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SAMPLING AND ANALYSIS PLAN EXTENDED SITE INVESTIGATION FOR POTENTIAL SOURCES OF CONTAMINATION 5, 8, 9, 29, 31, 32 AND 50 NAS JACKSONVILLE FL
05/26/2011
TETRA TECH NUS

Comprehensive Long-term Environmental Action Navy

CONTRACT NUMBER N62467-04-D-0055

Rev. 3
05/26/11

Sampling and Analysis Plan
(Field Sampling Plan and Quality Assurance Project Plan)

Extended Site Investigation for Potential Sources of Contamination 5, 8, 9, 29, 31, 32, and 50

Naval Air Station Jacksonville
Jacksonville, Florida

Contract Task Order 0152

May 2011

NAVFAC
Naval Facilities Engineering Command
NAVFAC SOUTHEAST

NAS Jacksonville
Jacksonville, Florida 32212-0030

TETRA TECH NUS, Inc.

SAP Worksheet No. 1 -- Title and Approval Page
UFP-QAPP Manual Section 2.1

SAMPLING AND ANALYSIS PLAN
(Field Sampling Plan and Quality Assurance Project Plan)
May 2011

Extended Site Investigation
for
PSC Sites 5, 8, 9, 29, 31, 32, and 50

Naval Air Station (NAS) Jacksonville
Jacksonville, Florida

Prepared for:
Naval Facilities Engineering Command Southeast
Naval Air Station Jacksonville, Building 903
Jacksonville, Florida 32212-0030

Prepared by:
Tetra Tech NUS, Inc.
661 Andersen Drive
Foster Plaza 7
Pittsburgh, Pennsylvania 15220-2745

Prepared under:
Comprehensive Long-Term Environmental Action Navy
CLEAN Contract No. N62467-04-D-0055
Contract Task Order 0152

SAP Worksheet #1 - Approval Page

(UFP-QAPP Manual Section 2.1)

Document Title: Sampling and Analysis Plan, (Field Sampling Plan and Quality Assurance Project Plan), Extended Site Investigation for Potential Source of Contamination (PSC) Sites 5, 8, 9, 29, 31, 32, and 50, Naval Air Station (NAS) Jacksonville, Florida

Lead Organization: Naval Facilities Engineering Command (NAVFAC) Southeast

Preparer's Name and Organizational Affiliation: Brad Peebles, Tetra Tech NUS, Inc.

Preparer's Address and Telephone Number: 5601 Mariner Street , Suite 490
Tampa, Florida 33609
(813) 282-7890 Ext. 1015

Preparation Date (Day/Month/Year): October 2010

Investigative Organization's Task Order Manager:

Signature/Date October 29, 2010
Mark A. Peterson, Tetra Tech NUS, Inc.

Investigative Organization's Project QA Manager:

Signature/Date October 29, 2010
Kelly Carper, Tetra Tech NUS, Inc.

Lead Organization's Remedial Project Manager:

Signature/Date
Adrienne Wilson, NAVFAC SE

Lead Organization's QA Officer:

Signature/Date
NAVFAC Atlantic QAO Chemist

Approval Signatures:

Signature/Date
Pete Dao, USEPA Region 4

Signature/Date
David Grabka, FDEP

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Kelly Carper, Tetra Tech NUS, Inc.

Lead Organization's Remedial Project Manager:

Signature/Date
Adrienne Wilson, NAVFAC SE

Lead Organization's QA Officer:

TUCKER.JONATHAN.P.1239524180

Digitally signed by TUCKER.JONATHAN.P.1239524180
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Date: 2010.05.10 17:49:13 -04'00'

Signature/Date
NAVFAC Atlantic QAO Chemist

Approval Signatures:

Signature/Date
Pete Dao, USEPA Region 4

Signature/Date
David Grabka, FDEP

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Signature/Date
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Lead Organization's QA Officer:

TUCKERJONATHAN.P.1239524180 Digitally signed by TUCKERJONATHAN.P.1239524180 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USN, cn=TUCKERJONATHAN.P.1239524180 Date: 2010.05.10 17:49:13 -04'00'

Signature/Date
NAVFAC Atlantic QAO Chemist

Approval Signatures:

6/10/11
Signature/Date
Pete Dao, USEPA Region 4

Signature/Date
David Grabka, FDEP

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Preparer's Address and Telephone Number: 5601 Mariner Street, Suite 490
Tampa, Florida 33609
(813) 282-7890 Ext. 1015

Preparation Date (Day/Month/Year): October 2010

Investigative Organization's Task Order Manager: Mark A. Peterson

Signature/Date October 29, 2010
Mark A. Peterson, Tetra Tech NUS, Inc.

Investigative Organization's Project QA Manager: Kelly A Carper

Signature/Date October 29, 2010
Kelly Carper, Tetra Tech NUS, Inc.

Lead Organization's Remedial Project Manager: A. Wilson 12-17-10

Signature/Date
Adrienne Wilson, NAVFAC SE

Lead Organization's QA Officer:

Signature/Date
NAVFAC Atlantic QAO Chemist

Approval Signatures:

Signature/Date
Pete Dao, USEPA Region 4

David P. Grabka 12/17/10

Signature/Date
David Grabka, FDEP

EXECUTIVE SUMMARY

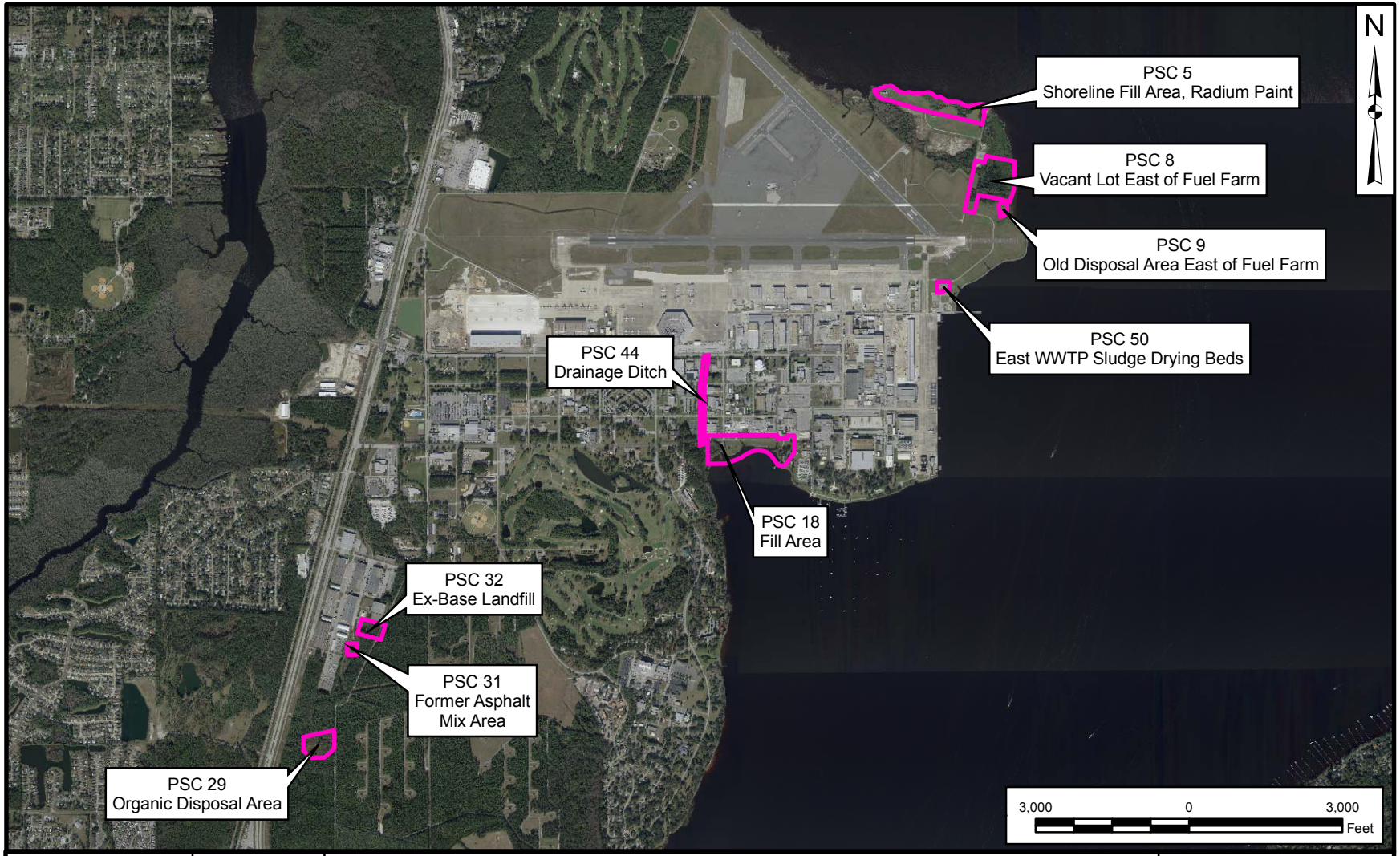
Tetra Tech NUS, Inc. (TtNUS) has prepared this Uniform Federal Policy Sampling and Analysis Plan (UFP-SAP) under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract No. N62467-04-D-0055, Contract Task Order (CTO) 0152. This plan was prepared for two soil sampling events at seven Potential Sources of Contamination (PSC) sites located at Naval Air Station (NAS) Jacksonville. Figure ES-1 presents a facility location map depicting the locations of the seven PSC sites on the installation, plus PSC 18 and PSC 44, which do not require further investigation, but will be included in the Final Record of Decision for these PSC Sites.

This plan was generated for, and complies with, applicable United States Navy, the United States Environmental Protection Agency (USEPA), and the Florida Department of Environmental Protection (FDEP) requirements, regulations, guidance, and technical standards. This includes the Department of Defense (DoD), Department of Energy (DOE), and USEPA Interagency Data Quality Task Force (IDQTF) environmental requirements regarding federal facilities. To comply with IDQTF requirements, this UFP-SAP is presented in the format of standard worksheets specified in the Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) guidance documents (IDQTF, 2005).

PSC Sites 5, 8, 9, 29, 31, 32, and 50 were given no further remedial action planned (NFRAP) status with land use controls (LUCs) based on preliminary site assessments and some preliminary remediation activities. It was later determined that these LUC boundaries were developed based on a limited data set and the extent of contamination had not been defined. New data are required to verify the presence and extent of contamination at the PSC sites. Once the data are collected, the Project Team can decide if the current LUCs should be modified and if a groundwater investigation may be necessary, or if no further action (NFA), pursuant to Chapter 62-780 of the Florida Administrative Code (F.A.C.), is required.

Two soil sampling events are planned which will generate the information needed to make appropriate decisions regarding future action at the seven PSC Sites. The sampling events will occur in two phases. Soil samples collected during Phase I will be analyzed for total concentrations of site-specific chemicals of potential concern (COPCs) in milligrams per kilogram (mg/kg). These results will be used to determine where additional samples will be collected during Phase II. Phase II soil samples will be analyzed for total concentrations (mg/kg) and Synthetic Precipitation Leaching Procedure (SPLP) leachate concentrations in micrograms per liter (µg/L) of site-specific COPCs. The reported concentrations of COPCs from both phases will be compared against the applicable regulatory criteria listed in Chapter 62-777 of the F.A.C. and Chapter 62-550, F.A.C. Decisions related to any further action at the seven PSC sites will be based on the outcome of this comparison.

P:\GIS\JACKSONVILLE_NAS\MAPDOCS\MXD\PSC_ALL_SITE_MAP.MXD 3/10/10 KM



DRAWN BY J. ENGLISH	DATE 12/07/09	PSC SITE LOCATIONS NAS JACKSONVILLE JACKSONVILLE, FLORIDA	CONTRACT NUMBER CTO 0152
CHECKED BY J. JOHNSON	DATE 3/10/10		APPROVED BY ___ DATE ___
REVISED BY T. WHEATON	DATE 02/04/10		APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. ES-1 / REV 0

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TABLE

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APPENDICES

A Field Standard Operating Procedures and Field Forms
B Laboratory Standard Operating Procedures and DoD ELAP Accreditation
C Sampling Data Tables from Previous Investigations

ACRONYMS

°C	Degrees Celsius
%D	Percent Difference or Percent Drift
%R	Percent Recovery
amsl	above mean sea level
BEI	Bechtel Environmental, Inc.
bgs	below ground surface
BNA	Base/Neutral/Acid-Extractable Compound
CA	Corrective Action
CAS	Chemical Abstract Service
CCB	Continuing Calibration Blank
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CHSO	Company Health and Safety Officer
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Program
COPC	Chemical of Potential Concern
CSM	Conceptual Site Model
CTL	Cleanup Target Level
CTO	Contract Task Order
DCB	Decachlorobiphenyl
DFTPP	Decafluorotriphenylphosphine
DI	De-ionized
DoD	Department of Defense
DOE	Department of Energy
DPT	Direct-Push Technology
DQI	Data Quality Indicator
DQO	Data Quality Objective
DVM	Data Validation Manager
ECD	Electron Capture Detector
EE/CA	Engineering Evaluation/Cost Analysis
ELAP	Environmental Laboratory Accreditation Program
Empirical	Empirical Laboratories, LLC
EP Tox	Extraction Procedure Toxicity Test

ACRONYMS (CONTINUED)

Ext	Extension
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FOL	Field Operations Leader
FTMR	Field Task Modification Request
G&M	Geraghty & Miller
GC	Gas Chromatography
GC/MS	Gas Chromatograph/Mass Spectrometer
GCTL	Groundwater Cleanup Target Level
Hart	Fred C. Hart Associates, Inc.
HASP	Health and Safety Plan
HLA	Harding Lawson Associates
HNO_3	Nitric Acid
HSM	Health and Safety Manager
IAS	Initial Assessment Study
ICAL	Initial Calibration
ICB	Initial Calibration Blank
ICP	Inductively Coupled Plasma
ICP-AES	Inductively Coupled Plasma-Atomic Emission Spectroscopy
ICS	Interference Check Standard
ICV	Initial Calibration Verification
IDQTF	Interagency Data Quality Task Force
IDW	Investigation-Derived Waste
IRCDQM	Installation Restoration Chemical Data Quality Manual
IRP	Installation Restoration Program
IS	Internal Standard
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUC	Land Use Control
MDL	Minimum Detection Limit
mg/kg	Milligrams per Kilogram
mL	Milliliter

ACRONYMS (CONTINUED)

MPC	Measurement Performance Criterion
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NA	Not Applicable
NAS	Naval Air Station
NAVFAC SE	Naval Facilities Engineering Command Southeast
NTCRA	Non-Time-Critical Removal Action
NFA	No Further Action
NFRAP	No Further Remedial Action Planned
NIRIS	Naval Installation Restoration Information Solutions
OSHA	Occupational Safety and Health Administration
PAH	Polycyclic Aromatic Hydrocarbon
PAL	Project Action Limit
PCB	Polychlorinated Biphenyl
PM	Project Manager
POC	Point of Contact
PPE	Personal Protective Equipment
ppm	Parts Per Million
PQL	Practical Quantitation Limit
PSC	Potential Source of Contamination
PT	Proficiency Testing (previously known as performance evaluation sample)
PVC	Polyvinyl Chloride
QA	Quality Assurance
QAM	Quality Assurance Manager
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
QSM	Quality Systems Manual
r	Linear Regression Correlation Coefficient
RF	Response Factor
RI	Remedial Investigation
RMO I	Risk Management Options – Level 1
RPD	Relative Percent Difference
RPM	Remedial Project Manager
RSD	Relative Standard Deviation
SAP	Sampling and Analysis Plan

ACRONYMS (CONTINUED)

SCTL	Soil Cleanup Target Level
SDG	Sample Delivery Group
SOP	Standard Operating Procedure
SQL	Structured Query Language
SPLP	Synthetic Precipitation Leaching Procedure
SRCR	Sample Receipt Condition Report
SSO	Site Safety Officer
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TBD	To Be Determined
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TCMX	Tetra-chloro-meta-xylene
TOM	Task Order Manager
TPH	Total Petroleum
TtNUS	Tetra Tech NUS, Inc.
UCL	Upper Confidence Limit
UFP	Uniform Federal Policy
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plan
UFP-SAP	Uniform Federal Policy Sampling and Analysis Plan
µg/L	Microgram per Liter
U.S.	United States
USEPA	United States Environmental Protection Agency
USGS	United States Geological Society
UST	Underground Storage Tank
VOC	Volatile Organic Compound
VP-30	Patrol Squadron Thirty
WWTP	Wastewater Treatment Plant

SAP Worksheet #2 -- SAP Identifying Information
(UFP-QAPP Manual Section 2.2.4)

Site Name/Number:	Potential Source of Contamination (PSC) Sites 5, 8, 9, 29, 31, 32, and 50
Contractor Name:	Tetra Tech NUS, Inc. (TtNUS)
Contract Number:	N62467-04-D-0055
Contract Title:	Comprehensive Long-Term Environmental Action Navy (CLEAN)
Work Assignment Number:	Contract Task Order (CTO) 0152

1. This Sampling and Analysis Plan (SAP) was prepared in accordance with the requirements of the *Uniform Federal Policy for Quality Assurance Plans (UFP-QAPP)* (USEPA, 2005) and *United States Environmental Protection Agency (USEPA) Guidance for Quality Assurance Project Plans, EPA QA/G-5, QAMS (USEPA, 2002)*.

2. Identify regulatory program: Chapter 62-780, Florida Administrative Code (F.A.C.).

3. This SAP is a project-specific SAP.

4. List dates of scoping sessions that were held:

Scoping Session	Date
Data Quality Objective (DQO) Scoping Meetings (Project Team)	July 20 and 21, 2009

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

Title	Date
Sampling Event Report, PSC 5	April 1999
Sampling Event Report, PSC 8	March 1999
Sampling Event Report, PSC 9	August 1999
Sampling Event Report, PSC 29	June 1999
Sampling Event Report, PSC 31	March 1999
Sampling Event Report, PSC 32	June 1999
Sampling Event Report, PSC 50	March 1999

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

Florida Department of Environmental Protection (FDEP) (regulatory stakeholder)
USEPA Region 4 (regulatory stakeholder)
NAS Jacksonville (property owner)

1. Lead organization

Naval Facilities Engineering Command Southeast (NAVFAC SE)

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

Not Applicable (NA), as there are no exclusions.

SAP Worksheet #3 - Distribution List
(UFP-QAPP Manual Section 2.3.1)

Name of SAP Recipients	Title/Role	Organization	Telephone Number	E-Mail Address or Mailing Address	Document Control Number
Adrienne Wilson	Remedial Project Manager (RPM)/ Manages Project Activities for the Navy	NAVFAC IPT South Atlantic Code OPA6, Cube 36 135 Ajax Street Jacksonville, FL 32212-0030	(904) 542-6160	Adrienne.Wilson@navy.mil	NA
Tim Curtin	Installation Restoration Program (IRP) Manager/ NAS Jacksonville Point of Contact (POC)	NAS Jacksonville Building 1, Code 064TC NASJAX /Yorktown/Langley Jacksonville, FL 32212	(904) 542-4228	Tim.L.Curtin@navy.mil	NA
To Be Determined (TBD)	NAVFAC Quality Assurance Officer (QAO)/Chemist	TBD	TBD	TBD	TBD
Julie Johnson	Administrative Project Assistant (NAS Jacksonville Administrative Record)	TtNUS 8640 Philips Hwy, Ste 16 Jacksonville, FL 32256	(904) 730-4669 Ext. 224	julie.johnson@tetratech.com	NA
David Grabka	RPM/ Provides Regulator Input	FDEP 2600 Blair Stone Road, MS 4535 Tallahassee, FL 32399-2400	850-245-8997	david.grabka@dep.state.fl.us	NA
Pete Dao	RPM/ Provides Regulator Input	USEPA Region 4 Atlanta Federal Center 61 Forsyth Street, SW Atlanta, GA 30303-8960	TBD	TBD	NA
Debra Humbert	TtNUS Program Manager / Manages Navy Initiatives	TtNUS 661 Andersen Drive Foster Plaza 7 Pittsburgh, PA 15220	(412)921-1990	debra.humbert@tetratech.com	NA

Name of SAP Recipients	Title/Role	Organization	Telephone Number	E-Mail Address or Mailing Address	Document Control Number
Chris Pike (copy of cover letter only)	Deputy Program Manager/ Manages Program Activities	TtNUS 661 Andersen Drive Foster Plaza 7 Pittsburgh, PA 15220	(412)921-8861	chris.pike@tetratech.com	NA
Mark Peterson	TtNUS Task Order Manager (TOM)/ Manages Project Activities	TtNUS 8640 Philips Hwy, Ste 16 Jacksonville, FL 32256	(904) 730-4669 Ext. 213	mark.peterson@tetratech.com	NA
Alan Pate	TtNUS Field Operations Leader (FOL) / Site Safety Officer (SSO)/ Manages Field Operation and Site Safety Issues	TtNUS 8640 Philips Hwy, Ste 16 Jacksonville, FL 32256	(904) 730-4669 Ext 214	alan.pate@tetratech.com	NA
Kelly Carper (electronic copy only)	TtNUS Quality Assurance Manager (QAM)/ Manages Corporate Quality Assurance (QA) Program and Implementation	TtNUS 661 Andersen Drive Foster Plaza 7 Pittsburgh, PA 15220	(412) 921-7273	kelly.carper@tetratech.com	NA
Peggy Churchill (electronic copy only)	TtNUS Environmental Scientist/ Provides DQO and SAP Support	TtNUS 11 Riverside Dr. Ste 206 Cocoa, FL 32922	(321) 636-6470	peggy.churchill@tetratech.com	NA
Matt Soltis [Health and Safety Plan (HASP) only]	TtNUS Health and Safety Manager (HSM)/ Manages Corporate Health and Safety Program	TtNUS 661 Andersen Drive Foster Plaza 7 Pittsburgh, PA 15220	(412) 921-8912	matt.soltis@tetratech.com	NA

Name of SAP Recipients	Title/Role	Organization	Telephone Number	E-Mail Address or Mailing Address	Document Control Number
Shauna Stotler-Hardy (electronic copy only)	TtNUS Project Chemist/ Provides Coordination with Laboratory	TtNUS 900 Trail Ridge Rd. Aiken, SC 29803	(803) 641-4944	shauna.stotlerhardy@tetratech.com	NA
Joseph Samchuck (electronic copy only)	TtNUS Data Validation Manager (DVM)/ Manages Data Validation	TtNUS 661 Andersen Drive Foster Plaza 7 Pittsburgh, PA 15220	(412) 921-8510	joseph.samchuck@tetratech.com	NA
Lee Leck (electronic copy only)	TtNUS Data Manager/ Manages Databases	TtNUS 661 Andersen Drive Foster Plaza 7 Pittsburgh, PA 15220	(412) 921-8856	lee.leck@tetratech.com	NA
Kim Kostzer (electronic copy only)	Laboratory Project Manager (PM)/ Representative for Laboratory and Analytical Issues	Empirical Laboratories, LLC (Empirical) 621 Mainstream Drive, Suite 270 Nashville, TN 37228	(615) 345-1115	kkostzer@empirlabs.com	NA
Driller (TBD) (electronic copy only)	Well Installation Subcontractor PM/ Provides Drilling Services	TBD	TBD	TBD	NA

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

(UFP-QAPP Manual Section 2.3.2)

Certification that project personnel have read the text will be obtained by one of the following methods as applicable:

1. In the case of regulatory agency personnel with oversight authority, approval letters or e-mails will constitute verification that applicable sections of the SAP have been reviewed. Copies of regulatory agency approval letters / e-mails will be retained in the project files and are listed in Worksheet #29 as project records.

2. E-mails will be sent to the Navy, TtNUS, and subcontractor project personnel who will be requested to verify by e-mail that they have read the applicable SAP / sections and the date on which they were reviewed. Copies of the verification e-mail will be included in the project files and is identified in Worksheet #29.

   A copy of the signed Worksheet #4 will be retained in the project files and is identified as a project document in Worksheet #29.

Name	Organization/Title/Role	Telephone Number	Signature/E-Mail Receipt	SAP Section Reviewed	Date SAP Read
Navy and Regulator Project Team Personnel					
Adrienne Wilson	Navy/ RPM/ Manages Project Activities for the Navy	(904) 542-6160	See Worksheet #1 for signature	All	
Tim Curtin	Navy/ IRP Manager/ NAS Jacksonville POC	(904) 542-4228		All	
David Grabka	FDEP/ RPM/ Provides Regulator Input	TBD	See Worksheet #1 for signature	All	
Peter Dao	USEPA Region 4/ RPM/ Provides Regulator Input	TBD	See Worksheet #1 for signature	TBD	

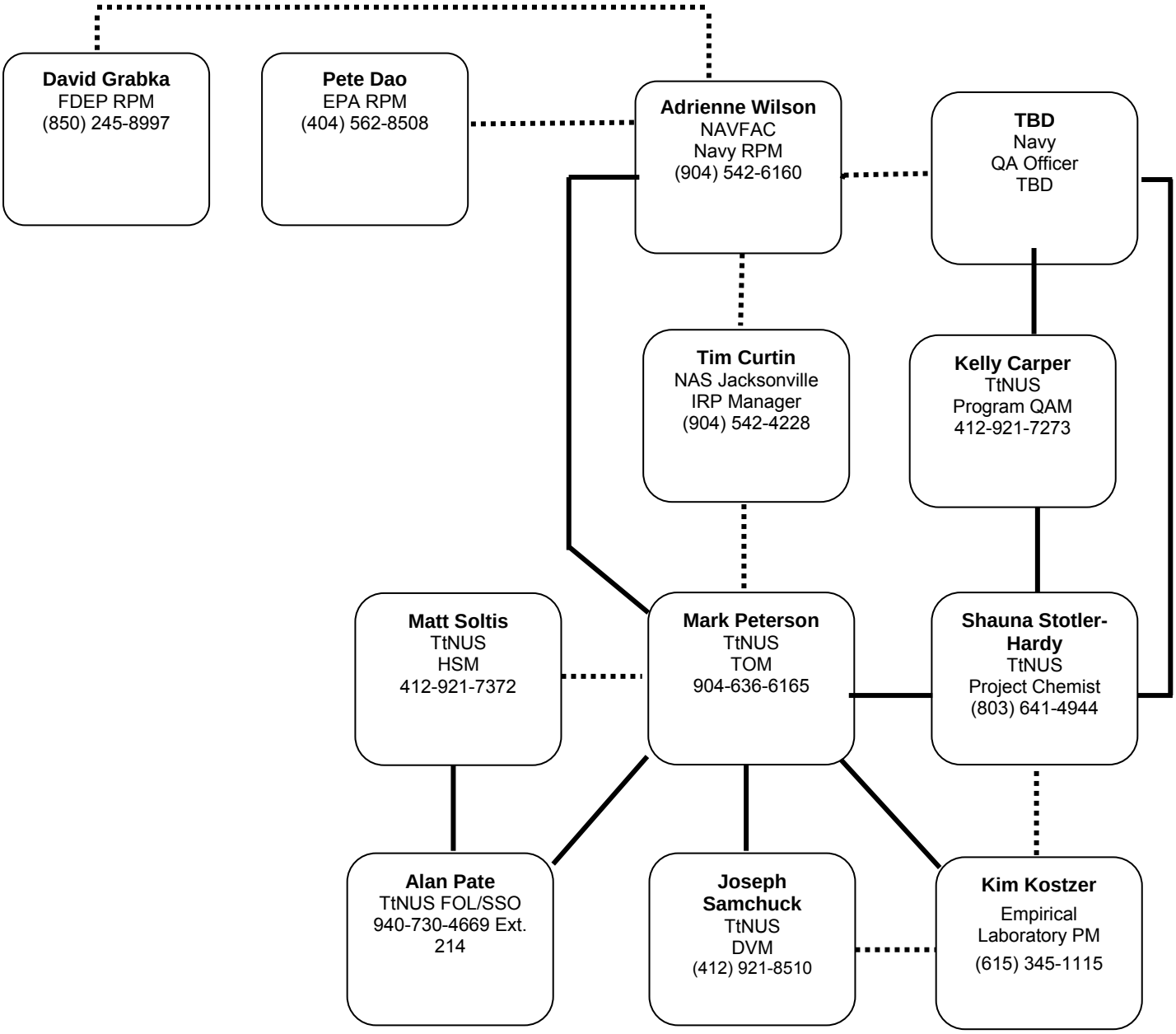
Name	Organization/Title/Role	Telephone Number	Signature/E-Mail Receipt	SAP Section Reviewed	Date SAP Read
TtNUS Project Team Personnel					
Mark Peterson	TtNUS/ TOM/ Manages Project Activities	904-730-4669 Ext 213	See Worksheet #1 for signature	All	
Alan Pate	TtNUS/ FOL/SSO/ Manages Field Operation and Site Safety Issues	904-730-4669 Ext 214		All	
Kelly Carper	TtNUS/ QAM/ Manages NAVFAC SE Contract QA Program and Implementation	(412) 921-7273	See Worksheet #1 for signature	All	
Matt Soltis	TtNUS/ HSM/ Manages Corporate Health and Safety Program	(412)921-8912	See HASP for signature	HASP	
Peggy Churchill	TtNUS/Environmental Scientist/ Provides DQO and SAP Support	(321) 636-6470		All	
Shauna Stotler-Hardy	TtNUS/ Project Chemist/ Provides Coordination with Laboratory	(803) 641-4944		All	
Joseph Samchuck	TtNUS/ DVM/ Manages Data Validation	(412) 921-8510		Worksheet Nos. 12, 14, 15, 19, 20, 23-28, 30, and 34-37	
Lee Leck	TtNUS/ Data Manager/ Manages Databases	(412)921-8856		Worksheet Nos. 12, 14, 15, 19, 20, 23-28, 30, and 34-37	

Name	Organization/Title/Role	Telephone Number	Signature/E-Mail Receipt	SAP Section Reviewed	Date SAP Read
Subcontractor Personnel					
Kim Kostzer	Empirical/ Laboratory PM/ Representative for Laboratory and Analytical Issues	(615) 345-1115		Worksheet Nos. 6, 12, 14, 15, 19, 23-28, 30, and 34-36	
TBD	TBD/ Subcontractor PM/ Driller for DPT and Monitoring Well Installation	TBD		Worksheet Nos. 6, 14, 17, and Figures	

SAP Worksheet #5 - Project Organizational Chart

(UFP-QAPP Manual Section 2.4.1)

Lines of Authority ——— Lines of Communication ·····



SAP Worksheet #6 -- Communication Pathways
(UFP-QAPP Manual Section 2.4.2)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or E-Mail	Procedure (timing, pathway to & from, etc.)
SAP amendments	TtNUS FOL/SSO TtNUS TOM Navy RPM	Alan Pate Mark Peterson Adrienne Wilson	(904) 730-4669 Ext 214 (904) 730-4669 Ext 213 (904) 542-6160	The TtNUS FOL will verbally inform the TtNUS TOM within 24 hours of realizing a need for an amendment. The TtNUS TOM will document the proposed changes via a Field Task Modification Request (FTMR) form within five days and send the Navy RPM a concurrence letter within seven days of identifying the need for change. SAP amendments will be submitted by the TtNUS TOM to the Navy RPM for review and approval. The Navy RPM will notify the regulators by mail of changes to the SAP. The TtNUS TOM will send scope changes to the Project Team via e-mail within one business day.
Changes in schedule	TtNUS TOM Navy RPM NAS Jacksonville POC	Mark Peterson Adrienne Wilson Tim Curtin	(904) 730-4669 Ext 213 (904) 542-6160 (904) 542-4228	The TtNUS TOM will verbally inform the Navy RPM and the NAS Jacksonville POC on the day that schedule change is known and document via schedule impact letter within one business day of when impact is realized.

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or E-Mail	Procedure (timing, pathway to & from, etc.)
Issues in the field that lead to changes in the scope of work	TtNUS FOL/SSO TtNUS TOM Navy RPM NAS Jacksonville POC	Alan Pate Mark Peterson Adrienne Wilson Tim Curtin	(904) 730-4669 Ext 214 (904) 730-4669 Ext 213 (904) 542-6160 (904) 542-4228	The TtNUS FOL will verbally inform the TtNUS TOM on the day that the issue is discovered. The TtNUS TOM will inform the Navy RPM and the NAS Jacksonville POC (verbally or via e-mail) within one business day of discovery. The Navy RPM will issue scope change (verbally or via e-mail), if warranted. The scope change is to be implemented before further work is executed. The TtNUS TOM will document the change via an FTMR form within two days of identifying the need for change and will obtain required approvals within five days of initiating the form.
Recommendation to stop work and initiate work upon corrective action	TtNUS FOL/SSO TtNUS TOM TtNUS QAM Navy RPM NAS Jacksonville POC	Alan Pate Mark Peterson Kelly Carper Adrienne Wilson Tim Curtin	(904) 730-4669 Ext 214 (904) 730-4669 Ext 213 (412) 921-7273 (904) 542-6160 (904) 542-4228	If TtNUS is the responsible party for a stop work command, the TtNUS FOL will inform on-site personnel, subcontractor(s), the NAS Jacksonville POC, and the identified Project Team members within one hour (verbally or by e-mail). If a subcontractor is the responsible party, the subcontractor PM must inform the TtNUS FOL within 15 minutes, and the TtNUS FOL will then follow the procedure listed above.

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or E-Mail	Procedure (timing, pathway to & from, etc.)
Corrective action for field program	TtNUS QAM TtNUS TOM	Kelly Carper Mark Peterson	(412) 921-7273 (904) 730-4669 Ext 213	The TtNUS QAM will notify the TtNUS TOM verbally or by e-mail within one business day that the corrective action has been completed. The TtNUS TOM will then notify the Navy RPM within one business day.
Field data quality issues	TtNUS FOL/SSO TtNUS TOM	Alan Pate Mark Peterson	(904) 730-4669 Ext 214 (904) 730-4669 Ext 213	The TtNUS FOL will inform the TtNUS TOM verbally or by e-mail on the same day that a field data quality issue is discovered.
Analytical data quality issues	Laboratory PM Project Chemist	Kim Kostzer Shauna Stotler-Hardy	(615) 345-1115 (803) 641-4944	The Laboratory PM will notify (verbally or via e-mail) the TtNUS Project Chemist within one business day of when an issue related to laboratory data is discovered. The TtNUS Project Chemist will notify (verbally or via e-mail) the data validation staff and the TtNUS TOM within one business day. The TtNUS TOM will notify the Navy RPM (verbally or via e-mail) of data quality issues within seven business days.

SAP Worksheet #7 - Responsibilities and Qualifications Table

(UFP-QAPP Manual Section 2.4.3)

The personnel responsible for implementing the SAP are identified in the following table. Resumes are available upon request.

Name	Title/Role	Organizational Affiliation	Responsibilities
Adrienne Wilson	Navy RPM	NAVFAC SE	Oversees project implementation, including scoping, data review, and evaluation.
Tim Curtin	IRP Manager	NAS Jacksonville	Oversees site activities and participates in scoping, data review, evaluation, and reviews the SAP.
David Grabka	RPM	FDEP	Participates in scoping, data review, evaluation, and approves the SAP.
Pete Dao	RPM	USEPA Region 4	Participates in scoping, data review, evaluation, and approves the SAP.
Mark Peterson	TOM	TtNUS	Oversees project, manages financial, schedule, and technical day-to-day activities of the project, including the following: • Ensures timely resolution of project-related technical, quality, and safety questions associated with TtNUS operations. • Functions as the primary TtNUS interface with the Navy RPM, Base personnel, TtNUS field and office personnel, and laboratory POCs. • Ensures that TtNUS health and safety issues related to this project are communicated effectively to all personnel and off-site laboratory. • Monitors and evaluates all TtNUS subcontractor performance. • Coordinates and oversees work performed by TtNUS field and office technical staff (including data validation, data interpretation, and report preparation). • Coordinates and oversees maintenance of all TtNUS project records. • Coordinates and oversees review of TtNUS project deliverables. • Prepares and issues TtNUS deliverables to the Navy and Project Team.

