxic: danger of serious damage to health by prolonged skin contact.

Eyes – Risk of serious damage to eyes.

Ingestion – Harmful: danger of serious damage to health if ingested.

OSHA recommended a maximum average amount of dieldrin in the air to be 250 micrograms in a cubic meter of air ($\mu\text{g}/\text{m}^3$) for an 8-hour workday over a 40-hour workweek. NIOSH recommended the same limit ($250 \mu\text{g}/\text{m}^3$) for up to a 10-hour workday over a 40-hour workweek.

Selected LD50s and LC50s for Dieldrin

DIELDRIN IO1750000 Inhalation LC50 Rat : 13 $\text{mg}/\text{m}^3/4\text{H}$

Oral LD50 Rat : 38300 $\mu\text{g}/\text{kg}$

Oral LD50 Mouse : 38 mg/kg

Dermal LD50 Rabbit : 250 mg/kg

Long term exposure may cause cause nausea and vomiting, higher exposure causes unconsciousness. Dieldrin is listed as a possible carcinogen.

5.2 Real-Time Exposure Measurement

Monitoring shall be performed where there may be a question of employee exposure to hazardous concentrations of hazardous substances in order to assure proper selection of engineering controls, work practices and personal protective equipment so that employees are not exposed to levels which exceed permissible exposure limits, or published exposure levels if there are no permissible exposure limits.

Air monitoring shall be used to identify and quantify airborne levels of hazardous substances and safety and health hazards in order to determine the appropriate level of employee protection needed on site. Periodic monitoring shall be conducted when the possibility of an IDLH condition or flammable atmosphere has developed or when there is indication that exposures may have risen over permissible exposure limits or published exposure levels since prior monitoring. Situations where it shall be considered whether the possibility that exposures have risen are as follows:

- When work begins on a different portion of the site
- When contaminants other than those previously identified are being handled
- When a different type of operation is initiated (e.g., drum opening as opposed to exploratory well drilling)
- When employees are handling leaking drums or containers or working in areas with obvious liquid contamination

Monitoring shall be performed within the work area on site to detect the presence and relative levels of toxic substances. The data collected throughout monitoring shall be used to determine the appropriate levels of PPE. Table 5-1 specifies the real-time monitoring equipment, which will be used for this project.

Table 5-1 Monitoring Parameters and Equipment		
Instrument	Manufacturer/Model*	Substances Detected
Photo Ionization Detector (PID)	RAE Systems Mini-RAE or Multi-RAE (min. 10.2 eV bulb)	Organic Solvents, Pesticides
Flame Ionization Detector (FID)	TVA 1000B	Aromatic Hydrocarbons

Note:

*Or similar unit, as approved by the Resolution Consultants Health and Safety Manager or designee

5.2.1 Health and Safety Action Levels

An action level is a point at which increased protection is required due to the concentration of contaminants in the work area or other environmental conditions. The concentration level (above background level) and the ability of the PPE to protect against that specific contaminant determine each action level. The action levels are based on concentrations in the breathing zone. Action levels are based upon sound scientific principles as expressed by various regulatory agencies or industry groups.

If ambient levels are measured which exceed the action levels in areas accessible to unprotected personnel, necessary control measures (barricades, warning signs, and mitigative actions to limit, etc.) must be implemented prior to commencing activities at the specific work area.

Personnel should also be able to upgrade or downgrade their level of protection with the concurrence of SSHO or the Resolution Consultants Health and Safety Manager or designee.

Reasons to upgrade:

- Known or suspected presence of dermal hazards
- Occurrence or likely occurrence of gas, vapor, or dust emission
- Change in work task that will increase the exposure or potential exposure to hazardous materials

Reasons to downgrade:

- New information indicating that the situation is less hazardous than was originally suspected
- Change in site conditions that decrease the potential hazard
- Change in work task that will reduce exposure to hazardous materials

5.2.2 Monitoring Procedures

The SSHO will assess the atmosphere for acceptable concentrations/levels using the prescribed hand-held direct read instrumentation prior to any personnel entering into the area, and continuously thereafter. The monitoring devices may then be assigned to individual personnel working within the Exclusion Zone (EZ). Care should be taken to apply all necessary correction factors to your monitoring results (VOC and Explosive Atmosphere channels) specific to the contaminants of concern.

Parameter	Location and Interval	Response Level (Meter Units/ppm Above Background)	Response
Hydrocarbons, VOCs, SVOCs, Pesticides (Total by PID)	Continuous in the worker's breathing zone or in the immediate work area for sustained reading of 2 minutes in duration. Confined spaces will require initial and continuous monitoring.	< 1 ppm	Level D work and continue monitoring (not applicable for initial assessment of unknown drums or containers).
		≥ 1 ppm	Contact the SSHO, and if no potential for change in conditions exist (drum/container activities increasing airborne levels), don Level C (GME/P100 cartridges or equivalent chemical cartridge combined with P100) and continue monitoring. Or Stop Work. Not consistent with chemical contamination and concentrations identified in the specifications. Based upon the inconsistency, additional chemical specific monitoring and/or upgrade to Level B may be required.
		Initial entry or opening/sampling unknown drums/containers	Stop Work. Not consistent with chemical contamination and concentrations identified in the specifications. Based upon the inconsistency, additional chemical specific monitoring and/or upgrade to Level B may be required. Consult with PM and H&S Professional.
		≥ 5 ppm	
Hydrocarbons, PAHs (Total by FID)	Site perimeter at least every 30 minutes during intrusive activities involving impacted materials.	< 1 ppm	Continue work and continue monitoring.
		≥ 1 ppm (Sustained for more than 5 minutes)	Implement mitigation measures and contact the SSO.

5.2.2.1 Monitoring Equipment Calibration

All instruments used will be calibrated at the beginning and end of each work shift, in accordance with the manufacturer's recommendations. If the owner's manual is not available, the personnel operating the equipment will contact the applicable office representative, rental agency or manufacturer for technical guidance for proper calibration. If equipment cannot be pre-calibrated to specifications, site operations requiring monitoring for worker exposure or off-site migration of contaminants will be postponed or temporarily ceased until this requirement is completed.

5.2.2.2 Personal Sampling

Should site activities warrant performing personal sampling (breathing zone) to better assess chemical exposures experienced by Resolution Consultants employees, the SSHO, under the direction of a Certified Industrial Hygienist (CIH) or a Certified Safety Professional (CSP) will be responsible for specifying the monitoring required. Within five working days after the receipt of monitoring results, the CIH or CSP will notify each employee, in writing, of the results that represent that employee's exposure. Copies of air sampling results will be maintained in the SSHO project files.

If the site activities warrant, the subcontractor will ensure its employees' exposures are quantified via the use of appropriate sampling techniques. The subcontractor shall notify the employees sampled in accordance with health and safety regulations, and provide the results to the SSHO for use in determining the potential for other employees' exposure.

5.3 Heat and Cold Stress

Heat and cold stress may vary based upon work activities, PPE/clothing selection, geographical locations, and weather conditions. To reduce the potential of developing heat/cold stress, be aware of the signs and symptoms of heat/cold stress and watch fellow employees for signs of heat/cold stress.

5.3.1 Responding to Heat-Related Illness

Heat stress can be a significant field site hazard, particularly for non-acclimated personnel operating in a hot, humid setting. Site personnel will be instructed in the identification of a heat stress victim, the first-aid treatment procedures for the victim and the prevention of heat stress casualties. Work-rest cycles will be determined and the appropriate measures taken to prevent heat stress as outlined in *5-511-Heat Stress Prevention*.

The guidance below will be used in identifying and treating heat-related illness.

Table 5-3 Identification and Treatment of Heat-Related Illness		
Type of Heat-Related Illness	Description	First Aid
Mild Heat Strain	The mildest form of heat-related illness. Victims exhibit irritability, lethargy, and significant sweating. The victim may complain of headache or nausea. This is the initial stage of overheating, and prompt action at this point may prevent more severe heat-related illness from occurring.	<ul style="list-style-type: none"> • Provide the victim with a work break during which he/she may relax, remove any excess protective clothing, and drink cool fluids. • If an air-conditioned spot is available, this is an ideal break location. • Once the victim shows improvement, he/she may resume working; however, the work pace should be moderated to prevent recurrence of the symptoms.
Heat Exhaustion	Usually begins with muscular weakness and cramping, dizziness, staggering gait, and nausea. The victim will have pale, clammy moist skin and may perspire profusely. The pulse is weak and fast and the victim may faint unless they lie down. The bowels may move involuntarily.	<ul style="list-style-type: none"> • Immediately remove the victim from the work area to a shady or cool area with good air circulation (<i>avoid drafts or sudden chilling</i>). • Remove all protective outerwear. • Call a physician. • Treat the victim for shock. (<i>Make the victim lie down, raise his or her feet 6–12 inches, and keep him/her cool by loosening all clothing</i>). • If the victim is conscious, it may be helpful to give him/her sips of water. • Transport victim to a medical facility ASAP.
Heat Stroke	The most serious of heat illness, heat stroke represents the collapse of the body's cooling mechanisms. As a result, body temperature may rise to 104 degrees Fahrenheit or higher. As the victim progresses toward heat stroke, symptoms such as headache, dizziness, nausea can be noted, and the skin is observed to be dry, red, and hot. Sudden collapse and loss of consciousness follows quickly and death is imminent if exposure continues. Heat stroke can occur suddenly.	<ul style="list-style-type: none"> • Immediately evacuate the victim to a cool/shady area. • Remove all protective outerwear and as much personal clothing as decency permits. • Lay the victim on his/her back w/the feet slightly elevated. • Apply cold wet towels or ice bags to the head, armpits, and thighs. • Sponge off the bare skin with cool water. • The main objective is to cool without chilling the victim. • Give no stimulants or hot drinks. • Since heat stroke is a severe medical condition requiring professional medical attention, emergency medical help should be summoned immediately to provide onsite treatment of the victim and proper transport to a medical facility.

6.0 ENVIRONMENTAL PROGRAM (ENVIRONMENT)

6.1 Environmental Compliance and Management

This project and the individual tasks will comply with all federal, state, provincial, and local environmental requirements.

6.1.1 Air Emissions

No air emission concerns are foreseen on the site. As such, no additional protective measures are required for the execution of the project.

6.1.2 Hazardous Waste Management

All investigation derived waste will be containerized in U.S. Department of Transportation approved steel open top drums or temporary onsite storage tank. The drums and/or tank will be labeled as investigation derived waste, the generation date, generator name, and contact phone number. If a tank is utilized to hold purge water, it will be locked to prevent tampering. Resolution Consultants will sample the drums for disposal parameters and assist the client in making arrangements for disposal within 90-days of generation. All manifests and waste profiles will be signed by the client.

6.1.3 Storm Water Pollution Prevention

No storm water pollution prevention concerns are foreseen on the site. As such, no additional protective measures are required for the execution of the project.

6.1.4 Wetlands Protection

No wetland protection concerns are foreseen on the site. As such, no additional protective measures are required for the execution of the project.

6.1.5 Critical Habitat Protection

No critical habitat protection concerns are foreseen on the site. As such, no additional protective measures are required for the execution of the project.

6.1.6 Environmental Protection

No additional environmental protection concerns are foreseen on the site. As such, no additional protective measures are required for the execution of the project.

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7.0 PERSONAL PROTECTIVE EQUIPMENT

7.1 Personal Protective Equipment

The purpose of personal protective equipment (PPE) is to provide a barrier, which will shield or isolate individuals from the chemical and/or physical hazards that may be encountered during work activities. *5-208-Personal Protective Equipment Program* lists the general requirements for selection and usage of PPE. Table 7-1 lists the minimum PPE required during site operations and additional PPE that may be necessary. The specific PPE requirements for each work task are specified in the individual THAs. By signing this HASP the employee agree having been trained in the use, limitations, care and maintenance of the protective equipment to be used by the employee at this project. If training has not been provided, request same of the PM/SSHO for the proper training before signing.

Table 7-1 Personal Protective Equipment

Type	Material	Additional Information
Minimum PPE		
Safety Vest	ANSI Type II high-visibility	Must have reflective tape/be visible from all sides
Boots	Leather	ANSI approved safety toe
Safety Glasses		ANSI Approved; ≥98% UV protection
Hard Hat		ANSI Approved; recommended wide-brim
Work Uniform		No shorts/cutoff jeans or sleeveless shirts
Additional PPE		
Hearing Protection	Ear plugs and/ or muffs	In hazardous noise areas
Leather Gloves		If working with sharp objects or powered equipment.
Protective Chemical Gloves	Inner: Chemical resistant	Use during handling of all potentially impacted media.
Protective Chemical Coveralls	Chemical resistant	For use where contact potential with COC impacted media exists.
Protective Chemical Boots	Rubber Overboots or traditional chemical protective boots	For use where contact potential with COC impacted media exists.
Level C Respiratory Protection	(Full Face or Half Face as needed) equipped with appropriate respiratory protection cartridge	Upgrade based on air monitoring requirements established in Section 5.0.
Sunscreen	SPF 30 or higher	
Insect Repellent	Deet, Permethrin, etc.	Adhere to manufacturers application instructions and precautions
Biological Wipes or Wash	Ivy X Wipes or Technu	Post exposure wipes and wash for poison oak, ivy, sumac etc.
Fall Protection	Body Harness with Lanyard or Self Retracting Lifeline	For use adjacent to top of excavation within orange safety fencing.

7.2 PPE Doffing and Donning (UTILIZATION) Information

The following information is to provide field personnel with helpful hints that, when applied, make donning and doffing of PPE a more safe and manageable task:

- Never cut disposable booties from your feet with basic utility knives. This has resulted in workers cutting through the bootie and the underlying sturdy leather work boot, resulting in significant cuts to the legs/ankles. Use a pair of scissors or a package/letter opener (cut above and parallel with the work boot) to start a cut in the edge of the bootie, then manually tear the material down to the sole of the bootie for easy removal.
- When applying duct tape to PPE interfaces (wrist, lower leg, around respirator, etc.) and zippers, leave approximately one inch at the end of the tape to fold over onto itself. This will make it much easier to remove the tape by providing a small handle to grab while still wearing gloves. Without this fold, trying to pull up the tape end with multiple gloves on may be difficult and result in premature tearing of the PPE.
- Have a “buddy” check your ensemble to ensure proper donning before entering controlled work areas. Without mirrors, the most obvious discrepancies can go unnoticed and may result in a potential exposure situation.
- Never perform personal decontamination with a pressure washer.

7.3 Decontamination

7.3.1 General Requirements

All possible and necessary steps shall be taken to reduce or minimize contact with chemicals and contaminated/impacted materials while performing field activities (e.g., avoid sitting or leaning on, walking through, dragging equipment through or over, tracking, or splashing potential or known contaminated/impacted materials, etc.)

All personal decontamination activities shall be performed with an attendant (buddy) to provide assistance to personnel that are performing decontamination activities. Depending on specific site hazards, attendants may be required to wear a level of protection that is equal to the required level in the EZ.

All persons and equipment entering the EZ shall be considered contaminated, and thus, must be properly decontaminated prior to entering the Support Zone (SZ).

Decontamination procedures may vary based on site conditions and nature of the contaminant(s). If chemicals or decontamination solutions are used, care should be taken to minimize reactions between the solutions and contaminated materials. In addition, personnel must assess the potential exposures created by the decontamination chemical(s) or solutions. The applicable Material Safety Data Sheet (MSDS) must be reviewed, implemented, and filed by personnel contacting the chemicals/solutions.

All contaminated PPE and decontamination materials shall be contained, stored and disposed of in accordance with site-specific requirements determined by site management.

7.3.2 Decontamination Equipment

The equipment required to perform decontamination may vary based on site-specific conditions and the nature of the contaminant(s). The following equipment is commonly used for decontamination purposes:

- Soft-bristle scrub brushes or long-handled brushes to remove contaminants
- Hoses, buckets of water or garden sprayers for rinsing
- Large plastic/galvanized wash tubs or children's wading pools for washing and rinsing solutions
- Large plastic garbage cans or similar containers lined with plastic bags for the storage of contaminated clothing and equipment
- Metal or plastic cans or drums for the temporary storage of contaminated liquids
- Paper or cloth towels for drying protective clothing and equipment

7.3.3 Personal/Equipment Decontamination

All equipment leaving the EZ shall be considered contaminated and must be properly decontaminated to minimize the potential for exposure and off-site migration of impacted materials. Such equipment may include, but is not limited to: sampling tools, heavy equipment, vehicles, PPE, support devices (e.g., hoses, cylinders, etc.), and various handheld tools.

All employees performing equipment decontamination shall wear the appropriate PPE to protect against exposure to contaminated materials. The level of PPE may be equivalent to the level of PPE required in the EZ. Other PPE may include splash protection, such as face-shields and splash suits, and knee protectors. Following equipment decontamination, employees may be required to follow the proper personal decontamination procedures above.

The PPE to be used on-site is considered disposable and will be removed and containerized in the CRZ during decontamination activities. Suits and booties will be removed first, and gloves last.

1. For Overbootie Removal
 - Grasp top of overbootie and roll downward (inside out)
 - Using gloved hands, place booties in receptacle

2. For Suit Removal
 - Unzip suit and remove arms, turning inside-out
 - Slide suit down, over waist
 - Slide suit downward over legs, and step out
 - Using gloved hands, grasp inside of suit, and place in receptacle.

3. For Glove removal:
 - Grasp the cuff of the dominant hand and pull glove over the bulk of the hand, leaving the fingers inside the glove.
 - Use the dominant hand to grasp the cuff of the non-dominant hand and pull the glove completely off (inside-out) and place inside of the dominant hand glove.
 - Once removed, employee should only touch the inside material of the dominant hand glove.
 - Thoroughly wash hands.

4. For APR Removal
 - Remove cartridges and place in receptacle
 - Loosen straps, grasp back strap and face piece, and doff mask
 - Decon mask and hang to dry

For larger equipment, a high-pressure washer may need to be used. Some contaminants require the use of a detergent or chemical solution and scrub brushes to ensure proper decontamination. Before heavy equipment and trucks are taken offsite, the SS and/or SSHO will visually inspect them for signs of contamination. If contamination is present, the equipment must be decontaminated.

For equipment, use the following steps for decontamination:

1. Remove majority of visible gross contamination in EZ
2. Wash equipment in decontamination solution with a scrub brush and/or power wash heavy equipment

3. Rinse equipment
4. Visually inspect for remaining contamination
5. Follow appropriate personal decontamination steps outlined above

All decontaminated equipment shall be visually inspected for contamination prior to leaving the Contaminant Reduction Zone (CRZ). Signs of visible contamination may include an oily sheen, residue or contaminated soils left on the equipment. All equipment with visible signs of contamination shall be discarded or re-decontaminated until clean. Depending on the nature of the contaminant, equipment may have to be analyzed using a wipe method or other means.

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8.0 PROJECT HEALTH AND SAFETY ORGANIZATION

8.1 Project Manager [*Marianne Sweeney*]

The Project Manager (PM) has overall management authority and responsibility for all site operations, including safety. The PM will provide the site supervisor with work plans, staff, and budgetary resources, which are appropriate to meet the safety needs of the project operations.

8.2 Site Supervisor [*Rhonda Gibson*]

The site supervisor has the overall responsibility and authority to direct work operations at the job site according to the provided work plans. The PM may act as the site supervisor while on site.

8.2.1 Responsibilities

The site supervisor is responsible to:

- Discuss deviations from the work plan with the SSHO and PM
- Discuss safety issues with the PM, SSHO, and field personnel
- Assist the SSHO with the development and implementation of corrective actions for site safety deficiencies
- Assist the SSHO with the implementation of this HASP and ensuring compliance
- Assist the SSHO with inspections of the site for compliance with this HASP and applicable SOPs

8.2.2 Authority

The site supervisor has authority to:

- Verify that all operations are in compliance with the requirements of this HASP, and halt any activity that poses a potential hazard to personnel, property, or the environment.
- Temporarily suspend individuals from field activities for infractions against the HASP pending consideration by the SSHO, the Resolution Consultants Health and Safety Manager or designee, and the PM.

8.2.3 Qualifications

In addition to being Hazardous Waste Operations and Emergency Response (HAZWOPER)-qualified (see Section 4.1), the Site Supervisor is required to have completed the 8-hour HAZWOPER Supervisor Training Course in accordance with 29 CFR 1910.120 (e)(4).

8.3 Site Safety Health Officer [*Rhonda Gibson*]

8.3.1 Responsibilities

The SSHO is responsible to:

- Update the site-specific HASP to reflect changes in site conditions or the scope of work. HASP updates must be reviewed and approved by the Resolution Consultants Health and Safety Manager or designee. Updates must be documented using the Revision History in Attachment 2.
- Be aware of changes in Resolution Consultants Safety Policies, Programmatic Health and Safety Plan (PSHP), or SOPs.
- Monitor the lost time incidence rate for this project and work toward improving it.
- Inspect the site for compliance with this HASP and the SOPs using the appropriate audit inspection checklist provided by the Resolution Consultants Health and Safety Manager or designee.
- Work with the site supervisor and PM to develop and implement corrective action plans to correct deficiencies discovered during site inspections. Deficiencies will be discussed with project management to determine appropriate corrective action(s).
- Contact the Resolution Consultants Health and Safety Manager or designee for technical advice regarding safety issues.
- Provide a means for employees to communicate safety issues to management in a discreet manner (e.g., suggestion box, etc.).
- Determine emergency evacuation routes, establishing and posting local emergency telephone numbers, and arranging emergency transportation.
- Check that all site personnel and visitors have received the proper training and medical clearance prior to entering the site.
- Establish any necessary controlled work areas (as designated in this HASP or other safety documentation).
- Present tailgate safety meetings and maintain attendance logs and records.
- Discuss potential health and safety hazards with the Site Supervisor, the Resolution Consultants Health and Safety Manager or designee, and the PM.
- Select an alternate SSHO by name and inform him/her of their duties, in the event that the SSHO must leave or is absent from the site. The alternate SSHO must be approved by the PM.

8.3.2 Authority

The SSHO has authority to:

- Verify that all operations are in compliance with the requirements of this HASP.
- Issue a "Stop Work Order" under the conditions set forth in this HASP.

- Temporarily suspend individuals from field activities for infractions against the HASP pending consideration by the Resolution Consultants Health and Safety Manager or designee and the PM.

8.3.3 Qualifications

In addition to being HAZWOPER-qualified, the SSHO is required to have completed the 8-hour HAZWOPER Supervisor Training Course in accordance with 29 CFR 1910.120 (e)(4).

8.4 Employees

8.4.1 Employee Responsibilities

Responsibilities of employees associated with this project include, but are not limited to:

- Understanding and abiding by the policies and procedures specified in the HASP and other applicable safety policies, and clarifying those areas where understanding is incomplete.
- Providing feedback to health and safety management relating to omissions and modifications in the HASP or other safety policies.
- Notifying the SSHO, in writing, of unsafe conditions and acts.

8.4.2 Employee Authority

The health and safety authority of each employee assigned to the site includes the following:

- The right to refuse to work and/or stop work authority when the employee feels that the work is unsafe (including subcontractors or team contractors), or where specified safety precautions are not adequate or fully understood.
- The right to refuse to work on any site or operation where the safety procedures specified in this HASP or other safety policies are not being followed.
- The right to contact the SSHO or the Resolution Consultants Health and Safety Manager or designee at any time to discuss potential concerns.
- The right and duty to stop work when conditions are unsafe, and to assist in correcting these conditions

8.5 Resolution Consultants Health and Safety Manager [*John Knopf, CSP*]

The Health and Safety Manager is assigned to provide guidance and technical support for the project. Duties include the following:

- Approving this HASP and any required changes
- Approving the designated Site Safety Health Officer (SSHO)
- Reviewing all personal exposure monitoring results
- Investigating any reported unsafe acts or conditions

The Health and Safety Manager may designate another safety professional as the direct liaison for this project; if that is the case, he will remain available for any or all of the tasks listed here or elsewhere in this HASP in lieu of the designee.

8.6 Subcontractors

The requirements for subcontractor selection and subcontractor safety responsibilities are outlined in *5-213-Subcontractors*. Each Resolution Consultants subcontractor is responsible for assigning specific work tasks to their employees. Each subcontractor's management will provide qualified employees and allocate sufficient time, materials, and equipment to safely complete assigned tasks. In particular, each subcontractor is responsible for equipping its personnel with any required personnel protective equipment (PPE) and all required training.

Resolution Consultants considers each subcontractor to be an expert in all aspects of the work operations for which they are tasked to provide, and each subcontractor is responsible for compliance with the regulatory requirements that pertain to those services. Each subcontractor is expected to perform its operations in accordance with its own unique safety policies and procedures, to ensure that hazards associated with the performance of the work activities are properly controlled. Copies of any required safety documentation for a subcontractor's work activities will be provided to Resolution Consultants for review prior to the start of onsite activities, if required.

Hazards not listed in this HASP but known to any subcontractor, or known to be associated with a subcontractor's services, must be identified and addressed to the Resolution Consultants PM or the Site Supervisor prior to beginning work operations. The Site Supervisor or authorized representative has the authority to halt any subcontractor operations, and to remove any subcontractor or subcontractor employee from the site for failure to comply with established health and safety procedures or for operating in an unsafe manner.

8.7 Visitors

Authorized visitors (e.g., client representatives, regulators, Resolution Consultants management staff, etc.) requiring entry to any work location on the site will be briefed by the PM on the hazards present at that location. Visitors will be escorted at all times at the work location and will be responsible for compliance with their employer's health and safety policies. In addition, this HASP specifies the minimum acceptable qualifications, training and personal protective equipment

which are required for entry to any controlled work area; visitors must comply with these requirements at all times.

8.7.1 Visitor Access

Visitors to any HAZWOPER controlled-work area must comply with the health and safety requirements of this HASP, and demonstrate an acceptable need for entry into the work area. All visitors desiring to enter any controlled work area must observe the following procedures:

1. A written confirmation must be received by Resolution Consultants documenting that each of the visitors has received the proper training and medical monitoring required by this HASP. Verbal confirmation can be considered acceptable provided such confirmation is made by an officer or other authorized representative of the visitor's organization.
2. Each visitor will be briefed on the hazards associated with the site activities being performed and acknowledge receipt of this briefing by signing the appropriate tailgate safety briefing form.
3. All visitors must be escorted by a Resolution Consultants employee.

If the site visitor requires entry to any EZ, but does not comply with the above requirements, all work activities within the EZ must be suspended. Until these requirements have been met, entry will not be permitted.

Unauthorized visitors, and visitors not meeting the specified qualifications, will not be permitted within established controlled work areas.

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9.0 SITE CONTROL

9.1 General

The purpose of site control is to minimize potential contamination of workers, protect the public from site hazards, and prevent vandalism. The degree of site control necessary depends on the site characteristics, site size, and the surrounding community.

Controlled work areas will be established at each work location, and if required, will be established directly prior to the work being conducted. Diagrams designating specific controlled work areas will be drawn on site maps, posted in the support vehicle or trailer and discussed during the daily safety meetings. If the site layout changes, the new areas and their potential hazards will be discussed immediately after the changes are made. General examples of zone layouts have been developed for drilling and earth moving activities (e.g., excavating, trenching, drilling) and are attached to this section.

9.2 Controlled Work Areas

Each HAZWOPER controlled work area will consist of the following three zones:

- *Exclusion Zone:* Contaminated work area
- *Contamination Reduction Zone:* Decontamination area
- *Support Zone:* Uncontaminated or "clean area" where personnel should not be exposed to hazardous conditions

Each zone will be periodically monitored in accordance with the air monitoring requirements established in this HASP. The Exclusion Zone and the Contamination Reduction Zone are considered work areas. The Support Zone is accessible to the public (e.g., vendors, inspectors).

9.2.1 Exclusion Zone

The Exclusion Zone is the area where primary activities occur, such as sampling, remediation operations, installation of wells, cleanup work, etc. This area must be clearly marked with hazard tape, barricades or cones, or enclosed by fences or ropes. Only personnel involved in work activities, and meeting the requirements specified in the applicable THA and this HASP will be allowed in an Exclusion Zone. The extent of each area will be sufficient to ensure that personnel located at/beyond its boundaries will not be affected in any substantial way by hazards associated with sample collection activities.

- **Direct Push Drilling Activities.** A distance of 20 feet (minimum) in all directions will be cleared from the rig. The cleared area will be sufficient to accommodate movement of

necessary equipment and soil sampling supplies. Vehicles and other hard barriers should be used where applicable to protect employees and public.

- **HSA Drilling.** Determine the mast height of the drill rig. This height will be cleared (minimum), if practical, in all directions from the bore-hole location and designated as the exclusion zone. The cleared area will be sufficient to accommodate movement of necessary equipment and the stockpiling of spoils piles. Vehicles and other hard barriers should be used where applicable to protect employees and public.
- **Slab Cutting.** A distance of 10 feet (minimum) in all directions from the cutting location will be cleared when using manual methods (i.e., chisel or equivalent) and 20 feet when using a concrete saw. The cleared area will be sufficient to accommodate movement of necessary equipment and the stockpiling of debris. Vehicles and other hard barriers should be used where applicable to protect employees and public.

All personnel should be alert to prevent unauthorized, accidental entrance into controlled-access areas (the EZ and CRZ). If such an entry should occur, the trespasser should be immediately escorted outside the area, or all HAZWOPER-related work must cease. All personnel, equipment, and supplies that enter controlled-access areas must be decontaminated or containerized as waste prior to leaving (through the CRZ only).

9.2.2 Contamination Reduction Zone

The Contamination Reduction Zone is the transition area between the contaminated area and the clean area. Decontamination is the main focus in this area. The decontamination of workers and equipment limits the physical transfer of hazardous substances into the clean area. This area must also be clearly marked with hazard tape and access limited to personnel involved in decontamination.

9.2.3 Support Zone

The Support Zone is an uncontaminated zone where administrative and other support functions, such as first aid, equipment supply, emergency information, etc., are located. The Support Zone shall have minimal potential for significant exposure to contaminants (i.e., background levels).

Employees will establish a Support Zone (if necessary) at the site before the commencement of site activities. The Support Zone would also serve as the entry point for controlling site access.

9.3 Site Access Documentation

If implemented by the PM, all personnel entering the site shall complete the "Site Entry/Exit Log" located at the site trailer or primary site support vehicle.

9.4 Site Security

Site security is necessary to:

- Prevent the exposure of unauthorized, unprotected people to site hazards
- Avoid the increased hazards from vandals or persons seeking to abandon other wastes on the site
- Prevent theft
- Avoid interference with safe working procedures

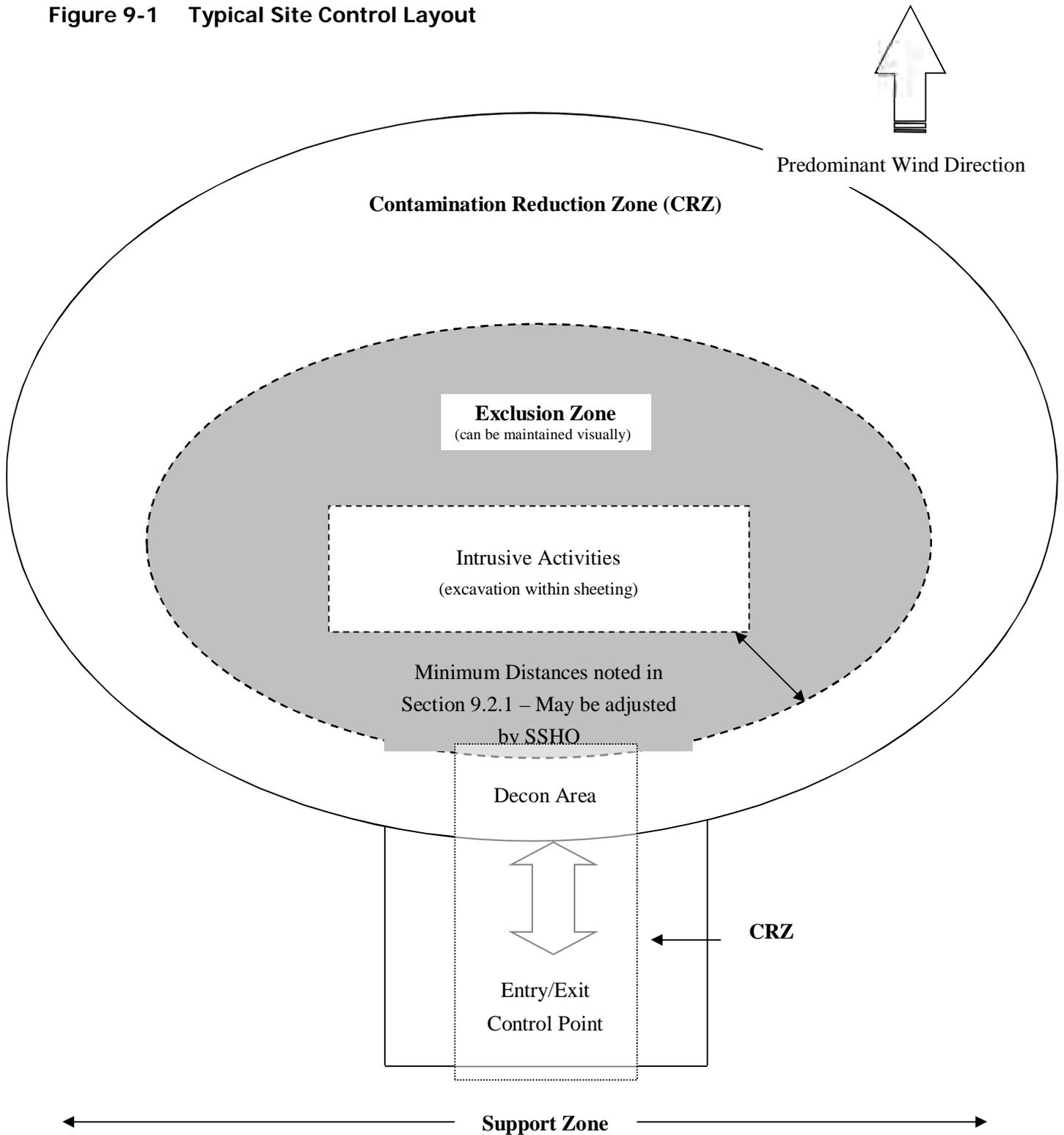
To maintain site security during working hours:

1. Maintain security in the Support Zone and at access control points.
2. Establish an identification system to identify authorized persons and limitations to their approved activities.
3. Assign responsibility for enforcing authority for entry and exit requirements.
4. When feasible, install fencing or other physical barrier around the site.
5. If the site is not fenced, post signs around the perimeter and whenever possible, use guards to patrol the perimeter. Guards must be fully apprised of the hazards involved and trained in emergency procedures.
6. Have the PM approve all visitors to the site. Make sure they have valid purpose for entering the site. Have trained site personnel accompany visitors at all times and require them to wear the appropriate protective equipment.

To maintain site security during off-duty hours:

1. If possible, assign trained, in-house technicians for site surveillance. They will be familiar with the site, the nature of the work, the site's hazards, and respiratory protection techniques.
2. If necessary, use security guards to patrol the site boundary. Such personnel may be less expensive than trained technicians, but will be more difficult to train in safety procedures and will be less confident in reacting to problems around hazardous substances.
3. Enlist public enforcement agencies, such as the local police department, if the site presents a significant risk to local health and safety.
4. Secure the equipment.

Figure 9-1 Typical Site Control Layout



10.0 EMERGENCY RESPONSE PLANNING

10.1 Emergency Action Plan

Although the potential for an emergency to occur is remote, an emergency action plan has been prepared for this project should such critical situations arise. The only significant type of onsite emergency that may occur is physical injury or illness to a member of the Resolution Consultants team. The Emergency Action Plan (EAP) will be reviewed by all personnel prior to the start of field activities. On long term sites, a test of the EAP will be performed within the first three (3) days of the project field operations. This test will be evaluated and documented in the project records.

Four major categories of emergencies could occur during site operations:

1. Illnesses and physical injuries (including injury-causing chemical exposure)
2. Catastrophic events (fire, explosion, earthquake, or chemical)
3. Workplace Violence, Bomb Threat
4. Safety equipment problems

10.1.1 Emergency Coordinator

The duties of the Emergency Coordinator (EC) include:

- Implement the EAP based on the identified emergency condition
- Notify the appropriate project and SH&E Department personnel of the emergency (Table 10-1)
- Verify emergency evacuation routes and muster points are accessible
- Conduct routine EAP drills and evaluate compliance with the EAP

Table 10-1 Emergency Contacts

Emergency Coordinators/Key Personnel			
Name	Title/Workstation	Telephone Number	Mobile Phone
Art Sanford	Client Contact	(843) 743-2135	
Marianne Sweeney	Project Manager	(407) 304-4446	(407) 341-8763
Rhonda Gibson	Site Supervisor	(407) 304-4411	(616) 340-6500
Rhonda Gibson	Site Safety Health Officer	(407) 304-4411	(616) 340-6500
Rhonda Gibson	Emergency Coordinator	(407) 304-4411	(616) 340-6500
John Knopf	Resolution Consultants H&S Manager	(901) 372-7962	(901) 451-1464
Harold Hannah	AECOM Regional SH&E Manager	(412) 904-3606	(412) 303-1199
Sean Liddy	AECOM District SH&E Manager		(443) 553-1403
Russ Reynolds	AECOM District SH&E Manager	(864) 234-3042	(864) 906-7309
Incident Reporting	AECOM Personnel	(800) 348-5046	
	EnSafe Personnel	Call John Knopf	
Ann-Alyssa Hill	AECOM TDG/IATA Shipping Expert	(804) 515-8506	(804) 640-4815
Kevin Arick	EnSafe TDG/IATA Shipping Expert	(901) 372-7962	(901) 356-3525
Organization/Agency			
Name			Telephone Number
Police Department (local)			911 (407) 246-2470
Fire Department (local)			911 (407) 246-4406
Ambulance Service <i>(EMT will determine appropriate hospital for treatment)</i>			911 (407) 246-4406
Emergency Hospital <i>(Use by site personnel is only for emergency cases)</i>			
Florida Hospital – Main Campus			(407) 303-5600
601 East Rollins Street, Orlando, FL 32803			
Emergency Hospital Route: See Figure 10-1			
Poison Control Center			(800) 222-1222
Pollution Emergency			(800) 292-4706
National Response Center			(800) 424-8802
Title 3 Hotline			(800) 424-9346
Public Utilities			
Name			Telephone Number
Call Before You Dig			811

10.1.2 Site-Specific Emergency Procedures

Prior to the start of site operations, the EC will complete Table 10-2 with any site-specific information regarding evacuations, muster points, communication, and other site-specific emergency procedures.

Table 10-2 Emergency Planning

Emergency	Evacuation Route	Muster Location
Chemical Spill	<ul style="list-style-type: none"> Upwind 	<ul style="list-style-type: none"> Site vehicles
Fire/Explosion	<ul style="list-style-type: none"> Upwind 	<ul style="list-style-type: none"> Site vehicles
Tornado/Severe Weather	<ul style="list-style-type: none"> Closest available tornado shelter 	<ul style="list-style-type: none"> Building # (TBD by SSHO)
Lightning	<ul style="list-style-type: none"> Closest available shelter 	<ul style="list-style-type: none"> Vehicle/Site Trailer
Additional Information		
Communication Procedures	Direct verbal communications. Must be supplemented when voices cannot be clearly perceived above ambient noise levels and when a clear line-of-sight cannot be maintained by personnel. Personnel will bring a mobile phone to the site to ensure that communications with local emergency responders is maintained, when necessary.	
CPR/First Aid Trained Personnel	Rhonda Gibson	
Site-Specific Spill Response Procedures	Chemicals brought onsite will be limited to fuel for vehicles and small quantities of laboratory preservatives. In the event of a minor spill, sorbent material will be placed on the spill and then transferred to a container for disposal. Field personnel will immediately notify the PM who in turn will notify the account manager and the Department project representative.	

10.1.3 Spill Containment Procedure

Work activities may involve the use of hazardous materials (e.g., fuels, solvents) or work involving drums or other containers. State specific spill reporting procedures have been included in Attachment 8. If anything beyond these procedures is required, a site specific spill reporting card/procedure must be developed for the site. Procedures outlined below will be used to prevent or contain spills:

- All hazardous material will be stored in appropriate containers
- Tops/lids will be placed back on containers after use
- Containers of hazardous materials will be stored appropriately away from moving equipment

At least one spill response kit, to include an appropriate empty container, materials to allow for booming or diking the area to minimize the size of the spill, and appropriate clean-up material (e.g., speedy dri) shall be available at each work site (more as needed).

- All hazardous commodities in use (e.g., fuels) shall be properly labeled
- Containers shall only be lifted using equipment specifically manufactured for that purpose
- Drums/containers will be secured and handled in a manner which minimizes spillage and reduces the risk of musculoskeletal injuries

10.1.4 Safety Accident/Incident Reporting

All accidents and incidents that occur on-site during any field activity will be promptly reported to the SSHO and the immediate supervisor.

If any Resolution Consultants employee is injured and requires medical treatment, the Site Supervisor will report the incident in accordance with Resolution Consultants' incident reporting procedures. A copy of the final Supervisor's Report of Incident will be provided to the Resolution Consultants Health and Safety Manager or designee before the end of the following shift.

If any employee of a subcontractor is injured, documentation of the incident will be accomplished in accordance with the subcontractor's procedures; however, copies of all documentation (which at a minimum must include the OSHA Form 301 or equivalent) must be provided to the SSHO within 24 hours after the accident has occurred.

All accidents/incidents will be investigated. Copies of all subcontractor accident investigations will be provided to the SSHO within five (5) days of the accident/incident.

Near misses describe incidents where no property was damaged and no personal injury was sustained, but where, given a slight shift in time or position, damage and/or injury easily could have occurred. Near misses shall be reported to the Resolution Consultants H&S Manager as soon as possible.

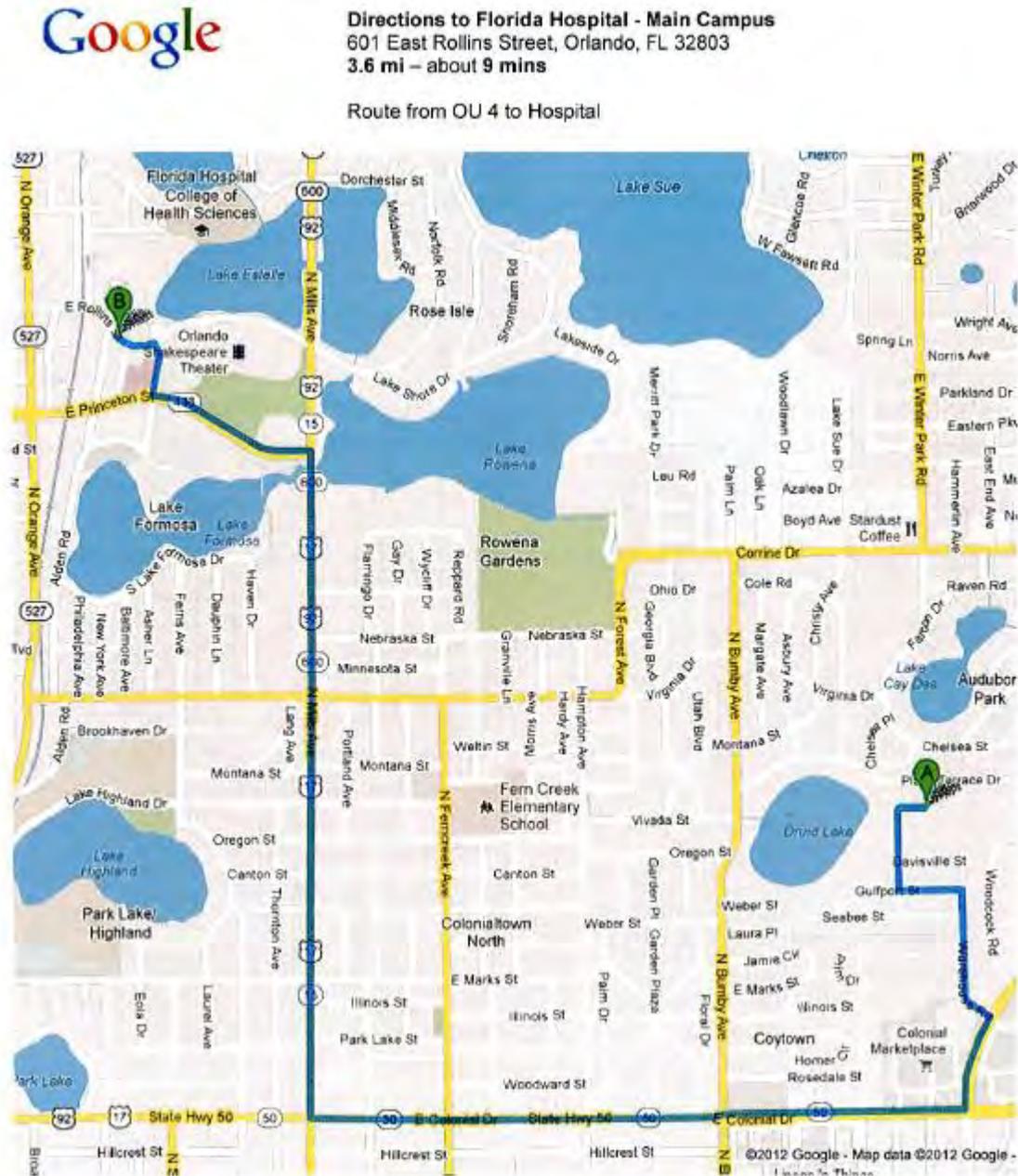
10.1.5 Environmental Spill/Release Reporting

All environmental spills or releases of hazardous materials (e.g., fuels, solvents, etc.), whether in excess of the Reportable Quantity or not, will be reported to the PM and Resolution Consultants H&S Manager. In determining whether a spill or release must be reported to a regulatory agency, the Site Supervisor will assess the quantity of the spill or release and evaluate the reporting criteria against the state-specific reporting requirements, your applicable regulatory permit, and/or client-specific reporting procedures. In order to support the Site Supervisor and expedite the

decision to report to a state regulatory agency, state specific spill reporting procedures and/or spill reporting card are included in (Attachment 8). **If reporting to a US state or Federal regulatory agency is required, Resolution Consultants has 15 minutes from the time of the spill/release to officially report it.**

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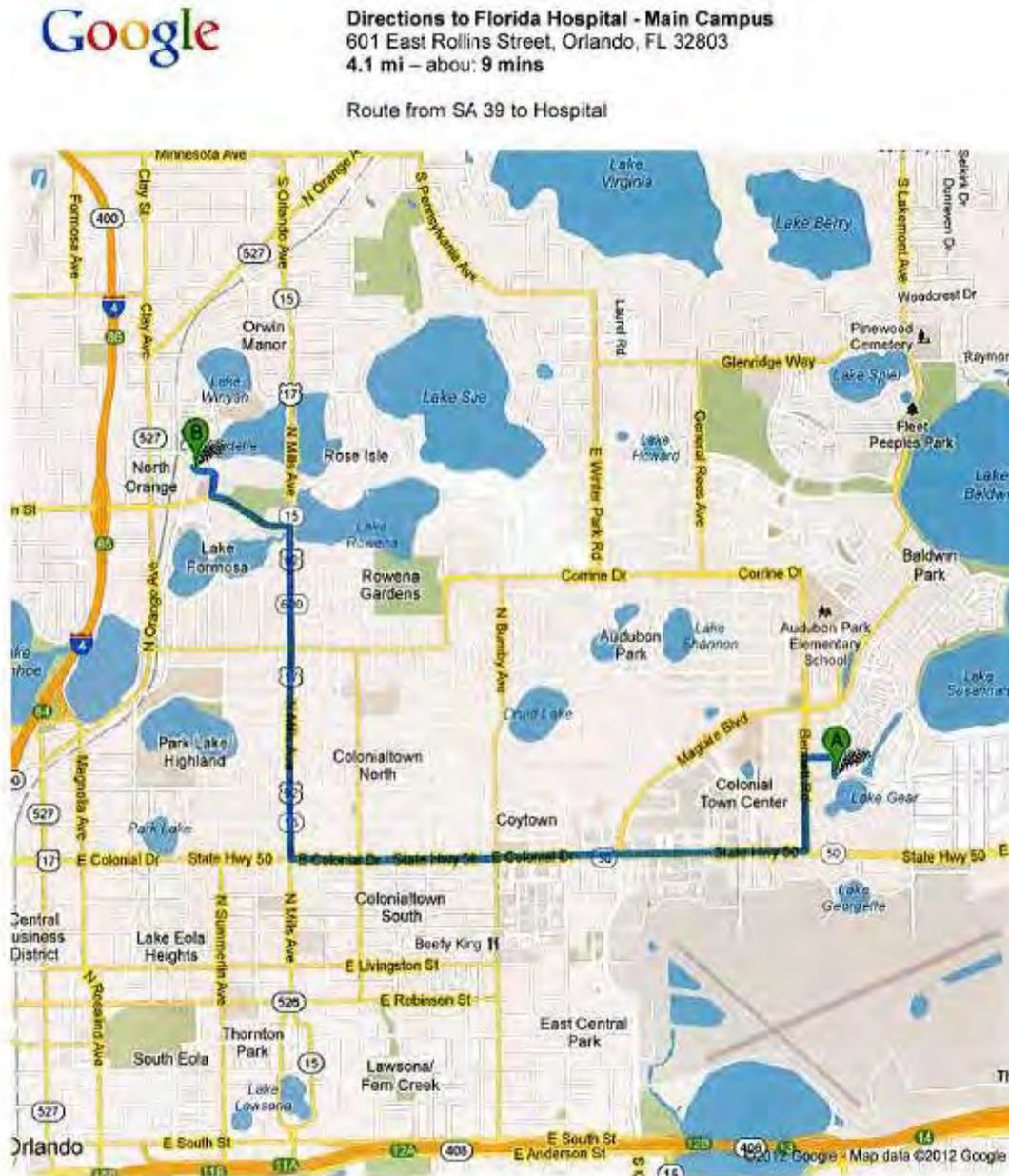
Figure 10-1 Emergency Occupational Hospital Route/Detail Map (OU 4)



Exit the work area south on Warehouse Rd. Turn right at Maguire Blvd, then right at Colonial Drive (SR 50). Travel west to Mills Avenue (US 17-92). Turn right and head north on Mills Avenue to Princeton Street. Turn left on Princeton Street, then right into hospital.

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Figure 10-2 Emergency Occupational Hospital Route/Detail Map (SA 39)



From the work area, head west to Bennett Road. Turn left on Bennett Road and head south to Colonial Drive (SR 50). Travel west to Mills Avenue (US 17-92). Turn right and head north on Mills Avenue to Princeton Street. Turn left on Princeton Street, then right into hospital.

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Attachment 1
Cross Reference Table

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The following cross-reference table provides information concerning the corresponding elements between the HASP and the accident prevention plan (APP) outline presented in Appendix A of the 2008 United States Army Corps of Engineers (USACE) *Safety and Health Requirements Manual*, EM-385-1-1. The format, content, procedures, and requirements in this HASP are directed solely to meet the onsite needs of Resolution Consultants’ field workers and subcontractors who will be performing the work activities addressed in the HASP. Consequently, the document does not address any non site-specific safety performance requirements or programs, except to specify site/task-level site implementation in the work force. Nor does the HASP attempt to duplicate or reproduce any of Resolution Consultants’ Corporate Safety, Health, and Environmental (SH&E) Program requirements, or information, except where specifying site-specific implementation needs¹. APP outline elements, which are not site specific, and are only addressed in Resolution Consultants’ Corporate SH&E Program (rather than the HASP), are so indicated.

USACE Accident Prevention Plan Requirement	Resolution Consultants’ Health and Safety Plan Section
1. SIGNATURE SHEET.	An Approval page is located at the front of the HASP. The CTO manager and health and safety manager provide signed approval of the FINAL (not Draft) version of the HASP.
2. BACKGROUND INFORMATION. List the following:	
a. Contractor	HASP Cover and Section 1.
b. Contract number	HASP Cover and Section 1.
c. Project name	HASP Cover and Section 1.
d. Brief project description, description of work to be performed, and location (map)	HASP Section 2. Information is presented in the Work Plan and will be available on the work site.
e. Contractor accident experience (provide information such as EMR, OSHA 200 Forms, corporate safety trend analyses)	This information is not site/project specific, and hence is not included as part of HASP.
f. Listing of phases of work and hazardous activities requiring activity hazards analyses	HASP Section 2.2.
3. STATEMENT OF SAFETY AND HEALTH POLICY.	HASP Section 1.2.
4. RESPONSIBILITIES AND LINES OF AUTHORITIES.	
a. Identification and accountability of personnel responsible for safety – at both corporate and project level	HASP Section 8.
b. Lines of authority	HASP Section 8.
c. Names of Competent Persons	HASP Section 4.2.1
d. Competent Person Role	HASP Section 4.2.1

¹ Resolution Consultants’ Corporate Health and Safety Program documentation was provided to NAVFAC Pacific and accepted as part of the CLEAN Contract award process. Since these Programs are not site-specific they are not included as part of the CTO’s work planning document submittals.

USACE Accident Prevention Plan Requirement	Resolution Consultants' Health and Safety Plan Section
e. Requirements for pre-task hazard analysis.	HASP Section 3.5
f. Lines of Authority	HASP Section 8.
g. Non-compliance policies and Procedures	Information not included in HASP. Programmatic level documents/plans.
h. Manager/Supervisor accountability for safety.	HASP Section 8.
5. SUBCONTRACTORS AND SUPPLIERS. Provide the following:	
a. Identification of subcontractors and suppliers (if known)	HASP Executive Summary and Section 2.
b. Means for controlling and coordinating subcontractors and suppliers	HASP Section 8.6
c. Safety responsibilities of subcontractors and suppliers	HASP Section 8.6
6. TRAINING.	
a. List subjects to be discussed with employees in safety indoctrination	HASP Section 4.2
b. List mandatory training and certifications, which are applicable to this project and any requirements for periodic retraining/recertification	HASP Section 4.1 through 4.5
c. Identify requirements for emergency response training (if applicable)	HASP Section 10
d. Outline requirements (who attends, when given, who will conduct etc.) for supervisory and employee safety meetings	HASP Section 4.3
7. SAFETY AND HEALTH INSPECTIONS.	
a. Who will conduct safety inspections, when inspections will be conducted, how the inspections will be recorded, deficiency tracking system, follow-up procedures, etc	HASP Section 8. Resolution Consultants' site audit policies are also part of our Corporate SH&E Program documentation.
b. Any external inspections/certifications which may be required	HASP Section 4.9
8. ACCIDENT REPORTING.	
a. Exposure data (man hours worked).	This information is part of Resolution Consultants' Corporate SH&E Program and are not included in this HASP.
b. Accident investigations, reports, logs.	HASP Section 8, 10.5 and 10.6
c. Requirements for immediate notifications	HASP Section 10.5 and Attachment 6
9. PLANS (PROGRAMS, PROCEDURES) REQUIRED BY THE SAFETY MANUAL (as applicable).	
a. Layout plans (04.A.01)	HASP Section 2 (if applicable)
b. Emergency response plans:	HASP Section 10
- procedures and tests (01.E.01)	HASP Section 10.3
- spill plans (01.E.01, 06.A.02)	HASP Section 10.4 and 10.6

USACE Accident Prevention Plan Requirement	Resolution Consultants' Health and Safety Plan Section
- firefighting plan (01.E.01, Section 19)	Not applicable. Resolution Consultants' policy is to notify professional fire response agencies immediately in the event of fire. Resolution Consultants do not perform fire fighting activities.
- posting of emergency telephone numbers (01.E.05)	HASP Section 10, Table 10-1
- man overboard/abandon ship (19.A.04)	HASP Section 10 (if applicable)
- Medical Support (Section 03.A.02; 03.D)	HASP Section 10.3, Table 10-2
c. Prevention of alcohol and drug abuse (01.C.02)	Information not included in HASP. Programmatic level documents/plans.
d. Site Sanitation Plan (Section 02)	HASP Section 4.7.3
e. Access and haul road plan (4.B)	HASP Section 2 (if applicable)
f. Respiratory protection plan (05.G)	HASP Section 7
g. Health hazard control program (06.A)	HASP Section 5 and individual Task Hazard Analyses presented in Attachment 3.
h. Hazard communication program (06.B.01)	HASP Section 4.4
i. Process Safety Management Plan (06.B.04)	HASP Section 5 (if applicable)
j. Lead abatement plan (06.B.05 & specifications)	Provided as Attachment 9 if applicable.
k. Asbestos abatement plan (06.B.05 & specifications)	Provided as Attachment 9 if applicable.
l. Radiation Safety Program (06.E.03.a)	Provided as Attachment 9 if applicable.
m. Abrasive blasting (06.H.01)	Provided as Attachment 9 if applicable.
n. Heat/Cold Stress Monitoring Plan (06.I.02)	HASP Section 5.3
o. Crystalline Silica Monitoring Plan (assessment) (06.M)	Provided as Attachment 9 if applicable.
p. Night Operations Lighting Plan (07.A.08)	Provided as Attachment 9 if applicable.
q. Fire Prevention Plan (09.A)	HASP Section 10 and individual Task Hazard Analyses presented in Attachment 3.
r. Wild Land Fire Management Plan (09.K)	Provided as Attachment 9 if applicable.
s. Hazardous energy control plan (12.A.01)	HASP Section 3.
t. Critical lift plan (16.H)	Provided as Attachment 9 if applicable.
u. Contingency plan for severe weather (19.A.03)	HASP Section 3.4 and Table 10-2
v. Float Plan (19.F.04)	Provided as Attachment 9 if applicable.
w. Site Specific Fall Protection & Prevention Plan (21.C)	Provided as Attachment 9 if applicable.
x. Demolition plan (to include engineering survey) (23.A.01)	Provided as Attachment 9 if applicable.

USACE Accident Prevention Plan Requirement	Resolution Consultants' Health and Safety Plan Section
y. Excavation/Trenching Plan (25.A.01)	HASP Section 2
z. Emergency rescue (tunneling) (26.A)	HASP Section 10 (if applicable)
aa. Underground construction fire prevention and protection plan (26.D.01)	HASP Section 10 (if applicable)
bb. Compressed air plan (26.I.01)	Provided as Attachment 9 if applicable.
cc. Formwork and shoring erection and removal plans (27.C)	Provided as Attachment 9 if applicable.
dd. Pre-cast concrete plans (27.D)	Provided as Attachment 9 if applicable
ee. Lift slab plans (27.E)	Provided as Attachment 9 if applicable
ff. Steel Erection Plan (27.F.01)	Provided as Attachment 9 if applicable
gg. Site Safety & Health Plan for HTRW Work (28.B)	Refer to HASP, Section 1
hh. Blasting plan (29.A.01)	Provided as Attachment 9 if applicable
ii. Diving plan (30.A.13)	Provided as Attachment 9 if applicable
jj. Confined Space Program (34.A)	HASP Section 4.5 (if applicable)
10. Risk Management Processes	
a. Hazards and Controls outlined in Activity Hazard Analysis for each major phase/activity of work (01.A.13)	HASP Section 3.5. Individual Task Hazard Analyses presented in Attachment 3.

CLEAN Comprehensive Long-Term Environmental Action Navy

CTO contract task order

EMR experience modification ratio

HASP Health and Safety Plan

IDW investigation derived waste

OSHA Occupational Safety and Health Administration

PPE personal protective equipment

SH&E Safety, Health, and Environment

SOP standard operating procedure

USACE United States Army Corps of Engineers

Attachment 2
HASP Revision Table

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Site Health and Safety Plan
NTC Orlando
Revision History

Revision No.	Revision Date	Approved By (Initials)	Changes, Discussion
1	3/2012	JK	Addition of Soil and Groundwater Sampling at Building 148/SA 56 at Area C Southwest

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Attachment 3
Task Hazard Analysis

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Task Hazard Analysis (THA)

Activity/Work Task: Drilling (Well Installation/ Abandonment)	Overall Risk Assessment Code (RAC) (Use highest code)	M				
Project Location: OPERABLE UNIT 4, STUDY AREA 39 NAVAL TRAINING CENTER, ORLANDO, FLORIDA	Risk Assessment Code (RAC) Matrix					
Project Number: 60270384	Severity	Probability				
Date Prepared: 10/25/2012		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title): Rhonda Gibson/ Site Safety Officer	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
Reviewed by (Name/Title): Russell Reynolds/ H&S Specialist	Negligible	M	L	L	L	L
Notes: (Field Notes, Review Comments, etc.) The drilling contractor will conduct these activities in accordance with Florida Department of Environmental Regulations policies.	Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above)					
	"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.				RAC Chart	
	"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible				E = Extremely High Risk	
	Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.				H = High Risk	
M = Moderate Risk						
L = Low Risk						
Recommended PPE: <input checked="" type="checkbox"/> Safety Glasses With Sideshields <input checked="" type="checkbox"/> Steel-Toed Boots <input checked="" type="checkbox"/> Hard Hat <input checked="" type="checkbox"/> Nitrile Gloves <input type="checkbox"/> Leather Gloves <input checked="" type="checkbox"/> Hearing Protection <input type="checkbox"/> Flame Retardant Clothing						
Job Steps	Hazards	Controls				RAC
General Physical Hazards	<ul style="list-style-type: none"> Slip/Trip/Fall Cold/Heat Stress Biological Hazards Cuts/Scrapes/Bruises Manual lifting 	<ul style="list-style-type: none"> Level D PPE required. Maintain a clean and organized work area. Watch your step and ensure proper footing. Provide drinking water and first aid kit. Wear appropriate clothing for weather conditions. Assess work area for poisonous plants and animals and communicate observations to avoid them. Wear appropriate work gloves for task Use proper lifting techniques by bending and lifting with legs and not back, and do not over extend or twist (Do not lift over 49lb. without assistance) 				L
	<ul style="list-style-type: none"> Adverse Weather 	<ul style="list-style-type: none"> Be aware of changing weather condition and provide appropriate weather gear. When work is halted due to inclement weather, personnel are to seek shelter in vehicles or building designated Shelter in Place (SIP) 				

Job Steps	Hazards	Controls	RAC
Mobilization / Site Set Up	<ul style="list-style-type: none"> Slips, Trips, Falls 	<ul style="list-style-type: none"> Clear trees, roots, weeds, limbs and other ground hazards from the drilling location. Practice good housekeeping to keep the ground around the drilling site clear of obstructions, equipment, and other tripping hazards. Wear appropriate foot protection to prevent slips and trips. Use caution when working on uneven and wet ground surfaces. 	L
	<ul style="list-style-type: none"> General equipment hazards <ul style="list-style-type: none"> Overhead and underground utilities Noise Hazard Pinch points/swing radius Chemical exposure potential Eye Injury Fire 	<ul style="list-style-type: none"> All equipment will be properly secured during transport. All vehicles and equipment will comply with DOT requirements. Never move the drill rig with the mast upright. Ensure the sampling site foundation is stable and as level as possible. Use a ground guide along with a functioning back-up alarm during equipment backing. Confirm Utility Locations Inspect vehicles and equipment daily (Checklists provided in HASP) Maintain clean and organized work area. Wear appropriate clothing and PPE, (no loose clothing or jewelry) Earplugs and/or ear muffs required in EZ Position the drill rig and personnel up wind of drilling location Monitoring breathing zone with PID and upgrade PPE as required. Avoid creating splash hazards while drilling. Keep a safe distance from drill rig. Use hand signals, keep clear of moving equipment, and ensure eye contact with operator prior to approaching. Have fire extinguisher on site. 	
	<ul style="list-style-type: none"> Contact with utilities 	<ul style="list-style-type: none"> Inspect for buried and overhead utilities in the vicinity of the drilling location. Clearance will be required, as stipulated in the HASP. 	
	<ul style="list-style-type: none"> Traffic in adjacent roadway 	<ul style="list-style-type: none"> Use combination of vehicles, cones, traffic barriers, and caution tape 	
Boring Process	<ul style="list-style-type: none"> Cuts 	<ul style="list-style-type: none"> Wear appropriate work gloves to prevent cuts, lacerations 	M
	<ul style="list-style-type: none"> Dermal Contact 	<ul style="list-style-type: none"> Wear appropriate protective clothing to avoid dermal or personal clothing contact with sampled material. 	

Job Steps	Hazards	Controls	RAC
	<ul style="list-style-type: none"> • Slips, Trips, Falls 	<ul style="list-style-type: none"> • Clear trees, roots, weeds, limbs and other ground hazards from the drilling location. Practice good housekeeping to keep the ground around the drilling site clear of obstructions, equipment and other tripping hazards. Wear appropriate foot protection to prevent slips and trips. Use caution when working on uneven and wet ground surfaces. 	
	<ul style="list-style-type: none"> • Volatile Organic Compounds (VOCs) 	<ul style="list-style-type: none"> • If the results of previous surveys indicate the presence of VOCs in hazardous levels, rig operators should be prepared to protect both personnel and equipment from VOC inhalation and flammable atmospheres. 	
Drill Rod / Auger / Tool Handling	<ul style="list-style-type: none"> • Struck By 	<ul style="list-style-type: none"> • Drill rods and augers stored and transported in racks shall be blocked to prevent shifting. Unload drill rods and augers layer by layer. Be prepared for sudden shifting when tailing rod sections. Keep a wide base and secure footing. 	M
	<ul style="list-style-type: none"> • Back Strain 	<ul style="list-style-type: none"> • Use proper lifting techniques when manually handling rods, augers and tools. Use mechanical equipment during lifting whenever possible. Use the buddy system when lifting tools and supplies. 	
Hoisting Operations	<ul style="list-style-type: none"> • Struck By 	<ul style="list-style-type: none"> • Never engage the rotary clutch until all personnel and equipment are clear. Never leave the brake unattended when engaged. Drill rods and auger sections should not be picked up or dropped suddenly. Do not lift more than 10 feet of augers or one joint of pipe between tool breaks. Test the brakes daily. Use caution when drilling in wet or damp conditions. Suspend drilling activities if moisture comprises the performance of the braking mechanism. 	M
Catline Operations	<ul style="list-style-type: none"> • Struck By 	<ul style="list-style-type: none"> • Do not use more wraps than necessary to lift the load. More than one layer of wraps on the cathead is not allowed. Personnel should not stand near, step over or go under the cathead rope under tension. The cathead must be kept clear of obstructions and entanglements. Never leave the cathead unattended when engaged. Do not stand under the object being lifted with the cathead. 	M
Derrick Operations	<ul style="list-style-type: none"> • Falls 	<ul style="list-style-type: none"> • The mast should be lowered, if possible, to make repairs or to free up entangled wire rope or obstructions. If the mast must be ascended while upright, a proper ladder safety climbing device or safety block system must be used in conjunction with a full body harness. 	M
Auger Operations	<ul style="list-style-type: none"> • Struck By 	<ul style="list-style-type: none"> • Use a long handled flat head shovel when removing auger cuttings. Stay away from the augers when rotating. Prevent shovel from lodging into the augers and kicking out. Do not wear loose clothing or dangling jewelry when working with augers. Long hair must be tucked under PPE. 	L

Job Steps	Hazards	Controls	RAC
Maintenance	<ul style="list-style-type: none"> Equipment 	<ul style="list-style-type: none"> The drilling rig and associated equipment must be maintained in a proper functioning condition. All motors must be shut off and electrical, mechanical and hydraulic components locked out of service when making repairs. All equipment must be inspected daily prior to use. Equipment must be operated and maintained in accordance with manufacturer's guidelines. Safety shutoff system must be tested daily and not disabled. Bleed off pressure on hydraulic lines before undoing fittings. Do not leave tools or parts loose on the rig after maintenance has been performed. 	L
	<ul style="list-style-type: none"> Fire 	<ul style="list-style-type: none"> All motors must be shut off during refueling. Smoking in the vicinity of the drilling rig is not permitted. An A-B-C fire extinguisher must be maintained on the drilling rig and associated motorized equipment. Fuel containers will not be stored within 10' of the drilling rig motor. Fuel will be stored in UL approved safety containers with contents clearly labeled. 	
Pumping / Grouting	<ul style="list-style-type: none"> Blow Out 	<ul style="list-style-type: none"> The pump must not exceed the maximum rated pressure of grout and mud lines. High-pressure lines must be secured to the rig. Lines and hoses must be inspected daily and replaced if worn or damaged. Engage pump in low gear, then shift to subsequent higher gears. 	L
Hazardous Drilling Locations	<ul style="list-style-type: none"> Fire/explosion 	<ul style="list-style-type: none"> Special procedures will be implemented when drilling in known natural gas locations, such as special mud procedures and blow out preventers. 	M
Sample collection and packaging	<ul style="list-style-type: none"> Chemical exposure potential 	<ul style="list-style-type: none"> Follow proper decontamination procedures 	L
	<ul style="list-style-type: none"> Cuts/Scrapes 	<ul style="list-style-type: none"> Inspect glassware for breakage and avoid sharp edges and wear gloves (nitrile and cut resistant leather or Kevlar) 	
	<ul style="list-style-type: none"> Manual lifting of equipment 	<ul style="list-style-type: none"> Use proper lifting techniques and do not over-extend 	
Rig decontamination	<ul style="list-style-type: none"> High pressure water Splash Hazard 	<ul style="list-style-type: none"> Spray away from body Wear full-face shield, gloves, rubber boots, and Tyvek or other suitable attire. 	L

Chemical Hazards and Monitoring Procedures

Chemical Hazard(s) (list):	
Applicable HASP Section(s):	
Monitoring Instrument(s):	

Additional Safety Considerations

1. Ensure all personnel have read the HASP
2. Ensure all equipment is equipped with necessary fire extinguishers (min 5 lbs BC). Ensure equipment has a working kill switch and back-up alarms, and

Additional Safety Considerations

- follow equipment inspection procedures.
3. Ensure underground utilities are verified with facility, marked, markings maintained, and operator aware of location
 4. All equipment operators must be Competent Persons for the task/equipment being performed/operated.
 5. All ground personnel must stay clear of equipment and make eye contact (and receive confirmation) with operator prior to approaching. Wear high visibility reflective vests and stay out of travel lanes and swing radius of heavy equipment.
 6. Dust hazard expected to be minimal due to saturated state of soils and regular precipitation. If visible emissions of dust observed, then dust suppression techniques will be implemented.
 7. Follow safe driving procedures. Always use the buddy system when moving vehicles. Plan your travel path ahead of time Use maps and known construction zones to make your selection. Consult with the other team members before making any changes to travel path.
 8. Use an equipment checklist to verify you have the appropriate equipment/tools for your tasks. Consult appropriate THAs or SOPs.
 9. Stow all materials in vehicle properly; use appropriate cases and bags. Secure equipment in bed of truck with netting or straps. Do not leave any equipment loose in the cab or bed of the truck. It can cause property damage or serious injuries by falling from vehicle.
 10. When securing equipment, watch for pinch points. Straps and netting can get caught on objects and snap back as well as trap a finger if hand placement is not correct. Use a buddy to help secure equipment when possible.
 11. Conduct equipment inspection of all hoses and switches. Stay clear of running equipment.
 12. Maintain good housekeeping practices. When possible, use mechanical equipment to perform lifting of heavy objects. When lifting, follow safe lifting practices. Use the buddy system when lifting.
 13. Stay clear of moving rig, do not move rig with mast raised, do not drive on slopes greater than 30 degrees, avoid soft areas when moving rig and setting up, and chock wheels. Use spotter when moving rig, check for overhead obstructions.
 14. Wear nitrile gloves when collecting samples in soil to avoid dermal contact with potential contaminants. Be observant for tripping hazards, holes, stickups, vines, old fence wire, etc.
 15. For equipment decontamination, triple rinse using distilled or deionized water andalconox for first rinse and distilled or deionized water for second and third rinses. Always clean materials between locations and at the site. Do not bring equipment back to the office without proper decontamination.

Additional Operational Safety Procedures	PPE
SH&E 305, Hand & Power Tools SH&E 308, Manual Lifting SH&E 313, Wildlife, Plants, Insects SH&E 405, Drilling and Boring SH&E 406, Overhead Electrical Lines SH&E 417, Identifying Underground Utilities SH&E 508, Hazardous Materials and Sample Shipping SH&E 511, Heat Stress	LEVEL D <ul style="list-style-type: none"> • ANSI approved hard hat • ANSI approved safety glasses • Shirts with sleeves and full-length pants. • ANSI approved steel safety-toe boots or approved equivalent. • High visibility reflective traffic vest • Nitrile Gloves • Leather work gloves • Hearing protection required when around operating machines (85 dBA). • First aid kit (located in vehicle). • Fire extinguisher (located in vehicle). Modified LEVEL D (biohazard avoidance) <ul style="list-style-type: none"> • Tyvek suit LEVEL C (upgrade per Air Monitoring Requirements) <ul style="list-style-type: none"> • APR with OV/P100 cartridges ; change cartridges daily

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
Drill Rig	Sampling to be performed by competent person as certified by employer.	Equipment will be inspected daily by the rig operator. Any safety deficiencies detected will require cessation of sampling activities until appropriate repairs have been made.

Acknowledgement

All employees, subcontractors, and visitors must sign the Acknowledgement form, in this section, before conducting field activities at this site.

By signing this form, Resolution Consultants employees agree that:

- I have read this Task Hazard Analysis and I understand the requirements of the THA.
- I will conduct work at this site in accordance with the requirements of the THA.

By signing this form, subcontractors and visitors agree that:

- I have read and understood the potential hazards associated with the site.
- I will ensure compliance with my company's policies on health and safety.

Task Hazard Analysis (THA)

Activity/Work Task: Remediation System – Component Repair/Replacement	Overall Risk Assessment Code (RAC) (Use highest code)	L				
Project Location: OPERABLE UNIT 4, NAVAL TRAINING CENTER, ORLANDO, FLORIDA	Risk Assessment Code (RAC) Matrix					
Project Number: 60270384	Severity	Probability				
Date Prepared: 10/25/2012		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title): Rhonda Gibson/ Site Safety Officer	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
Reviewed by (Name/Title): Russell Reynolds/ H&S Specialist	Negligible	M	L	L	L	L
Notes: (Field Notes, Review Comments, etc.) Work will include but not be limited to: <ul style="list-style-type: none"> Cleaning and troubleshooting of recovery, injection and treatment equipment (pumps, compressors, blowers, etc.). 	Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above)					
	"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.				RAC Chart	
	"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible				E = Extremely High Risk	
	Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.				H = High Risk	
Recommended PPE: <input checked="" type="checkbox"/> Safety Glasses With Sideshields <input checked="" type="checkbox"/> Steel-Toed Boots <input checked="" type="checkbox"/> Hard Hat <input checked="" type="checkbox"/> Nitrile Gloves <input type="checkbox"/> Leather Gloves <input checked="" type="checkbox"/> Hearing Protection <input type="checkbox"/> Flame Retardant Clothing						
Job Steps	Hazards	Controls				RAC
General Physical Hazards	<ul style="list-style-type: none"> Slip/Trip/Fall Cold/Heat Stress Biological Hazards Cuts/Scrapes/Bruises Manual lifting 	<ul style="list-style-type: none"> Level D PPE required. Maintain a clean and organized work area. Watch your step and ensure proper footing. Provide drinking water and first aid kit. Wear appropriate clothing for weather conditions. Assess work area for poisonous plants and animals and communicate observations to avoid them. Wear appropriate work gloves for task Use proper lifting techniques by bending and lifting with legs and not back, and do not over extend or twist (Do not lift over 49lb. without assistance) 				L
	<ul style="list-style-type: none"> Adverse Weather 	<ul style="list-style-type: none"> Be aware of changing weather condition and provide appropriate weather gear. When work is halted due to inclement weather, personnel are to seek shelter in vehicles or building designated Shelter in Place (SIP) 				

Job Steps	Hazards	Controls	RAC
Maintenance / General Repair Work	<ul style="list-style-type: none"> Slips, Trips, Falls 	<ul style="list-style-type: none"> Level D PPE required. Maintain a clean and organized work area. Watch your step and ensure proper footing. Wear appropriate foot protection to prevent slips and trips. Use caution when working on uneven and wet ground surfaces. 	L
	<ul style="list-style-type: none"> General equipment hazards <ul style="list-style-type: none"> Mechanical/Physical Hazard Noise Hazard Eye Injury Fire 	<ul style="list-style-type: none"> All vehicles and equipment will comply with DOT requirements. Inspect vehicles and equipment daily (Checklists provided in HASP) Be aware of physical hazards associated with small equipment (pinch points, small moving parts, etc.) Maintain clean and organized work area. Wear appropriate clothing and PPE, (no loose clothing or jewelry) Wear earplugs and/or ear muffs as required around noisy equipment. Avoid creating splash hazards while repairing equipment Have fire extinguisher on site. 	
	<ul style="list-style-type: none"> Electrical/Lockout/Tagout 	<ul style="list-style-type: none"> De-energize and Lockout/Tagout all applicable electrical circuits during maintenance 	

Chemical Hazards and Monitoring Procedures	
Chemical Hazard(s) (list):	
Applicable HASP Section(s):	
Monitoring Instrument(s):	

Additional Safety Considerations
<ol style="list-style-type: none"> Ensure all personnel have read the HASP Ensure all equipment is equipped with necessary fire extinguishers (min 5 lbs BC). Ensure equipment has a working kill switch and back-up alarms, and follow equipment inspection procedures. Ensure underground utilities are verified with facility, marked, markings maintained, and operator aware of location All equipment operators must be Competent Persons for the task/equipment being performed/operated. All ground personnel must stay clear of equipment and make eye contact (and receive confirmation) with operator prior to approaching. Wear high visibility reflective vests and stay out of travel lanes and swing radius of heavy equipment. Dust hazard expected to be minimal due to saturated state of soils and regular precipitation. If visible emissions of dust observed, then dust suppression techniques will be implemented. Follow safe driving procedures. Always use the buddy system when moving vehicles. Plan your travel path ahead of time Use maps and known construction zones to make your selection. Consult with the other team members before making any changes to travel path. Use an equipment checklist to verify you have the appropriate equipment/tools for your tasks. Consult appropriate THAs or SOPs. Stow all materials in vehicle properly; use appropriate cases and bags. Secure equipment in bed of truck with netting or straps. Do not leave any

Additional Safety Considerations

- equipment loose in the cab or bed of the truck. It can cause property damage or serious injuries by falling from vehicle.
10. When securing equipment, watch for pinch points. Straps and netting can get caught on objects and snap back as well as trap a finger if hand placement is not correct. Use a buddy to help secure equipment when possible.
 11. Conduct equipment inspection of all hoses and switches. Stay clear of running equipment.
 12. Maintain good housekeeping practices. When possible, use mechanical equipment to perform lifting of heavy objects. When lifting, follow safe lifting practices. Use the buddy system when lifting.
 13. Stay clear of moving rig, do not move rig with mast raised, do not drive on slopes greater than 30 degrees, avoid soft areas when moving rig and setting up, and chock wheels. Use spotter when moving rig, check for overhead obstructions.
 14. Wear nitrile gloves when collecting samples in soil to avoid dermal contact with potential contaminants. Be observant for tripping hazards, holes, stickups, vines, old fence wire, etc.
 15. For equipment decontamination, triple rinse using distilled or deionized water andalconox for first rinse and distilled or deionized water for second and third rinses. Always clean materials between locations and at the site. Do not bring equipment back to the office without proper decontamination.

Additional Operational Safety Procedures	PPE
SH&E 305, Hand & Power Tools SH&E 308, Manual Lifting SH&E 313, Wildlife, Plants, Insects SH&E 406, Overhead Electrical Lines SH&E 417, Identifying Underground Utilities SH&E 511, Heat Stress	LEVEL D <ul style="list-style-type: none"> • ANSI approved hard hat • ANSI approved safety glasses • Shirts with sleeves and full-length pants. • ANSI approved steel safety-toe boots or approved equivalent. • High visibility reflective traffic vest • Nitrile Gloves • Leather work gloves • Hearing protection required when around operating machines (85 dBA). • First aid kit (located in vehicle). • Fire extinguisher (located in vehicle). LEVEL C (upgrade per Air Monitoring Requirements) <ul style="list-style-type: none"> • APR with OV/P100 cartridges ; change cartridges daily

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements

Acknowledgement

All employees, subcontractors, and visitors must sign the Acknowledgement form, in this section, before conducting field activities at this site.

By signing this form, Resolution Consultants employees agree that:

- I have read this Task Hazard Analysis and I understand the requirements of the THA.
- I will conduct work at this site in accordance with the requirements of the THA.

By signing this form, subcontractors and visitors agree that:

- I have read and understood the potential hazards associated with the site.
- I will ensure compliance with my company's policies on health and safety.

Task Hazard Analysis (THA)

Activity/Work Task: Warehouse equipment and material removal	Overall Risk Assessment Code (RAC) (Use highest code)	M				
Project Location: NTC Orlando, FL	Risk Assessment Code (RAC) Matrix					
Project Number:	Severity	Probability				
Date Prepared: 12/20/2012		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title): Greg Gillaspay/Construction Manager	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
Reviewed by (Name/Title):	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L
Notes: (Field Notes, Review Comments, etc.)	Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above)					
	"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.				RAC Chart	
	"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible				E = Extremely High Risk	
	Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.				H = High Risk	
M = Moderate Risk						
L = Low Risk						
Recommended PPE:						
<input checked="" type="checkbox"/> Safety Glasses With Sideshields <input checked="" type="checkbox"/> Steel-Toed Boots <input checked="" type="checkbox"/> Hard Hat <input type="checkbox"/> Nitrile Gloves <input checked="" type="checkbox"/> Leather Gloves <input type="checkbox"/> Hearing Protection <input checked="" type="checkbox"/> Reflective Vest						
Job Steps	Hazards	Controls				RAC
General Physical Hazards	<ul style="list-style-type: none"> Slip/Trip/Fall Cold/Heat Stress Biological Hazards Cuts/Scrapes/Bruises Manual lifting 	<ul style="list-style-type: none"> Level D PPE required. Maintain a clean and organized work area. Watch your step and ensure proper footing. Provide drinking water and first aid kit. Wear appropriate clothing for weather conditions. Assess work area for poisonous plants and animals and communicate observations to avoid them. Wear appropriate work gloves for task Use proper lifting techniques by bending and lifting with legs and not back, and do not over extend or twist (Do not lift over 49lb. without assistance) 				L
	<ul style="list-style-type: none"> Adverse Weather 	<ul style="list-style-type: none"> Be aware of changing weather condition and provide appropriate weather gear. When work is halted due to inclement weather, personnel are to seek shelter in vehicles or building designated Shelter in Place (SIP) 				

Job Steps	Hazards	Controls	RAC
Mobilization / Site Set Up	<ul style="list-style-type: none"> Slips, Trips, Falls 	<ul style="list-style-type: none"> Clear trees, roots, weeds, limbs and other ground hazards from the area. Practice good housekeeping to keep the ground around the area clear of obstructions, equipment, and other tripping hazards. Wear appropriate foot protection to prevent slips and trips. Use caution when working on uneven and wet ground surfaces. 	L
	<ul style="list-style-type: none"> General equipment hazards <ul style="list-style-type: none"> Overhead and underground utilities Noise Hazard Pinch points/swing radius Chemical exposure potential Eye Injury Fire 	<ul style="list-style-type: none"> Never move the equipment with the bucket or attachment elevated. Ensure the site is stable and as level as possible. Use a ground guide or a functioning back-up alarm during equipment backing. Confirm Utility Locations Inspect vehicles and equipment daily (Checklists provided in HASP) Maintain clean and organized work area. Wear appropriate clothing and PPE, (no loose clothing or jewelry) Earplugs and/or ear muffs required as required Keep a safe distance from equipment. Use hand signals, keep clear of moving equipment, and ensure eye contact with operator prior to approaching. Have fire extinguisher on site. 	
	<ul style="list-style-type: none"> Contact with utilities 	<ul style="list-style-type: none"> Inspect for buried and overhead utilities in the area. Clearance will be required, as stipulated in the HASP. 	
	<ul style="list-style-type: none"> Traffic in adjacent roadway 	<ul style="list-style-type: none"> Use combination of vehicles, cones, traffic barriers, and caution tape 	
Material and Equipment removal process	<ul style="list-style-type: none"> Cuts 	<ul style="list-style-type: none"> Wear appropriate work gloves to prevent cuts, lacerations 	M
	<ul style="list-style-type: none"> Dermal Contact 	<ul style="list-style-type: none"> Wear appropriate protective clothing to avoid dermal or personal contact with any liquid or solid materials. 	

Job Steps	Hazards	Controls	RAC
	<ul style="list-style-type: none"> Slips, Trips, Falls 	<ul style="list-style-type: none"> Clear trees, roots, weeds, limbs and other ground hazards from the area. Practice good housekeeping to keep the ground around the site clear of obstructions, equipment and other tripping hazards. Wear appropriate foot protection to prevent slips and trips. Use caution when working on uneven and wet ground surfaces. 	
	<ul style="list-style-type: none"> Back Strain 	<ul style="list-style-type: none"> Use proper lifting techniques when manually handling rods, augers and tools. Use mechanical equipment during lifting whenever possible. Use the buddy system when lifting heavy objects. 	
Skid Steer Operations	<ul style="list-style-type: none"> Tilting or tipping of equipment 	<ul style="list-style-type: none"> Always travel with the load close to the ground to keep the center of gravity low. Do not turn sharply with a load while entering into a grade, this can cause the equipment to roll. 	M
	<ul style="list-style-type: none"> Collision with personnel, equipment or structures. Back Strain 	<ul style="list-style-type: none"> Watch for other equipment, ground crew and other objects. Know the scope of work to be performed and what personnel and equipment will be working in the area. Make sure the equipment has a working back up alarm. Never back up blind, if you can't see get a spotter. 	

Chemical Hazards and Monitoring Procedures	
Chemical Hazard(s) (list):	
Applicable HASP Section(s):	
Monitoring Instrument(s):	

Additional Safety Considerations
<ol style="list-style-type: none"> Ensure all personnel have read the HASP Ensure all equipment is equipped with necessary fire extinguishers (min 5 lbs BC). Ensure equipment has a working kill switch and back-up alarms, and follow equipment inspection procedures. Ensure underground utilities are verified with facility, marked, markings maintained, and operator aware of location All equipment operators must be Competent Persons for the task/equipment being performed/operated. All ground personnel must stay clear of equipment and make eye contact (and receive confirmation) with operator prior to approaching. Wear high visibility reflective vests and stay out of travel lanes and swing radius of heavy equipment. Dust hazard expected to be minimal. If visible emissions of dust observed, then dust suppression techniques will be implemented. Follow safe driving procedures. Always use the buddy system when moving vehicles. Plan your travel path ahead of time Use maps and known construction zones to make your selection. Consult with the other team members before making any changes to travel path. Use an equipment checklist to verify you have the appropriate equipment/tools for your tasks. Consult appropriate THAs or SOPs. Stow all materials in vehicle properly; use appropriate cases and bags. Secure equipment in bed of truck with netting or straps. Do not leave any equipment loose in the cab or bed of the truck. It can cause property damage or serious injuries by falling from vehicle. When securing equipment, watch for pinch points. Straps and netting can get caught on objects and snap back as well as trap a finger if hand placement is not correct. Use a buddy to help secure equipment when possible. Conduct equipment inspection of all hoses and switches. Stay clear of running equipment. Maintain good housekeeping practices. When possible, use mechanical equipment to perform lifting of heavy objects. When lifting, follow safe lifting

Additional Safety Considerations

- practices. Use the buddy system when lifting.
13. Stay clear of moving equipment, do not drive on slopes greater than 30 degrees, avoid soft areas when moving, and chock wheels, check for overhead obstructions.
14. Wear gloves when handling materials. Be observant for tripping hazards, holes, stickups, vines, old fence wire, etc.

Additional Operational Safety Procedures	PPE
SH&E 305, Hand & Power Tools SH&E 308, Manual Lifting SH&E 313, Wildlife, Plants, Insects SH&E 309, Mobile and Heavy equipment SH&E 406, Overhead Electrical Lines SH&E 417, Identifying Underground Utilities SH&E 508, Hazardous Materials and Sample Shipping SH&E 511, Heat Stress	LEVEL D <ul style="list-style-type: none"> • ANSI approved hard hat • ANSI approved safety glasses • Shirts with sleeves and full-length pants. • ANSI approved steel safety-toe boots or approved equivalent. • High visibility reflective traffic vest • Leather work gloves • Hearing protection required when around operating machines (85 dBA). • First aid kit (located in vehicle). • Fire extinguisher (located in vehicle).

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
Tracked Skid Steer Loader	Operation to be performed by competent person as certified by employer.	Equipment will be inspected daily by the operator. Any safety deficiencies detected will require cessation of activities until appropriate repairs have been made.

Acknowledgement

All employees, subcontractors, and visitors must sign the Acknowledgement form, in this section, before conducting field activities at this site.

By signing this form, Resolution Consultants employees agree that:

- I have read this Task Hazard Analysis and I understand the requirements of the THA.
- I will conduct work at this site in accordance with the requirements of the THA.

By signing this form, subcontractors and visitors agree that:

- I have read and understood the potential hazards associated with the site.
- I will ensure compliance with my company's policies on health and safety.

Print Name & Company

Date

Signature

Print Name & Company

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Print Name & Company

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Task Hazard Analysis (THA)

Activity/Work Task: Soil Sampling, Hand Auger Use	Overall Risk Assessment Code (RAC) (Use highest code)	M
Project Location: Area C Southwest NAVAL TRAINING CENTER, ORLANDO, FLORIDA	Risk Assessment Code (RAC) Matrix	
Project Number: 60285781	Severity	Probability
Date Prepared: 3/1/2013		Frequent Likely Occasional Seldom Unlikely
Prepared by (Name/Title): Rhonda Gibson / Site Safety Officer	Catastrophic	E E H H M
Reviewed by (Name/Title): Russell Reynolds / H&S Specialist	Critical	E H H M L
	Marginal	H M M L L
Notes: (Field Notes, Review Comments, etc.)	Negligible	M L L L L
	<p>Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above)</p> <p>"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.</p> <p>"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible</p> <p>Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.</p>	
<p>Recommended PPE: <input checked="" type="checkbox"/> Safety Glasses With Sideshields <input checked="" type="checkbox"/> Steel-Toed Boots <input checked="" type="checkbox"/> Hard Hat <input checked="" type="checkbox"/> Nitrile Gloves <input checked="" type="checkbox"/> Leather Gloves <input type="checkbox"/> Hearing Protection <input type="checkbox"/> Flame Retardant Clothing</p>		
Job Steps	Hazards	Controls
General Physical Hazards	<ul style="list-style-type: none"> Slip/Trip/Fall Cold/Heat Stress Biological Hazards Cuts/Scrapes/Bruises Manual lifting 	<ul style="list-style-type: none"> Level D PPE required. Maintain a clean and organized work area. Watch your step and ensure proper footing. Provide drinking water and first aid kit. Wear appropriate clothing for weather conditions. Assess work area for poisonous plants and animals and communicate observations to avoid them. Wear appropriate work gloves for task Maintain 3 points of contact when climbing into vehicle Use proper lifting techniques by bending and lifting with legs and not back, and do not over extend or twist (Do not lift over 49lb. without assistance)
	<ul style="list-style-type: none"> Adverse Weather 	<ul style="list-style-type: none"> Be aware of changing weather condition and provide appropriate weather gear. When work is halted due to inclement weather, personnel are to seek shelter in vehicles or building designated Shelter in Place (SIP)
		RAC L

Establish EZ and unload/set-up equipment	<ul style="list-style-type: none"> Traffic in roadways and parking lots 	<ul style="list-style-type: none"> Use combination of vehicles, cones, traffic barriers and caution tape. A traffic plan may be necessary depending on location. 	L
	<ul style="list-style-type: none"> Cuts/scrapes 	<ul style="list-style-type: none"> Wear leather gloves. 	
	<ul style="list-style-type: none"> Struck by 	<ul style="list-style-type: none"> Exercise caution when moving auger extensions to avoid contact with other objects 	
Hand augering	<ul style="list-style-type: none"> Cuts/scrapes 	<ul style="list-style-type: none"> Wear leather gloves when using auger 	M
	<ul style="list-style-type: none"> Subsurface structures 	<ul style="list-style-type: none"> Watch for changes in soil types or other indications of backfill or non-native material. Stop if unanticipated items (e.g., steel objects) noted. 	
	<ul style="list-style-type: none"> Muscle strain 	<ul style="list-style-type: none"> Use proper lifting techniques and tools. When possible use buddy system when adding or removing T-handle, section of the shaft, or auger tip. Do not attempt excessive force if the auger does not turn. 	
	<ul style="list-style-type: none"> Underground utilities 	<ul style="list-style-type: none"> Inspect for buried and overhead utilities in the vicinity of the drilling location. Clearance will be required, as stipulated in the HASP. 	
	<ul style="list-style-type: none"> Exposure potential 	<ul style="list-style-type: none"> Use respiratory protection, depending on measurements. 	
IDW handling	<ul style="list-style-type: none"> Chemical Exposure Manual lifting Splash Hazard Spills 	<ul style="list-style-type: none"> Wear modified level D PPE when necessary (Tyvek and face shields or dust masks) Use respiratory protection, depending on measurements. Inspect Drums/Containers prior to use for integrity and contaminants Place used PPE and disposable sampling equipment in garbage bags to be disposed of properly. 	L
Sample collection and packaging	<ul style="list-style-type: none"> Chemical exposure potential 	<ul style="list-style-type: none"> Follow proper decontamination procedures 	L
	<ul style="list-style-type: none"> Cuts/Scrapes 	<ul style="list-style-type: none"> Inspect glassware for breakage and avoid sharp edges and wear gloves (nitrile and cut resistant leather or Kevlar) 	
	<ul style="list-style-type: none"> Manual lifting of equipment 	<ul style="list-style-type: none"> Use proper lifting techniques and do not over-extend 	
Decontamination	<ul style="list-style-type: none"> Chemical exposure potential Cuts/Scrapes Manual lifting of equipment 	<ul style="list-style-type: none"> Wear modified level D PPE when necessary (Tyvek and face shields or dust masks) Have portable eyewash on site Pour water from buckets into drums/containers as soon as practicable and lifting with legs. 	L

Chemical Hazards and Monitoring Procedures

Chemical Hazard(s) (list):	
Applicable HASP Section(s):	
Monitoring Instrument(s):	

Additional Safety Considerations

1. Ensure all personnel have read the HASP
2. Ensure all equipment is equipped with necessary fire extinguishers (min 5 lbs BC).
3. Follow safe driving procedures. Always use the buddy system when moving vehicles. Plan your travel path ahead of time. Use maps and known construction zones to make your selection. Consult with the other team members before making any changes to travel path.
4. Use an equipment checklist to verify you have the appropriate equipment/tools for your tasks. Consult appropriate THAs or SOPs.
5. Stow all materials in vehicle properly, use appropriate cases and bags. Secure equipment in bed of truck with netting or straps. Do not leave any equipment loose in the cab or bed of the truck. It can cause property damage or serious injuries by falling from vehicle.
6. When securing equipment, watch for pinch points. Straps and netting can get caught on objects and snap back as well as trap a finger if hand placement is not correct. Use a buddy to help secure equipment when possible.
7. Maintain good housekeeping practices. When possible, use mechanical equipment to perform lifting of heavy objects. When lifting, follow safe lifting practices. Use the buddy system when lifting.
8. Wear nitrile gloves when collecting samples in soil to avoid dermal contact with potential contaminants. Be observant for tripping hazards, holes, stickups, vines, old fence wire, etc.

Additional Operational Safety Procedures	PPE
SH&E 305, Hand & Power Tools SH&E 308, Manual Lifting SH&E 313, Wildlife, Plants, Insects SH&E 508, Hazardous Materials and Sample Shipping SH&E 511, Heat Stress	LEVEL D <ul style="list-style-type: none"> • ANSI approved hard hat • ANSI approved safety glasses • Shirts with sleeves and full-length pants. • ANSI approved steel safety-toe boots or approved equivalent. • High visibility reflective traffic vest if near moving vehicles • Nitrile Gloves • Leather work gloves • First aid kit (located in vehicle). • Fire extinguisher (located in vehicle). Modified LEVEL D (biohazard avoidance) <ul style="list-style-type: none"> • Tyvek suit LEVEL C (upgrade per Air Monitoring Requirements) <ul style="list-style-type: none"> • APR with OV/P100 cartridges ; change cartridges daily

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
Hand auger	To be performed by qualified person.	Equipment will be inspected prior to use. Any safety deficiencies detected will require cessation of sampling activities until appropriate repairs have been made.

Acknowledgement

All employees, subcontractors, and visitors must sign the Acknowledgement form, in this section, before conducting field activities at this site.

By signing this form, Resolution Consultants employees agree that:

- I have read this Task Hazard Analysis and I understand the requirements of the THA.
- I will conduct work at this site in accordance with the requirements of the THA.

By signing this form, subcontractors and visitors agree that:

- I have read and understood the potential hazards associated with the site.
- I will ensure compliance with my company's policies on health and safety.

Print Name & Company

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Task Hazard Analysis (THA)

Activity/Work Task: Groundwater Sampling, Monitoring Well Development	Overall Risk Assessment Code (RAC) (Use highest code)	L				
Project Location: Area C Southwest NAVAL TRAINING CENTER, ORLANDO, FLORIDA	Risk Assessment Code (RAC) Matrix					
Project Number: 60285781	Severity	Probability				
Date Prepared: 3/1/2013		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title): Rhonda Gibson / Site Safety Officer	Catastrophic	E	E	H	H	M
Reviewed by (Name/Title): Russell Reynolds / H&S Specialist	Critical	E	H	H	M	L
Notes: (Field Notes, Review Comments, etc.)	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L
Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above)		RAC Chart				
"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.		E = Extremely High Risk				
"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible		H = High Risk				
Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.		M = Moderate Risk				
Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.		L = Low Risk				
Recommended PPE: <input checked="" type="checkbox"/> Safety Glasses With Sideshields <input checked="" type="checkbox"/> Steel-Toed Boots <input checked="" type="checkbox"/> Hard Hat <input checked="" type="checkbox"/> Nitrile Gloves <input checked="" type="checkbox"/> Leather Gloves <input type="checkbox"/> Hearing Protection <input type="checkbox"/> Flame Retardant Clothing						
Job Steps	Hazards	Controls				RAC
General Physical Hazards	<ul style="list-style-type: none"> Slip/Trip/Fall Cold/Heat Stress Biological Hazards Cuts/Scrapes/Bruises Manual lifting 	<ul style="list-style-type: none"> Level D PPE required. Maintain a clean and organized work area. Watch your step and ensure proper footing. Provide drinking water and first aid kit. Wear appropriate clothing for weather conditions. Assess work area for poisonous plants and animals and communicate observations to avoid them. Wear appropriate work gloves for task Maintain 3 points of contact when climbing into vehicle Use proper lifting techniques by bending and lifting with legs and not back, and do not over extend or twist (Do not lift over 49lb. without assistance) 				L
	<ul style="list-style-type: none"> Adverse Weather 	<ul style="list-style-type: none"> Be aware of changing weather condition and provide appropriate weather gear. When work is halted due to inclement weather, personnel are to seek shelter in vehicles or building designated Shelter in Place (SIP) 				

Establish EZ around well and unload/set-up equipment	<ul style="list-style-type: none"> • Traffic in roadways and parking lots 	<ul style="list-style-type: none"> • Use combination of vehicles, cones, traffic barriers and caution tape. • A traffic plan may be necessary depending on location. 	L
	<ul style="list-style-type: none"> • Cuts/scrapes 	<ul style="list-style-type: none"> • Wear leather gloves. 	
	<ul style="list-style-type: none"> • Stacking heights 	<ul style="list-style-type: none"> • Avoid stacking equipment and boxes. 	
Open well and take water level measurement.	<ul style="list-style-type: none"> • Cuts/scrapes • Biological Hazards • Exposure potential 	<ul style="list-style-type: none"> • Wear leather gloves when un-bolting well lid • Look for spiders, scorpions, etc. in the well head. • Use ventilation procedures on each well, monitoring at well head and breathing zone. • Use respiratory protection, depending on measurements. • Wear nitrile gloves to remove plug and taking measurement. 	L
Sample/develop purge using a bailer or pump Well will be purged prior to sampling.	<ul style="list-style-type: none"> • Exposure potential • Cuts/scrapes • Electrical • Manual lifting 	<ul style="list-style-type: none"> • Wear nitrile gloves while taking flow rates • Monitor breathing zone continuously during sampling event. • Use respiratory protection, depending on measurements. • Ensure employees are properly trained in the use of the compressors, e.g., use correct contacts for 12 volt batteries and avoid arcing situations • Use proper lifting techniques and ergonomics awareness. • Use appropriate cutting devices for tubing boxes and proper tools for pump repairs/maintenance. 	L
IDW handling	<ul style="list-style-type: none"> • Chemical Exposure • Manual lifting • Splash Hazard • Spills 	<ul style="list-style-type: none"> • Wear modified level D PPE when necessary (Tyvek and face shields or dust masks) • Use respiratory protection, depending on measurements. • Have portable eyewash on site • Inspect Drums/Containers prior to use for integrity and contaminants • Pour water from buckets into drums/containers as soon as practicable. • Place used PPE and disposable sampling equipment in garbage bags to be disposed of properly. 	L
Sample collection and packaging	<ul style="list-style-type: none"> • Chemical exposure potential 	<ul style="list-style-type: none"> • Follow proper decontamination procedures 	L
	<ul style="list-style-type: none"> • Cuts/Scrapes 	<ul style="list-style-type: none"> • Inspect glassware for breakage and avoid sharp edges and wear gloves (nitrile and cut resistant leather or Kevlar) 	
	<ul style="list-style-type: none"> • Manual lifting of equipment 	<ul style="list-style-type: none"> • Use proper lifting techniques and do not over-extend 	
Decontamination	<ul style="list-style-type: none"> • Chemical exposure potential • Cuts/Scrapes • Manual lifting of equipment 	<ul style="list-style-type: none"> • Wear modified level D PPE when necessary (Tyvek and face shields or dust masks) • Have portable eyewash on site • Pour water from buckets into drums/containers as soon as practicable and lifting with legs. 	L

Chemical Hazards and Monitoring Procedures

Chemical Hazard(s) (list):

Applicable HASP Section(s):	
Monitoring Instrument(s):	

Additional Safety Considerations
<ol style="list-style-type: none"> 1. Ensure all personnel have read the HASP 2. Ensure all equipment is equipped with necessary fire extinguishers (min 5 lbs BC). 3. Follow safe driving procedures. Always use the buddy system when moving vehicles. Plan your travel path ahead of time. Use maps and known construction zones to make your selection. Consult with the other team members before making any changes to travel path. 4. Use an equipment checklist to verify you have the appropriate equipment/tools for your tasks. Consult appropriate THAs or SOPs. 5. Stow all materials in vehicle properly, use appropriate cases and bags. Secure equipment in bed of truck with netting or straps. Do not leave any equipment loose in the cab or bed of the truck. It can cause property damage or serious injuries by falling from vehicle. 6. When securing equipment, watch for pinch points. Straps and netting can get caught on objects and snap back as well as trap a finger if hand placement is not correct. Use a buddy to help secure equipment when possible. 7. Maintain good housekeeping practices. When possible, use mechanical equipment to perform lifting of heavy objects. When lifting, follow safe lifting practices. Use the buddy system when lifting. 8. Wear nitrile gloves when collecting samples in soil to avoid dermal contact with potential contaminants. Be observant for tripping hazards, holes, stickups, vines, old fence wire, etc.

Additional Operational Safety Procedures	PPE
SH&E 305, Hand & Power Tools SH&E 308, Manual Lifting SH&E 313, Wildlife, Plants, Insects SH&E 508, Hazardous Materials and Sample Shipping SH&E 511, Heat Stress	LEVEL D <ul style="list-style-type: none"> • ANSI approved hard hat • ANSI approved safety glasses • Shirts with sleeves and full-length pants. • ANSI approved steel safety-toe boots or approved equivalent. • High visibility reflective traffic vest if near moving vehicles • Nitrile Gloves • Leather work gloves • First aid kit (located in vehicle). • Fire extinguisher (located in vehicle). Modified LEVEL D (biohazard avoidance) <ul style="list-style-type: none"> • Tyvek suit LEVEL C (upgrade per Air Monitoring Requirements) <ul style="list-style-type: none"> • APR with OV/P100 cartridges ; change cartridges daily

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
Pump	Development to be performed by qualified person.	Equipment will be inspected prior to use. Any safety deficiencies detected will require cessation of sampling activities until appropriate repairs have been made.

Acknowledgement

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- I will conduct work at this site in accordance with the requirements of the THA.

By signing this form, subcontractors and visitors agree that:

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Attachment 4
Resolution Consultants Safety
Standard Operating Procedures

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5-213-Subcontractors

1.0 Purpose and Scope

- 1.1 Provides a process through which Resolution Subcontractors are evaluated to determine if the use of that Subcontractor will pose an unacceptable risk to Resolution and/or its clients, employees, equipment, or property.
- 1.2 This policy applies to all Resolution North America based operations.

2.0 Terms and Definitions

- 2.1 **Subcontractor:** Any contractor or organization procured to provide direct services for, or in support of, an Resolution managed activity or operation. This is inclusive of any Resolution managed activity or operation that requires the physical presence of that contractor at the location to conduct the contracted service. Examples include, but are not limited to:
- Heavy equipment operations
 - Surveying
 - Construction/renovation/clean-construction operations
 - Demolition
 - Well abandonment
 - Electrical system installation/service
 - HAZWOPER Activities
- 2.2 **Resolution field site:** A site at which Resolution is providing field-related services.

3.0 References

None.

4.0 Procedure

4.1 Subcontractor Selection Requirements

- 4.1.1 For all subcontractors, the selection process will include consideration of the candidate firms' SH&E management and performance indicators.
- 4.1.2 Subcontractor bids/submittals shall include a completed Subcontractor SH&E Evaluation. Each questionnaire will be evaluated during the subcontractor selection process to identify any organizations whose past SH&E performance may disqualify them from selection.
- 4.1.3 Prior to the start of their on-site operations, the selected subcontractor firms are required to provide copies of any SH&E documentation (e.g., insurance carrier supplied Experience Modification Rates documents, insurance certificates, safety plan, manual of safety procedures, employee training/medical monitoring certifications) to the Project Manager and/or subcontractor selection manager.
- 4.1.4 Although the questionnaire is to be used as a guideline to determine whether a bidder's safety and health record is acceptable, there are no simple pass/fail criteria. The guidance outlines the standards Resolution's JV Partner's SH&E Department has established to reflect performance acceptability. Marginal performance (Score is less than 3) will require evaluation for final approval of a subcontractor by the PM in coordination with the SH&E Department. Priority will be given to subcontractors who have obtained certification standards (e.g., OHSAS 18001; Certificate of Recognition).