Name	Title/Role	Organizational Affiliation	Responsibilities
Alan Pate	FOL/SSO	TtNUS	Supervises, coordinates, and performs field sampling activities, including the following: • Ensures that all health and safety requirements applicable to the field work are implemented. • Functions as the on-site communications link between field staff members, Navy RPM, Base personnel, and TtNUS TOM. • Alerts off-site analytical laboratory of any special health and safety hazards associated with environmental samples. • Oversees the mobilization and demobilization of all field equipment and subcontractors. • Coordinates and manages the field technical staff. • Adheres to the work schedules provided by the TtNUS TOM. • Ensures the proper maintenance of site logbooks, field logbooks, and field recordkeeping. • Initiates FTMRs (if necessary). • Identifies and resolves problems in the field; resolves difficulties via consultation with the TtNUS TOM, Navy RPM, and Base personnel; implements and documents corrective actions related to field work; and serves as communication link between the field team and project management. As the SSO, is responsible for training and monitoring site conditions. The SSO reports to the Company Health and Safety Officer (CHSO) and to the TtNUS TOM. Details of the SSO's responsibilities are presented in the site-specific HASP.
Kelly Carper	QAM	TtNUS	Approves SAP and ensures that quality aspects of the CLEAN program are implemented, including the following: • Develops, maintains, and monitors QA policies and procedures. • Provides training to TtNUS staff in QA/quality control (QC) policies and procedures. • Conducts management and technical audits to monitor compliance with environmental regulations, contractual requirements, SAP requirements, and corporate policies and procedures. • Audits project records. • Monitors subcontractor quality controls and records. • Assists in the development of corrective action plans and ensuring correction of non-conformances reported in internal or external audits. • Ensures that this SAP meets TtNUS, Navy, USEPA and FDEP requirements. • Prepares QA reports for management.

Name	Title/Role	Organizational Affiliation	Responsibilities
Matt Soltis	HSM	TtNUS	Oversees CLEAN Program Health and Safety Program, including: • Provides technical advice to the TtNUS TOM on matters of health and safety. • Oversees the development and review of the HASP. • Conducts health and safety audits. • Prepares health and safety reports for management.
Shauna Stotler-Hardy	Project Chemist	TtNUS	Prepares laboratory scopes of work, coordinates analyses with laboratory, ensures that the laboratory scope of work is followed, and communicates with TtNUS staff. Performs data quality reviews. • Ensures that the project meets objectives from the standpoint of laboratory performance. • Provides technical advice to the Project Team on matters of data quality and project chemistry. • Monitors and evaluates subcontractor laboratory performance. • Ensures timely resolution of laboratory-related technical, quality, or other issues affecting project goals. • Functions as the primary interface between the subcontracted laboratory and the TtNUS TOM. • Coordinates and oversees work performed by the subcontracted laboratory. • Oversees the completion of TtNUS data validation. • Coordinates and oversees review of laboratory deliverables. • Recommends appropriate laboratory corrective actions.
Joseph Samchuck	DVM	TtNUS	Provides QA of data validation deliverables, including the following: • Oversees data validation activities. • Serves as communication link between TtNUS and subcontracted laboratory on data validation and electronic data positing activities. • Establishes TtNUS data validation protocols in support of projects.
Lee Leck	Data Manager	TtNUS	Manages TtNUS databases and ensures input of data.

Name	Title/Role	Organizational Affiliation	Responsibilities
Kim Kostzer	Laboratory PM	Empirical	Interfaces directly with the TtNUS Project Chemist, TtNUS TOM, and TtNUS QAM. • Ensures that methods and project-specific requirements are properly communicated and understood by laboratory personnel. • Ensures that all laboratory resources are available on an as-required basis. • Ensures compliance with analytical and project QA requirements. • Reviews data packages for completeness, clarity, and compliance with project requirements. • Informs the TtNUS TOM of project status and any sample receipt or analytical problems. • Oversees the preparation of and approves final analytical reports before they are submitted to TtNUS.
TBD	Driller	TBD	Performs Direct Push Technology (DPT) soil borings according to scope of work.
TBD	Utility Locator	Subcontractor	Utility Location.

In some cases, one person may be designated responsibilities for more than one position. For example, the FOL will be responsible for SSO duties. This action will be performed only as credentials, experience, and availability permits.

SAP Worksheet #8 -- Special Personnel Training Requirements Table

(UFP-QAPP Manual Section 2.4.4)

Each site worker will be required to have completed a 40-hour course (and 8-hour refresher, if applicable) in Health and Safety Training as described under Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120(b)(4). Safety requirements are addressed in greater detail in the site-specific TtNUS HASP.

SAP Worksheet #9 – Internal Project Scoping Session Participants Sheet
(UFP-QAPP Manual Section 2.5.1)

Project Name: NAS Jacksonville Projected Date(s) of Sampling: Project Manager: Mark Peterson	Site Name: PSC Sites Site Location: NAS Jacksonville, Florida

Date of Session: July 20 and 21, 2009
Scoping Session Purpose: DQO development

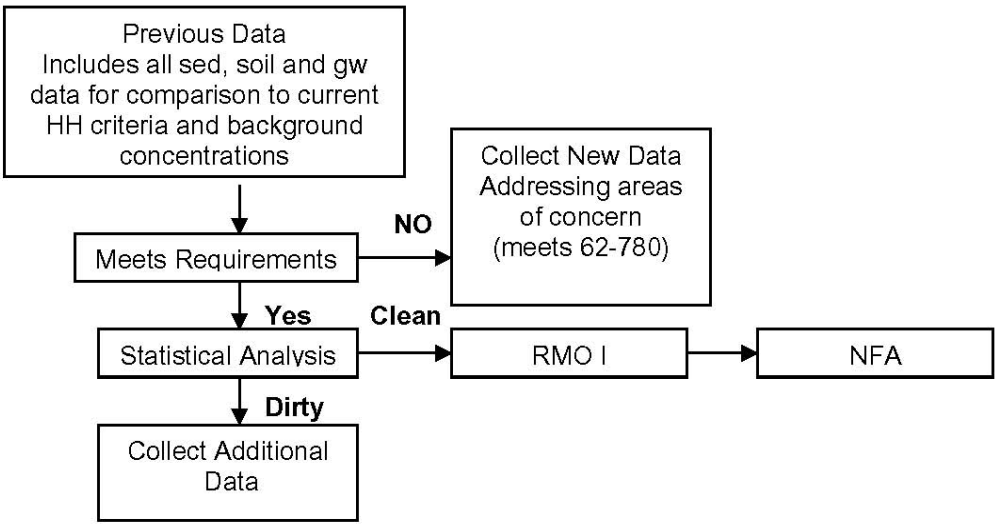
Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Pete Dao	USEPA RPM	USEPA	(404) 562-8508	Dao.Peter@epa.gov	USEPA RPM
Hal Davis	Geologist	USGS	(850) 553-3673	hdavis@usgs.gov	
Casey Hudson	RAC Contractor	CH2M Hill	(770) 604-9182 Ext. 54172	Casey.Hudson@ch2m.com	RAC Contractor
Robbie Darby	Tier II	NAVFAC SE	(904) 542-6989	Robbie.Darby@navy.mil	Tier II
Adrienne Wilson	Navy RPM	NAVFAC SE	(904) 542-6160	Adrienne.Wilson@navy.mil	Navy RPM
Tim Curtin	IRP Manager NAS Jacksonville	NAVFAC SE	(904) 542-4228	Tim.L.Curtin@navy.mil	IRP Manager
David Grabka	Federal Facilities RPM	FDEP	(850) 245-8997	David.Grabka@dep.state.fl.us	FDEP RPM
Eric Davis	RAC Contractor	CH2M Hill	(678) 530-4085	Eric.Davis@ch2m.com	RAC Contractor
Mark Peterson	TOM	TtNUS	(904) 730-4669 ext 213	Mark.Peterson@ tetratech.com	TOM
Mike Maughon	Senior Environmental Engineer	TtNUS	(843) 886-4547	Mike.Maughon@tetratech.com	Technical Support
Peggy Churchill	Environmental Scientist	TtNUS	(321) 636-6470	peggy.churchill@tetratech.com	QAPP Facilitator
Julie Johnson	Admin. Project Assistant III	TtNUS	(904) 730-4669	Julie.Johnson@tetratech.com	Scribe

Comments/Decisions: The DQO process was presented and the following was discussed:

Problem Statement (Step 1): What environmental question are we trying to answer?

1. Is contamination still present in the site media at concentrations that exceed residential & industrial screening values/regulatory criteria? If yes,
2. Are the land use control (LUC) boundaries appropriate and tied to site data?
3. Does the previously collected data exceed current criteria?
4. Does surface & subsurface soil contamination have the potential to leach to groundwater?

A flow-chart that illustrated the next stages in the process was developed and is reproduced below.



The process involves reviewing previously collected data to determine if these data meet the requirements that would allow for a statistical analysis. If so, then such an analysis would be undertaken and the site would be determined to be "Clean" or "Dirty". If the data did not meet the requirements that would allow for a statistical analysis then it would be necessary to design a data collection plan that focused only on the PSC areas of concern.

Action Items: Review the collected data to determine these data meet the requirements that would allow for a statistical analysis and make a decision on either conducting the statistical analysis or designing a data collection plan.

Action Taken: It was determined that the sample sizes associated with previously collected data were not large enough to support a statistical analysis on the data. It was also determined that the extent of contamination at each PSC has not been defined. Therefore, a data collection plan was developed, which is the subject of this UFP-SAP. The original LUC boundaries were developed on the initial data set, which was limited, hence the need for this investigation. The new data set will be robust enough to statistically and spatially represent the entire area of each PSC. The results associated with the data collection plan will be analyzed as per the decision chart that was developed during the July 20 and 21, 2009 Internal Project Scoping Session. That decision chart is presented in Worksheet #11. The goal of the data collection plan is to provide data that will be used to characterize each PSC in terms of (a) areas restricted to industrial/commercial, and or, residential use only and (b) areas of unrestricted use. LUCs will be used to define the area restricted to industrial/commercial use only.

SAP Worksheet #10 - Conceptual Site Model
(UFP-QAPP Manual Section 2.5.2)

10.1 INTRODUCTION

NAS Jacksonville was commissioned in October 1940 to provide facilities for pilot training and a Navy Aviation Trades School for ground crewmen. The facility is located in Duval County, Florida on the western bank of the St. Johns River. The facility is approximately 3,800 acres in size and its current mission is to provide facilities and support for the operation and maintenance of naval weapons and aircraft. Support facilities include an airfield and air operations for pilot training, a maintenance depot, a Naval Hospital, a Fleet Industrial Supply Center, a Fleet and Family Support Center, and a recreational facility.

The main portion of NAS Jacksonville is bordered to the north by the Timuquana Country Club, to the east and northeast by the St. Johns River, to the south by a residential area, and to the west by Highway 17, with Westside Regional Park, commercial developments, and other NAS Jacksonville operations. The facility is located approximately 24 miles inland from the Atlantic Ocean.

NAS Jacksonville is home to Patrol Squadron Thirty (VP-30), the Navy's largest aviation squadron and the only P-3 Orion Fleet Replacement Squadron that prepares and trains U.S. and foreign pilots, air crew, and maintenance personnel for further operational assignments. Support facilities include an airfield for pilot training, a maintenance depot employing more than 150 different trade skills capable of performing maintenance as basic as changing a tire to intricate micro-electronics or total engine disassembly, a Naval Hospital, a Fleet Industrial Supply Center, and a Navy Family Service Center.

Work in support of the base mission includes fuel storage and transportation systems and the overhaul, intermediate maintenance and repair of aircraft and engines. Maintenance activities at NAS Jacksonville over the years generated a variety of materials, of which some were disposed of on the base. These include materials resulting from construction activities; municipal solid waste and municipal wastewater treatment plant sludge; and miscellaneous industrial wastes, including waste oils or solvents, paints, and spilled fuels. Current disposal practices are regularly surveyed for conformity to local, state, and federal regulations.

This UFP-SAP addresses soil sampling and analysis at the following seven PSC sites located on the NAS Jacksonville facility (Figure ES-1).

- PSC 5 – Shoreline Fill West of the Fuel Barge Dock
- PSC 8 – Vacant Lot East of the Fuel Farm

- PSC 9 – Old Disposal Area East of the Fuel Farm
- PSC 29 – Organic Disposal Area
- PSC 31 – Former Asphalt Mixing Area
- PSC 32 – Ex-Base Landfill
- PSC 50 – East Side Wastewater Treatment Plant (WWTP) Sludge Drying Beds

Land use controls (LUCs) were originally developed for the seven PSC sites based upon the findings in a series of reports developed by Harding Lawson Associates (HLA, 1999a - g). The LUCs are used to bound the areas in each PSC that are restricted, through land deed modifications, to industrial/commercial use only. Under Chapter 62-780 of the F.A.C, statistical analysis can be used to define the horizontal and vertical extent of contamination. Such a definition is required before one can establish LUC boundaries. As noted in Worksheet #9, it was determined that the sample sizes associated with 1997 data were not large enough to support a statistical analysis on those data. It was also determined that the horizontal and vertical extents of contamination have not been defined; therefore, the current proposed LUC boundaries do not meet the requirements of Chapter 62-780, F.A.C.

Each of the seven PSC sites has similar physical characteristics, but each site presents slight differences associated with the source of contaminated material and therefore the chemicals of potential concern (COPCs) vary slightly between sites. HLA conducted a study on the seven PSC sites and determined that there were a number of analytes detected above the FDEP Soil Cleanup Target Levels (SCTLs) and Groundwater Cleanup Target Levels (GCTLs) in place at the time the reports were published (HLA, 1999a - g). The PSC-specific COPCs, used in this UFP-SAP, are those detected analytes that were reported by HLA to be greater than the current FDEP SCTL criteria (last updated 2005) for residential exposure and or greater than the GCTLs. The tables presenting the soil and groundwater concentrations, referenced in the HLA Sampling Event Reports are presented in Appendix C. The PSC-specific COPCs are listed in Table 10-1.

The similar physical characteristics among the seven PSC sites offer a similar exposure paradigm; that is, release mechanism/pathways/routes/receptors. Therefore, a generic Conceptual Site Model (CSM) is presented in Worksheet #10. The information used to build the generic CSM is detailed in Sections 10.1 through 10.9 and summarized in Table 10-1. The generic CSM is presented on Figure 10-1. This CSM will be refined at each PSC site, should the results of the soil investigation warrant refinement.

The remainder of Worksheet #10 presents the information that was used to develop the CSM, as represented by Figure 10-1 and Table 10-1.

TABLE 10-1
TABULAR REPRESENTATION OF CONCEPTUAL SITE EXPOSURE MODEL
FOR PSC SITES 5. 8, 9, 29, 31, 32, AND 50
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

PSC	Potential Source(s)	COPCs	Release Mechanism	Pathways	Route	Receptor
5	Waste associated with paint and painting activities	Arsenic Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene Dibenz(a,h)anthracene Indeno(1,2,3-cd)pyrene	Leaching	Soil to groundwater	Dermal (direct contact with soil), incidental ingestion, inhalation	Construction workers, maintenance or utility workers
			Impacted Surface Soil/Sheet flow during rainfall events	Surface soils scrubbed into ditches		Construction workers, maintenance or utility workers, and industrial workers
8	Sediment from a Waste Water Treatment Plant former polishing pond.	Arsenic Dieldrin Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene Dibenz(a,h)anthracene Indeno(1,2,3-cd)pyrene	Leaching	Soil to groundwater	Dermal (direct contact with soil), incidental ingestion, inhalation	Construction workers, maintenance or utility workers
			Impacted Surface Soil/Sheet flow during rainfall events	Surface soils scrubbed into ditches		Construction workers, maintenance or utility workers, and industrial workers

TABLE 10-1
TABULAR REPRESENTATION OF CONCEPTUAL SITE EXPOSURE MODEL
FOR PSC SITES 5. 8, 9, 29, 31, 32, AND 50
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

PSC	Potential Source(s)	COPCs	Release Mechanism	Pathways	Route	Receptor
9	Garbage, construction debris	Arsenic Barium Chromium (total) Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene Dibenz(a,h)anthracene Indeno(1,2,3-cd)pyrene	Leaching	Soil to groundwater	Dermal (direct contact with soil), incidental ingestion, inhalation	Construction workers, maintenance or utility workers
			Impacted Surface Soil/Sheet flow during rainfall events	Surface soils scrubbed into ditches		Construction workers, maintenance or utility workers, and industrial workers
29	Crushed drums, construction debris, metal, abrasive material, creosote covered material	Arsenic Manganese Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene Dibenz(a,h)anthracene Indeno(1,2,3-cd)pyrene	Leaching	Soil to groundwater	Dermal (direct contact with soil), incidental ingestion, inhalation	Construction workers, maintenance or utility workers
			Impacted Surface Soil/Sheet flow during rainfall events	Surface soils scrubbed into ditches		Construction workers, maintenance or utility workers, and industrial workers

TABLE 10-1
TABULAR REPRESENTATION OF CONCEPTUAL SITE EXPOSURE MODEL
FOR PSC SITES 5. 8, 9, 29, 31, 32, AND 50
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

PSC	Potential Source(s)	COPCs	Release Mechanism	Pathways	Route	Receptor
31	Leaking drums containing asphalt/polychlorinated biphenyl (PCB)-oil mix materials	Aroclor-1260 Barium Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Chromium (total) Chrysene Dibenz(a,h)anthracene Dieldrin Indeno(1,2,3-cd)pyrene	Leaching	Soil to groundwater	Dermal (direct contact with soil), incidental ingestion, inhalation	Construction workers, maintenance or utility workers
			Impacted Surface Soil/Sheet flow during rainfall events	Surface soils scrubbed into ditches		Construction workers, maintenance or utility workers, and industrial workers
32	Soil, refuse, construction debris, and junked vehicles	Aroclor-1260 Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene Dibenz(a,h)anthracene Indeno(1,2,3-cd)pyrene	Leaching	Soil to groundwater	Dermal (direct contact with soil), incidental ingestion, inhalation	Construction workers, maintenance or utility workers
			Impacted Surface Soil/Sheet flow during rainfall events	Surface soils scrubbed into ditches		Construction workers, maintenance or utility workers, and industrial workers
50	Buried WWTP sludge	Aroclor-1260 Barium Chromium (total) Copper Dieldrin Lead Silver	Leaching from sludge due to direct contact with groundwater	Groundwater to surface water	Dermal (direct contact with sludge), incidental ingestion, inhalation	Construction workers, maintenance or utility workers
			Sheet flow during rainfall events	Surface soils scrubbed into ditches		Construction workers, maintenance or utility workers, and industrial workers

10.2 PSC 5

The following sections describe PSC 5, Shoreline Fill West of the Fuel Barge Dock.

10.2.1 Site Description

The Shoreline Fill Area West of the Fuel Barge Dock was identified as a PSC during the Initial Assessment Study (IAS) (Fred C. Hart Associates, Inc.[Hart], 1983) and stretches along the shoreline of the St. Johns River from east of runway 14 to Catapult Road and the fuel barge dock. The IAS report defined PSC 5 as approximately 200 feet wide by 600 feet long (Figure 10-2). The area designated as PSC 5 was later extended to encompass an area approximately 300 feet wide by 2,100 feet long. PSC 5 is accessible by foot from Catapult Road, where it meets the fuel barge dock.

10.2.2 Previous Investigations

A verification study was not recommended in the IAS because hazardous waste material disposal was not evident at this site. However, previous information indicated that paint and strippings mixed with paint remover and solvents, as well as radioactive paint, were deposited on PSC 5 during 1945 and 1946 and later covered with concrete rubble. As a result, PSC 5 was included in the Verification Study Report (G&M, 1985), during which one monitoring well was installed and one groundwater sample was collected. The verification study report concluded that PSC 5 did not pose an imminent hazard to human health or the environment and proposed no further action. In July and August 1997, additional soil and groundwater samples were collected by HLA (1999a) (Figure 10-2). As noted in Section 10.1, the PSC 5 COPCs (Table 10-1) are based on the findings presented in the HLA Sampling Event Report.

10.2.3 Conceptual Site Model

The COPCs contained in soil are associated with the paint waste material deposited in PSC 5. These COPCs can be leached from the soil and enter the groundwater through rainfall infiltration. The surface soil can be scrubbed from its current location during rainfall events and swept into nearby surface water features (i.e., ditch/creek to the immediate west or the St. Johns River to the immediate north).

The current land use is industrial. Therefore, the route of exposure is related to the types of activities that occur at an industrial site. This limits the route of exposure to dermal (direct contact with soil), incidental ingestion, and inhalation. The potential receptors are construction workers, maintenance or utility workers, and industrial workers.

This information is summarized in Table 10-1 and the generic graphic CSM is presented on Figure 10-1. Figure 10-2 depicts sampling rational from arbitrary LUC boundaries. Any future step out samples will be performed as necessary to complete delineation at this site to satisfy ROD requirements.

10.3 PSC 8

The following sections describe PSC 8, Vacant Lot East of the Fuel Farm.

10.3.1 Site Description

PSC 8 is a vacant lot east of Gas Hill (PSC 7) off Catapult Road (Figure 10-3). PSC 8 is approximately 200 feet wide by 2,000 feet long and is accessible from Catapult Road. It is located near the flight line and is inaccessible to most people at NAS Jacksonville. The eastern part is densely vegetated with bamboo and other shrubbery that limits access to this area. The site is mostly flat and slopes gently to the east. A drainage ditch, which flows east from Catapult Road to the St. Johns River, runs through the center of PSC 8. Groundwater flow is toward the east.

The northwest part of PSC 8 was used for storage of fighter jets used for parts. The area is lined with marsden matting. Several empty 55-gallon drums labeled “white regular dry waterborne traffic safety paint” were previously stored north of the planes.

Undated sewer line diagrams indicate a 6-inch cast iron sludge line running from the Old East Side WWTP north to the area where the planes were stored. According to a previous report, the pipe led to sludge drying beds. According to a former sewage plant foreman, industrial waste entered the Old East Side WWTP, went through a primary clarifier, was transported by pipe under the runway, and was discharged into a cut-out area that is the present drainage ditch to the west of Gas Hill (PSC 7) on the west side of PSC 8. The pipe was reportedly crushed during construction of the runway extension in 1961.

According to NAS Jacksonville personnel, sediment from a former polishing pond was periodically cleared out and spread in diked areas of PSC 8 north of the drainage ditch.

10.3.2 Previous Investigations

In February 1996, surface soil samples were collected in the areas of the sludge/spoil area, former sludge drying beds, and the clearing location where the sediments had been spread and buried. Pesticides and metals were detected in each of the samples, but none had concentrations exceeding the FDEP residential SCTLs, with the exception of arsenic in two of the samples.

In April 1997, site screening was performed at the site (HLA, 1999b). Samples were collected from visible suspect areas (Figure 10-3). Soil, subsurface soil, surface water, and sediment samples were collected for analysis of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs) – including polycyclic aromatic hydrocarbons (PAHs), pesticides, PCBs, and inorganics. The PSC 8 COPCs, as presented in Table 10-1, are based on the findings presented in the HLA Sampling Event Report (1999b).

10.3.3 Conceptual Site Model

The PSC 8 COPCs contained in soil are associated with former sewage plant sludge. These COPCs can be leached from the soil and enter the groundwater through rainfall infiltration. The surface soil can be scrubbed from its current location during rainfall events and swept into nearby surface water features (i.e., small creek to the immediate south and the St. Johns River to the immediate east).

The LUC restriction is industrial. Therefore, the route of exposure is related to the types of activities that occur at an industrial site. This limits the route of exposure to dermal (direct contact with soil), incidental ingestion, and inhalation. The potential receptors are construction workers, maintenance or utility workers, and industrial workers.

This information is summarized in Table 10-1 and the generic graphic CSM is presented on Figure 10-1. Figure 10-3 depicts sampling rational from arbitrary LUC boundaries. Any future step out samples will be performed as necessary to complete delineation at this site to satisfy ROD requirements.

10.4 PSC 9

The following sections describe PSC 9, the Old Disposal Area East of the Fuel Farm (Figure 10-3).

10.4.1 Site Description

The Old Disposal Area East of the Fuel Farm was identified as a PSC during the IAS (Hart, 1983). According to the IAS report, the site contained garbage, construction debris, and a few 55-gallon drums that were disposed of from 1977 to 1978. PSC 9 is located near the shoreline of the St. Johns River, just north and east of the main east-west runway. The site is approximately 200 feet wide by 400 feet long and is accessible from Catapult Road. The proximity of PSC 9 to the flight line makes it inaccessible to most people. PSC 9 has dense ground cover and shrubs, which also limits access to the site. The shoreline near PSC 9 is built up with concrete rubble and bricks. PSC 9 is located between two drainage ditches that flow east to the St. Johns River. The site is mostly flat and gently slopes to the east. Storm water runoff and groundwater flow is generally east toward the St. Johns River. The Verification Study Report (G&M, 1985) concluded that the specific conductance of the groundwater at PSC 9 was

influenced by the brackish water of the St. Johns River and that the river is a discharge point for groundwater.

In a 1959 aerial photograph, PSC 9 was devoid of vegetation; a small driveway led to the site. This photograph indicates that disposal at this site may have occurred prior to 1977. According to an engineer on station, unauthorized disposal also occurred at PSC 9 for an undetermined period after 1978 (HLA, 1999c). Between 1985 and 1988, organic and possibly other materials were disposed at PSC 9. Concrete runway debris was placed over the entire disposal area at PSC 9 and pushed underground by bulldozers (HLA, 1999c).

10.4.2 Previous Investigations

The IAS report recommended this site for a verification study based on the detection of chromium in soil and the potential for contaminant migration to surface water. During the Verification Study (G&M, 1985), three VOCs (methylene chloride, trichloroethene, and trans-1,2-dichloroethene) were detected at concentrations of 1.2 micrograms per liter (µg/L), 1.2 µg/L, and 21 µg/L, respectively. Three soil samples were collected and analyzed using the extraction procedure toxicity (EP Tox) test. According to the Verification Study Report, the EP Tox leachable concentrations of metals were less than the concentrations used to classify hazardous waste. In June and August 1997, HLA (1999c) collected additional soil, groundwater, surface water, and sediment samples (Figure 10-3). The findings of the 1997 sampling event were used to develop the COPCs listed in Table 10-1.

10.4.3 Conceptual Site Model

The PSC 9 COPCs contained in soil are associated with garbage and construction debris. These COPCs can be leached from the soil and enter the groundwater through rainfall infiltration. The surface soil can be scrubbed from its current location during rainfall events and swept into nearby surface water features (i.e., a small creek/drainage ditch to the north, a drainage ditch to the south, and the St. Johns River to the immediate east).

The current LUC restriction is industrial. Therefore, the route of exposure is related to the types of activities that occur at an industrial site. This limits the route of exposure to dermal (direct contact with soil), incidental ingestion, and inhalation. The potential receptors are construction workers, maintenance or utility workers, and industrial workers.

This information is summarized in Table 10-1 and the generic graphic CSM is presented on Figure 10-1. Figure 10-3 depicts sampling rational from arbitrary LUC boundaries. Any future step out samples will be performed as necessary to complete delineation at this site to satisfy ROD requirements.

10.5 PSC 29

The following sections describe PSC 29, Organic Disposal Area (Figure 10-4).

10.5.1 Site Description

PSC 29 is located to the east of Patrol Road near the southwest corner of NAS Jacksonville. It occupies approximately 15 acres and is relatively flat with debris piles. Crushed drums, construction debris, metal, abrasive material, creosote covered material, and polyvinyl chloride (PVC) pipe has been observed at the site, though it was designated as an organic disposal area. Since March 1991, NAS Jacksonville restricted access to PSC 29 and limited disposal to clean construction, demolition debris, dirt, street sweepings, organic material for landscaping, grass clippings, trees, stumps, and clean lumber. This landfill was closed to all activity in 2003.

10.5.2 Previous Investigations

Site screening was performed in 1997 and included soil and groundwater sampling (HLA, 1999d). Remedial action, consisting of contaminated soil removal, occurred in 1999 (BEI, 1999). The remedial action at PSC 29 consisted of excavating 1 foot of surface soils within a 15-foot radius of a hot spot (see soil sample #29S00501 on Figure 10-4). The findings of the 1997 sampling event were used to develop the COPCs listed in Table 10-1.

10.5.3 Conceptual Site Model

The PSC 29 COPCs contained in soil are associated with crushed drums, construction debris, metal, abrasive material, and creosote covered material. These COPCs can be leached from the soil and enter the groundwater through rainfall infiltration. The surface soil can be scrubbed from their current location during rainfall events and swept into nearby surface water features (i.e., a drainage ditch to the northwest).

The current LUC restriction is industrial. Therefore, the route of exposure is related to the types of activities that occur at an industrial site. This limits the route of exposure to dermal (direct contact with soil), incidental ingestion, and inhalation. The potential receptors are construction workers, maintenance or utility workers, and industrial workers.

This information is summarized in Table 10-1 and the generic graphic CSM is presented on Figure 10-1. Figure 10-4 depicts sampling rational from arbitrary LUC boundaries. Any future step out samples will be performed as necessary to complete delineation at this site to satisfy ROD requirements.

10.6 PSC 31

The following sections describe PSC 31, Former Asphalt Mixing Area (Figure 10-5).

10.6.1 Site Description

PSC 31 is located inside the Public Works Materials Laydown Area. It is approximately 1/3 acre in size and includes Building 1969 and the surrounding unpaved, graded gravel area. Leaking drums containing asphalt mix materials were reported to have been stored at this site. It is possible the oils used to mix the asphalt contained PCBs.

PSC 31 is generally flat with unlined drainage ditches to the west and east of the Laydown Area. At the time of the investigation, large piles of crushed limerock were present at the site (HLA, 1999e). The site is accessible by a paved road and locked gate. The Laydown Area surrounding PSC 31 contains piles of construction debris.

10.6.2 Previous Investigations

In 1997, HLA (HLA, 1999e) collected additional soil and subsurface soil samples, and one material sample (Figure 10-5). The PSC 31 COPCs were developed based on the findings of the 1997 sampling event and are presented in Table 10-1.

10.6.3 Conceptual Site Model

The PSC 31 COPCs contained in soil are associated with leaking drums containing asphalt/PCB-oil mix materials. These COPCs can be leached from the soil and enter the groundwater through rainfall infiltration. The surface soil can be scrubbed from their current location during rainfall events and swept into nearby surface water features (i.e., a small creek to the east).

The current LUC restriction is industrial. Therefore, the route of exposure is related to the types of activities that occur at an industrial site. This limits the route of exposure to dermal (direct contact with soil), incidental ingestion, and inhalation. The potential receptors are construction workers, maintenance or utility workers, and industrial workers.

This information is summarized in Table 10-1 and the generic graphic CSM is presented on Figure 10-1. Figure 10-5 depicts sampling rational from arbitrary LUC boundaries. Any future step out samples will be performed as necessary to complete delineation at this site to satisfy ROD requirements.

10.7 PSC 32

The following sections describe PSC 32, Ex-Base Landfill.

10.7.1 Site Description

PSC 32, the Ex-Base Landfill, is located east of Building 144 and 147 (Figure 10-5). PSC 32 originally occupied approximately 1½ acres; however, in 1990, the debris was combined into one mound occupying approximately 1/3 acre to the south. PSC 32 had been used during the 1960s for the disposal of soil, refuse, construction debris, and junked vehicles. In addition, dumpsters were present at PSC 32 to collect large household refuse such as appliances. The mound associated with the landfill was estimated to be nearly 300 feet long, 50 feet wide, and about 5 feet high.

The area surrounding PSC 32 is relatively flat. According to the Topographic and Drainage Map contained in the IAS report, PSC 32 is within the drainage basin of the Ortega River, approximately ¾ mile to the west. Groundwater is thought to flow to the southwest toward drainage ditches and tributary streams to the Ortega River. Storm water runoff likely flows toward the drainage ditch to the west-southwest of PSC 32.

10.7.2 Previous Investigations

A site screening was performed at PSC 32 in 1997 (HLA, 1999f). Seven surface soil and seven subsurface soil samples were collected (Figure 10-5). Two micro monitoring wells were installed along the downgradient perimeter of the site (Figure 10-5). All samples were analyzed for the full suite of Target Compound List (TCL) and Target Analyte List (TAL) parameters. The COPCs associated with PSC 32 were based on the findings in the referenced report and are presented in Table 10-1.

10.7.3 Conceptual Site Model

The PSC 32 COPCs contained in soil are associated with disposed material (e.g., soil, refuse, construction debris, and junked vehicles). These COPCs can be leached from the soil and enter the groundwater through rainfall infiltration. The surface soil can be scrubbed from their current location during rainfall events and swept into nearby surface water features (i.e., a small creek to the south or a small pond to the north).

The current LUC restriction is industrial. Therefore, the route of exposure is related to the types of activities that occur at an industrial site. This limits the route of exposure to dermal (direct contact with

soil), incidental ingestion, and inhalation. The potential receptors are construction workers, maintenance or utility workers, and industrial workers.

This information is summarized in Table 10-1 and the generic graphic CSM is presented on Figure 10-1. Figure 10-5 depicts sampling rational from arbitrary LUC boundaries. Any future step out samples will be performed as necessary to complete delineation at this site to satisfy ROD requirements.

10.8 PSC 50

The following sections describe PSC 50, East Side WWTP Sludge Disposal Area.

10.8.1 Site Description

PSC 50 is located south of the east end of the 9/27 taxiway and east of Bravo taxiway (Figure 10-6). The original East Side WWTP area was approximately 1 to 2 acres. The ground slopes gently from the paved area towards unlined drainage ditches to the south and east. The area is flat with an elevation of 7 to 8 feet above mean sea level (amsl). The facility was demolished after January 1975 and is now paved. After the East Side WWTP was demolished, the remaining sludge from the digesters and the sludge drying beds was dumped in a pit on the site and buried.

10.8.2 Previous Investigations

PSC 50 is a sludge disposal pit associated with the demolition of the East Side WWTP facility. The disposal pit was delineated and the sludge emitted organic vapor analysis readings between 1,000 to 1,200 parts per million (ppm). Organic vapors were not detected in the soil above or surrounding the pit. The pit was rectangular in shape, measuring approximately 108 feet long by 23 feet wide. There is no information on the design depth of the pit. Lithological logs indicate the sludge was noted in a range between 5 and 7.5 feet below ground surface (bgs). The depth to water was not recorded. The sludge was reported to be visibly distinguishable from the surrounding soil as the sludge was blackish in color and had a clay-like texture (HLA, 1999g). There were no reports indicating the sludge was removed and replaced with clean fill.

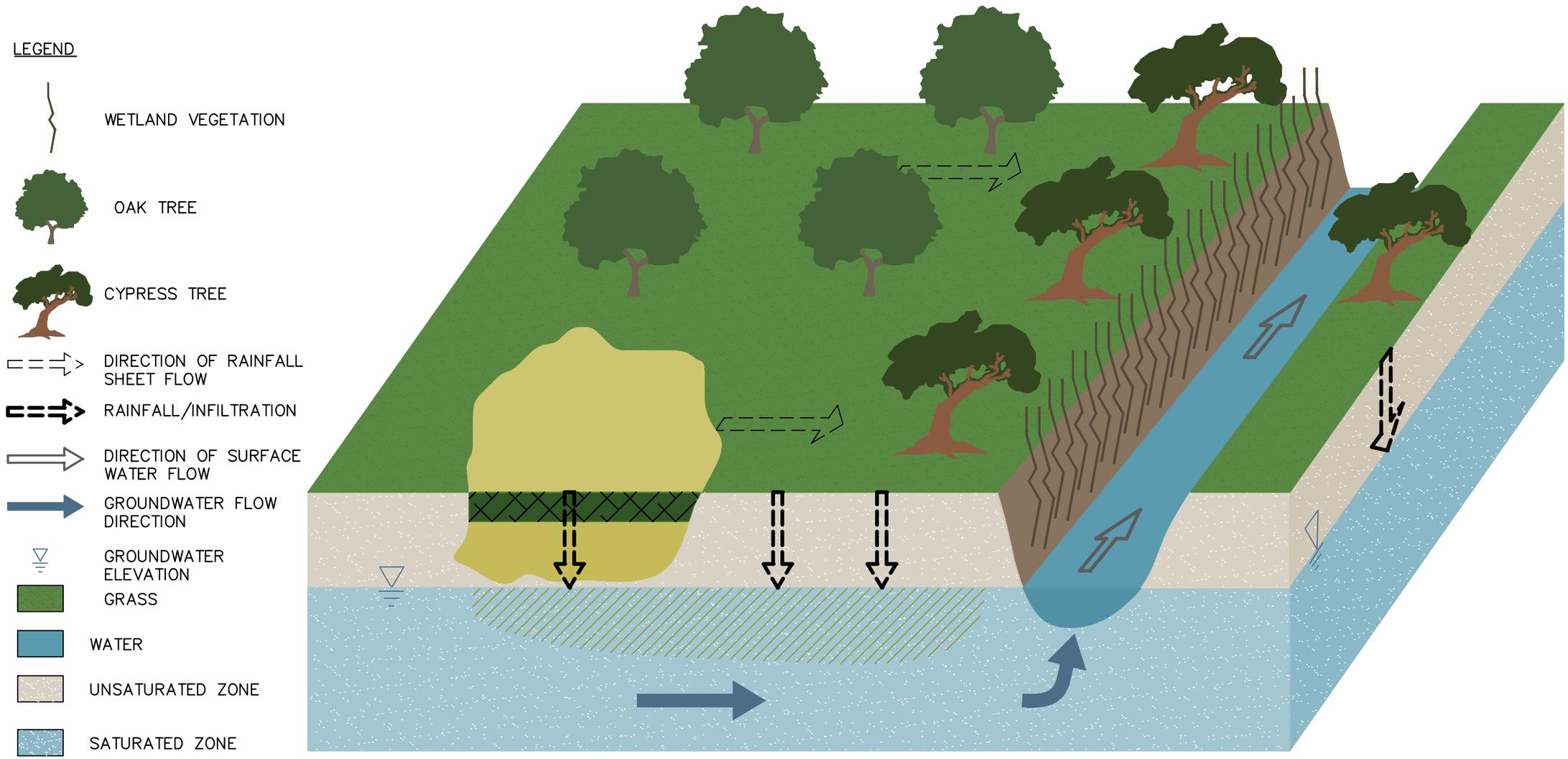
A study was conducted in April 1997 by HLA (1999g) during which soil samples were collected from four locations and groundwater samples were collected from two locations (Figure 10-6). The COPCs associated with PSC 50 were based on the study's findings and are presented in Table 10-1.

10.8.3 Conceptual Site Model

The PSC 50 COPCs contained in soil are associated with buried WWTP sludge. The area is paved; therefore, leaching of COPCs from soils into groundwater by rainfall infiltration is unlikely. In addition, the paved area removes the opportunity for surface soils, contaminated by buried WWTP sludge, to be scrubbed into ditches or surface water. These COPCs can be leached from the buried WWTP sludge that may be in direct contact with the groundwater. The groundwater, containing the COPCs, may then discharge into a drainage feature that is less than 300 feet to the southeast of PSC 50. This drainage feature directly connects to the St. Johns River.

The current LUC restriction is industrial. Therefore, the route of exposure is related to the types of activities that occur at an industrial site. This limits the route of exposure to dermal (direct contact with soil), incidental ingestion, and inhalation. The potential receptors are construction workers, maintenance or utility workers, and would only occur if there was a need to perform work below the current asphalt covered parking lot.

This information is summarized in Table 10-1 and the generic graphic CSM is presented on Figure 10-1. Figure 10-6 depicts sampling rational from arbitrary LUC boundaries. Any future step out samples will be performed as necessary to complete delineation at this site to satisfy ROD requirements.



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REVISED BY DATE			APPROVED BY DATE
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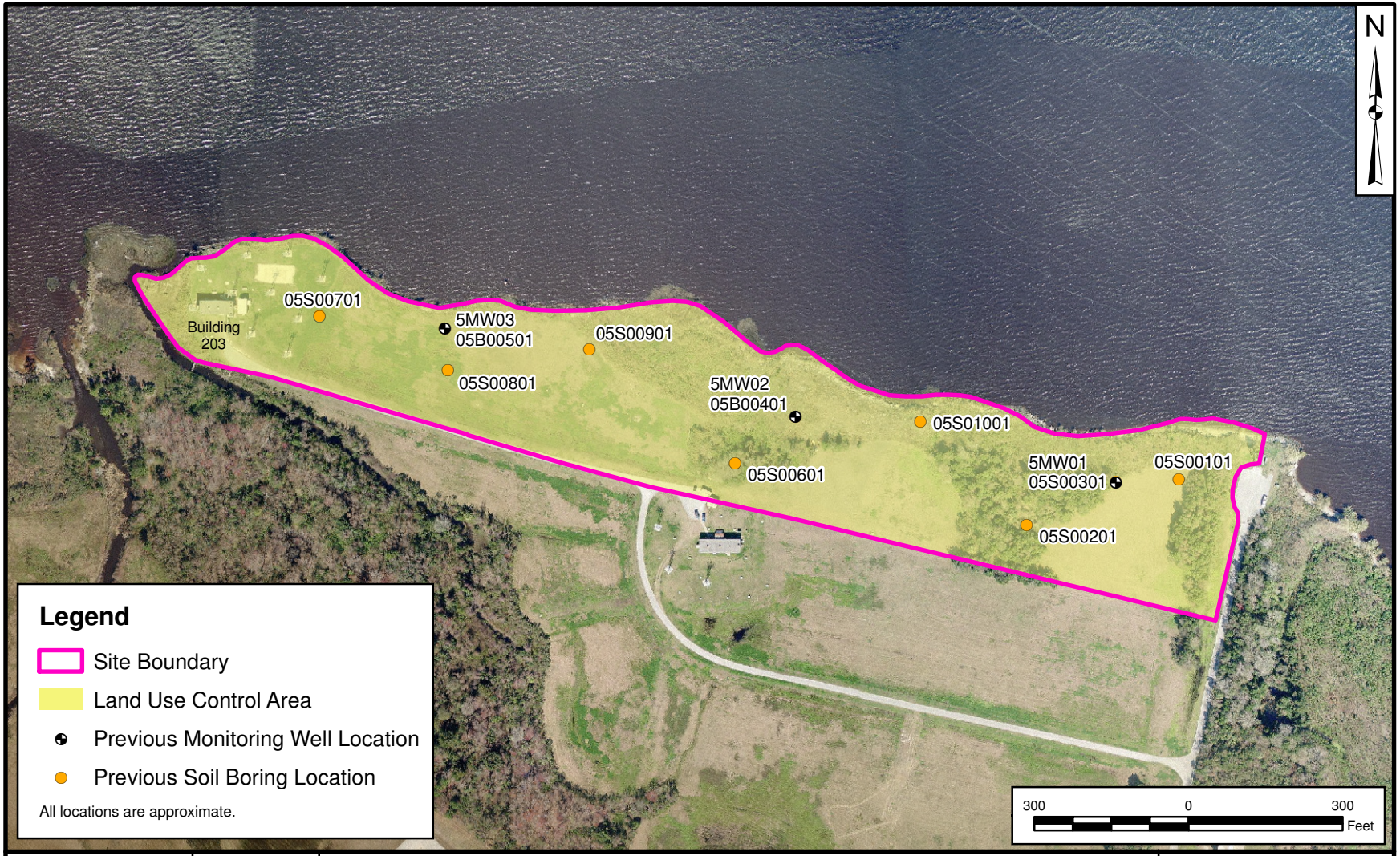

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SCALE AS NOTED	NAVFAC		FIGURE NO. 10-2 REV 0

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S. STROZ	5/11/11
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A. PATE	5/11/11
REVISED BY	DATE
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SCALE	
AS NOTED	

NAVFAC

HISTORICAL SAMPLE LOCATIONS
PSC 8 (VACANT LOT EAST OF FUEL FARM) AND
PSC 9 (OLD DISPOSAL AREA EAST OF FUEL FARM)
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

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FIGURE NO.	REV
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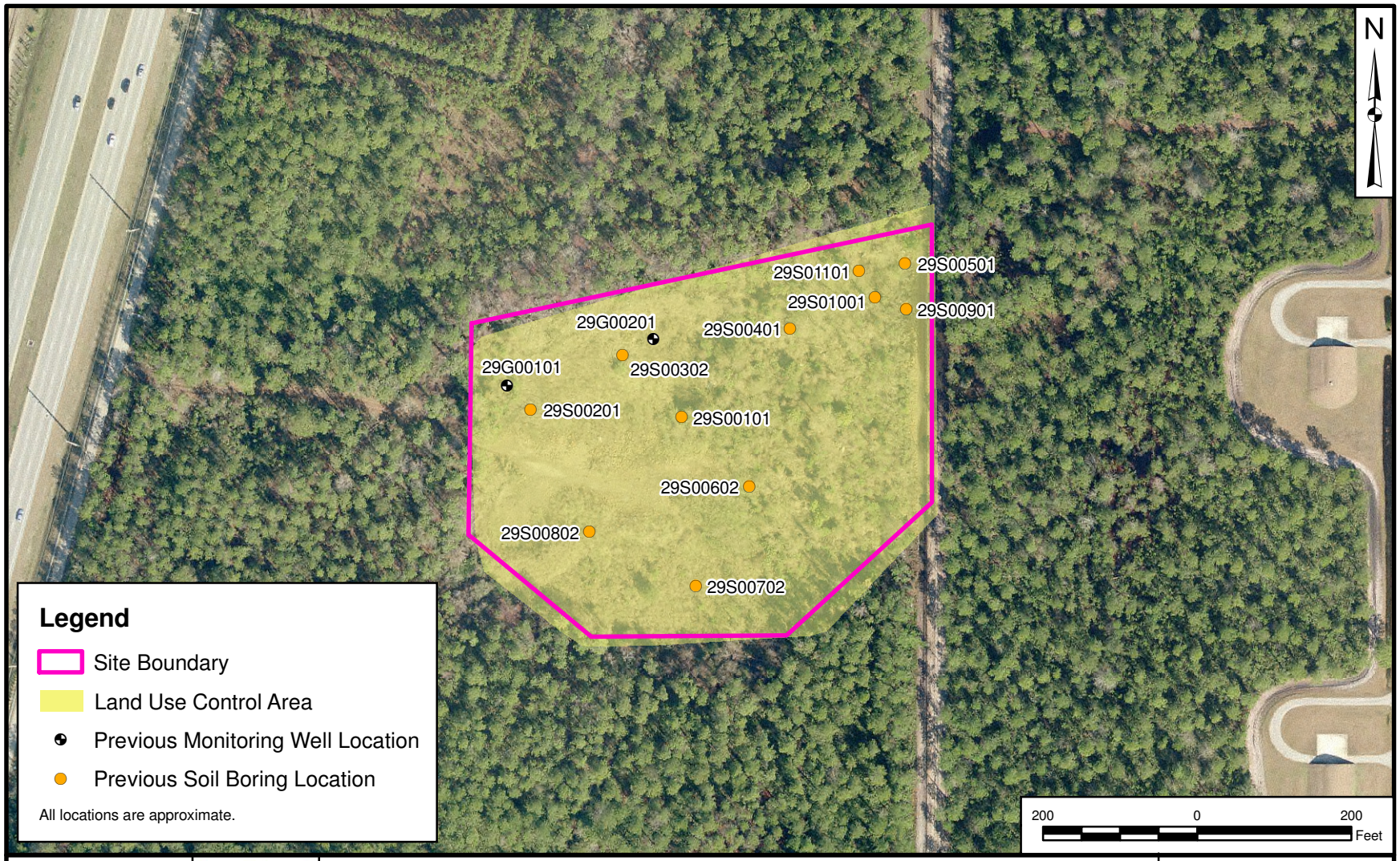

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REVISED BY ___	DATE ___	
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HISTORICAL SAMPLE LOCATIONS
PSC 29 - ORGANIC DISPOSAL AREA
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

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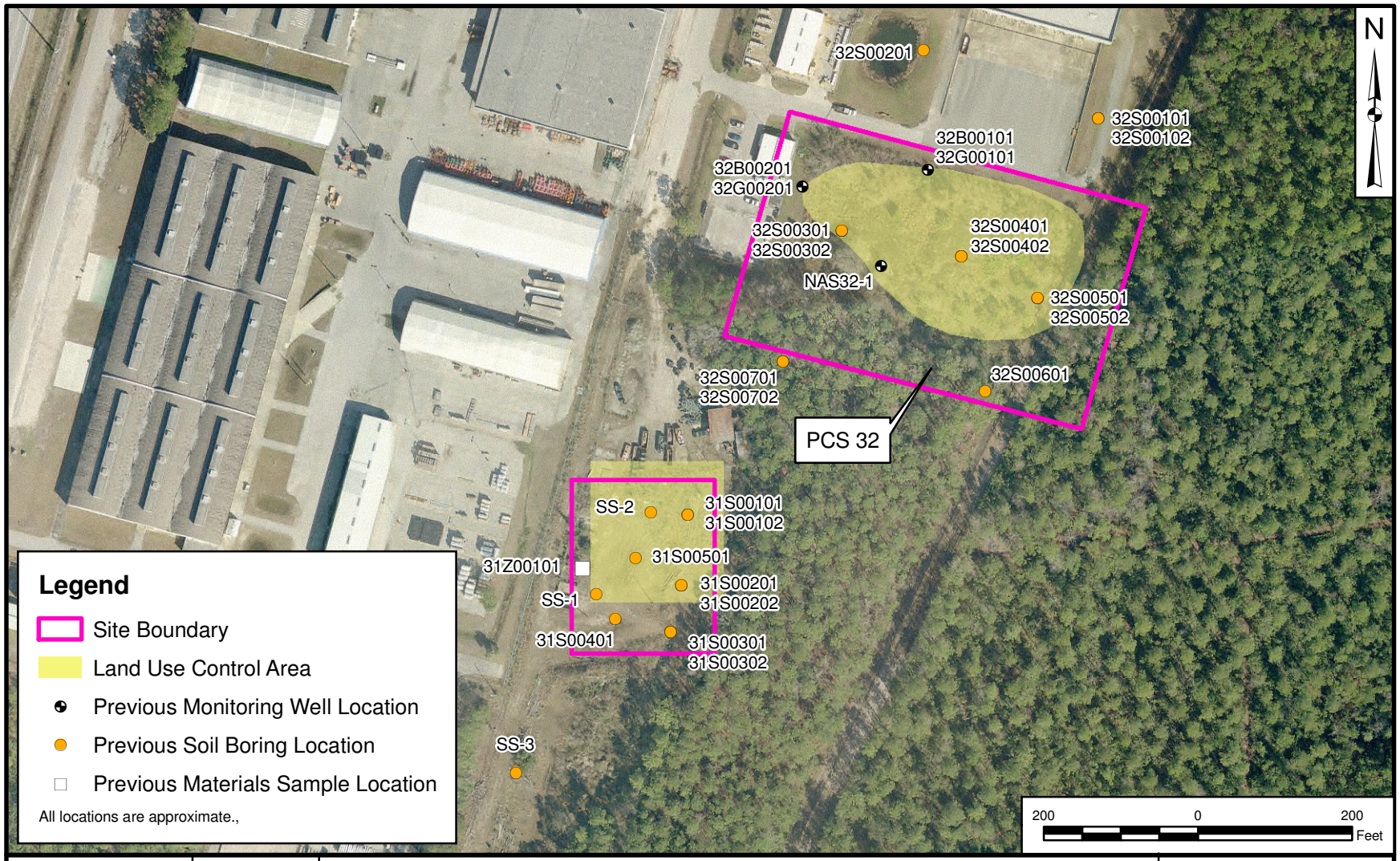

DRAWN BY S. STROZ	DATE 05/11/11	HISTORICAL SAMPLE LOCATIONS PSC 32 (EX-BASE LANDFILL) AND PSC 31 (FORMER ASPHALT MIX AREA) NAS JACKSONVILLE JACKSONVILLE, FLORIDA	CONTRACT NUMBER CTO 0152
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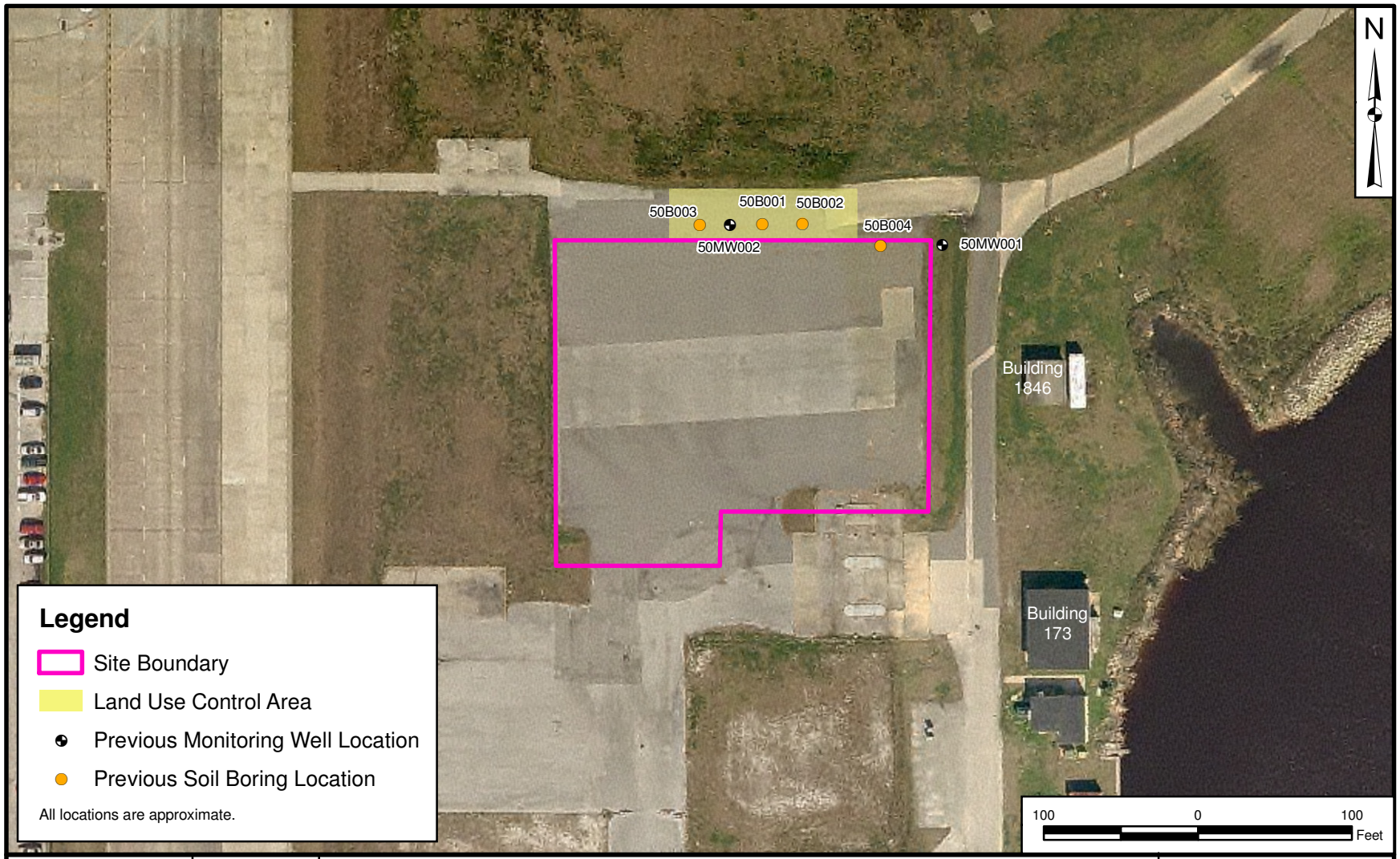

DRAWN BY J. ENGLISH	DATE 01/28/10	HISTORICAL SAMPLE LOCATIONS PSC 50 - EAST WWTP SLUDGE DRYING BEDS NAS JACKSONVILLE JACKSONVILLE, FLORIDA	CONTRACT NUMBER CTO 0152
CHECKED BY A. PATE	DATE 05/10/11		APPROVED BY ___ DATE ___
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SCALE AS NOTED			FIGURE NO. 10-6 / REV 0

SAP Worksheet #11 Data Quality Objectives/Systematic Planning Process Statements
(UFP-QAPP Manual Section 2.6.1)

11.1 PROBLEM DEFINITION

Historical activities related to site operations at PSC Sites 5, 8, 9, 29, 31, 32, and 50 led to contamination in surface soil and other environmental site media. Soil chemical concentrations that exceeded FDEP regulatory criteria were identified during a series of investigations conducted by HLA (HLA, 1999a - g). As a result, LUCs have been applied to these sites to protect human receptors from exposure to contaminated surface soil and to prevent access to groundwater for human consumption. However, because the LUC boundaries were developed based on a limited data set that could not be evaluated by statistical analysis, new data are required to verify the presence and extent of contamination at the sites. The original LUC boundaries were developed on the initial data set, which was limited, hence the need for this investigation. The new data set will be robust enough to statistically and spatially represent the entire area of each PSC. Once the new data has been collected, the Project Team can decide if LUCs with optimized boundaries are appropriate, if a groundwater investigation may be necessary, or if NFA is required for these PSC sites using residential soil data criteria.

11.2 INFORMATION INPUTS

To resolve the problem described in Section 11.1, the inputs presented below are needed. The Project Team has determined that a two-phase data collection effort is necessary. The first phase will evaluate total concentrations (mg/kg) of PSC-specific COPCs in soil and the second phase will additionally evaluate corresponding SPLP leachate concentrations (µg/L) in soil.

1. Chemical Data: Soil at the seven PSC sites will be analyzed for PSC-specific COPCs. The analytical methods are presented in Worksheet #19. The analytical methods will yield information on total concentrations (mg/kg) in soil and on the SPLP leachate concentrations (µg/L) in soil.

2. Project Action Limits (PALs): To facilitate decision-making, the soil total COPC concentrations (mg/kg) and the soil SPLP leachate COPC concentrations (µg/L) will be compared against the applicable FDEP criteria (SCTLs for soil and GCTLs for SPLP leachate, as identified in Chapter 62-777 F.A.C.). To conduct comparisons of PSC site total soil COPC concentrations and SPLP leachate COPC concentrations to the applicable PALs, the selected laboratory must be able to achieve Limits of Quantitation (LOQs) that are low enough to measure constituent concentrations that are less than the PALs for as many COPCs as possible using conventional methods. During project planning, some exceptions were noted for which the PALs will not be achievable with these methods. In those cases, Practical Quantitation Limits (PQLs) will become the default PAL in order for the Project Team to make decisions regarding this data. This

approach is consistent with the FDEP's guidance on how to manage conditions when the cleanup target level (CTL) is less than the quantitation limit using conventional methods (FDEP, 2007). Any such data limitations will be documented in the report. http://www.dep.state.fl.us/waste/quick_topics/rules/documents/62-777/TableIGroundwaterCTLs4-17-05.pdf

11.3 STUDY BOUNDARIES

Data will be collected from several populations of interest. These are surface soil (0 to 6 inches bgs and 6 inches to 2 feet bgs), subsurface soil (2 feet bgs to 4 feet bgs), subsurface soil (5 feet bgs to 7.5 feet bgs), and soil that has the potential to leach COPCs that may enter the groundwater. For this UFP-SAP, the subsurface population of soil is 2 to 4 feet bgs, or from 2 feet bgs to the bottom of the distinguishable sludge.

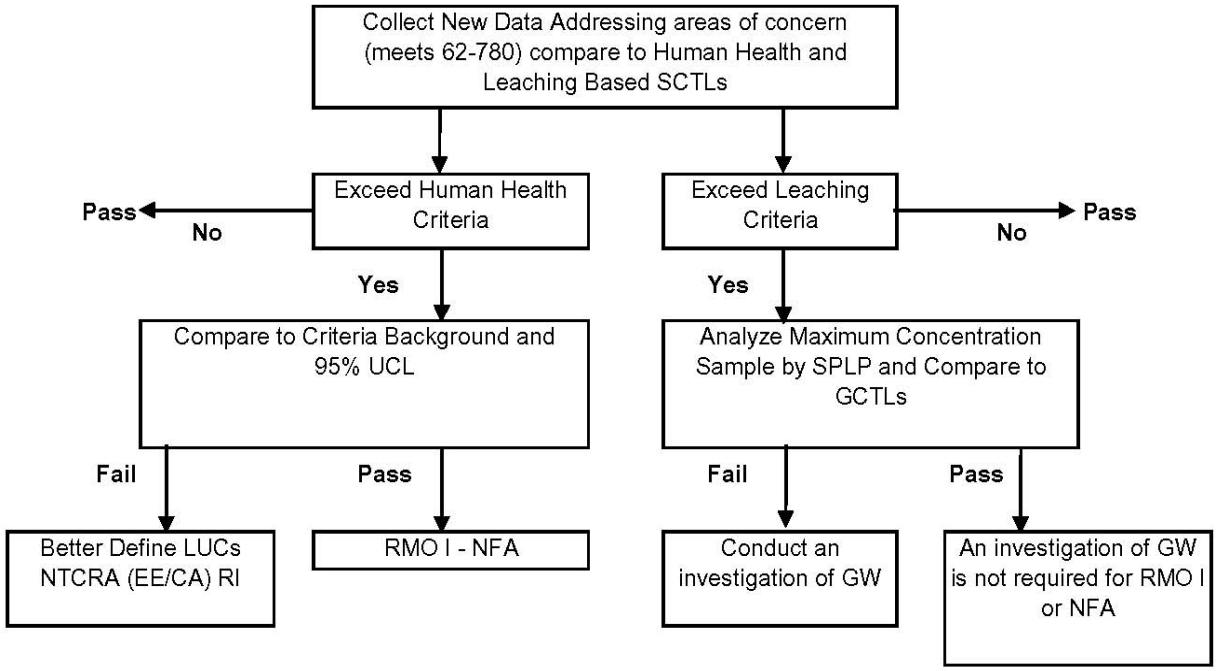
Horizontal Boundaries: Soils with COPC concentrations in excess of their PALs are expected to be contained within the horizontal site boundaries as noted on Figures 10-2 through 10-6. These site boundaries are based on prior land use activity and the results of prior site investigations.

Vertical Boundaries: The vertical boundary of the seven PSC sites is the shallowest of 4 feet bgs or the top of the water table. For PSC 50, the vertical boundary is the shallowest of 2 feet bgs or the top of the water table, as only two soil samples will be taken from each sampling location at PSC 50.

Temporal Boundaries: A two-phase data collection effort is required. The first phase will evaluate total soil concentrations (mg/kg) and the second phase will additionally evaluate corresponding soil SPLP leachate concentrations (µg/L). In order to maintain the representativeness of the data, the second phase soil samples must be collected within 120 days of when the first phase soil samples were collected.

11.4 ANALYTIC APPROACH

The analytical approach was developed during the Partnering Team meeting of July 21 and 22, 2009 and presented, during the meeting, as a flow chart which is reproduced in this section.



Contained in the flow chart are four potential outcomes. The four potential outcomes, and the pass or fail condition that leads to those outcomes, are presented in the following table.

Potential Outcomes		
Soil (mg/kg)	**Leachate (µg/L)**	**Potential Outcome**
Pass	Pass	Risk Management Options - Level I (RMO 1) on soils. No further action (NFA) on groundwater.
Fail	Fail	Better define LUCs; Conduct an Engineering Evaluation/Cost Analysis (EE/CA), a Non-Time-Critical Removal Action (NTCRA), and/or a remedial investigation (RI) on soils. Conduct a groundwater investigation.
Fail	Pass	Better define LUCs; Collect additional samples; Conduct an EE/CA, a NTCRA, and/or a RI on soils. NFA on groundwater.
Pass	Fail	RMO 1 on soils. Conduct a groundwater investigation.

The "Pass Outcome" for soil (mg/kg) has four possible conditions [Chapter 62-780.680(1)(b)(1)] associated with human health criteria and three possible conditions associated with leachability criteria. Only one condition is required for soil (mg/kg) to pass. The conditions are that the total soil concentrations (mg/kg) do not exceed the less stringent of:

Human Health

(I) The residential SCTL, or
(II) the 95% UCL of apportioned residential SCTLs, or
(III) background, or
(IV) the best achievable detection limits.

Leachability

(I) The leachability SCTL, or
(II) SPLP analyses of maximum value to GCTL, or
(III) groundwater comparison to GCTL.

Based on the flow chart and the potential outcome table, the following decision rules were developed. These decision rules define the decisions that will be made based on the obtained data.

Decision Rule #1

If one of the four "Pass" conditions for soil (mg/kg) exist and the SPLP leachate COPC concentrations (µg/L) do not exceed any PALs, then a Risk Management Options - Level I (RMO 1) will be conducted on soils to evaluate the existing LUC boundary, and no further action (NFA) will be requested on groundwater.

Decision Rule #2

If none of the four "Pass" conditions for soil (mg/kg) exist and a SPLP leachate COPC concentration (µg/L) does exceed the corresponding PALs, then the Project Team will evaluate the appropriate response action(s) for soil, which are: (a) better defining the LUCs by collecting additional samples to reduce the current boundary, or (b) an EE/CA, which will provide the basis for the selection of a NTCRA, or (c) an RI; and a groundwater investigation will be undertaken.

Decision Rule #3

If none of the four "Pass" conditions for soil (mg/kg) exist and a SPLP leachate COPC concentration (µg/L) does not exceed the PALs; then, no further action (NFA) is required on groundwater, but the Project Team will evaluate the appropriate response action(s) for soil, which are: (a) better defining the LUCs, or (b) an EE/CA which will provide the basis for the selection of a NTCRA, or (c) an RI.

Decision Rule #4

If one of the "Pass" four conditions for soil (mg/kg) exists and a SPLP leachate COPC concentration (µg/L) does exceed the PALs; then a RMO 1 will be conducted on soils and an investigation on groundwater is required.

11.5 PERFORMANCE/ ACCEPTANCE CRITERIA

Sample locations were based on the results from prior investigations (HLA, 1999a - g) and were strategically placed to determine if COPC concentrations exceed the PALs. This non-random selection of sample locations does not support the use of quantitative statistics to estimate decision performance as specified in the Guidance on Systematic Planning using the DQO Process (USEPA, 2006). Furthermore, the comparison of the 95% UCL against the PAL is not a statistical hypothesis test. Therefore, it is not necessary to specify limits on decision errors (USEPA, 2006).

The Project Team will use the results of the investigation based on this biased sampling approach to determine if the amount and type of data collected are sufficient to support the attainment of project

objectives. This will include an evaluation to ensure that targeted Method Detection Limits (MDLs), Limits of Detection (LOD), and LOQs meet the quality specifications in Worksheet #15, and other data quality indicators (DQIs) meet the specifications of Worksheets #34 through #37. . For example, If these parameters are not met, to determine NFA, or to reduce the current LUC boundary, TtNUS will propose additional sampling to reduce analytes, and propose a sampling strategy to better define or exclude the LUCs, per data collected in the previous sampling events, or, If all planned locations have yielded the intended data and the data are not compromised by quality deficiencies, the data will be concluded to be suitable and sufficient for decision making.

11.6 PLAN FOR OBTAINING DATA

The sampling design is presented in Worksheet #17.

SAP Worksheet #12 -- Measurement Performance Criteria Table - Field QC Samples

(UFP-QAPP Manual Section 2.6.2)

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPCs)	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Equipment Rinsate Blanks	All Fractions	One per 20 field samples per matrix per sampling equipment[1].	Accuracy/Bias/ Contamination	No analytes > ½ LOQ, except common laboratory contaminants, which must be < LOQ.	S&A
Field Duplicate	All Fractions	One per 10 field samples collected.	Precision	Values > 5X LOQ: Relative Percent Difference (RPD) must be ≤ 30%[2,3] .	S&A
Cooler Temperature Indicator	All Fractions	One per cooler.	Representativeness	Temperature must be between 2 and 6 degrees Celsius (4 ± 2 °C).	S

Notes:

1 Equipment rinsate blanks will be collected if non-dedicated submersible pumps or other equipment are used.

2 If duplicate values for non-metals are < 5x LOQ, the absolute difference should be < 2x LOQ.

3 If duplicate values for metals are < 5x LOQ, the absolute difference should be < 4x LOQ.

SAP Worksheet #13 -- Secondary Data Criteria and Limitations Table
(UFP-QAPP Manual Section 2.7)

Secondary Data	Data Source	Data Generator(s)	How Data Will Be Used	Limitations on Data Use
Aerial Photographs	Google Earth	TtNUS, Geographic Information Systems Department, January 2009	Data will be used to determine approximate sample areas and sample locations.	None.
Historical data on COPC concentrations in soil and groundwater	(HLA, 1999a-g)	Originating Organization: Harding Lawson Associates. Tallahassee, Florida Data Types: Soil and Groundwater Data Collection Dates: Summer 1997	Data may be used with data to be collected under this UFP-SAP to determine the appropriate response action for each of the seven PSC sites.	Although the analytical data are not recent, given the non-mobile nature of COPCs, it is believed that the data, when used with those collected under this UFP-SAP, will help the Project Team make scientifically valid decisions on the appropriate response actions.

SAP Worksheet #14 -- Summary of Project Tasks
(UFP-QAPP Manual Section 2.8.1)

14.1 FIELD INVESTIGATION TASKS

The field activities include:

- Mobilization/Demobilization
- Health and Safety Training
- Utility Clearance/dig permits
- Monitoring Equipment Calibration
- Soil Sampling
- Investigation-Derived Waste (IDW) Management/inspections
- Field Decontamination Procedures
- Field Documentation Procedures

Additional project activities include the following tasks:

- Analytical Tasks
- Data Management
- Data Review
- Project Reports

14.2 MOBILIZATION/DEMOBILIZATION

As noted in Worksheet #17, two mobilizations are required as one of the project objectives is to develop a relationship between SPLP leachate COPC concentrations (µg/L) and total COPC concentrations (mg/kg). As discussed in Worksheet #17, it is not possible in advance of sampling to determine which soil samples will be subjected to the SPLP. Therefore, the soil samples from the first mobilization will be analyzed for total COPC concentrations. These results will be used to determine where to collect soil samples that will additionally be subjected to the SPLP. Please see Worksheet #17 for more information on this subject.

Each mobilization shall consist of the delivery of all equipment, materials, and supplies to the site, the complete assembly in satisfactory working order of all such equipment at the site, and the satisfactory storage at the site of all such materials and supplies. TtNUS will coordinate with the Base to identify locations for the storage of equipment and supplies.

Each demobilization shall consist of the prompt and timely removal of all equipment, materials, and supplies from the site following completion of the work. Demobilization includes the cleanup and removal of waste generated during the conduction of the investigation.

14.3 HEALTH AND SAFETY TRAINING

Site-specific Health and Safety Training to all TtNUS field staff and subcontractors will be provided as part of the site mobilization.

14.4 UTILITY CLEARANCE/DIG PERMITS

Prior to the commencement of any intrusive activities, TtNUS will coordinate utility clearance with the Base and Sunshine State One Call. The Base and Utility Companies subscribed to Sunshine State One Call will identify and mark-out utilities that may be present within the soil boring locations.

14.5 MONITORING EQUIPMENT CALIBRATION

These procedures are described in Worksheet #22.

14.6 SOIL SAMPLING

The soil samples from the first mobilization will be analyzed for total COPC concentrations. The results will be used to determine which soil sample locations will be targeted in the second mobilization. The samples collected during the second mobilization will be analyzed for total COPC concentrations and SPLP leachate COPC concentrations.

14.6.1 Soil Samples: Total COPC Concentrations (mg/kg)

A total of 352 soil samples plus field QC samples will be collected from the seven PSC sites and analyzed for total COPC concentrations (mg/kg). All of the soil samples will be collected using the procedures specified in FS 3000, Soil Sampling (FDEP, 2008). Worksheets #17 and #18 specify the soil sampling locations and analyte groups for this investigation. Worksheet #19 specifies the analytical methods to be used.

14.6.2 Soil Samples: SPLP Leachate COPC Concentrations (µg/L)

A total of 21 soil samples plus field QC samples will be collected from the seven PSC sites and analyzed for SPLP leachate concentrations (µg/L). All of the soil samples will be collected using the procedures specified in FS 3000, Soil Sampling (FDEP, 2008). Worksheets #17 and #18 specify the soil sampling

locations and analyte groups for this investigation. Worksheet #19 specifies the analytical methods to be used.

14.7 INVESTIGATION-DERIVED WASTE MANAGEMENT/INSPECTIONS

Types of IDW generated during this investigation that could be potentially contaminated include excess soil material collected but not placed in the laboratory supplied sample jars, sampling equipment decontamination wastewaters, and personnel protective equipment (PPE) and clothing. Based on the historical site activities and types of contaminants present, none of these IDW materials is expected to present a significant risk to human health or the environment if properly managed, but will be disposed of in 55-gallon labeled, sealable steel drums provided by NAS Jacksonville Public Works Department. Excess soil will initially be placed in 55-gallon labeled, sealable steel drums provided by NAS Jacksonville Public Works Department. The drums will be inspected weekly until picked up and transported by the Public Works Department to a secured area designated by the Navy. Proper disposal of these wastes will be performed by the Navy (or its designee) after the analytical results of the soil samples are received from the laboratory and reviewed. Proper disposal of these wastes will be performed by the Navy (or its designee) after the analytical results of the groundwater samples are received from the laboratory and reviewed. PPE and clothing will be placed in 55-gallon labeled, sealable steel drums provided by NAS Jacksonville Public Works Department.

14.8 FIELD DECONTAMINATION PROCEDURE

Decontamination of major equipment and sampling equipment will be in general accordance with FC 1000, Cleaning / Decontamination Procedures (FDEP, 2008).