- 4.2 **Procurement Phase.** Prior to starting fieldwork, each subcontractor organization shall provide the Resolution Project Manager (or Resolution representative) with at least one of the following for review and acceptance:
- 4.2.1 Site-specific SH&E documentation addressing specific performance requirements for the subcontractor's on-site work activities, site safety coordinator's name and responsible persons; or
- 4.2.2 A written statement of adoption of the provisions in Resolution's project SH&E documentation as the subcontractor's minimum procedures while working on the job site. This documentation must be in letter format (company letterhead), and must include the following information:
- Site location
 - Anticipated scope of work activities to be performed and equipment to be used by the subcontractor
 - Name of the subcontractor's Site Safety Officer, with contact phone numbers
 - Name of the subcontractor's Health and Safety Manager, with contact phone numbers
 - In addition to the subcontractor's own SH&E requirements, a statement adopting the Resolution's project SH&E documentation as the subcontractor's minimum requirements for the project
 - Statement requiring that only qualified and trained personnel (to the level of assigned responsibilities) will perform assigned work activities on the site
 - Designation of required personal protective equipment anticipated for the subcontractor's assigned work activities
 - Copies of supplemental or additional subcontractor-specific provisions, policies, procedures and/or protocols that will be implemented by the subcontractor during site activities
- 4.3 **On-Site Subcontractor SH&E Requirements**
- 4.3.1 Subcontractor organizations are responsible for safely performing their assigned work activities in accordance with all applicable federal and state/provincial/territorial occupational safety and health regulations, acts, and codes.
- 4.3.2 Subcontractors are responsible for providing Resolution with a copy of their project-specific SH&E documentation for the subject work. The specification of minimum acceptable on-site SH&E performance should be included.
- 4.3.3 Subcontractors are responsible for confirming that their employees are provided the appropriate equipment and training to perform the work safely.
- 4.3.4 All subcontractors must provide input to, and be orientated to, the hazards associated with the site and activities of the project.
- 4.3.5 All subcontractors must provide proof of safety training as required for the hazards identified, inclusive of any required medical surveillance documentation.
- 4.3.6 Subcontractors will be provided with a copy of Resolution's project-specific SH&E documentation for the specification of minimum acceptable on-site SH&E performance.
- 4.3.7 If at any time the subcontractor obtains the services of another subcontractor, consultant, or lower tier subcontractor for any portion of the work to be performed, a copy of the Statement of Work and the approved project-specific SH&E documentation shall be provided as part of the package submitted to each respective subcontractor, consultant, or lower-tier subcontractor. Prior to the start of work, the subcontractor shall submit in writing to the PM, subcontractor selection manager, or their designee the names of any lower-tier subcontractors that may be used in the project that have yet to be approved. The start of work is conditional upon this approval.
- 4.4 **Roles and Responsibilities**
- 4.4.1 **Regional Management** is responsible for:

- Providing the resources to implement the subcontractor evaluation process.
- Maintaining all subcontractor SH&E performance data (developing and managing a database recommended).

4.4.2 **Project Managers** are responsible for confirming that all subcontractors have been properly evaluated for SH&E performance and potential risk. This includes:

- Communicating the requirements established in this procedure to the subcontractor and providing them with the Subcontractor SH&E Evaluation form.
- Reviewing the completed subcontractor evaluation and confirming their potential risk prior to the start of work.
- Providing a completed evaluation to the project file and the administrator or database manager in their region.
- Verifying a subcontractor's minimum level of insurance coverage as stipulated by Resolution's Legal and Procurement Departments (Workers' Compensation, Auto Insurance, General Liability, etc.).

4.4.3 **Regional SH&E Manager** is responsible for:

- Providing support to the project managers in understanding the subcontractor evaluation process and requirements.

5.0 Records

5.1 Business Line management will maintain subcontractor evaluations and associated documentation either in the project file, or, preferably, in a centralized database for tracking.

6.0 Attachments

5-213-Subcontractor SH&E Evaluation

5-305- Hand and Power Tools

1.0 Purpose and Scope

- 1.1 This procedure provides Resolution Consultants' requirements for all manually-operated hand and power tools and equipment use, handling and storage.
- 1.2 Applies to all Resolution Consultants staff and field worksites.

2.0 Terms and Definitions

None.

3.0 References

- 3.1 5-305-Hand and Power Tools
- 3.2 5-410-Hazardous Energy Control
- 3.3 5-302-Electrical, General
- 3.4 5-208-Personal Protective Equipment Program
- 3.5 5-510-Hearing Conservation Program

4.0 Procedure

4.1 Roles and Responsibilities

- 4.1.1 **Project Manager (Field Task Manager, Supervisor)** Each Manager/Supervisor must ensure that all aspects of this procedure are followed and adhered to on all Resolution Consultants projects, sites and locations. If a specific tool is not included in this work instruction section of this SOP, appropriate guidelines shall be established prior to work associated with that equipment, including following manufacturer's recommendations.
- 4.1.2 **Regional SH&E Professionals** provides technical guidance and support as to this procedure.
- 4.1.3 **Employees** shall not work with any tool that they are not familiar with without first obtaining training associated with that equipment. In addition, employees must following manufacturer's recommendations for its use and must not modify the equipment without first obtaining authorization from the manufacturer..

4.2 Restrictions

- 4.2.1 No employee shall use any hand tool, unless they are familiar with the use and operation of the equipment or have received specific instruction on its use and operation.
- 4.2.2 All tools will be used in accordance with manufacturer's specifications. Personnel involved in the performance of certain activities will not be permitted to smoke, eat, drink, or use smokeless tobacco, except during breaks (e.g., HAZWOPER-controlled work areas).

4.3 Training

- 4.3.1 Instruction in the proper use, safe handling, and maintenance of tools will be provided to employees unfamiliar with the tool.

4.4 Personal Protective Equipment

- 4.4.1 Lockout devices (padlocks, multiple lock hasps, tags), gloves appropriate to the task, safety-toed boots, as required, hard hats and eye & face protection, as required.

4.5 Inspections

- 4.5.1 All tools must be inspected prior to each use. Any tool that is defective or has missing parts must not be used. Every broken or defective tool must be tagged or identified as such. Tagged tools will be returned to your supervisor for repair or replacement. Tagged tools will be immediately removed from service.
- 4.5.2 All tools must be inspected to manufacture's specifications according to tool rests and guard adjustment tolerances. All tools will be inspected to ascertain that all safety devices are present and functioning properly.

5.0 Records

None.

6.0 Attachments

None.

7.0 Records

None.

8.0 Attachments

None.

5-307 Housekeeping, Worksite

1.0 Purpose and Scope

- 1.1 This procedure provides Resolution Consultants' work practices as well as personal hygiene and work site sanitation standards for housekeeping.
- 1.2 Applies to all Resolution Consultants staff and field worksites.

2.0 Terms and Definitions

None.

3.0 References

None.

4.0 Procedure

4.1 Roles and Responsibilities

- 4.1.1 **Project Manager (Field Task Manager, Supervisor)** is responsible for the procedure's implementation and the details of addressing housekeeping policy within the construction/demolition worksite.
- 4.1.2 **SH&E Professionals** will monitor, assess, and report on project housekeeping when visiting locations.
- 4.1.3 Employees are responsible for reporting any areas of concern to the Site Supervisor for prompt resolution as well as for maintaining worksites that are free from debris, clutter, and slipping or tripping hazards.

4.2 Smoking, Eating, and Drinking

- 4.2.1 Eating and drinking will be permitted in designated areas at Resolution Consultant project sites and as specified on client sites. Smoking will be permitted only in areas designated in compliance with applicable local laws, regulations, legislation, and ordinances, by the Field Supervisor and situated in locations that are not in the immediate vicinity of activities associated with work site activities. Additionally, Field Supervisor will designate each smoking area giving primary consideration to those personnel who do not smoke.
- 4.2.2 Personnel involved in the performance of certain activities will not be permitted to smoke, eat, drink, or use smokeless tobacco, except during breaks (e.g., HAZWOPER-controlled work areas).
- 4.2.3 Site personnel will first wash hands and face after completing work activities and prior to eating or drinking.

4.3 Water Supply

- 4.3.1 Water supplies will be available for use on site and will comply with the following requirements:
- 4.3.2 **Potable Water:** An adequate supply of drinking water will be available for site personnel consumption. Potable water can be provided in the form of approved well or city water, bottled water, or drinking fountains. Where drinking fountains are not available, individual use cups will be provided as well as adequate disposal containers. Potable water containers will be properly identified and tape sealed in order to distinguish them from nonpotable water sources and protect the potable water integrity.
- 4.3.3 **Nonpotable Water:** Nonpotable water will not be used for drinking purposes. Nonpotable water may not be used for hand washing or other personal hygiene activities but may be used for other types of cleaning activities. All containers/supplies of nonpotable water used will be properly identified and labeled as such.

4.4 Toilet Facilities

- 4.4.1 Toilet facilities will be available for site personnel and visitors. Should subcontractor personnel be located on-site for extended periods, it may become necessary to obtain temporary toilet facilities.

Exceptions to this requirement will apply to mobile crews where work activities and locations permit transportation to nearby toilet facilities.

- 4.4.2 A minimum of one toilet will be provided for every 20 site personnel, with separate toilets maintained for each sex, except where there are less than five total personnel on site. For mobile crews where work activities and locations permit use of nearby toilet facilities (e.g., gas station, or rest stop), on-site facilities are not required.

4.4.3 **Washing Facilities**

- 4.4.4 **Hand and Face:** Site personnel will wash hands and face after completing work activities and prior to breaks, lunch, or completion of workday.

- 4.4.5 **Personal Cleaning Supplies:** Cleaning supplies at Resolution Consultant project sites will consist of soap, water, and disposable paper towels or items of equal use/application (e.g., anti-bacterial gels, wipes, etc.).

4.5 **Clothing and Personal Protective Equipment (PPE)**

- 4.5.1 All PPE will be kept clean at all times and maintained in accordance with the manufacturer's, Resolution Consultant's, and applicable regulatory, legislative, or provincial requirements.

4.5.2 **General Work Areas**

- 4.5.3 At all times work areas will be kept free of dirt and debris that may impact the safety of site personnel and visitors. All trash receptacles will be emptied regularly.

4.5.4 **Break Areas and Lunchrooms**

Site personnel will observe the following requirements when using break areas and lunchrooms at Resolution Consultant project sites:

- 4.5.5 All food and drink items will be properly stored when not in use.
- 4.5.6 Food items will not be stored in personal lockers for extended periods in order to prevent the potential for vermin infestation.
- 4.5.7 Perishable foods will be refrigerated whenever possible.
- 4.5.8 All waste food containers will be discarded in trash receptacles.
- 4.5.9 All tables, chairs, counters, sinks, and similar surfaces will be kept clean and free of dirt, waste food, and food containers at all times.
- 4.5.10 Refrigerators used to store food items will be maintained at 45 degrees Fahrenheit and emptied of all unclaimed food items weekly. Refrigerators used to store food will be labeled as such so that only food and drinks are stored within the refrigerator.
- 4.5.11 Routine cleaning of refrigerators will also be performed on a regular basis.

4.6 **Vermin Control**

- 4.6.1 Every enclosed workplace shall be constructed, equipped, and maintained, so far as reasonably practicable, to prevent the entrance or harborage of rodents, insects, and other vermin.
- 4.6.2 A continuing and effective extermination program shall be instituted where the presence of rodents, insects, or other vermin is detected.

4.7 **General Housekeeping**

- 4.7.1 All work areas shall be kept clean to the extent that the nature of the work allows.
- 4.7.2 Every work area shall be maintained, so far as practicable, in a dry condition. Where wet processes are used, drainage shall be maintained and platforms, mats, or other dry standing places shall be provided, where practicable, or appropriate waterproof footwear shall be provided.
- 4.7.3 Protruding objects or placement of materials on paths or foot traffic areas present a problem with regard to slips, trips, falls, and puncture wounds. Personnel will use a reasonable amount of effort to keep slip, trip, and fall hazards to a minimum.

- 4.7.4 Excess debris and trash will be collected and stored in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) prior to disposal.
- 4.7.5 At no time will debris or trash be intermingled with waste PPE or contaminated materials.
- 4.7.6 Material and equipment must be placed, stacked, or stored in a stable and secure manner. Stacked material or containers must be stabilized as necessary by interlocking, strapping, or other effective means of restraint to protect the safety of workers.
- 4.7.7 An area in which material may be dropped, dumped, or spilled must be guarded to prevent inadvertent entry by workers or protected by adequate covers and guarding.
- 4.7.8 Floors, platforms, ramps, stairs, and walkways available for use by workers must be maintained in a state of good repair and kept free of slipping and tripping hazards. If such areas are taken out of service, the employer must take reasonable means for preventing entry or use.
- 4.7.9 Hazardous areas not intended to be accessible to workers must be secured by locked doors or equivalent means of security and must not be entered unless safe work procedures are developed and followed.

4.8 Worksite Offices and Trailers

Worksite offices and trailers will be maintained in accordance with *RC-103-Housekeeping, Office*.

5.0 Records

None.

6.0 Attachments

None.

5-308-Manual Lifting, Field

1.0 Purpose and Scope

- 1.1 This procedure provides the requirements for use when performing manual materials handling activities (e.g., lifting/handling of items or materials).
- 1.2 This procedure applies to all field staff for Resolution Consultants operations.

2.0 Terms and Definitions

- 2.1 **Manual Materials Handling:** Moving or handling things by lifting, lowering, pushing, pulling, carrying, holding, or restraining.
- 2.2 **Team Handling:** Team handling occurs when more than one person is involved during the lift.

3.0 References

- 3.1 OSHA Technical Manual: http://www.osha.gov/dts/osta/otm/otm_vii/otm_vii_1.html
- 3.3 National Safety Council: www.nsc.org

4.0 Procedure

4.1 Roles and Responsibilities

- 4.1.1 The **Project Manager** will effectively implement the procedure, providing resources as required, and providing direction on proper lifting/handling techniques.
- 4.1.2 The **Resolution Consultants Health and Safety Manager** will assist in identifying activities with a high potential for lifting/handling strains/injuries as well as the associated mitigation strategies and training on proper lifting/manual materials handling techniques.
- 4.1.3 **Employees** are responsible for reviewing and following *5-308- Manual Lifting Safe Work Practices*.

4.2 Mechanical Controls

- 4.2.1 Mechanical equipment or assistance such as dollies, carts, come-alongs, or rollers are preferable to be used whenever possible rather than the employee physically moving materials.
- 4.2.2 Mechanical assistance will be of proper size, have wheels sized for the terrain, and be designed to prevent pinching or undue stress on wrists.
- 4.2.3 Objects to be moved will be secured to prevent falling and properly balanced to prevent tipping.

4.3 Administrative Controls

- 4.4 When significant, sustained lifting work is required, it is desirable to rotate employees to spread the work load among several people and thereby avoid fatigue.
- 4.5 Rotation is not simply performing a different job but instead is performing a job that utilizes a completely different muscle group from the ones that have been overexerted.

5.0 Records

None.

6.0 Attachments

None.

5-313 Wildlife, Plants and Insects

1.0 Purpose and Scope

- 1.1 Communicates the requirements and precautions to be taken by Resolution employees to protect against the biological hazards associated with insects, arachnids, snakes, poisonous plants, and other animals referred to herein collectively as “biological hazards”.
- 1.2 This procedure applies to all Resolution employees and operations.

2.0 Terms and Definitions

- 2.1 **Field Work:** Field work is defined as any activity conducted at a site that contains brush, overgrown grass, leaf litter, poisonous plants, or is located near mosquito breeding areas and includes work in structures where animals might exist that harbor fleas or ticks or where spiders and mites could be present. Field work includes, but is not limited to, Phase I, Phase II, Operations Monitoring & Maintenance (OM&M), biological surveys, and other work that meets the definition of field work.
- 2.2 **Poisonous:** Capable of harming or killing by or as if by poison; toxic or venomous.
- 2.3 **Phase I Environmental Site Assessment:** Investigation of real property to determine the possibility of contamination, based on visual observation and property history, but no physical testing. Under new Environmental Protection Agency regulations that went into effect on November 1, 2006, a Phase I, as it is called for short, will be mandatory for all investors who wish to take advantage of CERCLA defenses that will shield them from liability for future cleanup, should that prove necessary. The new Phase I rules, called “All Appropriate Inquiry” or AAI, also require more investigation than previously mandated. Investors can expect to see dramatic price increases over prior experiences.
- 2.4 **Phase II Environmental Site Assessment:** Investigation of real property through physical samplings and analyses to determine the nature and extent of contamination and, if indicated, a description of the recommended remediation method.

3.0 References

- 3.1 Public Health Agency of Canada (<http://www.phac-aspc.gc.ca/id-mi/tickinfo-eng.php>) on Ticks and Lyme Disease in Canada
- 3.2 Public Health Agency of Canada (<http://www.phac-aspc.gc.ca/wn-no/index-eng.php>) on West Nile Virus
- 3.3 United States Center for Disease Control (CDC) (<http://www.cdc.gov/ncidod/dvbid/lyme/index.htm>) on Lyme Disease
- 3.4 New York State Department of Health, 2007. Health Advisory, Tick and Insect Repellents. <http://www.health.state.ny.us/nysdoh/westnile/pdf/2737.pdf>
- 3.5 Spectrum Brands, 2007. Personal Insect Repellent Products. http://www.spectrumbrandshomeandgarden.com/CorpNav/AboutSpectrum/ProductCategories/insect_repellent.htm
- 3.6 U.S. Centers for Disease Control and Prevention, 2004. Tick Management Handbook. <http://www.cdc.gov/ncidod/dvbid/lyme/resources/handbook.pdf>
- 3.7 U.S. Environmental Protection Agency, 2006. Permethrin Facts: Preregistration Eligibility Decision Fact Sheet. http://www.epa.gov/oppsrrd1/reregistration/REDS/factsheets/permethrin_fs.htm
- 3.8 U.S. National Pesticide Information Center, 1997, National Pesticide Telecommunications Network Fact Sheet for Permethrin. <http://npic.orst.edu/factsheets/permethrin.pdf>
- 3.9 U.S. Environmental Protection Agency, 2005. New Pesticide Fact Sheet, Picaridin <http://www.epa.gov/oppr001/factsheets/picaridin.pdf>

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 Project Managers and Supervisors

- **Project Managers** and **Supervisors** responsible for managing field work will work with employees conducting the work to see that a Task Hazard Analysis (THA) for the work to be conducted has been performed prior to the beginning of the field work and that it includes an assessment of potential biological hazards.
- If biological hazards are identified as an exposure risk in the workplace, control measures that may be applied at the project site will be implemented to reduce the potential for employees to be exposed to injuries and illnesses while working.
- If the exposures cannot be eliminated or managed with engineering controls, the **Project Manager** or **Supervisor** will approve the use of PPE and protective repellents and lotions and ensure that exposed employees have and use these products.

4.1.2 District Operations Manager

- Approve the costs associated with the PPE and materials necessary to protect employees from the biological hazards covered by this Procedure.
- During the performance of project site visits, managers will assess the precautions being taken against the requirements of this Procedure.

4.1.3 Regional SH&E Manager

- Participate in incident reporting and investigations when appropriate.
- Work with office SH&E Department and project Safety Professionals, provide training and guidance to employees consistent with this procedure.
- Assist project teams in identifying hazards and selecting appropriate control measures.

4.1.4 Operational Managers

- Assure implementation of this procedure in their regions and offices.
- Participate in incident reporting and investigations when appropriate.

4.1.5 Employees

- Participate in required training on this procedure.
- Participate in the development of THAs for the project, identify control measures to limit exposure and request PPE, repellents, and protective lotions required by this Procedure.
- Obtain approval from **Project Managers** and/or **Supervisors** to purchase selected PPE prior to purchasing.
- Implement the precautions appropriate to prevent exposure to the hazardous wildlife, insects and plants.
- Observe requirements for reporting as detailed within the Procedure.
- Participate in incident reporting and investigations when appropriate.

4.2 Overview

4.2.1 The procedures discussed below are detailed because these hazards have historically posed the most significant risk to Resolution employees. Note that this discussion is not a fully encompassing list of hazards and as part of the Task Hazard Analysis conducted by the project team, additional consideration must be given to other biological hazards.

4.2.2 Departments of Public Health local to the worksite, as well as the Centers for Disease Control (CDC) can serve as a resource for identifying biological hazards not discussed in this Procedure.

4.2.3 If additional biological hazards are identified, the project team should contact the **Resolution SH&E Manager** to discuss the hazards and identify effective control measures that can be implemented at the project site.

4.3 **Planning and Hazard Assessment**

- 4.3.1 The Resolution project team shall ensure that the potential for exposure to specific biological hazards are assessed prior to the commencement of work and that the procedures specified by this SOP are integrated into the project planning process and conveyed to Resolution employees conducting the field work. This information shall be communicated in the site specific Safe Work Plan (SWP), Health and Safety Plan (HASP), the THA, pre-project kickoff meetings, and tailgate meetings at the project site.
- 4.3.2 It is important to note that the precautions to be taken by Resolution employees to decrease the risk of exposure to biological hazards can directly increase the risk of heat-related illness due to thermal stresses. Therefore, heat stress monitoring and precautions shall be included as a critical component of the project-specific hazard assessments in accordance with *5-511 Heat Stress Prevention*.
- 4.3.3 During the preparation of the project specific Safe Work Plan (SWP), HASP and project specific THA, **Project Managers, Supervisors**, and the project staff will determine what biological hazards might be encountered during the project and will prescribe the precautions to be taken to reduce the potential for exposure and the severity of resulting illnesses. Consideration will be given to conditions such as weather, proximity to breeding areas, host animals, and published information discussing the presence of the hazards.
- 4.3.4 It should be assumed that at least one of the biological hazards exists whenever working on undeveloped property. This can include insect activity any time that local temperatures exceed 40°F for a period of more than 24 hours. The stubble and roots of poisonous plants can be a hazard any time of year, including when some plants are dormant or mown.
- 4.3.5 The hazard assessments must also consider the additional hazards posed by vegetative clearing such as the increased risk of coming in contact with poison ivy, oak or sumac and hazards associated with the use of tools and equipment to remove vegetation.
- 4.3.6 Employees in the field where biological hazards exist will not enter the hazard areas unless they are wearing the appropriate protective clothing, repellents, and barrier creams specified below. If the hazard is recognized in the field but was not adequately assessed during the THA, the affected employees shall stop work and not proceed until the THA has been amended and protective measures implemented.
- 4.3.7 A decision flow chart and table for determining the potential for biological hazards in US states has been provided in *5-313-Biological Hazard Assessment Decision Flow Chart Hazard Assessment (US States)*.

4.4 **Restrictions**

- 4.4.1 Staff with life-threatening reactions shall not undertake work in areas infested with the allergen (e.g., wasps, poison ivy), unless precautions are met which satisfy a medical practitioner's requirements.

4.5 **Employee Sensitivity**

- 4.5.1 Sensitivity to toxins generated by plants, insects and animals varies according to dosage and the ability of the victim to process the toxin, therefore it is difficult to predict whether a reaction will occur, or how severe the reaction will be. Staff should be aware that there are a large number of organisms capable of causing serious irritations and allergic reactions. Some reactions will only erupt if a secondary exposure to sunlight occurs. Depending on the severity of the reaction, the result can be severe scarring, blindness or even death.
- 4.5.2 Employees also need to consider whether they are sensitive to the use of insect repellents.

4.6 **Personal Protective Equipment**

- 4.6.1 The selection of Personal Protective Equipment is dependent on the hazard present and a PPE Hazard Analysis should be conducted to determine situation specific PPE required. (refer to SOP 5-208 *Personal Protective Equipment Program*)
- 4.6.2 At a minimum, in addition to any project specific PPE, long sleeves and pants should be worn on field projects where the risk of biological encounter exists.
- 4.6.3 PPE for insects should include sunscreen, bug nets, bug jackets, or insect repellent. Socks should be pulled over pant legs and rubber boots should be worn where the threat of exposure is anticipated.

- 4.6.4 Epi-pens¹ or other personal medication should be carried by those staff that are aware that anaphylactic shock is a possibility for them.
- 4.7 **Remedies**
- 4.7.1 If you suspect exposure to an irritant, identify the cause including obtaining a specimen if possible. Document the occurrence as a safety precaution if the exposure should lead to complications.
- 4.7.2 Go to a doctor or call WorkCare for advice if necessary.
- 4.8 **Training**
- 4.8.1 Field staff must learn to recognize organisms that represent a threat in the regions in which they work – experienced field staff must provide on the job training to assist staff with hazard recognition.
- 4.8.2 Staff who have severe allergic reactions are strongly recommended to notify their project manager, field supervisor, and co-workers of the potential for a reaction and demonstrate what medication they might need and how it is administered.
- 4.9 **Insects**
- 4.9.1 Insects for which precautionary measures should be taken include but are not limited to: mosquitoes (potential carriers of disease aside from dermatitis), black flies, wasps, bees, ticks, Fire Ants and European Fire Ants.
- 4.9.2 Wasps and bees will cause a painful sting to anyone if they are harassed. They are of most concern for individuals with allergic reactions who can go into anaphylactic shock. Also, instances where an individual is exposed to multiple stings can cause a serious health concern for anyone. These insects are most likely to sting when their hive or nest is threatened.
- 4.9.3 Ticks can be encountered when walking in tall grass or shrubs. They crawl up clothing searching for exposed skin where they will insert mouthparts to drink blood. The most serious concern is a possibility of contracting Lyme disease which is spread by the Black-legged or Deer Tick. The larger Wood Ticks are widespread in the west but these rarely carry diseases. Occasionally a tick can cause Tick Paralysis if it is able to remain feeding for several days. Full recovery usually occurs shortly after the tick is removed.
- 4.9.4 The Fire Ant (southern and western US) and the European Fire Ant (northeastern US and eastern Canada) is often very abundant where it is established. It is very aggressive and commonly climbs up clothing and stings unprovoked when it comes into contact with skin. Painful irritations will persist for an hour or more.
- 4.10 **Ticks**
- 4.10.1 Data from the CDC indicates that tick-borne diseases have become increasingly prevalent. At the same time, tick repellents have become both safe and effective so it is possible to prevent the vast majority of bites and therefore most related illnesses.
- 4.10.2 The most common and severe tick-borne illnesses in the U.S. are Lyme disease, Ehrlichiosis, and Rocky Mountain spotted fever. A summary table listing CDC informational resources for these diseases is provided in 5-313-Ticks, along with a listing of CDC information resources and maps showing the distribution of common tick-borne diseases in the U.S.
- 4.10.3 When working in areas where ticks may occur, it is recommended that clothes are turned inside out and shaken at the end of day; do not wear the same clothes two days in a row.
- 4.10.4 To remove ticks that are embedded in skin, use tweezers or fingers to carefully grasp the tick as close to the skin as possible and pull slowly upward, avoiding twisting or crushing the tick. Do not try to burn or smother the tick. Cleanse the bite area with soap and water, alcohol, or household antiseptic. Note the date and location of the bite and save the tick in a secure container such as an empty pill vial or film canister. A bit of moistened paper towel placed inside the container will keep ticks from drying out.

¹ Epi-pens must be prescribed by a personal physician. Renew epi-pens on a regular schedule to ensure effectiveness and make sure your field companions know where it is and how to use it if you cannot self administer the dose.

- 4.10.5 Familiarize yourself with the characteristic bulls-eye pattern of Lyme disease infection surrounding the bite. If noted, report to medical help for inoculation.
- 4.10.6 If possible, submit any ticks found or captured to the following laboratories for species identification.
- Canada – National Microbiology Laboratory (NML) (Phone: (204) 789-2000; email: ticks@phac-aspc.gc.ca). The NML will conduct diagnostic testing for the Lyme disease agent as well as several other disease-causing agents. The NML results will not only benefit anyone bit by the tick, but will also assist the NML in their goal to accurately map the distribution of the tick species and associated diseases in Canada.
 - US – IGeneX, Inc. (Phone: (800) 832-3200; www.igenex.com). IGeneX will test the tick for the presence of the Lyme bacteria. They also test ticks for *Babesia microti* and/or *Babesia duncani* (formerly WA-1), Ehrlichia, Bartonella henselae and Rickettsia (Rocky Mountain Spotted Fever). These diseases are also carried by ticks. The testing request form is attached as 5-313-FM Tick Test Request Form.
- 4.10.7 If you experience symptoms such as fever, headache, fatigue, and a skin rash, you should immediately visit a medical practitioner as Lyme disease is treated easily with antibiotics in the early stages, but can spread to the heart, joints, and nervous system if left untreated.
- 4.11 **Chiggers**
- 4.11.1 Chiggers are mite larvae, approximately ½ mm in size, and typically invisible to the naked eye. While chiggers are not known to carry infectious diseases, their bites and resulting rashes and itching can lead to dermatitis and a secondary infection.
- 4.11.2 Chiggers are typically active from the last hard freeze in the winter or spring to the first hard freeze. They are active all year in the Gulf Coast and tropical areas.
- 4.12 **Spiders**
- 4.12.1 Spiders can be found in derelict buildings, sheltered areas, basements, storage areas, well heads and even on open ground. Spiders can be found year round in sheltered areas and are often present in well heads and valve boxes.
- 4.12.2 Most spider bites produce wounds with localized inflammation and swelling. The Black Widow and Brown Recluse spiders in the US and others outside the US inject a toxin that causes extensive tissue damage and intense pain.
- 4.12.3 Additional information on spider identification can be found in attachment 5-313-Poisonous Spider Identification.
- 4.13 **Mosquitoes**
- 4.13.1 Mosquitoes can transmit the West Nile Virus and other forms of encephalitis after becoming infected by feeding on the blood of birds which carry the virus. Positive cases of West Nile Virus have been confirmed throughout North America since 2007.
- 4.13.2 Most people infected with the virus experience no symptoms or they have flu-like symptoms. Sometimes though, the virus can cause severe illness, resulting in hospitalization and even death ,so proper precautions should be taken. Consult a medical practitioner if you suspect you have West Nile Virus.
- 4.13.3 When a mosquito bites, it injects an enzyme that breaks down blood capillaries and acts as an anticoagulant. The enzymes induce an immune response in the host that results in itching and local inflammation. The tendency to scratch the bite sites can lead to secondary infections.
- 4.13.4 CDC data indicates that mosquito-borne illnesses, including the strains of encephalitis, are a health risk to employees working in outdoor environments. At least one of the Encephalitis strains listed below is known to exist in every area of the U.S. and in many other countries as well:
- Eastern Equine encephalitis (EEE)
 - Western Equine encephalitis (WEE)
 - West Nile Virus
 - St. Louis encephalitis (SLE)
 - La Crosse (LAC) encephalitis

- 4.13.5 Other diseases including Dengue Fever and Malaria are spread by mosquitoes in the sub-tropic and tropical parts of the world. See 5-313-Mosquito Borne Diseases for information on the locations where mosquito borne diseases are known to be present.
- 4.14 **Bees and Hornets**
- 4.14.1 Bees, hornets, and wasps may be found in derelict buildings, sheltered areas, and even on open ground. The flying/stinging insects are not specifically included in the scope of this procedure and the PPE and other protective measures are not normally effective against aggressive, flying insects. Avoid reaching into areas where visibility is limited.
- 4.14.2 If stung by a wasp or bee or hornet, notify a co-worker or someone who can help should you have an allergic reaction. Stay calm and treat the area with ice or cold water. Seek medical attention if you have any reactions to the sting such as developing a rash, excessive swelling or pain at the site of the bite or sting, or any swelling or numbness beyond the site of the bite or sting.
- 4.14.3 Employees with known allergies to insect stings should consult their personal physician for advice on any immediate medications that they should carry with them. Resolution highly recommends that employees with known allergies inform their co-workers of the allergy and the location of the medications they might carry for the allergy.
- 4.15 **Poisonous Plants**
- 4.15.1 Poisonous plants including poison ivy, oak and sumac, which contain the oil urushiol that produces a rash, can lead to dermatitis and infections. Exposure to urushiol produces a rash that can be irritating and cause the exposed employee to scratch the affected area, increasing susceptibility for an infection. It should be noted that each time an employee is exposed to urushiol the severity of the reaction increases. In cases that involve severe rashes, medical treatment may be necessary to control the rash.
- 4.15.2 Wild parsnip is found throughout the U.S. and contains a poison that produces a rash similar to poison oak and ivy. Unlike poison oak and ivy, the active oil will not be present on unbroken leaves..
- 4.15.3 Plants that field staff should recognize and take precautions to avoid include: Poison Sumac, Poison Ivy (terrestrial and climbing), Poison Oak, Giant Hogweed² (or Giant Cow Parsnip), Wild Parsnip, Devil's Club and Stinging Nettle. Many others are extremely poisonous to eat (e.g., Poison Hemlock; Water Parsnip) – do not eat anything that has not been identified.
- 4.15.4 See 5-313-Plants of Concern for information on locations where some of these poisonous plants are found in the US.
- 4.15.5 Of the toxic plants in the cashew family, Poison Ivy (*Rhus radicans*) is most widespread occurring across southern Canada. It is usually a low sprawling shrub or ground cover but in southwestern Ontario it also grows as a thick woody vine that grows high into the tree canopy. Poison Oak (*Rhus diversiloba*) is a low shrub that grows only in southwestern British Columbia and Poison Sumac (*Rhus vernix*) is a tall shrub that grows in southern Ontario but is quite rare. All of these plants possess urushiol oils in nearly all parts of the plant. Touching the plant causes an itchy skin rash that shows up several days following contact. People have a wide range of reactions which in severe cases can lead to oozing blisters on large parts of the body. Some people apparently never react and others may develop an allergy after no reaction after years of frequent contact.
- 4.15.6 Several plants in the carrot family contain toxic sap that causes severe dermatitis if it comes into contact with skin that is then exposed to sunlight. The most serious reaction is caused by the Giant Hogweed (*Heracleum mantegazzianum*), a garden that is spreading in southern Ontario and is also present in southwestern British Columbia. The plant is enormous, attaining up to 5 m in height, which it does in one growing season. Contact causes painful blistering that can cause permanent disfigurement. It is to be avoided. Similar but less serious reactions can be caused by Meadow Parsnip (*Pastinaca sativa*) and Cow Parsnip (*Heracleum lanatum*). Meadow Parsnip can be very abundant on disturbed sites.
- 4.15.7 Nettles, particularly Stinging Nettle (*Urtica dioica*) and Wood Nettle (*Laportea canadensis*) contain urticating hairs on the leaves and stems that cause sharp pain or itchiness on contact with skin. The

² *Phytophthora* producer: keep skin covered and wash well after exposure
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irritation is immediate and normally lasts no more than an hour and there are no lasting consequences.

- 4.15.8 Some plants contain abundant stiff spines that can present a safety hazard, particularly if one is to fall into them. Fragile Prickly Pear cactus (*Opuntia fragilis*) is common in semi arid areas of the southern Prairie Provinces and interior British Columbia. Pieces will break off and imbed into one's ankle by scarcely brushing them. Devils Club (*Oplopanax horridum*) can form dominant understorey in humid forests among the western mountains. It contains semi-soft spines on the stems that will break off in the skin causing considerable irritation for days. In some areas of Ontario, Prickly-ash (*Zanthoxylon americanum*) a tall shrub with sturdy spines, sometimes forms dense single stands that are nearly impenetrable.
- 4.15.9 A large number of plants are not harmful to touch but may contain poisonous berries or foliage that could cause serious complications or death if they are ingested. It goes without saying not to eat any berries or plants if you are not absolutely sure of their identity.
- 4.15.10 Of all the plants, Giant Hogweed presents the most serious health risk. Field staff should learn to recognize and avoid it if encountered.
- 4.15.11 Employees who develop a rash as a result of exposure to poisonous plants shall report the exposure immediately to their **Supervisor** or **Project Manager** who will then forward the report to the **Regional SH&E Manager**.

4.16 **Additional Biological Hazards**

4.16.1 Additional Work Instructions are provided for protection and prevention from the following:

- 5-313-Snakes
- 5-313-Alligators

4.17 **Habitat Avoidance, Elimination, and/or Control**

4.17.1 Ticks, Spiders and Insects

- The most effective method to manage worker safety and health is to eliminate, avoid and/or control hazards. Clearing the project site of brush, high grass and foliage reduces the potential for exposure to biological hazards. Clearing will not eliminate the exposure to flying insects and there might be an increased exposure to ticks, spiders, and poisonous plants during the clearing process.
- Resolution projects such as subsurface environmental assessment or remediation are often candidates for brush and overgrown grass to be cleared. In these instances, the Resolution project manager shall either request that the client eliminate vegetation, or request approval from the client to have vegetation clearing added to the scope of work.
- When projects must be conducted in areas that cannot or may not be cleared of foliage, personal precautions and protective measures outlined in this SOP shall be prescribed.
- Mosquitoes breed in stagnant water and typically only travel a quarter mile from their breeding site. Whenever possible, stagnant water should be drained to eliminate breeding areas. Project Managers and client site managers should be contacted to determine whether water can be drained and the most appropriate method for draining containers, containment areas, and other objects of standing water.
- If water cannot be drained, products similar to Mosquito Dunks® can be placed in the water to control mosquitoes. Once wet, the Mosquito Dunks® kill the immature, aquatic stage of the mosquito. The active ingredient is a beneficial organism that is lethal to mosquito larvae, but harmless to fish, humans, and other animals. Mosquito Dunks® provide long-term protection for 30 days or more.

4.17.2 Poisonous Plants

- If poisonous plants are identified in the work area, employees will mark the plants using either flags or marking paint, and discuss what the specific indicator will be to signal to other employees to avoid the designated area. If employees decide to use ground-marking paint to identify poisonous plants, they should discuss this tactic with the **Project Manager** and/or Client to gain approval.

- If removal of the plants is considered, it should be subcontracted to a professional landscaping service that is capable and experienced in removing the plant. If herbicides are considered for use, a discussion will need to occur with the **Project Manager** and Client to determine whether it is acceptable to apply herbicides at the work site. Application of herbicides may require a license.
- Resolution employees shall not attempt to physically remove poisonous plants from the work area unless a clearing procedure including PPE is prepared in advance and approved by the Regional SH&E Manager. If a SWP or HASP is prepared for the project, the clearing procedure should be included and the required PPE specified.

4.17.3 Bird Droppings

- Bird excrement may be encountered due to the nesting of pigeons and other birds and winged animals (e.g., bats) on or in structures. Substantial accumulations of droppings can pose physical and health risks as slippery surfaces (if wet) and if the material is disturbed and becomes airborne, it can be inhaled or ingested if personal hygiene practices are not implemented. Inhalation of airborne droppings can cause diseases such as histoplasmosis. Exposure to surfaces with bird droppings shall be safeguarded by implementing proper work practices, training employees for awareness and using PPE.

4.18 Personal Precautions and Personal Protective Measures

4.18.1 Precautions

- Be aware of the potential irritants in your area and know how to recognize them.
- Modify activities to avoid encounters (diurnal rhythms, seasonal rhythms).
- Wear protective clothing.
- When working in areas where there may be small insects that “hitchhike” (e.g., ticks, spiders, scorpions), it is recommended that clothes are turned inside out and shaken at the end of day; do not wear same clothes two days in a row.
- Staff should always be aware of where they are placing their hands, or where they are sitting in order to avoid contact with potential toxins.

4.18.2 PPE

- The following recommendations may be considered by the project team to determine if the use of PPE is necessary for the type of work planned: Disposable gloves may be cotton, leather, or synthetic materials and must not be reused after removing.
- Clearing activities present the greatest risk of employee exposure but reduce the risks once completed. Recommendation – Resolution employees actively participating in clearing will use full protection from ticks and insects during the clearing activities including insect repellents, Tyvek® coveralls, and gloves.
- If the foliage being cleared includes poisonous plants, exposed skin will be treated with a dermal barrier cream such as Tecnu®’s Oak ‘n Ivy Armor or Enviroderm’s Ivy Block and either a full face respirator or a half face respirator (with goggles) fitted with a P-100 (HEPA) dust filter.
- Work in habitats with direct exposure to ticks, mosquitoes, and poisonous plants is likely and the scope of work does not allow for worksite control measures like vegetative clearing: Recommendation – Full protection from biological hazards including insect repellents, Tyvek® coveralls or full length clothing, poisonous plant barrier creams and wipes, and gloves.
- Work in habitats with direct exposure to ticks and mosquitoes and no exposure to poisonous plants is likely and the scope of work typically does allow for worksite control measures like vegetative clearing: Recommendation – Protection including insect repellents and Tyvek® coveralls or full length clothing.
- Work in habitats with direct exposure to poisonous plants and no exposure to ticks or insects is likely and the scope of work does not allow for worksite control measures like vegetative clearing: Recommendation – Full protection from poisonous plants including insect repellents, Tyvek® coveralls or full length clothing, poisonous plant barrier creams and wipes, and gloves.
- Industrial/Commercial/Office Facilities – Direct contact with biological hazards is considered unlikely or low risk: Recommendation – PPE for biological hazards are not required; however, Tyvek coveralls and insect repellent should be available if exposure to spiders, flying insects, or other biological hazards is encountered.

- Work in areas where no biological hazards are expected because of the local environment, winter weather, or property development: Recommendation – PPE for biological hazards is not required; however, Tyvek® coveralls and insect repellent should be available if exposures to spiders, flying insects, or other biological hazards are encountered.
- The following precautions and protective measures shall be implemented by Resolution employees conducting field work where the biological hazards covered by this SOP exist:

4.18.3 Insects, Spiders, and Ticks

- Chemically-treated field clothing, full-length clothing, or Tyvek® coveralls.
- Application of insect repellent to clothing and/or exposed skin.
- Routine personal checks.
- Exercise care when collecting samples and avoid reaching into areas where visibility is limited. If stung by an insect or bitten by a spider or tick, attempt to identify the attacker and notify a co-worker or someone who can help should the bite site become painful, discolored, or swollen. Stay calm and treat the area with ice or cold water. Seek medical attention if you have any reactions to the sting such as developing a rash, excessive swelling or pain at the site of the bite, or any swelling or numbness beyond the site of the bite.
- Oil of lemon eucalyptus, DEET, and Permethrin have been recommended by the Centers for Disease Control and Prevention for effective protection against mosquitoes that may carry the West Nile virus and related diseases.
- Note that DEET will reduce the effectiveness of Fire Resistance Clothing (FRC) and should not be applied to this clothing. If working in FRC, employees can apply DEET to their skin and let dry prior to putting FRC on, or use Permethrin as it has been shown not to reduce the effectiveness of FRC. Permethrin will need to be applied to FRC well in advance of the planned work.

4.18.4 Poisonous Plants

- Employees working in areas where poisonous plants exist shall wear either long sleeve clothing or Tyvek® coveralls, and disposable cotton, leather or synthetic gloves. Employees must not touch exposed skin (neck and face) with potentially contaminated gloves. Tyvek® and gloves worn to protect from exposure to poisonous plants will be treated as contaminated, removed from the body in a manner that the contamination is not spread, and placed in plastic bags for disposal.
- Personal clothing that has been exposed to poisonous plants shall be decontaminated with a poisonous plant cleanser such as Tecnu® or removed in a careful manner, bagged and washed separately from other clothing to remove urushiol.
- Work boots will be decontaminated with either soap and water or a cleansing agent such as Tecnu® cleanser.
- Remember that in the fall and winter the hazard still exists in the form of stubble and roots.
- Employees who develop a rash as a result of exposure to poisonous plants shall report the exposure immediately to their **Supervisor** or **Project Manager** who will forward the report to the RSHEM.
- For dermatitis caused by Poison Ivy, Poison Oak, or Poison Sumac, calamine lotion is effective.

4.19 Selection and Configuration of Field Clothing

- 4.19.1 At a minimum, employees will wear long legged pants and long sleeve shirts or Tyvek® coveralls to reduce the amount of exposed skin when biological hazards are identified at the work site. Gloves will also be worn consistent with the recommendations of the site-specific SWP, HASP and/or THA to minimize hand exposure.
- 4.19.2 Where ticks, chiggers, and spiders are presumed to exist, the Tyvek® or chemically-treated clothing will be taped to the work boots.
- 4.19.3 See *5-313-Configuration Clothing for Protection against ticks and insects* for illustrations and instructions for configuring, taping, and tucking clothing.
- 4.19.4 Chemical Treatment of Field Clothing
 - Oil of lemon eucalyptus, DEET, and Permethrin have been recommended by the Centers for Disease Control and Prevention for effective protection against mosquitoes that may carry the West Nile virus and related diseases.

- Note that DEET will reduce the effectiveness of Fire Resistance Clothing (FRC) and should not be applied to this clothing. If working in FRC, employees can apply DEET to their skin prior to putting FRC on, or use Permethrin as it has been shown not to reduce the effectiveness of FRC. Permethrin will need to be applied to FRC well in advance of the planned work.

4.19.5 Permethrin

- When selected as part of a project's PPE requirements, the Resolution **Project Manager** shall ensure that field teams wear clothing treated with the chemical Permethrin, which is an insecticide with repellent properties registered with the U.S. Environmental Protection Agency (EPA), and recommended by the CDC. Information regarding the toxicity and product safety of Permethrin is provided in *5-313-Insect Repellent Active Ingredient Product Information*. Permethrin is highly effective in preventing tick bites when applied to clothing, but is not effective when applied directly to the skin. Two options are available for Permethrin treatment of clothing worn during field work: 1) pre-treatment of fabric by the clothing manufacturer; or 2) employee treatment of their personal clothing using 0.5% Permethrin spray. Resolution strongly recommends the first option (employees obtaining pre-treated clothing) to avoid the time required, potential risk, and housekeeping issues involved with manually treating the clothing with spray. Purchase pre-treated clothing in accordance with *5-208 Personal Protective Equipment Program* and with the approval of your **Supervisor**.
- The Permethrin pre-treatment is odorless and retains its effectiveness for approximately 25 washings. After 25 washings, the pre-treated clothing will be considered no longer effective and removed from service. Clothing that has been manually treated by employees will be considered effective for 5 wash cycles.
- Also, use of clothing that has been pre-treated with Permethrin offers a reduction in the use and application of other insect repellents that must be applied directly to the skin.. Costs for clothing shall be charged to projects as a consumable item. If charging to the project is not possible, the charges should be managed as a department expense. **Supervisor** or **Department Manager** approval is required prior to purchase.
- If an employee opts not to utilize chemically pre-treated clothing while potentially exposed to insects, spiders and/or ticks, they must either: 1) wear Tyvek® coveralls taped to the boots, 2) full length clothing consisting of long legged pants and long sleeved shirts treated with an insect repellent containing Permethrin, DEET, or an organic alternative to their work clothing.

4.19.6 Manual Treatment of Field Clothing

- If clothing pre-treated with Permethrin is not available or not purchased prior to field work, employees may manually treat their clothing with Permethrin spray. The outer surfaces of all external clothing to be worn during field work should be treated with 0.5% Permethrin spray a minimum of 2 to 4 hours prior to field work (boots, trousers, shirt, jackets, rain gear; refer to Section 4.16 for selection of field clothing) in accordance with recommendations provided by the New York State Department of Health. This will likely require treatment at home or the office prior to field mobilization. Caution should be used when applying Permethrin as it is highly toxic to fish and house cats. Clothing treatment will last for approximately 5 wash cycles (check the specific instructions for the product used.)

4.19.7 Lemon Eucalyptus

- Lemon Eucalyptus is a plant-based insect repellent on the market as Repel Lemon Eucalyptus. The products have been proven to be effective against mosquitoes, deer ticks, and no-see-ums for up to six hours. Derived from Oil of Lemon Eucalyptus, this non-greasy lotion or spray has a pleasant scent and is not known to be toxic to humans. The spray or lotions will be effective for approximately two to six hours and should be reapplied every two hours to sustain protection. Lemon Eucalyptus products cannot be applied to fire retardant clothing.

4.19.8 Purchase of PPE and Repellents and Lotions

- Costs for clothing, repellents, lotions, and other PPE shall be charged to projects as a consumable item. If charging to the project is not possible, the charges should be managed as a department expense. Supervisor or Department Manager approval is required prior to purchase.
- Material Safety Data Sheets (MSDS) for the repellents, lotions, and cleansers discussed in this Procedure are not required because the repellents, lotion, and clothing are consumer products used in the manner intended for the general public. Although not required, a MSDS should be

obtained for the products used and placed into the office MSDS library and site-specific health and safety plans.

4.20 **Personal Hygiene and Body Checks**

- 4.20.1 Tick-borne diseases typically require that the tick be imbedded for four hours to begin disease transfer. The oils from poisonous plants can take up to 4 hours after exposure to penetrate the skin and react with the live proteins under the skin.
- 4.20.2 It is recommended that exposed skin be checked frequently for the presence of ticks, insects, rashes, or discolorations. External clothing should also be checked for the presence of ticks and insects; these should be retained for identification and to determine if medical treatment is needed.
- 4.20.3 Employees will shower as soon as practical after working in the field and examine their bodies for the presence of ticks, insect bites, rashes, or swollen areas. If imbedded ticks are found, they should be removed using the technique described in *5-313-Ticks*, the tick should be preserved with the date and location of the bite noted, and retained for identification if medical treatment is needed as described in Section 4.13.1 of this Procedure.
- 4.20.4 The presence of an imbedded tick, rash, or abnormal reactions will be reported as an SH&E Incident to the **Project Manager** or **Supervisor** who will forward the report to the RCSHEM for follow up.

5.0 **Records**

None.

5-313-Snakes

1.0 Hazard

- 1.1 **Snakes have the ability to inject venom.** A bite from a venomous snake, which may inject varying degrees of toxic venom, is rarely fatal but should always be considered a medical emergency.

2.0 Personal Protective Equipment

- 2.1 Long pants and shirts.
- 2.2 Heavy gloves if staff will be handling debris or be close to the ground.
- 2.3 Rubber boots, or boots that fully cover the foot (not sandals!) and preferably are at least 10" high.
- 2.4 Snake Chaps that cover at least the shin.
- 2.5 Personal first aid kit.

3.0 Restrictions

- 3.1 Staff must not work alone in areas where the risk of a snake encounter is high.

4.0 Training

- 4.1 Staff must be notified of the hazard before work commences.

5.0 Safe Work Practice

- 5.1 Staff working in areas known to be inhabited by venomous snakes should take extra precautions, be able to identify the local snake species, and understand the best practices for administering first aid.
- 5.2 Most snakes in Canada are non-venomous; and most snake bites are not fatal, only painful. Learning to identify snake species will assist you in responding appropriately to an encounter, and will assist medical professionals in determining if antivenin needs to be administered if anyone is bit.
- 5.3 Most snakes are non-aggressive and will only attack if immediately threatened.

5.4 Prevention

- 5.4.1 Before venturing out into the wilderness, familiarize yourself with the snakes in your area, both venomous and non-venomous species.
- 5.4.2 Learn which habitats the venomous species in your region are likely to be encountered in, and use caution when in those habitats.
- 5.4.3 Try as much as possible not to take a snake by surprise.
- 5.4.4 Stay on trails where possible, and watch where you place your hands and feet, especially when climbing or stepping over fences, large rocks, and logs, or when collecting firewood. Take care when overturning any objects on the ground when in snake country.
- 5.4.5 If you see a snake, give it as much room as possible. Most snakes have a strike distance that is only half the length of their body.
- 5.4.6 If you get very close to a rattlesnake, hold very still until it calms down and starts to move away. Then slowly move backwards until you are at least one snake-body length away.

5.5 Treatment

- 5.5.1 Venomous snakebites are rare, and they are rarely fatal to humans. Of the 8,000 snakebite victims in the United States each year, only about 10 to 15 die. In Canada the number of snake bites each year is very small. However, for any snakebite the best course of action is to get medical care as soon as possible.

- 5.5.2 Try to keep the snakebite victim still, as movement helps the venom spread through the body.
- 5.5.3 Keep the injured body part motionless and just below heart level.
- 5.5.4 Keep the victim warm, calm, and at rest, and transport him or her immediately to medical care.
- 5.5.5 Do not allow him to eat or drink anything.
- 5.5.6 If medical care is more than half an hour away, wrap a bandage a few inches above the bite, keeping it loose enough to enable blood flow (you should be able to fit a finger beneath it). Do not cut off blood flow with a tight tourniquet. Leave the bandage in place until reaching medical care.
- 5.5.7 If you have a snakebite kit, wash the bite, and place the kit's suction device over the bite. (Do not suck the poison out with your mouth.) Do not remove the suction device until you reach a medical facility.
- 5.5.8 Identify the snake that caused the bite to determine if it is venomous, and if antivenin needs to be administered. Do not waste time or endanger yourself trying to capture or kill it. Note the shape & color of the snake's head.
- 5.5.9 If you are alone and on foot, start walking slowly toward help, exerting the injured area as little as possible.
- Note that there are several species of snakes that superficially resemble rattlesnakes. Several species, including Bull, Milk, Fox, and Rat Snakes will even rattle their tails when startled.
 - Massasauga Rattlesnake is recognized as a Threatened Species in Ontario and it is an offence to harass, , or destroy the habitat of this species.
 - One scorpion species, the Northern Scorpion (*Paruroctonus boreus*) occurs in semi-arid areas of southern British Columbia, Alberta, and Saskatchewan. It carries a stinger on the end of its tail. The sting is painful but not life threatening unless there is an allergic reaction.

6.0 Species

6.1 Venomous Snakes in Canada

<p>Eastern Massasauga Rattlesnake (<i>Sistrurus catenatus</i>) found around Wainfleet, Windsor, Bruce Peninsula and eastern Georgian Bay in Ontario.</p>	 <p>Eastern Massasauga Rattlesnake picture by Michael Redmer/Courtesy Lincoln Park Zoo</p>
<p>Northern Pacific Rattlesnake (<i>Crotalus viridis</i>) found primarily in Okanagan and Thompson River valleys of southern British Columbia.</p>	 <p>LANCE TANNAHILL 2000</p>

<p>Prairie Rattlesnake (<i>Crotalus viridis</i>) found in south eastern Alberta, and south western Saskatchewan.</p>	
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6.2 **Venomous snakes in the U.S.**

<p>Rattlesnake(<i>Crotalus cerastes</i>) found mostly concentrated in the southwestern United States, they extend north, east and south in diminishing numbers and varieties. Every contiguous state has one or more varieties of rattlesnake.</p> <p>The rattlesnake is found in many different biomes ranging from along the coast at sea level, the inland prairies and desert areas to the mountains at elevations of more than 10,000 feet.</p> <p>Species include: Sidewinder, Santa Catalina, Western, Mojave, Red Diamond, Western Diamond, Ridge Nosed, Eastern Diamondback, and Pigmy.</p>	 <p>Western Rattlesnake</p>  <p>Eastern Diamondback</p>
<p>Copperhead (<i>Agkistrodon contortrix</i>) is the most common venomous snake found in the eastern US. It can be found in the states of Texas, Oklahoma, Kansas, Missouri, Arkansas, Louisiana, Mississippi, Alabama, Georgia, Florida, South Carolina, North Carolina, Tennessee, Kentucky, Virginia, Illinois, Indiana, Ohio, Iowa, Pennsylvania, Maryland, New Jersey, Delaware, New York, Connecticut, and Massachusetts.</p>	
<p>Cottonmouths (water moccasins) (<i>Agkistrodon piscivorus</i>) found in the eastern United States from Virginia, south through the Florida peninsula and west to Arkansas, eastern and southern Oklahoma, and east and central Texas..</p>	

Coral Snake (*Micrurus sp.*) found in the southern range of many temperate US states including North Carolina, Georgia, Alabama, Mississippi, Louisiana, Texas, Arkansas, Kentucky, Arizona, and New Mexico.