14.9 FIELD DOCUMENTATION PROCEDURES

Pre-preserved, certified-clean bottle ware will be supplied by Empirical. Matrix-specific sample log sheets will be maintained for each sample collected. In addition, sample collection information will be recorded in bound field notebooks or specific field forms. Samples will be packaged and shipped according to FS 1000, General Sampling Procedures (FDEP, 2008).

Field documentation will be performed in accordance with TtNUS Standard Operating Procedure (SOP) SA-6.3 (Appendix A). A summary of all field activities will be properly recorded in a bound logbook with consecutively numbered pages that cannot be removed. Logbooks will be assigned to field personnel and will be stored in a secured area when not in use.

At a minimum, the following information will be recorded in the site logbook:

- Name of the person to whom the logbook is assigned.
- Project name.
- Project start date.
- Names and responsibilities of on-site project personnel including subcontractor personnel.
- Arrival/departure of site visitors.
- Arrival/departure of equipment.
- Sampling activities and sample log sheet references.
- Description of subcontractor activities.
- Sample pick-up information, including chain-of-custody numbers, air bill numbers, carrier, time, and date.
- Description of borehole or monitoring well installation activities and operations.
- Health and safety issues.
- Description of photographs including date, time, photographer, roll and picture number, location, and compass direction of photograph.

All entries will be written in ink and no erasures will be made. If an incorrect entry is made, striking a single line through the incorrect information will make the correction; the person making the correction will initial and date the change.

14.10 ANALYTICAL TASKS

Chemical analyses will be performed by Empirical. Empirical is a current DoD Environmental Laboratory Accreditation Program (ELAP) accredited laboratory. A copy of the DoD ELAP accreditation for Empirical is provided in Appendix B. Analyses will be performed in accordance with the analytical methods identified in Worksheet #19. Empirical is expected to meet the PALs to the extent identified in Worksheet #15. Empirical will perform chemical analysis following laboratory-specific SOPs (Worksheets #19 and #23) developed based on the analytical methods listed in Worksheets #19 and #30. Copies of the Laboratory SOPs are included in Appendix B.

All soil results will be reported by the laboratory on a dry-weight basis. Results of percent moisture will be reported in each analytical data package and electronic data files. This information will also be captured

in the project database which will eventually be uploaded to Naval Installation Restoration Information Solutions (NIRIS). Percent moisture information will also be captured in the Site Investigation report.

14.11 DATA MANAGEMENT

Data Handling and Management – After the field investigation is completed, the field sampling log sheets will be organized by date and media and filed in the project files. The field logbooks for this project will be used only for these sites, and will also be categorized and maintained in the project files after the completion of the field program. Project personnel completing concurrent field sampling activities may maintain multiple field logbooks. When possible, logbooks will be segregated by sampling activity. The field logbooks will be titled based on date and activity. The data handling procedures to be followed by the laboratories will meet the requirements of the technical specification. The electronic data results will be automatically downloaded into the TtNUS database in accordance with proprietary TtNUS processes.

Data Tracking and Control – The TtNUS TOM (or designee) is responsible for the overall tracking and control of data generated for the project.

- Data Tracking: Data is tracked from its generation to its archiving in the TtNUS project-specific files. The TtNUS Project Chemist (or designee) is responsible for tracking the samples collected and shipped to the subcontracted laboratory. Upon receipt of the data packages from the analytical laboratory, the TtNUS Project Chemist will oversee the data validation effort, which includes verifying that the data packages are complete and results for all samples have been delivered by the analytical laboratory.

- Data Storage, Archiving, and Retrieval: The data packages received from the subcontracted laboratory are tracked in the data validation logbook. After the data are validated, the data packages are entered into the TtNUS CLEAN file system and archived in secure files. The field records including field logbooks, sample logs, chain-of-custody records, and field calibration logs will be submitted by the FOL to be entered into the CLEAN file system prior to archiving in secure project files. The project files are audited for accuracy and completeness. At the completion of the Navy contract, the records will be stored by TtNUS and eventually handed over to NAVFAC.

- Data Security: The TtNUS project files are restricted to designated personnel only. Records can only be borrowed temporarily from the project file using a sign-out system. The TtNUS Data Manager maintains the electronic data files. Access to the data files is restricted to qualified personnel only. File and data backup procedures are routinely performed.

Assessment and Oversight – Refer to Worksheet #32 for assessment findings and corrective actions and Worksheet #33 for QA management reports.

14.12 DATA REVIEW

- Data verification is described in Worksheet #34.
- Data validation is described in Worksheets #35 and #36.
- Usability assessment is described in Worksheet #37.

14.13 PROJECT REPORTS

Phase I and Phase II PSC Site Investigation reports will be prepared to document the results from the sampling events. The reports will include appropriate sections concerning site investigation activities, physical characteristics, nature and extent of contamination, and conclusions and recommendations.

Each report will be issued in draft to NAVFAC SE for initial review. NAVFAC SE comments will be addressed and the draft final report will be issued for regulatory review.

SAP Worksheet #15 - Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

List of Site-Specific COPCs at Each PSC Site

Analyte	PSC 5	PSC 8	PSC 9	PSC 29	PSC 31	PSC 32	PSC 50
PAHs (See next page for list of analytes)	Y	Y	Y	Y	Y	Y	
Pesticides							
Dieldrin		Y			Y		Y
PCBs							
Aroclor-1254						Y	
Aroclor-1260					Y	Y	Y
Metals							
Arsenic	Y	Y	Y	Y			
Barium			Y		Y		Y
Chromium (total)			Y		Y		Y
Copper							Y
Lead							Y
Manganese				Y			
Silver							Y

Y – This analyte (or analytical group) is a COPC at the PSC.

Matrix: Shallow surface soil and subsurface soil

Analyte	CAS Number	PAL (mg/kg)	PAL Reference[1]	Project Quantitation Limit Goal (mg/kg)	Empirical		
					LOQ (mg/kg)	LOD (mg/kg)	MDL (mg/kg)
PAHs (Low-Level)[2]							
Benzo(a)anthracene	56-55-3	0.15	USEPA R-RSL	0.050	0.010	0.005	0.0025
Benzo(a)pyrene	50-32-8	0.1	FDEP SCTL	0.033	0.010	0.005	0.0025
Benzo(b)fluoranthene	205-99-2	0.15	USEPA R-RSL	0.050	0.010	0.005	0.0025
Benzo(k)fluoranthene	207-08-9	1.5	USEPA R-RSL	0.50	0.010	0.005	0.0025
Chrysene	218-01-9	15	USEPA R-RSL	5.0	0.010	0.005	0.0025
Dibenz(a,h)anthracene	53-70-3	0.015	USEPA R-RSL	0.0050	0.010	0.005	0.0025
Indeno(1,2,3-cd)pyrene	193-39-5	0.15	USEPA R-RSL	0.050	0.010	0.005	0.0025
Pesticides							
Dieldrin	60-57-1	0.06	FDEP SCTL	0.020	0.020	0.01	0.005
PCBs							
Aroclor-1254	11097-69-1	0.5	FDEP SCTL	0.17	0.050	0.025	0.010
Aroclor-1260	11096-82-5	0.5	FDEP SCTL	0.17	0.050	0.025	0.010
Metals							
Arsenic	7440-38-2	2.1	FDEP SCTL	0.70	0.60	0.30	0.15
Barium	7440-39-3	120	FDEP SCTL	40	10	5	2
Chromium (total)[3]	7440-47-3	210	FDEP SCTL	40	10	5	2
Copper	7440-50-8	150	FDEP SCTL	50	10	5.0	2.0
Lead	7439-92-1	400	FDEP SCTL	130	5.0	2.5	1.0
Manganese	7439-96-5	3,500	FDEP SCTL	1,200	5.0	2.0	1.0
Silver	7440-22-4	410	FDEP SCTL	140	10	5.0	2.0

Analyte	CAS Number	PAL (mg/kg)	PAL Reference[1]	Project Quantitation Limit Goal (mg/kg)	Empirical		
					LOQ (mg/kg)	LOD (mg/kg)	MDL (mg/kg)

[1] PAL references: FDEP SCTLs at http://www.dep.state.fl.us/waste/quick_topics/rules/documents/62-777/TableIISoilCTLs4-17-05.pdf. USEPA Residential Regional Screening Levels (R-RSLs) (USEPA, 2009) at www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm.

[2] 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 February 2005 'Final Technical Report: Development of Cleanup Target Levels (CTLs) for Chapter 62-777, F.A.C. (FDEP, 2005).

[3] Unless concentrations for both chromium III and VI are known, total chromium concentrations should by compared with direct exposure SCTLs for chromium VI.

CAS – Chemical Abstract Service

Matrix: SPLP Leachate

Analyte	CAS Number	PAL (ug/L)	PAL Reference[1]	Project Quantitation Limit Goal (ug/L)	Empirical		
					LOQ (ug/L)	LOD (ug/L)	MDL (ug/L)
PAHs (Low-Level)[2]							
Benzo(a)anthracene	56-55-3	0.2	FDEP GCTL	0.067	0.20	0.10	0.05
Benzo(a)pyrene	50-32-8	0.2	FDEP GCTL	0.067	0.20	0.10	0.05
Benzo(b)fluoranthene	205-99-2	0.2	FDEP GCTL	0.067	0.20	0.10	0.05
Benzo(k)fluoranthene	207-08-9	0.2	FDEP GCTL	0.067	0.20	0.10	0.05
Chrysene	218-01-9	0.2	FDEP GCTL	0.067	0.20	0.10	0.05
Dibenz(a,h)anthracene	53-70-3	0.2	FDEP GCTL	0.067	0.20	0.10	0.05
Indeno(1,2,3-cd)pyrene	193-39-5	0.2	FDEP GCTL	0.067	0.20	0.10	0.05
Pesticides							
Dieldrin	60-57-1	0.2	FDEP GCTL	0.067	0.020	0.010	0.005
PCBs							
Aroclor-1254	11097-69-1	0.5	FDEP GCTL	0.17	0.50	0.25	0.125
Aroclor-1260	11096-82-5	0.5	FDEP GCTL	0.17	0.50	0.25	0.125
Metals							
Arsenic	7440-38-2	10	FDEP GCTL	3.3	2.5[3]	1.5[3]	0.5[3]
Barium	7440-39-3	2,000	FDEP GCTL	670	40	20	10
Chromium (total)	NOCAS	100	FDEP GCTL	33	10	4.0	2.0
Copper	7440-50-8	1,000	FDEP GCTL	330	25	12	6
Lead	7439-92-1	15	FDEP GCTL	5.0	5.0	2.5	1.0
Manganese	7439-96-5	50	FDEP GCTL	17	15	6.0	3.0
Silver	7440-22-4	100	FDEP GCTL	33	10	5.0	2.5

[1] FDEP GCTLs at http://www.dep.state.fl.us/waste/quick_topics/rules/documents/62-777/TableIGroundwaterCTLs4-17-05.pdf
[2] All PAHs will be converted to Benzo(a)pyrene equivalents and summed to compare to the FDEP GCTL for benzo(a)pyrene.
[3] LOQ, LOD, and MDL for these compounds - requires a 4X concentration step as outlined in USEPA Method 200.7.

SAP Worksheet #16 -- Project Schedule / Timeline Table
(UFP-QAPP Manual Section 2.8.2)

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Field Team First Mobilization	TtNUS	06/01/10	06/02/10	NA	NA
Soil Sampling	TtNUS	06/02/10	06/21/10		
Demobilization	TtNUS	06/21/10	06/22/10	NA	NA
Report Draft Submittal	TtNUS	08/01/10	08/01/10	Report Draft Submittal	08/01/10
Field Team Second Mobilization	TtNUS	08/05/10	08/07/10	NA	NA
Soil Sampling	TtNUS	08/07/10	08/27/10		
Demobilization	TtNUS	08/27/10	08/29/10	NA	NA
Report Draft Submittal	TtNUS	10/27/10	10/28/10	Report Draft Submittal	10/28/10

SAP Worksheet #17 –Sampling Design and Rationale
(UFP-QAPP Manual Section 3.1.1)

17.1 INTRODUCTION

The proposed soil sampling locations were chosen based on the current understanding of site-specific conditions. Previous investigations indicate that elevated levels of certain COPCs, including PAHs, pesticides, PCBs, and metals, are present in soil at the seven PSC sites (see Figure 10-2 through 10-6 and the associated tables in Appendix C). The purpose of the soil sampling and analysis is to provide data that will allow the Project Team to determine if no further action (NFA) is warranted, if the current LUC boundaries need to be adjusted, or if groundwater investigation is necessary. The decision as to which alternative may be appropriate for each of the seven PSC sites will be based on comparing total COPC concentrations in soil (mg/kg) and soil SPLP leachate COPC concentrations (µg/L) against the FDEP SCTL and GCTL criteria listed in Chapter 62-777 F.A.C. and other PALs as identified in Worksheet #15.

For sites that fail on direct leachability, one of the Project Team objectives is to develop a relationship between SPLP leachate COPC concentrations (µg/L) and total COPC concentrations (mg/kg). To achieve this objective, soil samples containing three relative concentrations (Low mg/kg, Medium mg/kg, and High mg/kg) of COPCs must be subjected to the SPLP procedure. Due to the nature of the COPCs, it is not possible in advance of sampling to determine which soil samples will contain one of the three relative concentrations of COPCs. Therefore, two mobilizations are required.

The soil samples from the first mobilization will be analyzed for total COPC concentrations (mg/kg). The results, based on previous historical sampling data, will be used to identify any exceedances of the soil PALs and to determine which soil sample locations contain one or more of the three relative concentrations (low mg/kg, medium mg/kg, and high mg/kg). A second mobilization is planned, during which time targeted locations will be resampled. These samples will be analyzed for total COPC concentrations (mg/kg) and for SPLP leachate COPC concentrations (µg/L). The leachate samples will be analyzed for the PSC-specific COPCs shown in Worksheet #15. The soil samples associated with the second mobilization should not be associated with used oil or similar petroleum products. Therefore, the use of the Toxicity Characteristic Leaching Procedure (TCLP) extraction method is not envisioned. The analytical results will be used to produce a graph of the SPLP leachate COPC concentrations (µg/L) versus the corresponding total COPC concentrations (mg/kg).

The location of the second mobilization samples will be based upon the laboratory results on the first mobilization samples. A “Low/Medium/High” criterion will be used to determine second mobilization sample locations. For example, If these parameters are not met, to determine NFA, or to reduce the current LUC boundary, TtNUS will propose additional sampling to reduce analytes, and propose a

sampling strategy to better define or exclude the LUCs, per data collected in the previous sampling events.

- At PSC 5, a first mobilization sample location that yields a relatively "Low" concentration (mg/kg) of a frequently detected COPC will be used to select a one of the three second mobilization locations. A "Medium" and a "High" concentration first mobilization sample location result will be used to select the locations of the remaining two second mobilization locations. A "Low" concentration is a concentration that is not above the 33rd percentile for the frequently detected COPC. A "Medium" concentration is a concentration between the 33rd percentile and the 66th percentile for the frequently detected COPC. The "High" concentration is a concentration that is above the 66th percentile for the frequently detected COPC. If expected COPC analytical groups (i.e., pesticides or PCBs) are not detected in at least three first mobilization samples within any particular PSC, the number of second mobilization samples within that PSC for that analytical group may be reduced accordingly, taking into account OVA readings from across the site.

Each of these seven PSC sites has unique characteristics that result in slight differences in number of samples and number and types of target analytes. However, there are important commonalities for all seven PSC sites. For example, the first mobilization will occur in the spring of 2010. The soil sampling activities will occur within 20 days. Demobilization will occur when the field crew leaves the site on or before the 20th day of field activity (see Worksheet #16). The second mobilization will occur approximately 60 days after receipt of the last set of data from the laboratory from the Phase I sampling event. At this time, it is envisioned that this second mobilization will occur in the summer of 2010. The soil sampling activities will occur within 20 days. Demobilization will occur when the field crew leaves the site on or before the 20th day of field activity.

Figures 17-1 through 17-5 depict sampling rational from arbitrary LUC boundaries. Any future step out samples will be performed as necessary to complete delineation at each site to satisfy ROD requirements.

The SOPs for each PSC site are listed in Worksheet #17. All PSC sites will follow FDEP SOP 001/01 FS 3000 for soil samples.

The COPCs associated with the soil total and SPLP leachate for each PSC site are presented in Worksheet #15. The Analytical Method/SOPs are identified in Worksheet #23. The number of QC samples is presented in Worksheet #20.

The number of soil sample locations and the sampling interval for each PSC site where the sample will be subjected to a total analysis is shown in the following table.

Site	Number of Sample Locations	Sampling Intervals				Total Field Samples	Total Field QC Samples
		0 to 0.5	0.5 to 2 feet	2 feet to 4 feet	5 feet to 7.5 feet		
PSC 5	32	x	x	x	-	96	15
PSC 8	8	x	x	x	-	24	6
	12	x	-	-	-	12	
PSC 9	8	x	x	x	-	24	8
	24	x	-	-	-	24	
PSC 29	28	x	-	-	-	28	5
PSC 31	12	x	x	x	-	36	8
	8	x	-	-	-	8	
PSC 32	20	x	x	x	-	60	12
	16	x	-	-	-	16	
PSC 50	12	-	x	x	x	36	8

The number of soil samples per site that will be subjected to the SPLP is three. The anticipated number of soil samples to be subjected to the SPLP by PSC site are shown in the following table.

Site	Anticipated Number of Phase II Samples
PSC 5	3
PSC 8	3
PSC 9	3
PSC 29	3
PSC 31	3
PSC 32	3
PSC 50	3

17.2 PSC 5

Soil samples from 32 locations will be collected from three soil horizons (see Worksheet #11, Worksheet #18, and Figure 17-1). The sampling intervals will be as follows: 0 to 6 inches bgs, 6 inches to 2 feet bgs, and 2 feet to 4 feet bgs (or 2 feet bgs to the top of the water table, if the top of the water table

is less than 4 feet bgs). This approach yields 96 soil samples. Three of these samples will be subjected to SPLP. Field QC samples will be collected, including 10 Field Duplicates, 5 samples for Matrix Spike/Matrix Spike Duplicate (MS/MSD) analysis (or MS/sample duplicate for metals), and 5 Equipment Rinsate Blanks.

17.3 PSC 8

Soil samples from 20 locations will be collected (see Worksheet #11 and Figure 17-2). For eight of the locations, the sampling intervals will be as follows: 0 to 6 inches bgs, 6 inches to 2 feet bgs, and 2 feet to 4 feet bgs (or 2 feet bgs to the top of the water table if the top of the water table is less than 4 feet bgs). For 12 of the locations, sampling interval is 0 to 6 inches bgs. This approach yields 36 soil samples. Three of these samples will be subjected to SPLP. Field QC samples will be collected, including four Field Duplicates, two samples for MS/MSD analysis (or MS/sample duplicate for metals), and two Equipment Rinsate Blanks.

17.4 PSC 9

Soil samples from 32 locations will be collected (see Worksheet #11 and Figure 17-2). For eight of the locations, the sampling intervals will be as follows: 0 to 6 inches bgs, 6 inches to 2 feet bgs, and 2 feet to 4 feet bgs (or 2 feet bgs to the top of the water table, if the top of the water table is less than 4 feet bgs). For 24 of the locations, sampling interval is 0 to 6 inches bgs. This approach yields 48 soil samples. Three of these samples will be subjected to SPLP. Field QC samples will be collected, including five Field Duplicates, three samples for MS/MSD analysis (or MS/sample duplicate for metals), and three Equipment Rinsate Blanks.

17.5 PSC 29

Soil samples from 28 locations will be collected from one soil horizon (see Worksheet #11 and Figure 17-3). The sampling intervals will be 0 to 6 inches bgs. This approach yields 28 soil samples. Three of these samples will be subjected to SPLP. Field QC samples will be collected, including three Field Duplicates, two samples for MS/MSD analysis (or MS/sample duplicate for metals), and two Equipment Rinsate Blanks.

17.6 PSC 31

Soil samples from 20 locations will be collected (see Worksheet #11 and Figure 17-4). For 12 of the locations, the sampling intervals will be as follows: 0 to 6 inches bgs, 6 inches to 2 feet bgs, and 2 feet to 4 feet bgs (or 2 feet to the top of the water table, if the top of the water table is less than 4 feet bgs). For eight of the locations, sampling interval is 0 to 6 inches bgs. This approach yields 44 soil samples. Three

of these samples will be subjected to SPLP. Field QC samples will be collected, including five Field Duplicates, three samples for MS/MSD analysis (or MS/sample duplicate for metals), and three Equipment Rinsate Blanks.

17.7 PSC 32

Soil samples from 36 locations will be collected (see Worksheet #11 and Figure 17-4). For 20 of the locations, the sampling intervals will be as follows: 0to 6 inches bgs, 6 inches to 2 feet bgs, and 2 feet to 4 feet bgs (or 2 feet to the top of the water table, if the top of the water table is less than 4 feet bgs). For 16 of the locations, sampling interval is 0 to 6 inches bgs. This approach yields 76 soil samples. Three of these samples will be subjected to SPLP. Field QC samples will be collected, including eight Field Duplicates, four samples for MS/MSD analysis (or MS/sample duplicate for metals), and four Equipment Rinsate Blanks.

17.8 PSC 50

Soil samples from 12 locations will be collected from three soil horizons (see Worksheet #11 and Figure 17-5). The sampling intervals will be as follows: 6 inches to 2 feet bgs, 2 feet to 4 feet bgs, and 5 feet to 7.5 feet, (or 2 feet bgs to the top of the water table, if the top of the water table is less than 4 feet bgs). This approach yields 36 soil samples. Three of these samples will be subjected to SPLP. Field QC samples will be collected, including three Field Duplicates, two samples for MS/MSD analysis (or MS/sample duplicate for metals), and two Equipment Rinsate Blanks.

P:\GIS\JACKSONVILLE_NAS\MAPDOCS\MXD\PSC05_SAMP_LOCS.MXD 3/10/10 KM

DRAWN BY	DATE
J. ENGLISH	10/29/09
CHECKED BY	DATE
J. JOHNSON	3/10/10
REVISED BY	DATE
T. WHEATON	02/03/10
SCALE	
AS NOTED	

NAVFAC

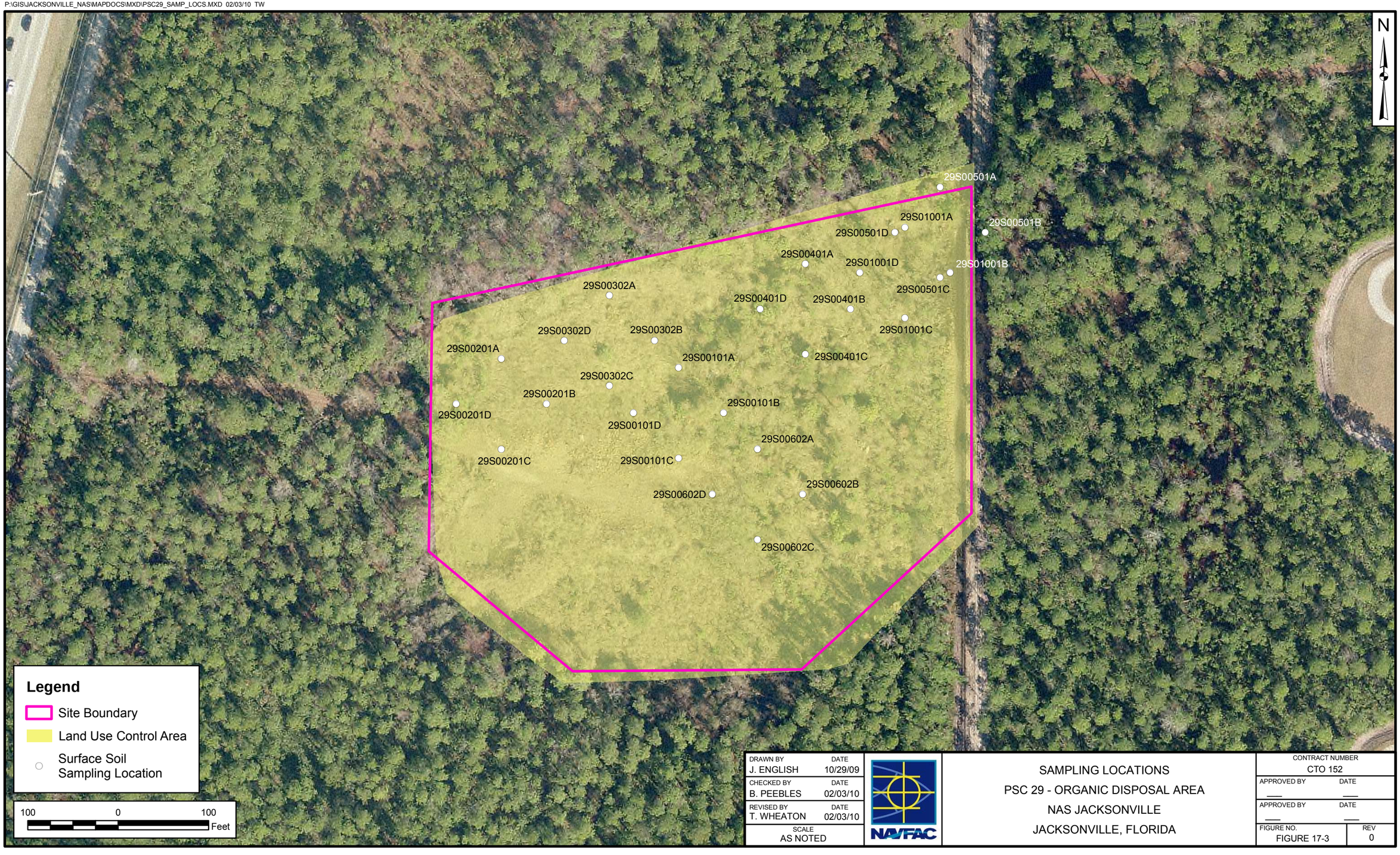
SAMPLING LOCATIONS
PSC 5 - SHORELINE FILL AREA AND RADIUM PLANT
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

CONTRACT NUMBER	
CTO 152	
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO.	REV
FIGURE 17-1	0

P:\GIS\JACKSONVILLE_NAS\MAPDOCS\MXD\PSC08_SAMP_LOCS.MXD 3/10/10 KM

DRAWN BY J. ENGLISH	DATE 10/29/09	SAMPLING LOCATIONS PSC 8 (VACANT LOT EAST OF FUEL FARM) AND PSC 9 (OLD DISPOSAL AREA EAST OF FUEL FARM) NAS JACKSONVILLE JACKSONVILLE, FLORIDA	CONTRACT NUMBER CTO 152
CHECKED BY J. JOHNSON	DATE 3/10/10		APPROVED BY ___ DATE ___
REVISED BY T. WHEATON	DATE 02/03/10		APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 17-2 / REV 0

P:\GIS\JACKSONVILLE_NAS\MAPDOCS\MXD\PSC29_SAMP_LOCS.MXD 02/03/10 TW



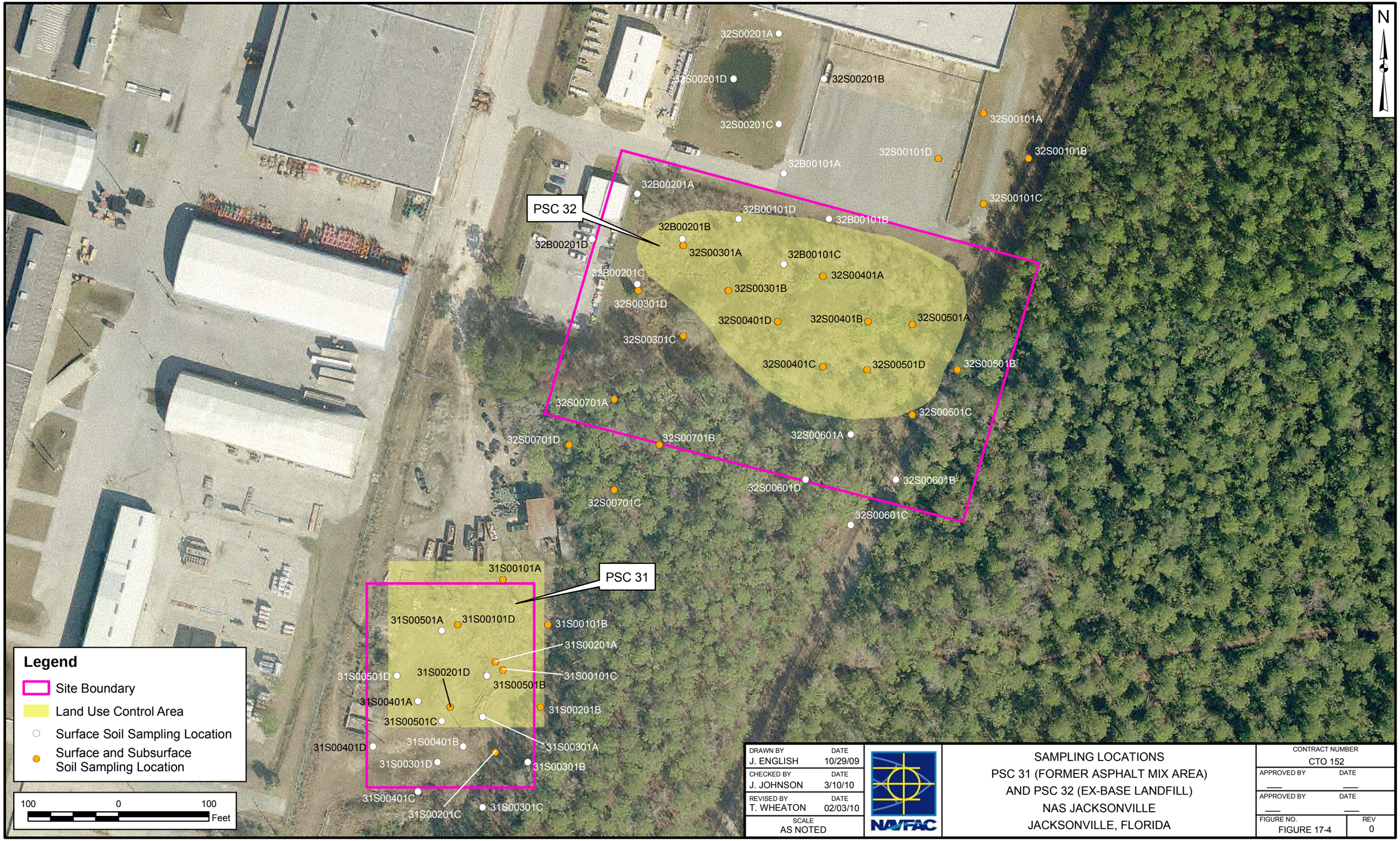
DRAWN BY	DATE
J. ENGLISH	10/29/09
CHECKED BY	DATE
B. PEEBLES	02/03/10
REVISED BY	DATE
T. WHEATON	02/03/10
SCALE	
AS NOTED	

NAVFAC

SAMPLING LOCATIONS
PSC 29 - ORGANIC DISPOSAL AREA
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

CONTRACT NUMBER	
CTO 152	
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO.	REV
FIGURE 17-3	0

P:\GIS\JACKSONVILLE_NAS\MAPDOCS\MXD\PSC3132_SAMP_LOCS.MXD 3/10/10 KM



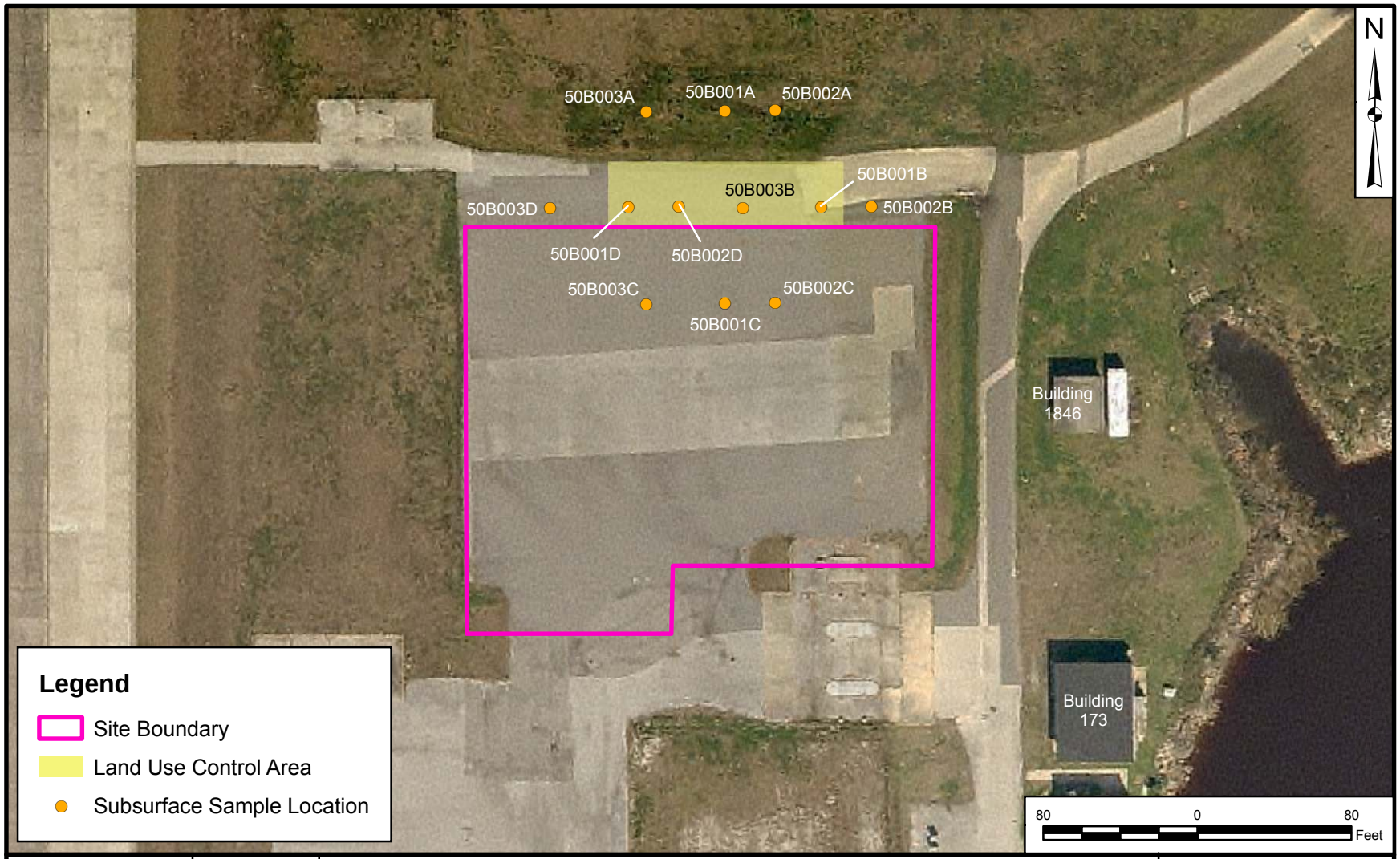
DRAWN BY	DATE
J. ENGLISH	10/29/09
CHECKED BY	DATE
J. JOHNSON	3/10/10
REVISED BY	DATE
T. WHEATON	02/03/10
SCALE	
AS NOTED	

NAVFAC

SAMPLING LOCATIONS
PSC 31 (FORMER ASPHALT MIX AREA)
AND PSC 32 (EX-BASE LANDFILL)
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

CONTRACT NUMBER	
CTO 152	
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO.	REV
FIGURE 17-4	0

P:\GIS\JACKSONVILLE_NAS\MXD\PSC50_SAMP_LOCS.MXD 02/03/10 TW



DRAWN BY J. ENGLISH	DATE 10/29/09	SAMPLING LOCATIONS PSC 50 - EAST WWTP SLUDGE DRYING BEDS NAS JACKSONVILLE JACKSONVILLE, FLORIDA	CONTRACT NUMBER CTO 152
CHECKED BY B. PEEBLES	DATE 02/03/10		APPROVED BY ___ DATE ___
REVISED BY T. WHEATON	DATE 02/03/10		APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 17-5 / REV 0

SAP Worksheet #18 –Sampling Locations and Methods/SOP Requirements Table
(UFP-QAPP Manual Section 3.1.1)

SAP Worksheet #18.1 –PSC 5 Soil Sampling Locations and Methods/SOP Requirements Table

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
05S0100A	05S0100A-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1, FDEP SOP 001/01 FS3000
05S0100A	05S0100A-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1, FDEP SOP 001/01 FS3000
05S0100A	05S0100A-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1, FDEP SOP 001/01 FS3000
05S0100B	05S0100B-S0-Date	soil	0 to 0.5	Metals and PAHs	1 + duplicate	CT-04, CT-05, SA-6.3, SA-7.1, FDEP SOP 001/01 FS3000
05S0100B	05S0100B-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1, FDEP SOP 001/01 FS3000
05S0100B	05S0100B-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1, FDEP SOP 001/01 FS3000
05S0100C	05S0100C-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1, FDEP SOP 001/01 FS3000
05S0100C	05S0100C-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1, FDEP SOP 001/01 FS3000
05S0100C	05S0100C-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1, FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
05S0100D	05S0100D-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1, FDEP SOP 001/01 FS3000
05S0100D	05S0100D-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1, FDEP SOP 001/01 FS3000
05S0100D	05S0100D-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1, FDEP SOP 001/01 FS3000
05S00101A	05S00101A-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1, FDEP SOP 001/01 FS3000
05S00101A	05S00101A-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1, FDEP SOP 001/01 FS3000
05S00101A	05S00101A-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1, FDEP SOP 001/01 FS3000
05S00101B	05S00101B-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1, FDEP SOP 001/01 FS3000
05S00101B	05S00101B-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1, FDEP SOP 001/01 FS3000
05S00101B	05S00101B-S2-Date	soil	2 to 4	Metals and PAHs	1 + duplicate	CT-04, CT-05, SA-6.3, SA-7.1, FDEP SOP 001/01 FS3000
05S00101C	05S00101C-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1, FDEP SOP 001/01 FS3000
05S00101C	05S00101C-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1, FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
05S00101C	05S00101C-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00101D	05S00101D-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00101D	05S00101D-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00101D	05S00101D-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00301A	05B00301A-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00301A	05B00301A-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00301A	05B00301A-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00301B	05B00301B-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00301B	05B00301B-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00301B	05B00301B-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00301C	05B00301C-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
05B00301C	05B00301C-S1-Date	soil	0.5 to 2	Metals and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00301C	05B00301C-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00301D	05B00301D-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00301D	05B00301D-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00301D	05B00301D-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00401A	05B00401A-S0-Date	soil	0 to 0.5	Metals and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00401A	05B00401A-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00401A	05B00401A-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00401B	05B00401B-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00401B	05B00401B-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00401B	05B00401B-S2-Date	soil	2 to 4	Metals and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
05B00401C	05B00401C-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00401C	05B00401C-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00401C	05B00401C-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00401D	05B00401D-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00401D	05B00401D-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00401D	05B00401D-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00501A	05B00501A-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00501A	05B00501A-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00501A	05B00501A-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00501B	05B00501B-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00501B	05B00501B-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
05B00501B	05B00501B-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00501C	05B00501C-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00501C	05B00501C-S1-Date	soil	0.5 to 2	Metals and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00501C	05B00501C-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00501D	05B00501D-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00501D	05B00501D-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05B00501D	05B00501D-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00701A	05S00701A-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00701A	05S00701A-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00701A	05S00701A-S2-Date	soil	2 to 4	Metals and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00701B	05S00701B-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
05S00701B	05S00701B-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00701B	05S00701B-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00701C	05S00701C-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00701C	05S00701C-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00701C	05S00701C-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00701D	05S00701D-S0-Date	soil	0 to 0.5	Metals and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00701D	05S00701D-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00701D	05S00701D-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00801A	05S00801A-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00801A	05S00801A-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00801A	05S00801A-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
05S00801B	05S00801B-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00801B	05S00801B-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00801B	05S00801B-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00801C	05S00801C-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00801C	05S00801C-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00801C	05S00801C-S2-Date	soil	2 to 4	Metals and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00801D	05S00801D-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00801D	05S00801D-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00801D	05S00801D-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00901A	05S00901A-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00901A	05S00901A-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
05S00901A	05S00901A-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00901B	05S00901B-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00901B	05S00901B-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00901B	05S00901B-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00901C	05S00901C-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00901C	05S00901C-S1-Date	soil	0.5 to 2	Metals and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00901C	05S00901C-S2-Date	soil	2 to 4	Metals and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00901D	05S00901D-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00901D	05S00901D-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
05S00901D	05S00901D-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
Phase II Soil Sampling Locations for SPLP Leachate COPC concentrations						
05S0TBD	05S0TBD-STBD-Date	soil	TBD	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 F3000
05S0TBD	05S0TBD-STBD-Date	soil	TBD	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 F3000
05S0TBD	05S0TBD-STBD-Date	soil	TBD	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 F3000

1 Depth as noted or to top of water table; whichever comes first.

2 For the Phase II Sampling Event, sample location, final ID Number and depth are to be determined (TBD) based upon the results from the Total COPC concentrations (mg/kg) sampling event.