Eastern Coral Snake, *Micrurus fulvius*

7.0 References

- 7.1 *The Eastern Massasauga Rattlesnake Stewardship Guide. A resource and field guide for living with rattlesnakes in Ontario.* Sponsored by the Government of Canada, and distributed on behalf of the Toronto Zoo and the Eastern Massasauga Rattlesnake Recover Team.
- 7.2 <http://www.rattlesnakes.us/>
- 7.3 <http://drdavidson.ucsd.edu/Portals/0/snake/Crotalus.htm>

5-313-Alligators

1.0 Hazard

- 1.1 Your chance of encountering an alligator is greatest during the animal's courtship and mating season, which takes place from March through September. This is when male alligators become most dominant and aggressive as they try to intimidate rival males and attract females by their show of power. Some males end up having to travel to find a mate. July through September is when mother alligators are guarding nests.
- 1.2 Mating season takes up much of the warmer months - a very popular time in the southeastern USA for outdoor activities - and alligators are solar-powered, so-to-speak. The warmth from the sun fires up their metabolism, giving them renewed energy; and renewed energy means great potential for conflict.

2.0 Encounter

- 2.1 The alligator is naturally wary of humans, and will flee quickly if you get too close to it, or it may utter a very audible and compelling warning hiss. In some cases; however, alligators may charge or attack. Here are some examples of such cases:
 - 2.1.1 An alligator that is accustomed to being fed by humans may not be so shy.
 - 2.1.2 An alligator that is surprised and alarmed by your approach may attack, thinking that it is being attacked itself.
 - 2.1.3 A mother alligator caring for her nest or for live babies. If you see alligator babies, or if you encounter a nest (usually a mound of vegetation mixed with mud), remove yourself to a safe distance, the mother alligator is sure to be close by. If you get close, the mother may sound a very audible and intimidating warning hiss. Such a nest may be difficult to identify for a non-expert, but it is likely the mother will issue you a warning.
 - 2.1.4 Alligator mothers are well-known to be practically fearless when defending their offspring, whether the little ones have hatched or not. A mother alligator was observed leaping, jaws agape, to attack a helicopter as it approached the nest area to land! (The helicopter carried biologists studying alligator nests.)
- 2.2 Also be careful near heavy vegetation in or near the water's edge. This is where an alligator likes to enjoy privacy and peace during the daylight hours. If you trudge through there and surprise it, the outcome may not be positive.
- 2.3 Generally, a good minimum distance to keep between you and an alligator or nest is 15 feet/ 4.6 meters.
- 2.4 When trying to get past an alligator, make sure not to walk between the alligator and the water, because if it's spooked, it's going to run to the water.
- 2.5 If an alligator does approach in a threatening manner, make as much noise and movement as possible. This should show the alligator that he has taken on more than he can handle and he'll back away.



3.0 Alligator Charge

- 3.1 The alligator is not a natural runner. Those short legs obviously don't serve it like a horse's legs do, and the alligator can actually tire out in a relatively short time. When it charges after a human or animal, it is either trying to scare it away or seize it. It has a fast and furious burst of energy which

serves it well for stealth hunting -- grabbing prey when it doesn't expect it. Furthermore, the reptile is opportunistic, which means, quite simply, it doesn't like to work very hard to get its food if it doesn't have to.

- 3.2 In the very rare event you are charged or chased by an alligator, move in as straight a line as possible away from it as fast as you reasonably can. In many cases, the vegetation features of the wild will serve to protect you by slowing the alligator down, like trees, bumps, bushes, etc. -- your comparatively long legs usually make it easier for you to maneuver through the trees and brush than an alligator's short legs do.
- 3.3 Most adult humans can outrun even a fast crocodylian, which has been clocked at a maximum of about 10 mph/17 kilometers per hour (kph), compared to a human speed of 15-17 mph/24-27 kph. But this doesn't matter much; an alligator will often give up the chase because it sees that the runner is moving away too quickly, and realizes that too much effort will be required to continue pursuit.
- 3.4 You may have heard somewhere that the zigzag run (running in a "z" pattern, side-to-side) is a good idea, but this is not only an unnecessary maneuver but probably a very unwise one. Here's why:
 - 3.4.1 Unless you're an Olympic athlete, running zigzag over natural topography increases your risk of tripping and falling over rocks, plants, roots, and the like. And it goes without saying that falling while being pursued by an alligator is not good.
 - 3.4.2 Furthermore, an alligator doesn't have the degree of stereoscopic vision we have. It actually has a small 'blind spot' directly in front of it. Hence, the alligator's vision is most effective in the 'sides' of its field of view. So, running zigzag not only slows your rate of distance from your pursuer, it may clearly indicate to the animal exactly where you are; even this point hardly matters since in many cases the alligator may keep its eyes shut while pursuing so as not to get them hit by twigs, grass stalks and branches in its path.
 - 3.4.3 Finally, an alligator bites very effectively in a side-swiping motion, so if you are trying to run zigzag and are slowed down by plants, rocks, or other obstacles, the backwards flying leg of a running human is an optimal target for side-swiping, chomping jaws (the operative word here is "side").
- 3.5 Simply put, when faced with an attack, move directly away from the alligator as quickly as possible, navigating the terrain as carefully as possible. The zigzag idea will likely not serve you well.

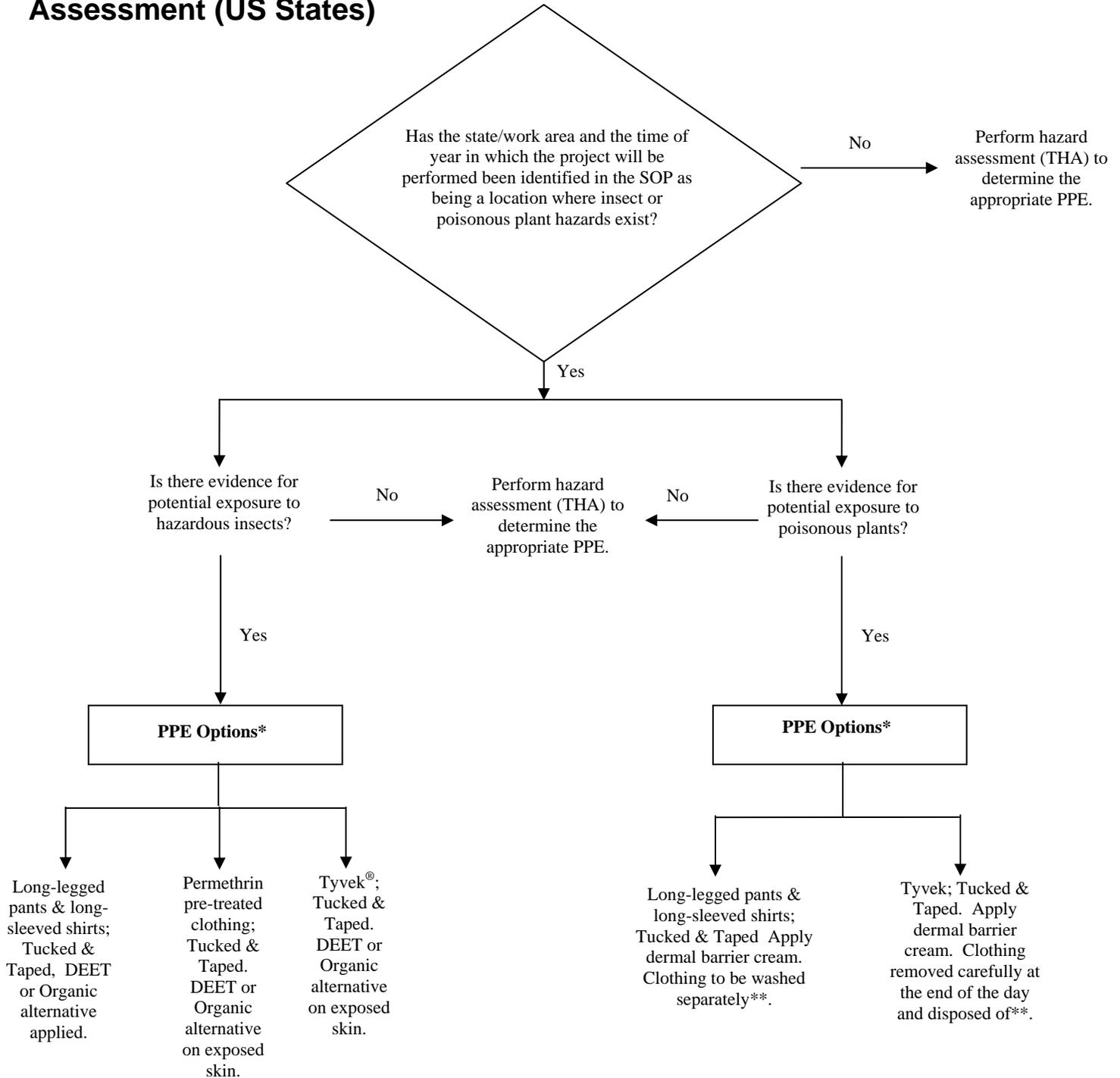
4.0 Alligator Attack

- 4.1 If it seizes prey, and the prey fights back hard, the alligator may release it, depending on factors such as its own size relative to that of the victim, its own level of aggression, and its measure of hunger. Merely struggling to break free may not be enough counter-aggression to stop an alligator, and may actually prompt a devastating "death roll" response, in which the reptile furiously spins on its central axis to tear muscle and bone free of the victim's body.
- 4.2 These armored saurian are among the toughest beasts in the animal kingdom, so an attack victim should channel his or her nervous energy and will to survive and take the offensive by fighting hard. Not struggling...fighting very, very, very hard. Others on hand during such an event may be able to help by fighting the reptile, too. This should include punching the snout, poking the eyes, and even jabbing the ears, which are seen as small slits behind the eyes.

5.0 Additional Resources

- 5.1 Additional resources can be found at:
 - 5.1.1 <http://www.tpwd.state.tx.us/huntwild/wild/species/alligator/index.phtml>
 - 5.1.2 <http://corkscrew.audubon.org/Wildlife/Alligators.html>

5-313-Biological Hazard Assessment Decision Flow Chart Hazard Assessment (US States)



* indicates that when both insect and poisonous plant hazards are recognized hazards at a project site, the most conservative combination of the available PPE choices will be selected.

** indicates that clothing that has been known or suspected to have come in contact with poisonous plants must be washed before it can be worn again. Similarly, Tyvek® that has been known or suspected to have come in contact with poisonous plants will be disposed of rather than reused during a subsequent day or project.



Biological Hazard Assessment Decision Flow Chart Hazard Assessment

State by State Guideline for Exposure

States	Tick-Borne Diseases	Mosquito-Borne Diseases	Poisonous Plants
Alabama	Year Round Low Risk	Year Round	Year round
Alaska	No Risk	No Risk	No Risk
Arizona	No Risk	March - July	March - November
Arkansas	March - November	March - November	March - November
California	Low Risk	March - November	Year Round
Colorado	Low Risk	March - November	No Risk
Connecticut	March - November	Low Risk March - November	March - November
Delaware	March - November	Low Risk March - November	March - November
Florida	Year Round Low Risk	Year Round	Year round
Georgia	Year Round Low Risk	Year Round	Year round
Hawaii	No Risk	No Risk	No Risk
Idaho	No Risk	Low Risk March - November	No Risk
Illinois	March - November	March - November	March - November
Indiana	March - November	March - November	March - November
Iowa	March - November	March - November	March - November
Kansas	Low Risk	March - November	March - November
Kentucky	March - November	March - November	March - November
Louisiana	Year Round Low Risk	Year Round	Year round
Maine	March - November	March - November	March - November
Maryland	March - November	Low Risk	March - November
Massachusetts	March - November	March - November	March - November
Michigan	March - November	March - November	March - November
Minnesota	March - November	March - November	March - November
Mississippi	Year Round	Year Round	Year round
Missouri	March - November	March - November	March - November
Montana	Low Risk March - July	Low Risk March - July	No Risk
Nebraska	Low Risk	Low Risk	Low Risk
Nevada	Low Risk March - July	Low Risk March - July	Low Risk March - November
New Hampshire	March - November	March - November	March - November
New Jersey	March - November	March - November	March - November
New Mexico	No Risk	Low Risk March - July	No Risk
New York	March - November	March - November	March - November
North Carolina	March - November	March - November	March - November
North Dakota	No Risk	March - November	No Risk
Ohio	Low Risk March - November	March - November	March - November
Oklahoma	March - November	Low Risk March - November	March - November
Oregon	Low Risk March - November	Low Risk March - November	March - November
Pennsylvania	March - November	March - November	March - November
Puerto Rico	???	Low Risk March - November	Year round



Biological Hazard Assessment Decision Flow Chart Hazard Assessment

States	Tick-Borne Diseases	Mosquito-Borne Diseases	Poisonous Plants
Rhode Island	March - November	Low Risk March - November	March - November
South Carolina	March - November	Low Risk March - November	March - November
South Dakota	Low Risk March - November	March - November	March - November
Tennessee	March - November	March - November	March - November
Texas	Year Round Low Risk	Year Round	Year round
Utah	Low Risk March - July	Low Risk March - July	No Risk
Vermont	March - November	Low Risk March - November	March - November
Virginia	Low Risk March - November	March - November	March - November
Washington	Low Risk March - November	Low Risk March - November	March - November
West Virginia	Low Risk March - November	March - November	March - November
Wisconsin	March - November	March - November	March - November
Wyoming	No Risk March - July	Low Risk March - July	No Risk

5-313-Plants of Concern

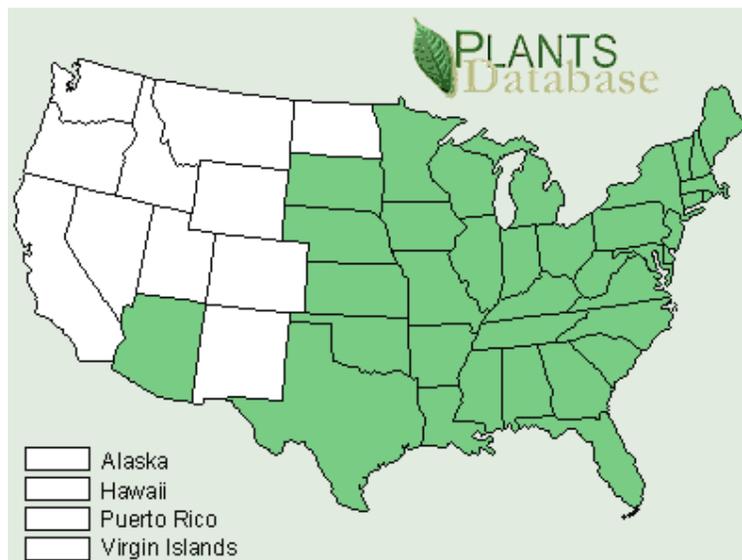
1.0 Background

- 1.1 Poison ivy, oak and sumac (poisonous plants) pose a significant threat to Resolution Consultants employees due to the dermatitis that results from exposure to the oil on these plants, called urushiol.
- 1.2 Exposure to urushiol produces a rash that can be irritating and cause the exposed employee to scratch the infected area, increasing susceptibility for an infection to result from the rash.
- 1.3 It should be noted that each time an employee is exposed to urushiol, it increases the severity of the reaction they will have in subsequent exposures.

2.0 Treatment

- 2.1 In cases that involve severe rashes, medical treatment may be necessary to control the rash.
- 2.2 Employees that develop a rash as a result of exposure to poison ivy, oak or sumac should report the exposure immediately to their Supervisor, Project Manager and RSHEM.

Figure 1
Distribution Map for Poison Ivy



**Figure 2
Distribution Map for Poison Oak**



**Figure 3
Distribution Map for Poison Sumac**



Source for Figures 1, 2, and 3: <http://www.tecnuextreme.com/plant-map.htm>

5-313-Poisonous Spider Identification

Black Widow Spider

- Abdomen usually shows hourglass marking.
- The female is 3-4 centimeters in diameter.
- Have been found in well casings and flush-mount covers.
- Not aggressive, but more likely to bite if guarding eggs.
- Light, local swelling and reddening of the bite are early signs of a bite, followed by intense muscular pain, rigidity of the abdomen and legs, difficulty breathing, and nausea.
- If bitten, see physician as soon as possible.



Brown Spiders (Recluse)

- Central and South U.S., although in some other areas, as well.
- ¼-to-½-inch-long body and the size of silver dollar.
- Hides in decaying wood, baseboards, ceilings, cracks, and undisturbed piles of material.
- Bite either may go unnoticed or may be followed by a severe localized reaction, including scabbing, necrosis of affected tissue, and very slow healing.
- If bitten, see physician as soon as possible.



Exercise care when collecting samples and avoid reaching into areas where visibility is limited. If bitten by a spider, attempt to identify the spider, notify a co-worker or someone who can help should the bite site become painful, discolored, or swollen. Stay calm and treat the area with ice or cold water. Seek medical attention if you have any reactions to the sting such as developing a rash, excessive swelling or pain at the site of the bite or any swelling or numbness beyond the site of the bite.

Additional USA Spider Identification charts are available at <http://www.termite.com/spider-identification.html>

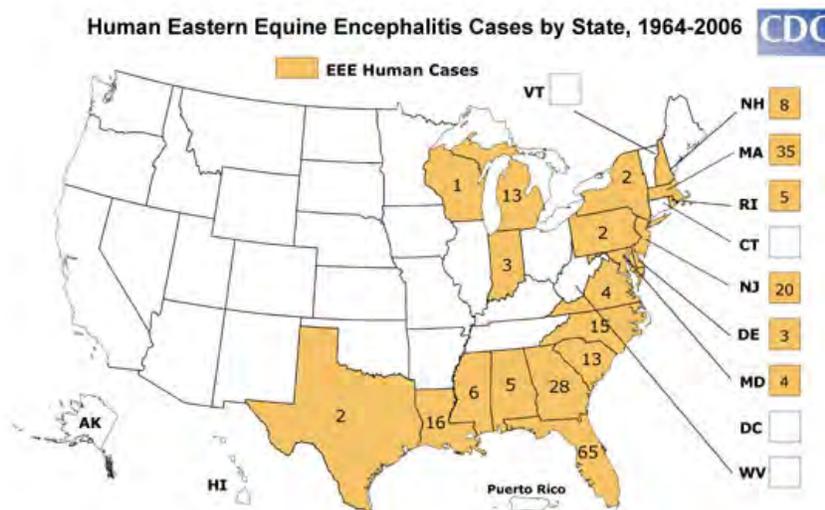
5-313-Mosquito-Borne Diseases

1.0 Background

- 1.1 CDC data indicates that mosquito-borne illnesses, including encephalitis, are a health risk to employees working in outdoor environments.
- 1.2 Mosquitoes pose a risk of causing infection with various forms of encephalitis and other diseases in Resolution Consultants employees. This section will focus on the transmission of encephalitis. West Nile encephalitis is an infection of the brain that is caused by a virus known as the West Nile virus.
- 1.3 If other mosquito-borne diseases are identified in the project area, the local Public Health Department and CDC should be consulted to determine what diseases are present and exposure prevention recommendation.
- 1.4 According to the CDC, arboviral encephalitis is a virus that is “maintained in nature through biological transmission between susceptible vertebrate hosts by blood feeding arthropods”, e.g., mosquitoes. It exists in various forms in global distribution, and in four primary forms in the U.S.: 1) eastern equine encephalitis (EEE), 2) western equine encephalitis (WEE), 3) St. Louis encephalitis (SLE), and 4) La Crosse (LAC) encephalitis; all of which are transmitted by mosquitoes.
- 1.5 Mosquitoes are known to breed in standing water; therefore, when standing water is found at a job site, actions should be taken to drain the water. Typically, mosquitoes will fly only a quarter of a mile (400 meters) from their breeding location.

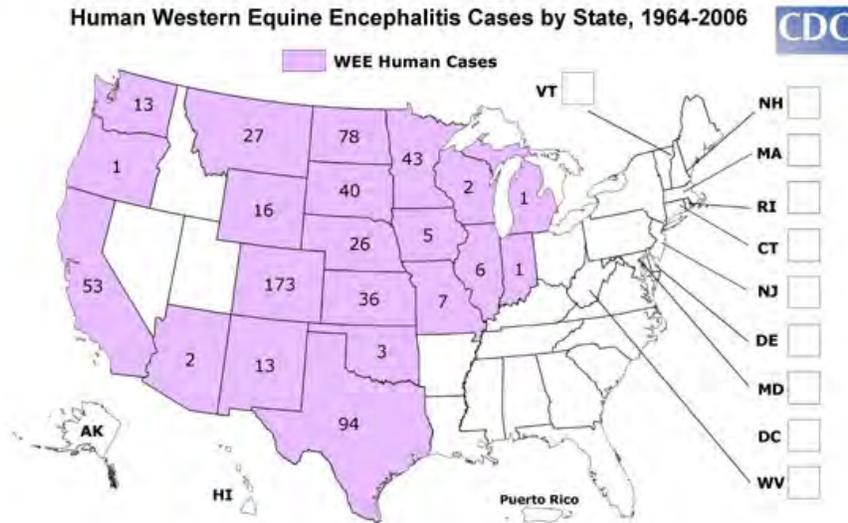
2.0 Distribution

Figure 1
Distribution Map for EEE Cases



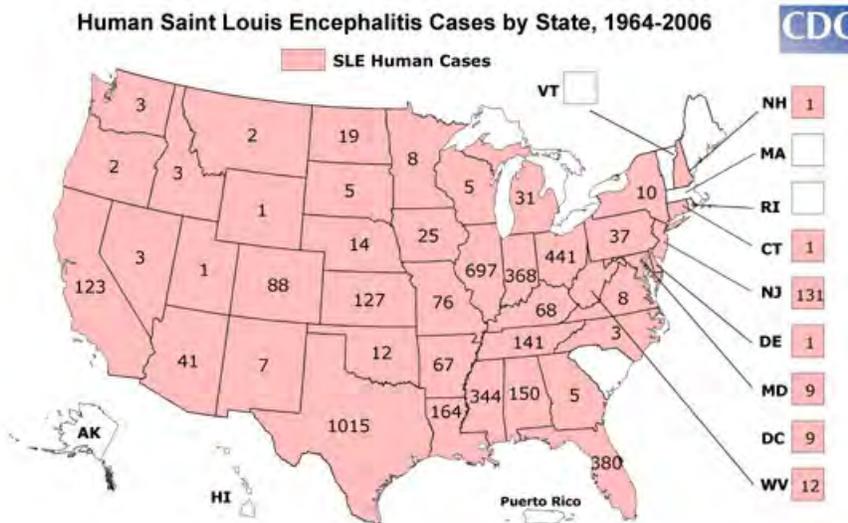
Source: http://www.cdc.gov/ncidod/dvbid/arbor/images/EEE_Map.jpg

Figure 2
Distribution Map for WEE Cases



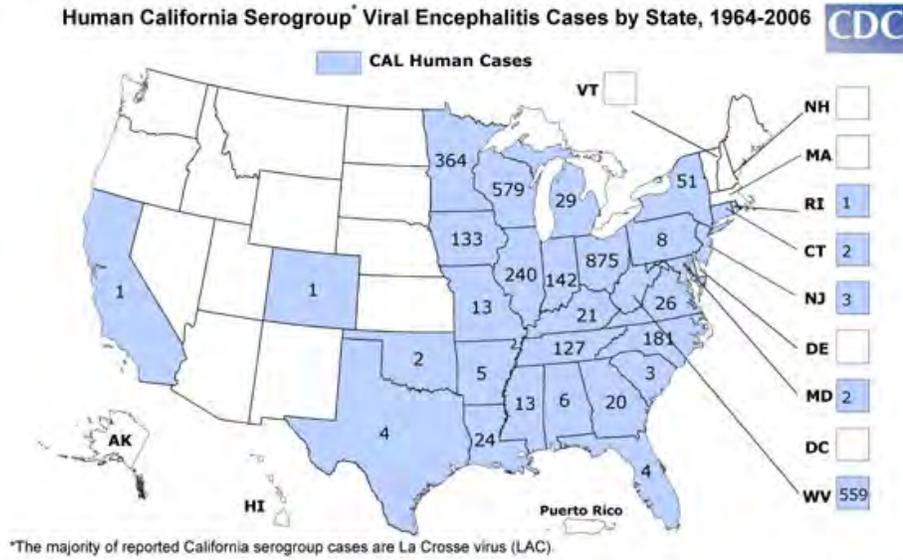
Source: http://www.cdc.gov/ncidod/dvbid/arbor/images/WEE_Map.jpg

Figure 3
Distribution Map for SLE Cases



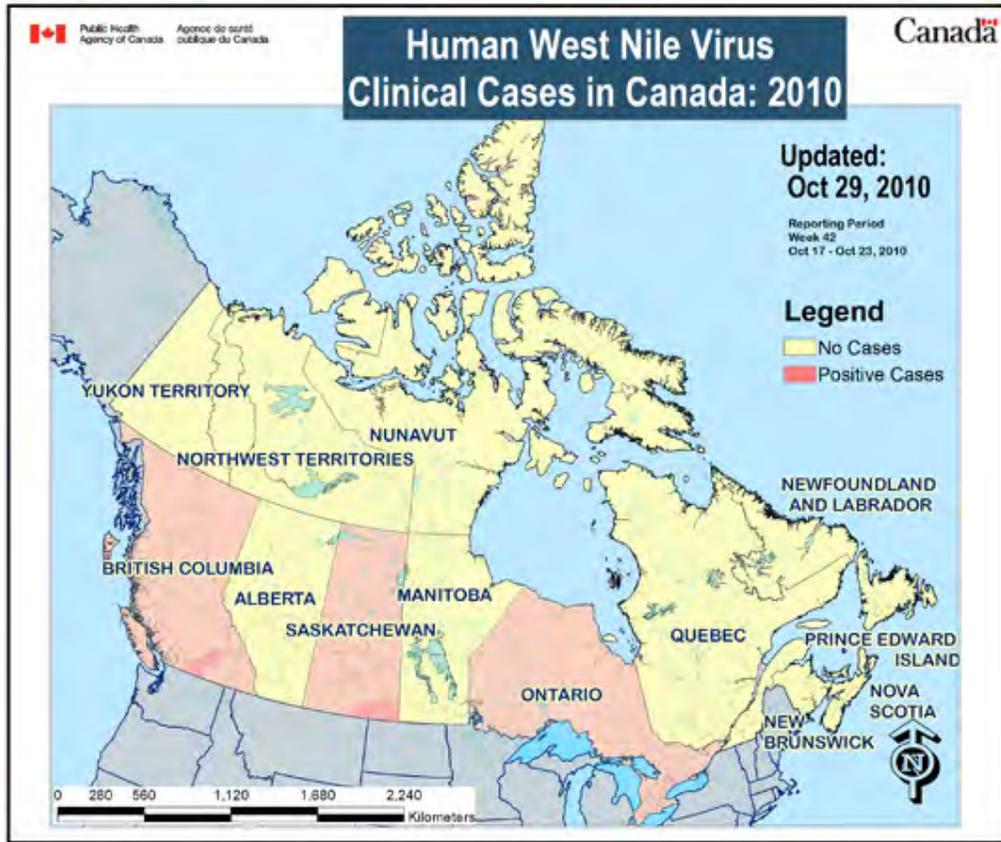
Source: http://www.cdc.gov/ncidod/dvbid/arbor/images/SLE_Map.jpg

**Figure 4
Distribution Map for LAC Cases**



Source: http://www.cdc.gov/ncidod/dvbid/arbor/images/LAC_Map.jpg

Canadian Mosquito Borne Diseases



Source: <http://www.eidgis.com/wnvmonitorca/>

Disease	Distribution
California encephalitis	Canada-wide
Western equine encephalitis	Western Canada
Eastern equine encephalitis	Quebec, Ontario
St Louis encephalitis	Ontario, Quebec, Manitoba, Saskatchewan
Cache Valley	Ontario, Manitoba, Saskatchewan, Alberta

Source: [Paediatr Child Health. 2000 May-Jun; 5\(4\): 206-212.](#)

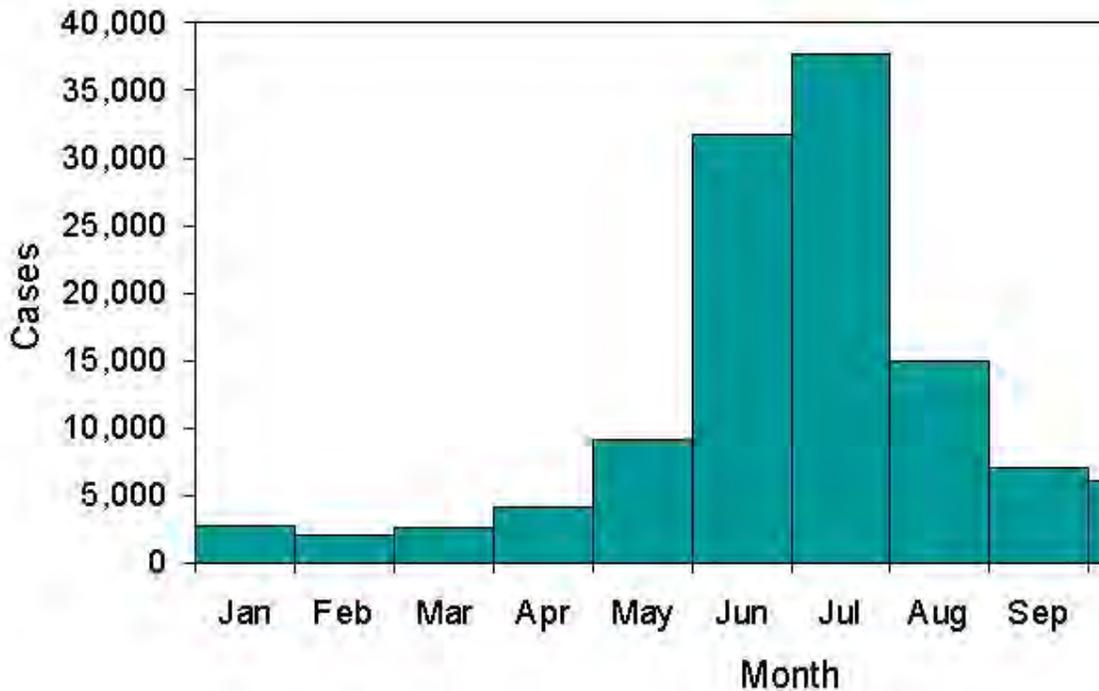
5-313-Ticks

1.0 Background

- 1.1 The Public Health Agency of Canada (PHAC) works with the provinces, health authorities and other experts on research to define and monitor the occurrence of the ticks that carry *Borrelia burgdorferi*, the bacterium that causes Lyme disease. In Canada, the blacklegged tick (*Ixodes scapularis*; often referred to as a deer tick) and the western blacklegged tick (*Ixodes pacificus*) are the species known to transmit this disease-causing agent, as well as other less common agents.
- 1.2 In Quebec, blacklegged tick populations are becoming established in parts of the Monteregie and Estrie regions in the southeast of the province. In Ontario, populations can be found in Long Point; Point Pelee National Park; Rondeau Provincial Park; Turkey Point; Prince Edward Point National Wildlife Area and St. Lawrence Islands National Park in the Thousand Islands region of eastern Ontario. In Nova Scotia, blacklegged tick populations are found in the Lunenburg, Bedford and Shelburne areas. An established population has also been found in the southeastern corner of Manitoba. Western blacklegged ticks, on the other hand, are found in British Columbia; they are fairly widely distributed but populations are largest in the lower mainland, on Vancouver Island, and in the Fraser Valley.
- 1.3 Although the distribution of blacklegged ticks in Canada appears to be limited, surveillance indicates that some of the established populations are spreading within certain areas of southern Canada. The potential expansion of localized tick populations makes it difficult to precisely define the geographic limits of any given population; however, people living in or visiting areas adjacent to established tick populations may have a greater chance of contact with blacklegged ticks. Although current evidence does not suggest a widespread distribution of blacklegged tick populations in Canada, the establishment of new populations appears to be an ongoing process. Hence, it is desirable to continue surveillance and to take precautions to reduce tick contact.
- 1.4 The rate of infection of ticks with the bacterium that causes Lyme disease varies. Infection rates are typically higher in adult ticks compared to the other stages (nymphs and larvae). Despite the lower rates of infection, people are most likely to acquire Lyme disease from a nymph because this stage is so small (see Figure 2) and thus more likely to go unnoticed and feed for a sufficient amount of time for the Lyme disease bacterium to be transmitted (24-36 hours). Infection rates are often greater in tick populations that have been established for long periods of time (such as Long Point) compared to newly established ones. As many as 60 percent of the adult ticks at Long Point are infected; however, infection rates in adults are more often between 10 and 25 percent at the other localities where ticks are established. Partly because of differences in the types of hosts that they feed upon, infection rates of the Lyme disease agent in *Ixodes pacificus* are much lower (1-3 percent) than *Ixodes scapularis*.
- 1.5 While there is a higher risk of coming in contact with infected blacklegged ticks in areas where populations are established, there is also a low risk of Lyme disease being contracted almost anywhere in Canada because migratory birds transport infected ticks over large geographic distances. Surveillance data indicates that about 12 percent of the ticks detected outside of areas where tick populations are established, and likely transported there on migratory birds, are infected with the agent of Lyme disease.
- 1.6 Source: <http://www.phac-aspc.gc.ca/id-mi/tickinfo-eng.php>

Figure 1

Reported Cases of Lyme Disease by Month of Illness Onset United States, 1992-2004



Lyme disease patients are most likely to have illness onset in June, July, or August and less likely to have illness onset from December through March.

Lyme disease likelihood = April through November http://www.cdc.gov/ncidod/dvbid/lyme/ld_rptmthofill.htm

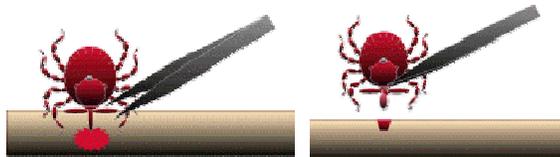
2.0 Tick removal tips from CDC

<http://www.cdc.gov/ncidod/dvrd/ehrlichia/Q&A/Q&A.htm>

3.0 To Remove Attached Ticks



- 3.1 Use fine-tipped tweezers or notched tick extractor, and protect your fingers with a tissue, paper towel, or latex gloves (see figure). Persons should avoid removing ticks with bare hands.
- 3.2 Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. (If this happens, remove mouthparts with tweezers. Consult your health care provider if illness occurs.)
- 3.3 After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.
- 3.4 Do not squeeze, crush, or puncture the body of the tick because its fluids may contain infectious organisms. Skin accidentally exposed to tick fluids can be disinfected with iodine scrub, rubbing alcohol, or water containing detergents.
- 3.5 Save the tick for identification in case you become ill. This may help your doctor make an accurate diagnosis of potential diseases by determining what type of tick it is. Place the tick in a sealable plastic bag and put it in your freezer. Write the date of the bite on a piece of paper with a pencil and place it in the bag.



4.0 Devices Designed for Removing Ticks

- 4.1 [The Tick Tool - http://www.ticktool.com/index.html](http://www.ticktool.com/index.html)

5.0 Folklore Remedies Don't Work

- 5.1 Folklore remedies, such as the use of petroleum jelly or hot matches, do little to encourage a tick to detach from skin. In fact, they may make matters worse by irritating the tick and stimulating it to release additional saliva or regurgitate gut contents, increasing the chances of transmitting the pathogen. These methods of tick removal should be avoided.

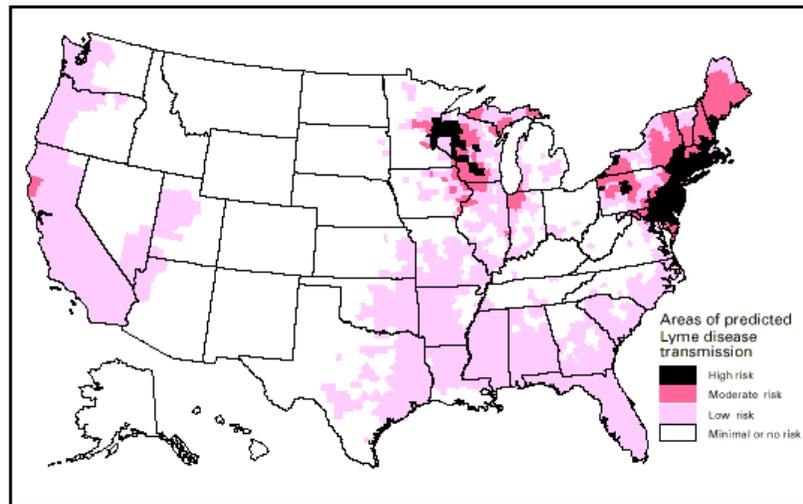
**Information Regarding Common Tick-Borne Diseases and
Tick Removal Procedures**

**Table 1
Common Tick-Borne Diseases in the U.S. and Information Resources**

Disease	Tick Species	CDC Informational Web Pages
Lyme disease	<ul style="list-style-type: none"> • Black-legged or deer tick • Western black legged tick 	http://www.cdc.gov/ncidod/dvbid/lyme/
Ehrlichiosis	<ul style="list-style-type: none"> • Lone star tick • Black-legged or deer tick • Western black legged tick 	http://www.cdc.gov/Ncidod/dvrd/ehrlichia/Index.htm
Rocky Mountain spotted fever	<ul style="list-style-type: none"> • American dog tick • Rocky Mountain wood tick • Brown dog tick 	http://www.cdc.gov/ncidod/dvrd/rmsf/index.htm

6.0 Distribution

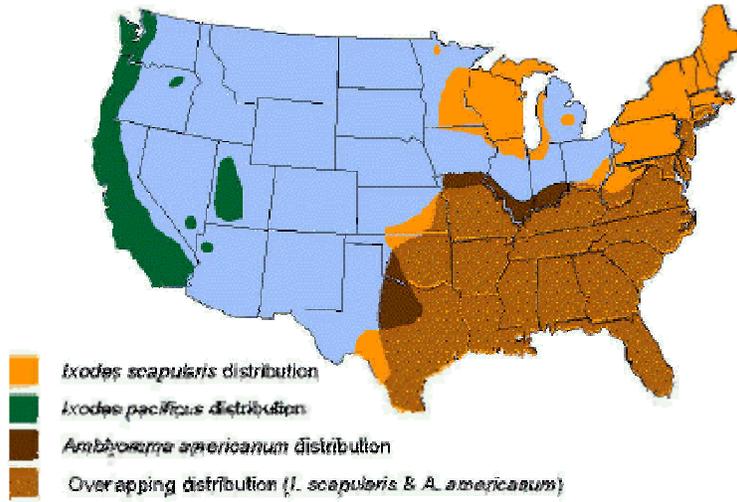
**Figure 2
Distribution Map for Lyme Disease Risk, U.S.**



Note: This map demonstrates an approximate distribution of predicted Lyme disease risk in the United States. The true relative risk in any given county compared with other counties might differ from that shown here and might change from year to year. Risk categories are defined in the accompanying text. Information on risk distribution within states and counties is best obtained from state and local public health authorities.

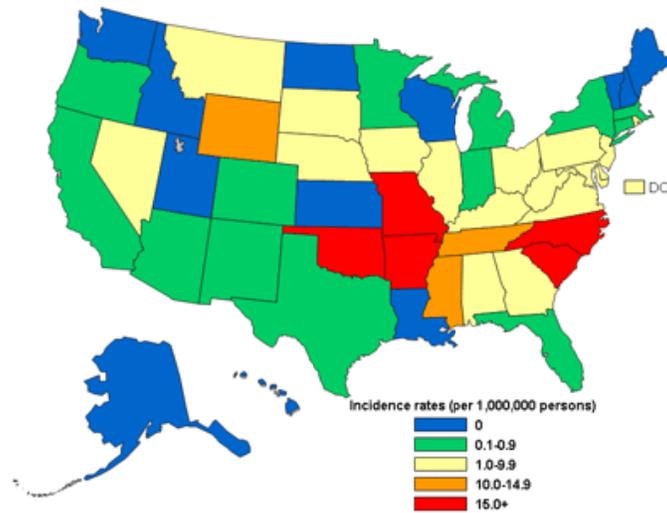
Source: CDC, <http://www.cdc.gov/ncidod/dvbid/lyme/riskmap.htm>

Figure 3
Distribution Map of Vector
Tick Species for Human Ehrlichiosis, U.S.



Source: CDC, <http://www.cdc.gov/ncidod/dvrd/ehrlichia/Q&A/Q&A.htm>

Figure 4
Distribution Map of Annual Incidence
of Rocky Mountain Spotted Fever, U.S



Data for calendar year 2002

Source: CDC, <http://www.cdc.gov/ncidod/dvrd/rmsf/Epidemiology.htm>

5-313-Insect Repellent Active Ingredient Product Information

1.0 Application of Insect Repellent

- 1.1 Immediately prior to the commencement of work in the field, an Resolution Consults -approved insect repellent shall be applied to exposed skin, and to the outer surface of pant leg cuffs tucked into socks, shirt tails tucked into pants at the waist, and shirt cuffs.
- 1.2 Table 1 provides a list of Resolution Consults-approved insect repellent active ingredients; employees may utilize any brand containing the minimum concentration of active ingredients as listed.
- 1.3 All products are registered with the EPA and recommended by the CDC.
- 1.4 Employees should select the Resolution Consults approved repellent which is best for them based on skin sensitivity/allergies, and personal preference, but be aware that reapplication frequency will be greater for Picaridin and lemon eucalyptus products.
- 1.5 Employees shall carefully read and comply with manufacturer recommendations and instructions on product labels prior to application. Repellent shall not be applied beneath clothing to minimize the potential for irritation and/or allergic reaction.
- 1.6 The chemical N,N-diethyl-*m*-toluamide (DEET) shall not be applied to Nomex™ fire retardant clothing as it reduces the effectiveness of the fabric.

**Table 1
Approved Insect Repellents**

Active ingredient and minimum concentration	Products Available	Approximate Duration of Effectiveness	Notes and Web Link to Product Safety Information
Permethrin (0.5%)	-Repel® Permanone -Coulston's Duranon™	2 weeks ¹	-Application to clothing and equipment only
DEET (23.8%)	-Deep Woods Off!® -Repel® Sportsmen Formula®	5 hours ²	-Cannot be applied to Nomex™ fabric
Picaridin (7%)	-Cutter Advanced™	4 hours ³	-Protection equivalent to approximately 10% DEET
Oil of Lemon Eucalyptus (30%)	-Repel® Lemon Eucalyptus	2 hours ²	-Protection equivalent to approximately 7% DEET -Natural, plant based product

¹ – New York State Department of Health, 2007

² – Fradin and Day, 2002

³ – Spectrum Brands, 2007

- 1.7 Repellent shall be reapplied multiple times daily over the course of the day at a frequency identified during the hazard assessment based on manufacturers' recommendations, the approximate effective period provided in Table 1, and other factors such as perspiration, precipitation, etc.
- 1.8 All approved repellents are available at most department or sporting goods stores.

Product Safety Information

Facts about the repellants recommended by Resolution Consults are available by clicking on the embedded link.

National Pesticide Telecommunications Network Fact Sheet: Permethrin and Picaridin

Picaridin



Picaridin Fact
Sheet.pdf

Permethrin



Permethrin Fact
Sheet.pdf

DEET



DEET Fact Sheet.pdf

Lemon Eucalyptus



Lemon Eucalyptus
fact sheet.pdf

5-313-Configuration Clothing for Protection Against Ticks and Insects

1.0 Configuration of Clothing

- 1.1 Loose-cuff trousers must be tucked into socks, wrapped with duct tape (or equivalent) completely around the cuff of the sock up on to the surface of the pant leg to prevent entry of insects between the sock and pants, and preferably reverse-wrapped with "sticky" side out (see figure below). Once the clothing is configured, insect repellent containing DEET (or acceptable alternative) should be applied to the clothing.



5-405 Drilling, Boring, and Direct Push Probing

1.0 Purpose and Scope

- 1.1 Provides the minimum requirements to be followed when drilling and boring work are performed.
- 1.2 This procedure applies to all Resolution Consultants employees and operations.

2.0 Terms and Definitions

None.

3.0 References

None.

4.0 Procedure

- 4.1 All client on-site safety procedures shall be understood and adhered to.
- 4.2 Be aware of the provincial/territorial regulations that govern drill rig operations and exposed moving parts.
- 4.3 **Roles and Responsibilities**
 - 4.3.1 **Project Manager or Resident Engineer** is responsible for ensuring that sound principles of safety, training, inspection, maintenance, and operation consistent with all resource data available from the manufacturer, OSHA, and ANSI is provided to the operator and users by the Contractor or operating entity.
 - 4.3.2 **Site Safety Officer (SSO)** shall assist the **Project Manager** in compliance with the requirements of this procedure.
 - 4.3.3 The **H&S Department** shall assist site management with guidance about this procedure.
 - 4.3.4 **Resolution Consultants employees** engaged in project field activities shall be cognizant of contractor activities that may affect their safety and shall follow these procedures.
 - 4.3.5 **Resolution Consultants Equipment Operator**
 - In cases where Resolution Consultants owns and operates drilling, boring, or probing equipment, the lead equipment operator is responsible for the maintenance and safe operation of equipment under their control consistent with those responsibilities of a Contractor.
 - Operations will be terminated during an electrical storm, and all crew members will move away from the rig. If lightning is observed, shut down all rig operations immediately.
 - 4.3.6 **Contractors**
 - **Contractors** have direct control over the application and operation of all drilling, boring, and probing equipment owned by their organization.
 - It is the **Equipment Contractor** operator's responsibility to implement safe work practices provided by the **Contractor's** project management or supervisory staff supplemented by good judgment, safe control, and caution whenever operating drilling, boring, and probing equipment.
 - 4.3.7 **Safety Representative:** Unless the **Contractor** has a designated **Safety Representative**, the **Contractor's** responsible person for safety for the drill crew will be the drill rig operator. The safety person's responsibilities are to
 - Consider the "responsibility" for safety and the "authority" to enforce safety to be a matter of first importance.
 - Be the leader in using proper personal protective equipment (PPE) and set an example in following the rules that are being enforced on others. See section 4.5 for PPE required by this SOP.

- Enforce the use of proper safety equipment and take appropriate corrective action when proper PPE is not being used.
- Understand that the proper maintenance of tools and equipment and general housekeeping on the drill rig will provide an environment that promotes and enforces safety. See Sections 4.7 and 4.9 for housekeeping and maintenance requirements of this SOP.
- Ensure that the operator has had adequate training and is thoroughly familiar with the rig, its controls, and its capabilities prior to commencement of drilling activities.
- Inspect the rig at least daily for structural damage, loose bolts and nuts, proper tension in chain drives, loose or missing guards or protective covers, fluid leaks, damaged hoses, and/or damaged pressure gauges and pressure relief valves.
- Check and test all safety devices such as emergency shutdown switches at least daily and preferably at the start of a work shift. Rig operation should not be permitted until all emergency shutdown and warning systems are working correctly. Wiring around, bypassing, or removing an emergency device is not permitted.
- Check that all gauges, warning lights, and control levers are functioning properly, and listen for unusual sounds on each starting of an engine.
- Ensure that all new rig workers are informed of safe operating practices on and around the rig. Provide each new rig worker with a copy of the organization's drilling operations safety procedures and, when appropriate, the rig manufacturer's operations and maintenance manual. The safety person should ensure that each new employee reads and understands the safety procedures.
- Ensure that a first aid kit and fire extinguishers are available and properly maintained on each rig and on each additional vehicle.
- Be well trained and capable of using a first aid kit, a fire extinguisher, and all other safety devices and equipment.
- Maintain a list of addresses and telephone numbers of emergency assistance units (ambulance services, police, hospitals, etc.), and inform other members of the drill crew of its location.
- See that new workers are instructed in rig safety, and observe the new worker's progress toward understanding safe operating practices.
- Observe the mental, emotional, and physical capability of workers to perform the assigned work in a proper and safe manner. Dismiss from the job site any worker whose mental and physical capabilities might cause injury to the worker or coworkers.
- Rig Crew and Other Field Personnel (Those employees involved in fieldwork): All personnel engaged in site activities are required to become thoroughly familiar with, and to conform to, the provisions of Resolution Consultants' safety plan, procedures, and such other safety directives as may be considered appropriate by **Project Managers, Safety Officers, and Supervisors.**
- Rig Workers: Personnel are encouraged to offer ideas, suggestions, or recommendations regarding any operational condition, procedure, or practice that may enhance the safety of site personnel or the public. Their primary responsibilities will be:
 - Perform all required work safely.
 - Familiarize themselves with and understand the plan, including proper use of personal protective equipment.
 - Report any unsafe conditions to supervisory personnel.
 - Be aware of signs and symptoms of thermal stress.

4.4 Training

- 4.4.1 All staff shall be provided with on-site orientation to the rig and its operator.
- 4.4.2 All operators and assistants shall have industry-standard safety training and be versed in the equipment to be utilized. This may include, but is not limited to, HAZWOPER, Petroleum Safety Training (or Construction Safety Training), and others as appropriate.

4.5 Personal Protective Equipment

- 4.6 For most geotechnical, mineral, and/or groundwater drilling projects, PPE should include
- Hard hat: Hard hats shall be worn by everyone working at a drilling/boring site. Hats should meet the requirements of ANSI Z89 and be kept clean and in good repair with the headband and crown straps properly adjusted for the employee.
 - Safety shoes: Safety shoes or boots shall be worn by all drilling personnel and all visitors to the site who observe operations within close proximity of the rig. Safety shoes or boots should meet the requirements of ANSI Z4 1.1.
 - Safety glasses: All rig personnel shall wear safety glasses meeting the requirements of ANSI Z87.1.
 - High Visibility Class II Safety Vest shall be worn by all **Resolution Consultants employees**. All rig personnel should attempt to wear high-visibility clothing that should be close fitting and not have large cuffs or loose material that can catch on rotating or translating components of the rig.
 - Close fitting gloves and clothing: All rig personnel should wear gloves for hand protection against cuts and abrasions that could occur while handling wire rope or cable and from contact with sharp edges and burrs on drill rods and other drilling or sampling tools. Gloves should be close fitting and not have large cuffs or loose ties which can catch on rotating or translating components of the rig.
 - Face shield: Face shields shall be worn by anyone performing battery maintenance activities where a splash hazard exists. Face shields shall meet the requirements of ANSI Z87.
 - Other protective equipment: For some operations, the project may dictate use of other protective equipment. The management of the contractor and its safety person shall determine the requirements. Such equipment might include face or ear protection or reflective clothing. The design and composition of the protective equipment and clothing should be determined as a joint effort of management and the client.
 - Each worker should wear noise reducing ear protectors around operating equipment or during elevated noise levels.
 - When drilling, boring, or probing is performed in chemically or radiological contaminated ground, special protective equipment and clothing will probably be required.
 - The clothing of the individual rig worker is not generally considered protective equipment; however, clothing should be close fitting and comfortable without loose ends, straps, draw strings or belts or otherwise unfastened parts that might catch on some rotating or translating component of the rig. Rings and jewelry should not be worn during a work shift.

4.7 Housekeeping

- 4.7.1 A key requirement for safe field operations is that the Contractor safety person understands and fulfills the responsibility for maintenance and “housekeeping” on and around the drill rig, including the following:
- Suitable storage locations should be provided for all tools, materials, and supplies so that tools, materials, and supplies can be conveniently and safely handled without hitting or falling on a member of the crew or a visitor.
 - Storage or transporting tools, materials, or supplies within or on the mast (derrick) of the rig should be avoided.
 - Pipe, drill rods, probe rods, casing augers, and similar tooling should be orderly stacked on racks or sills to prevent spreading, rolling, or sliding.
 - Penetration or other driving hammers should be placed at a safe location on the ground or be secured to prevent movement when not in use.

- Work areas, platforms, walkways, scaffolding and other accesses should be kept free of materials, debris and obstructions and substances such as ice, grease, or oil that could cause a surface to become slick or otherwise hazardous.
- All controls, control linkages, warning and operation lights, and lenses should be kept free of oil, grease, and/or ice.
- Do not store gasoline in any portable container other than a non-sparking, red safety container with a flame arrester in the fill spout and having the word “gasoline” easily visible.

4.8 **Traffic Control**

4.8.1 When operating near public vehicular and pedestrian traffic, the on-site personnel shall take every precaution necessary to see that the work zone is properly established, identified, and isolated from both moving traffic and passerby pedestrians.

4.8.2 All traffic control devices shall be installed, placed, and maintained in accordance with the Traffic Control Plan, client specifications, and/or the Manual of Uniform Traffic Control Devices (MUTCD). Traffic control devices shall consist of and not be limited to:

- Directional and informational signage;
- High visibility barricades, cones, or barrels;
- Lighting; and
- Other equipment and devices as required.

4.9 **Maintenance & Inspection**

4.9.1 Good maintenance and thorough inspection will make operations safer. Maintenance tasks should be done safely by a qualified maintenance person. Inspection and maintenance tasks include but are not limited to the following requirements:

- Inspections shall be completed at the beginning of each day by the equipment operator and in the presence of an Resolution Consultants employee when the equipment is not owned and operated by Resolution Consultants.
- Safety glasses should be worn when performing maintenance on a rig or on drilling or probing tools.
- The drill rig engine should be shut down to make repairs or adjustments to a drill rig or to lubricate fittings (except repairs or adjustments that can only be made with the engine running).
- Precautions should be taken to prevent accidental starting of an engine during maintenance by removing or tagging the ignition key.
- Wheels or the lowering of leveling jacks or both should be blocked (“zero energy state”) and hand brakes set before working under a drill rig.
- When possible and appropriate, all pressure on the hydraulic systems should be released as well as the drilling fluid system and the air pressure systems of the drill rig prior to performing maintenance. In other words, reduce the drill rig and operating systems to a “zero energy state” before performing maintenance. Use extreme caution when opening drain plugs and radiator caps and other pressurized plugs and caps.
- Personnel shall not touch an engine or the exhaust system of an engine following its operation until the engine and exhaust system have adequate time to cool.
- Welding and cutting shall not occur on or near a fuel tank.
- Wire rope safety factors shall be in accordance with American National Standards Institute B 30.5-1968 or SAE J959-1966.
- Gasoline or other volatile or flammable liquids shall not be used as a cleaning agent on or around a rig.
- The manufacturer's recommendations should be followed for applying the proper quantity and quality of lubricants, hydraulic oils, and/or coolants.
- All caps, filler plugs, protective guards, panels, high-pressure hose clamps, chains, or cables that have been removed for maintenance should be replaced.

4.10 **Hand Tools**

4.10.1 A large number of hand tools can be used on or around a drill or probe rig and in repair shops and more than an equal number of instructions for proper use exist. "Use the tool for its intended purpose" is the most important rule. Additionally, equipment operators and assistants should not use their hand in place of the proper tool; work shall be stopped until the correct tool can be found. The following are a few specific and some general suggestions that apply to the safe use of several hand tools that are often used on and around rigs:

- When a tool becomes damaged, either repair it before using it again or get rid of it.
- When using a hammer, any kind of hammer for any purpose, wear safety glasses and require all others around you to wear safety glasses.
- When using a chisel, any kind of chisel, for any purpose, wear safety glasses and require all others around you to wear safety glasses.
- Keep all tools cleaned and orderly stored when not in use.
- Use wrenches on nuts; don't use pliers on nuts.
- Use screwdrivers with blades that fit the screw slot.
- When using a wrench on a tight nut, first use some penetrating oil, use the largest wrench available that fits the nut, when possible pull on the wrench handle rather than pushing, and apply force to the wrench with both hands when possible and with both feet firmly placed. Don't push or pull with one or both feet on the drill rig or the side of a mud pit or some other blocking-off device. Always assume that you may lose your footing – check the place where you may fall for sharp objects.
- Keep all pipe wrenches clean and in good repair. The jaws of pipe wrenches should be wire brushed frequently to prevent an accumulation of dirt and grease which would otherwise build up and cause wrenches to slip. Replace hook and heel jaws when they become visibly worn.
- Avoid the use pipe wrenches in place of a rod-holding device whenever possible.
- When breaking tool joints on the ground or on a drilling platform, position your hands so that your fingers will not be smashed between the wrench handle and the ground or the platform, should the wrench slip or the joint suddenly let go.

4.11 **Clearing Work Areas**

4.11.1 Prior to set up, adequate site clearing and leveling should be performed to accommodate the rig and supplies and provide a safe working area. Clearing the site includes clearing the intended drilling area of underground utilities in accordance with *5-417-Utilities Underground*. Drilling or probing should not be commenced when tree limbs, unstable ground or site obstructions cause unsafe tool handling conditions.

4.11.2 **Start-Up**

- All rig personnel and visitors should be instructed to "stand clear" of the rig immediately prior to and during starting of an engine.
- Make sure all gear boxes are in neutral, all hoist levers are disengaged, all hydraulic levers are in the neutral-actuating positions, and the cathead rope is not on the cathead before starting a drill rig engine.
- Start all engines according to the manufacturer's manual.

4.12 **Drilling and Probing Operations**

4.12.1 The following safety measures shall be taken during drilling and probing operations on-site:

- The operator and helper shall be present during all active rig operations.
- Site personnel shall remain within visual contact of the rig operator.
- Hard hats, approved safety boots and hearing protection shall be worn in the presence of a rig.
- Services shall be cleared prior to drilling or probing.
- Hands shall be kept away from moving parts (augers).
- The emergency shut-off switch on the rig should be identified to site personnel and tested on a regular basis by the operator.

- Unauthorized personnel shall be kept clear of the rig.
- 4.12.2 Safety requires the attention and cooperation of every worker and site visitor.
- Do not drive the rig from hole to hole with the mast (derrick) in the raised position.
 - Before raising the mast (derrick) look up to check for overhead obstructions. Refer to 5-417-*Utilities, Underground* and 5-406-*Electrical Lines, Overhead*.
 - Before raising the mast (derrick), all rig personnel (with the exception of the operator) and visitors should be cleared from the areas immediately to the rear and the sides of the mast. All rig personnel and visitors should be informed that the mast is being raised prior to raising it.
 - Before the mast (derrick) of a drill rig is raised and drilling is commenced, the drill rig shall be first leveled and stabilized with leveling jacks and/or solid cribbing. The drill rig should be releveled if it settles after initial set up. Lower the mast (derrick) only when the leveling jacks are down, and do not raise the leveling jack pads until the mast (derrick) is lowered completely.
 - Before starting drilling operations, secure and/or lock the mast (derrick) if required according to the drill manufacturer's recommendations.
 - The operator of a rig should only operate a drill rig from the position of the controls. If the operator of the rig shall leave the area of the controls, the operator should shift the transmission controlling the rotary drive into neutral and place the feed control lever in neutral. The operator should shut down the drill engine before leaving the vicinity of the drill.
 - Throwing or dropping tools will not be permitted. All tools should be carefully passed by hand between personnel or a hoist line should be used.
 - Do not consume alcoholic beverages or other depressants or chemical stimulants prior to starting work on a rig or while on the job.
 - If it is necessary to operate the rig within an enclosed area, make certain that exhaust fumes are conducted out of the area. Exhaust fumes can be toxic and some cannot be detected by smell.
 - Clean mud and grease from your boots before mounting a rig platform and use hand holds and railings. Watch for slippery ground when dismounting from the platform.
 - During freezing weather, do not touch any metal parts of the rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously.
 - All air and water lines and pumps should be drained when not in use if freezing weather is expected.
 - All unattended bore holes shall be adequately covered or otherwise protected to prevent rig personnel, site visitors, or animals from stepping or falling into the hole. All open bore holes should be covered, protected, or backfilled adequately and according to local or state regulations on completion of the drilling project.
 - "Horsing around" within the vicinity of the drill rig and tool and supply storage areas should never be allowed, even when the rig is shut down.
 - When using a ladder on a rig, face the ladder and grasp either the side rails or the rungs with both hands while ascending or descending. Always use adequate fall protection and a full body harness when climbing above six feet of the ground. Do not attempt to use one or both hands to carry a tool while on a ladder. Use a hoist line and a tool "bucket" or a safety hook to raise or lower hand tools.

4.13 **Elevated Derrick Platforms**

4.13.1 The following precautions should be used:

- When a rig worker first arrives at a derrick platform, the platform should immediately be inspected for broken members, loose connections, and loose tools or other loose materials.
- A derrick platform over 4 feet (1.2 m) above ground surface should have toe boards and safety railings that are in good condition.
- When climbing to a derrick platform that is higher than 6 feet (2 m), a fall arresting device shall be used. The fall arresting device should consist of a full body harness and fall protection. The harness should fit snugly but comfortably. The lifeline when attached to the derrick should be less than 6 feet (2 m) long and attached to a fall arrester. The harness and lifeline should be strong enough to withstand the dynamic force of a 250-pound (115 kg) weight (contained within the belt) falling 6 feet (2 m).

- When a rig worker is on a derrick platform, the lifeline should be fastened to the derrick just above the derrick platform and to a structural member that is not attached to the platform or to other lines or cables supporting the platform.
- Tools should be securely attached to the platform with safety lines. Do not attach a tool to a line attached to your wrist or any other part of your body.
- When you are working on a derrick platform, do not guide drill rods or pipe into racks or other supports by taking hold of a moving hoist line or a traveling block.
- Loose tools and similar items should not be left on the derrick platform or on structural members of the derrick.
- Workers on the ground or the drilling floor should avoid being under rig workers on elevated platforms whenever possible.

4.14 **Lifting Heavy Objects**

- 4.14.1 Before lifting any object without using a hoist, make sure that the load is within your personal lifting capacity. If it is too heavy, ask for assistance.
- 4.14.2 Before lifting a relatively heavy object, approach the object by bending at the knees, keeping your back vertical and unarched while obtaining a firm footing. Grasp the object firmly with both hands and stand slowly and squarely while keeping your back vertical and unarched. In other words, perform the lifting with the muscles in your legs, not with the muscles in your lower back.
- 4.14.3 If a heavy object shall be moved some distance without the aid of machinery, keep your back straight and unarched. Change directions by moving your feet, not by twisting your body.
- 4.14.4 Move heavy objects with the aid of handcarts or lifting devices whenever possible.

4.15 **Use of Wire Line Hoists, Wire Rope, and Hoisting Hardware**

- 4.15.1 The use of wire line hoists, wire rope, and hoisting hardware should be as stipulated by the American Iron Steel Institute, Wire Rope Users Manual.
- All wire ropes and fittings should be visually inspected during use and thoroughly inspected at least once a week for abrasion, broken wires, wear, reduction in rope diameter, reduction in wire diameter, fatigue, corrosion, damage from heat, improper reving, jamming, crushing, bird caging, kinking, core protrusion, and damage to lifting hardware. Wire ropes should be replaced when inspection indicates excessive damage according to the Wire Rope Users Manual. All wire ropes that have not been used for a period of a month or more should be thoroughly inspected before being returned to service.
 - End fittings and connections consist of spliced eyes and various manufactured devices. All manufactured end fittings and connections should be installed according to the manufacturer's instructions and loaded according to the manufacturer's specifications.
 - If a ball-bearing type hoisting swivel is used to hoist drill rods, swivel bearings should be inspected and lubricated daily to ensure that the swivel freely rotates under load.
 - If a rod-slipping device is used to hoist drill or probe rods, do not drill through or rotate drill rods through the slipping device; do not hoist more than 1 foot (. 3 m) of the rod column above the top of the mast (derrick); and do not hoist a rod column with loose tool joints while the rod column is being supported by a rod slipping device. If rods should slip back into the hole, do not attempt to break the fall of the rods with your hands or by applying tension to the slipping device.
 - Most sheaves on exploration drill rigs are stationary with a single part line. The number of parts of line should never be increased without first consulting with the manufacturer of the drill rig.
 - Wire ropes shall be properly matched with each sheave. If the rope is too large, the sheave will pinch the wire rope; if the rope is too small, it will groove the sheave. Once the sheave is grooved, it will severely pinch and damage larger-sized wire ropes and therefore shall be replaced.
- 4.15.2 The following procedures and precautions shall be understood and implemented for safe use of wire ropes and rigging hardware.
- Use tool-handling hoists only for vertical lifting of tools (except when angle hole drilling). Do not use tool-handling hoists to pull on objects always from the rig; however, drills may be moved

using the main hoist if the wire rope is spooled through proper sheaves according to the manufacturer's recommendations.

- When struck tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the stuck tools directly to the feed mechanism of the drill. Do not use hydraulic leveling jacks for added pull to the hoist line or the feed mechanism of the drill.
- When attempting to pull out a mired down vehicle or drill rig carrier, only use a winch on the front or rear of the vehicle and stay as far as possible away from the wire rope. Do not attempt to use tool hoists to pull out a mired down vehicle or drill rig carrier.
- Minimize shock loading of a wire rope. Apply loads smoothly and steadily. Avoid sudden loading in cold weather.
- Never use frozen ropes.
- Protect wire rope from sharp corners or edges.
- Replace faulty guides and rollers.
- Replace damaged safety latches on safety hooks before using.
- Know the safe working load of the equipment and tackle being used. Never exceed this limit.
- Clutches and brakes of hoists should be periodically inspected and tested.
- Know and do not exceed the rated capacity of hooks, rings, links, swivels, shackles, and other lifting aids.
- Always wear gloves when handling wire ropes.
- Do not guide wire rope on hoist drums with your hands.
- Following the installation of a new wire rope, first lift a light load to allow the wire rope to adjust.
- Never carry out any hoisting operations when the weather conditions are such that hazards to personnel, the public, or property are created.
- Never leave a load suspended in the air when the hoist is unattended.
- Keep your hands away from hoists, wire rope, hoisting hooks, sheaves, and pinch points while slack is being taken up and when the load is being hoisted.
- Never hoist the load over the head, body, or feet of any personnel. Never use a hoist line to "ride" up the mast (derrick) of a drill rig.
- Replacement wire ropes should conform to the drill rig manufacturer's specifications.

4.16 **Use of Cathead and Rope Hoists**

4.16.1 The following safety procedures should be employed when using a cathead hoist:

- Keep the cathead clean and free of rust and oil and/or grease. The cathead should be cleaned with a wire brush if it becomes rusty.
- Check the cathead periodically, when the engine is not running, for rope wear grooves. If a rope groove forms to a depth greater than 1/8 inches (3 mm), the cathead should be replaced.
- Always use a clean, dry, sound rope. A wet or oily rope may "grab" the cathead and cause drill tools or other items to be rapidly hoisted to the top of the mast.
- Should the rope "grab" the cathead or otherwise become tangled in the drum, release the rope and sound an appropriate alarm for all personnel to rapidly back away and stay clear. The operator should also back away and stay clear. If the rope "grabs" the cathead, and tools are hoisted to the sheaves at the top of the mast, the rope will often break, releasing the tools. If the rope does not break, stay clear of the drill rig until the operator cautiously returns to turn off the drill rig engine and appropriate action is taken to release the tools. The operator should keep careful watch on the suspended tools and should quickly back away after turning off the engine.
- The rope should always be protected from contact with all chemicals. Chemicals can cause deterioration of the rope that may not be visibly detectable.
- Never wrap the rope from the cathead (or any other rope, wire rope or cable on the drill rig) around a hand, wrist, arm, foot, ankle, leg or any other part of your body.
- Always maintain a minimum of 18 inches of clearance between the operating hand and the cathead drum when driving samplers, casing or other tools with the cathead and rope method. Be aware that the rope advances toward the cathead with each hammer blow as the sampler or other drilling tool advances into the ground.

- Never operate a cathead (or perform any other task around a drill rig) with loose unbuttoned or otherwise unfastened clothing or when wearing gloves with large cuffs or loose straps or lacinings.
- Do not use a rope that is any longer than necessary. A rope that is too long can form a ground loop or otherwise become entangled with the operator's legs.
- Do not use more rope wraps than are required to hoist a load.
- Do not leave a cathead unattended with the rope wrapped on the drum. Position all other hoist lines to prevent contact with the operating cathead rope.
- When using the cathead and rope for driving or back driving, make sure that all threaded connections are tight and stay as far away as possible from the hammer impact point.
- The cathead operator shall be able to operate the cathead standing on a level surface with good, firm footing conditions without distraction or disturbance.

4.17 **Use of Augers**

4.17.1 The following general procedures should be used when starting a boring with continuous flight of hollow-stem augers:

- Prepare to start an auger boring with the drill rig level, the clutch or hydraulic rotation control disengaged, the transmission in low gear, and the engine running at low RPM.
- Apply an adequate amount of down pressure prior to rotation to seat the auger head below the ground surface.
- Look at the auger head while slowly engaging the clutch or rotation control and starting rotation. Stay clear of the auger.
- Slowly rotate the auger and auger head while continuing to apply down pressure. Keep one hand on the clutch or the rotation control at all times until the auger has penetrated about one foot or more below ground surface.
- If the auger head slides out of alignment, disengage the clutch or hydraulic rotation control and repeat the hole starting process.
- An auger guide can facilitate the starting of a straight hole through hard ground or a pavement.
- The operator and tool handler should establish a system of responsibility for the series of various activities required for auger drilling, such as connecting and disconnection auger sections, and inserting and removing the auger fork. The operator shall ensure that the tool handler is well away from the auger column and that the auger fork is removed before starting rotation.
- Only use the manufacturer's recommended method of securing the auger to the power coupling. Do not touch the coupling or the auger with your hands, a wrench, or any other tools during rotation.
- Whenever possible, use tool hoists to handle auger sections.
- Never place hands or fingers under the bottom of an auger section when hoisting the auger over the top of the auger section in the ground or other hard surfaces such as the drill rig platform.
- Never allow feet to get under the auger section that is being hoisted.
- When rotating augers, stay clear of the rotating auger and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason.
- Use a long-handled shovel to move auger cuttings away from the auger. Never use your hands or feet to move cuttings away from the auger.
- Do not attempt to remove earth from rotating augers. Augers should be cleaned only when the drill rig is in neutral and the augers are stopped from rotating.

4.18 **Rotary and Core Drilling**

4.18.1 Rotary drilling tools should be safety checked prior to drilling:

- Water swivels and hoisting plugs should be lubricated and checked for "frozen" bearings before use.
- Drill rod chuck jaws should be checked periodically and replaced when necessary.
- The capacities of hoists and sheaves should be checked against the anticipated weight to the drill rod string plus other expected hoisting loads.

- 4.18.2 Special precautions that should be taken for safe rotary or core drilling involve chucking, joint break, hoisting, and lowering of drill rods:
- Only the operator of the drill rig should brake or set a manual chuck so that rotation of the chuck will not occur prior to removing the wrench from the chuck.
 - Drill rods should not be braked during lowering into the hole with drill rod chuck jaws. Drill rods should not be held or lowered into the hole with pipe wrenches.
 - If a string of drill rods are accidentally or inadvertently released into the hole, do not attempt to grab the falling rods with your hands or a wrench.
 - In the event of a plugged bit or other circulation blockage, the high pressure in the piping and hose between the pump and the obstruction should be relieved or bled down before breaking the first tool joint.
 - When drill rods are hoisted from the hole, they should be cleaned for safe handling with a rubber or other suitable rod wiper. Do not use your hands to clean drilling fluids from drill rods.
 - If work shall progress over a portable drilling fluid (mud) pit, do not attempt to stand on narrow sides or cross members. The mud pit should be equipped with rough-surfaced, fitted cover panels of adequate strength to hold drill rig personnel.
 - Drill rods should not be lifted and leaned unsecured against the mast. Either provide some method of securing the upper ends of the drill rod sections for safe vertical storage or lay the rods down.
- 4.19 **Site Movement of Equipment**
- 4.19.1 The individual who transports a rig on and off a drilling site should:
- Be properly licensed and should only operate the vehicle according to federal, state, and local regulations.
 - Know the traveling height (overhead clearance), width, length and weight of the rig with carrier and know highway and bridge load, width and overhead limits, making sure these limits are not exceeded with an adequate margin.
 - Never move an I rig unless the vehicle brakes are in sound working order.
 - Allow for mast overhand when cornering or approaching other vehicles or structures.
 - Be aware that the canopies of service stations and motels are often too low for a drill rig mast to clear with the mast in the travel position.
 - Watch for low hanging electrical lines, particularly at the entrances to drilling sites or restaurants, motels, other commercial sites.
 - Never travel on a street, road, or highway with the mast (derrick) of the rig in the raised or partially raised position.
 - Remove all ignition keys if rig is left unattended.
- 4.19.2 Loading and Unloading
- Use ramps of adequate design that are solid and substantial enough to bear the weight of the rig with carrier, including tools.
 - Load and unload on level ground.
 - Use the assistance of someone on the ground as a guide.
 - Check the brakes on the rig carrier before approaching loading ramps.
 - Distribute the weight of the rig, carrier, and tools on the trailer so that the center of eight is approximately on the centerline of the trailer and so that some of the trailer load is transferred to the high of the pulling vehicle. Refer to the trailer manufacturer's weight distribution recommendations.
 - The rig and tools should be secured to the hauling vehicle with ties, chains, and/or load binders of adequate capacity.
- 4.19.3 Off-Road Movement
- The following safety suggestions relate to off-road movement:

- Before moving a drill rig, first walk the route of travel, inspecting for depressions, stumps, gullies, ruts, and similar obstacles.
- Always check the brakes of a drill rig carrier before traveling, particularly on rough, uneven, or hilly ground.
- Check the complete drive train of a carrier at least weekly for loose or damaged bolts, nuts, studs, shafts, and mountings.
- Discharge all passengers before moving a drill rig on rough or hilly terrain.
- Engage the front axle (for 4 x 4, 6 x 6, etc. vehicles or carriers) when traveling off highway on hilly terrain.
- Use caution when traveling side-hill. Conservatively evaluate side-hill capability of drill rigs, because the arbitrary addition of drilling tools may raise the center of mass. When possible, travel directly uphill or downhill. Increase tire pressures before traveling in hilly terrain (do not exceed rated tire pressure).
- Attempt to cross obstacles such as small logs and small erosion channels or ditches squarely, not at an angle.
- Use the assistance of someone on the ground as a guide when lateral or overhead clearance is close.
- After the drill has been moved to a new drilling site, set all brakes and/or locks. Always block/chock the wheels.

4.20 **Tires, Batteries, and Fuel**

- 4.20.1 Tires on the rig shall be checked daily for safety and during extended travel for loss of air and they shall be maintained and/or repaired in a safe manner. If tires are deflated to reduce ground pressure for movement on soft ground, the tires should be inflated to normal pressures before movement on firm or hilly ground or on streets, roads and highways. Under-inflated tires are not as stable on firm ground as properly inflated tires. Air pressures should be maintained for travel on streets, roads, and highways according to the manufacturer's recommendations. During air pressure checks, inspect for:
- Missing or loose wheel lugs.
 - Objects wedged between dual or embedded in the tire casing. Damaged or poorly fitting rims or rim flanges.
 - Abnormal wear, cuts, breaks, or tears in the casing.
 - The repair of truck and off-highway tires should only be made with required special tools and following the recommendations of a tire manufacturer's repair manual.
- 4.20.2 Batteries contain strong acid. Use extreme caution when servicing batteries.
- Batteries should only be serviced in a ventilated area while wearing safety glasses (and face shield if a splash hazard exists).
 - When a battery is removed from a vehicle or service unit, disconnect the battery ground clamp first.
 - When installing a battery, connect the battery ground clamp last.
 - When charging a battery with a battery charger, turn off the power source to the battery before either connecting or disconnecting charger leads to the battery posts. Cell caps should be loosened prior to charging to permit the escape of gas.
 - Spilled battery acid can burn your skin and damage your eyes. Spilled battery acid should be immediately flushed off of your skin with lots of water. Should battery acid get into someone's eyes, flush immediately with large amounts of water and see a physician at once.
 - To avoid battery explosions, keep the cells filled with electrolyte; use a flashlight (not an open flame) to check electrolyte levels and avoid creating sparks around the battery by shorting across a battery terminal. Keep lighted smoking materials and flames away from batteries.
- 4.20.3 Special precautions shall be taken for handling fuel and refueling the rig or carrier. Only use the type and quality of fuel recommended by the engine manufacturer.
- Refuel in a well-ventilated area.



- Do not fill fuel tanks while the engine is running. Turn off all electrical switches. Do not spill fuel on hot surfaces. Clean any spillage before starting an engine. Wipe up spilled fuel with cotton rags or cloths. Do not use wool or metallic cloth.
- Keep open lights, lighted smoking materials, and flames or sparking equipment well away from the fueling area.
- Turn off heaters in carrier cabs when refueling the carrier or the drill rig.
- Do not fill portable fuel containers completely full to allow expansion of the fuel during temperature changes.
- Keep the fuel nozzle in contact with the tank being filled to prevent static sparks from igniting the fuel.
- Do not transport portable fuel containers in the vehicle or carrier cab with personnel.
- Fuel containers and hoses should remain in contact with a metal surface during travel to prevent the buildup of static charge.

4.21 **First Aid**

4.21.1 At least one member of the crew (and if only one, preferably the drilling and safety supervisor) should be trained to perform first aid. First aid is taught on a person-to-person basis, not by providing or reading a manual. Manuals should only provide continuing reminders and be used for reference. It is suggested that courses provided or sponsored by the American Red Cross or a similar organization would best satisfy the requirements of first aid training for drill crews.

4.21.2 For drilling and probing operations it is particularly important that the individual responsible for first aid should be able to recognize the symptoms and be able to provide first aid for electrical shock, heart attack, stroke, broken bones, eye injury, snake bite, and cuts or abrasions to the skin. Again, first aid for these situations is best taught to drill crewmembers by instructors qualified by an agency such as the American Red Cross.

4.21.3 A first aid kit should be available and well maintained on each drill site. The contents of the first aid kit shall be placed in a weatherproof container with individual sealed packages for each type of item.

4.22 **Rig Utilization**

4.22.1 Do not attempt to exceed manufacturers' ratings of speed, force, torque, pressure, flow, etc.

4.22.2 Only use the drill rig and tools for the purposes that they are intended and designed.

4.23 **Rig Alterations**

4.23.1 Alterations to a rig or drilling or probing tools should only be made by qualified personnel and only after consultation with the manufacturer.

5.0 **Records**

None.

6.0 **Attachments**

None.

5-406 Electrical Lines, Overhead

1.0 Purpose and Scope

- 1.1 Provides the safe work requirements to be observed where overhead power lines are present on a job site.
- 1.2 This procedure applies to all Resolution Consultants employees and operations.

2.0 Terms and Definitions

- 2.1 Types of overhead lines:
 - 2.1.1 Overhead power lines
 - 2.1.2 Structural cable supports
 - 2.1.3 Guy wires
 - 2.1.4 Cable television / communication lines

3.0 References

None.

4.0 Procedure

- 4.1 An appropriate distance must be kept between equipment and overhead utility lines.
- 4.2 Employees must contact the power line operator before work is done or before equipment is operated within 15.25 metres (50 feet) of an energized overhead power line, in order to:
 - determine the voltage of the power line, and
 - establish the appropriate safe limit of approach distance as identified by provincial/territorial regulations.
- 4.3 The safe limit of approach distances do not apply to a load, equipment, or building that is transported under energized overhead power lines if the total height, including equipment transporting it, is less than 4.15 metres (13.5 feet).
- 4.4 **Employers or CTO Managers** must formally notify (using the Overhead Electrical Lines Acknowledgement form) all subcontractors or equipment operators of an energized overhead power line before work is done or equipment is operated in the vicinity of the power line at distances less than the safe limit of approach distances and obtain the operator's assistance in protecting workers involved.
- 4.5 Employees must not place earth or other material under or beside an overhead power line if doing so reduces the safe clearance to less than the safe limit of approach distances.
- 4.6 To maintain minimum safe clearances:
 - 4.6.1 Install warning devices and signs (hang a sign from and mark all guy wires to warn traffic of low clearance; provide warning signage for all overhead services).
 - 4.6.2 Install telescopic, nonconductive posts and flagging across right-of-way at the minimum allowable clearance as allowed by regulations for the line voltage.
 - 4.6.3 Position signs or other devices to determine the "Danger Zone."
 - 4.6.4 Inform all on-site staff with the on-site clearances required.
 - 4.6.5 Beware of atmospheric conditions, such as temperature, humidity, and wind, that may dictate more stringent safety procedures.
- 4.7 Operation of heavy equipment and cranes in areas with overhead power lines represents a significant hazard to all personnel on the job site. Accidental contact with an energized line or arcing between a

high power line and grounded equipment can cause electrocution of equipment operators or nearby ground personnel, and damage to power transmission and operating equipment. Although maintaining a safe distance from all energized lines is the preferred means for control of this hazard, site conditions may not always accommodate this. If work will (or may) occur within 50 feet of any energized line, the procedures outlined below will be observed.

- 4.8 Overhead power lines will be identified on each job site before the work commences. For each identified line, the Project Manager must determine whether it is energized (and the operating voltage for energized lines), and whether work operations will require that activities with heavy equipment (excavators, loaders, cranes, etc.) will occur within 50 feet (15.25 metres) of the line. Unless verified, it will be assumed that all lines are energized.
- 4.9 Safe working distance is the minimum distance that must be maintained between any energized electrical line and any part of the operating equipment to maintain adequate safety margins and is based on the line voltage of the power line. Figure 4-1 lists the line voltages in kilovolts and the Minimum Safe Work Distance in the United States and Figure 4-2 indicates the Nominal Phase to Phase voltage rating in kilovolts for Canada. The following safe working distance criteria will be applied for all Resolution Consultants operations:

Figure 4-1: United States Overhead Line Criteria

Line Voltage (Kilovolts)	Minimum Safe Working Distance
0 – 50	10 feet
>50 – 200	15 feet
>200 – 350	20 feet
>350 – 500	25 feet
>500 – 750	35 feet
>750 – 1,000	45 feet

Source: American National Standards Institute, Publication B30.5.

Figure 4-2: Canadian Overhead Line Criteria

Column 1	Column 2
Nominal phase-to-phase voltage rating	Minimum Distance
Over 425 to 12,000	3.0 metres
Over 12,000 to 22,000	3.0 metres
Over 22,000 to 50,000	3.0 metres
Over 50,000 to 90,000	4.5 metres
Over 90,000 to 120,000	4.5 metres
Over 120,000 to 150,000	6.0 metres
Over 150,000 to 250,000	6.0 metres
Over 250,000 to 300,000	7.5 metres
Over 300,000 to 350,000	7.5 metres
Over 350,000 to 400,000	9.0 metres

Source: Canada Occupational Health and Safety Regulations Electrical Safety- Subsection 8.5(6).

4.10 Under no circumstances will any object pass closer than 3 metres to any energised, uninsulated electrical line.

4.11 Formally notify all subcontractors of Overhead Power lines.

4.12 **Acceptable Safety Procedures**

4.12.1 Where any work task will not allow the minimum safe working distance to be maintained at all times, an alternate means of protection must be identified and approved by the SH&E Department. In order of preference, acceptable procedures are

- De-energize the power line(s)/lockout by local utility authorities
- Install insulated sleeves on power lines
- Assign line spotters to assist the equipment operator

4.12.2 De-energize Power Lines

Elimination of electrical power provides the most acceptable means of ensuring safety of personnel. While temporary site power lines are under the control of the site manager (and can be de-energized locally), electrical distribution and transmission lines can be de-energized only by the owner of the line (generally the local electrical utility). Therefore, de-energizing of a line requires advance coordination with the line owner; generally, at least one week advance notice should be provided.

4.12.3 Install Insulating Sleeves

Insulating sleeves can be placed over power lines to provide a contact and arcing barrier if work must occur closer to the power lines than the accepted safe work distance. Although not as desirable as line de-energizing, the use of these sleeves can provide an acceptable alternative where electrical lines are required to remain in service.

As with de-energizing of distribution and transmission lines, placement of insulating sleeves can be performed only by the line owner. This requires advance coordination with the line owner; generally, at least one week advance notice should be provided. To install the sleeves, representatives of the line owner will require access to the job site.

4.12.4 Assign Line Spotters

A line spotter is a person located at ground level who is assigned to observe equipment operations, with the specific duty of assisting the equipment operator to ensure that no part of the equipment gets too close to an energized, unprotected electrical line.

Persons assigned to act as line spotters must meet the following requirements:

- While acting as a line spotter, no other duties may be performed (e.g., the line spotter cannot also act as the load spotter during a lifting operations).
- The spotter will have a radio or other direct means of communicating with the equipment operator at all times.
- The spotter will be positioned at a right angle to the equipment operator's line of sight to maximize the sight angles between the personnel.

Under no circumstances will any portion of a piece of equipment pass closer than 10 feet to any energized, uninsulated electrical line.

4.13 **Additional Safety Measures**

4.13.1 The following additional safety measures can be implemented as needed when working around energized power lines:

- Provide equipment with proximity warning devices. These provide an audible alarm if any part of the equipment gets too close to a line.
- Install ground safety stops. These prevent vehicles from accidentally entering hazardous areas.
- Equip cranes with a boom-cage guard. This prevents the boom from becoming energized if an electrical line is contacted.
- Utilize insulated links and polypropylene tag lines. These prevent the transmission of electricity to loads or tag line handlers if an electrical line is contacted.

NOTE: These additional safeguards are intended as supplemental protection. Use of these measures is not permissible as a substitute for maintaining the safe working distance or implementation of the procedures in Section 4.1.

4.13.2 If an electrical power line is hit or an electrical arc occurs:

- All ground personnel must evacuate IMMEDIATELY to a distance of at least 50 feet (15.25 metres). DO NOT attempt to rescue any injured person until the line can be de-energized.
- The operator should remain in the cab until the line can be de-energized and should carefully try to extricate the equipment from the power line. This may not be possible where melting of insulator material or metal has occurred.
- Contact the line owner to report the line contact and request that the line be de-energized immediately.
- Once the line has been confirmed to be de-energized, the operator can safely evacuate the cab and rescue can commence for any injured personnel.
- Contact the SH&E Department to report the incident and implement any instructions provided.

If the operator must evacuate while the line is still energized (because of fire or other life-threatening condition) he/she should jump clear of the equipment (making sure to avoid touching the equipment and the ground simultaneously), and land upright and with feet together. Once on the ground, proceed in a direct line away from the equipment using a short, shuffling gait (feet touching, sliding each foot no more than 1 foot forward at a time) to minimize shock hazard from electrical energy being transmitted through the ground.

5.0 Records

None.

6.0 Attachments

None.

5-417-Utilities, Underground

1.0 Purpose and Scope

- 1.1 Establishes requirements to ensure that underground installations are identified properly before excavation work commences.
- 1.2 This procedure applies to all Resolution Consultants employees and operations.

2.0 Terms and Definitions

- 2.1 **Underground Utilities:** All utility systems located beneath grade level, including, but not limited to, gas, electrical, water, compressed air, sewage, signaling and communications, etc.
- 2.2 **Ground Disturbance (GD):** Any indentation, interruption, intrusion, excavation, construction, or other activity in the earth's surface as a result of work that results in the penetration of the ground.

3.0 References

- 3.1 American Public Works Association, Excavator's Damage Prevention Guide and One-Call System Directory International 1990-1991, Utility Location and Coordination Committee.

4.0 Procedure

- 4.1 Ground disturbance may be conducted for a variety of purposes, including, but not limited to, exposing existing buried lines, soil sampling, remedial excavations, or installing monitoring wells or test pits.
- 4.2 Improper ground disturbance may impact a buried pipeline or utility line and cause a major release of a hazardous substance, flood, or electrocution. Serious injuries and significant property damage have resulted from insufficient/inadequate identification of underground installations during the course of ground disturbance work.
- 4.3 To control hazards associated with coming in contact with such installations, the American Public Works Association's (APWA) guidelines for the uniform identification of underground installations has been adopted.
- 4.4 **CTO Managers** are responsible for ensuring that all work, including the identification, location, and access to all underground utilities, is planned and performed in accordance with contract specifications and safety requirements.
 - 4.4.1 The planning for associated work and avoidance of contacting underground utilities shall be part of the project safety planning in the HASP.
- 4.5 The **CTO Manager or Site Supervisor** is responsible for the execution of work in accordance with this and other associated Resolution Consultants SOPs, including:
 - The review of the HASP.
 - Verification that all steps have been taken to identify existing underground utilities in the area to be disturbed.
- 4.6 **Regional SH&E Professional** provides guidance as needed.
- 4.7 **Personal Protective Equipment**
 - Long sleeved shirt and pants (coveralls/Nomex LILA for upstream oil and gas)
 - Safety toe boots
 - Hard hat
 - High-visibility clothing
 - Gloves

- Respirator with organic vapor/particulate filter cartridge (for use when the exposure exceeds the occupational exposure limit stated on the MSDS), as required
- Hydrogen Sulfide (H₂S) Monitor (for areas with known or suspected H₂S)

4.8 **Training**

- 4.8.1 Staff shall successfully complete a Ground Disturbance training course.
- 4.8.2 Some clients may also have required client-based Ground Disturbance training.

4.9 **Underground Utility Lines**

- 4.9.1 To avoid injury from electrical and other utilities on site, utility lines shall be located and marked prior to conducting any drilling or digging on site. If available, refer to site drawings or client interviews for information pertaining to utilities on site.
- 4.9.2 Types of underground lines:
- Gas line
 - Potable water line
 - Raw water line
 - Sewer line
 - Power line
 - Cable television/communication line
 - Cathodic protection lines
 - Grounding cable
 - Process piping/flow line
- 4.9.3 Prior to conducting the ground disturbance, you shall locate all pipelines and utilities that pass within (30 m) of the work area. This is your search and control area. To do so, you need to do the following:
- Notify all pipeline and utility companies, and confirm that their notification requirements are fulfilled prior to conducting a ground disturbance.
 - Identify pipelines, power lines, utilities, and irrigation canals in a 30-foot (9.1 m) zone of the work area with the owner of the utility.
 - On private property, a properly trained and competent third party utility locator shall be used.
 - Get approval for work within a right-of-way (ROW) or within 15 feet (4.6 m) of a line if there is no ROW.
 - Prepare a site map identifying the search area, the ground disturbance area, and known underground utilities.
 - Confirm that all pipelines, power lines, and utilities are marked.
- 4.9.4 Look for pipeline indicators:
- Look for warning signs where pipelines cross roads or water courses.
 - Look for cut lines, wells, tanks, or valves that may indicate the presence of pipelines.
 - Look for ground settling from previous work.
 - Talk to nearby landowners and residents.
 - Look for vegetation appearing “different” from the surrounding vegetation (e.g., greener, taller, shorter, or more brown than surrounding vegetation).

- 4.9.5 When you are working within a pipeline right-of-way, you shall get written approval from the pipeline owner prior to doing your work.
- 4.9.6 Call the pipeline owner at least two full working days before you dig so the pipeline can be located and marked.
- 4.9.7 Expose the pipeline by hand/hydrovac before digging within 15 feet (4.6 m) of the pipeline with machinery (no machinery comes may come within 2 feet [60 cm] of the pipeline) with the supervision of the owner or their representative, and call the owner at least one full day before you cover the exposed line.
- 4.9.8 During ground disturbance:
- All underground utilities shall be hand exposed or hydrovac'd within 3.3 feet (1 m) of a mark out or within the distance required by the owner of the utility before operating any mechanized equipment.
 - Make arrangements for supervision ("a Signal Person") during hand exposure.
 - If for any reason these hand excavations are temporarily filled in, mark them.
 - Make arrangements for supervision ("a Signal Person") during any mechanical excavation within 5 m of the underground utility.
 - Make arrangements for supervision ("a Signal Person") during backfilling of utilities.
 - Cutting back and shoring of excavations shall be completed to ensure that there are no cave-ins (follow *5-303-Excavation and Trenching*).
 - Do not damage utilities by shovels when hand exposing and picks should not be used.
 - Remember that all workers have the right and responsibility to refuse to carry out any work or procedures that they feel are unsafe.
 - If the ground disturbance is deeper than 3.3 feet (1 m), all crew members shall have appropriate training for excavations and trenches and shall be protected from cave-ins or sliding/rolling materials (follow *5-303-Excavation and Trenching*).
 - Remember that incidents, injuries, and near misses shall be reported immediately.
 - Review the site-specific emergency response plan.
- 4.9.9 If you hit an underground facility, stop the work immediately and notify the owner of the facility.
- The owner shall be informed of the location of the contact and the type of damage that resulted.
 - If the facility is a pipeline, the company (client) shall immediately notify the required agencies and regulatory bodies of the location of the contact and the type of damage that resulted.
 - The government agencies will require a written record and the company (client) should conduct an incident investigation into the causes and make recommendations for the future prevention of this incident.
- 4.10 **Identification of Installations**
- 4.10.1 Various forms of underground utility lines or pipes may be encountered during Resolution Consultants deployments to field sites. Damaged utilities, in particular, can present other hazards including asbestos, explosion, electric shock, scalding, etc., and they shall be avoided. The presence of damaged utilities at any work location shall be immediately brought to the attention of the site supervisor or other member of the Resolution Consultants site management team.
- 4.10.2 Guidance will be provided on the appropriate action to be taken, which could include suspension of work until the responsible utility agency is contacted and the hazard is either isolated or eliminated.
- 4.10.3 Extreme caution shall always be exercised when attempting to locate underground utilities. The location of utilities can be in some cases not consistent as shown on drawings, as indicated by the placement of surface signage, or as described by personnel. Coordination and planning of the job shall be required with the client or owner.
- Prior to digging and drilling operations, the client shall always be informed of the potential location(s) of underground utility systems.
 - If a utility permit is required from the client or owner, it shall be secured.
 - The client shall explain how the utility line may be identified—e.g., red concrete encasement.

- All underground installations shall be considered “live” and “operational” until the owner, client, or utility authority isolates any hazardous energy or deactivates the system and can demonstrate that condition.
- Where a line placement and depth is known or suspected and where there is potential for contact, hand digging, or hand auguring, instrumentation and other investigative techniques shall be used.

4.10.4 The One Call System Definition and Directory or its equivalent shall be used to prepare for excavation work in the event the identity of an underground installation(s) is unknown.

4.10.5 Line location documentation (or appropriate regional agency or company) provides a listing of companies that have registered buried facilities in the proposed work area. Some public utilities and private companies are not members of the One Call System. In order to give line operators sufficient time to respond to a request to locate, a minimum waiting period of 72 business hours is required prior to beginning work.

4.10.6 Once the underground installation has been identified, proper surface markings shall be made in accordance with the guidelines contained in this SOP or as contract-specified.

4.11 **Surface Markings**

4.11.1 Color-coded surface marks (paints or similar coatings) shall be used to indicate the type, location, and route of buried installations. Additionally, to increase visibility, color-coded vertical markers (temporary stakes or flags) shall supplement surface marks.

4.11.2 All marks and markers shall indicate the name, initials, or logo of the company that owns or operates the installation and the width of the installation if it is greater than two inches.

4.11.3 If the surface over the buried installation is to be removed, supplemental offset marking shall be used. Offset markings shall be on a uniform alignment and shall clearly indicate that the actual installation is a specific distance away.

4.12 **Uniform Color-Coding**

4.12.1 The colors and corresponding installation type are as follows unless otherwise contract-specified.

4.12.2 Red: Electric Power Lines, Cables, Conduit, and Lighting Cables

4.12.3 Yellow : Gas, Oil, Stream, Petroleum, or Gaseous Materials

4.12.4 Orange :Communication, Alarm or Signal Lines, Cables, or Conduit

4.12.5 Green: Sewers and Drain Lines

4.12.6 White : Proposed Ground Disturbance area

4.12.7 Pink: Temporary Survey Markings

4.12.8 Purple: Nonpotable Water

5.0 **Records**

5.1 The following records on the identification of and response to underground utilities will be maintained in the project files:

5.1.1 All information regarding the identification of underground installations (this information can also be transferred to the appropriate drawings and/or prints and shall be available on site).

5.1.2 Drawings and/or prints shall be maintained for the life of this project.

5.1.3 Identifying Underground Installations Checklist.

6.0 **Attachments**

None.

5-508 Hazardous Materials Handling and Shipping

1.0 Purpose and Scope

- 1.1 Prescribes the minimum requirements for shipping samples, hazardous materials (HZM) and dangerous goods. It is designed to provide a framework for compliance with the requirements of the U.S. Department of Transportation (DOT) Hazardous Materials Regulations (HMR) published under 49 CFR or for shipment of hazardous materials/dangerous goods by land, and the International Air Transportation Association (IATA) Dangerous Goods Regulations (DGR) for shipping dangerous goods by air.
- 1.2 Applies to all Resolution Consultants staff and operations.

2.0 Terms and Definitions

A complete list of definitions can be found in their entirety in the HMR, the TDG Regulations, and the IATA DGR.

- 2.1 **Carrier:** A person engaged in the transportation of passengers or property by land, water, or air either as a common, contract, private carrier, or civil aircraft.
- 2.2 **Dangerous goods:** Articles or substances which are capable of posing a risk to health, safety, property or the environment and which are shown in the list of dangerous goods in the TDG Regulations and/or IATA regulations or which are classified according to the TDG Regulations and/or IATA regulations. Generally synonymous with hazardous materials.
- 2.3 **Hazardous materials (HzM):** A substance or material which has been determined by the U.S. Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and includes hazardous substances, hazardous wastes, marine pollutants, and elevated temperature materials.
- 2.3.1 Hazardous materials may include, but are not limited to: batteries, adhesives, paints, compressed gases, nuclear density meters, laboratory reagents, field samples, soil and sand siftings, hazardous wastes, and materials used for bench scale and pilot plant operations. While most environmental samples (both water and soil) do not meet the definition of hazardous material, extreme care must be taken to properly classify materials. HzM Classifications are as follows:
- Class 1 Explosives
 - Class 2 Compressed Gases
 - Class 3 Flammable Liquids
 - Class 4 Flammable Solids, Spontaneously Combustible and Water Reactive Solids
 - Class 5 Oxidizers and Organic Peroxides
 - Class 6 Poisonous and Infectious Substances
 - Class 7 Radioactive Materials
 - Class 8 Corrosive Substances
 - Class 9 Miscellaneous
- 2.4 **HzM employee:** A person who is employed by Resolution Consultants who in the course of employment directly affects dangerous goods/hazardous materials transportation safety. This term includes employees who prepare hazardous materials for transportation, or are responsible for safety of transporting hazardous materials.

- 2.5 **HzM employer:** A person who uses one or more of its employees in connection with transporting dangerous goods/hazardous materials in commerce, causing hazardous materials to be transported or shipping in commerce.
- 2.6 **HMR:** Hazardous Material Regulation
- 2.7 **IATA:** International Air Transport Association.
- 2.8 **ICAO:** International Civil Aviation Organization
- 2.9 **Materials of Trade:** A hazardous material, other than a hazardous waste, that is carried on a motor vehicle
- 2.9.1 For the purpose of protecting the health and safety of the motor vehicle operator or passengers;
- 2.9.2 For the purpose of supporting the operation or maintenance of a motor vehicle (including its auxiliary equipment); or
- 2.9.3 By a private motor carrier in direct support of a principal business that is other than transportation by motor vehicle.
- 2.10 **NAPL:** Non-aqueous phase liquid
- 2.11 **Offeror:** Any person who performs functions including selecting packaging, physical transfer of hazardous materials, classifying hazardous materials, preparing shipping papers, signing hazardous material certifications on shipping papers (as agent for), marking or placarding vehicles or packagings, or providing placards to carriers.
- 2.12 **Reportable Quantity (RQ):** The spill- or incident-related quantity of a material listed in the applicable regulations requiring a formal report.
- 2.13 **Serious Hazardous Materials Incident:** Anytime a material is found outside of its containment and has the potential to harm people or the environment.
- 2.14 **Shipper:** see Carrier

3.0 References

None.

4.0 Procedure

4.1 Shipping

- 4.1.1 Select the best way to ship the hazardous material based on the quantity, hazard(s), and mode of transportation (e.g., air, land, water). Since more restrictive requirements apply to air shipments, ground shipment (e.g., use of a lab courier service) is encouraged for shipping HzM.
- 4.1.2 Most (if not all) package shipments (Common Carriers such as Federal Express, UPS, etc.) are transported by air. Air transportation of hazardous materials is regulated by IATA. Resolution Consultants will occasionally ship HzM internationally (e.g., Puerto Rico is considered an international destination by Federal Express). Resolution Consultants employees must follow the IATA DGR for any air transportation of hazardous materials.
- 4.2 **Ground transportation of HzM may use either HMR or TDG Regulations protocols.**
- 4.2.1 Specific packaging and shipping instructions apply to all dangerous goods shipments. These instructions vary by chemical/product and are different for passenger aircraft and cargo aircraft.
- 4.2.2 Carrier-specific requirements can be obtained from the Internet or by calling the carrier's customer service line.
- 4.2.3 The process for offering HzM for shipment includes:
- Determine the proper shipping name, hazard class, labeling requirements, and packing group.

- Determine and comply with the proper packaging instructions.
- Choose the proper package based on the packaging instruction and the type and quantity of material being shipped.
- Ensure package contents are compatible.
- Package, mark and label according to applicable regulations and instructions.
- Prepare shipping papers and complete the bill of lading or shipper's declaration for dangerous goods, according to applicable regulations and according to the carrier's specific requirements.
- Include on the shipping documents the shipper's certification, emergency response information and telephone number.
- Include with the shipment a copy of the applicable emergency response information with shipping papers for responders to use in emergency situations. This information includes, but is not limited to, appropriate pages from the DOT Emergency Response Guidebook (ERG) and/or Material Safety Data Sheets (MSDS).

4.2.4 Resolution Consultants personnel participating in shipping HzM are required to provide a 24-hour emergency response telephone number that must be answered by a person either with information on the hazards of the shipment or with immediate access to such a person. Please contact the sponsoring Resolution Consultants HzM shipping specialist (listed in the project health and safety plan emergency contacts) for specific information pertaining to identification of the 24-hour emergency response telephone number.

4.2.5 Determine the placard or placards required for the materials being offered for transportation, provide placards and affix as required.

4.2.6 Notify the carrier of the proper shipping name, hazard class and total quantity of each hazardous material being offered for transportation, and make a final check for compliance with regulations and instructions before tendering the shipment to the carrier. All HzM shipping papers and dangerous goods airbills must be typed.

4.3 **Training**

4.3.1 Employees involved in shipping hazardous materials/dangerous goods (e.g., packaging, preparing paperwork, loading and/or unloading, and transporting hazardous materials) are required to have documented training prior to shipping activities. Training requirements are based on the type of materials shipped (e.g., calibration/compressed gases, laboratory reagents, field samples, hazardous wastes, etc.) and employee responsibility. Training curriculum will include function-specific, general awareness, safety and security awareness based on the two levels of expertise defined below.

4.4 **Training Documentation**

4.4.1 Employees are required to have documented training prior to performing activities that involve the shipment of hazardous materials/dangerous goods.

4.4.2 Documentation of training will be maintained by employees (certificates) and in employees' office locations. Documentation must include the following: course outline, sign-up/log-in sheet with employee name, date(s) of training, and certificate of completion from the training institute. The SH&E Department will log the training information to track compliance and refresher dates.

4.5 **Incident Reporting**

4.5.1 Resolution Consultants employees who ship HzM must be aware of the reporting requirements for any incident that occurs with material we have offered for shipment or that we are transporting as carriers (*5-004-Incident Reporting*).

4.5.2 Except for transportation by aircraft, a carrier must notify DOT by telephone when any serious hazardous material incident (defined in 49 CFR 171.15) occurs during the course of loading, unloading, transportation, or temporary storage. Reports are to be made by telephone at the earliest practical

moment. The nearest FAA Civil Aviation Security Office may be notified in place of the DOT if the incident involves shipment transported by aircraft.

4.5.3 A carrier must file a written report of the hazardous material incident in addition to telephone notification. The report must be completed using DOT's Hazardous Materials Incident Report (DOT Form F 5800.1) and submitted within 30 days of the incident's discovery to the Research and Special Programs Administration (RSPA) or the nearest FAA Civil Aviation Security Office if the incident involved transportation by aircraft.

4.5.4 As required by the Resolution Consultants incident reporting requirements, an initial telephone report is required whenever any of the following occurs during the course of transportation in commerce (including loading, unloading, and temporary storage) from the shipping of hazardous materials by Resolution Consultants personnel: As a direct result of a hazardous material:

- A person is killed;
- A person receives an injury requiring admittance to a hospital;
- The general public is evacuated for one hour or more;
- A major transportation artery or facility is closed or shut down for one hour or more; or
- The operational flight pattern or routine of an aircraft is altered;
- Fire, breakage, spillage or suspected radioactive contamination occurs involving a radioactive material (see also the DOT regulations at 49 CFR § 176.48);
- Fire, breakage, spillage or suspected contamination occurs involving an infectious substance other than a regulated medical waste;
- A release of a marine pollutant occurs in a quantity exceeding 450 L (119 gallons) for a liquid or 400 kg (882 pounds) for a solid; or
- A situation exists of such a nature (e.g., a continuing danger to life exists at the scene of the incident) that, in the judgment of the person in possession of the hazardous material, it should be reported to the NRC even though it does not meet the criteria of paragraph (b) (1), (2), (3) or (4) of this section.

4.6 **Roles and Responsibilities**

4.6.1 **Group SH&E Director (AECOM) / Corpportate HS Manager (EnSafe)** is responsible for the following:

- Define the training to be required of employees involved in HZM shipping and facilitate the delivery of that training.
- Coordinate information/resources for Resolution Consultants employees involved in shipping materials.
- Collect and file copies of all HZM shipping papers in a central location for review by the DOT and other agencies.
- Provide resources to employees involved in shipping hazardous materials.
- Contract a 24-hour emergency response service with a telephone number that will be answered by a person either with information on the hazards of the shipment or with immediate access to such a person.
- Serve as the central point of contact for information regarding this policy and procedure.

4.6.2 **Regional SH&E Managers** are responsible for the following:

- Ensure that District, Office, and Project Managers who have personnel involved in the process of preparing hazardous materials for shipment have appropriately trained individuals, including both office and field personnel.

- The Regional SH&E Manager will assign a HZM shipping specialist or specialists to manage the Region's hazardous materials program.
- 4.6.3 **Project Managers (including Field task managers, supervisors)** are responsible for the following:
- Be familiar with the training requirements for shipment, labeling, and packaging of HzM.
 - Confirm compliance and implementation of this procedure for all operations under their control. Also confirm that affected personnel have the required formal training in accordance with this procedure for both field/project sites and office locations.
 - File copies of all completed HzM shipping papers in the project file and provide a copy to their HzM Shipping Specialist.
- 4.6.4 **Office Manager (AECOM) / HzM Shipping Specialist (EnSafe)** is responsible for the following:
- Develop a process by which hazardous materials will be properly shipped and received.
 - Identify properly trained personnel to manage the hazardous material shipping/receipt process within the office.
- 4.6.5 **HzM Employees** are responsible for the following:
- Shipper/Receiver - Awareness Level
 - Level 1 Shipper
 - Level 2 Shipping Specialist
- 4.6.6 **Shipper - Awareness Level** is responsible for the following:
- Any Resolution Consultants employee who receives, ships, or packages anything for transport (Fed Ex, UPS, US Postal, etc.) is required to be trained at the awareness level. The training is an education and guidance tool for any personnel that send or receive packages.
- 4.6.7 **Level 1 Shipper** is responsible for the following:
- Employees who ship sample coolers and transport field equipment are required to be trained in accordance with DOT HMR/TDG Regulations/IATA DGR requirements. This training provides an elevated level of education for employees in more dynamic roles. This level of training is required for all personnel involved in transport or preparation of paperwork, packaging, and labeling of any hazardous and/or potentially HzM. Level 1 personnel must have direct support from a Level 2 Resolution Consultants Shipping Specialist when receiving or shipping regulated materials or when questioning the regulated status of materials.
- 4.6.8 **Level 2 Shipping Specialist** is responsible for the following:
- The Resolution Consultants Level 2 Shipping Specialist is responsible for oversight of the HzM Program within their respective District or Section. Level 2 personnel must complete a comprehensive 2-day HzM shipping training course to comply with applicable regulations on transporting HzM. Consult with your representative **District or Regional SH&E Manager** for additional information.
- 4.6.9 **Employees** are responsible for the following:
- Do not handle, receive or ship samples, HzM or dangerous goods without having appropriate and documented training as specified in this procedure. Note that if the employee does not think he/she would be allowed to carry the material onto a passenger aircraft, it is probably HzM.
 - The employee shall immediately notify the Field Task Manager or Office Manager of concerns or questions about the condition/contents of samples, HzM, or dangerous goods to be shipped and/or received.