SAP Worksheet #18.2 –PSC 8 Soil Sampling Locations and Methods/SOP Requirements Table
(UFP-QAPP Manual Section 3.1.1)

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
08S001A	08S001A-S0-Date	soil	0 to 0.5	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S001A	08S001A-S1-Date	soil	0.5 to 2	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S001A	08S001A-S2-Date	soil	2 to 4	Metals, pesticides, and PAHs	1 + duplicate	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S001B	08S001B-S0-Date	soil	0 to 0.5	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S001B	08S001B-S1-Date	soil	0.5 to 2	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S001B	08S001B-S2-Date	soil	2 to 4	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S001C	08S001C-S0-Date	soil	0 to 0.5	Metals, pesticides, and PAHs	1 + duplicate	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S001C	08S001C-S1-Date	soil	0.5 to 2	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S001C	08S001C-S2-Date	soil	2 to 4	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S001D	08S001D-S0-Date	soil	0 to 0.5	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
08S001D	08S001D-S1-Date	soil	0.5 to 2	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S001D	08S001D-S2-Date	soil	2 to 4	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S002A	08S002A-S0-Date	soil	0 to 0.5	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S002B	08S002B-S0-Date	soil	0 to 0.5	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S002C	08S002C-S0-Date	soil	0 to 0.5	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S002D	08S002D-S0-Date	soil	0 to 0.5	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S003A	08S003A-S0-Date	soil	0 to 0.5	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S003B	08S003B-S0-Date	soil	0 to 0.5	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S003C	08S003C-S0-Date	soil	0 to 0.5	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S003D	08S003D-S0-Date	soil	0 to 0.5	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
08S004A	08S004A-S0-Date	soil	0 to 0.5	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S004A	08S004A-S1-Date	soil	0.5 to 2	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S004A	08S004A-S2-Date	soil	2 to 4	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S004B	08S004B-S0-Date	soil	0 to 0.5	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S004B	08S004B-S1-Date	soil	0.5 to 2	Metals, pesticides, and PAHs	1 + duplicate	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S004B	08S004B-S2-Date	soil	2 to 4	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S004C	08S004C-S0-Date	soil	0 to 0.5	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S004C	08S004C-S1-Date	soil	0.5 to 2	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S004C	08S004C-S2-Date	soil	2 to 4	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S004D	08S004D-S0-Date	soil	0 to 0.5	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
08S004D	08S004D-S1-Date	soil	0.5 to 2	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S004D	08S004D-S2-Date	soil	2 to 4	Metals, pesticides, and PAHs	1 + duplicate	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S005A	08S005A-S0-Date	soil	0 to 0.5	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S005B	08S005B-S0-Date	soil	0 to 0.5	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S005C	08S005C-S0-Date	soil	0 to 0.5	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
08S005D	08S005D-S0-Date	soil	0 to 0.5	Metals, pesticides, and PAHs	1	CT-04, CT-05, SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
Phase II Soil Sampling Locations for SPLP Leachate COPC concentrations						
08STBD	08STBD-STBD-Date	soil	TBD	Metals, pesticides and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 F3000
08STBD	08STBD-STBD-Date	soil	TBD	Metals, pesticides and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 F3000
08STBD	08STBD-STBD-Date	soil	TBD	Metals, pesticides and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 F3000

1 Depth as noted or to top of water table; whichever comes first.
2 For the Phase II Sampling Event, sample location, final ID Number and depth are to be determined (TBD) based upon the results from the Total COPC concentrations (mg/kg) sampling event.

SAP Worksheet #18.3 –PSC 9 Soil Sampling Locations and Methods/SOP Requirements Table
(UFP-QAPP Manual Section 3.1.1)

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
09B00101A	09B00101A-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00101A	09B00101A-S1-Date	soil	0.5 to 2	Metals and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00101A	09B00101A-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00101B	09B00101B-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00101B	09B00101B-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00101B	09B00101B-S2-Date	soil	2 to 4	Metals and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00101C	09B00101C-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
09B00101C	09B00101C-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00101C	09B00101C-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00101D	09B00101D-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00101D	09B00101D-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00101D	09B00101D-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00102A	09B00102A-S0-Date	soil	0 to 0.5	Metals and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00102A	09B00102A-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00102B	09B00102B-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
09B00102B	09B00102B-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00102C	09B00102C-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00102C	09B00102C-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00102D	09B00102D-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00102D	09B00102D-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00102D	09B00102D-S2-Date	soil	2 to 4	Metals and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00201A	09B00201A-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00201A	09B00201A-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
09B00201A	09B00201A-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00201B	09B00201B-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00201B	09B00201B-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00201B	09B00201B-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00201C	09B00201C-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00201C	09B00201C-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00201C	09B00201C-S2-Date	soil	2 to 4	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09B00201D	09B00201D-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
09B00201D	09B00201D-S1-Date	soil	0.5 to 2	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09S00101A	09S00101A-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09S00101B	09S00101B-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09S00101C	09S00101C-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09S00101D	09S00101D-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09S00301A	09S00301A-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09S00301B	09S00301B-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09S00301C	09S00301C-S0-Date	soil	0 to 0.5	Metals and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
09S00301D	09S00301D-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09S00401A	09S00401A-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09S00401B	09S00401B-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09S00401C	09S00401C-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09S00401D	09S00401D-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09S00501A	09S00501A-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09S00501B	09S00501B-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
09S00501C	09S00501C-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
09S00501D	09S00501D-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
Phase II Soil Sampling Locations for SPLP Leachate COPC concentrations						
09B00TBD	09B00TBD-STBD-Date	soil	TBD	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 F3000
09B00TBD	09B00TBD--Date	soil	TBD	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 F3000
09B00TBD	09B00TBD-STBD-Date	soil	TBD	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 F3000

1 Depth as noted or to top of water table; whichever comes first.

2 For the Phase II Sampling Event, sample location, final ID Number and depth are to be determined (TBD) based upon the results from the Total COPC concentrations (mg/kg) sampling event.

SAP Worksheet #18.4 –PSC 29 Soil Sampling Locations and Methods/SOP Requirements Table
(UFP-QAPP Manual Section 3.1.1)

Sampling Location	ID Number	Matrix	Depth (feet)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
29S01001A	29S01001A-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S01001B	29S01001B-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S01001C	29S01001C-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S01001D	29S01001D-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S00101A	29S00101A-S0-Date	soil	0 to 0.5	Metals and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S00101B	29S00101B-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S00101C	29S00101C-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S00101D	29S00101D-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S00201A	29S00201A-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
29S00201B	29S00201B-S0-Date	soil	0 to 0.5	Metals and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S00201C	29S00201C-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S00201D	29S00201D-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S00302A	29S00302A-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S00302B	29S00302B-S0-Date	soil	0 to 0.5	Metals and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S00302C	29S00302C-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S00302D	29S00302D-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S00401A	29S00401A-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S00401B	29S00401B-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S00401C	29S00401C-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
29S00401D	29S00401D-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S00501A	29S00501A-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S00501B	29S00501B-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S00501C	29S00501C-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S00501D	29S00501D-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S00602A	29S00602A-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S00602B	29S00602B-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S00602C	29S00602C-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
29S00602D	29S00602D-S0-Date	soil	0 to 0.5	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
Phase II Soil Sampling Locations for SPLP Leachate COPC concentrations						
29S0TBD	29S0TBD-STBD-Date	soil	TBD	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 F3000
29S0TBD	29S0TBD-STBD-Date	soil	TBD	Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 F3000
29S0TBD	29S0TBD-STBD-Date	soil	TBD	Metals and PAHs	1+ duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 F3000

1 For the Phase II Sampling Event, sample location, final ID Number and depth are to be determined (TBD) based upon the results from the Total COPC concentrations (mg/kg) sampling event.

SAP Worksheet #18.5 –PSC 31 Soil Sampling Locations and Methods/SOP Requirements Table
(UFP-QAPP Manual Section 3.1.1)

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
31S00101A	31S00101A-S0-Date	soil	0 to 0.5	PCBs, Pesticides, Metals, and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00101A	31S00101A-S1-Date	soil	0.5 to 2	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00101A	31S00101A-S2-Date	soil	2 to 4	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00101B	31S00101B-S0-Date	soil	0 to 0.5	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00101B	31S00101B-S1-Date	soil	0.5 to 2	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00101B	31S00101B-S2-Date	soil	2 to 4	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00101C	31S00101C-S0-Date	soil	0 to 0.5	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00101C	31S00101C-S1-Date	soil	0.5 to 2	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00101C	31S00101C-S2-Date	soil	2 to 4	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
31S00101D	31S00101D-S0-Date	soil	0 to 0.5	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00101D	31S00101D-S1-Date	soil	0.5 to 2	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00101D	31S00101D-S2-Date	soil	2 to 4	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00201A	31S00201A-S0-Date	soil	0 to 0.5	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00201A	31S00201A-S1-Date	soil	0.5 to 2	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00201A	31S00201A-S2-Date	soil	2 to 4	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00201B	31S00201B-S0-Date	soil	0 to 0.5	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00201B	31S00201B-S1-Date	soil	0.5 to 2	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00201B	31S00201B-S2-Date	soil	2 to 4	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00201C	31S00201C-S0-Date	soil	0 to 0.5	PCBs, Pesticides, Metals, and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
31S00201C	31S00201C-S1-Date	soil	0.5 to 2	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00201C	31S00201C-S2-Date	soil	2 to 4	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00201D	31S00201D-S0-Date	soil	0 to 0.5	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00201D	31S00201D-S1-Date	soil	0.5 to 2	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00201D	31S00201D-S2-Date	soil	2 to 4	PCBs, Pesticides, Metals, and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00301A	31S00301A-S0-Date	soil	0 to 0.5	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00301A	31S00301A-S1-Date	soil	0.5 to 2	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00301A	31S00301A-S2-Date	soil	2 to 4	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00301B	31S00301B-S0-Date	soil	0 to 0.5	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00301B	31S00301B-S1-Date	soil	0.5 to 2	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
31S00301B	31S00301B-S2-Date	soil	2 to 4	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00301C	31S00301C-S0-Date	soil	0 to 0.5	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00301C	31S00301C-S1-Date	soil	0.5 to 2	PCBs, Pesticides, Metals, and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00301C	31S00301C-S2-Date	soil	2 to 4	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00301D	31S00301D-S0-Date	soil	0 to 0.5	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00301D	31S00301D-S1-Date	soil	0.5 to 2	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00301D	31S00301D-S2-Date	soil	2 to 4	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00401A	31S00401A-S0-Date	soil	0 to 0.5	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00401B	31S00401B-S0-Date	soil	0 to 0.5	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00401C	31S00401C-S0-Date	soil	0 to 0.5	PCBs, Pesticides, Metals, and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
31S00401D	31S00401D-S0-Date	soil	0 to 0.5	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00501A	31S00501A-S0-Date	soil	0 to 0.5	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00501B	31S00501B-S0-Date	soil	0 to 0.5	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00501C	31S00501C-S0-Date	soil	0 to 0.5	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
31S00501D	31S00501D-S0-Date	soil	0 to 0.5	PCBs, Pesticides, Metals, and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
Phase II Soil Sampling Locations for SPLP Leachate COPC concentrations						
31S00TBD	31S00TBD-STBD-Date	soil	TBD	PCBs, Pesticides, Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 F3000
31S00TBD	31S00TBD-STBD-Date	soil	TBD	PCBs, Pesticides, Metals and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 F3000
31S00TBD	31S00TBD-STBD-Date	soil	TBD	PCBs, Pesticides, Metals and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 F3000

1 Depth as noted or to top of water table; whichever comes first.

2 For the Phase II Sampling Event, sample location, final ID Number and depth are to be determined (TBD) based upon the results from the Total COPC concentrations (mg/kg) sampling event.

SAP Worksheet #18.6 –PSC 32 Soil Sampling Locations and Methods/SOP Requirements Table
(UFP-QAPP Manual Section 3.1.1)

Sampling Location	ID Number	Matrix	Depth (feet)	Analytical Group[1]	Number of Samples (identify field duplicates)	Sampling SOP Reference
32B00101A	32B00101A-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32B00101B	32B00101B-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32B00101C	32B00101C-S0-Date	soil	0 to 0.5	PCBs and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32B00101D	32B00101D-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32B00201A	32B00201A-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32B00201B	32B00201B-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32B00201C	32B00201C-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32B00201D	32B00201D-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00101A	32S00101A-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)	Analytical Group[1]	Number of Samples (identify field duplicates)	Sampling SOP Reference
32S00101A	32S00101A-S1-Date	soil	0.5 to 2	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00101A	32S00101A-S2-Date	soil	2 to 4	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00101B	32S00101B-S0-Date	soil	0 to 0.5	PCBs and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00101B	32S00101B-S1-Date	soil	0.5 to 2	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00101B	32S00101B-S2-Date	soil	2 to 4	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00101C	32S00101C-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00101C	32S00101C-S1-Date	soil	0.5 to 2	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00101C	32S00101C-S2-Date	soil	2 to 4	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00101D	32S00101D-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00101D	32S00101D-S1-Date	soil	0.5 to 2	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)	Analytical Group[1]	Number of Samples (identify field duplicates)	Sampling SOP Reference
32S00101D	32S00101D-S2-Date	soil	2 to 4	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00201A	32S00201A-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00201B	32S00201B-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00201C	32S00201C-S0-Date	soil	0 to 0.5	PCBs and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00201D	32S00201D-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00301A	32S00301A-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00301A	32S00301A-S1-Date	soil	0.5 to 2	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00301A	32S00301A-S2-Date	soil	2 to 4	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00301B	32S00301B-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00301B	32S00301B-S1-Date	soil	0.5 to 2	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)	Analytical Group[1]	Number of Samples (identify field duplicates)	Sampling SOP Reference
32S00301B	32S00301B-S2-Date	soil	2 to 4	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00301C	32S00301C-S0-Date	soil	0 to 0.5	PCBs and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00301C	32S00301C-S1-Date	soil	0.5 to 2	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00301C	32S00301C-S2-Date	soil	2 to 4	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00301D	32S00301D-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00301D	32S00301D-S1-Date	soil	0.5 to 2	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00301D	32S00301D-S2-Date	soil	2 to 4	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00401A	32S00401A-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00401A	32S00401A-S1-Date	soil	0.5 to 2	PCBs and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00401A	32S00401A-S2-Date	soil	2 to 4	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)	Analytical Group[1]	Number of Samples (identify field duplicates)	Sampling SOP Reference
32S00401B	32S00401B-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00401B	32S00401B-S1-Date	soil	0.5 to 2	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00401B	32S00401B-S2-Date	soil	2 to 4	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00401C	32S00401C-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00401C	32S00401C-S1-Date	soil	0.5 to 2	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00401C	32S00401C-S2-Date	soil	2 to 4	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00401D	32S00401D-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00401D	32S00401D-S1-Date	soil	0.5 to 2	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00401D	32S00401D-S2-Date	soil	2 to 4	PCBs and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00501A	32S00501A-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)	Analytical Group[1]	Number of Samples (identify field duplicates)	Sampling SOP Reference
32S00501A	32S00501A-S1-Date	soil	0.5 to 2	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00501A	32S00501A-S2-Date	soil	2 to 4	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00501B	32S00501B-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00501B	32S00501B-S1-Date	soil	0.5 to 2	PCBs and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00501B	32S00501B-S2-Date	soil	2 to 4	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00501C	32S00501C-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00501C	32S00501C-S1-Date	soil	0.5 to 2	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00501C	32S00501C-S2-Date	soil	2 to 4	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00501D	32S00501D-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00501D	32S00501D-S1-Date	soil	0.5 to 2	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)	Analytical Group[1]	Number of Samples (identify field duplicates)	Sampling SOP Reference
32S00501D	32S00501D-S2-Date	soil	2 to 4	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00601A	32S00601A-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00601B	32S00601B-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00601C	32S00601C-S0-Date	soil	0 to 0.5	PCBs and PAHs	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00601D	32S00601D-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00701A	32S00701A-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00701A	32S00701A-S1-Date	soil	0.5 to 2	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00701A	32S00701A-S2-Date	soil	2 to 4	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00701B	32S00701B-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00701B	32S00701B-S1-Date	soil	0.5 to 2	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)	Analytical Group[1]	Number of Samples (identify field duplicates)	Sampling SOP Reference
32S00701B	32S00701B-S2-Date	soil	2 to 4	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00701C	32S00701C-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00701C	32S00701C-S1-Date	soil	0.5 to 2	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00701C	32S00701C-S2-Date	soil	2 to 4	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00701D	32S00701D-S0-Date	soil	0 to 0.5	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00701D	32S00701D-S1-Date	soil	0.5 to 2	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
32S00701D	32S00701D-S2-Date	soil	2 to 4	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000

Sampling Location	ID Number	Matrix	Depth (feet)	Analytical Group[1]	Number of Samples (identify field duplicates)	Sampling SOP Reference
Phase II Soil Sampling Locations for SPLP Leachate COPC concentrations						
32S00TBD	32S00TBD-STBD-Date	soil	TBD	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 F3000
32S00TBD	32S00TBD-STBD-Date	soil	TBD	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 F3000
32S00TBD	32S00TBD-STBD-Date	soil	TBD	PCBs and PAHs	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 F3000

1 Depth as noted or to top of water table; whichever comes first.

2 For the Phase II Sampling Event, sample location, final ID Number and depth are to be determined (TBD) based upon the results from the Total COPC concentrations (mg/kg) sampling event.

SAP Worksheet #18.7 –PSC 50 Soil Sampling Locations and Methods/SOP Requirements Table
(UFP-QAPP Manual Section 3.1.1)

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
50B001A	50B001A-S1-Date	soil	0.5 to 2	PCBs, Pesticides, and Metals	1 + duplicate	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
50B001A	50B001A-S2-Date	soil	2 to 4	PCBs, Pesticides, and Metals	1	
50B001A	50B001A-S3-Date	Soil	5 to 7.5	PCBs, Pesticides, and Metals	1	
50B001B	50B001B-S1-Date	soil	0.5 to 2	PCBs, Pesticides, and Metals	1	
50B001B	50B001B-S2-Date	soil	2 to 4	PCBs, Pesticides, and Metals	1 + duplicate	
50B001B	50B001B-S3-Date	Soil	5 to 7.5	PCBs, Pesticides, and Metals	1	
50B001C	50B001C-S1-Date	soil	0.5 to 2	PCBs, Pesticides, and Metals	1	
50B001C	50B001C-S2-Date	soil	2 to 4	PCBs, Pesticides, and Metals	1	
50B001C	50B001C-S3-Date	Soil	5 to 7.5	PCBs, Pesticides, and Metals	1	
50B001D	50B001D-S1-Date	soil	0.5 to 2	PCBs, Pesticides, and Metals	1	
50B001D	50B001D-S2-Date	soil	2 to 4	PCBs, Pesticides, and Metals	1	

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
50B001D	50B001D-S3-Date	Soil	5 to 7.5	PCBs, Pesticides, and Metals	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
50B002A	50B002A-S1-Date	soil	0.5 to 2	PCBs, Pesticides, and Metals	1	
50B002A	50B002A-S2-Date	soil	2 to 4	PCBs, Pesticides, and Metals	1	
50B002A	50B002A-S3-Date	Soil	5 to 7.5	PCBs, Pesticides, and Metals	1	
50B002B	50B002B-S1-Date	soil	0.5 to 2	PCBs, Pesticides, and Metals	1	
50B002B	50B002B-S2-Date	soil	2 to 4	PCBs, Pesticides, and Metals	1	
50B002B	50B002B-S3-Date	Soil	5 to 7.5	PCBs, Pesticides, and Metals	1	
50B002C	50B002C-S1-Date	soil	0.5 to 2	PCBs, Pesticides, and Metals	1	
50B002C	50B002C-S2-Date	soil	2 to 4	PCBs, Pesticides, and Metals	1	
50B002C	50B002C-S3-Date	Soil	5 to 7.5	PCBs, Pesticides, and Metals	1	
50B002D	50B002D-S1-Date	soil	0.5 to 2	PCBs, Pesticides, and Metals	1	
50B002D	50B002D-S2-Date	soil	2 to 4	PCBs, Pesticides, and Metals	1	
50B002D	50B002D-S3-Date	Soil	5 to 7.5	PCBs, Pesticides, and Metals	1	
50B003A	50B003A-S1-Date	soil	0.5 to 2	PCBs, Pesticides, and Metals	1	

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
50B003A	50B003A-S2-Date	soil	2 to 4	PCBs, Pesticides, and Metals	1	CT-04, CT-05,SA-6.3, SA-7.1,FDEP SOP 001/01 FS3000
50B003A	50B003A-S3-Date	Soil	5 to 7.5	PCBs, Pesticides, and Metals	1	
50B003B	50B003B-S1-Date	soil	0.5 to 2	PCBs, Pesticides, and Metals	1	
50B003B	50B003B-S2-Date	soil	2 to 4	PCBs, Pesticides, and Metals	1	
50B003B	50B003B-S3-Date	Soil	5 to 7.5	PCBs, Pesticides, and Metals	1	
50B003C	50B003C-S1-Date	soil	0.5 to 2	PCBs, Pesticides, and Metals	1 + duplicate	
50B003C	50B003C-S2-Date	soil	2 to 4	PCBs, Pesticides, and Metals	1	
50B003C	50B003C-S3-Date	Soil	5 to 7.5	PCBs, Pesticides, and Metals	1	
50B003D	50B003D-S1-Date	soil	0.5 to 2	PCBs, Pesticides, and Metals	1	
50B003D	50B003D-S2-Date	soil	2 to 4	PCBs, Pesticides, and Metals	1	
50B003D	50B003D-S3-Date	Soil	5 to 7.5	PCBs, Pesticides, and Metals	1	

Sampling Location	ID Number	Matrix	Depth (feet)[1]	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
Phase II Soil Sampling Locations for SPLP Leachate COPC concentrations						
50B00TBD	50B00TBD-STBD-Date	soil	TBD	PCBs, Pesticides, Metals	1	CT-04, CT-05,SA-6.3, SA-7.1, FDEP SOP 001/01 F3000
50B00TBD	50B00TBD-STBD-Date	soil	TBD	PCBs, Pesticides, Metals	1	CT-04, CT-05,SA-6.3, SA-7.1, FDEP SOP 001/01 F3000
50B00TBD	50B00TBD-STBD-Date	soil	TBD	PCBs, Pesticides, Metals	1+ duplicate	

1 Depth as noted or to top of water table; whichever comes first.

2 For the Phase II Sampling Event, sample location, final ID Number and depth are to be determined (TBD) based upon the results from the Total COPC concentrations (mg/kg) sampling event.

SAP Worksheet #19 -- Analytical SOP Requirements Table
(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference	Containers (number, size, and type)	Sample Volume (units)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Soil	PAHs Low-Level	SW-846 3546/8270D Low-Level, Empirical SOP-201/343	One 4-ounce glass jar	30 grams	Cool to 4 (± 2) °C	14 days until extraction, 40 days to analysis
Soil	Pesticides	SW-846 3546/8081B, Empirical SOP-211/343	One 4-ounce glass jar	30 grams	Cool to 4 (± 2) °C	14 days until extraction, 40 days to analysis
Soil	PCBs	SW-846 3546/8082A, Empirical SOP-211/343	One 4-ounce glass jar	30 grams	Cool to 4 (± 2) °C	14 days until extraction, 40 days to analysis
Soil	Metals	SW-846 3050B/ 6010C, Empirical SOP-100/105	One 4-ounce glass jar	1 to 2 grams	Cool to 4 (± 2) °C	180 days to analysis
Soil	SPLP	SW-846 1312, Empirical SOP-147	One 4-ounce glass jar	100 grams	Cool to 4 (± 2) °C	14 days to leach for PAHs, Pesticides, PCBs, 7 days to extraction 180 days to leach for metals, 180 days to digestion

Matrix	**Analytical Group**	**Analytical and Preparation Method / SOP Reference**	**Containers** (number, size, and type)	**Sample Volume** (units)	**Preservation Requirements** (chemical, temperature, light protected)	**Maximum Holding Time** (preparation/ analysis)
SPLP leachate and aqueous QC blanks	PAHs Low-Level	SW-846 3510C/ 8270D Low-Level, Empirical SOP-201/300	Two 1-liter glass amber bottles	1,000 milliliter (mL)	Cool to 4 (± 2) °C	7 days until extraction, 40 days to analysis
SPLP leachate and aqueous QC blanks	Pesticides	SW-846 3510C/ 3520/8081B, Empirical SOP-211/302	Two 1-liter glass amber bottles	1,000 mL	Cool to 4 (± 2) °C	7 days until extraction, 40 days to analysis
SPLP leachate and aqueous QC blanks	PCBs	SW-846 510C/3520/8082A, Empirical SOP-211/302	Two 1-liter glass amber bottles	1,000 mL	Cool to 4 (± 2) °C	7 days until extraction, 40 days to analysis
SPLP leachate and aqueous QC blanks	Metals	SW-846 3010A/6010C, Empirical SOP-100/105	One 500-mL plastic bottle	50 mL	Nitric acid (HNO_3) to pH <2; Cool to 4 (± 2) °C	180 days to analysis

SAP Worksheet #20 -- Field QC Sample Summary Tables
(UFP-QAPP Manual Section 3.1.1)

Phase I Sampling - Total COPC concentrations (mg/kg)

Site	Matrix	Analytical Group	No. of Phase I Sampling Locations[2]	No. of Field Duplicates	No. of MS/MSDs[1]	No. of Field Blanks	No. of Equip. Blanks[3]	Total No. of Samples to Lab
PSC 5	Soil	Metals and PAHs	96	10	5/5	0	5	111
PSC 8	Soil	Metals, Pesticides, and PAHs	36	4	2/2	0	2	42
PSC 9	Soil	Metals and PAHs	48	5	3/3	0	3	56
PSC 29	Soil	Metals and PAHs	28	3	2/2	0	2	33
PSC 31	Soil	PCBs, Pesticides, Metals, and PAHs	44	5	3/3	0	3	52
PSC 32	Soil	PCBs and PAHs	76	8	4/4	0	4	88
PSC 50	Soil	PCBs, Pesticides, and Metals	24	3	2/2	0	2	29

1 Although the Matrix Spike/Matrix Spike Duplicate (MS/MSD) (or MS/sample duplicate for metals) are not typically considered field QC samples, they are included here because location determination is often established in the field.

2 If samples will be collected at different depths at the same location, count each discrete sampling depth as a separate sampling location or station.

3 Equipment Rinsate Blanks may not be necessary if the samples are collected using dedicated sampling equipment or if there is no equipment used to collect the samples.

Phase 2 Sampling - Total SPLP Leachate COPC concentrations (µg/L)

Site	Matrix	Analytical Group	No. of Phase 2 Sampling Locations[2]	No. of Field Duplicates	No. of MS/MSDs[1]	No. of Field Blanks	No. of Equip. Blanks[3]	Total No. of Samples to Lab
PSC 5	Soil-SPLP-Leachate	Metals and PAHs	3	0	0/0	0	0	3
PSC 8	Soil-SPLP-Leachate	Metals, Pesticides, and PAHs	3	0	0/0	0	0	3
PSC 9	Soil-SPLP-Leachate	Metals and PAHs	3	0	0/0	0	0	3
PSC 29	Soil-SPLP-Leachate	Metals and PAHs	3	1	1/1	0	1	5
PSC 31	Soil-SPLP-Leachate	PCBs, Pesticides, Metals, and PAHs	3	1	1/1	0	1	5
PSC 32	Soil-SPLP-Leachate	Metals and PAHs	3	0	0/0	0	0	3
PSC 50	Soil-SPLP-Leachate	PCBs, Pesticides, and Metals	3	1	1/1	0	1	5

1 Although the Matrix Spike/Matrix Spike Duplicate (MS/MSD) (or MS/sample duplicate for metals) are not typically considered field QC samples and are not included in the Total No. of Samples to Lab, they are included here because location determination is often established in the field.

2 If samples will be collected at different depths at the same location, count each discrete sampling depth as a separate sampling location or station.

3 Equipment Rinsate Blanks may not be necessary if the samples are collected using dedicated sampling equipment or if there is no equipment used to collect the samples.

SAP Worksheet #21 -- Project Sampling SOP References Table
(UFP-QAPP Manual Section 3.1.2)

Reference Number	Title, Revision Date and/or Number[1]	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
CT-04	Sample Nomenclature (Revision 2, 03/09/09)	TtNUS	NA	N	SOP is included in Appendix A.
CT-05	Database Records and Quality Assurance, (Revision 2, 01/29/01)	TtNUS	NA	N	SOP is included in Appendix A.
FDEP SOP 001/01 FS 3000	DEP-SOP-001/01 FS 3000 Soil March 31, 2008 (Effective 12/3/08)	FDEP	NA	N	SOP is included in Appendix A.
SA-6.3	Field Documentation Revision 3, 03/09/09)	TtNUS	Field Logbook, Field Sample Forms, Boring Logs	N	SOP is included in Appendix A.
SA-7.1	Decontamination of Field Equipment (Revision 6, 01/28/09)	TtNUS	Decontamination Equipment (scrub brushes, phosphate free detergent, de-ionized water)	N	SOP is included in Appendix A.

1 The TtNUS SOPs are currently in review. TtNUS will review, update, or revise these SOPs on a periodic basis. (e.g., every two to three years).

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

(UFP-QAPP Manual Section 3.1.2.4)

Field Equipment	Activity[1]	Frequency	Acceptance Criteria	CA	Responsible Person	SOP Reference[2]	Comments
Disposable Hand Trowel – Soil Sampling	Inspection	Per Use	NA	Replace	FOL or designee	FDEP SOP 001/01 FS 3000	None

1 Activities may include: calibration, verification, testing, maintenance, and/or inspection.
2 Specify the appropriate reference letter or number from the Project Sampling SOP References table (Worksheet #21).

SAP Worksheet #23 -- Analytical SOP References Table
(UFP-QAPP Manual Section 3.2.1)

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
Empirical SOP-100	Metals Digestion/Preparation Methods 3005A, 3010A, 3020A, 3030, 3040A, 3050B, USEPA CLP ILMO 4.1 Aqueous & Soil/Sediment, USEPA Method 200.7 (Standard Methods) 3030C (Revision. 20, 4/27/10)	Definitive	Soil, SPLP leachate, and aqueous QC blanks/ Metals digestion	NA/Preparation	Empirical	Y - Arsenic requires concentration step as outlined in USEPA method 200.7.
Empirical SOP-105	Metals Analysis by Inductively Coupled Plasma (ICP) Technique Methods 200.7, SW846 6010C, SM 19th Edition 2340B, USEPA ILMO 4.1 (Revision 16, 4/11/10)	Definitive	Soil, SPLP leachate, and aqueous QC blanks/ Metals	Inductively Coupled Plasma – Atomic Emission Spectroscopy (ICP-AES)	Empirical	N
Empirical SOP-147	Synthetic Precipitation Leaching Procedure SW 846 1312 (Revision 0, 5/26/09)	Definitive	Soil	NA/Preparation	Empirical	N
Empirical SOP-201	GC/MS Semivolatiles and Low-Concentration PAHs by EPA Method 625 and SW-846 Method 8270C and 8270D, Including Additional Appendix IX Compounds (Revision 20, 4/26/10)	Definitive	Soil, SPLP leachate, and aqueous QC blanks/ Low-Level PAHs	Gas Chromatography/ Mass Spectrometer (GC/MS)	Empirical	N
Empirical SOP-211	Gas Chromatography/Electron Capture Detector (GC/ECD) Organochlorine Pesticides/PCBs by USEPA Method 608 and SW846 Method 8081A/8082 (Revision 21, 4/11/10)	Definitive	Soil, SPLP leachate, and aqueous QC blanks/ PCBs	GC/ECD	Empirical	N

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
Empirical SOP-300	GC/MS Semivolatile BNA-Aqueous Matrix Extraction Using SW-846 Method 3510C for 8270C/625 Analysis (Revision 18, 4/25/10)	Definitive	SPLP leachate and aqueous QC blanks/ SVOCs Extraction	NA/Extraction	Empirical	N
Empirical SOP-302	Pesticide/PCBs- Aqueous Matrix Extraction for USEPA 608 and SW846 Method 8081A/8082 Using Method 3510C (Revision 17, 4/25/10)	Definitive	SPLP leachate and aqueous QC blanks/ PCBs Extraction	NA/Extraction	Empirical	N
Empirical SOP-343	BNA & Pest/PCB & TPH Non-Aqueous Matrix (Microwave Extraction) Using SW846 3546 (Revision 0, 8/1/09)	Definitive	Soil/ PAHs, Pesticides, and PCBs Extraction	NA/Extraction	Empirical	N
Empirical SOP-404	Laboratory Sample Receiving Log-in and Storage SOPs (Revision 13, 6/29/09)	Definitive	Log-in	NA/ Log-in	Empirical	N
Empirical SOP-405	Analytical Laboratory Waste Disposal (Revision 5, 6/23/09)	Definitive	Disposal	NA/ Disposal	Empirical	N
Empirical SOP-410	SOPs for Laboratory Sample Storage, Secure Areas, and Sample Custody (Revision 7, 6/23/09)	Definitive	Log-in	NA/ Log-in	Empirical	N

Copies of all the SOPs listed are included in Appendix B.