5.0 Records

None.

6.0 Attachments

None.

5-510-Hearing Conservation Program

1.0 Purpose and Scope

- 1.1 Establishes procedures to confirm that personal noise exposure remains within acceptable limits and establishes the requirements of an acceptable hearing conservation program.
- 1.2 This procedure applies to all Resolution Consultants North America-based employees and operations.

2.0 Terms and Definitions

- 2.1 **Decibel (dB):** Logarithmic unit of measurement of sound level.
- 2.2 **Action Level:** An eight-hour, time-weighted average of 85 decibels measured on the A-scale, slow response, or equivalently; a noise dose of 50 percent.
- 2.3 **Standard Threshold Shift (STS):** When one's hearing threshold has changed (relative to the baseline audiogram) an average of 10 dB or more at 2000, 3000, or 4000 Hz in either ear.
- 2.4 **Noise Reduction Rating (NRR):** The measure, in decibels, of how well a hearing protector reduces noise, as specified by the Environmental Protection Agency.

3.0 References

None.

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 Regional SH&E Managers or their designate

- Provide access to initial and refresher hearing conservation training.
- Inform employees of noise monitoring results when full-shift noise exposure is at or above the action level.
- Designate areas and tasks where employees' exposure is at or above the action level.
- Conduct noise monitoring, as applicable, and support hazardous noise assessment/evaluation efforts.

4.1.2 Project or Office Managers

- Implement the hearing conservation program.
- Confirm that a hazardous noise assessment/evaluation has been conducted.
- Confirm that a hazardous noise assessment/evaluation is conducted when a change in equipment, procedures, or personnel may increase employee exposure to noise.
- Implement engineering controls to reduce noise levels when such measures are considered feasible and when required by regulation.
- Purchase, monitor, and replenish for employees' use a supply of hearing protection devices with a minimum Noise Reduction Rating (NRR) of 26 dBA.
- Confirm that individuals included in the program receive training and that the training meets the criteria outlined in this program.
- Investigate and implement corrective action to all reports of nonconformance with this procedure, including reports of standard threshold shifts or employees' failure to wear hearing protectors in designated areas.



4.1.3 **Supervisors**

- Maintain an awareness of the noise levels in work areas for which he/she is responsible.
- Place warning signs in areas where sound levels would require the use of hearing protectors.
- Request that a hazardous noise assessment/evaluation be conducted when a change in equipment, procedures, or personnel may increase employee exposure to noise.
- Confirm that all employees are aware of the requirements for hearing protection for any designated area or task.
- Enforce the use of hearing protection by employees in designated areas and for designated tasks.

4.1.4 **Employees**

- Comply with the requirements of the Hearing Conservation program.
- Wear hearing protection devices in designated areas or for designated tasks.
- Inspect and maintain hearing protection devices.
- Report any suspected change in noise levels of work area to supervisor.
- Report any signs or symptoms experienced that could be the result of overexposure to noise to supervisor.
- Participate in audiometric testing and hearing protection training when required.

4.2 **Requirements**

4.2.1 The requirements of this procedure apply to all locations/facilities/projects where employee noise exposure may equal or exceed 50 percent of the allowable noise dose or Permissible Exposure Limit (PEL). Table 1 provides information relative to the current PEL for noise exposure expressed as a time-weighted average.

Table 1. Permissible Exposure Limit

SOUND LEVEL (dBA)	TIME (hours)
85	8
90	4
95	2
100	1
105	0.5
110	0.25
115	0.125

4.2.2 Table 2 provides information relative to the Action Level (or 50 percent allowable noise dose) expressed as a time-weighted average. The action levels outlined in the table below and PELs described in Table 1 are calculated without regard to the protection afforded by the use of hearing protectors.

Table 2. Action Levels for Hearing Conservation Program

SOUND LEVEL (dBA)	TIME (hours)
85	4
90	2
95	1
100	0.5
105	0.25



4.3

110	0.125
115	0.0625

Training Program

4.3.1 All employees with potential exposure above the action levels established in Table 2 of this procedure or who otherwise utilize any type of hearing protector will participate in a hearing conservation training program.

4.3.2 Training Objectives

4.3.3 The initial and subsequent annual hearing conservation training will address, at a minimum, the following topics:

- The effects of noise on hearing, recognizing hazardous noise, and symptoms of overexposure to hazardous noise.
- When and/or where hearing protectors are required to be worn.
- The purpose of hearing protectors.
- The advantages, disadvantages, and effectiveness of various types of protectors.
- Instructions on how to select, use, fit, and care for hearing protectors.
- The purpose of audiometric testing, including an explanation of the test procedures.
- Hearing Conservation Program requirements and responsibilities.

4.3.4 Hearing protection training is conducted biannually for all affected employees or more frequently for employees who do not properly use hearing protectors or otherwise fail to comply with this policy.

4.4 Audiometric Testing

4.4.1 All Resolution Consultants personnel with exposure greater than the action level may be enrolled in the medical surveillance program and undergo a baseline audiogram. Thereafter, annual audiograms will be compared with the baseline exam.

4.4.2 Enrolled employees will receive audiograms during their exit physicals.

4.4.3 When a Standard Threshold Shift (STS), as identified by the Resolution Consultants Medical Consultant, is noted between the last valid baseline and the annual audiogram, the following steps will be taken:

- A retest will be conducted within 30 days to confirm the STS. The employee will not be exposed to workplace/hobby noise for 14 hours or will be provided with adequate hearing protection prior to testing.
- If the STS persists, ear protection will be upgraded to one with a greater NRR. The minimum NRR will be 26 dBA.
- The employee will be counseled and Resolution Consultants will obtain information regarding the employee's possible noise exposure away from the workplace or existing ear pathology.
- Qualified medical personnel will review the audiograms. This group will determine the need for a medical referral.
- The employee will be notified in writing by either the SH&E Department or the Resolution Consultants Medical Provider of the STS, within 21 days of determination, as required by regulation.
- The employee's supervisor will be notified of the shift in hearing threshold.

4.4.4 If the employee who has experienced an STS is exposed to 85 dBA for eight hours or 80 dBA for 12 hours, mandatory use of ear protection is required.

4.5 Monitoring of Noise Levels

4.5.1 As deemed necessary by an SH&E Professional, or a Project Health and Safety Plan, Resolution Consultants will periodically monitor personal and area noise levels using noise dosimetry and/or sound level meters.



4.6 Hearing Protectors

4.6.1 Selection of appropriate hearing protectors must be based on actual or anticipated exposure levels. At a minimum, hearing protectors must provide a level of protection that brings actual or anticipated exposure below the PEL established for the time period shown in the table above. Additional information relative to hearing protector use is as follows:

- Hearing protection will be mandatory for all employees exposed to 85 dBA for eight hours.
- Hearing protection will be mandatory for all employees working in any area that has not been evaluated for noise exposure and the ambient noise level in the area is such that you must raise your voice to have a normal conversation with someone less than four feet from you and/or when within 25 feet of an operating piece of heavy equipment.
- Hearing protection will be mandatory for all employees who work on or near heavy equipment unless personal dosimetry or other techniques have been used to document actual exposure.
- Hearing protectors will be made available to all employees who may be exposed to 85 dBA for eight hours.
- Hearing protection will be mandatory for all employees exposed to 85 dBA for any period of time and who have experienced an STS.

5.0 Records

5.1.1 Noise exposure measurement records will be retained for three years at the project/facility.

5.1.2 Audiogram records will be retained in the employee's medical records as per Resolution Consultants' Medical Surveillance Procedure for a period as directed by regulation or Resolution Consultants' Medical Provider.

5.1.3 Employee training session documentation will be retained for the duration of employment.

6.0 Attachments

6.1 5-510-Specific Hearing Conservation Program

6.2 5-510-Hearing Protection Guidelines



5-510-Site-Specific Hearing Conservation Program

Site (Project)

1.0 Monitoring

As per regulation, noise monitoring will be conducted by the following procedure:

Such monitoring will consist of (*check those that apply*):

- Noise Dosimetry Sound Level Meter Survey

Specific instrumentation to be used is (make/model):

Make	Model

and will be calibrated at a frequency of and documented in the .

Monitoring strategy is as follows (*list all equipment and activities on site that may involve sound pressure levels above 80 dBA and an explanation of the strategy to document actual exposures*):

Area/Equipment	Monitoring Strategy

Where areas or equipment are not clearly identified, all monitoring will be documented utilizing an illustrated layout (*attach form developed for the specific site*). Monitoring frequency will be in accordance with the strategy outlined above and when the following changes in site conditions/activities occur:

1.
2.
3.
4.
5.



2.0 Employee Notification

All site employees exposed above the regulated action level (85 dBA – 8 hour TWA) will be notified of the monitoring results by *(insert name/title)* at an interval not to exceed after completion of monitoring.

Notification shall be written, with a copy to the SH&E Department. Documentation of employee notifications and corresponding signatures of notified employees will be kept in the site health and safety logbook/files.

3.0 Observation of Monitoring

All employees affected by the monitoring, or a designated employee representative, shall be given the opportunity to observe noise monitoring procedures. This will be achieved by:

4.0 Audiometric Testing Program and Requirements

Resolution Consultants personnel who perform field activities where noise exposure above action levels is expected are required to participate in an audiometric testing program. Additionally, any subcontractors performing work on Resolution Consultants projects where noise levels exceeding action level will be required to provide documentation that they participate in an audiometric testing program that meets the applicable regulations. Documentation of participation in the testing program will be maintained by and will be located at .

5.0 Hearing Protectors and Estimating Attenuation

A selection of suitable hearing protectors will be made available to all employees who are expected to have 8-hour TWA noise exposures above 85 dBA. The types anticipated to be available include:

Protection Type	Attenuation

Hearing protector attenuation will be evaluated by for specific noise environments according to the following method prior to determining their suitability for use:

1.
2.
3.

The following site personnel will be required to wear hearing protectors during specific activities and the results of site-specific monitoring conducted in accordance with this procedure. *(This section can be completed after monitoring, if necessary).*



Employee Name	Activity Type	Type of Protection

Hearing protectors will be properly fitted by _____ upon initial distribution to site workers.

Training in the use and care of hearing protectors shall be conducted by _____ during the initial site-specific health and safety training. Training contents shall meet the requirements set forth in this procedure and the applicable regulations.

Hearing protectors will be distributed by _____ from the storage location at the _____.

6.0 Access to Information and Training Materials

All information required by regulation to be made available to the employees will be posted by (*insert name/title*) _____ at the _____.

Local Occupational Health and Safety Regulations will also be kept on site.

7.0 Recordkeeping

Records required by Resolution Consultants' Hearing Conservation Program and Regulations shall be completed by _____ and shall be maintained at the _____ and placed on permanent file at the _____ for the minimum duration required by the standard. Employees can access their individual records by contacting _____.

All records required by this section will be transferred to any employee's successive employer if Resolution Consultants ceases to do business.

8.0 Approvals

Project Manager: _____ Date: _____

SH&E Representative: _____ Date: _____

5-511 Heat Stress Prevention

1.0 Purpose and Scope

- 1.1 Establishes a heat stress prevention program to help ensure that employees know and recognize the symptoms of heat stress-related illnesses and are prepared to take appropriate corrective action.
- 1.2 This procedure applies to all Resolution Consultants employees and operations.

2.0 Terms and Definitions

- 2.1 **Acclimated:** Workers who have developed physiological adaptation to hot environments characterized by increased sweating efficiency, circulation stability, and tolerance of high temperatures without stress. Acclimatization occurs after 7 to 10 consecutive days of exposure to heat and much of its benefit may be lost if exposure to hot environments is discontinued for a week.
- 2.2 **Chemical Protective Clothing (CPC):** Apparel that is constructed of relatively impermeable materials intended to act as a barrier to physical contact of the worker with potentially hazardous materials in the workplace. Such materials include: Tyvek® coveralls (all types) and polyvinyl chloride (PVC) coveralls and rain suits.
- 2.3 **Unacclimated:** Workers who have not been exposed to hot work conditions for one week or more or who have become heat-intolerant due to illness or other reasons.
- 2.4 **Heat Cramps:** A form of heat stress brought on by profuse sweating and the resultant loss of salt from the body.
- 2.5 **Heat Exhaustion:** A form of heat stress brought about by the pooling of blood in the vessels of the skin and in the extremities.
- 2.6 **Heat Rash:** A heat-induced condition characterized by a red, bumpy rash with severe itching.
- 2.7 **Heat Stress.** The combination of environmental and physical work factors that constitute the total heat load imposed on the body.
- 2.8 **Heat Stroke:** The most serious form of heat stress, which involves a profound disturbance of the body's heat-regulating mechanism.
- 2.9 **Sunburn:** Is caused by unprotected exposure to ultraviolet light that is damaging to the skin. The injury is characterized by red painful skin, blisters, and/or peeling.

3.0 References

- 3.1 5-003-SH&E Training
- 3.2 5-208-Personal Protective Equipment
- 3.3 5-314-Working Alone and Remote Travel

4.0 Procedures

4.1 Restrictions

- 4.1.1 Staff working in extreme heat or sun for extended periods of time away from a shelter or vehicle must not work alone.
- 4.1.2 Staff shall not be exposed to levels that exceed those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard.
- 4.1.3 Clothing corrections shall be applied in accordance with the heat stress and strain section of the ACGIH Standard.

4.2 Roles and Responsibilities

- 4.2.1 Project Managers'/field task managers' responsibilities:

- Evaluate the need for heat stress prevention measures and incorporate as appropriate into the Health and Safety Plan.
 - Implement heat stress prevention measures, as applicable, at each work site.
 - Develop/coordinate a work-rest schedule, as applicable.
 - Ensure heat stress hazard assessments/evaluations were completed for the planned activities.
 - Assign personnel physically capable of performing the assigned tasks.
 - Ensure that personnel are properly trained in the recognition of heat stress-related symptoms.
- 4.2.2 SH&E Managers' responsibilities:
- Provide heat stress awareness training.
 - Assist project teams develop appropriate work-rest schedules.
 - Conduct/support incident investigations related to potential heat stress-related illnesses.
- 4.2.3 Site Supervisors' responsibilities:
- Identify those tasks that may be most impacted by heat stress and communicate the hazard to the assigned employees.
 - Ensure that employees have been trained on the recognition of heat stress-related illness.
 - Ensure that adequate supplies of appropriate fluids are readily available to employees.
 - Ensure that a proper rest area is available.
 - Conduct heat stress monitoring, as applicable.
 - Implement the work-rest schedule.
 - Ensure that first aid measures are implemented once heat stress symptoms are identified.
 - Ensure personnel are physically capable of performing the assigned tasks and are not in a physically compromised condition.
 - Report all suspected heat stress-related illnesses.
- 4.2.4 Employees' responsibilities:
- Observe each other for the early symptoms of heat stress-related illnesses.
 - Maintain an adequate intake of available fluids.
 - Be familiar with heat stress hazards, predisposing factors, and preventative measures.
 - Report to work in a properly vested and hydrated condition.
 - Report all suspected heat stress-related illnesses.
- 4.3 **Controls**
- 4.3.1 If staff are or may be exposed, the supervisor shall:
- Conduct a heat stress assessment to determine the potential for hazardous exposure of workers, and
 - Develop and implement a heat stress exposure control plan.
- 4.3.2 If staff are or may be exposed, the supervisor shall implement engineering controls (e.g., shelters, cooling devices, etc.) to reduce the exposure of staff to levels below those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard.
- 4.3.3 If engineering controls are not practicable, the supervisor shall reduce the exposure of workers to levels below those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard by providing administrative controls, including a work-rest cycle or personal protective equipment, if the equipment provides protection equally effective as administrative controls.
- 4.3.4 If staff are or may be exposed, the supervisor shall provide and maintain an adequate supply of cool, potable water close to the work area for the use of a heat exposed worker.
- 4.3.5 If a staff person shows signs or reports symptoms of heat stress or strain, they shall be removed from the hot environment and treated by an appropriate first aid attendant, if available, or by a physician.

- 4.3.6 Heat stress can be a significant field site hazard, especially for workers wearing CPC. The workforce will gradually work up to a full workload under potentially stressful conditions to allow for proper acclimation.
- 4.3.7 Site personnel shall be instructed in the recognition of heat stress symptoms, the first aid treatment procedures for severe heat stress, and the prevention of heat stress injuries. Workers must be encouraged to immediately report any heat stress that they may experience or observe in fellow workers. Supervisors must use such information to adjust the work-rest schedule to accommodate such problems.
- 4.3.8 Wherever possible, a designated break area should be established in an air conditioned space, or in shaded areas where air conditioning is impractical. The break area should be equipped to allow workers to loosen or remove protective clothing, and sufficient seating should be available for all personnel. During breaks, workers must be encouraged to drink plenty of water or other liquids, even if not thirsty, to replace lost fluids and to help cool off. Cool water should be available at all times in the break area, and in the work area itself unless hygiene/chemical exposure issues prevent it.

4.4 **Symptoms and Treatment**

- 4.4.1 Workers who exhibit ANY signs of significant heat stress (e.g., profuse sweating, confusion and irritability, pale, clammy skin), shall be relieved of all duties at once, made to rest in a cool location, and provided with large amounts of cool water.
- 4.4.2 Anyone exhibiting symptoms of heat stroke (red, dry skin, or unconsciousness) must be taken immediately to the nearest medical facility, taking steps to cool the person during transportation (clothing removal, wet the skin, air conditioning, etc.).
- 4.4.3 Severe heat stress (heat stroke) is a life-threatening condition that must be treated by a competent medical authority.

4.5 **Prevention**

- 4.5.1 All staff working in extreme heat or sun should understand the following guidelines for preventing and detecting heat exhaustion and heat stroke.
- If you experience heat exhaustion or heat stroke you must immediately seek shelter and water.
 - Take frequent short breaks in areas sheltered from direct sunlight; eat and drink small amounts frequently.
 - Try to schedule work for the coolest part of the day, early morning and evening.
- 4.5.2 Prevention of heat-related illnesses:
- Avoid strenuous physical activity outdoors during the hottest part of the day.
 - Wear a hat and light-colored, loose-fitting clothing to reflect the sun.
 - Avoid sudden changes of temperature. Air out a hot vehicle before getting into it.
 - If you take diuretics, ask your doctor about taking a lower dose during hot weather.
 - Drink 8 to 10 glasses of water per day. Drink even more if you are working or exercising in hot weather.
 - Avoid caffeine and alcohol as they increase dehydration.
 - If you exercise strenuously in hot weather, drink more liquid than your thirst seems to require.

4.6 **Personal Protective Equipment**

- Wear a hat and light-colored, loose-fitting clothing to reflect the sun.
- Apply sunscreen to exposed skin (SPF 30 or greater, follow directions on label).
- Wear sunglasses with UV protection.
- Pack extra water to avoid dehydration (try freezing water in bottles overnight to help keep the water cooler for longer during the day).

4.7 **Work-Rest Schedule Practices**

- Intake of fluid will be increased beyond that which satisfies thirst, and it is important to avoid "fluid debt," which will not be made up as long as the individual is sweating.
- Two 8-ounce glasses of water should be taken prior to beginning work, then up to 32 oz. per hour during the work shift; fluid replacement at frequent intervals is most effective.

- The best fluid to drink is water; liquids like coffee or soda do not provide efficient hydration and may increase loss of water.
- If commercial electrolyte drinks (e.g., Gatorade) are used, the drink should be diluted with water, or 8 ounces of water should be taken with each 8 ounces of electrolyte beverage.
- Additional salt is usually not needed and salt tablets should not be taken.
- Replacement fluids should be cool, but not cold.
- Breaks will be taken in a cool, shaded location, and any impermeable clothing should be opened or removed.
- Dry clothing or towels will be available to minimize chills when taking breaks.
- Manual labor will not be performed during breaks, other than paperwork or similar light tasks.
- Other controls that may be used include:
 - Scheduling work at night or during the cooler parts of the day (6 am–10 am, 3 pm–7 pm).
 - Erecting a cover or partition to shade the work area.
 - Wearing cooling devices such as vortex tubes or cooling vests beneath protective garments. If cooling devices are worn, only physiological monitoring will be used to determine work activity.

4.8 **Evaluating the Work-Rest Schedule's Effectiveness**

4.8.1 Once a work-rest schedule is established, the work supervisor must continually evaluate its effectiveness through observation of workers for signs/symptoms of heat stress. Measurement of each worker's vitals (e.g., pulse, blood pressure, and temperature) can provide additional information in determining if the schedule is adequate, and is accomplished as follows:

4.8.2 At the start of the workday each worker's baseline pulse rate (in beats per minute – bpm) is determined by taking a pulse count for 15 seconds and multiplying the result by four or an automated pulse count device may be utilized. Worker pulse rates can then be measured at the beginning and end of each break period to determine if the rest period allows adequate cooling by applying the following criteria:

- Each worker's maximum heart rate at the start of any break should be less than [180 minus worker's age] bpm. If this value is exceeded for any worker, the duration of the following work period will be decreased by at least 10 minutes.
- At the end of each work period all workers' heart rates must have returned to within +10% of the baseline pulse rate. If any worker's pulse rate exceeds this value the break period will be extended for at least 5 minutes, at the end of which pulse rates will be remeasured and the end-of-break criteria again applied.

4.8.3 Use a clinical thermometer or similar device to measure the oral/ear temperature at the beginning (before drinking liquids) and end of each break period and apply the following criteria:

- If the oral temperature exceeds 99.6°F, shorten the next work cycle by one-third without changing the rest period.
- If the oral temperature still exceeds 99.6°F (36.6°C) at the beginning of the next rest period, shorten the following work cycle by one-third.

4.8.4 Use of an automated or similar blood pressure device will be used to assess each employee's blood pressure at the beginning and end of each break period to determine if the rest period allows adequate cooling by applying the following criteria:

- If the blood pressure of an employee is outside of 90/60 to 150/90, then the employee will not be allowed to begin or resume work; extend the break period by at least five minutes, at the end of which blood pressure rates will be remeasured and the end-of-break criteria again applied.

4.8.5 All physiological monitoring of heat stress will be documented using *5-511-Heat/Cold Stress Monitoring Log*.

4.9 **Training**

4.9.1 Project staff and their supervisors that may be exposed to the hazard will be oriented to the hazard and the controls prior to work commencing.

4.9.2 Those personnel potentially exposed to heat stress will receive training including, but not limited to

- Sources of heat stress, influence of protective clothing, and importance of acclimatization.
- How the body handles heat.
- Recognition of heat-related illness symptoms.
- Preventative/corrective measures.
 - Employees will be informed of the harmful effects of excessive alcohol consumption in the prevention of heat stress.
 - All employees will be informed of the importance of adequate rest and proper diet in the prevention of heat stress.
- First aid procedures for heat stress-related illnesses.

5.0 Records

None.

6.0 Attachments

- 6.1 5-511-FM Heat/Cold Stress Monitoring Log



5-511 Form 1 Heat Stress Monitoring Log

The purpose of this form is to track entry into hot zones wearing chemically protective clothing and monitor employees for heat stress-related illness. It is the responsibility of the foreman or supervisor-in-charge to ensure that each person entering the hot zone completes the required information. Vital signs must be taken by a competent person.

Project Name:			Foreman/Supervisor:				Work/Rest Schedule1:		IN (min)	OUT (min)						
Date:	Water Provided ²		Acclimated ³		Initial Vitals ³	Vital Signs and Time In/Out ⁴										
Employee Name	Yes	No	Yes	No	Vitals	In	Out	Vitals	In	Out	Vitals	In	Out	Vitals	In	Out
					P			P			P			P		
					BP			BP			BP			BP		
					Temp			Temp			Temp			Temp		
					P			P			P			P		
					BP			BP			BP			BP		
					Temp			Temp			Temp			Temp		
					P			P			P			P		
					BP			BP			BP			BP		
					Temp			Temp			Temp			Temp		
					P			P			P			P		
					BP			BP			BP			BP		
					Temp			Temp			Temp			Temp		
					P			P			P			P		
					BP			BP			BP			BP		
					Temp			Temp			Temp			Temp		

1. Please refer to 5-511 Heat Stress. Section 6.3 provides specific details on how to develop a work-rest schedule.
2. Each employee should be provided a sufficient amount of water or sports drink before entering the hot zone. Drinks such as coffee and cola should be discouraged.
3. A worker is "acclimated" if he/she has worked in a hot environment for at least 7 to 10 consecutive days. If a worker is acclimated, check "Yes." If a worker is not acclimated, check "No" and reduce the "Min In" by 50 percent for that employee until the 7- to 10-day period is reached.
4. "Vitals" refers to employee vital signs (e.g., pulse [P], blood pressure [BP], body temperature [Temp], etc.). Initial vitals must be taken and recorded before the start of work operations in the hot zone. Each time the employee exits the hot zone, vitals must be taken and evaluated for heat stress criteria. Section 6.4 of 5-511 Heat Stress provides specific instructions for taking and evaluating employee vital signs.
5. Body temperature vital signs will be recorded in °F.

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Attachment 5
Daily Safety Meeting Form (SWAP)

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Resolution Consultants

Daily Safe Work Assessment & Permit (SWAP)

This form must be filled out daily prior to work in the field and reviewed with all project personnel in a daily safety brief. The SWAP is to be completed before each work day to continually assess and communicate project-related hazards. Please have all SWAPs initiated by the Project Manager or Supervisor after returning from the field and place all completed SWAPs in the project file.

Section 1: Project Information

Project/Client Name: _____ SWAP Date/Time: _____
 Location of the Work: _____ Project Number: _____
 Description of Work: _____

Has a HASP been created for this job? Yes No If Yes, has the HASP been reviewed prior to work? Yes No

Section 2: Identify hazards associated with tasks and tools FOR THIS DAY:

Critical Safety Tasks are listed below: (If answered "Yes" please call H&S for additional guidance/checks)

	Yes	No		Yes	No
Performing work in Confined Spaces - - - - -	<input type="checkbox"/>	<input type="checkbox"/>	Use of Respiratory Protection- - - - -	<input type="checkbox"/>	<input type="checkbox"/>
Hazardous Chemical Exposure- - - - -	<input type="checkbox"/>	<input type="checkbox"/>	Involvement with Lockout/Tagout Activities - - -	<input type="checkbox"/>	<input type="checkbox"/>
Falls Greater than Six (6) Feet- - - - -	<input type="checkbox"/>	<input type="checkbox"/>	Trenching or Excavation - - - - -	<input type="checkbox"/>	<input type="checkbox"/>

List each task that presents hazards and identify controls you will take to minimize risk. If No hazards were identified, write NONE in the first Task box. All additional project personnel involved must initial the bottom of each task identified below signifying that they have reviewed this information. Use back of SWAP as necessary for General Safety and Precautions, and to add additional hazards.

Following is a non-inclusive list of potential hazards.

- Chemicals (inhalation, dermal)
- Biologic Hazards (poison ivy, ants, snakes)
- Potentially unsafe area or neighborhood
- Sampling around heavy equipment (backhoe bucket, Vac. Truck, etc.)
- Working around high noise (> 85 dBA)
- Activities that require coring or drilling
- Drilling around underground utilities
- Work with equipment around power lines
- Slick, uneven walking/working surfaces
- Climbing ladders / scaffolds
- Using gas or propane powered equipment in enclosed areas
- Work in extreme heat (> 104°F) or extreme cold (<30°F)
- Working around heavy equipment / traffic
- Power tools (hammer drills, auger, etc.)
- Working with lifting / hoisting equipment
- Vehicular traffic, fork lifts, scissors lifts
- Inclement weather (lightning, high winds)
- Work with ergonomic hazards (lifting hazards, twisting, excessive repetitive)
- Working in proximity to deep water > 3ft
- Remote location w/ limited communication

Task: _____

Hazards: _____

Controls: _____

Attachment 6
Incident Investigation and Reporting Forms

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EnSafe Investigation Report

Select the report type: ___ near miss - ___ incident - ___ injury

1. Dates					
Of Near Miss/Incident/Injury	Investigation Started		Investigation Completed		
2. Location			3. Time		
4. EnSafe Employees					
Injured	Involved		Witnesses		
5. Others					
Injured	Involved		Witnesses		
6. Injured					
Name	Length of time with firm	EnSafe Employee Yes/no	Job Title or Occupation	How long assigned to job	Nature and Extent of Injury
7. Equipment/Tools/Vehicles Involved					
Item:					
Damage:					
Ownership:					

8. Description

Events leading up to:

Accident/Incident/Event/Illness:

Contributing Factors:

9. Cause

Immediate Cause:

Root Cause:

10. Policy, Work Rule, Regulation, Standard

Applicable:

Violations:

11. Recommendations

To Prevent Recurrence:

Empty text box for recommendations to prevent recurrence.

Additional Training:

Empty text box for additional training.

12. Investigation Team

Leader:		Members:	
Signature:			
Date:			

13. Review

Reviewed by	Signature	Date

Comments:

Empty text box for comments.

14. Corrective Action

Action	Date	Signature
1		
2.		
3.		
4.		
5.		
6.		

EnSafe Investigation Report

Select the report type: ___ near miss - ___ incident - ___ injury

1. Dates					
Of Near Miss/Incident/Injury		Investigation Started		Investigation Completed	
Date of event		Date investigation started, hopefully the day of the event.		Date that all parties agree on the findings and corrective actions.	
2. Location			3. Time		
Where did this event occur? Provide as much detail as possible.			What time of the day did the event occur? Approximate if able, if you are not able then just list unknown.		
4. EnSafe Employees					
Injured		Involved		Witnesses	
Injured EnSafe personnel		Other EnSafe personnel involved.		Any EnSafe personnel who witnessed the event.	
5. Others					
Injured		Involved		Witnesses	
Injured 'Other' personnel		Other' personnel involved.		Any 'Other' personnel who witnessed the event.	
6. Injured					
Name	Length of time with employer	EnSafe Employee Yes/no	Job Title or Occupation	How long assigned to job	Nature and Extent of Injury
	If known.		If known.	If known.	If known.
7. Equipment/Tools/Vehicles Involved					
Item:					
List all items that were involved with the incident such as vehicles, power tools, heavy equipment, etc.					
Damage:					
If anything was damaged, please list.					
Ownership:					
List who owns the equipment.					

8. Description

Events leading up to:

What was occurring right before the event. Ex: Employee was collecting samples from the bucket of an excavator.

Accident/Incident/Event/Illness:

What was the event? Ex: Employee was collecting sample from the bucket when he slipped into the excavation hole.

Contributing Factors:

This is where we talk about 'other' things that may have contributed to the event: Ex: Ground was wet from a morning rainstorm and this created a slick walking surface which contributed to the employee losing his footing and falling into the excavation. Furthermore, the sample point was too close to the excavation.

9. Cause

Immediate Cause:

This is the main (immediate) reason that the event occurred. Ex: Employee stood too closely to the excavation area and fell into the excavation.

Root Cause:

This is the point that you look deeply to trace the problem back to the root. You have to ask yourself the hard questions that are not so obvious. Your thought process should be: Why was the employee so close to the excavation? Were there issues with the excavator's reach capability? What protocol exists that dictates how closely the employee is allowed to the excavation? If the employee was too close why didn't someone force the move back to a safe location? Has there been a lack of enforcement of safety protocol on the jobsite? NOTE: This section is never enjoyable but it is the most critical. If you fail to identify the root cause you will not be able to prevent the problem from manifesting itself again.

10. Policy, Work Rule, Regulation, Standard

Applicable:

Do we have any governance in place to help prevent this from occurring?

Violations:

If we do have governance in place, was their a violation of those policiies? If so was it intentional or unintentional.

11. Recommendations

To Prevent Recurrence:

This is where we provide instructions and thoughts on the different ways that we can prevent the event from occurring again. This needs to provide enough detail that it can be read and understood by a broad audience during distribution.

Additional Training:

List any training here that might help to prevent this from occurring again.

12. Investigation Team

Leader:	Usually the senior person on-scene.	Members:	Additional people who assisted with preparing or reviewing the report.
Signature:			
Date:	Date of the report being final.		

13. Review

Reviewed by	Signature	Date
Usually the Project Manager		
Usually the Corporate HS Manager		
Any 'other' personnel		

Comments:

Comments from those who are reviewing the report.

14. Corrective Action

Action	Date	Signature
1 Corrective actions listed here.	Date action put in place.	Person who carried out the corrective action.
2.		
3.		
4.		
5.		
6.		

Attachment 7
Material Safety Data Sheets

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Material Safety Data Sheet

Revision Issued: 3/04/2010 Supercedes: 11/02/2005 First Issued: 6/24/1987

Section I - Chemical Product And Company Identification

Product Name: Perchloroethylene

CAS Number: 127-18-4

HBCC MSDS No. CP05000



HILL BROTHERS *Chemical Co.*

1675 NORTHMAIN STREET • ORANGE, CALIFORNIA 92867-3499
(714) 998-8800 • FAX: (714) 998-6310
<http://hillbrothers.com>

1675 No. Main Street, Orange, California 92867
Telephone No: 714-998-8800 | Outside Calif: 800-821-7234
Chemtrec: 800-424-9300

Section II - Composition/Information On Ingredients

Chemical Name	CAS Number	%
Perchloroethylene	127-18-4	100

See Section VIII for exposure guidelines

Section III - Hazard Identification

Routes of Exposure: Perchloroethylene can affect the body either through ingestion, inhalation, or contact with the eyes and/or skin.

Summary of Acute Health Hazards

Ingestion: May cause irritation of the gastrointestinal tract with vomiting. If vomiting results in aspiration, chemical pneumonia could follow. Absorption through the gastrointestinal tract may produce symptoms of central nervous system depression ranging from light-headedness to unconsciousness.

Inhalation: Excessive inhalation may produce symptoms of central nervous system depression, ranging from light-headedness, nausea and vomiting, to unconsciousness and death.

Skin: Mildly irritating to the skin. Skin contact may produce a burning sensation. Prolonged or repeated contact may cause skin to become reddened, rough, and dry due to the removal of natural oils and may result in dermatitis.

Eyes: An irritant to the eyes, causing pain, lacrimation, and general inflammation.

Summary of Chronic Health Hazards: Can cause headache, mental confusion, depression, fatigue, loss of appetite, nausea, vomiting, coughing, loss of sense of balance, and visual disturbances. Prolonged or repeated skin contact may cause dermatitis.

Signs and Symptoms of Exposure: N/A

Effects of Overexposure: N/A

Medical Conditions Generally Aggravated by Exposure: Persons with pre-existing skin disorders, impaired liver function, or impaired renal function might have increased health risks working with perchloroethylene.

Note to Physicians: Do not administer adrenaline or epinephrine to a victim of chlorinated solvent poisoning.

Section IV - First Aid Measures

Ingestion: NEVER give anything by mouth to an unconscious person. Have the conscious victim drink 2 glasses of water to dilute. DO NOT INDUCE VOMITING. Keep the airway clear. GET MEDICAL ATTENTION IMMEDIATELY.

Inhalation: Remove the victim to fresh air immediately. If breathing is difficult, administer oxygen; if breathing has stopped, perform artificial respiration. GET MEDICAL ATTENTION IMMEDIATELY.

Skin: Wash the contaminated skin with plenty of soap and water for at least 15 minutes. If irritation persists after washing, get medical attention.

Eyes: Wash the eyes immediately with large amounts of water for at least 15 minutes, lifting the upper and lower lids. If irritation persists after washing, GET MEDICAL ATTENTION. Contact lenses should not worn with this product.

Section V - Fire Fighting Measures

Flash Point: Not Flammable **Autoignition Temperature:** Not Flammable

Lower Explosive Limit: N/A **Upper Explosive Limit:** N/A

Unusual Fire and Explosion Hazards: Perchloroethylene is nonflammable and non-explosive under normal conditions of use. At high temperatures PCE decomposes to give off hydrochloric acid as gas plus other toxic and irritating vapors such as phosgene. Vapors are heavier than air and collect in low-lying areas.

Extinguishing Media: Water spray, dry chemical, carbon dioxide, or foam may be used where perchloroethylene is stored.

Special Firefighting Procedures: Storage containers exposed to fire should be kept cool with a water spray in order to prevent pressure build-up. 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.

Section VI - Accidental Release Measures

Ventilate the area of the leak or spill. Persons performing clean-up work should wear adequate personal protective equipment and clothing. Keep material out of water sources and sewers. Build dikes to contain flow as necessary. 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. Flush area with water to remove trace residue, and dispose of the flush solution.

Section VII - Handling and Storage

Do not get in eyes, on skin, or on clothing, and avoid breathing the mist. Keep containers closed, and use with adequate ventilation. Wash thoroughly after handling. Under normal conditions, perchloroethylene may be stored satisfactorily in

galvanized iron, black iron or steel. Aluminum is not generally recommended for storage or handling. Store drums in a cool place (bungs up and closed tightly). Ventilation should be provided at the floor level.

Section VIII - Exposure Controls/Personal Protection

Exposure Controls

Engineering Controls: This product should be confined within closed equipment, in which case general (mechanical) room ventilation should be suitable. Special, local ventilation is needed at points where vapors are expected to be vented to the workplace air. Have eye baths and safety showers immediately available where eye contact and skin contact can occur.

Work/Hygienic Practices: All employees who handle perchloroethylene should wash their hands before eating, smoking, or using the toilet facilities. Do NOT place food, coffee or other drinks in the area where dusting or splashing of solutions is possible.

Exposure Guideline(s): Perchloroethylene: CAS Number 127-18-4, Exposure Limits (TWAs) in Air: ACGIH TLV: 25 ppm; OSHA PEL: 100 ppm; STEL: 100 ppm

Personal Protection

Personal Protection Equipment (PPE): Use only a MSHA/NIOSH-approved respirator to prevent overexposure if vapor levels may or do exceed the exposure limits. See SUPPLEMENTAL INFORMATION.

Protective Clothing: Wear chemical goggles if there is the likelihood of contact with the eyes. Wear appropriate impervious gloves and protective clothing to prevent skin contact. Wear face shields and impervious aprons when splashing is likely. Remove contaminated clothing promptly and launder before reuse.

Eye Protection: Employees should be provided with and required to use splash-proof safety goggles where there is any possibility of Perchloroethylene contacting the eyes.

Section IX - Physical and Chemical Properties

Physical State: Liquid

pH: N/A

Melting Point/Range: -19°C (-2.2°F) **Boiling Point/Range:** 121°C (250°F)

Appearance/Color/Odor: Clear, colorless liquid with an odor like chloroform or ether

Solubility in Water: 0.015 g/100 g H₂O

Vapor Pressure (mmHg): 18 @ 25°C (77°F)

Specific Gravity (Water=1): 1.62

Molecular Weight: 165.85

Vapor Density (Air=1): 5.7

% Volatiles: 100

Evaporation Rate (BuAc=1): 0.33 (trichloroethylene = 1)

How to detect this compound: In air, adsorption on charcoal, workup with CS₂, analysis by gas chromatography. In water, inert gas purge followed by gas chromatography with halide specific detection (EPA Method 601) or gas chromatography plus mass spectrometry (EPA Method 624).

Section X - Stability and Reactivity

Stability: Stable under ordinary conditions of use and storage. Slowly decomposed by light. Deteriorates rapidly in warm, moist climates.

Hazardous Polymerization: Will Not Occur

Conditions to Avoid: High Temperatures, and moisture.

Materials to Avoid: Pure oxygen, strong oxidizers, alkali metals, open flames, and electrical arcs. PCE reacts violently with concentrated nitric acid to give carbon dioxide as a primary product. Zinc, barium, lithium. Slowly corrodes aluminum, iron and zinc.

Hazardous Decomposition Products: At high temperatures, PCE decomposes to give off hydrogen chloride gas, trichloroacetic acid and small quantities of other toxic and irritating vapors such as phosgene. Carbon dioxide and carbon monoxide may form when heated to decomposition.

Section XI - Toxicological Information

Oral rat LD50: 2629 mg/kg; inhalation rat LC50: 4100 ppm/6H

Section XII - Ecological Information

N/A

Section XIII - Disposal Considerations

Dispose of in accordance with applicable local, county, state and federal regulations.

Section XIV - Transport Information

DOT Proper Shipping Name: Tetrachloroethylene

DOT Hazard Class/ I.D. No.: 6.1, UN1897, III

Section XV - Regulatory Information

CALIFORNIA PROPOSITION 65: WARNING

This product contains Tetrachloroethylene (Perchloroethylene), a substance known to the State of California to cause cancer.

CERCLA (Comprehensive Environmental Response, Compensation, and

Liability Act) Hazardous Substance: Perchloroethylene, CAS # 127-18-4

100 Pounds (45.4 Kilograms) Reportable Quantity (RQ)

RCRA (Resource Conservation & Recovery Act) Hazardous Waste Code:

Perchloroethylene, CAS # 127-18-4, U210

Section 313 Supplier Notification: Perchloroethylene, CAS # 127-18-4, % by Weight: 100%

NFPA (National Fire Protection Association) Rating:

Health - 2; Flammability - 0; Instability - 0

0=Insignificant 1=Slight 2=Moderate 3=High 4=Extreme

Carcinogenicity Lists: National Toxicology Program (NTP): Yes

International Agency for Research on Cancer (IARC) Monograph: Yes

Occupational Safety & Health Administration (OSHA) Regulated: Yes

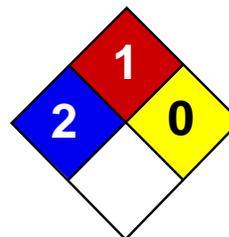
Section XVI - Other Information

Synonyms/Common Names: Tetrachloroethylene, Perclene, Carbon Dichloride, PCE

Chemical Family/Type: N/A

Sections changed since last revision: II, IV, V, VI, VIII, IX, X, XI

IMPORTANT! Read this MSDS before use or disposal of this product. Pass along the information to employees and any other persons who could be exposed to the product to be sure that they are aware of the information before use or other exposure. This MSDS has been prepared according to the OSHA Hazard Communication Standard [29 CFR 1910.1200]. The MSDS information is based on sources believed to be reliable. However, since data, safety standards, and government regulations are subject to change and the conditions of handling and use, or misuse are beyond our control, **Hill Brothers Chemical Company** makes no warranty, either expressed or implied, with respect to the completeness or continuing accuracy of the information contained herein and disclaims all liability for reliance thereon. Also, additional information may be necessary or helpful for specific conditions and circumstances of use. It is the user's responsibility to determine the suitability of this product and to evaluate risks prior to use, and then to exercise appropriate precautions for protection of employees and others.



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

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Material Safety Data Sheet

HAZARD WARNINGS	RISK PHRASES	PROTECTIVE CLOTHING
	Flammable liquid, keep away from heat and sources of ignition. Light, air, and moisture sensitive.	

Section I. Chemical Product and Company Identification

Chemical Name	cis-1,2-Dichloroethylene		
Catalog Number	D0367	Supplier	TCl America 9211 N. Harbortgate St. Portland OR 1-800-423-8616
Synonym	cis-Acetylene Dichloride		
Chemical Formula	C1CH:CHCl		
CAS Number	156-59-2	In case of Emergency Call	Chemtrec® (800) 424-9300 (U.S.) (703) 527-3887 (International)

Section II. Composition and Information on Ingredients

Chemical Name	CAS Number	Percent (%)	TLV/PEL	Toxicology Data
cis-1,2-Dichloroethylene	156-59-2	Min. 99.0 (GC)	TWA: 200 (ppm) from ACGIH TWA: 200 (ppm) from OSHA/NIOSH Consult local authorities for acceptable exposure limits.	Mouse LCLo (inhalation) 65000 mg/m ³ /2H Cat LCLo (inhalation) 20000 mg/m ³ /6H

Section III. Hazards Identification

Acute Health Effects	Harmful liquid and fumes. Toxic to the liver, kidneys, and nervous system. Irritating to eyes and skin on contact. Inhalation causes irritation of the lungs and respiratory system. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering. Follow safe industrial hygiene practices and always wear proper protective equipment when handling this compound.
Chronic Health Effects	CARCINOGENIC EFFECTS : Not available. MUTAGENIC EFFECTS : Unscheduled DNA synthesis: Rat (liver cell) 4300 µmol/L Mutations: Yeast (S cerevisiae) 100 mmol/L (-S9) TERATOGENIC EFFECTS : Not available. Toxicity to the reproductive system: Not available. There is no known effect from chronic exposure to this product. Repeated or prolonged exposure to this compound is not known to aggravate existing medical conditions.

Section IV. 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. Flush eyes with running water for a minimum of 15 minutes, occasionally lifting the upper and lower eyelids. Seek medical attention. Treat symptomatically and supportively.
Skin Contact	If the chemical gets spilled on a clothed portion of the body, remove the contaminated clothes as quickly as possible, protecting your own hands and body. Place the victim under a deluge shower. If the chemical touches the victim's exposed skin, such as the hands: Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. COLD water may be used. Cover the irritated skin with an emollient. Seek medical attention. Treat symptomatically and supportively. Wash any contaminated clothing before reusing.
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 artificial respiration. Seek medical attention. Treat symptomatically and supportively.
Ingestion	Remove dentures if any. Watch for an obstruction in the victim's mouth. Remove if possible what is causing the obstruction but do not force fingers or a hard object between the victim's teeth. Have conscious person drink several glasses of water or milk. INDUCE VOMITING by sticking finger in throat. Seek immediate medical attention and, if possible, show the chemical label. Treat symptomatically and supportively.

Section V. Fire and Explosion Data

Flammability	Flammable.	Auto-Ignition	460°C (860°F)
Flash Points	closed cup: 2.2-3.9°C open cup: 6°C (42.8°F)	Flammable Limits	LOWER: 9.7% UPPER: 12.8%
Combustion Products	These products include toxic carbon oxides (CO, CO ₂), and halogenated compounds. WARNING: TOXIC HCl gas produced as a result of combustion.		
Fire Hazards	Reactive with strong oxidizers. Vapors may travel to source of ignition and flash back. Closed containers may explode from the heat of a fire. Highly flammable in presence of open flames and sparks, of heat.		
Explosion Hazards	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. MAY RELEASE EXPLOSIVE CHLOROACETYLENE BY CONTACT WITH COPPER OR COPPER ALLOYS.		
Fire Fighting Media and Instructions	Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemicals, CO ₂ , alcohol foam or water spray. LARGE FIRE: Use alcohol foam, water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion. Consult with local fire authorities before attempting large scale fire-fighting operations.		

Section VI. Accidental Release Measures

Spill Cleanup Instructions	Flammable liquid. Keep away from heat and sources of ignition. Mechanical exhaust required. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. DO NOT touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all sources of ignition.
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Section VII. Handling and Storage

Handling and Storage Information	FLAMMABLE. AIR, LIGHT, AND MOISTURE SENSITIVE. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. DO NOT ingest. Do not breathe gas, fumes, vapor or spray. 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. Always store away from incompatible compounds such as oxidizing agents, alkalis, air, light, and moisture.
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Section VIII. 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 station and safety shower is proximal to the work-station location.
Personal Protection	Splash goggles. Lab coat. Vapor respirator. Boots. Gloves. A MSHA/NIOSH approved respirator 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: 200 (ppm) from ACGIH TWA: 200 (ppm) from OSHA/NIOSH Consult local authorities for acceptable exposure limits.

**Section IX. Physical and Chemical Properties**

Physical state @ 20°C	Liquid.	Solubility	Soluble in methanol, diethyl ether, acetone. Partially soluble in cold water, hot water.
Specific Gravity	1.29	Partition Coefficient	1.68
Molecular Weight	96.94	Vapor Pressure	400 mm of Hg (@ 41°C)
Boiling Point	61°C (141.8°F)	Vapor Density	3.34 (Air = 1)
Melting Point	-80.5°C (-112.9°F)	Volatility	Not available.
Refractive Index	Not available.	Odor	Not available.
Critical Temperature	Not available.	Taste	Not available.
Viscosity	Not available.		

Section X. Stability and Reactivity Data

Stability	This material is stable if stored under proper conditions. (See Section VII for instructions)
Conditions of Instability	Avoid excessive heat and light. Decomposes slowly on exposure to air, light, and moisture.
Incompatibilities	Highly reactive with oxidizing agents, alkalis.

Section XI. Toxicological Information

RTECS Number	KV9420000
Routes of Exposure	Ingestion. Inhalation. Eye contact. Skin contact.
Toxicity Data	Mouse LCLo (inhalation) 65000 mg/m ³ /2H Cat LCLo (inhalation) 20000 mg/m ³ /6H
Chronic Toxic Effects	CARCINOGENIC EFFECTS : Not available. MUTAGENIC EFFECTS : Unscheduled DNA synthesis: Rat (liver cell) 4300 µmol/L Mutations: Yeast (<i>S cerevisiae</i>) 100 mmol/L (-S9) TERATOGENIC EFFECTS : Not available. Toxicity to the reproductive system: Not available. There is no known effect from chronic exposure to this product. Repeated or prolonged exposure to this compound is not known to aggravate existing medical conditions.
Acute Toxic Effects	Harmful liquid and fumes. Toxic to the liver, kidneys, and nervous system. Irritating to eyes and skin on contact. Inhalation causes irritation of the lungs and respiratory system. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering. Follow safe industrial hygiene practices and always wear proper protective equipment when handling this compound.

Section XII. Ecological Information

Ecotoxicity	Not available.
Environmental Fate	If released to soil, this compound should evaporate and/or leach into the groundwater where very slow biodegradation should occur. If released to water, it will be lost mainly to volatilization (half life 3 hours in model river). If released to atmosphere, it should be lost by reaction with photochemically produced hydroxyl radicals (half life 8 days).

Section XIII. Disposal Considerations

Waste Disposal	Recycle to process, if possible. Consult your local or regional authorities. You may be able to dissolve or mix material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber system. Observe all federal, state, and local regulations when disposing of this substance.
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Section XIV. Transport Information

DOT Classification	DOT CLASS 3: Flammable liquid.
PIN Number	UN1150
Proper Shipping Name	1,2-Dichloroethylene
Packing Group (PG)	II
DOT Pictograms	

Section XV. Other Regulatory Information and Pictograms

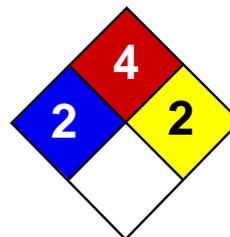
TSCA Chemical Inventory (EPA)	This product is ON the EPA Toxic Substances Control Act (TSCA) inventory.
WHMIS Classification (Canada)	WHMIS CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
EINECS Number (EEC)	205-859-7
EEC Risk Statements	R12- Extremely flammable.
Japanese Regulatory Data	Not available.

Section XVI. Other Information

Version 1.0
Validated on 12/23/1996.
Printed 2/2/2005.

Notice to Reader

TCl laboratory chemicals are for research purposes only and are NOT intended for use as drugs, food additives, households, or pesticides. The information herein is believed to be correct, but does not claim to be all inclusive and should be used only as a guide. 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 chemical reagents must be handled with the recognition that their chemical, physiological, toxicological, and hazardous properties have not been fully investigated or determined. All chemical reagents should be handled only by individuals who are familiar with their potential hazards and who have been fully trained in proper safety, laboratory, and chemical handling procedures. Although certain hazards are described herein, we can not guarantee that these are the only hazards which exist. Our MSDS sheets are based only on data available at the time of shipping and are subject to change without notice as new information is obtained. Avoid long storage periods since the product is subject to degradation with age and may become more dangerous or hazardous. It is the responsibility of the user to request updated MSDS sheets for products that are stored for extended periods. Disposal of unused product must be undertaken by qualified personnel who are knowledgeable in all applicable regulations and follow all pertinent safety precautions including the use of appropriate protective equipment (e.g. protective goggles, protective clothing, breathing equipment, facial mask, fume hood). For proper handling and disposal, always comply with federal, state, and local regulations.



Health	2
Fire	4
Reactivity	0
Personal Protection	G

Material Safety Data Sheet

Vinylidene Chloride MSDS

Section 1: Chemical Product and Company Identification

Product Name: Vinylidene Chloride

Catalog Codes: SLV1063

CAS#: 75-35-4

RTECS: KV9275000

TSCA: TSCA 8(b) inventory: Vinylidene Chloride

CI#: Not available.

Synonym: 1,1-Dichloroethylene

Chemical Name: Vinylidene Chloride

Chemical Formula: C₂H₂Cl₂

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
Vinylidene Chloride	75-35-4	100

Toxicological Data on Ingredients: Vinylidene Chloride: ORAL (LD50): Acute: 194 mg/kg [Mouse]. 200 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of skin contact (irritant). Slightly hazardous in case of eye contact (irritant), of inhalation (lung irritant). Severe over-exposure can result in death.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Classified 4 (No evidence.) by NTP. A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC. **MUTAGENIC EFFECTS:** Not available. **TERATOGENIC EFFECTS:** Not available. **DEVELOPMENTAL TOXICITY:** Classified Reproductive system/toxin/female [POSSIBLE]. The substance may be toxic to kidneys, liver, bladder, gastrointestinal tract, skin, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage. 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. WARM water MUST be used. 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 immediate medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get 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. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek medical attention.

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: Flammable.