SAP Worksheet #24 -- Analytical Instrument Calibration Table
(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
GC/MS Low Concentra-tion PAHs	Initial Calibration (ICAL) – Minimum of a 5-point calibration curve is prepared.	Perform after major instrument maintenance and upon failure of second consecutive continuing calibration verification (CCV).	The average response factor (RF) must be ≥0.010 for all Low-Level PAHs. The relative standard deviation (RSD) for each analyte must be ≤ 15%, or the linear least squares regression correlation coefficient (r) must be ≥ 0.995, or the coefficient of determineation (r^2) must be ≥ 0.99 (6 points are required for second order).	Repeat calibration if criterion is not met.	Analyst, Department Manager	Empirical SOP-201/ 300/343
	Initial Calibration Verification (ICV) – Second Source	Once after each ICAL, prior to beginning a sample run.	The percent recovery (%R) of all analytes must be within 80-120% of true value. RFs must be ≥ 0.010 for Low-Level PAHs.	Correct problem and verify second source standard. Reanalyze ICAL.	Analyst, Department Manager	
	Retention Time (RT) Window Position Establishment	Once per ICAL for each analyte and surrogate.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	NA.	Analyst, Department Manager	
	Evaluation of Relative Retention Times (RRTs)	With each sample.	RRT of each target analyte must be within ± 0.006 RRT units.	Correct problem, then rerun ICAL.	Analyst, Department Manager	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
	CCV	Perform one per 12-hour analysis period after tune and before sample analysis.	RFs must be ≥0.010 for Low-Level PAHs. The percent difference or percent drift (%D) must be ≤ 20% for all Low-Level PAHs.	Repeat ICAL and reanalyze all samples analyzed since the last successful CCV.	Analyst, Department Manager	
	Tune Verification – decafluorotriphenyl-phosphine (DFTPP)	At the beginning of each 12-hour analytical sequence.	Must meet the ion abundance criteria required by the method. No samples may be accepted without a valid tune.	Retune and/or clean source.	Analyst, Department Manager	
	Breakdown Check - Injection Port Performance Compounds	Perform daily prior to sample analysis.	Not applicable when Low-Level PAHs are the only target analytes.	NA.	Analyst, Department Manager	
GC/ECD Pesticides	ICAL – A 5-point calibration of individual pesticides, with a mid-point calibration of toxaphene and chlordane.	Upon instrument receipt, major instrument change, or when the CCV does not meet criteria.	The RSD for each analyte must be ≤ 20%, or r must be ≥ 0.995, or r^2 must be ≥ 0.99 (6 points are required for second order).	Repeat ICAL if single point calibration for toxaphene, or chlordane is identified in analysis of sample; 5-point calibration run of identified compound with reanalysis of sample.	Analyst, Department Manager	Empirical SOP-211/302/343
	ICV – Second Source	Once after each ICAL prior to sample analysis.	The %R of all analytes must be within 80-120% of true value.	Identify source of problem, correct, repeat calibration, rerun samples.	Analyst, Department Manager	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
	CCV	Analyze standard at the beginning and end of sequence and every 10 field samples.	The %R of all analytes must be within 80-120% of true value.	Identify source of problem, correct, repeat ICAL, rerun samples.	Analyst, Department Manager	
	Breakdown Check (pesticides only)	Perform daily prior to sample analysis.	The degradation must be ≤ 15% for both Endrin and DDT to verify inertness.	Column maintenance; injection port maintenance.	Analyst, Department Manager	
GC/ECD PCBs	ICAL - A 5-point calibration of Aroclor 1660 (1016/1260 mixture).	Instrument receipt, major instrument change, when CCV does not meet criteria.	The RSD for each 1016/1260 and surrogates must be ≤ 20%, or r must be ≥ 0.995. Non-linear calibration requires a minimum of 6 points and r^2 must be ≥ 0.990. Mid-point calibration of other Aroclors.	Repeat ICAL and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data.	Analyst, Department Manager	Empirical SOP-211/302/343
	ICV – Second Source	Once after each ICAL prior to sample analysis.	The %R of all analytes must be within 80-120% of true value.	Identify source of problem, correct, repeat ICAL, rerun samples.	Analyst, Department Manager	
	CCV	Analyze standard at the beginning and end of sequence and after every 10 field samples.	The %R of all analytes must be within 80-120% of true value.	Identify source of problem, correct, repeat ICAL, rerun samples.	Analyst, Department Manager	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
ICP-AES Metals	ICAL - the instrument is calibrated by a 1-point calibration per manufacturer's guidelines.	At the beginning of each day, or if the QC is out of criteria.	None; only one high standard and a calibration blank must be analyzed. If more than one calibration standard is used, r must be ≥ 0.995.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst, Department Manager	Empirical SOP-100/105
	ICV – Second Source	Following ICAL, prior to the analysis of samples.	The %R must be within 90-110% of the true value.	Investigate reasons for failure, reanalyze once. If still unacceptable, repeat ICAL.	Analyst, Department Manager	
	Initial Calibration Blank (ICB)	Before beginning a sample sequence.	No analytes detected > LOD.	Correct the problem, then re-prepare and reanalyze.	Analyst, Department Manager	
	CCV	At the beginning and end of the sequence and after every 10 samples.	The %R must be within 90-110% of true value.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst, Department Manager	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
	Continuing Calibration Blank (CCB)	After the initial CCV, after every 10 field samples, and at the end of the sequence.	No analytes detected > LOD.	Correct the problem, then re-prepare and reanalyze calibration blank and previous 10 samples.	Analyst, Department Manager	
	Low-Level Check Standard (if using 1-point ICAL)	Daily after ICAL and before samples.	The %R must be within 80-120% of the true value.	Investigate and perform necessary equipment maintenance. Recalibrate and reanalyze all affected samples.	Analyst, Department Manager	
	Interference Check Standards (ICS – ICS A and ICS B)	At the beginning and end of an analytical run and after each batch of 20 samples.	ICS A recoveries must be within the absolute value of the LOD; and ICS B recoveries must be within 80-120 %R of the true value.	Terminate analysis; locate and correct problem; reanalyze ICS.	Analyst, Department Manager	

Notes:

[1] Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).

SAP Worksheet #25 -- Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table
(UFP-QAPP Manual Section 3.2.3)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
GC/MS	Check pressure and gas supply daily. Manual tune if DFTPP not in criteria, change septa as needed, change liner as needed, cut column as needed. Other maintenance specified in laboratory Equipment Maintenance SOP.	Low Concentration PAHs	Ion source, injector liner, column, column flow.	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	Analyst, Department Manager	Empirical SOP-201/ 300/343
GC/ECD	Check pressure and gas supply daily. Change septa and/or liner as needed, replace or cut column as needed. Other maintenance specified in laboratory Equipment Maintenance SOP.	Pesticides and PCBs	Injector liner, septa, column, column flow.	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	Analyst, Department Manager	Empirical SOP 211/ 302/343

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
ICP-AES	Clean torch assembly and spray chamber when discolored or when degradation in data quality is observed. Clean nebulizer, check argon, replace peristaltic pump tubing as needed. Other maintenance specified in laboratory Equipment Maintenance SOP.	Metals	Torch, nebulizer chamber, pump, pump tubing.	Prior to ICAL and as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	Analyst, Department Manager	Empirical SOP-100/105

Notes:

[1] Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).

SAP Worksheet #26 -- Sample Handling System

(UFP-QAPP Manual Appendix A)

Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): FOL or designee/TtNUS
Sample Packaging (Personnel/Organization): FOL or designee/TtNUS
Coordination of Shipment (Personnel/Organization): FOL or designee/TtNUS
Type of Shipment/Carrier: Federal Express
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample Custodians/Empirical
Sample Custody and Storage (Personnel/Organization): Sample Custodians/Empirical
Sample Preparation (Personnel/Organization): Extraction Laboratory, Metals Preparation Laboratory /Empirical
Sample Determinative Analysis (Personnel/Organization): GC Laboratory, GC/MS Laboratory, Metals Laboratory/ Empirical
SAMPLE ARCHIVING
Field Sample Storage (Number of days from sample collection): 60 days from receipt
Sample Extract/Digestate Storage (number of days from extraction/digestion): 3 months from sample digestion/extraction
Biological Sample Storage (Number of days from sample collection): NA
SAMPLE DISPOSAL
Personnel/Organization: Sample Custodians/ Empirical

SAP Worksheet #27 – Sample Custody Requirements Table
(UFP-QAPP Manual Section 3.3.3)

27.1 SAMPLE NOMENCLATURE, SAMPLE COLLECTION DOCUMENTATION, HANDLING, TRACKING, AND CUSTODY PROCEDURES

The following sections outline the procedures that will be used to document project activities and sample collection, handling, tracking, and custody procedures during the investigation. All forms must be filled in as completely as possible.

27.1.1 Sample Identification

Refer to Worksheet #18 for how the samples will be labeled. Also, refer to Worksheet #20 for how the field QA/QC samples will be labeled.

27.1.2 Sample Collection Documentation

Documentation of field observations will be recorded in a field logbook and/or field log sheets including sample collection logs, boring logs, and monitoring well construction logs. Field logbooks utilized on this project will consist of a bound, water-resistant logbook. All pages of the logbook will be numbered sequentially and observations will be recorded with indelible ink.

Field sample log sheets will be used to document sample collection details, and other observations and activities will be recorded in the field logbook. Instrument calibration logs will be used to record the daily instrument calibration. Example field forms are included in Appendix A.

For sampling and field activities, the following types of information will be recorded in the field log as appropriate:

- Site name and location
- Date and time of logbook entries
- Personnel and their affiliations
- Weather conditions
- Activities involved with the sampling
- Subcontractor activity summary
- Site observations including site entry and exit times
- Site sketches made on site

- Visitor names, affiliations, arrival and departure times
- Health and safety issues including PPE

27.1.3 Sample Handling and Tracking System

Following sample collection into the appropriate bottle ware, all samples will be immediately placed on ice in a cooler. The glass sample containers will be enclosed in bubble-wrap in order to protect the bottle ware during shipment. The cooler will be secured using strapping tape along with a signed custody seal. Sample coolers will be delivered to a local courier location for priority overnight delivery to the selected laboratory for analysis. Samples will be preserved as appropriate based on the analytical method. The laboratories will provide pre-preserved sample containers for sample collection. Samples will be maintained at 4 (± 2) °C until delivery to the laboratory. Proper custody procedures will be followed throughout all phases of sample collection and handling.

After collection, each sample will be maintained in the sampler's custody until formally transferred to another party (e.g., Federal Express). For all samples collected, chain-of-custody forms will document the date and time of sample collection, the sampler's name, and the names of all others who subsequently held custody of the sample. Specifications for chemical analyses will also be documented on the chain-of-custody form. TtNUS SOP SA-6.3 (Field Documentation) provides further details on the chain-of-custody procedure, which is provided in Appendix A.

These subsections outline the procedures that will be used by field and laboratory personnel to document project activities and sample collection procedures during this extended site investigation. All forms must be filled in as completely as possible.

27.1.4 Sample Handling

Sample handling requirements are described in Worksheet #26. TtNUS personnel will collect the samples. The samplers will take care not to contaminate samples through improper handling. Samples will be sealed in appropriate containers, packaged by TtNUS personnel and placed into sealed coolers under chain-of-custody in accordance with the applicable SOP (See Worksheet #21). All coolers will contain a temperature blank. Samples will be transferred under chain-of-custody to a courier as described below. Once received by the laboratory, receipt will be documented on the chain-of-custody form and the samples will be checked in. The samples will remain under chain-of-custody throughout the analysis period to ensure their integrity is preserved. Details are provided below.

27.1.5 Sample Delivery

Samples to be delivered to the laboratory will be made by a public courier (i.e., Federal Express). After samples have been collected, they will be sent to the laboratory within 24 hours. Under no circumstances will sample holding times be exceeded.

27.1.6 Sample Custody

Chain-of-custody protocols will be used throughout sample handling to establish the evidentiary integrity of sample containers. These protocols will be used to demonstrate that the samples were handled and transferred in a manner that would eliminate possible tampering. Samples for the laboratory will be packaged and shipped in accordance with TtNUS SOP SA-6.1 (Appendix A).

A sample is under custody if:

- The sample is in the physical possession of an authorized person.
- The sample is in view of an authorized person after being in his/her possession.
- The sample is placed in a secure area by an authorized person after being in his/her possession.
- The sample is in a secure area, restricted to authorized personnel only.

Custody documentation is designed to provide documentation of preparation, handling, storage, and shipping of all samples collected. A multi-part form is used with each page of the form signed and dated by the recipient of a sample or portion of sample. The person releasing the sample and the person receiving the sample each will retain a copy of the form each time a sample transfer occurs.

Integrity of the samples collected during the site investigation will be the responsibility of identified persons from the time the samples are collected until the samples, or their derived data, are incorporated into the final report. Sample custody is described in Worksheet #27.

The TtNUS FOL is responsible for the care and custody of the samples collected until they are delivered to the laboratory or are entrusted to a carrier. When transferring samples, the individuals relinquishing and receiving them will sign, date, and note the time on the chain-of-custody form. This record documents the sample custody transfer from the sampler to the laboratory, often through another person or agency (common carrier). Upon arrival at the laboratory, internal sample custody procedures will be followed as defined in the Laboratory SOPs included in Appendix B.

27.1.7 Laboratory Custody

Custody Seals are supplied with all bottle orders. They are affixed to the cooler after sampling. The presence or absence of Custody Seals is noted on the Sample Receipt Condition Report (SRCR).

Upon receipt of samples from the field, the laboratory sample management personnel will sign off on the chain-of-custody, open the sample cooler(s), verify sample integrity and conduct a check against the chain-of-custody. If there is a discrepancy or problem (i.e. broken sample containers) the laboratory will contact the field leader or other qualified personnel and resolve the issue. Additionally, the laboratory completes a SRCR, which documents visual inspection of the samples and specific parameters such as cooler temperature, holding times, and preservation. Discrepancies or changes will be documented on the SRCR.

The laboratory sample management personnel assigns a unique laboratory work order number for the entire sample set listed on the chain-of-custody. The samples are then logged into our laboratory information management system and a Login Chain-of-Custody Report is generated. Each sample within a work order is labeled numerically. Each container of a particular sample is uniquely identified by adding a alphabetical suffix to the sample number. The laboratory labels each sample container with a Laboratory Custody Label which will remain on the sample bottle for the duration of the laboratory sample storage. The laboratory also initiates the appropriate Internal Custody Record for the sample set. Personnel fill out the Internal Custody Records to document sample removal from and return to sample storage.

A laboratory data file is also initiated for the work order. This file includes the Login Chain-of-Custody, Chain-of-Custody, and SRCR. The folder also includes a Login File Sheet which summarizes the analyses that the work order has been logged for. This sheet is used to track data completion.

Samples for a project may be batched or grouped together by the laboratory. A series of batched work orders is referred to as a Sample Delivery Group (SDG). The SDG includes those samples received on a chain-of-custody, duplicate samples, and field QA/QC samples, and can include samples of different media. QA/QC samples will be run at the frequency specified in the analytical methods. The sample delivery group is given a specific identification number.

Samples are stored at the laboratory in refrigerators prior to, during and after analysis. Refrigerators at the laboratory are constantly monitored for temperature. Proper temperatures and lighting are maintained in the refrigerators to ensure sample integrity and preservation. Samples are retained by the laboratory for a period of 90 days after the data report is mailed to the client unless otherwise specified in a client contract. The laboratory then disposes of non-hazardous samples, following certified disposal practices.

Hazardous samples are either returned to the client or disposed of through a licensed broker. Documentation of disposal is maintained by the laboratory.

Chain-of-custody requirements are also documented with instructions contained in each shipment from the laboratory [Empirical SOP-404 (Laboratory Sample Receiving Log-In and Storage)], which is provided in Appendix B.

SAP Worksheet #28 -- Laboratory QC Samples Table
(UFP-QAPP Manual Section 3.4)

Matrix	Soil, SPLP Leachate, and Aqueous QC blanks
Analytical Group	Low Concentration PAHs
Analytical Method/ SOP Reference	SW-846 8270D/8270D Empirical SOP-201/300/343

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparation batch of 20 or fewer samples of similar matrix.	All analytes must be ≤ ½ LOQ and ≤ 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	(1) Investigate source of contamination (2) Re-prepare and analyze method blank and all samples processed with the contaminated blank.	Analyst, Laboratory Department Manager, and Data Validator	Bias/ Contamination	Same as Method/SOP QC Acceptance Limits.

Matrix	Soil, SPLP Leachate, and Aqueous QC blanks
Analytical Group	Low Concentration PAHs
Analytical Method/ SOP Reference	SW-846 8270D/8270D Empirical SOP-201/300/343

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Surrogates	Two per sample for Low Concentration PAHs 2-Fluorobiphenyl Terphenyl-d	Empirical %R limits (Appendix B).	(1) Check chromatogram for interference; if found, then flag data. (2) If not found, then check instrument performance; if problem is found, then correct and reanalyze. (3) If still out, then re-extract and analyze sample. (4) If reanalysis is out, then flag data.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.

Matrix	Soil, SPLP Leachate, and Aqueous QC blanks
Analytical Group	Low Concentration PAHs
Analytical Method/ SOP Reference	SW-846 8270D/8270D Empirical SOP-201/300/343

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory Control Sample (LCS) LCS duplicate (LCSD) (not required)	One is performed for each batch of up to 20 samples.	Empirical %R limits (Appendix B). RPD must be ≤30% (for LCS/LCSD).	Evaluate and reanalyze if possible. If an MS/MSD was performed in the same 12 hour clock and is acceptable, then narrate. If the LCS recoveries are high but the sample results are <LOQ, then narrate. Otherwise, re-prepare and reanalyze.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy / Bias Precision also, if LCSD is analyzed	Same as Method/SOP QC Acceptance Limits.

Matrix	Soil, SPLP Leachate, and Aqueous QC blanks
Analytical Group	Low Concentration PAHs
Analytical Method/ SOP Reference	SW-846 8270D/8270D Empirical SOP-201/300/343

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Internal Standard (IS)	Two per sample – Phenanthrene-d10 Perylene-d12	Retention times for ISs must be within ± 30 seconds and the response areas must be within -50% to +100% of the ICAL midpoint standard or sequence CCV.	Reanalyze affected samples.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/ Bias	Same as Method/SOP QC Acceptance Limits.
MS/MSD	One per SDG or every 20 samples.	Empirical %R limits (Appendix B). RPD should be ≤ 30%.	Corrective Action will not be taken for samples when %Rs are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD are unacceptable, then re-prepare the samples and QC.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/ Bias / Precision	Same as Method/SOP QC Acceptance Limits.

Matrix	Soil, SPLP Leachate, and Aqueous QC blanks
Analytical Group	Pesticides / PCBs
Analytical Method/ SOP Reference	SW-846 8081B/8082A Empirical SOP-211/302/343

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparation batch of 20 or fewer samples of similar matrix.	All analytes must be ≤ ½ LOQ and ≤ 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Investigate source of contamination. Evaluate the samples and associated QC: i.e., if the blank results are above the LOQ, then report sample results which are <LOQ or > 10X the blank concentration. Otherwise, re-prepare a blank and samples >LOQ and <10X LOQ.	Analyst, Laboratory Department Manager, and Data Validator	Bias/ Contamination	Same as Method/SOP QC Acceptance Limits.

Matrix	Soil, SPLP Leachate, and Aqueous QC blanks
Analytical Group	Pesticides / PCBs
Analytical Method/ SOP Reference	SW-846 8081B/8082A Empirical SOP-211/302/343

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Surrogates	Two per sample: Tetrachloro-m-xylene (TCMX) Decachlorobiphenyl (DCB)	%Rs must be within the DoD Quality Systems Manual (QSM) for Environmental Laboratories, Version 4.1 limits as per Appendix G of the DoD QSM.	No corrective action will be taken when one surrogate is within criteria. If surrogates recoveries are high and sample is <LOQ, then no corrective action is taken. If surrogates recoveries are low, then the affected samples are re-extracted and reanalyzed.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.

Matrix	Soil, SPLP Leachate, and Aqueous QC blanks
Analytical Group	Pesticides / PCBs
Analytical Method/ SOP Reference	SW-846 8081B/8082A Empirical SOP-211/302/343

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCS LCSD (not required)	One is performed for each batch of up to 20 samples.	%Rs must be within the DoD QSM Version 4.1 limits as per Appendix G of the DoD QSM. If LCSD is performed, then the RPD between LCS and LCSD must be ≤30%.	If an MS/MSD was performed and is acceptable, then narrate. If an LCS/LCSD was performed and only one of the set was unacceptable, then narrate. If the LCS recovery is high, but the sample results are <LOQ, then narrate. Otherwise, re-extract blank and affected sample batch.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/ Bias Precision also, if LCSD is analyzed	Same as Method/SOP QC Acceptance Limits.

Matrix	Soil, SPLP Leachate, and Aqueous QC blanks
Analytical Group	Pesticides / PCBs
Analytical Method/ SOP Reference	SW-846 8081B/8082A Empirical SOP-211/302/343

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MS/MSD	One per 20 samples of similar matrix.	%Rs should be within the DoD QSM Version 4.1 limits as per Appendix G of the DoD QSM. The RPD between MS and MSD should be ≤30%.	Evaluate the samples and associated QC and if the LCS results are acceptable, then narrate. If both the LCS and MS/MSD are unacceptable, then re-prepare the samples and QC.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy / Bias / Precision	Same as Method/SOP QC Acceptance Limits.
Second Column Confirmation	All positive results must be confirmed.	Results between primary and second column must be RPD ≤ 40%. The higher of the two results will be reported unless matrix interference is apparent.	None. Apply qualifier if RPD >40% and discuss in the case narrative.	Analyst, Laboratory Department Manager, and Data Validator	Precision	Same as Method/SOP QC Acceptance Limits.

Matrix	Soil, SPLP Leachate, and Aqueous QC blanks
Analytical Group	Metals
Analytical Method / SOP Reference	SW-846 6010C Empirical SOP-100/105

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per digestion batch of 20 or fewer samples.	All analytes must be ≤ ½ LOQ.	If the blank value > LOQ, then report sample results. If the blank value < LOQ or > 10x the blank value; then redigest. If blank value is less than negative LOQ, then report sample results. If > 10x the absolute value of the blank result, then redigest.	Analyst, Laboratory Department Manager, and Data Validator	Bias/ Contamina-tion	Same as Method/SOP QC Acceptance Limits.

Matrix	Soil, SPLP Leachate, and Aqueous QC blanks
Analytical Group	Metals
Analytical Method / SOP Reference	SW-846 6010C Empirical SOP-100/105

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCS	One is performed for each batch of up to 20 samples.	The %R must be within 90-110%.	Redigest and reanalyze all associated samples for affected analyte(s).	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/ Bias	Same as Method/SOP QC Acceptance Limits.

Matrix	Soil, SPLP Leachate, and Aqueous QC blanks
Analytical Group	Metals
Analytical Method / SOP Reference	SW-846 6010C Empirical SOP-100/105

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Duplicate Sample	One per preparation batch of 20 or fewer samples of similar matrix.	The RPD should be ≤20%.	Narrate any results that are outside control limits.	Analyst, Laboratory Department Manager, and Data Validator	Precision	Same as Method/SOP QC Acceptance Limits.
MS	One per preparation batch of 20 samples of similar matrix.	The %R should be within 80-120%, if sample < 4x spike added.	Qualify results for affected analytes for all associated samples.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/ Bias	Same as Method/SOP QC Acceptance Limits.
Serial Dilution	One is performed for each preparation batch with sample concentration(s) > 50x LOQ.	The five-fold dilution result must agree within ± 10%D of the original sample result.	For ICP, Perform Post Digestion Spike	Analyst, Laboratory Department Manager, and Data Validator	Precision	Same as Method/SOP QC Acceptance Limits.

Matrix	Soil, SPLP Leachate, and Aqueous QC blanks
Analytical Group	Metals
Analytical Method / SOP Reference	SW-846 6010C Empirical SOP-100/105

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Post Digestion Spike - ICP	One is performed when serial dilution fails or analyte concentration(s) in all samples < 50x LOD.	The %R must be within 75-125% of expected result to verify the absence of an interference. Spike addition should produce a concentration of 10-100x LOQ.	Flag results of samples of same matrix as estimates in case narrative.	Analyst, Laboratory Department Manager, and Data Validator	Precision	Same as Method/SOP QC Acceptance Limits.

SAP Worksheet #29 -- Project Documents and Records Table
(UFP-QAPP Manual Section 3.5.1)

DOCUMENT	LOCATION MAINTAINED
Sample Collection Documents and Records: • Field logbook (and sampling notes) • Field sample forms (e.g. boring logs, sample log sheets, drilling logs, etc.) • Chain-of-custody records • Sample shipment airbills • Equipment calibration logs • Photographs • FTMR Forms • Field Sampling SOPs	TtNUS project file; results will be discussed in the subject document.
Laboratory Documents and Records: • Sample receipt/login form • Sample storage records • Sample preparation logs • Standard traceability logs • Equipment calibration logs • Sample analysis run logs • Equipment maintenance, testing, and inspection logs • CA forms • Reported results for standards, QC checks, and QC samples • Data completeness checklists • Sample storage and disposal records • Telephone logs • Extraction/cleanup records • Raw data	TtNUS project file; long-term data package storage at third party commercial document storage firm.
Other Documents • HASP • All versions of SAP • All letter and e-mail correspondence with regulatory agencies, including approvals and comments • Field Investigation data package • All version of project reports	TtNUS project file.

SAP Worksheet #30 -- Analytical Services Table
(UFP-QAPP Manual Section 3.5.2.3)

Matrix	Analytical Group	Sample Locations/ ID Numbers	Analytical Method	Data Package Turnaround Time	Laboratory / Organization (name and address, contact person and telephone number)	Backup Laboratory/ Organization (name and address, contact person and telephone number)
Soil, SPLP leachate, and aqueous QC blanks	Low Concentration PAHs	See Worksheet #18	SW-846 8270D	21 calendar days	Kim Kostzer kkostzer@empirlabs.com Empirical Laboratories, LLC 621 Mainstream Drive, Suite 270 Nashville, TN 37228 615-345-1115	NA
	Pesticides		SW-846 8081B			
	PCBs		SW-846 8082A			
	Metals		SW-846 6010C			

SAP Worksheet #31 -- Planned Project Assessments Table
(UFP-QAPP Manual Section 4.1.1)

Assessment Type	**Frequency**	**Internal or External**	**Organization Performing Assessment**	**Person(s) Responsible for Performing Assessment** (title and organizational affiliation)	**Person(s) Responsible for Responding to Assessment Findings** (title and organizational affiliation)	**Person(s) Responsible for Identifying and Implementing Corrective Actions (CA)** (title and organizational affiliation)	**Person(s) Responsible for Monitoring Effectiveness of CA** (title and organizational affiliation)
Field Systems Audit	1 per contract year	Internal	TtNUS	Person assigned by TtNUS QAM	TOM and FOL, TtNUS	Auditor and TOM, TtNUS	CLEAN QAM, TtNUS
Laboratory System Audit[1]	2 years	External	DoD ELAP	DoD ELAP Accrediting Body Auditor	Laboratory QAM or Laboratory Manager, Empirical	Laboratory QAM or Laboratory Manager, Empirical	Laboratory QAM or Laboratory Manager, Empirical

[1] Empirical has successfully completed the laboratory evaluation process required in the DoD Environmental Laboratory Accreditation Program (DoD ELAP). The DoD ELAP accreditation letter is included in Appendix B.

SAP Worksheet #32 -- Assessment Findings and Corrective Action Responses Table
(UFP-QAPP Manual Section 4.1.2)

Assessment Type	**Nature of Deficiencies Documentation**	**Individual(s) Notified of Findings** (name, title, organization)	**Timeframe of Notification**	**Nature of Corrective Action Response Documentation**	**Individual(s) Receiving Corrective Action Response** (name, title, organization)	**Timeframe for Response**
Field Sampling System Audit (1)	Audit checklist [as per Navy Installation Restoration Chemical Data Quality Manual (IRCDQM)] and written audit report	Mark Peterson, TOM, TtNUS Alan Pate, FOL, TtNUS Debra Humbert, Program Manager, TtNUS Chris Pike, Deputy Program Manager, TtNUS	Dependent on the finding; if major, a stop work may be issued immediately; however, if minor within 1 week of audit	Written memo	Mark Peterson, TOM, TtNUS Alan Pate, FOL, TtNUS Debra Humbert, Program Manager, TtNUS Chris Pike, Deputy Program Manager, TtNUS	Within 48 hours of notification
Laboratory System Audit	Written audit report	Laboratory QAM	Not specified by DoD ELAP	Letter	DoD ELAP Accrediting Body	Specified by DoD ELAP Accrediting Body

Notes:

1 Audits are scheduled at the TtNUS program level at a frequency of 1 per contract year and may or may not include this project.

SAP Worksheet #33 -- QA Management Reports Table
(UFP QAPP Manual Section 4.2)

Type of Report	**Frequency** (daily, weekly, monthly, quarterly, annually, etc.)	**Projected Delivery Date(s)**	**Person(s) Responsible for Report Preparation** (title and organizational affiliation)	**Report Recipient(s)** (title and organizational affiliation)
Data validation report	Per SDG	Within 3 weeks of receipt of laboratory data	DVM or designee, TtNUS	TOM and project file, TtNUS
Major analysis problem identification (Internal Memorandum)	When persistent analysis problems are detected	Immediately upon detection of problem (on the same day)	CLEAN QAM, TtNUS	TOM, CLEAN QAM, Program Manager, and project file, TtNUS
Project monthly progress report	Monthly for duration of the project	Monthly	TtNUS TOM, TtNUS	TOM, CLEAN QAM, Program Manager, and project file, TtNUS
Laboratory QA Report	When significant plan deviations result from unanticipated circumstances	Immediately upon detection of problem (on the same day)	Laboratory PM, Empirical	TOM and project file, TtNUS

SAP Worksheet #34 -- Verification (Step I) Process Table
(UFP-QAPP Manual Section 5.2.1)

Verification Input	Description	Internal/ External	Responsible for Verification (name, organization)
Chain-of-custody forms	The TtNUS FOL or designee will review and sign the chain-of-custody form to verify that all samples listed are included in the shipment to the laboratory and the sample information is accurate. The forms will be signed by the sampler and a copy will be retained for the project file, the TtNUS TOM, and the TtNUS Data Validators. See SOP SA-6.3.	Internal	Sampler and FOL, TtNUS
SAP Sample tables	Verify that all proposed samples listed in the SAP tables have been collected.	Internal	FOL or designee, TtNUS
Sample log sheets	Verify that information recorded in the log sheets is accurate and complete.	Internal	FOL or designee, TtNUS
Field QC samples	Check that field QC samples listed in Worksheet #20 were collected as required.	Internal	FOL or designee, TtNUS
Chain-of-custody forms	The Empirical Laboratory Sample Custodian will review the sample shipment for completeness, integrity, and sign accepting the shipment. The TtNUS Data Validators will check that the chain-of-custody form was signed/dated by the TtNUS FOL or designee relinquishing the samples and also by the Laboratory Sample Custodian receiving the samples for analyses.	Internal/ External	1 – Laboratory Sample Custodian, Empirical 2 - Data Validators, TtNUS

Verification Input	**Description**	**Internal/ External**	**Responsible for Verification** (name, organization)
Analytical data package	All analytical data packages will be verified internally for completeness by the laboratory performing the work. The Empirical Laboratory QAM will sign the case narrative for each data package.	Internal	Laboratory QAM, Empirical
Analytical data package	The data package will be verified for completeness by TtNUS Data Validators. Missing information will be requested from the laboratory and validation will be suspended until missing data are received.	External	Data Validators, TtNUS
Electronic data deliverables	The electronic data will be verified against the chain-of-custody and hard copy data package for accuracy and completeness.	External	Data Validators, TtNUS,

Notes:

Verification includes field data verification and laboratory data verification. Verification inputs as per Worksheet #34 will be checked.

SAP Worksheet #35 -- Validation (Steps IIa and IIb) Process Table
(UFP-QAPP Manual Section 5.2.2) (Figure 37; page 110 UFP-QAPP Manual) (Table 9 UFP-QAPP Manual)

Step IIa / IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIa	Sample Coordinates	Verify that sample locations are correct and in accordance with the SAP proposed locations.	TOM, FOL, or designee, TtNUS
IIa	Chain-of-Custody Forms	Ensure that the custody and integrity of the samples were maintained from collection to analysis and the custody records are complete and any deviations are recorded.	Project Chemist or Data Validators, TtNUS
IIa	Holding Times	Review that the samples were shipped and store at the required temperature and sample pH for chemically-preserved samples meet the requirements listed in Worksheet #19. Ensure that the analyses were performed within the holding times listed in Worksheet #19.	Project Chemist or Data Validators, TtNUS
IIa/IIb	Laboratory Data Results for Accuracy	Ensure that the laboratory QC samples listed in Worksheet #28 were analyzed and that the measurement performance criteria listed in Worksheet #12 were met for all field samples and QC analyses. Check that specified field QC samples were collected and analyzed and that the analytical QC criteria set up for this project were met.	Project Chemist or Data Validators, TtNUS
IIa/IIb	Field and Laboratory Duplicate Analyses for Precision	Check the field sampling precision by calculating the RPD for field duplicate samples. Check the laboratory precision by reviewing the RPD or percent difference values from laboratory duplicate analyses; MS/MSDs; and LCS/LCSDs. Ensure compliance with the methods and project MPC accuracy goals listed in Worksheets #12 and #28.	Project Chemist or Data Validators, TtNUS

Step IIa / IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIa/IIb	Sample Results for Representativeness	Check that the laboratory recorded the temperature at sample receipt and the pH of the chemically preserved samples to ensure sample integrity from sample collection to analysis.	Project Chemist or Data Validators, TtNUS
IIa/IIb	PALs	Discuss the impact on matrix interferences or sample dilutions performed because of the high concentration of one or more contaminant, on the other target compounds reported as non-detected. Document this usability issue and inform the TtNUS TOM.	Project Chemist or Data Validators, TtNUS
IIa/IIb	Data Validation Report	Summarize deviations from methods, procedures, or contracts. Qualify data results based on method or QC deviation and explain all the data qualifications. Print a copy of the project data base qualified data depicting data qualifiers and data qualifiers codes that summarize the reason for data qualifications. Determine if the data met the MPC and determine the impact of any deviations on the technical usability of the data.	Project Chemist or Data Validators, TtNUS
IIa/IIb	SAP QC Sample Documentation	Ensure that all QC samples specified in the SAP were collected and analyzed and that the associated results were within prescribed SAP acceptance limits. Ensure that QC samples and standards prescribed in analytical SOPs were analyzed and within the prescribed control limits. If any significant QC deviations occur, the Laboratory QAM shall have contacted the TtNUS TOM.	TOM or designee, TtNUS

Step IIa / IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIa/IIb	Documentation of Analytical Reports for Completeness	Review the chain-of-custody form generated in the field to ensure that the required analytical samples have been collected, appropriate sample identifications have been used, and correct analytical methods have been applied. The TtNUS Data Validator will verify that elements of the data package required for validation are present, and if not, the laboratory will be contacted and the missing information will be requested. Validation will be performed as per Worksheet #36. Check that all data have been transferred correctly and completely to the final Structured Query Language (SQL) database.	Project Chemist or Data Validators, TtNUS
IIa/IIb	PALs	Review and add PALs to the laboratory electronic data deliverable. Flag samples and notify PM of samples that exceed PALs as listed in Worksheet #15.	TOM or designee, TtNUS
IIb	Project Quantitation Limits for sensitivity	Ensure that the project LOQs listed in Worksheet #15 were achieved.	Project Chemist or Data Validators, TtNUS
IIb	Analytical data Deviations	Determine the impact of any deviation from sampling or analytical methods, SOPs requirements, and matrix interferences effect on the analytical results.	Project Chemist or Data Validators, TtNUS

SAP Worksheet #36 –Analytical Data Validation (Steps IIa and IIb) Summary Table
(UFP-QAPP Manual Section 5.2.2.1) (Figure 37, page 110 UFP-QAPP Manual)

Step IIa / IIb	Matrix	Analytical Group	Validation Criteria	Data Validator (title and organizational affiliation)
IIa and IIb	Soil, SPLP leachate, and aqueous QC blanks	PAHs, Pesticides, and PCBs	SW-846 8270D, 8081B, and 8082A, method specific criteria, DoD QSM criteria, and those criteria listed in Worksheets #12, #15, #24, and #28 will be used. If not included in Worksheet #12, #15, #24, or #28, the logic outlined in USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic Data Review USEPA-540/R-99-008, October 1999 will be used to apply qualifiers to data.	Data Validation Specialist, TtNUS
IIa and IIb	Soil, SPLP leachate, and aqueous QC blanks	Metals	SW-846 6010C method specific criteria, DoD QSM criteria, and those listed in Worksheets #12, #15, #24, and #28 will be used. If not included in Worksheet #12, #15, #24, or #28, the logic outlined in USEPA CLP National Functional Guidelines for Inorganic Data Review USEPA 540-R-04-004, October 2004 will be used to apply qualifiers to data.	Data Validation Specialist, TtNUS

SAP Worksheet #37 -- Usability Assessment

(UFP-QAPP Manual Section 5.2.3)

Data Usability Assessment

The usability of the data directly affects whether project objectives can be achieved. The following characteristics will be evaluated at a minimum. The results of these evaluations will be included in the project report. The characteristics will be evaluated for multiple concentration levels if the evaluator determines that this is necessary. To the extent required by the type of data being reviewed, the assessors will consult with other technically competent individuals to render sound technical assessments of these DQI characteristics:

Completeness

- For each matrix that was scheduled to be sampled, the TtNUS FOL acting on behalf of the Project Team will prepare a table listing planned samples/analyses to collected samples/analyses. If deviations from the scheduled sample collection or analyses are identified the TtNUS TOM and risk assessor will determine whether the deviations compromise the ability to meet project objectives. If they do, the TtNUS TOM will consult with the Navy RPM and other project team members, as necessary (determined by the Navy RPM), to develop appropriate corrective actions.

Precision

- The TtNUS Project Chemist acting on behalf of the Project Team will determine whether precision goals for field duplicates and laboratory duplicates were met. This will be accomplished by comparing duplicate results to precision goals identified in Worksheets #12 and #28. This will also include a comparison of field and laboratory precision with the expectation that field duplicate results will be no less precise than laboratory duplicate results. If the goals are not met, or data have been flagged as estimated (J qualifier), limitations on the use of the data will be described in the project report.

Accuracy

- The TtNUS Project Chemist acting on behalf of the Project Team will determine whether the accuracy/bias goals were met for project data. This will be accomplished by comparing percent recoveries of LCS, LCSD, MS, MSD, and surrogate compounds to accuracy goals identified in Worksheet #28. This assessment will include an evaluation of field and laboratory contamination; instrument calibration variability; and analyte recoveries for surrogates, MS, and LCS. If the goals are not met, limitations on the use of the data will be described in the project report. Bias of the qualified results and a description of the impact of identified non-compliances on a specific data package or on the overall project data will be described in the project report.

Representativeness

- A project scientist identified by the TtNUS TOM and acting on behalf of the Project Team will determine whether the data are adequately representative of intended populations, both spatially and temporally. This will be accomplished by verifying that samples were collected and processed for analysis in accordance with the SAP, by reviewing spatial and temporal data variations, and by comparing these characteristics to expectations. The usability report will describe the representativeness of the data for each matrix and analytical fraction. This will not require quantitative comparisons unless professional judgment of the project scientist indicates that a quantitative analysis is required.

Comparability

- The TtNUS Project Chemist acting on behalf of the Project Team will determine whether the data generated under this project are sufficiently comparable to historical site data generated by different methods and for samples collected using different procedures and under different site conditions. This will be accomplished by comparing overall precision and bias among data sets for each matrix and analytical fraction. This will not require quantitative comparisons

unless professional judgment of the TtNUS Project Chemist indicates that such quantitative analysis is required.

Sensitivity

- The TtNUS Project Chemist acting on behalf of the Project Team will determine whether project sensitivity goals listed in Worksheet #15 are achieved. The overall sensitivity and quantitation limits from multiple data sets for each matrix and analysis will be compared. If sensitivity goals are not achieved, the limitations on the data will be described. The TtNUS Project Chemist will enlist the help of the project risk assessor to evaluate deviations from planned sensitivity goals.

Project Assumptions and Data Outliers

- The TtNUS TOM and designated team members will evaluate whether project assumptions are valid. This will typically be a qualitative evaluation but may be supported by quantitative evaluations. The type of evaluation depends on the assumption being tested.

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APPENDIX A

FIELD STANDARD OPERATING PROCEDURES AND FIELD FORMS

FS 3000. SOIL

Strikeouts and/or inserts by Brad Peebles (2/19/10) to render this NUS SOP specific to the tasks presented in the UFP-SAP

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. <u>Preservation (see FS 1000, Table FS 1000-7)</u>

5.3.1. <u>Low Level (≤ 200 µg/kg volatile organics)</u>

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.

After collecting the samples, remove the temporary casing (if used) and fill the hole filled with the excavated soil.

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 4000. SEDIMENT SAMPLING

Strikeouts and/or inserts by Brad Peebles (2/19/10) to render this NUS SOP specific to the tasks presented in the UFP-SAP

See also the following Standard Operating Procedures:

- FA 1000 Administrative
- FC 1000 Field Cleaning
- FD 1000 Documentation
- FM 1000 Field Mobilization
- FQ 1000 Quality Control
- FS 1000 General Sampling
- FS 7400 Benthic Macroinvertebate Sampling
- FT 1000 – 2000 Field Testing

1. INTRODUCTION AND SCOPE

Sediments occur in freshwater and marine environments such as streams/rivers, ponds/lakes, canals, ditches, wetlands, lagoons, and estuaries. Recently exposed sediment (due to low water levels) may also be sampled, but exposure to air could affect the characteristics of the sediment (for example, redox) and hence, the interpretation of the results of chemical or other analyses. The following methods are for physical, chemical, and toxicological sampling. See FS 7400 for benthic invertebrate sampling.

1.1. Select sampling locations for sediments depending upon the project objectives. Collect:

1.1.1. Sediment samples as an adjunct to surface water samples;

1.1.2. A series of sediment samples for compositing to determine water or sediment quality in a system;

1.1.3. Sediment samples above and below an outfall to document degradation due to a point source discharge; or

1.1.4. Sediment samples if stressed shore vegetation or visible surface water contamination is evident.

1.2. Decisions related to the selection of sampling locations will not be discussed in this document.

1.3. Collect, preserve and containerize surface water samples prior to collecting sediment samples (see FS 2100).

2. EQUIPMENT AND SUPPLIES

2.1. Refer to Table FS 4000-1 and FS 1000, Tables FS 1000-1, 1000-2 and 1000-3, for selection of sampling equipment and construction.

2.2. For information on the selection of appropriate sample containers, see FS 1000 Table FS 1000-6.

2.3. For information on cleaning requirements for sample containers, equipment and utensils, see FC 1000.

2.4. For information on documentation requirements, see FD 1000.

2.5. For information on preservation and holding time requirements, see FS 1000 Table FS 1000-6.

3. Sample Collection Protocols

Take sediment samples using one of three different types of equipment: scoops, corers and dredges or grab samplers.

3.1. Soil sampling equipment is generally not applicable to sediments because of the low cohesion of the medium.

3.2. When selecting the appropriate sampling equipment, consider sampling location (edge or middle of lagoon), depth of water and sediment, sediment grain size (fineness), water velocity and analytes of interest.

3.3. Direct collection with the appropriate sample container may be appropriate in very low water or where sediment is exposed.

3.4. Use dredges for hard or rocky substrates. They are heavy enough to use in high velocity streams.

3.5. Use coring devices in quiescent waters, unless water depth precludes effective sample collection.

3.6. Scoops or Similar Equipment

3.6.1. Scooping is generally most useful around the margin or shore of the water body or by wading in shallow waters.

3.6.1.1. Stand facing the direction of flow and approach the location from the downstream direction.

3.6.1.2. Take precautions not to disturb the bottom prior to scooping.

3.6.1.3. Scoop the sample in the upstream direction of flow.

3.6.2. For obtaining samples several feet from shore or from a boat, DEP recommends attaching the scoop to an extendible pole.

3.6.3. Transfer sample to the appropriate sample container(s), using a clean non-reactive utensil.

3.6.4. Label, preserve to 4°C with wet ice and complete field notes.

3.7. Corers

3.7.1. Coring devices can be easily fabricated from many materials. Although stainless steel, glass or Teflon must be used for sampling extractable organics, volatile organics and inorganics, aggregate organics, petroleum hydrocarbons and oil & grease, other inexpensive material (e.g., PVC, carbon steel, etc.) may be used for inorganic non-metallics and metals.

3.7.2. Some corers are simple “push tubes,” whereas other more sophisticated models may be finned, gravity driven devices.

3.7.3. A core may be useful for preserving the historical layering of sediments.

3.7.4. Upon descent, water displacement is minimal with core samplers, which minimizes the shock wave produced by other equipment such as dredges.

3.7.5. The corer is an acceptable choice for sampling fine sediments in static waters, especially those containing trace organics and metals.

3.7.6. Corer diameter, grain size and sample consistency will determine if the sample will remain in the corer upon withdrawal.

3.7.7. Sample washout can be a problem and there are several ways to reduce or prevent it.

3.7.7.1. Fit the leading edge of the corer with a nosepiece or core catcher that physically keeps the sample from slipping back out of the corer. The core catcher material must also be compatible with the analytes of interest.

3.7.7.2. A second option is fit the top or back end with a check valve which creates negative pressure on the back of the sample as it is being pulled from the substrate and prevents surface water from washing out the top portion of the sample.

3.7.8. Rotate the corer, if needed, as it is pushed into the sediment.

3.7.8.1. Rotate be around its axis (do not rock the coring device back and forth).

3.7.8.2. Rotation improves penetration and prevents compaction of the sample as it is pushed to the full length of the corer.

3.7.9. Upon withdrawal from the water surface, place a cap on the bottom to prevent the sample from sliding out.

3.7.10. Corers can also be fitted with liners. This is advantageous if a complete core is desired that has not been in contact with the atmosphere. It is also advantageous if the coring device is not constructed of the proper material (e.g., PVC) and one of the analytes requires a sampler of inert construction (glass, stainless steel or Teflon).

3.7.11. As the core is extruded, carefully remove the sample with a clean, non-reactive utensil and transfer into the appropriate sample container(s).

3.7.12. Label, preserve to 4°C with wet ice and complete field notes.

3.8. <u>Dredges or Grab Samplers</u>

3.8.1. The three main types of devices used in freshwater are the Ekman, Peterson and Ponar. ~~Heavier oceanographic dredges are used in marine and estuarine waters.~~

3.8.2. Refer to Table FS 4000-1 for additional types of dredges. The Peterson and Ponar dredges are suitable for hard or rocky substrates ~~or deep water bodies~~.

3.8.2.1. The Peterson and Ponar are virtually the same, except that the Ponar has been adapted with a top screen and side plates to prevent sample loss upon ascent. For this reason, the Ponar is the dredge of choice for rocky substrates. These dredges are heavy enough to use in streams with fast currents.

3.8.2.2. Open the jaws and place the cross bar into the proper notch.

3.8.2.3. Lower the dredge to the bottom, making sure it settles flat.

3.8.2.4. When tension is removed from the line, the cross bar will drop, enabling the dredge to close as the line is pulled upward during retrieval.

3.8.2.5. Pull the sampler to the surface. Check to make sure the jaws are fully closed and that no sample was lost while lifting the dredge.

3.8.2.6. Carefully open the jaws, remove the sample with a clean, non-reactive utensil and transfer the sample into the appropriate sample container(s), label, preserve to 4°C with wet ice and complete field notes.

3.8.3. The Ekman is designed for sampling soft substrates (e.g., sand, silt or mud) in areas with little current.

3.8.3.1. Open the spring-loaded jaws and attach the chains to the pegs at the top of the sampler.

3.8.3.2. Lower the dredge to the bottom, making sure it settles flat.

3.8.3.3. Holding the line taut and send down the messenger to close the jaws of the dredge.

3.8.3.4. Pull the sampler to the surface. Check to make sure the jaws are fully closed and that no sample was lost while lifting the dredge.

3.8.3.5. Carefully open the jaws, remove the sample with a clean, non-reactive utensil and transfer the sample into the appropriate sample container(s).

3.8.3.6. Label, preserve to 4°C with wet ice and complete field notes.

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 sediment samples. The appropriateness of compositing sediment samples will depend on the data quality objectives of the project. However, it is sometimes advantageous to composite sediment 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. Collection of Interstitial or Pore Water Samples

5.1. ASTM identifies interstitial water or pore water as the “water occupying the space between sediment…particles.” It “is often isolated to provide either a matrix for toxicity testing or an indication of the concentration and partitioning of contaminants with a sediment matrix.” See American Society for Testing and Materials, Annual Book of ASTM Standards, Standard Guide for Collection, Storage, Characterization and Manipulation of Sediments for Toxicological Testing and for Selection of Samplers Used to Collect Benthic Invertebrates, Section E 1391-03, Volume 11-05. Collect pore water using available technology that will preserve the integrity of the analytes of interest during collection. Pore water may be extracted in the laboratory from field-collected sediments. Consult the detailed discussion in the ASTM guidance if pore water is to be extracted and analyzed as part of the sampling design. Use of pore water wells (e.g., shallow PVC wells) or pore water equilibrators (e.g., Plexiglas plates with built-in wells or other appropriate construction) is also acceptable.

5.2. Collect adequate amounts of sample in the field to obtain desired quantities of pore water for testing. Sandy sediments retain less water than fine sediments do; thus, the

substrate type will dictate the amount of additional sample needed. In all cases, consult the laboratory conducting the analyses to provide estimates of the amount of sediment necessary to obtain the desired quantity of pore water.

Appendix FS 4000

Tables, Figures and Forms

Table FS 4000-1: Summary of Bottom Sampling Equipment [from ASTM E 1391-94]

TABLE FS 4000-1 Summary of Bottom Sampling Equipment [from ASTM E 1391-94]

Device	Use	Advantages	Disadvantages
Teflon or glass tube	Shallow wadeable waters ~~or deep waters if SCUBA available.~~ Soft or semi-consolidated deposits.	Preserves layering and permits historical study of sediment deposition. Rapid - samples immediately ready for laboratory shipment. Minimal risk of contamination.	Small sample size requires repetitive sampling.
Hand corer with removable teflon or glass liners	Same as above except more consolidated sediments can be obtained.	Handles provide for greater ease of substrate penetration. Above advantages.	Careful handling necessary to prevent spillage. Requires removal of liners before repetitive sampling. Slight risk of metal contamination from barrel and core cutter.
Box corer	Same as above.	Collection of large sample undisturbed, allowing for subsampling.	Hard to handle.
Gravity corers, such as Phleger Corer	~~Deep lakes and rivers~~. Semi-consolidated sediments.	Low risk of sample contamination. Maintains sediment integrity relatively well.	Careful handling necessary to avoid sediment spillage. Small sample, require repetitive operation and removal of liners. Time consuming.
Young grab (Teflon or kynar-lined, modified 0.1-m^2 Van Veen)	Lakes ~~and marine areas~~.	Eliminates metal contamination. Reduced bow wake.	Expensive. Requires winch.
Ekman or box dredge	Soft to semi-soft sediments. Can be used from boat, bridge, or pier in waters of various depths.	Obtains a larger sample than coring tubes. Can be subsampled through box lid.	Possible incomplete jaw closure and sample loss. Possible shock wave, which may disturb the "fines". Metal construction may introduce contaminants. Possible loss of "fines" on retrieval.
PONAR grab sampler Petite PONAR grab sampler	~~Deep lakes, rivers and estuaries.~~ Useful on sand, silt, or clay.	Most universal grab sampler. Adequate on most substrates. Large sample obtained intact, permitting subsampling.	Shock wave from descent may disturb "fines." Possible incomplete closure of jaws results in sample loss. Possible contamination from metal frame construction. Sample must be further prepared for analysis.
~~BMH 53 piston corer~~	~~Waters of 4 to 6 ft deep when used with extension rod. Soft to semi-consolidated deposits.~~	~~Piston provides for greater sample retention.~~	~~Cores must be extruded on site to other containers. Metal barrels introduce risk of metal contamination.~~
Van Veen dredge	~~Deep lakes, rivers and estuaries.~~ Useful on sand, silt, or clay.	Adequate on most substrates. Large sample obtained intact, permitting subsampling.	Shock wave from descent may disturb "fines." Possible incomplete closure of jaws results in sample loss. Possible contamination from metal frame construction. Sample must be further prepared for analysis.
BMH-60 grab sampler	Sampling moving waters from a fixed platform.	Streamlined configuration allows sampling where other devices could not achieve proper orientation.	Possible contamination from metal construction. Subsampling difficult. Not effective for sampling fine sediments.
Petersen grab sampler	~~Deep lakes, rivers and estuaries.~~ Useful on most substrates.	Large sample; can penetrate most substrates.	Heavy. May require winch. No cover lid to permit subsampling. All other disadvantages of Ekman and Ponar.
~~Shipek grab sampler~~	~~Used primarily in marine waters and large inland lakes and reservoirs.~~	~~Sample bucket may be opened to permit subsampling. Retains fine-grained sediments effectively.~~	~~Possible contamination from metal construction. Heavy. May require winch.~~
Orange-Peel grab Smith-McIntyre grab	~~Deep lakes, rivers and estuaries.~~ Useful on most substrates.	Designed for sampling hard substrates.	Loss of fines. Heavy. May require winch. Possible metal contamination.
Scoops Drag Buckets	Various environments, depending on depth and substrate.	Inexpensive, easy to handle.	Loss of fines on retrieval through water column.

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1.0 PURPOSE

The purpose of this document is to specify a consistent sample nomenclature system that will facilitate subsequent data management in a cost-effective manner. The sample nomenclature system has been devised such that the following objectives can be attained:

- Sorting of data by matrix.
- Sorting of data by depth.
- Maintenance of consistency (field, laboratory, and data base sample numbers).
- Accommodation of all project-specific requirements.
- Accommodation of laboratory sample number length constraints (maximum of 20 characters).

2.0 SCOPE

The methods described in this procedure shall be used consistently for all projects requiring electronic data.

3.0 GLOSSARY

None.

4.0 RESPONSIBILITIES

Program Manager - It shall be the responsibility of the Program Manager (or designee) to inform contract-specific Project Managers of the existence and requirements of this Standard Operating Procedure.

Project Manager - It shall be the responsibility of the Project Manager to determine the applicability of this Standard Operating Procedure based on: (1) program-specific requirements, and (2) project size and objectives. It shall be the responsibility of the Project Manager (or designee) to ensure that the sample nomenclature is thoroughly specified in the relevant project planning document (e.g., sampling and analysis plan) and is consistent with this Standard Operating Procedure if relevant. It shall be the responsibility of the project manager to ensure that the Field Operations Leader is familiar with the sample nomenclature system.

Field Operations Leader - It shall be the responsibility of the Field Operations Leader to ensure that all field technicians or sampling personnel are thoroughly familiar with this Standard Operating Procedure and the project-specific sample nomenclature system. It shall be the responsibility of the Field Operations Leader to ensure that the sample nomenclature system is used during all project-specific sampling efforts.

5.0 PROCEDURES

5.1 Introduction

The sample identification (ID) system can consist of as few as 8 but not more than 20 distinct alpha-numeric characters. The sample ID will be provided to the laboratory on the sample labels and chain-of-custody forms. The basic sample ID provided to the lab has three segments and shall be as follows where "A" indicates "alpha," and "N" indicates "numeric":

A or N 3- or 4-Characters	AAA 2- or 3-Characters	A or N 3- to 6-Characters
Site Identifier	Sample Type	Sample Location

Additional segments may be added as needed. For example:

(1) Soil and Sediment Sample ID

A or N 3- or 4-Characters	AAA 2- or 3-Characters	A or N 3- to 6-Characters	NNNN 4-Characters
Site Identifier	Sample Type	Sample Location	Sample Depth

(2) Aqueous (groundwater or surface water) Sample ID

A or N 3- or 4-Characters	AAA 2- or 3-Characters	A or N 3- to 6-Characters	NN 2-Characters	-A
Site Identifier	Sample type	Sample Location	Round Number	Filtered Sample only

(3) Biota Sample ID

A or N 3- or 4-Characters	AAA 2- or 3-Characters	A or N 3- to 6-Characters	AA 2-Characters	NNN 3-Characters
Site Identifier	Sample Type	Sample Location	Species Identifier	Sample Group Number

5.2 Sample Identification Field Requirements

The various fields in the sample ID will include but are not limited to the following:

- Site Identifier
- Sample Type
- Sample Location
- Sample Depth
- Sampling Round Number
- Filtered
- Species Identifier
- Sample Group Number

The site identifier must be a three- or four-character field (numeric characters, alpha characters, or a mixture of alpha and numeric characters may be used). A site number is necessary since many facilities/sites have multiple individual sites, SWMUs, operable units, etc. Several examples are presented in Section 5.3 of this SOP.

The sample type must be a two- or three-character alpha field. Suggested codes are provided in Section 5.3 of this SOP.

The sample location must be at least a three-character field but may have up to six-characters (alpha, numeric, or a mixture). The six-characters may be useful in identifying a monitoring well to be sampled or describing a grid location.

The sample depth field is used to note the depth below ground surface (bgs) at which a soil or sediment sample is collected. The first two numbers of the four-number code specify the top interval, and the third and fourth specify the bottom interval in feet bgs of the sample. If the sample depth is equal to or greater than 100, then only the top interval would be represented and the sampling depth would be truncated to

three-characters. The depths will be noted in whole numbers only; further detail, if needed, will be recorded on the sample log sheet, boring log, logbook, etc.

A two-digit round number will be used to track the number of aqueous samples taken from a particular aqueous sample location. The first sample collected from a location will be assigned the round identifier 01, the second 02, etc. This applies to both existing and proposed monitoring wells and surface water locations.

Aqueous samples that are field filtered (dissolved analysis) will be identified with an "-F" in the last field segment. No entry in this segment signifies an unfiltered (total) sample.

The species identifier must be a two-character alpha field. Several suggested codes are provided in Section 5.3 of this SOP.

The three digit sample group number will be used to track the number of biota sample groups (a particular group size may be determined by sample technique, media type, the number of individual caught, weight issues, time, etc.) by species and location. The first sample group of a particular species collected from a given location will be assigned the sample group number 001 and the second sample group of the same species collected from the same location will be assigned the sample group number 002.

5.3 Example Sample Field Designations

Examples of each of the fields are as follows:

Site Identifier - Examples of site numbers/designations are as follows:

A01 - Area of Concern Number 1
125 - Solid Waste Management Unit Number 125
000 - Base or Facility Wide Sample (e.g., upgradient well)
BBG - Base Background

The examples cited are only suggestions. Each Project Manager (or designee) must designate appropriate (and consistent) site designations for their individual project.

Sample Type - Examples of sample types are as follows:

AH - Ash Sample
AS - Air Sample
BM - Building Material Sample
BSB - Biota Sample Full Body
BSF - Biota Sample Fillet
CP - Composite Sample
CS - Chip Sample
DS - Drum Sample
DU - Dust Sample
FP - Free Product
IDW - Investigation Derived Waste Sample
LT - Leachate Sample
MW - Monitoring Well Groundwater Sample
OF - Outfall Sample
RW - Residential Well Sample
SB - Soil Boring Sample
SD - Sediment Sample
SC - Scrape Sample

SG - Soil Gas Sample
SL - Sludge Sample
SP - Seep Sample
SS - Surface Soil Sample
ST - Storm Sewer Water Sample
SW - Surface Water Sample
TP - Test Pit Sample
TW - Temporary Well Sample
WC - Well Construction Material Sample
WP - Wipe Sample
WS - Waste/Solid Sample
WW - Wastewater Sample

Sample Location - Examples of the location field are as follows:

001 - Monitoring Well 1
N32E92 - Grid location 32 North and 92 East
D096 - Investigation derived waste drum number 96

Species Identifier - Examples of species identifier are as follows:

BC - Blue Crab
GB - Blue Gill
CO - Corn
SB - Soybean

5.4 Examples of Sample Nomenclature

The first round monitoring well groundwater sample collected from existing monitoring well 001 at SWMU 16 for a filtered sample would be designated as 016MW00101-F.

The second round monitoring well groundwater sample collected from existing monitoring well C20P2 at Site 23 for an unfiltered sample would be designated as 023MWC20P202.

The second surface water sample collected from point 01 at SWMU 130 for an unfiltered sample would be designated as 130SW00102.

A surface soil sample collected from grid location 32 North and 92 East at Site 32 at the 0- to 2-foot interval would be designated as 032SSN32E920002.

A subsurface soil sample from soil boring 03 at SWMU 32 at an interval of 4 to 5 feet bgs would be designated as 032SB0030405.

A sediment sample collected at SWMU 19 from 0 to 6 inches at location 14 would be designated as 019SD0140001. The sample data sheet would reflect the precise depth at which this sample was collected.

During biota sampling for full body analysis the first time a minnow trap was checked at grid location A25 of SWMU 1415 three small blue gills were captured, collected and designated with the sample ID of 1415BSBA25BG001. The second time blue gill were collected at the same location (grid location A25 at SWMU 1415) the sample ID designation given was 1415BSBA25BG002.

Note: No dash (-) or spacing is used between the segments with the exception of the filtered segment. The "F" used for a filtered aqueous sample is preceded by a dash "-F".

5.5 Field Quality Assurance/Quality Control (QA/QC) Sample Nomenclature)

Field QA/QC will be designated using a different coding system. The QC code will consist of a three- to four-segment alpha-numeric code that identifies the sample QC type, the date the sample was collected, and the number of this type of QC sample collected on that date.

AA	NNNNNN	NN	-F
QC Type	Date	Sequence Number (per day)	Filtered (aqueous only, if needed)

The QC types are identified as:

TB = Trip Blank
RB = Rinsate Blank (Equipment Blank)
FD = Field Duplicate
AB = Ambient Conditions Blank
WB = Source Water Blank

The sampling time recorded on the Chain-of-Custody Form, labels, and tags for duplicate samples will be 0000 so that the samples are "blind" to the laboratory. Notes detailing the sample number, time, date, and type will be recorded on the routine sample log sheets and will document the location of the duplicate sample (sample log sheets are not provided to the laboratory). Documentation for all other QC types (TB, RB, AB, and WB) will be recorded on the QC Sample Log sheet (see SOP on Field Documentation).

5.6 Examples of Field QA/QC Sample Nomenclature

The first duplicate of the day for a filtered ground water sample collected on June 3, 2000 would be designated as FD06030001-F.

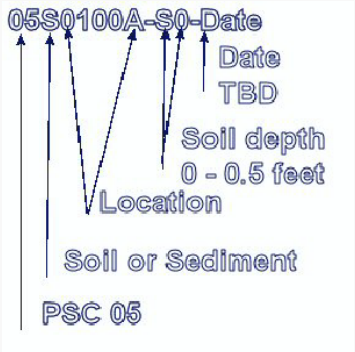
The third duplicate of the day taken of a subsurface soil sample collected on November 17, 2003 would be designated as FD11170303.

The first trip blank associated with samples collected on October 12, 2000 would be designated as TB10120001.

The only rinsate blank collected on November 17, 2001 would be designated as RB11170101.

6.0 DEVIATIONS

Any deviation from this SOP must be addressed in detail in the site specific planning documents.



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Strikeouts and/or inserts by Brad Peebles (2/19/10) to render this NUS SOP specific to the tasks presented in the UFP-SAP

1.0 PURPOSE

The purpose of this document is to specify a consistent procedure for the quality assurance review of electronic and hard copy databases. This SOP outlines the requirements for establishment of a Database Record File, Quality Assurance review procedures, and documentation of the Quality Assurance Review Process.

2.0 SCOPE

The methods described in this Standard Operating Procedure (SOP) shall be used consistently for all projects managed by Tetra Tech NUS (TtNUS).

3.0 GLOSSARY

Chain-of-Custody Form - A Chain-of-Custody Form is a printed form that accompanies a sample or a group of samples from the time of sample collection to the laboratory. The Chain-of-Custody Form is retained with the samples during transfer of samples from one custodian to another. The Chain-of-Custody Form is a controlled document that becomes part of the permanent project file. Chain-of-Custody and field documentation requirements are addressed in SOP SA-6.1.

Electronic Database - A database provided on a compact laser disk (CD). Such electronic databases will generally be prepared using public domain software such as DBase, RBase, Oracle, Visual FoxPro, Microsoft Access, Paradox, etc.

Hardcopy Database - A printed copy of a database prepared using the software discussed under the definition of an electronic database.

Form I - A printed copy of the analytical results for each sample.

Sample Tracking Summary - A printed record of sample information including the date the samples were collected, the number of samples collected, the sample matrix, the laboratory to which the samples were shipped, the associated analytical requirements for the samples, the date the analytical data were received from the laboratory, and the date that validation of the sample data was completed.

4.0 RESPONSIBILITIES

Database Records Custodian - It shall be the responsibility of the Database Records Custodian to update and file the Sample Tracking Summaries for all active projects on a weekly basis. It shall be the responsibility of the Database Records Custodian to ensure that the most recent copies of the Sample Tracking Summaries are placed in the Database Records file. It shall be the responsibility of the Database Records Custodian to ensure that a copy of all validation deliverables is provided to the Project Manager (for placement in the project file). It shall be the responsibility of the Database Records Custodian to ensure that photocopies of all validation deliverables and historical data and reports (as applicable) are placed in the Database Records file.

Data Validation Coordinator - It shall be the responsibility of the Data Validation Coordinator (or designee) to ensure that the Sample Tracking Summaries are maintained by the Database Records Custodian. It shall be the responsibility of the Data Validation Coordinator (or designee) to ensure that photocopies of all data validation deliverables are placed in the applicable Database Records file by the Database Records Custodian.

Earth Sciences Department Manager - It shall be the responsibility of the Earth Sciences Department Manager (or equivalent) to ensure that all field personnel are familiar with the requirements of this Standard Operating Procedure (specifically Section 5.5).

FOL - It shall be the responsibility of the FOL (FOL) of each project to ensure that all field technicians or sampling personnel are thoroughly familiar with this SOP, specifically regarding provision of the Chain-of-Custody Forms to the Database Records Custodian. Other responsibilities of the FOL are described in Sections 5.4 and 5.5.

Management Information Systems (MIS) Manager - It shall be the responsibility of the MIS Manager to ensure that copies of original electronic deliverables (CDs) are placed in both the project files and the Database Records File. It shall be the responsibility of the MIS Manager (or designee) to verify the completeness of the database (presence of all samples) in both electronic and hardcopy form in the Database Records File. It shall be the responsibility of the MIS Manager to ensure that Quality Assurance Reviews are completed and are attested to by Quality Assurance Reviewers. It shall be the responsibility of the MIS Manager to ensure that records of the Quality Assurance review process are placed in the Database Records File. It shall be the responsibility of the MIS Manager to ensure that both electronic and hardcopy forms of the final database are placed in both the project and the Database Record File. It shall be the responsibility of the MIS Manager to ensure that data validation qualifiers are entered in the database.

Furthermore, it shall be the responsibility of the MIS Manager to participate in project planning at the request of the Project Manager, specifically with respect to the generation of level of effort and schedule estimates. To support the project planning effort, the MIS Manager shall provide a copy of the MIS Request From included as Attachment A to the project manager. It shall be the responsibility of the MIS Manager to generate level of effort and budget estimates at the time database support is requested if a budget does not exist at the time of the request. The MIS Request Form shall be provided to the Project Manager at the time of any such requests. It shall be the responsibility of the MIS Manager to notify the Project Manager of any anticipated level of effort overruns or schedule noncompliances as soon as such problems arise along with full justification for any deviations from the budget estimates (provided they were generated by the MIS Manager). It shall be the responsibility of the MIS Manager to document any changes to the scope of work dictated by the Project Manager, along with an estimate of the impact of the change on the level of effort and the schedule.

Program/Department Managers - It shall be the responsibility of the Department and/or Program Managers (or designees) to inform their respective department's Project Managers of the existence and requirements of this SOP.

Project Manager - It shall be the responsibility of each Project Manager to determine the applicability of this SOP based on: (1) program-specific requirements, and (2) project size and objectives. It shall be the responsibility of the Project Manager (or designee) to ensure that the FOL is familiar with the requirements regarding Chain-of-Custody Form provision to the Database Records Custodian. It shall be the responsibility of the Project Manager (or designee) to determine which, if any, historical data are relevant and to ensure that such data (including all relevant information such as originating entity, sample locations, sampling dates, etc.) are provided to the Database Records Custodian for inclusion in the Database Records File. It shall be the responsibility of the Project Manager to obtain project planning input regarding the level of effort and schedule from the MIS Manager. It shall be the responsibility of the Project Manager to complete the database checklist (Attachment A) to support the level of effort and schedule estimate and to facilitate database preparation and subroutine execution.

Risk Assessment Department Manager - It shall be the responsibility of the Risk Assessment Department Manager to monitor compliance with this Standard Operating Procedure, to modify this SOP as necessary, and to take corrective action if necessary. Monitoring of the process shall be completed on a quarterly basis.

Quality Assurance Reviewers - It shall be the responsibility of the Quality Assurance Reviewers to verify the completeness of the sample results via review of the Chain-of-Custody Forms and Sample Tracking Summaries. It shall be the responsibility of the Quality Assurance Reviewers to ensure the correctness of the database via direct comparison of the hardcopy printout of the database and the hardcopy summaries of the original analytical data (e.g., Form Is provided in data validation deliverables). Correctness includes the presence of all relevant sample information (all sample information fields), agreement of the laboratory and database analytical results, and the presence of data validation qualifiers.

Quality Manager - It shall be the responsibility of the Quality Manager to monitor compliance with this Standard Operating Procedure via routine audits.

5.0 PROCEDURES

5.1 Introduction

Verification of the accuracy and completeness of an electronic database can only be accomplished via comparison of a hardcopy of the database with hardcopy of all relevant sample information. The primary purposes of this SOP are to ensure that 1) all necessary hardcopy information is readily available to Quality Assurance Reviewers; 2) ensure that the Quality Assurance review is completed in a consistent and comprehensive manner, and; 3) ensure that documentation of the Quality Assurance review process is maintained in the project file.

5.2 File Establishment

A Database Record file shall be established for a specific project at the discretion of the Project Manager. Initiation of the filing procedure will commence upon receipt of the first set of Chain-of-Custody documents from a FOL or sampling technician. The Database Record Custodian shall establish a project-specific file for placement in the Database Record File. Each file in the Database Record File shall consist of standard components placed in the file as the project progresses. Each file shall be clearly labeled with the project number, which shall be placed on the front of the file drawer and on each and every hanging file folder relevant to the project. The following constitute the minimum components of a completed file:

- Electronic Deliverables
- Sample Tracking Forms
- Chain-of-Custody Forms
- Data Validation Letters
- Quality Assurance Records

5.3 Electronic Deliverables

The format of electronic deliverables shall be specified in the laboratory procurement specification and shall be provided by the laboratory. The integrity of all original electronic data deliverables shall be maintained. This shall be accomplished via the generation of copies of each electronic deliverable provided by the laboratory. The original electronic deliverable shall be provided to the project manager for inclusion in the project file. A copy of the original electronic deliverable shall be placed in the Database Record File. The second copy shall be maintained by the MIS Manager (or designee) to be used as a working copy.