Auto-Ignition Temperature: 520°C (968°F)

Flash Points: CLOSED CUP: -28°C (-18.4°F).

Flammable Limits: LOWER: 8.4% UPPER: 16.5%

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:

Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

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:

Flammable liquid. Poisonous liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. 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. 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. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with skin. Wear suitable protective clothing. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, moisture.

Storage:

Store in a segregated and approved area. 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). 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. Ensure that eyewash stations and safety showers are proximal to the work-station location.

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:

STEL: 20 (ppm) from ACGIH (TLV) [United States] TWA: 1 from OSHA (PEL) [United States] TWA: 2 (ppm) [Austria] TWA: 5 (ppm) [Belgium] TWA: 5 (ppm) [Denmark] TWA: 2 (ppm) [Germany] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Chloroform-like (Slight.)

Taste: Not available.

Molecular Weight: 96.94 g/mole

Color: Colorless.

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

Boiling Point: 31°C (87.8°F)

Melting Point: -122.5°C (-188.5°F)

Critical Temperature: Not available.

Specific Gravity: 1.213 (Water = 1)

Vapor Pressure: 78.8 kPa (@ 20°C)

Vapor Density: 3.25 (Air = 1)

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Very slightly dispersed in cold water, hot water, diethyl ether, acetone.

Solubility: Very slightly soluble in cold water, 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: Reactive with oxidizing agents, moisture.

Corrosivity: Corrosive in presence of steel.

Special Remarks on Reactivity:

Do not mix with Aluminum or Copper. May cause polymerization when exposed to Nitric Acid, Chlorosulfonic Acid, Oleum

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 194 mg/kg [Mouse].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified 4 (No evidence.) by NTP. A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC. DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female [POSSIBLE]. May cause damage to the following organs: kidneys, liver, bladder, gastrointestinal tract, skin, central nervous system (CNS).

Other Toxic Effects on Humans:

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

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 product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Vinylidene chloride, Inhibited UNNA: 1303 PG: I

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

Pennsylvania RTK: Vinylidene Chloride Florida: Vinylidene Chloride Minnesota: Vinylidene Chloride Michigan critical material: Vinylidene Chloride Massachusetts RTK: Vinylidene Chloride New Jersey: Vinylidene Chloride TSCA 8(b) inventory: Vinylidene Chloride TSCA 8(a) PAIR: Vinylidene Chloride TSCA 8(d) H and S data reporting: Vinylidene Chloride: 8/4/95 CERCLA: Hazardous substances.: Vinylidene Chloride: 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 B-3: Combustible liquid with a flash point between 37.8°C (100°F) and 93.3°C (200°F).

DSCL (EEC):

R12- Extremely flammable. R20- Harmful by inhalation. R40- Possible risks of irreversible effects.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 4

Reactivity: 0

Personal Protection: g

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

Health: 2

Flammability: 4

Reactivity: 2

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 12:15 AM

Last Updated: 06/09/2012 12:00 PM

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Linde Gas LLC (216) 642-6600
 P.O. Box 94737
 Cleveland, Ohio 44101
 www.us.lindegas.com

**MATERIAL
 SAFETY
 DATA SHEET**

No. 155

PRODUCT NAME Vinyl Chloride	CAS # 75-01-4
TRADE NAME AND SYNONYMS Vinyl chloride, inhibited (D.O.T.)	DOT I.D. No.: UN 1086; RQ 1.0 (0.454)
	DOT Hazard Class: Division 2.1
CHEMICAL NAME AND SYNONYMS Vinyl Chloride, Chloroethylene; Chloroethene	Formula C ₂ H ₃ Cl or CH ₂ CHCl
	Chemical Family: Halogenated Alkene
ISSUE DATES AND REVISIONS Revised january 1995	

HEALTH HAZARD DATA

<p>TIME WEIGHTED AVERAGE EXPOSURE LIMIT TWA = 5 molar ppm with an A1 Carcinogen Rating (ACGIH 1994-1995). AI is a confirmed human carcinogen. OSHA 1993. 1910.1017, 8 Hr. TWA = 1 Molar PPM (Continued on Page 4)</p>
<p>SYMPTOMS OF EXPOSURE Inhaling high concentrations causes mild symptoms of drowsiness, blurred vision, staggering gate and tingling and numbness in the extremities. Liquid vinyl chloride may cause severe irritation or burns on skin or eye contact.</p>
<p>TOXICOLOGICAL PROPERTIES Several workers who handled and used vinyl chloride developed a rare form of liver cancer. IARC, NTP and OSHA all list vinyl chloride as a carcinogen. Persons in ill health where such illness would be aggravated by exposure to vinyl chloride should not be allowed to work with or handle this product.</p>
<p>RECOMMENDED FIRST AID TREATMENT PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO VINYL CHLORIDE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS AND BE COGNIZANT OF EXTREME FIRE AND EXPLOSION HAZARD. Inhalation: Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, given assisted respiration and supplemental oxygen. Further treatment should be symptomatic and supportive.</p> <p style="text-align: right;">(Continued an Page 4)</p>

Information contained in this material safety data sheet is offered without charge for use by technically qualified personnel at their discretion and risk. All statements, technical information and recommendations contained herein are based on tests and data which we believe to be reliable, but the accuracy or completeness thereof is not guaranteed and no warranty of any kind is made with respect thereto. This information is not intended as a license to operate under or a recommendation to practice or infringe any patent of this Company or others covering any process, composition of matter or use.
 Since the Company shall have no control of the use of the product described herein, the Company assumes no liability for loss or damage incurred from the proper or improper use of such product.

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES

Vinyl chloride polymerizes on exposure to sunlight, heat or in the presence of oxygen or air. The addition of phenol or hydroquinone inhibits the polymerization. It is flammable in air.

PHYSICAL DATA

BOILING POINT 7.3°F (-13.7°C)	LIQUID DENSITY AT BOILING POINT 60.6 lb/ft ³ (971 kg/m ³)
VAPOR PRESSURE @ 70°F (21.1°C) = 52 psia (360 kPa)	GAS DENSITY AT 70°F, 1 atm @ 77°F (25°C) = .164 lb/ft ³ (2.63 kg/m ³)
SOLUBILITY IN WATER Slightly Soluble	FREEZING POINT -244.8°F (-153.8°C)
EVAPORATION RATE N/A (Gas)	SPECIFIC GRAVITY (AIR=1) @ 77°F (25°C) = 2.22
APPEARANCE AND ODOR Colorless gas with a pleasant, sweet odor	

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) -108°F (CC)	AUTO IGNITION TEMPERATURE 882°F (472°C)	FLAMMABLE LIMITS % BY VOLUME (See Page 4) LEL 3.6 UEL 33
EXTINGUISHING MEDIA Water, dry chemical, carbon dioxide		ELECTRICAL CLASSIFICATION Class 1, Group Not Specified
SPECIAL FIRE FIGHTING PROCEDURES Attempt to stop the flow of vinyl chloride. Use water spray to cool surrounding containers.		
UNUSUAL FIRE AND EXPLOSION HAZARDS Vinyl chloride vapors are heavier than air and may travel a considerable distance to a source of ignition. Should fire be extinguished and flow of gas continue, increase ventilation to prevent formation of flammable mixtures in low areas or pockets.		

REACTIVITY DATA

STABILITY Unstable		CONDITIONS TO AVOID None
Stable	X	
INCOMPATIBILITY (Materials to avoid) Oxidizers		
HAZARDOUS DECOMPOSITION PRODUCTS None		
HAZARDOUS POLYMERIZATION May Occur	X	CONDITIONS TO AVOID It is inhibited with phenol or hydroquinone to prevent polymerization.
Will Not Occur		

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. If leak is in container or container valve, contact your closest supplier location or call the emergency telephone number listed herein.
WASTE DISPOSAL METHOD Do not attempt to dispose of waste or unused quantities. Return in the shipping container <u>properly labeled, with any valve outlet plugs or caps secured and valve protection cap in place</u> to your supplier. For emergency disposal assistance, contact your closest supplier location or call the emergency telephone number listed herein.

SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type) Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.			
VENTILATION Hood with forced ventilation	LOCAL EXHAUST To prevent accumulation above the TWA	SPECIAL	N/A
	MECHANICAL (Gen.) In accordance with electrical codes	OTHER	N/A
PROTECTIVE GLOVES Most materials except natural rubber			
EYE PROTECTION Safety goggles or glasses			
OTHER PROTECTIVE EQUIPMENT Safety shoes, safety shower, eyewash "fountain," transparent face shield			

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION DOT Shipping Name: Vinyl chloride, inhibited DOT Shipping Label: Flammable Gas			I.D. No.: DOT Hazard Class:	UN 1086; RQ 1.0(0.454) Division 2.1
SPECIAL HANDLING RECOMMENDATIONS Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connectinn cylinder to lower pressure (<150 psiq) piping or systems. Do not heat cylinder by any means to increase tne discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder. For additional handling recommendations, consult Compressed Gas Association's Pamphlets I P-1 and P-10.				
SPECIAL STORAGE RECOMMENDATIONS Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of noncombustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 125F (52C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in - first out" inventory system to prevent full cylinders beins stored for excessive periods of time. Post "No Smoking or Open Flames" signs in the storage or use area. There should be no sources of ignition in the storage or use area. For additional storage recommendations, consult Compressed Gas Association's Pamphlet P-1 and P-10.				
SPECIAL PACKAGING RECOMMENDATIONS Most metals except copper and its alloys may be used with vinyl chloride. Copper and its alloys could form explosive acetylides by reacting with the acetylene impurity in the product. Teflon® is the preferred gasketing material.				
OTHER RECOMMENDATIONS OR PRECAUTIONS Earth-ground and bond all lines and equipment associated with the vinyl chloride system. Electrical equipment should be non-sparking or explosion proof. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of federal Law (49CFR).				

(Continued on Page 4)

*Various Government Agencies (i.e. Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation, handling, storage or use of this product which will not be reflected in this data sheet. The customer should review these regulations to ensure that he is in full compliance.

HEALTH HAZARD DATA

TWA DATA: (continued)

(<5 Molar PPM averaged over any period not exceeding 15 minutes) with the prohibition of any personal direct contact with vinyl chloride liquid and it is classified as a cancer suspect agent.

RECOMMENDED FIRST AID TREATMENT: (Continued)

Eye Contact: PERSONS WITH POTENTIAL EXPOSURE TO VINYL CHLORIDE SHOULD NOT WEAR CONTACT LENSES.

Flush contaminated eye(s) with copious quantities of water. Part eyelids with fingers to assure complete flushing. Continue for minimum of 15 minutes. An eye specialist should be summoned promptly.

Skin Contact: Flush affected areas with copious quantities of water. Remove affected clothing as rapidly as possible. A physician should see the patient. Follow the water flush with a soap and water wash.

SPECIAL PRECAUTIONS

OTHER RECOMMENDATIONS OR PRECAUTIONS: (Continued)

Always secure cylinders in an upright position before transporting them. Never transport cylinders in trunks of vehicles, enclosed vans, truck cabs or in passenger compartments. Transport cylinders secured in open flatbed or in open pick-up type vehicles.

Vinyl chloride is a toxic chemical and it is subject to the reporting requirements of SARA, Title III, Section 313.

MATERIAL SAFETY DATA SHEET

SECTION 1

PRODUCT AND COMPANY IDENTIFICATION

PRODUCT

Product Name: GASOLINE, UNLEADED AUTOMOTIVE

Product Description: Hydrocarbons and Additives

Intended Use: Fuel, Gasoline

COMPANY IDENTIFICATION

Supplier: EXXON MOBIL CORPORATION

3225 GALLOWS RD.

FAIRFAX, VA. 22037 USA

24 Hour Health Emergency 609-737-4411

Transportation Emergency Phone 800-424-9300

ExxonMobil Transportation No. 281-834-3296

MSDS Requests 713-613-3661

Product Technical Information 800-662-4525, 800-947-9147

MSDS Internet Address <http://www.exxon.com>, <http://www.mobil.com>

SECTION 2

COMPOSITION / INFORMATION ON INGREDIENTS

Reportable Hazardous Substance(s) or Complex Substance(s)

Name	CAS#	Concentration*
ETHYL ALCOHOL	64-17-5	< 11%
GASOLINE	86290-81-5	89 - 100%

Hazardous Constituent(s) Contained in Complex Substance(s)

Name	CAS#	Concentration*
BENZENE	71-43-2	0.1 - 5%
ETHYL BENZENE	100-41-4	1 - 5%
N-HEXANE	110-54-3	1 - 5%
NAPHTHALENE	91-20-3	<1%
PSEUDOCUMENE (1,2,4-TRIMETHYLBENZENE)	95-63-6	1 - 5%
TOLUENE	108-88-3	5 - 10%
TRIMETHYL BENZENE	25551-13-7	1 - 5%
XYLENES	1330-20-7	5 - 10%

* All concentrations are percent by weight unless material is a gas. Gas concentrations are in percent by volume.

NOTE: The concentration of the components shown above may vary substantially. In certain countries, benzene content may be limited to lower levels. Oxygenates such as tertiary-amyl-methyl ether, ethanol, diisopropyl ether, and ethyl-tertiary-butyl ether may be present. Because of volatility considerations, gasoline vapor may have concentrations of components very different from those of liquid gasoline. The major components of gasoline vapor are: butane, isobutane, pentane, and isopentane. The reportable component percentages, shown in the composition/information on ingredients section, are based on API's evaluation of a typical gasoline mixture.

SECTION 3

HAZARDS IDENTIFICATION

This material is considered to be hazardous according to regulatory guidelines (see (M)SDS Section 15).

POTENTIAL PHYSICAL / CHEMICAL EFFECTS

Extremely flammable. Material can release vapors that readily form flammable mixtures. Vapor accumulation could flash and/or explode if ignited. Material can accumulate static charges which may cause an incendiary electrical discharge.

POTENTIAL HEALTH EFFECTS

Irritating to skin. If swallowed, may be aspirated and cause lung damage. May be irritating to the eyes, nose, throat, and lungs. May cause central nervous system depression. High-pressure injection under skin may cause serious damage. Prolonged and repeated exposure to benzene may cause serious injury to blood forming organs and is associated with anemia and to the later development of acute myelogenous leukemia (AML).

Target Organs: Lung | Skin |

ENVIRONMENTAL HAZARDS

Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

NFPA Hazard ID:	Health: 1	Flammability: 3	Reactivity: 0
HMIS Hazard ID:	Health: 1*	Flammability: 3	Reactivity: 0

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 4	FIRST AID MEASURES
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INHALATION

Remove from further exposure. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance. If breathing has stopped, assist ventilation with a mechanical device or use mouth-to-mouth resuscitation.

SKIN CONTACT

Wash contact areas with soap and water. Remove contaminated clothing. Launder contaminated clothing before reuse. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

EYE CONTACT

Flush thoroughly with water. If irritation occurs, get medical assistance.

INGESTION

Seek immediate medical attention. Do not induce vomiting.

NOTE TO PHYSICIAN

If ingested, material may be aspirated into the lungs and cause chemical pneumonitis. Treat appropriately.

PRE-EXISTING MEDICAL CONDITIONS WHICH MAY BE AGGRAVATED BY EXPOSURE

Benzene- Individuals with liver disease may be more susceptible to toxic effects.

SECTION 5	FIRE FIGHTING MEASURES
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EXTINGUISHING MEDIA

Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO₂) to extinguish flames.

Inappropriate Extinguishing Media: Straight Streams of Water

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. If a leak or spill has not ignited, use water spray to disperse the vapors and to protect personnel attempting to stop a leak. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply. Firefighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Unusual Fire Hazards: Extremely Flammable. Vapors are flammable and heavier than air. Vapors may travel across the ground and reach remote ignition sources causing a flashback fire danger. Hazardous material. Firefighters should consider protective equipment indicated in Section 8.

Hazardous Combustion Products: Smoke, Fume, Sulfur oxides, Aldehydes, Oxides of carbon, Incomplete combustion products

FLAMMABILITY PROPERTIES

Flash Point [Method]: <-40C (-40F) [ASTM D-56]

Flammable Limits (Approximate volume % in air): LEL: 1.4 UEL: 7.6

Autoignition Temperature: >250°C (482°F)

SECTION 6

ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations. In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations. US regulations require reporting releases of this material to the environment which exceed the applicable reportable quantity or oil spills which could reach any waterway including intermittent dry creeks. The National Response Center can be reached at (800)424-8802.

PROTECTIVE MEASURES

Avoid contact with spilled material. Warn or evacuate occupants in surrounding and downwind areas if required due to toxicity or flammability of the material. See Section 5 for fire fighting information. See the Hazard Identification Section for Significant Hazards. See Section 4 for First Aid Advice. See Section 8 for Personal Protective Equipment.

SPILL MANAGEMENT

Land Spill: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Stop leak if you can do it without risk. All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Prevent entry into waterways, sewer, basements or confined areas. A vapor suppressing foam may be used to reduce vapors. Use clean non-sparking tools to collect absorbed material. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Large Spills: Water spray may reduce vapor; but may not prevent ignition in closed spaces. Recover by pumping or with suitable absorbent.

Water Spill: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Stop leak if you can do it without risk. Do not confine in area of spill. Advise occupants and shipping in downwind areas of fire and explosion hazard and warn them to stay clear. Allow liquid to evaporate from the surface. Seek the advice of a specialist before using dispersants.

Water spill and land spill recommendations are based on the most likely spill scenario for this material; however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

ENVIRONMENTAL PRECAUTIONS

Large Spills: Dike far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7

HANDLING AND STORAGE

HANDLING

Avoid breathing mists or vapors. Avoid contact with skin. Use non-sparking tools and explosion-proof equipment. Potentially toxic/irritating fumes/vapors may be evolved from heated or agitated material. Do not siphon by mouth. Use only with adequate ventilation. Use proper bonding and/or grounding procedures. Do not use as a cleaning solvent or other non-motor fuel uses. For use as a motor fuel only. It is dangerous and/or unlawful to put fuel into unapproved containers. Do not fill container while it is in or on a vehicle. Static electricity may ignite vapors and cause fire. Place container on ground when filling and keep nozzle in contact with container. Do not use electronic devices (including but not limited to cellular phones, computers, calculators, pagers or other electronic devices, etc.) in or around any fueling operation or storage area unless the devices are certified intrinsically safe by an approved national testing agency and to the safety standards required by national and/or local laws and regulations. Prevent small spills and leakage to avoid slip hazard. Material can accumulate static charges which may cause an electrical spark (ignition source).

Static Accumulator: This material is a static accumulator.

STORAGE

Ample fire water supply should be available. A fixed sprinkler/deluge system is recommended. Keep container closed. Handle containers with care. Open slowly in order to control possible pressure release. Store in a cool, well-ventilated area. Outside or detached storage preferred. Storage containers should be grounded and bonded. Drums must be grounded and bonded and equipped with self-closing valves, pressure vacuum bungs and flame arresters.

SECTION 8

EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE LIMIT VALUES

Exposure limits/standards (Note: Exposure limits are not additive)

Source	Form	Limit / Standard			Note	Source
BENZENE		OSHA Action level	0.5 ppm		N/A	OSHA Sp.Reg.
BENZENE		STEL	5 ppm		N/A	OSHA Sp.Reg.
BENZENE		TWA	1 ppm		N/A	OSHA Sp.Reg.
BENZENE		STEL	2.5 ppm		Skin	ACGIH
BENZENE		TWA	0.5 ppm		Skin	ACGIH
ETHYL ALCOHOL		TWA	1900 mg/m ³	1000 ppm	N/A	OSHA Z1
ETHYL ALCOHOL		TWA	1000 ppm		N/A	ACGIH
ETHYL BENZENE		TWA	435 mg/m ³	100 ppm	N/A	OSHA Z1
ETHYL BENZENE		STEL	125 ppm		N/A	ACGIH
ETHYL BENZENE		TWA	100 ppm		N/A	ACGIH
GASOLINE	Vapor.	TWA	300 mg/m ³	100 ppm	N/A	ExxonMobil
GASOLINE		STEL	500 ppm		N/A	ACGIH
GASOLINE		TWA	300 ppm		N/A	ACGIH
N-HEXANE		TWA	1800 mg/m ³	500 ppm	N/A	OSHA Z1

N-HEXANE		TWA	50 ppm		Skin	ACGIH
NAPHTHALENE		TWA	50 mg/m ³	10 ppm	N/A	OSHA Z1
NAPHTHALENE		STEL	15 ppm		Skin	ACGIH
NAPHTHALENE		TWA	10 ppm		Skin	ACGIH
PSEUDOCUMENE (1,2,4-TRIMETHYLBENZENE)		TWA	25 ppm		N/A	ACGIH
TOLUENE		Ceiling	300 ppm		N/A	OSHA Z2
TOLUENE		Maximum concentration	500 ppm		N/A	OSHA Z2
TOLUENE		TWA	200 ppm		N/A	OSHA Z2
TRIMETHYL BENZENE		TWA	25 ppm		N/A	ACGIH
XYLENES		TWA	435 mg/m ³	100 ppm	N/A	OSHA Z1
XYLENES		STEL	150 ppm		N/A	ACGIH
XYLENES		TWA	100 ppm		N/A	ACGIH

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:

Use explosion-proof ventilation equipment to stay below exposure limits.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:

No special requirements under ordinary conditions of use and with adequate ventilation.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapor warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Work conditions can greatly affect glove durability; inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:

If prolonged or repeated contact is likely, chemical resistant gloves are recommended. If contact with forearms is likely, wear gauntlet style gloves.

Eye Protection: If contact is likely, safety glasses with side shields are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published

literature or manufacturer data. The types of clothing to be considered for this material include:
If prolonged or repeated contact is likely, chemical, and oil resistant clothing is recommended.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping.

ENVIRONMENTAL CONTROLS

See Sections 6, 7, 12, 13.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Typical physical and chemical properties are given below. Consult the Supplier in Section 1 for additional data.

GENERAL INFORMATION

Physical State: Liquid
Color: Clear (May Be Dyed)
Odor: Petroleum/Solvent
Odor Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 15 C): 0.74
Flash Point [Method]: <-40C (-40F) [ASTM D-56]
Flammable Limits (Approximate volume % in air): LEL: 1.4 UEL: 7.6
Autoignition Temperature: >250°C (482°F)
Boiling Point / Range: > 20C (68F)
Vapor Density (Air = 1): 3 at 101 kPa
Vapor Pressure: > 26.6 kPa (200 mm Hg) at 20 C
Evaporation Rate (n-butyl acetate = 1): > 10
pH: N/A
Log Pow (n-Octanol/Water Partition Coefficient): > 3
Solubility in Water: Negligible
Viscosity: <1 cSt (1 mm²/sec) at 40 C
Oxidizing Properties: See Sections 3, 15, 16.

OTHER INFORMATION

Freezing Point: N/D
Melting Point: N/A

SECTION 10 STABILITY AND REACTIVITY

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Avoid heat, sparks, open flames and other ignition sources.

MATERIALS TO AVOID: Halogens, Strong Acids, Alkalies, Strong oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

HAZARDOUS POLYMERIZATION: Will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

ACUTE TOXICITY

<u>Route of Exposure</u>	<u>Conclusion / Remarks</u>
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Inhalation	
Toxicity (Rat): LC50 > 5000 mg/m3	Minimally Toxic. Based on test data for structurally similar materials.
Irritation: No end point data.	Elevated temperatures or mechanical action may form vapors, mist, or fumes which may be irritating to the eyes, nose, throat, or lungs. Based on assessment of the components.
Ingestion	
Toxicity (Rat): LD50 > 2000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Skin	
Toxicity (Rabbit): LD50 > 2000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Irritation: No end point data.	Moderately irritating to skin with prolonged exposure. Based on test data for structurally similar materials.
Eye	
Irritation: Data available.	May cause mild, short-lasting discomfort to eyes. Based on test data for structurally similar materials.

CHRONIC/OTHER EFFECTS

For the product itself:

Laboratory animal studies have shown that prolonged and repeated inhalation exposure to light hydrocarbon vapors in the same boiling range as this product can produce adverse kidney effects in male rats. However, these effects were not observed in similar studies with female rats, male and female mice, or in limited studies with other animal species. Additionally, in a number of human studies, there was no clinical evidence of such effects at normal occupational levels. In 1991, The U.S. EPA determined that the male rat kidney is not useful for assessing human risk.

Vapor concentrations above recommended exposure levels are irritating to the eyes and the respiratory tract, may cause headaches and dizziness, are anesthetic and may have other central nervous system effects.

Small amounts of liquid aspirated into the lungs during ingestion or from vomiting may cause chemical pneumonitis or pulmonary edema.

Gasoline unleaded: Caused cancer in animal tests. Chronic inhalation studies resulted in liver tumors in female mice and kidney tumors in male rats. Neither result considered significant for human health risk assessment by the United States EPA and others. Did not cause mutations In Vitro or In Vivo.

Negative in inhalation developmental studies and reproductive tox studies. Inhalation of high concentrations in animals resulted in reversible central nervous system depression, but no persistent toxic effect on the nervous system. Non-sensitizing in test animals. Caused nerve damage in humans from abusive use (sniffing).

Contains:

BENZENE: Caused cancer (leukemia), damage to the blood-producing system, and serious blood disorders from prolonged, high exposure based on human epidemiology studies. Caused genetic effects and effects on the immune system in laboratory animal and some human studies. Caused toxicity to the fetus in laboratory animal studies. **ETHANOL:** Prolonged or repeated exposure to high concentrations of ethanol vapor or overexposure by ingestion may produce adverse effects to brain, kidney, liver, and reproductive organs, birth defects in offspring, and developmental toxicity in offspring. **NAPHTHALENE:** Exposure to high concentrations of naphthalene may cause destruction of red blood cells, anemia, and cataracts. Naphthalene caused cancer in laboratory animal studies, but the relevance of these findings to humans is uncertain. **N-HEXANE:** Prolonged and/or repeated exposures to n-Hexane can cause progressive and potentially irreversible damage to the peripheral nervous system (e.g. fingers, feet, arms, legs, etc.). Simultaneous exposure to Methyl Ethyl Ketone (MEK) or Methyl Isobutyl Ketone (MIBK) and n-Hexane can potentiate the risk of adverse effects from n-Hexane on the peripheral nervous system. n-Hexane has been shown to cause testicular damage at high doses in male rats. The relevance of this effect for humans is unknown.

TOLUENE : Concentrated, prolonged or deliberate inhalation may cause brain and nervous system damage. Prolonged and repeated exposure of pregnant animals (> 1500 ppm) have been reported to

cause adverse fetal developmental effects.

TRIMETHYLBENZENE: Long-term inhalation exposure of trimethylbenzene caused effects to the blood in laboratory animals.

ETHYLBENZENE: Caused cancer in laboratory animal studies. The relevance of these findings to humans is uncertain.

Additional information is available by request.

The following ingredients are cited on the lists below:

Chemical Name	CAS Number	List Citations
NAPHTHALENE	91-20-3	2, 5
BENZENE	71-43-2	1, 3, 6
GASOLINE	86290-81-5	5
ETHYL BENZENE	100-41-4	5

--REGULATORY LISTS SEARCHED--

1 = NTP CARC
2 = NTP SUS

3 = IARC 1
4 = IARC 2A

5 = IARC 2B
6 = OSHA CARC

SECTION 12 ECOLOGICAL INFORMATION

The information given is based on data available for the material, the components of the material, and similar materials.

ECOTOXICITY

Material -- Expected to be toxic to aquatic organisms. May cause long-term adverse effects in the aquatic environment.

MOBILITY

More volatile component -- Highly volatile, will partition rapidly to air. Not expected to partition to sediment and wastewater solids.

Less volatile component -- Low solubility and floats and is expected to migrate from water to the land. Expected to partition to sediment and wastewater solids.

PERSISTENCE AND DEGRADABILITY

Biodegradation:

Majority of components -- Expected to be inherently biodegradable

Atmospheric Oxidation:

More volatile component -- Expected to degrade rapidly in air

BIOACCUMULATION POTENTIAL

Majority of components -- Has the potential to bioaccumulate, however metabolism or physical properties may reduce the bioconcentration or limit bioavailability.

SECTION 13 DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Product is suitable for burning in an enclosed controlled burner for fuel value or disposal by supervised

incineration at very high temperatures to prevent formation of undesirable combustion products.

REGULATORY DISPOSAL INFORMATION

RCRA Information: Disposal of unused product may be subject to RCRA regulations (40 CFR 261). Disposal of the used product may also be regulated due to ignitability, corrosivity, reactivity or toxicity as determined by the Toxicity Characteristic Leaching Procedure (TCLP). Potential RCRA characteristics: IGNITABILITY.
TCLP (BENZENE)

Empty Container Warning Empty Container Warning (where applicable): Empty containers may contain residue and can be dangerous. Do not attempt to refill or clean containers without proper instructions. Empty drums should be completely drained and safely stored until appropriately reconditioned or disposed. Empty containers should be taken for recycling, recovery, or disposal through suitably qualified or licensed contractor and in accordance with governmental regulations. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.

SECTION 14

TRANSPORT INFORMATION

LAND (DOT)

Proper Shipping Name: GASOLINE
Hazard Class & Division: 3
ID Number: 1203
Packing Group: II
ERG Number: 128
Label(s): 3
Transport Document Name: UN1203, GASOLINE, 3, PG II

LAND (TDG)

Proper Shipping Name: GASOLINE
Hazard Class & Division: 3
UN Number: 1203
Packing Group: II
Special Provisions: 17

SEA (IMDG)

Proper Shipping Name: MOTOR SPIRIT or GASOLINE or PETROL
Hazard Class & Division: 3
EMS Number: F-E, S-E
UN Number: 1203
Packing Group: II
Label(s): 3
Transport Document Name: UN1203, MOTOR SPIRIT or GASOLINE or PETROL, 3, PG II, (-40°C c.c.)

AIR (IATA)

Proper Shipping Name: GASOLINE
Hazard Class & Division: 3
UN Number: 1203
Packing Group: II
Label(s): 3
Transport Document Name: UN1203, GASOLINE, 3, PG II

SECTION 15

REGULATORY INFORMATION

OSHA HAZARD COMMUNICATION STANDARD: When used for its intended purpose, this material is classified as hazardous in accordance with OSHA 29CFR 1910.1200.

NATIONAL CHEMICAL INVENTORY LISTING: PICCS, ENCS, EINECS, DSL, AICS, KECI, TSCA

EPCRA: This material contains no extremely hazardous substances.

CERCLA: This material is not subject to any special reporting under the requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Contact local authorities to determine if other reporting requirements apply.

SARA (311/312) REPORTABLE HAZARD CATEGORIES: Fire. Immediate Health. Delayed Health.

SARA (313) TOXIC RELEASE INVENTORY:

Chemical Name	CAS Number	Typical Value
PSEUDOCUMENE (1,2,4-TRIMETHYLBENZENE)	95-63-6	1 - 5%
N-HEXANE	110-54-3	1 - 5%
ETHYL BENZENE	100-41-4	1 - 5%
XYLENES	1330-20-7	5 - 10%
BENZENE	71-43-2	0.1 - 5%
NAPHTHALENE	91-20-3	<1%
TOLUENE	108-88-3	5 - 10%

The Following Ingredients are Cited on the Lists Below:

Chemical Name	CAS Number	List Citations
BENZENE	71-43-2	1, 2, 4, 10, 11, 13, 15, 16, 17, 18, 19
ETHYL ALCOHOL	64-17-5	1, 4, 13, 16, 17, 18, 19
ETHYL BENZENE	100-41-4	1, 4, 10, 13, 16, 17, 18, 19
GASOLINE	86290-81-5	1, 18
N-HEXANE	110-54-3	1, 4, 13, 16, 17, 18, 19
NAPHTHALENE	91-20-3	1, 4, 5, 10
PSEUDOCUMENE (1,2,4-TRIMETHYLBENZENE)	95-63-6	1, 13, 16, 17, 18, 19
TOLUENE	108-88-3	4, 11, 13, 15, 16, 17, 18, 19
TRIMETHYL BENZENE	25551-13-7	1, 13, 16, 17, 18, 19
XYLENES	1330-20-7	1, 4, 5, 13, 15, 16, 17, 18, 19

--REGULATORY LISTS SEARCHED--

- | | | | |
|---------------|------------------|-------------------|-------------|
| 1 = ACGIH ALL | 6 = TSCA 5a2 | 11 = CA P65 REPRO | 16 = MN RTK |
| 2 = ACGIH A1 | 7 = TSCA 5e | 12 = CA RTK | 17 = NJ RTK |
| 3 = ACGIH A2 | 8 = TSCA 6 | 13 = IL RTK | 18 = PA RTK |
| 4 = OSHA Z | 9 = TSCA 12b | 14 = LA RTK | 19 = RI RTK |
| 5 = TSCA 4 | 10 = CA P65 CARC | 15 = MI 293 | |

Code key: CARC=Carcinogen; REPRO=Reproductive

SECTION 16	OTHER INFORMATION
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N/D = Not determined, N/A = Not applicable

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:

Revision Changes:

Section 01: Product Code was modified.

Section 11: Tox List Cited Table was modified.

Section 15: National Chemical Inventory Listing was modified.

THIS MSDS COVERS THE FOLLOWING MATERIALS: ESSO EXTRA MIDGRADE UNLEADED | ESSO MIDGRADE UNLEADED | ESSO PREMIUM UNLEADED | ESSO REGULAR UNLEADED | ESSO SUPER

PREMIUM UNLEADED | EXXON MIDGRADE UNLEADED | EXXON PREMIUM UNLEADED | EXXON
REGULAR UNLEADED | GASOLINE | INDOLINE GASOLINE | MIDGRADE UNLEADED | MOBIL EXTRA
UNLEADED | MOBIL REGULAR UNLEADED | MOBIL SPECIAL UNLEADED | MOBIL SUPER UNLEADED
| PREMIUM UNLEADED | REGULAR UNLEADED | UNLEADED GASOLINE

PRECAUTIONARY LABEL TEXT:

Contains: BENZENE, GASOLINE
DANGER!

HEALTH HAZARDS

Irritating to skin. If swallowed, may be aspirated and cause lung damage. Prolonged and repeated exposure to benzene may cause serious injury to blood forming organs and is associated with anemia and to the later development of acute myelogenous leukemia (AML).

Target Organs: Lung | Skin |

PHYSICAL HAZARDS

Extremely flammable. Material can accumulate static charges which may cause an incendiary electrical discharge. Material can release vapors that readily form flammable mixtures. Vapor accumulation could flash and/or explode if ignited.

PRECAUTIONS

Avoid breathing mists or vapors. Avoid contact with skin. Use non-sparking tools and explosion-proof equipment. Potentially toxic/irritating fumes/vapors may be evolved from heated or agitated material. Do not siphon by mouth. Use only with adequate ventilation. Use proper bonding and/or grounding procedures.

FIRST AID

Inhalation: Remove from further exposure. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance. If breathing has stopped, assist ventilation with a mechanical device or use mouth-to-mouth resuscitation.

Eye: Flush thoroughly with water. If irritation occurs, get medical assistance.

Oral: Seek immediate medical attention. Do not induce vomiting.

Skin: Wash contact areas with soap and water. Remove contaminated clothing. Launder contaminated clothing before reuse. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

FIRE FIGHTING MEDIA

Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

SPILL/LEAK

Land Spill: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Stop leak if you can do it without risk. Prevent entry into waterways, sewer, basements or confined areas. A vapor suppressing foam may be used to reduce vapors. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Recover by pumping or with suitable absorbent.

Water Spill: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Stop leak if you can do it without risk. Do not confine in area of spill. Advise occupants and shipping in downwind areas of fire and explosion hazard and warn them to stay clear. Allow liquid to evaporate from the surface. Seek the advice of a specialist before using dispersants.

This warning is given to comply with California Health and Safety Code 25249.6 and does not constitute an admission or a waiver of rights. This product contains a chemical known to the State of California to cause cancer, birth defects, or other reproductive harm. Chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm are created by the combustion of this product.

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MHC: 1A, 0, 0, 0, 3, 1

PPEC: CF

DGN: 2000316XUS (1011203)

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Safety Data Sheet

Material Name: Diesel Fuel, All Types

SDS No. 9909
US GHS

Synonyms: Ultra Low Sulfur Diesel; Low Sulfur Diesel; No. 2 Diesel; Motor Vehicle Diesel Fuel; Non-Road Diesel Fuel; Locomotive/Marine Diesel Fuel

*** Section 1 - Product and Company Identification ***

Manufacturer Information

Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095-0961

Phone: 732-750-6000 Corporate EHS
Emergency # 800-424-9300 CHEMTREC
www.hess.com (Environment, Health, Safety Internet Website)

*** Section 2 - Hazards Identification ***

GHS Classification:

Flammable Liquids - Category 3
Skin Corrosion/Irritation – Category 2
Germ Cell Mutagenicity – Category 2
Carcinogenicity - Category 2
Specific Target Organ Toxicity (Single Exposure) - Category 3 (respiratory irritation, narcosis)
Aspiration Hazard – Category 1
Hazardous to the Aquatic Environment, Acute Hazard – Category 3

GHS LABEL ELEMENTS

Symbol(s)



Signal Word

DANGER

Hazard Statements

Flammable liquid and vapor.
Causes skin irritation.
Suspected of causing genetic defects.
Suspected of causing cancer.
May cause respiratory irritation.
May cause drowsiness or dizziness.
May be fatal if swallowed and enters airways.
Harmful to aquatic life.

Precautionary Statements

Prevention

Keep away from heat/sparks/open flames/hot surfaces. No smoking
Keep container tightly closed.
Ground/bond container and receiving equipment.

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Use explosion-proof electrical/ventilating/lighting/equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Wear protective gloves/protective clothing/eye protection/face protection.
Wash hands and forearms thoroughly after handling.
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Avoid breathing fume/mist/vapours/spray.

Response

In case of fire: Use water spray, fog or foam to extinguish.
IF ON SKIN (or hair): Wash with plenty of soap and water. Remove/Take off immediately all contaminated clothing and wash it before reuse. If skin irritation occurs: Get medical advice/attention.
IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a poison center/doctor if you feel unwell.
If swallowed: Immediately call a poison center or doctor. Do NOT induce vomiting.
IF exposed or concerned: Get medical advice/attention.

Storage

Store in a well-ventilated place. Keep cool.
Keep container tightly closed.
Store locked up.

Disposal

Dispose of contents/container in accordance with local/regional/national/international regulations.

* * * Section 3 - Composition / Information on Ingredients * * *

CAS #	Component	Percent
68476-34-6	Fuels, diesel, no. 2	100
91-20-3	Naphthalene	<0.1

A complex mixture of hydrocarbons with carbon numbers in the range C9 and higher.

* * * Section 4 - First Aid Measures * * *

First Aid: Eyes

In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

First Aid: Skin

Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or with waterless hand cleanser. Obtain medical attention if irritation or redness develops. Thermal burns require immediate medical attention depending on the severity and the area of the body burned.

First Aid: Ingestion

DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Monitor for breathing difficulties. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

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Material Name: Diesel Fuel, All Types

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First Aid: Inhalation

Remove person to fresh air. If person is not breathing, provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

* * * Section 5 - Fire Fighting Measures * * *

General Fire Hazards

See Section 9 for Flammability Properties.

Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

Hazardous Combustion Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

Extinguishing Media

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO₂, water spray, fire fighting foam, and other gaseous agents.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

Unsuitable Extinguishing Media

None

Fire Fighting Equipment/Instructions

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment. Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing. Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

* * * Section 6 - Accidental Release Measures * * *

Recovery and Neutralization

Carefully contain and stop the source of the spill, if safe to do so.

Materials and Methods for Clean-Up

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal. Caution, flammable vapors may accumulate in closed containers.

Emergency Measures

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

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Personal Precautions and Protective Equipment

Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

Environmental Precautions

Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Prevention of Secondary Hazards

None

* * * Section 7 - Handling and Storage * * *

Handling Procedures

Handle as a combustible liquid. Keep away from heat, sparks, excessive temperatures and open flame! No smoking or open flame in storage, use or handling areas. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents."

Storage Procedures

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks."

Incompatibilities

Keep away from strong oxidizers.

* * * Section 8 - Exposure Controls / Personal Protection * * *

Component Exposure Limits

Fuels, diesel, no. 2 (68476-34-6)

ACGIH: 100 mg/m³ TWA (inhalable fraction and vapor, as total hydrocarbons, listed under Diesel fuel)
Skin - potential significant contribution to overall exposure by the cutaneous route (listed under Diesel fuel)

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Naphthalene (91-20-3)

ACGIH: 10 ppm TWA
15 ppm STEL
Skin - potential significant contribution to overall exposure by the cutaneous route
OSHA: 10 ppm TWA; 50 mg/m³ TWA
NIOSH: 10 ppm TWA; 50 mg/m³ TWA
15 ppm STEL; 75 mg/m³ STEL

Engineering Measures

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

Personal Protective Equipment: Respiratory

A NIOSH/MSHA-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

Personal Protective Equipment: Hands

Gloves constructed of nitrile, neoprene, or PVC are recommended.

Personal Protective Equipment: Eyes

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

Personal Protective Equipment: Skin and Body

Chemical protective clothing such as of E.I. DuPont TyChem®, Saranex® or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

* * * Section 9 - Physical & Chemical Properties * * *

Appearance:	Clear, straw-yellow.	Odor:	Mild, petroleum distillate odor
Physical State:	Liquid	pH:	ND
Vapor Pressure:	0.009 psia @ 70 °F (21 °C)	Vapor Density:	>1.0
Boiling Point:	320 to 690 °F (160 to 366 °C)	Melting Point:	ND
Solubility (H₂O):	Negligible	Specific Gravity:	0.83-0.876 @ 60°F (16°C)
Evaporation Rate:	Slow; varies with conditions	VOC:	ND
Percent Volatile:	100%	Octanol/H₂O Coeff.:	ND
Flash Point:	>125 °F (>52 °C) minimum	Flash Point Method:	PMCC
Upper Flammability Limit (UFL):	7.5	Lower Flammability Limit (LFL):	0.6
Burning Rate:	ND	Auto Ignition:	494°F (257°C)

* * * Section 10 - Chemical Stability & Reactivity Information * * *

Chemical Stability

This is a stable material.

Hazardous Reaction Potential

Will not occur.

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Conditions to Avoid

Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources.

Incompatible Products

Keep away from strong oxidizers.

Hazardous Decomposition Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

* * * Section 11 - Toxicological Information * * *

Acute Toxicity

A: General Product Information

Harmful if swallowed.

B: Component Analysis - LD50/LC50

Naphthalene (91-20-3)

Inhalation LC50 Rat >340 mg/m³ 1 h; Oral LD50 Rat 490 mg/kg; Dermal LD50 Rat >2500 mg/kg; Dermal LD50 Rabbit >20 g/kg

Potential Health Effects: Skin Corrosion Property/Stimulativeness

Practically non-toxic if absorbed following acute (single) exposure. May cause skin irritation with prolonged or repeated contact. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are repeatedly exposed.

Potential Health Effects: Eye Critical Damage/ Stimulativeness

Contact with eyes may cause mild irritation.

Potential Health Effects: Ingestion

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

Potential Health Effects: Inhalation

Excessive exposure may cause irritations to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

WARNING: the burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

Respiratory Organs Sensitization/Skin Sensitization

This product is not reported to have any skin sensitization effects.

Generative Cell Mutagenicity

This material has been positive in a mutagenicity study.

Carcinogenicity

A: General Product Information

Suspected of causing cancer.

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Studies have shown that similar products produce skin tumors in laboratory animals following repeated applications without washing or removal. The significance of this finding to human exposure has not been determined. Other studies with active skin carcinogens have shown that washing the animal's skin with soap and water between applications reduced tumor formation.

B: Component Carcinogenicity

Fuels, diesel, no. 2 (68476-34-6)

ACGIH: A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans (listed under Diesel fuel)

Naphthalene (91-20-3)

ACGIH: A4 - Not Classifiable as a Human Carcinogen

NTP: Reasonably Anticipated To Be A Human Carcinogen (Possible Select Carcinogen)

IARC: Monograph 82 [2002] (Group 2B (possibly carcinogenic to humans))

Reproductive Toxicity

This product is not reported to have any reproductive toxicity effects.

Specified Target Organ General Toxicity: Single Exposure

This product is not reported to have any specific target organ general toxicity single exposure effects.

Specified Target Organ General Toxicity: Repeated Exposure

This product is not reported to have any specific target organ general toxicity repeat exposure effects.

Aspiration Respiratory Organs Hazard

The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

* * * Section 12 - Ecological Information * * *

Ecotoxicity

A: General Product Information

Keep out of sewers, drainage areas and waterways. Report spills and releases, as applicable, under Federal and State regulations.

B: Component Analysis - Ecotoxicity - Aquatic Toxicity

Fuels, diesel, no. 2 (68476-34-6)

Test & Species

Test & Species	Conditions
96 Hr LC50 Pimephales promelas	35 mg/L [flow-through]

Conditions

Naphthalene (91-20-3)

Test & Species

Test & Species	Conditions
96 Hr LC50 Pimephales promelas	5.74-6.44 mg/L [flow-through]
96 Hr LC50 Oncorhynchus mykiss	1.6 mg/L [flow-through]
96 Hr LC50 Oncorhynchus mykiss	0.91-2.82 mg/L [static]
96 Hr LC50 Pimephales promelas	1.99 mg/L [static]

Conditions

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96 Hr LC50 Lepomis macrochirus	31.0265 mg/L [static]
72 Hr EC50 Skeletonema costatum	0.4 mg/L
48 Hr LC50 Daphnia magna	2.16 mg/L
48 Hr EC50 Daphnia magna	1.96 mg/L [Flow through]
48 Hr EC50 Daphnia magna	1.09 - 3.4 mg/L [Static]

Persistence/Degradability

No information available.

Bioaccumulation

No information available.

Mobility in Soil

No information available.

*** Section 13 - Disposal Considerations ***

Waste Disposal Instructions

See Section 7 for Handling Procedures. See Section 8 for Personal Protective Equipment recommendations.

Disposal of Contaminated Containers or Packaging

Dispose of contents/container in accordance with local/regional/national/international regulations.

*** Section 14 - Transportation Information ***

DOT Information

Shipping Name: Diesel Fuel

NA #: 1993 Hazard Class: 3 Packing Group: III

Placard:



*** Section 15 - Regulatory Information ***

Regulatory Information

Component Analysis

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4).

Naphthalene (91-20-3)

CERCLA: 100 lb final RQ; 45.4 kg final RQ

SARA Section 311/312 – Hazard Classes

<u>Acute Health</u>	<u>Chronic Health</u>	<u>Fire</u>	<u>Sudden Release of Pressure</u>	<u>Reactive</u>
X	X	X	--	--

Safety Data Sheet

Material Name: Diesel Fuel, All Types

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SARA SECTION 313 - SUPPLIER NOTIFICATION

This product may contain listed chemicals below the de minimis levels which therefore are not subject to the supplier notification requirements of Section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372. If you may be required to report releases of chemicals listed in 40 CFR 372.28, you may contact Hess Corporate Safety if you require additional information regarding this product.

State Regulations

Component Analysis - State

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA	RI
Fuels, diesel, no. 2	68476-34-6	No	No	No	Yes	No	No
Naphthalene	91-20-3	Yes	Yes	Yes	Yes	Yes	No

The following statement(s) are provided under the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65):

WARNING! This product contains a chemical known to the state of California to cause cancer.

Component Analysis - WHMIS IDL

No components are listed in the WHMIS IDL.

Additional Regulatory Information

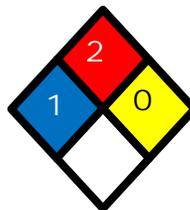
Component Analysis - Inventory

Component	CAS #	TSCA	CAN	EEC
Fuels, diesel, no. 2	68476-34-6	Yes	DSL	EINECS
Naphthalene	91-20-3	Yes	DSL	EINECS

*** Section 16 - Other Information ***

NFPA® Hazard Rating

Health	1
Fire	2
Reactivity	0



HMIS® Hazard Rating

Health	1*	Slight
Fire	2	Moderate
Physical	0	Minimal

*Chronic

Safety Data Sheet

Material Name: Diesel Fuel, All Types

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Key/Legend

ACGIH = American Conference of Governmental Industrial Hygienists; ADG = Australian Code for the Transport of Dangerous Goods by Road and Rail; ADR/RID = European Agreement of Dangerous Goods by Road/Rail; AS = Standards Australia; DFG = Deutsche Forschungsgemeinschaft; DOT = Department of Transportation; DSL = Domestic Substances List; EEC = European Economic Community; EINECS = European Inventory of Existing Commercial Chemical Substances; ELINCS = European List of Notified Chemical Substances; EU = European Union; HMIS = Hazardous Materials Identification System; IARC = International Agency for Research on Cancer; IMO = International Maritime Organization; IATA = International Air Transport Association; MAK = Maximum Concentration Value in the Workplace; NDSL = Non-Domestic Substances List; NFPA = National Fire Protection Association; NOHSC = National Occupational Health & Safety Commission; NTP = National Toxicology Program; STEL = Short-term Exposure Limit; TDG = Transportation of Dangerous Goods; TLV = Threshold Limit Value; TSCA = Toxic Substances Control Act; TWA = Time Weighted Average

Literature References

None

Other Information

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

End of Sheet

MATERIAL SAFETY DATA SHEET

SECTION 1

PRODUCT AND COMPANY IDENTIFICATION

PRODUCT

Product Name: MOBILFLUID 424
Product Description: Base Oil and Additives
Product Code: 522334-00, 971955
Intended Use: Hydraulic fluid

COMPANY IDENTIFICATION

Supplier: EXXON MOBIL CORPORATION
3225 GALLOWS RD.
FAIRFAX, VA. 22037 USA

24 Hour Health Emergency 609-737-4411
Transportation Emergency Phone 800-424-9300
ExxonMobil Transportation No. 281-834-3296
MSDS Requests 713-613-3661
Product Technical Information 800-662-4525, 800-947-9147
MSDS Internet Address <http://www.exxon.com>, <http://www.mobil.com>

SECTION 2

COMPOSITION / INFORMATION ON INGREDIENTS

Reportable Hazardous Substance(s) or Complex Substance(s)

Name	CAS#	Concentration*
ZINC DITHIOPHOSPHATE	68649-42-3	< 2.5%

* All concentrations are percent by weight unless material is a gas. Gas concentrations are in percent by volume.

SECTION 3

HAZARDS IDENTIFICATION

This material is not considered to be hazardous according to regulatory guidelines (see (M)SDS Section 15).

POTENTIAL HEALTH EFFECTS

Low order of toxicity. Excessive exposure may result in eye, skin, or respiratory irritation. High-pressure injection under skin may cause serious damage.

NFPA Hazard ID: Health: 0 Flammability: 1 Reactivity: 0
HMIS Hazard ID: Health: 0 Flammability: 1 Reactivity: 0

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 4

FIRST AID MEASURES

INHALATION

Remove from further exposure. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance. If breathing has stopped, assist ventilation with a mechanical device or use mouth-to-mouth resuscitation.

SKIN CONTACT

Wash contact areas with soap and water. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

EYE CONTACT

Flush thoroughly with water. If irritation occurs, get medical assistance.

INGESTION

First aid is normally not required. Seek medical attention if discomfort occurs.

SECTION 5	FIRE FIGHTING MEASURES
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EXTINGUISHING MEDIA

Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO₂) to extinguish flames.

Inappropriate Extinguishing Media: Straight Streams of Water

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply. Firefighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Unusual Fire Hazards: Pressurized mists may form a flammable mixture.

Hazardous Combustion Products: Aldehydes, Incomplete combustion products, Smoke, Fume, Oxides of carbon, Sulfur oxides

FLAMMABILITY PROPERTIES

Flash Point [Method]: >198°C (389°F) [ASTM D-92]

Flammable Limits (Approximate volume % in air): LEL: 0.9 UEL: 7.0

Autoignition Temperature: N/D

SECTION 6	ACCIDENTAL RELEASE MEASURES
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NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations. U.S. regulations require reporting releases of this material to the environment which exceed the reportable quantity or oil spills which could reach any waterway including intermittent dry creeks. The National Response Center can be reached at (800)424-8802.

SPILL MANAGEMENT

Land Spill: Stop leak if you can do it without risk. Recover by pumping or with suitable absorbent.

Water Spill: Confine the spill immediately with booms. Stop leak if you can do it without risk. Warn other shipping. Remove from the surface by skimming or with suitable absorbents. Seek the advice of a specialist before using dispersants.

Water spill and land spill recommendations are based on the most likely spill scenario for this material;

however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

ENVIRONMENTAL PRECAUTIONS

Large Spills: Dike far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7

HANDLING AND STORAGE

HANDLING

Prevent small spills and leakage to avoid slip hazard.

Static Accumulator: This material is a static accumulator.

STORAGE

Do not store in open or unlabelled containers.

SECTION 8

EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure limits/standards for materials that can be formed when handling this product: When mists / aerosols can occur, the following are recommended: 5 mg/m³ - ACGIH TLV, 10 mg/m³ - ACGIH STEL, 5 mg/m³ - OSHA PEL.

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:

No special requirements under ordinary conditions of use and with adequate ventilation.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:

No special requirements under ordinary conditions of use and with adequate ventilation.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapor warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Work conditions can greatly effect glove durability; inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:

No protection is ordinarily required under normal conditions of use.

Eye Protection: If contact is likely, safety glasses with side shields are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:
No skin protection is ordinarily required under normal conditions of use. In accordance with good industrial hygiene practices, precautions should be taken to avoid skin contact.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping.

ENVIRONMENTAL CONTROLS

See Sections 6, 7, 12, 13.

SECTION 9

PHYSICAL AND CHEMICAL PROPERTIES

Typical physical and chemical properties are given below. Consult the Supplier in Section 1 for additional data.

GENERAL INFORMATION

Physical State: Liquid
Color: Amber
Odor: Characteristic
Odor Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 15 °C): 0.884
Flash Point [Method]: >198°C (389°F) [ASTM D-92]
Flammable Limits (Approximate volume % in air): LEL: 0.9 UEL: 7.0
Autoignition Temperature: N/D
Boiling Point / Range: > 316°C (600°F)
Vapor Density (Air = 1): > 2 at 101 kPa
Vapor Pressure: < 0.013 kPa (0.1 mm Hg) at 20°C
Evaporation Rate (n-butyl acetate = 1): N/D
pH: N/A
Log Pow (n-Octanol/Water Partition Coefficient): > 3.5
Solubility in Water: Negligible
Viscosity: 55 cSt (55 mm²/sec) at 40 °C | 9.6 cSt (9.6 mm²/sec) at 100°C
Oxidizing Properties: See Sections 3, 15, 16.

OTHER INFORMATION

Freezing Point: N/D
Melting Point: N/A
Pour Point: -36°C (-33°F)
DMSO Extract (mineral oil only), IP-346: < 3 %wt

SECTION 10

STABILITY AND REACTIVITY

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Excessive heat. High energy sources of ignition.

MATERIALS TO AVOID: Strong oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

HAZARDOUS POLYMERIZATION: Will not occur.

SECTION 11	TOXICOLOGICAL INFORMATION
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ACUTE TOXICITY

<u>Route of Exposure</u>	<u>Conclusion / Remarks</u>
Inhalation	
Toxicity (Rat): LC50 > 5000 mg/m ³	Minimally Toxic. Based on assessment of the components.
Irritation: No end point data.	Negligible hazard at ambient/normal handling temperatures. Based on assessment of the components.
Ingestion	
Toxicity (Rat): LD50 > 2000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Skin	
Toxicity (Rabbit): LD50 > 2000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Irritation (Rabbit): Data available.	Negligible irritation to skin at ambient temperatures. Based on assessment of the components.
Eye	
Irritation (Rabbit): Data available.	May cause mild, short-lasting discomfort to eyes. Based on assessment of the components.

CHRONIC/OTHER EFFECTS

Contains:

Base oil severely refined: Not carcinogenic in animal studies. Representative material passes IP-346, Modified Ames test, and/or other screening tests. Dermal and inhalation studies showed minimal effects; lung non-specific infiltration of immune cells, oil deposition and minimal granuloma formation. Not sensitizing in test animals.

Additional information is available by request.

The following ingredients are cited on the lists below: None.

--REGULATORY LISTS SEARCHED--

1 = NTP CARC
2 = NTP SUS

3 = IARC 1
4 = IARC 2A

5 = IARC 2B
6 = OSHA CARC

SECTION 12	ECOLOGICAL INFORMATION
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The information given is based on data available for the material, the components of the material, and similar materials.

ECOTOXICITY

Material -- Not expected to be harmful to aquatic organisms.

MOBILITY

Base oil component -- Low solubility and floats and is expected to migrate from water to the land. Expected to partition to sediment and wastewater solids.

PERSISTENCE AND DEGRADABILITY

Biodegradation:

Base oil component -- Expected to be inherently biodegradable

BIOACCUMULATION POTENTIAL

Base oil component -- Has the potential to bioaccumulate, however metabolism or physical properties may reduce the bioconcentration or limit bioavailability.

SECTION 13

DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Product is suitable for burning in an enclosed controlled burner for fuel value or disposal by supervised incineration at very high temperatures to prevent formation of undesirable combustion products.

REGULATORY DISPOSAL INFORMATION

RCRA Information: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed as hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrosivity or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

Empty Container Warning PRECAUTIONARY LABEL TEXT: Empty containers may retain residue and can be dangerous. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION; THEY MAY EXPLODE AND CAUSE INJURY OR DEATH. Do not attempt to refill or clean container since residue is difficult to remove. Empty drums should be completely drained, properly bunged and promptly returned to a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations.

SECTION 14

TRANSPORT INFORMATION

LAND (DOT) : Not Regulated for Land Transport

LAND (TDG) : Not Regulated for Land Transport

SEA (IMDG) : Not Regulated for Sea Transport according to IMDG-Code

AIR (IATA) : Not Regulated for Air Transport

SECTION 15

REGULATORY INFORMATION

OSHA HAZARD COMMUNICATION STANDARD: When used for its intended purposes, this material is not classified as hazardous in accordance with OSHA 29 CFR 1910.1200.

NATIONAL CHEMICAL INVENTORY LISTING: AICS, DSL, EINECS, ENCS, KECI, PICCS, TSCA

EPCRA: This material contains no extremely hazardous substances.

SARA (311/312) REPORTABLE HAZARD CATEGORIES: None.

SARA (313) TOXIC RELEASE INVENTORY:

Chemical Name	CAS Number	Typical Value
ZINC DITHIOPHOSPHATE	68649-42-3	< 2.5%

The Following Ingredients are Cited on the Lists Below:*

Chemical Name	CAS Number	List Citations
PHOSPHORUS	7723-14-0	1, 4
TOLUENE	108-88-3	15
ZINC DITHIOPHOSPHATE	68649-42-3	13, 15, 17

--REGULATORY LISTS SEARCHED--

1 = ACGIH ALL	6 = TSCA 5a2	11 = CA P65 REPRO	16 = MN RTK
2 = ACGIH A1	7 = TSCA 5e	12 = CA RTK	17 = NJ RTK
3 = ACGIH A2	8 = TSCA 6	13 = IL RTK	18 = PA RTK
4 = OSHA Z	9 = TSCA 12b	14 = LA RTK	19 = RI RTK
5 = TSCA 4	10 = CA P65 CARC	15 = MI 293	

Code key: CARC=Carcinogen; REPRO=Reproductive

* EPA recently added new chemical substances to its TSCA Section 4 test rules. Please contact the supplier to confirm whether the ingredients in this product currently appear on a TSCA 4 or TSCA 12b list.

SECTION 16	OTHER INFORMATION
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N/D = Not determined, N/A = Not applicable

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:

No revision information is available.

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Internal Use Only

MHC: 0, 0, 0, 0, 0, 0

PPEC: A

DGN: 2005922XUS (538859)

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Material Safety Data Sheet

HAZARDOUS

Catalog Number: 157672

Revision date: 08-Mar-2005

Australia Hazardous Statement: **Hazardous according to criteria of NOHSC**

1. COMPANY DETAILS

Supplier: MP Biomedicals Australasia Pty Limited
Unit 12, 167 Prospect Hwy.
Seven Hills, NSW 2147 Aust.

Telephone Number: (02) 9838 7422
Fax Number: (02) 9838 7390

Emergency telephone number: (02) 9838 7422: hours: 8.30 AM to 5.00 PM

Australian Business Number (ABN): 31 106 467 109

2. IDENTIFICATION

Product name: DIELDRIN
Catalog Number: 157672
Synonyms: Alvit, Dieldrex

UN/Id No: 2761
Proper shipping name: Organochlorine, pesticide, solid, toxic
IATA Hazard Label(s): Toxic
Hazard Class: 6.1
- Toxic substances - dermal
Subsidiary risk: No Subsidiary Risk allocated
Packing group: II

Emergency Action Code (Hazchem code): 2X
Poisons schedule No. (Aust)/Toxic Substance (NZ): S7 Dangerous Poison.
Recommended use: Research product for non-human use

Component **Australia (AICS):**
DIELDRIN Present
60-57-1 (100)

3. PHYSICAL DESCRIPTION/PROPERTIES

Appearance and Odor: White crystalline solid or light brown dry flakes; odorless or mild chemical odor.

Physical state: Solid

Formula: C₁₂H₈Cl₆O

Molecular weight: 380.93

Boiling point/range: Decomposes upon boiling.

Melting point/range: 177 °C

Density: 1.75 (water = 1)

Vapor pressure: Less than 8 x 10⁻⁷ mm Hg at 20 °C
7.78 x 10⁻⁷ mm Hg at 25 °C

Vapor density:	13.2 (air = 1)
Solubility (in water):	Practically not soluble
Flash point:	Not determined
Autoignition temperature:	Not determined
Flammable limits in air - lower (%):	Not determined
Flammable limits in air - upper (%):	Not determined

4. INGREDIENTS

Components	CAS Number	Weight %	EC No.	Classification
DIELDRIN	60-57-1	100	200-484-5	T+; N

5. HAZARDS IDENTIFICATION

Australia Hazardous Statement: Hazardous according to criteria of NOHSC



Indication of Danger:

T+ - Very toxic.

N - Dangerous For The Environment.

Risk Phrases:

R27 - Very toxic in contact with skin.

R40 - Limited evidence of a carcinogenic effect.

R53 - May cause long-term adverse effects in the aquatic environment.

R50 - Very toxic to aquatic organisms.

R48/25 - Toxic: danger of serious damage to health by prolonged exposure if swallowed.

R25 - Toxic if swallowed.

Safety Phrases:

S61 - Avoid release to the environment. Refer to special instructions/Safety data sheets.

S45 - In case of accident or if you feel unwell, seek medical advice immediately (show label where possible).

S60 - This material and its container must be disposed of as hazardous waste.

S22 - Do not breathe dust.

S36/37 - Wear suitable protective clothing and gloves.

Category of Danger: Very Toxic , Dangerous for the environment , Carc. cat. 3

Poisons schedule No. (Aust)/Toxic Substance (NZ): S7 Dangerous Poison.

6. HEALTH HAZARD INFORMATION

HEALTH EFFECTS

EMERGENCY OVERVIEW:

Harmful to flora, fauna, soil organisms and aquatic organisms. Very toxic: danger of very serious irreversible effects in contact with skin. May also have serious irreversible effects through inhalation or ingestion.

Principle routes of exposure:

Skin

Inhalation:	Harmful: possible risk of irreversible effects through inhalation.
Ingestion:	Harmful: danger of serious damage to health if ingested.
Skin contact:	Very Toxic: danger of serious damage to health by prolonged skin contact.
Eye contact:	Risk of serious damage to eyes
Statements of hazard	Very toxic in contact with skin

Components	Australian Exposure Standards - Carcinogens	Australia - Exposure Standards - Short
DIELDRIN	Not Listed	Not Listed

Components	Australia - Exposure Standards - Skin E	Australia - Exposure Standards - Time W
DIELDRIN	skin absorption	0.25 mg/m ³ TWA

FIRST AID

General advice:	In the case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
Inhalation:	Move to fresh air. Call a physician immediately.
Skin contact:	Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician Remove and wash contaminated clothing before re-use
Ingestion:	Call a physician immediately. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Drink 1 or 2 glasses of water. Induce vomiting if person is conscious.
Eye contact:	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
Protection of first-aiders:	No information available
Notes to physician:	None
Medical conditions aggravated by exposure:	None known

7. PRECAUTIONS FOR USE

Section 8 Notes: TWA - The time-weighted average airborne concentration over an eight-hour working day, for a five-day working week over an entire working life. According to current knowledge this concentration should neither impair the health or, not cause undue discomfort to, nearly all workers.

Engineering measures: Ensure adequate ventilation, especially in confined areas.

PERSONAL PROTECTIVE EQUIPMENT

Respiratory protection: Self-contained breathing apparatus
Hand protection: Pvc disposable gloves
Skin and body protection: Impervious clothing Long sleeved clothing
Eye protection: Safety glasses
Hygiene measures: Avoid contact with skin, eyes and clothing.



8. SAFE HANDLING INFORMATION

Storage:

ROOM TEMPERATURE

Handling:	Use only in area provided with appropriate exhaust ventilation.
Safe handling advice:	Wear personal protective equipment. Remove and wash contaminated clothing before reuse.
Technical measures/storage conditions:	Keep containers tightly closed in a cool, well-ventilated place. Keep container tightly closed in a dry and well-ventilated place.
Stability:	Stable under recommended storage conditions.
Polymerization:	None under normal processing.
Hazardous decomposition products:	Chloride/Hydrochloric acid
Materials to avoid:	-
Conditions to avoid:	Exposure to air or moisture over prolonged periods.

Spills and Disposal:

Personal precautions:	Use personal protective equipment.
Environmental precautions:	Prevent product from entering drains.
Methods for cleaning up:	Sweep up and shovel into suitable containers for disposal.
Waste from residues / unused products:	Waste disposal must be in accordance with appropriate Federal, State, and local regulations. This product, if unaltered by use, may be disposed of by treatment at a permitted facility or as advised by your local hazardous waste regulatory authority. Residue from fires extinguished with this material may be hazardous.
Contaminated packaging:	Do not re-use empty containers

Fire/Explosion Hazards:

Suitable extinguishing media:	Use dry chemical, CO ₂ , water spray or "alcohol" foam
Specific hazards:	Burning produces irritant fumes.
Unusual hazards:	None known
Special protective equipment for firefighters:	As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear
Specific methods:	Water mist may be used to cool closed containers.

9. TOXICOLOGICAL INFORMATION

Product Information

Acute toxicity

Components	RTECS Number:	Selected LD50s and LC50s
DIELDRIN	IO1750000	Inhalation LC50 Rat : 13 mg/m ³ /4H Oral LD50 Rat : 38300 ug/kg Oral LD50 Mouse : 38 mg/kg Dermal LD50 Rabbit : 250 mg/kg

Chronic toxicity:	Chronic exposure may cause nausea and vomiting, higher exposure causes unconsciousness.
Local effects:	Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting.
Specific effects:	May include moderate to severe erythema (redness) and moderate edema (raised skin), nausea, vomiting, headache.
Carcinogenic effects:	Possible carcinogen
Mutagenic effects:	No data is available on the product itself.

Reproductive toxicity: No data is available on the product itself.

Components	NIOSH - Health Effects	NIOSH - Target Organs
DIELDRIN		CNS, liver, skin, kidneys (in animals: lung, liver, thyroid and adrenal gland tumors)

10. ECOLOGICAL INFORMATION

Mobility: No data available
Bioaccumulation: No data available
Ecotoxicity effects: No data available
Aquatic toxicity: May cause long-term adverse effects in the aquatic environment.

Components	U.S. DOT - Appendix B - Marine Pollutan	U.S. DOT - Appendix B - Severe Marine Pollutants	United Kingdom - The Red List:
DIELDRIN	Not Listed	DOT regulated severe marine pollutant	Original entry

Components	Germany VCI (WGK)	World Health Organization (WHO) - Drinking Water	Ecotoxicity - Fish Species Data
DIELDRIN	3	0.03 ug/L	Not Listed

Components	Ecotoxicity - Freshwater Algae Data	Ecotoxicity - Microtox Data	Ecotoxicity - Water Flea Data
DIELDRIN	Not Listed	Not Listed	Not Listed

Components	EPA - ATSDR Priority List	EPA - HPV Challenge Program Chemical List	California - Priority Toxic Pollutants
DIELDRIN	Rank (of 275): 018	Not Listed	Maximum concentration = 0.24 ug/L; continuous concentration = 0.056 ug/L

Components	California - Priority Toxic Pollutants	California - Priority Toxic Pollutants
DIELDRIN	Water and organisms = 0.00014 ug/L; organisms only = 0.00014 ug/L	Maximum concentration = 0.71 ug/L; continuous concentration = 0.0019 ug/L

11. TRANSPORT INFORMATION

IMDG/IMO

Proper shipping name: Organochlorine, pesticide, solid, toxic
IMDG - Hazard Classifications Not Applicable
IMDG - Marine Pollutants Not Applicable
IMDG - Marine Pollutants Not Applicable
IMDG - Regulated Substances Not Applicable
IMDG - Severe Marine Pollutants Not Applicable

IMO-labels:

Packing group: II
Proper shipping name: Organochlorine, pesticide, solid, toxic
UN/Id No: 2761

ADR/RID

Australia Hazardous Statement:
 Catalog Number: 157672

Hazardous according to criteria of NOHSC
 Product name: DIELDRIN

Hazard Class	6.1
Item:	DIELDRIN
ADR/RID-labels:	Toxic
UN/Id No:	2761
Emergency Action Code (Hazchem code):	2X
Proper shipping name:	Organochlorine, pesticide, solid, toxic

ICAO:

Hazard Class	6.1
Packing group:	II
Proper shipping name:	Organochlorine, pesticide, solid, toxic

12. REGULATORY INFORMATION**International inventories:**

DIELDRIN

Australia (AICS): Present**Inventory - China:** Present**EU EINECS List -** 200-484-5; C12H8Cl6O**Japan - Specified Chemical Substances** CLASS I; Products prohibited from import when containing Dieldrin: (1) wood preservatives, wood insecticides and wood fungicides, (2) paints (only those for preservatives, insecticides or fungicides,**Korean KECL:** KE-18415**Philippines PICCS:** Present**Contains:** DIELDRIN**Indication of Danger:**

T+ - Very toxic.

N - Dangerous For The Environment.

**Risk Phrases:** R27 - Very toxic in contact with skin.

R40 - Limited evidence of a carcinogenic effect.

R53 - May cause long-term adverse effects in the aquatic environment.

R50 - Very toxic to aquatic organisms.

R48/25 - Toxic: danger of serious damage to health by prolonged exposure if swallowed.

R25 - Toxic if swallowed.

Safety Phrases: S61 - Avoid release to the environment. Refer to special instructions/Safety data sheets.

S45 - In case of accident or if you feel unwell, seek medical advice immediately (show label where possible).

S60 - This material and its container must be disposed of as hazardous waste.

S22 - Do not breathe dust.

Safety Combination Phrases:

S36/37 - Wear suitable protective clothing and gloves.

Poisons schedule No. (Aust)/Toxic Substance (NZ): S7 Dangerous Poison.**13. OTHER INFORMATION****Prepared by:** Health & Safety

Disclaimer: The information and recommendations contained herein are based upon tests believed to be reliable. However, MP Biomedicals does not guarantee the accuracy or completeness NOR SHALL ANY OF THIS INFORMATION CONSTITUTE A WARRANTY, WHETHER EXPRESSED OR IMPLIED, AS TO THE SAFETY OF THE GOODS, THE MERCHANTABILITY OF THE GOODS, OR THE FITNESS OF THE GOODS FOR A PARTICULAR PURPOSE. Adjustment to conform to actual conditions of usage maybe required. MP Biomedicals assumes no responsibility for results obtained or for incidental or consequential damages, including lost profits arising from the use of these data. No warranty against infringement of any patent, copyright or trademark is made or implied.

End of Safety Data Sheet

Material Safety Data Sheet

Benzo[a]pyrene, 98%

ACC# 37175

Section 1 - Chemical Product and Company Identification

MSDS Name: Benzo[a]pyrene, 98%

Catalog Numbers: AC105600000, AC105600010, AC105601000, AC377200000, AC377200010, AC377201000 AC377201000

Synonyms: 3,4-Benzopyrene; 3,4-Benzpyrene; Benzo[def]chrysene.

Company Identification:

Acros Organics N.V.
One Reagent Lane
Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01

For emergencies in the US, call CHEMTREC: 800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
50-32-8	Benzo[a]pyrene	>96	200-028-5

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: yellow to brown powder.

Danger! May cause harm to the unborn child. May impair fertility. May cause eye, skin, and respiratory tract irritation. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Cancer hazard. May cause allergic skin reaction. May cause heritable genetic damage.

Target Organs: Reproductive system, skin.

Potential Health Effects

Eye: May cause eye irritation.

Skin: May cause skin irritation. May be harmful if absorbed through the skin. May cause an allergic reaction in certain individuals.

Ingestion: May cause irritation of the digestive tract. The toxicological properties of this substance have not been fully investigated. May be harmful if swallowed.

Inhalation: May cause respiratory tract irritation. The toxicological properties of this substance have not been fully investigated. May be harmful if inhaled.

Chronic: May cause cancer in humans. May cause reproductive and fetal effects. Laboratory experiments have resulted in mutagenic effects.

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.

Skin: Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Ingestion: Never give anything by mouth to an unconscious person. Get medical aid. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.

Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

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. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or appropriate foam.

Flash Point: Not available.

Autoignition Temperature: Not available.

Explosion Limits, Lower: Not available.

Upper: Not available.

NFPA Rating: (estimated) Health: 2; Flammability: 0; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin,

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 adequate ventilation to keep airborne concentrations low.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Benzo[a]pyrene	0.2 mg/m ³ TWA (as benzene soluble aerosol) (listed under Coal tar pitches).	0.1 mg/m ³ TWA (cyclohexane-extractable fraction) (listed under Coal tar pitches).80 mg/m ³ IDLH (listed under Coal tar pitches).	0.2 mg/m ³ TWA (as benzene soluble fraction) (listed under Coal tar pitches).

OSHA Vacated PELs: Benzo[a]pyrene: 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: Powder

Appearance: yellow to brown

Odor: faint aromatic odor

pH: Not available.

Vapor Pressure: Not available.

Vapor Density: Not available.

Evaporation Rate:Not available.

Viscosity: Not available.

Boiling Point: 495 deg C @ 760 mm Hg

Freezing/Melting Point:175 - 179 deg C

Decomposition Temperature:Not available.

Solubility: 1.60x10⁻³ mg/l @25°C

Specific Gravity/Density:Not available.

Molecular Formula:C₂₀H₁₂

Molecular Weight:252.31

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.

Conditions to Avoid: Dust generation.

Incompatibilities with Other Materials: Strong oxidizing agents.

Hazardous Decomposition Products: Carbon monoxide, carbon dioxide.

Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:

CAS# 50-32-8: DJ3675000

LD50/LC50:

Not available.

Carcinogenicity:

CAS# 50-32-8:

- **ACGIH:** A2 - Suspected Human Carcinogen
- **California:** carcinogen, initial date 7/1/87
- **NTP:** Suspect carcinogen
- **IARC:** Group 1 carcinogen (listed as Coal tar pitches).

Epidemiology: No information found

Teratogenicity: No information found

Reproductive Effects: Adverse reproductive effects have occurred in experimental animals.

Mutagenicity: Mutagenic effects have occurred in humans.Mutagenic effects have occurred in experimental animals.

Neurotoxicity: No information found

Other Studies:

Section 12 - Ecological Information

No information available.

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:

CAS# 50-32-8: waste number U022.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	NOT REGULATED FOR DOMESTIC TRANSPORT	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOL (Benzo{a}pyrene)
Hazard Class:		9
UN Number:		UN3077
Packing Group:		III

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 50-32-8 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# 50-32-8: 1 lb final RQ; 0.454 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 50-32-8: immediate, delayed.

Section 313

This material contains Benzo[a]pyrene (CAS# 50-32-8, >96%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR

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:

None of the chemicals in this product are listed as Hazardous Substances under the CWA. CAS# 50-32-8 is listed as a Priority Pollutant under the Clean Water Act.

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# 50-32-8 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains Benzo[a]pyrene, a chemical known to the state of California to cause cancer.

California No Significant Risk Level: CAS# 50-32-8: 0.06 µg/day NSRL

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

T N

Risk Phrases:

R 43 May cause sensitization by skin contact.

R 45 May cause cancer.

R 46 May cause heritable genetic damage.

R 60 May impair fertility.

R 61 May cause harm to the unborn child.

R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 53 Avoid exposure - obtain special instructions before use.

S 60 This material and its container must be disposed of as hazardous waste.

S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

WGK (Water Danger/Protection)

CAS# 50-32-8: No information available.

Canada - DSL/NDSL

CAS# 50-32-8 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D2A.

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# 50-32-8 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 9/02/1997

Revision #7 Date: 6/30/2006

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.

Attachment 8
State Spill Reporting Procedures/ Spill Reporting Card

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1.0 Excess Air Emissions

Report excess emissions immediately to:

Florida Warning Point Number

(850) 413-9911 (24-hour)

(800) 320-0519 (24-hour)

(850) 413-9900 (Non-emergencies)

Note: The report shall describe:

1. A description of the noncompliance and its cause.
2. The period of noncompliance, including exact dates and times.
3. If the noncompliance has not been corrected, the anticipated time it is expected to continue.
4. Steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

A subsequent written report may also be required.

Facilities holding an air operating permit will also have to report deviations from permit requirements in their quarterly or semiannual reports, including information on the probable cause of such deviations and any corrective actions or preventive measures taken. Likewise, facilities required to install continuous emission monitoring devices will be required to report excess emissions based on the type of facility and the type and extent of emissions.

Citation: Florida Rules and Regulations, Title 62, Sections 62-4.130, 62-4.160(8), 62-210.700(6), 62-213.440(1)(b)(3)

2.0 Hazardous Materials

Same as Hazardous Substances.

3.0 Hazardous Substances

Report any release of a hazardous substance immediately if the release exceeds the Reportable Quantity (see the Reportable Quantities section on ETConnect – US SH&E page/Resources page) for the substance (under the federal CERCLA law) for a 24-hour period. Report to:

Florida Warning Point Number**(850) 413-9911 (24-hour)****(800) 320-0519 (24-hour)****(850) 413-9900 (Non-emergencies)**

1. Florida interprets the "immediate" reporting requirement to mean within 15 minutes of an incident. If the 15-minute time frame is missed, an explanation will be required. State law also mandates reporting to the Warning Point Number within 1 working day of the release.
2. Reporting is also required for hazardous substance releases that threaten the population or the environment, or that require evacuation.
3. Releases of mixtures and solutions are subject to these notification requirements only where a component hazardous substance is released in a quantity equal to or greater than its RQ.
4. Notification of a reportable quantity of solid particles of antimony, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, selenium, silver thallium, or zinc is not required if the mean diameter of particles is larger than 100 micrometers (0.004 inches).
5. The report should contain the following information (see **Florida Spill Form**):
 - a. Name, address, and telephone number of person reporting.
 - b. Name, address, and telephone number of person responsible for the discharge or release, if known.
 - c. Date and time of the discharge or release.
 - d. Type or name of substance discharged or released, and whether the substance is an extremely hazardous substance.
 - e. Estimated amount of the discharge or release, and the medium into which the release occurred.
 - f. Location or address of the discharge or release.
 - g. Source and cause of the discharge or release.
 - h. Size and characteristics of area affected by the discharge or release.
 - i. Containment and cleanup actions taken to date.
 - j. Any known or anticipated acute or chronic health risks associated with the emergency and, where appropriate, advice regarding medical attention necessary for exposed individuals.
 - k. Other persons or agencies contacted.

Citation: Florida Administrative Code, Title 62, Section 62-150.300

4.0 Hazardous Wastes

Report immediately (at least within 24 hours) any noncompliance that may endanger health or the environment, including the release of any hazardous waste that may endanger public drinking water supplies or the occurrence of a fire or explosion from the facility that could threaten the environment or human health outside the facility. Report to:

National Response Center
(800) 424-8802

Florida Warning Point Number
(850) 413-9911 (24-hour)
(800) 320-0519 (24-hour)
(850) 413-9900 (Non-emergencies)

The report should indicate:

1. The name, address, EPA identification number, and telephone number of the facility and its operator.
2. The name and quantity of hazardous materials involved.
3. The extent of injuries, if any.
4. An assessment of actual or potential hazards.
5. The estimated quantity and disposition of any recovered material.

A written report shall be submitted within 5 days, providing the information above and the following material:

1. A description of the noncompliance and its cause.
2. If not corrected, a description of the expected time of correction, and the steps being taken to reduce, eliminate, and prevent recurrence of the noncompliance.

Citation: Florida Administrative Code, Title 62, Section 62-4.160(17)

5.0 Oil

Report all spills to waters of the state, or spills greater than 25 gallons or with the potential to be more than 25 gallons to soil or a pervious surface. Report to:

Florida Warning Point Number**(850) 413-9911 (24-hour)****(800) 320-0519 (24-hour)****(850) 413-9900 (Non-emergencies)**

1. Waters of the state include surface or underground.
2. Verbal report should include:
 - a. Name, address, and telephone number of person reporting.
 - b. Name, address, and telephone number of person responsible for the discharge or release, if known.
 - c. Date and time of the discharge or release.
 - d. Type or name of substance discharged or released.
 - e. Estimated amount of the discharge or release.
 - f. Location or address of the discharge or release.
 - g. Source and cause of the discharge or release.
 - h. Size and characteristics of area affected by the discharge or release.
 - i. Containment and cleanup actions taken to date.
 - j. Other persons or agencies contacted.
3. A Discharge Report Form shall be submitted for any discharge of petroleum products from an underground or above-ground tank and associated piping at retail outlets or bulk storage facilities. (See **Florida Spill Form**.)

Persons in charge of a vessel or terminal facility should provide notice of a pollutant discharge that enters or threatens to enter waters of the state. Provide notice within 1 hour to:

National Response Center**(800) 424-8802****Florida Warning Point Number****(850) 413-9911 (24-hour)****(800) 320-0519 (24-hour)****(850) 413-9900 (Non-emergencies)**

Provide information on:

1. Name, occupation, title and telephone number of person making notification.
2. Type of pollutant spilled.
3. Location of spill (nearest city, river, bay, miles, etc.).
4. Type of installation or carrier involved in the spill.
5. Estimated amount of pollutant spilled.
6. Date and time (local) of spill.

7. Persons and agencies already contacted.
8. Size and characteristics of area already affected by the spill.
9. Containment and cleanup efforts to date.
10. Cause of spill if known.
11. Person or firm in charge of source.

Citation: Florida Administrative Code, Title 62, Section 62N-16.022

Owners and operators of a terminal facility may also be subject to a discharge contingency plan, which will be facility-specific and which will identify circumstances under which notification will be required and the state agency to contact.

Citation: Florida Administrative Code, Title 62, Section 62N-16.033

Report all spills or leakage of oil, gas, other petroleum products, or waste material to:

Florida Department of Environmental Protection
Florida Geological Survey
(850) 488-4191

6.0 SARA Title III

Report releases and submit written follow-up emergency notice(s) to:

Florida Emergency Response Commission
Secretary, Florida Department of Community Affairs
2555 Shumard Oak Boulevard
Tallahassee, FL 32399
(850) 413-9970 (Information only)
(850) 413-9911 (24-hour, In-state, Emergencies)

7.0 Tank Leaks

Using the Incident Notification Form, report within 24 hours (see **Florida Tank Incident Form**):

1. A failed or inconclusive Statistical Inventory Reconciliation, or a failed or inconclusive tightness, pressure, or breach of integrity test.
2. Internal inspection results, including perforations, corrosion holes, weld failures, or other similar defects, that indicate a release could have occurred.
3. Unusual operating conditions, such as erratic behavior of product dispensing equipment, the sudden loss of product from a storage tank system, or any unexplained presence of water in a tank or unexplained presence of water with or without sheen in a piping sump, unless system equipment is found defective but not leaking.
4. The presence of odors of a regulated substance from surface water or groundwater, soil, basements, sewer and utility lines at a facility, or in the surrounding area from which it could be reasonably concluded that a release or discharge may have occurred.
5. The loss of a regulated substance from a storage tank system exceeding 100 gallons on impervious surfaces, other than secondary containment, such as driveways, airport runways, or other similar asphalt or concrete surfaces, provided that the loss does not come in contact with pervious surfaces.
6. The loss of a regulated substance exceeding 500 gallons inside a dike field area with secondary containment.
7. A positive response of release detection devices or methods.
8. The presence of free product in a piping sump.
9. For above-ground tanks, any discharge that exceeds 100 pounds of hydrobromic or hydrofluoric acid, 1,000 pounds of sulfuric acid, or 5,000 pounds of hydrochloric or phosphoric acid. Report verbally to the Florida Warning Point Number within 1 working day of discovery.
10. Any release into a secondary containment system of a mineral acid in excess of 110 gallons, or the Reportable Quantity for that substance under CERCLA, whichever is greater. Report to the Department within 3 working days of discovery of the release.

An Incident Notification Form need not be submitted if, within 24 hours of discovery of an incident, or before the close of the County's next business day, the investigation of the incident confirms that a discharge did not occur.

In addition, report releases or suspected releases within 24 hours to:

Florida Warning Point Number
(850) 413-9911 (24-hour)
(800) 320-0519 (24-hour)
(850) 413-9900 (Non-emergencies)

Using the Florida Spill Form, report within 24 hours (see **Florida Spill Form**):

1. Results of analytical or field tests of surface water or groundwater or soils indicating the presence of contamination by:
 - a. A hazardous substance from a UST system.
 - b. A regulated substance, other than petroleum products.
 - c. Petroleum products chemicals of concern identified by the state Department of Environmental Protection.
2. Free product or sheen of a regulated substance, or a regulated substance that is visibly observed in soil, on surface water, in groundwater samples, on basement floors, in subsurface utility conduits or vaults, or in sewer lines at the facility or in surrounding areas.
3. A spill or overfill event of a regulated substance to soil or another pervious surface, equal to or exceeding 25 gallons, unless the regulated substance has a more stringent reporting requirement specified in the Reportable Quantities listing.
4. Soils stained by regulated substances observed during a closure assessment performed under DEP rules.

Citation: Florida Administrative Code, Title 62, Sections 62-761.450, 62-762.451, 62-762.891(6)

8.0 Wastewater Excursions

Report excursions to:

Florida Warning Point Number

(850) 413-9911 (24-hour)

(800) 320-0519 (24-hour)

(850) 413-9900 (Non-emergencies)

Notes:

1. Any noncompliances which may endanger health or the environment, along with unauthorized spills of treated or untreated wastewater that are in excess of 1,000 gallons per incident, shall be reported orally as soon as possible but no later than 24 hours from the time of becoming aware of the circumstances. The following information should be included in the report:
 - a. Name, address, and telephone number of person reporting.
 - b. Name, address, and telephone number of permittee or responsible person for the discharge.
 - c. Date and time of the discharge and status of discharge (ongoing or ceased).
 - d. Characteristics of the wastewater spilled or released (untreated or treated, industrial or domestic wastewater).
 - e. Estimated amount of the discharge.
 - f. Location or address of the discharge.
 - g. Source and cause of the discharge.
 - h. Whether the discharge was contained on-site, and cleanup actions taken to date.
 - i. Description of area affected by the discharge, including name of water body affected, if any.
 - j. Other persons or agencies contacted.
2. A written submission shall also be provided within 5 days of becoming aware of the noncompliance. The written submission shall be submitted to the nearest Department of Environmental Protection district office (address available through Warning Point Number) and include the following information:
 - a. A description of the noncompliance and its cause.
 - b. The period of noncompliance, including exact dates and times.
 - c. If the noncompliance has not been corrected, the anticipated time it is expected to continue.
 - d. Steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.
3. The following incidents are included as types to be reported within 24 hours:
 - a. Any unanticipated bypass that causes any reclaimed water or the effluent to exceed any permit limitation or results in an unpermitted discharge.
 - b. Any upset that causes any reclaimed water or the effluent to exceed any limitation in the permit.
 - c. Violation of a maximum daily discharge limitation for any of the pollutants specifically listed in the permit for such notice.
 - d. Any unauthorized discharge to surface water or groundwater.

Citation: Florida Administrative Code, Title 62, Sections 62-4.130, 62-4.160(8), 62-620.610(20)

In addition, immediately report any routine or frequent release that poses a hazard or that involves a toxic pollutant, not covered in a permit, above the highest of the following levels:

1. One hundred micrograms per liter (100 mg/l).
2. Two hundred micrograms per liter (200 mg/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 mg/l) for 2,4-dinitrophenol and 2-methyl-4,6-dinitrophenol; and 1 milligram per liter (1 mg/l) for antimony.
3. Five times the maximum concentration value reported for that pollutant in the discharge permit application.

Also, facility owners/operators must report any nonroutine or infrequent release that poses a hazard or that involves a toxic pollutant, not covered in a permit, above the highest of the following levels:

1. Five hundred micrograms per liter (500 mg/l).
2. One milligram per liter (1 mg/l) for antimony.
3. Ten times the maximum concentration value reported for that pollutant in the discharge permit application.

Citation: Florida Administrative Code, Title 62, Section 62-620.625

9.0 Internet Resources

Agency

Department of Environmental Protection
Emergency Response Commission
State Warning Point

Internet Address

www.dep.state.fl.us
www.floridadisaster.org/cps/SERC/serc.htm
www.floridadisaster.org/bpr/Response/Operations/swp.htm



Discharge Report Form

PLEASE PRINT OR TYPE

DEP Form # <u>62-761.900(1)</u>
Form Title <u>Discharge Report Form</u>
Effective Date: <u>July 13, 1998</u>

Instructions are on the reverse side. Please complete all **applicable** blanks

1. Facility ID Number (if registered): _____ 2. Date of form completion: _____

3. General information

Facility name or responsible party (if applicable): _____
 Facility Owner or Operator, or Discharger: _____
 Contact Person: _____ Telephone Number: () _____ County: _____
 Facility or Discharger Mailing Address: _____
 Location of Discharge (street address): _____
 Latitude and Longitude of Discharge (if known) _____

4. Date of receipt of test results or discovery of confirmed discharge: _____ month/day/year
 5. Estimated number of gallons discharged: _____

6. Discharge affected: Air Soil Groundwater Drinking water well(s) Shoreline Surface water (water body name) _____

7. Method of discovery (check all that apply)

- | | | |
|--|---|---|
| <input type="checkbox"/> Liquid detector (automatic or manual) | <input type="checkbox"/> Internal inspection | <input type="checkbox"/> Closure/Closure Assessment |
| <input type="checkbox"/> Vapor detector (automatic or manual) | <input type="checkbox"/> Inventory control | <input type="checkbox"/> Groundwater analytical samples |
| <input type="checkbox"/> Tightness test | <input type="checkbox"/> Monitoring wells | <input type="checkbox"/> Soil analytical tests or samples |
| <input type="checkbox"/> Pressure test | <input type="checkbox"/> Automatic tank gauging | <input type="checkbox"/> Visual observation |
| <input type="checkbox"/> Statistical Inventory Reconciliation | <input type="checkbox"/> Manual tank gauging | <input type="checkbox"/> Other _____ |

8. Type of regulated substance discharged: (check one)

- | | | | | |
|---|---|-----------------------------------|--------------------------------------|---------------------------------------|
| <input type="checkbox"/> Unknown | <input type="checkbox"/> Used/waste oil | <input type="checkbox"/> Jet fuel | <input type="checkbox"/> Heating oil | <input type="checkbox"/> New/lube oil |
| <input type="checkbox"/> Gasoline | <input type="checkbox"/> Aviation gas | <input type="checkbox"/> Diesel | <input type="checkbox"/> Kerosene | <input type="checkbox"/> Mineral acid |
| <input type="checkbox"/> Hazardous substance - includes CERCLA substances from USTs above reportable quantities, pesticides, ammonia, chlorine, and derivatives (write in name or Chemical Abstract Service (CAS) number) _____ | | | | |
| <input type="checkbox"/> Other _____ | | | | |

9. Source of Discharge: (check all that apply)

- | | | | | |
|--|--|---------------------------------------|---|-----------------------------------|
| <input type="checkbox"/> Dispensing system | <input type="checkbox"/> Pipe | <input type="checkbox"/> Barge | <input type="checkbox"/> Pipeline | <input type="checkbox"/> Vehicle |
| <input type="checkbox"/> Tank | <input type="checkbox"/> Fitting | <input type="checkbox"/> Tanker ship | <input type="checkbox"/> Railroad tankcar | <input type="checkbox"/> Airplane |
| <input type="checkbox"/> Unknown | <input type="checkbox"/> Valve failure | <input type="checkbox"/> Other Vessel | <input type="checkbox"/> Tank truck | <input type="checkbox"/> Drum |
| <input type="checkbox"/> Other _____ | | | | |

10. Cause of the discharge: (check all that apply)

- | | | | | |
|---|-----------------------------------|--------------------------------------|---|---|
| <input type="checkbox"/> Loose connection | <input type="checkbox"/> Puncture | <input type="checkbox"/> Spill | <input type="checkbox"/> Collision | <input type="checkbox"/> Corrosion |
| <input type="checkbox"/> Fire/explosion | <input type="checkbox"/> Overfill | <input type="checkbox"/> Human error | <input type="checkbox"/> Vehicle Accident | <input type="checkbox"/> Installation failure |
| <input type="checkbox"/> Other _____ | | | | |

11. Actions taken in response to the discharge: _____

12. Comments: _____

13. Agencies notified (as applicable):

- | | | | | |
|--|---|--|---|--|
| <input type="checkbox"/> State Warning Point
1-800 320-0519 | <input type="checkbox"/> National Response Center
1-800-424-8802 | <input type="checkbox"/> Florida Marine Patrol
(800) 342-5367 | <input type="checkbox"/> Fire Department. | <input type="checkbox"/> DEP (district/person) |
| | | | | <input type="checkbox"/> County Tanks Program |

14. To the best of my knowledge and belief, all information submitted on this form is true, accurate, and complete.

Printed Name of Owner, Operator or Authorized Representative, or Discharger

Signature of Owner, Operator or Authorized Representative, or Discharger

Oil spills to navigable waters of the United States, and releases of reportable quantities of CERCLA hazardous substances must be reported within one hour to the National Response Center or the Florida Marine Patrol. Reports to the National Response Center of oil spills to navigable waters need not be repeated to any other federal, state, or local agency. Conditions at the site that do not involve spills to navigable waters of the United States, or CERCLA hazardous substances, that pose an immediate threat to human health or the environment, must be immediately reported to the State Warning Point or the Local Fire Department. This form must be submitted for all discharges from facilities with storage tank systems, and at other sites, in accordance with Chapters 62-761 and 62-770, F.A.C. Chapter 62-761 and 62-770, F.A.C., should be consulted for specific reporting requirements.

**State Warning Point
1-800-320-0519**

**National Response Center
1-(800)-424-8802**

**Local Fire Department
(obtain local number)**

This form must be used to report any confirmed discharge, or any one of the following from a storage tank system subject to Chapter 62-761, F.A.C., unless the discharge is from a previously-known and reported discharge:

1. Results of analytical or field tests of surface water, groundwater, or soils indicating the presence of contamination by:
 - a. A hazardous substance from a UST;
 - b. A regulated substance, other than petroleum products; or
 - c. Petroleum products' chemicals of concern specified in Chapter 62-770, F.A.C.;
2. A spill or overflow event of a regulated substance to soil equal to or exceeding 25 gallons, unless the regulated substance has a more stringent reporting requirement specified in CFR Title 40, Part 302;
3. Free product or sheen of a regulated substance present in surface water, groundwater, soils, basements, sewers, and utility lines at the facility or in the surrounding area; or
4. Soils stained by regulated substances observed during a closure assessment performed in accordance with Rule 62-761.800, F.A.C.

A copy of this form must be delivered or faxed to the County within 24 hours of the discovery of a discharge, or before the close of the next business day. It is recommended that the original copy be sent in the mail. If the discharge occurs at a county-owned facility, a copy of the form must be faxed or delivered to the local FDEP District office. A discharge of petroleum or petroleum products from a source other than a regulated storage tank system must be reported within one week of discovery in accordance with Rule 62-770.250, F.A.C.

FDEP District Office Addresses

Northwest District
160 Government Center
Pensacola FL 32501-5794
Phone: (850) 595-8360
Fax: (850) 595-8417

Northeast District
7825 Baymeadows Way
Suite 200B
Jacksonville, FL 32256-7590
Phone: (904) 448-4300

Central District
3319 Maguire Boulevard, Suite 232
Orlando, FL 32803-3767
Phone: (407) 894-7555
Fax: (407) 897-2966

Southwest District
3804 Coconut Palm Drive
Tampa, FL 33619-8218
Phone: (813) 632-7600
Fax: (813) 744-6084

South District
2295 Victoria Avenue, Suite 364
Ft. Myers, FL 33902-2549
Phone: (239) 332-6975
Fax: (239) 332-6969

Southeast District
400 North Congress Avenue
West Palm Beach, FL 33401
Phone: (561) 681-6600



Incident Notification Form

DEP Form # 62-761.900(6)

Form Title Incident Notification Form

Effective Date: July 13, 1998

PLEASE PRINT OR TYPE

Instructions are on the reverse side. Please complete all applicable blanks

1. Facility ID Number (if registered): _____ 2. Date of form completion: _____

3. General information

Facility name: _____
Facility Owner or Operator: _____
Contact Person: _____ Telephone number: () _____ County: _____
Facility mailing address: _____
Location of incident (facility street address): _____
Latitude and Longitude of incident (If known.) _____

4. Date of Discovery of incident: _____ month/day/year

5. Monitoring method that indicates a possible release or an incident: (check all that apply)

- | | | |
|--|---|---|
| <input type="checkbox"/> Liquid detector (automatic or manual) | <input type="checkbox"/> Groundwater samples | <input type="checkbox"/> Closure |
| <input type="checkbox"/> Vapor detector (automatic or manual) | <input type="checkbox"/> Monitoring wells | <input type="checkbox"/> Inventory control |
| <input type="checkbox"/> Tightness test | <input type="checkbox"/> Internal inspection | <input type="checkbox"/> Statistical Inventory Reconciliation |
| <input type="checkbox"/> Pressure test | <input type="checkbox"/> Odors in the vicinity | <input type="checkbox"/> Groundwater analytical samples |
| <input type="checkbox"/> Breach of integrity test | <input type="checkbox"/> Automatic tank gauging | <input type="checkbox"/> Soil analytical tests or samples |
| <input type="checkbox"/> Visual observation | <input type="checkbox"/> Manual tank gauging | <input type="checkbox"/> Other _____ |

6. Type of regulated substance stored in the storage system: (check one)

- | | | |
|--------------------------------------|---|---------------------------------------|
| <input type="checkbox"/> Diesel | <input type="checkbox"/> Used/waste oil | <input type="checkbox"/> New/lube oil |
| <input type="checkbox"/> Gasoline | <input type="checkbox"/> Aviation gas | <input type="checkbox"/> Kerosene |
| <input type="checkbox"/> Heating oil | <input type="checkbox"/> Jet fuel | <input type="checkbox"/> Other _____ |
- Hazardous substance - includes CERCLA substances, pesticides, ammonia, chlorine, and their derivatives, and mineral acids.
(write in name or Chemical Abstract Service (CAS) number) _____

7. Incident involves or originated from a: (check all that apply)

- | | | | | |
|---|---|--|--------------------------------|---|
| <input type="checkbox"/> Tank | <input type="checkbox"/> Unusual operating conditions | <input type="checkbox"/> Dispensing equipment | <input type="checkbox"/> Pipe | <input type="checkbox"/> Overfill protection device |
| <input type="checkbox"/> Piping sump | <input type="checkbox"/> Release detection equipment | <input type="checkbox"/> Secondary containment system | <input type="checkbox"/> Other | <input type="checkbox"/> Dispenser Liners |
| <input type="checkbox"/> Loss of >100 gallons to an impervious surface other than secondary containment | | <input type="checkbox"/> Loss of >500 gallons within secondary containment | | |

8. Cause of the incident, if known: (check all that apply)

- | | | | |
|---|--|---|--------------------------------------|
| <input type="checkbox"/> Overfill (<25 gallons) | <input type="checkbox"/> Spill (<25 gallons) | <input type="checkbox"/> Theft | <input type="checkbox"/> Corrosion |
| <input type="checkbox"/> Faulty Probe or sensor | <input type="checkbox"/> Human error | <input type="checkbox"/> Installation failure | <input type="checkbox"/> Other _____ |

9. Actions taken in response to the incident: _____

10. Comments: _____

11. Agencies notified (as applicable):

- | | | |
|---|--|--|
| <input type="checkbox"/> Fire Department. | <input type="checkbox"/> Local Program | <input type="checkbox"/> DEP (district/person) |
|---|--|--|

12. To the best of my knowledge and belief, all information submitted on this form is true, accurate, and complete.

Printed Name of Owner, Operator or Authorized Representative

Signature of Owner, Operator or Authorized Representative.

Instructions for completing the Incident Notification Form

This form must be completed to notify the County of all incidents, or of the following suspected releases:

1. A failed or inconclusive tightness, pressure, or breach of integrity test;
2. Internal inspection results, including perforations, corrosion holes, weld failures, or other similar defects that indicate that a release has occurred;
3. Unusual operating conditions such as the erratic behavior of product dispensing equipment, the sudden loss of product from the storage tank system, or any unexplained presence of water in the tank, unless system equipment is found to be defective but not leaking;
4. Odors of a regulated substance in surface or groundwater, soils, basements, sewers and utility lines at the facility or in the surrounding area;
5. The loss of a regulated substance from a storage tank system exceeding 100 gallons on impervious surfaces other than secondary containment, driveways, airport runways, or other similar asphalt or concrete surfaces;
6. The loss of a regulated substance exceeding 500 gallons inside a dike field area with secondary containment; and
7. A positive response of release detection devices or methods described in Rule 62-761.610, F.A.C., or approved under Rule 62-761.850, F.A.C. A positive response shall be the indication of a release of regulated substances, an exceedance of the Release Detection Response Level or a breach of integrity of a storage tank system.

If the investigation of an incident indicates that a discharge did not occur (for example, the investigation shows that the situation was the result of a theft or a malfunctioning electronic release detection probe), then a letter of retraction should be sent to the County within fourteen days with documentation that verifies that a discharge did not occur. If within 24 hours of an incident, or before the close of the County's next business day, the investigation of the incident does not confirm that a discharge has occurred, an Incident Report Form need not be submitted.

A copy of this form must be delivered or faxed to the County within 24 hours of the discovery of an incident, or before the close of the next business day. It is recommended that the original copy be sent in the mail. If the incident occurs at a county-owned facility, a copy of the form must be faxed or delivered to the local DEP District office.

FDEP District Office Addresses

Northwest District
160 Government Center
Pensacola FL 32501-5794
Phone: (850) 595-8360
Fax: (850) 595-8417

Northeast District
7825 Baymeadows Way
Suite 200B
Jacksonville, FL 32256-7590
Phone: (904) 448-4300

Central District
3319 Maguire Boulevard, Suite 232
Orlando, FL 32803-3767
Phone: (407) 894-7555
Fax: (407) 897-2966

Southwest District
3804 Coconut Palm Drive
Tampa, FL 33619-8218
Phone: (813) 632-7600
Fax: (813) 744-6084

South District
2295 Victoria Avenue, Suite 364
Ft. Myers, FL 33902-2549
Phone: (239) 332-6975
Fax: (239) 332-6969

Southeast District
400 North Congress Avenue
West Palm Beach, FL 33401
Phone: (561) 681-6600

APPENDIX G
LABORATORY ELAP CERTIFICATION
(PROVIDED ON CD ONLY)



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

ENVIRONMENTAL CONSERVATION LABORATORIES – ORLANDO

10775 Central Port Drive

Orlando, FL 32824

Russell Macomber Phone: 407 826 5314

rmacomber@encolabs.com

ENVIRONMENTAL

Valid To: March 31, 2014

Certificate Number: 3000.01

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

Testing Technologies

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

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
<u>Metals</u>	EPA 6020A/200.8	EPA 6020A
Zinc	EPA 6020A/200.8	EPA 6020A
<u>Microbiology</u>		
Total Coliforms	SM 9222B	-----
Fecal Coliforms	SM 9222D	-----
<u>General Chemistry</u>		
Acidity, as CaCO ₃	EPA 305.1/SM 2310 B (4A)	-----
Alkalinity as CaCO ₃	EPA 310.1/SM 2320 B	EPA 310.1/SM 2320 B
Alkalinity as CaCO ₃	EPA 310.2	EPA 310.2
Biochemical oxygen demand	EPA 405.1/SM 5210 B	-----
Bromide	EPA 300.0/9056A	EPA 9056A
Carbonaceous BOD (CBOD)	SM 5210 B	-----
Chemical oxygen demand	EPA 410.4	-----
Chloride	EPA 300.0/9056A	EPA 9056A
Chromium VI	EPA 7196/ SM 3500-Cr D	EPA 7196
Conductivity	EPA 120.1	-----
Cyanide	EPA 335.2/SM 4500-CN E	EPA 9014
Cyanide, Reactive	-----	SW-846 7.3.3
Ferric iron (calculated)	SM 3500-Fe D	-----
Ferrous iron	SM 3500-Fe D	-----
Fluoride	EPA 300.0/9056A	EPA 9056A
Hardness	EPA 130.2/SM 2340 C	-----
Kjeldahl nitrogen -total	EPA 351.2	EPA351.2
Nitrate as N	EPA 300.0/353.1/9056A	EPA 353.1/9056A
Nitrate-nitrite	EPA 300.0/353.1/9056A	EPA 353.1/9056A
Nitrite as N	EPA 300.0/354.1/9056A/SM 4500-NO ₂ B	EPA 9056A/ SM 4500-NO ₂ B
Organic nitrogen	EPA 351.2/350.1	EPA 351.2/350.1
Orthophosphate as P	EPA 365.1	-----
Orthophosphate as P	EPA 365.3	-----
pH	EPA 150.1/9040C/SM 4500-H ⁺ -B	EPA 9045D
Phosphorus, total	EPA 365.4	EPA 365.4
Residue-filterable (TDS)	SM 2540 C	-----
Residue-nonfilterable (TSS)	SM 2540 D	-----
Residue-total	SM 2540 B/SM 2540 G/EPA 160.3	SM 2540G/EPA 160.3
Residue-volatile	EPA 160.4	EPA 160.4
Sulfate	EPA 300.0/9056A	EPA 9056A
Sulfide	EPA 376.1/SM 4500-S E	EPA 9030B/9034
Sulfide, Reactive	-----	SW-846 7.3.4
Surfactants -MBAS	SM 5540 C	-----
Total nitrate-nitrite	EPA 9056 A/SM 4500-NO ₃ H	EPA 9056 A/SM 4500-NO ₃ H
Total cyanide	EPA 9014	EPA 9014
Total nitrogen	TKN + Total nitrate-nitrite	TKN + Total nitrate-nitrite
Total Organic Carbon	EPA 9060A/SM 5310B	TOC Walkley Black
Total phenolics	EPA 420.1	EPA 420.1
Total, fixed, and volatile residue	SM 2540 G	SM 2540 G
Turbidity	EPA 180.1	-----
Un-ionized ammonia	DEP SOP 10/03/83	DEP SOP 10/03/83
<u>Extractable Organics</u>		
1,2,4-Trichlorobenzene	EPA 8270D/625	EPA 8270D

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

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

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

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

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

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

Preparation Methods

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



The American Association for Laboratory Accreditation

World Class Accreditation

Accredited DoD ELAP Laboratory

A2LA has accredited

ENVIRONMENTAL CONSERVATION LABORATORIES - ORLANDO

Orlando, FL

for technical competence in the field of

Environmental Testing

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



Presented this 29th day of May 2012.

A handwritten signature in black ink, appearing to read "Peter Abney".

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

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