5.4 Sample Tracking Forms

Updated versions of the sample tracking form for each relevant project shall be maintained by the Database Record Custodian. The Sample Tracking Forms shall be updated any time additional Chain-of-Custody Forms are received from a FOL or sampling technician, or at any time that data are received from a laboratory, or at any time that validation of a given data package (sample delivery group) is completed. The Data Validation Coordinator shall inform the Database Record Custodian of the receipt of any data packages from the laboratory and of completion of validation of a given data package to facilitate updating of the Sample Tracking Form. The Database Record Custodian shall place a revised copy of the Sample Tracking Form in the Database Record File anytime it has been updated. Copies of the updated Sample Tracking Form shall also be provided to the project manager to apprise the project manager of sample package receipt, completion of validation, etc.

5.5 Chain-of-Custody Forms

The Chain-of-Custody Forms for all sampling efforts will be used as the basis for (1) updating the Sample Tracking Form, and (2) confirming that all required samples and associated analyses have been completed. It shall be the responsibility of the FOL (or sample technician) to provide a photocopy of all Chain-of-Custody Forms to the Database Record Custodian immediately upon completion of a sampling effort. The Database Record Custodian shall then place the copies of the Chain-of-Custody Form(s) in the Database Record File. Upon receipt of a sample data package from an analytical laboratory, the Data Validation Coordinator shall provide a copy of the laboratory Chain-of-Custody Form to the Database Record Custodian. The Database Record Custodian shall use this copy to update the Sample Tracking Summary and shall place the copy of the laboratory-provided Chain-of-Custody Form in the Database Record File. The photocopy of the laboratory-provided Chain-of Custody Form shall be stapled to the previously filed field copy. Upon receipt of all analytical data, two copies of the Chain-of-Custody will therefore be in the file. Review of the Chain-of-Custody Forms will therefore be a simple mechanism to determine if all data have been received. Chain-of-Custody is addressed in SOP SA-6.1.

5.6 Data Validation Letters

All data validation deliverables (or raw data summaries if validation is not conducted) shall be provided for inclusion in both the Database Record File and the project file. If USEPA regional- or client-specific requirements are such that Form Is (or similar analytical results) need not be provided with the validation deliverable, copies of such results must be appended to the deliverable. It is preferable, although not essential that the validation qualifiers be hand-written directly on the data summary forms. The data validation deliverables (and attendant analytical summaries) will provide the basis for direct comparison of the database printout and the raw data and qualifiers.

5.7 Historical Data

At the direction of the Project Manager, historical data may also be included in a project-specific analytical database. In the event that historical data are germane to the project, hardcopy of the historical data must be included in the Database Record File. Historical data may be maintained in the form of final reports or as raw data. The information contained in the historical data file must be sufficient to identify its origin, its collection date, the sample location, the matrix, and any and all other pertinent information. All available analytical data, Chain-of-Custody Forms, boring logs, well construction logs, sample location maps, shall be photocopied by the Project Manager (or designee) and placed in one or more 3-ring binders. All information shall be organized chronologically by matrix. It shall be the responsibility of the Project Manager (or designee) to ensure that all inconsistencies between analytical data, Chain-of-Custody Forms, boring logs, sample log sheets, and field logbooks are identified and corrected. The Project Manager (or designee) shall decide which nomenclature is appropriate and edit, initial and date all relevant forms. Data entry may only be performed on information that has undergone the aforementioned

editing process, thereby having a direct correlation between hardcopy information and what will become the electronic database.

6.0 RECORDS

Records regarding database preparation and quality assurance review include all those identified in the previous section. Upon completion of the database task, records from the file will be forwarded to the Project Manager for inclusion in the project file, or will be placed in bankers boxes (or equivalent) for storage. The final records for storage shall include the following minimum information on placards placed on both the top and end of the storage box:

Database Record File
PROJECT NUMBER: ____
SITE NAME: _____
DATE FILED: __/__/__
SUMMARY OF CONTENTS ENCLOSED
BOX _ OF _

Project- or program-specific record keeping requirements shall take precedence over the record keeping requirements of this SOP.

ATTACHMENT A

MIS REQUEST FORM

Tetra Tech NUS, Inc.

Project Name: _____ Request Date: _____
CTO: _____ Date Data Available for Production: _____
Project Manager: _____ Request in Support of: _____
Requestor: _____ Database Lead: _____
Program/Client: _____ GIS Lead: _____
State/EPA Region: _____ Statistics Lead: _____
Risk Lead: _____
Site Name(s) (Area, OU, etc.): _____
Sampling Date(s): _____
Matrix: ☐ GW ☐ SO ☐ SD ☐ SW ☐ Other: _____

Labels: ☐ Labels needed for an upcoming sampling event _____ Total # of Samples
_____ Estimated Hours
_____ Due Date
_____ Complete ETS Charge No.
_____ FOL
Additional Instructions: _____

Data Entry:
☐ Chemical data needs to be entered from hardcopy _____ Estimated # of Samples
☐ Chemical data needs to be formated electronically
☐ Field analytical data needs to be entered from hardcopy
☐ Geologic data needs to be entered from hardcopy
☐ Hydrology data needs to be entered from hardcopy
_____ Estimated Hours
_____ Due Date
_____ Complete ETS Charge No.
Additional Instructions: _____

Tables:
☐ Full Data Printout
☐ Summary of Positive Hits
☐ Occurance and Distribution ☐ with criteria
☐ Sampling Analytical Summary
☐ Other: _____
_____ Estimated Hours
_____ Due Date
_____ Complete ETS Charge No.
Additional Instructions: _____

GIS:
☐ General Facility Location
☐ Site Location
☐ Potentiometric Contours/Groundwater Flow
☐ Sample Location Proposed
☐ Sample Location Existing
☐ Tag Map Single Round
☐ Tag Map Multiple Round
☐ Isoconcentrations
☐ Chart Map
☐ 3D Visualization
☐ EGIS CD
☐ Other: _____
_____ Estimated Hours
_____ Due Date
_____ Complete ETS Charge No.
Additional Instructions: _____

Statistics: ☐ Yes
_____ Estimated Hours
_____ Due Date
_____ Complete ETS Charge No.
Additional Instructions: _____

Geostatistics: ☐ Yes
_____ Estimated Hours
_____ Due Date
_____ Complete ETS Charge No.
Additional Instructions: _____

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Strikeouts and/or inserts by Brad Peebles (2/19/10) to render this NUS SOP specific to the tasks presented in the UFP-SAP

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to identify and designate the field data record forms, logs and reports generally initiated and maintained for documenting Tetra Tech NUS field activities.

2.0 SCOPE

Documents presented within this procedure (or equivalents) shall be used for all Tetra Tech NUS field activities, as applicable. Other or additional documents may be required by specific client contracts or project planning documents.

3.0 GLOSSARY

None

4.0 RESPONSIBILITIES

Project Manager (PM) - The Project Manager is responsible for obtaining hardbound, controlled-distribution logbooks (from the appropriate source), as needed. In addition, the Project Manager is responsible for placing all field documentation used in site activities (i.e., records, field reports, sample data sheets, field notebooks, and the site logbook) in the project's central file upon the completion of field work.

Field Operations Leader (FOL) - The Field Operations Leader is responsible for ensuring that the site logbook, notebooks, and all appropriate and current forms and field reports illustrated in this guideline (and any additional forms required by the contract) are correctly used, accurately filled out, and completed in the required time-frame.

5.0 PROCEDURES

5.1 Site Logbook

5.1.1 General

The site logbook is a hard-bound, paginated, controlled-distribution record book in which all major onsite activities are documented. At a minimum, the following activities/events shall be recorded or referenced (daily) in the site logbook:

- All field personnel present
- Arrival/departure of site visitors
- Time and date of H&S training
- Arrival/departure of equipment
- Time and date of equipment calibration
- Start and/or completion of borehole, trench, monitoring well installation, etc.
- Daily onsite activities performed each day
- Sample pickup information
- Health and Safety issues (level of protection observed, etc.)
- Weather conditions

A site logbook shall be maintained for each project. The site logbook shall be initiated at the start of the first onsite activity (e.g., site visit or initial reconnaissance survey). Entries are to be made for every day

that onsite activities take place which involve Tetra Tech NUS or subcontractor personnel. Upon completion of the fieldwork, the site logbook must become part of the project's central file.

The following information must be recorded on the cover of each site logbook:

- Project name
- Tetra Tech NUS project number
- Sequential book number
- Start date
- End date

Information recorded daily in the site logbook need not be duplicated in other field notebooks (see Section 5.2), but must summarize the contents of these other notebooks and refer to specific page locations in these notebooks for detailed information (where applicable). An example of a typical site logbook entry is shown in Attachment A.

If measurements are made at any location, the measurements and equipment used must either be recorded in the site logbook or reference must be made to the field notebook in which the measurements are recorded (see Attachment A).

All logbook, notebook, and log sheet entries shall be made in indelible ink (black pen is preferred). No erasures are permitted. If an incorrect entry is made, the entry shall be crossed out with a single strike mark, and initialed and dated. At the completion of entries by any individual, the logbook pages used must be signed and dated. The site logbook must also be signed by the Field Operations Leader at the end of each day.

5.1.2 Photographs

When movies, slides, or photographs are taken of a site or any monitoring location, they must be numbered sequentially to correspond to logbook/notebook entries. The name of the photographer, date, time, site location, site description, and weather conditions must be entered in the logbook/notebook as the photographs are taken. A series entry may be used for rapid-sequence photographs. The photographer is not required to record the aperture settings and shutter speeds for photographs taken within the normal automatic exposure range. However, special lenses, films, filters, and other image-enhancement techniques must be noted in the logbook/notebook. If possible, such techniques shall be avoided, since they can adversely affect the accuracy of photographs. Chain-of-custody procedures depend upon the subject matter, type of camera (digital or film), and the processing it requires. Film used for aerial photography, confidential information, or criminal investigation require chain-of-custody procedures. Once processed, the slides of photographic prints shall be consecutively numbered and labeled according to the logbook/notebook descriptions. The site photographs and associated negatives and/or digitally saved images to compact disks must be docketed into the project's central file.

5.2 Field Notebooks

Key field team personnel may maintain a separate dedicated field notebook to document the pertinent field activities conducted directly under their supervision. For example, on large projects with multiple investigative sites and varying operating conditions, the Health and Safety Officer may elect to maintain a separate field notebook. Where several drill rigs are in operation simultaneously, each site geologist assigned to oversee a rig must maintain a field notebook.

5.3 Field Forms

All Tetra Tech NUS field forms (see list in Section 6.0 of this SOP) can be found on the company's intranet site (http://intranet.ttnus.com) under Field Log Sheets. Forms may be altered or revised for project-specific needs contingent upon client approval. Care must be taken to ensure that all essential information can be documented. Guidelines for completing these forms can be found in the related sampling SOP.

5.3.1 Sample Collection, Labeling, Shipment, Request for Analysis, and Field Test Results

5.3.1.1 Sample Log Sheet

Sample Log Sheets are used to record specified types of data while sampling. The data recorded on these sheets are useful in describing the sample as well as pointing out any problems, difficulties, or irregularities encountered during sampling. A log sheet must be completed for each sample obtained, including field quality control (QC) samples.

5.3.1.2 Sample Label

A typical sample label is illustrated in Attachment B. Adhesive labels must be completed and applied to every sample container. Sample labels can usually be obtained from the appropriate Program source electronically generated in-house, or are supplied from the laboratory subcontractor.

5.3.1.3 Chain-of-Custody Record Form

The Chain-of-Custody (COC) Record is a multi-part form that is initiated as samples are acquired and accompanies a sample (or group of samples) as they are transferred from person to person. This form must be used for any samples collected for chemical or geotechnical analysis whether the analyses are performed on site or off site. One carbonless copy of the completed COC form is retained by the field crew, one copy is sent to the Project Manager (or designee), while the original is sent to the laboratory. The original (top, signed copy) of the COC form shall be placed inside a large Ziploc-type bag and taped inside the lid of the shipping cooler. If multiple coolers are sent but are included on one COC form, the COC form should be sent with the cooler containing vials for VOC analysis or the cooler with the air bill attached. The air bill should then state how many coolers are included with that shipment. An example of a Chain-of-Custody Record form is provided as Attachment C. Once the samples are received at the laboratory, the sample cooler and contents are checked and any problems are noted on the enclosed COC form (any discrepancies between the sample labels and COC form and any other problems that are noted are resolved through communication between the laboratory point-of-contact and the Tetra Tech NUS Project Manager). The COC form is signed and copied. The laboratory will retain the copy while the original becomes part of the samples' corresponding analytical data package.

5.3.1.4 Chain-of-Custody Seal

Attachment D is an example of a custody seal. The Custody seal is an adhesive-backed label. It is part of a chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field and sealed in coolers for transport to the laboratory. The COC seals are signed and dated by the sampler(s) and affixed across the lid and body of each cooler (front and back) containing environmental samples (see SOP SA-6.1). COC seals may be available from the laboratory; these seals may also be purchased from a supplier.

5.3.1.5 Geochemical Parameters Log Sheets

Field Analytical Log Sheets are used to record geochemical and/or natural attenuation field test results.

5.3.2 Hydrogeological and Geotechnical Forms

5.3.2.1 ~~Groundwater Level Measurement Sheet~~

~~A Groundwater Level Measurement Sheet must be filled out for each round of water level measurements made at a site.~~

~~5.3.2.2 Data Sheet for Pumping Test~~

~~During the performance of a pumping test (or an in-situ hydraulic conductivity test), a large amount of data must be recorded, often within a short time period. The Pumping Test Data Sheet facilitates this task by standardizing the data collection format for the pumping well and observation wells, and allowing the time interval for collection to be laid out in advance.~~

~~5.3.2.3 Packer Test Report Form~~

~~A Packer Test Report Form must be completed for each well upon which a packer test is conducted.~~

~~5.3.2.4 Boring Log~~

~~During the progress of each boring, a log of the materials encountered, operation and driving of casing, and location of samples must be kept. The Summary Log of Boring, or Boring Log is used for this purpose and must be completed for each soil boring performed. In addition, if volatile organics are monitored on cores, samples, cuttings from the borehole, or breathing zone, (using a PID or FID), these readings must be entered on the boring log at the appropriate depth. The "Remarks" column can be used to subsequently enter the laboratory sample number, the concentration of key analytical results, or other pertinent information. This feature allows direct comparison of contaminant concentrations with soil characteristics.~~

~~5.3.2.5 Monitoring Well Construction Details Form~~

~~A Monitoring Well Construction Details Form must be completed for every monitoring well, piezometer, or temporary well point installed. This form contains specific information on length and type of well riser pipe and screen, backfill, filter pack, annular seal and grout characteristics, and surface seal characteristics. This information is important in evaluating the performance of the monitoring well, particularly in areas where water levels show temporal variation, or where there are multiple (immiscible) phases of contaminants. Depending on the type of monitoring well (in overburden or bedrock, stick-up or flush mount), different forms are used.~~

~~5.3.2.6 Test Pit Log~~

~~When a test pit or trench is constructed for investigative or sampling purposes, a Test Pit Log must be filled out by the responsible field geologist or sampling technician.~~

~~5.3.2.7 Miscellaneous Monitoring Well Forms~~

~~Monitoring Well Materials Certificate of Conformance should be used as the project directs to document all materials utilized during each monitoring well installation.~~

~~The Monitoring Well Development Record should be used as the project directs to document all well development activities.~~

5.3.2.8 Miscellaneous Field Forms - QA and Checklists

Container Sample and Inspection Sheet should be used as the project directs each time a container (drum, tank, etc.) is sampled and/or inspected.

QA Sample Log Sheet should be used at the project directs each time a QA sample is colleted, such as Rinsate Blank, Source Blank, etc.

Field Task Modification Request (FTMR) will be prepared for all deviations from the project planning documents. The FOL is responsible for initiating the FTMRs. Copies of all FTMRs will be maintained with the onsite planning documents and originals will be placed in the final evidence file.

The Field Project Daily Activities Check List and Field Project Pre-Mobilization Checklist should be used during both the planning and field effort to assure that all necessary tasks are planned for and completed. These two forms are not a requirement but a useful tool for most field work.

5.3.3 Equipment Calibration and Maintenance Form

The calibration or standardization of monitoring, measuring or test equipment is necessary to assure the proper operation and response of the equipment, to document the accuracy, precision or sensitivity of the measurement, and determine if correction should be applied to the readings. Some items of equipment require frequent calibration, others infrequent. Some are calibrated by the manufacturer, others by the user.

Each instrument requiring calibration has its own Equipment Calibration Log which documents that the manufacturer's instructions were followed for calibration of the equipment, including frequency and type of standard or calibration device. An Equipment Calibration Log must be maintained for each electronic measuring device used in the field; entries must be made for each day the equipment is used or in accordance with the manufacturer's recommendations.

5.4 Field Reports

The primary means of recording onsite activities is the site logbook. Other field notebooks may also be maintained. These logbooks and notebooks (and supporting forms) contain detailed information required for data interpretation or documentation, but are not easily useful for tracking and reporting of progress. Furthermore, the field logbook/notebooks remain onsite for extended periods of time and are thus not accessible for timely review by project management.

5.4.1 Daily Activities Report

To provide timely oversight of onsite contractors, Daily Activities Reports are completed and submitted as described below.

5.4.1.1 Description

The Daily Activities Report (DAR) documents the activities and progress for each day's field work. This report must be filled out on a daily basis whenever there are drilling, test pitting, well construction, or other related activities occurring which involve subcontractor personnel. These sheets summarize the work performed and form the basis of payment to subcontractors. The DAR form can be found on the TtNUS intranet site.

5.4.1.2 Responsibilities

It is the responsibility of the ~~rig~~ geologist to complete the DAR ~~and obtain the driller's signature acknowledging that the times and quantities of material entered are correct~~.

5.4.1.3 Submittal and Approval

At the end of the shift, the ~~rig~~ geologist must submit the Daily Activities Report to the Field Operations Leader (FOL) for review and filing. The Daily Activities Report is not a formal report and thus requires no further approval. The DAR reports are retained by the FOL for use in preparing the site logbook and in preparing weekly status reports for submission to the Project Manager.

5.4.2 Weekly Status Reports

To facilitate timely review by project management, photocopies of logbook/notebook entries may be made for internal use.

It should be noted that in addition to summaries described herein, other summary reports may also be contractually required.

All Tetra Tech NUS field forms can be found on the company's intranet site at http://intranet.ttnus.com under Field Log Sheets.

6.0 LISTING OF TETRA TECH NUS FIELD FORMS FOUND ON THE TTNUS INTRANET SITE. HTTP://INTRANET.TTNUS.COM CLICK ON FIELD LOG SHEETS

~~Groundwater Sample Log Sheet~~
~~Surface Water Sample Log Sheet~~
Soil/Sediment Sample Log Sheet
Container Sample and Inspection Sheet
~~Geochemical Parameters (Natural Attenuation)~~
~~Groundwater Level Measurement Sheet~~
~~Pumping Test Data Sheet~~
~~Packer Test Report Form~~
~~Boring Log~~
~~Monitoring Well Construction Bedrock Flush Mount~~
~~Monitoring Well Construction Bedrock Open Hole~~
~~Monitoring Well Construction Bedrock Stick Up~~
~~Monitoring Well Construction Confining Layer~~
~~Monitoring Well Construction Overburden Flush Mount~~
~~Monitoring Well Construction Overburden Stick Up~~
~~Test Pit Log~~
~~Monitoring Well Materials Certificate of Conformance~~
~~Monitoring Well Development Record~~

Daily Activities Record
Field Task Modification Request
~~Hydraulic Conductivity Test Data Sheet~~
~~Low Flow Purge Data Sheet~~
QA Sample Log Sheet
Equipment Calibration Log
Field Project Daily Activities Checklist
Field Project Pre-Mobilization Checklist

ATTACHMENT A
TYPICAL SITE LOGBOOK ENTRY

START TIME: _____ DATE: _____

SITE LEADER: _____

PERSONNEL:

TtNUS	DRILLER	SITE VISITORS
_____	_____	_____
_____	_____	_____
_____	_____	_____

WEATHER: Clear, 68°F, 2-5 mph wind from SE

ACTIVITIES:

1. Steam jenney and fire hoses were set up.
2. Drilling activities at well ____ resumes. Rig geologist was _____. See Geologist's Notebook, No. 1, page 29-30, for details of drilling activity. Sample No. 123-21-S4 collected; see sample logbook, page 42. Drilling activities completed at 11:50 and a 4-inch stainless steel well installed. See Geologist's Notebook, No. 1, page 31, and well construction details for well _____.
3. Drilling rig No. 2 steam-cleaned at decontamination pit. Then set up at location of well _____.
4. Well _____ drilled. Rig geologist was _____. See Geologist's Notebook, No. 2, page ____ for details of drilling activities. Sample numbers 123-22-S1, 123-22-S2, and 123-22-S3 collected; see sample logbook, pages 43, 44, and 45.
5. Well _____ was developed. Seven 55-gallon drums were filled in the flushing stage. The well was then pumped using the pitcher pump for 1 hour. At the end of the hour, water pumped from well was "sand free."
6. EPA remedial project manger arrives on site at 14:25 hours.
7. Large dump truck arrives at 14:45 and is steam-cleaned. Backhoe and dump truck set up over test pit _____.
8. Test pit _____ dug with cuttings placed in dump truck. Rig geologist was _____. See Geologist's Notebook, No. 1, page 32, for details of test pit activities. Test pit subsequently filled. No samples taken for chemical analysis. Due to shallow groundwater table, filling in of test pit ___ resulted in a very soft and wet area. A mound was developed and the area roped off.
9. Express carrier picked up samples (see Sample Logbook, pages 42 through 45) at 17:50 hours. Site activities terminated at 18:22 hours. All personnel off site, gate locked.

_____

Field Operations Leader

ATTACHMENT B

Tetra Tech NUS, Inc. 661 Andersen Drive Pittsburgh, 15220 (412)921-7090	**Project:** **Site:** **Location:**		
Sample No:			**Matrix:**
Date:	**Time:**	**Preserve:**	
Analysis:			
Sampled by:	**Laboratory:**		

ATTACHMENT C

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER 3413 | PAGE ___ OF ___

PROJECT NO:	FACILITY:	PROJECT MANAGER	PHONE NUMBER	LABORATORY NAME AND CONTACT:
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER	PHONE NUMBER	ADDRESS
		CARRIER/WAYBILL NUMBER		CITY, STATE

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR ___	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (FT)	BOTTOM DEPTH (FT)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAP (G) COMP (C)	No. OF CONTAINERS	CONTAINER TYPE PLASTIC (P) or GLASS (G) / PRESERVATIVE USED / TYPE OF ANALYSIS								COMMENTS

1. RELINQUISHED BY	DATE	TIME	1. RECEIVED BY	DATE	TIME
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

4/02R
FORM NO. TtNUS-001

ATTACHMENT D

CHAIN-OF-CUSTODY SEAL

CUSTODY SEAL	**CUSTODY SEAL**
Date	**Date**
Signature	**Signature**

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A INVESTIGATION-DERIVED WASTE LABEL 15

Strikeouts and/or inserts by Brad Peebles (2/19/10) to render this NUS SOP specific to the tasks presented in the UFP-SAP

1.0 PURPOSE

Decontamination is the process of removing and/or neutralizing site contaminants that have contacted and/or accumulated on equipment. The purpose of this Standard Operating Procedure (SOP) is to protect site personnel, the general public, and the environment while preserving or maintaining sample integrity. It is further intended through this procedure to describe the steps necessary for proper decontamination of drilling equipment, earth-moving equipment , chemical sampling equipment and field operation and analytical equipment.

2.0 SCOPE AND APPLICABILITY

This procedure applies to all equipment used to provide access to/acquire environmental samples that may have become contaminated through direct contact with contaminated media including air, water, and soil. This equipment includes drilling and heavy equipment and chemical sampling and field analytical equipment. Where technologically and economically feasible, single-use sealed disposable equipment will be employed to minimize the potential for cross-contamination. This SOP also provides general reference information on the control of contaminated materials.

Decontamination methods and equipment requirements may differ from one project to another. General equipment items are specified in Section 6.0, but project-specific equipment must be obtained to address the project-specific decontamination procedures presented in Section 7.0 and applicable subsections.

3.0 GLOSSARY

Alconox/Liquinox - A brand of phosphate-free laboratory-grade detergent.

Decontamination Solution - A solution selected/identified in the Health and Safety Plan or Project-Specific Quality Assurance Plan. The solution is selected and employed as directed by the project chemist/health and safety professional.

Deionized Water (DI) - Tap water that has been treated by passing through a standard deionizing resin column. This water may also pass through additional filtering media to attain various levels of analyte-free status. The DI water should meet College of American Pathologists (CAP) and National Committee for Clinical Laboratory Standards (NCCLS) specifications for reagent-grade Type I water.

Potable Water - Tap water from any municipal water treatment system. Use of an untreated potable water supply is not an acceptable substitute for tap water.

Pressure Washing - Process employing a high-pressure pump and nozzle configuration to create a high-pressure spray of potable water. High-pressure spray is employed to remove solids from equipment.

Solvent – A liquid in which solid chemicals or other liquids are dissolved. The solvent of choice is pesticide-grade isopropanol. Use of other solvents (methanol, acetone, or hexane) may be required for particular projects or for a particular purpose (e.g., removal of concentrated waste) and must be justified in the project planning documents. For example, it may be necessary to use hexane when analyzing for trace levels of pesticides, PCBs, or fuels. In addition, because many of these solvents are not miscible in water, the equipment should be air dried prior to use. Solvents should not be used on PVC equipment or well construction materials.

Steam Pressure Washing - A cleaning method employing a high-pressure spray of heated potable water to remove various organic/inorganic chemicals from equipment.

4.0 RESPONSIBILITIES AND PERSONNEL QUALIFICATIONS

Project Manager - Responsible for ensuring that all field activities are conducted in accordance with approved project plan(s) requirements.

Decontamination Personnel - Individuals assigned the task of decontamination. It is the responsibility of these individuals to understand the use and application of the decontamination process and solutions as well as the monitoring of that process to ensure that it is working properly. This is accomplished through visual evaluation, monitoring instrument scanning of decontaminated items, and/or through the collection of rinsate blanks to verify contaminant removal.

Field Operations Leader (FOL) - Responsible for the implementation of project-specific planning documents. This includes on-site verification that all field activities are performed in compliance with approved SOPs or as otherwise dictated by the approved project plan(s). The FOL is also responsible for the completion and accuracy of all field documentation.

Site Safety Officer (SSO) - Exercises shared responsibility with the FOL concerning decontamination effectiveness. All equipment arriving on site (as part of the equipment inspection), leaving the site, and moving between locations is required to go through a decontamination evaluation. This is accomplished through visual examination and/or instrument screening to determine the effectiveness of the decontamination process. Improper or incomplete decontamination is sufficient to restrict equipment from entering the site, exiting the site, or moving to a new location on the site until the objectives are successfully completed.

General personnel qualifications for decontamination activities include the following:

- Occupational Safety and Health Administration (OSHA) 40-hour and applicable refresher training.
- Capability of performing field work under the expected physical and environmental (i.e., weather) conditions.
- Familiarity with appropriate decontamination procedures.

5.0 HEALTH AND SAFETY

In addition to the health and safety issues and reminders specified in subsections of this SOP, the following considerations and requirements must be observed as SOPs for field equipment decontamination activities:

- If any solvents or hazardous chemicals (e.g., isopropyl alcohol) are to be used in equipment decontamination activities, the FOL must first obtain the manufacturer's/supplier's Material Safety Data Sheet (MSDS) and assure that it is reviewed by all users (prior to its use), added to the site Hazardous Chemical Inventory, and maintained on site as part of the project Hazard Communication Program.
- Review and observe specific health and safety requirements (e.g., personal protective equipment [PPE]) specified in the project-specific health and safety plan for this activity.

6.0 EQUIPMENT LIST

- Wood for decontamination pad construction, when applicable (see Section 7.1).

- Tools for constructing decontamination pad frame, when applicable (see Section 7.1).
- Visqueen sheeting or comparable material to cover decontamination pad frame, when applicable (see Section 7.1).
- Wash/drying racks for auger flights and drill/drive rods, when applicable (see Section 7.2).
- PPE as specified in the project health and safety plan.
- Soap and water for washing and rinsing.
- Deionized water for final rinsing.
- Solvents (e.g., pesticide-grade isopropanol) for rinsing (see applicable portions of Section 7.2).
- Tubs, buckets, etc. for containerizing rinse water (see applicable portions of Section 7.2).
- Sample bottles for collecting rinsate blanks (see Section 7.2).
- Calibrated photoionization detector (PID) or flame ionization detector (FID) to monitor decontaminated equipment for organic vapors generated through the existence of residual contamination or the presence of decontamination solvent remaining after the piece was rinsed.
- Aluminum foil or clear clean plastic bag for covering cleaned equipment (see applicable portions of Section 7.2).
- Paper towels or cloths for wiping.
- Brushes, scrapers, or other hand tools useful for removing solid materials from equipment.
- Clear plastic wrap for covering or wrapping large decontaminated equipment items (see Section 7.2.2).
- Drum-moving equipment for moving filled waste drums (optional) (see Section 7.3).
- Drum labels for waste drums (see Attachment A).

7.0 PROCEDURES

The process of decontamination is accomplished through the removal of contaminants, neutralization of contaminants, or isolation of contaminants. To accomplish this activity, preparation is required including site preparation, equipment selection, and evaluation of the decontamination requirements and processes. Site contaminant types, concentrations, and media types are primary drivers in the selection of the types of decontamination and where it will be conducted. For purposes of this SOP, discussion is limited to decontamination procedures for general environmental investigations.

Decontamination processes will be performed at the location(s) specified in project-specific planning documents. Typical decontamination locations include the following:

- Temporary decontamination pads/facilities
- Sample locations
- Centralized decontamination pad/facilities

- Combination of some or all of the above

The following discussion includes general considerations for the decontamination process. Specific construction and implementation procedures will be as specified in the project-specific planning documents and/or may be as dictated by site-specific conditions as long as the intent of the requirements in the planning documents is met. This intent is to contain any residual fluids and solids generated through the decontamination process.

7.1 Decontamination Pad Design/Construction Considerations

7.1.1 Temporary Decontamination Pads

Temporary decontamination pads may be constructed at satellite locations within the site area in support of temporary work areas. These structures are generally constructed to support the decontamination of heavy equipment such as drill rigs and earth-moving equipment but can be employed for smaller articles.

The purpose of the decontamination pad is to contain wash waters and potentially contaminated soil generated during decontamination procedures. Therefore, construction of these pads should take into account the following considerations:

- Site location – The decontamination site selected should be far enough from the work site to maximize decontamination effectiveness while minimizing travel distance. The location of the decontamination site shall be selected to provide, in the judgment of the FOL or FOL designee, compliance with as many of the following characteristics as practicable:

  - Well removed from pedestrian/vehicle thoroughfares.

  - Avoidance of areas where control/custody cannot be maintained.

  - Avoidance of areas where potential releases of contaminated media or decontamination fluids may be compounded through access to storm water transport systems, streams, or other potentially sensitive areas.

  - Avoidance of potentially contaminated areas.

  - Avoidance of areas too close to the ongoing operation, where cross-contamination may occur.

  The selected decontamination site should include the following, where possible:

  - Areas where potable water and electricity are provided.

> ***Safety Reminder***
>
> When utilizing electrical power sources, either hard-wired or portable-generated sources, ensure that:
>
> - All power is routed through a Ground Fault Circuit Interrupter (GFCI).
>
> - All power cords are in good condition (no physical damage), rated for the intended energy load, and designated for outdoor use.
>
> In situations where accomplishing these elements is not possible, it will be necessary to implement a site electrical grounding program.

- Areas where support activities such as removing decontamination waters soil and sediment are possible without entering an active exclusion zone.

- Areas that offer sufficient size to carry out the specific decontamination sequence.

- Decontamination pad (decon pad) – The decon pad shall be constructed to meet the following characteristics:

  - Size – The size of the pad should be sufficient to accept the equipment to be decontaminated as well as permitting free movement around the equipment by the personnel conducting the decontamination. The size should permit these movements utilizing pressure/steam washer wands and hoses and minimizing splash due to work in close quarters.

  - Slope – An adequate slope will be constructed to permit the collection of water and potentially contaminated soil within a trough or sump constructed at one end. The collection point for wash waters should be of adequate distance that the decontamination workers do not have to walk through the wash waters while completing their tasks. Because the pad will be sloped, place a light coating of sand over the plastic to minimize potential slips and falls. See the text about liners below.

  - Sidewalls – The sidewalls shall be at least 6 inches in height (or as high as possible if 6 inches is not achievable) to provide adequate containment for wash waters and soil. If splash represents a potential problem, splash guards should be constructed to control overspray. Sidewalls may be constructed of wood, inflatables, sand bags, etc. to permit containment. Splash guards are typically wood frames with Visqueen coverings to control overspray.

  - Liner – Depending on the types of equipment and decontamination method to be used, the liner should be of sufficient thickness to provide a puncture-resistant barrier between the decontamination operation and the unprotected environment. Care should be taken to examine the surface area prior to placing the liner to remove sharp articles (sticks, stones, debris) that could puncture the liner. Liners are intended to form an impermeable barrier. The thickness may vary from a minimum recommended thickness of 10 mil to 30 mil. The desired thickness may be achieved through layering materials of lighter construction. It should be noted that various materials (rubber, polyethylene sheeting) become slippery when wet. To minimize this potential hazard associated with a sloped liner, a light coating of sand shall be applied to provide traction as necessary.

  - Wash/drying racks – Auger flights, drill/drive rods, and similar equipment require racks positioned off of the ground to permit these articles to be washed, drained, and dried while secured from falling during this process.

For decontamination of direct-push technology (DPT) equipment, the pad may be as simple as a mortar tub containing buckets of soapy water for washing and an empty bucket to capture rinse waters. Decontamination may be conducted at the rear of the rig to permit rapid tool exchange.

- Maintenance – Maintain the decontamination area by:

  - Periodically clearing the work area of standing water, soil, and debris, and coiling hoses to aid in eliminating slip, trip, and fall hazards. In addition, these articles will reduce potential backsplash and cross-contamination.

- Regularly changing the decontamination fluids to ensure proper cleaning and prevent cross-contamination.

- PPE – Periodically evaluate the condition of, and maintain the decontamination equipment, including regular cleaning of face shields and safety glasses. This is critical to ensuring the safety of decontamination personnel and the integrity of the decontamination process, and it will ensure that equipment is functioning properly.

7.1.2 Decontamination Activities at Drill Rigs/DPT Units

During subsurface sampling activities including ~~drilling and~~ DPT activities, decontamination of drive rods, Macro Core Samplers, split spoons, etc. is typically conducted at an area adjacent to the operation. Decontamination is generally accomplished using a soap/water wash and rinse utilizing buckets and brushes. This area requires sufficient preparation to accomplish the decontamination objectives.

Buckets shall be placed within mortar tubs or similar secondary containment tubs to prevent splash and spills from reaching unprotected environmental media. Drying racks shall be employed as directed for temporary pads to permit parts to dry and be evaluated prior to use/reuse. Methodology regarding this activity is provided in Section 7.2.

7.1.3 Decontamination Activities at Remote Sample Locations

When sampling at remote locations, sampling equipment such as trowels ~~and pumps/tubing~~ should be evacuated of potentially contaminated media to the extent possible. This equipment should be wrapped in plastic for transport to the temporary/centralized decontamination location for final cleaning and disposition. Flushing and cleaning of single-use equipment such as disposable trowels, tubing, and surgeon's gloves may allow disposal of this equipment after visible soil and water remnants have been removed.

7.2 Equipment Decontamination Procedures

The following represents procedures to be employed for the decontamination of equipment that may have contacted and/or accumulated contamination through site investigation activities.

7.2.1 ~~Monitoring Well Sampling Equipment~~

~~7.2.1.1 Groundwater sampling equipment – This includes pumps inserted into monitoring wells such as bladder pumps, Whale pumps, and Redi-Flo pumps and reusable bailers, etc.~~

~~1. Evacuate to the extent possible, any purge water within the pump/bailer.~~

~~2. Scrub using soap and water and/or steam clean the outside of the pump/bailer and, if applicable, the pump tubing.~~

~~3. Insert the pump and tubing/bailer into a clean container of soapy water. Pump/run a sufficient amount of soapy water through the pump/bailer to flush out any residual well water. After the pump is flushed, circulate soapy water through the pump to ensure that the internal components are thoroughly flushed.~~

~~4. Remove the pump and tubing/bailer from the container~~

~~5. Rinse external pump components using tap water.~~

6. ~~Insert the pump and tubing/bailer into a clean container of tap water. Pump/run a sufficient amount of tap water through the pump/bailer to evacuate all of the soapy water (until clear).~~

> ~~***CAUTION***~~
> ~~Do not rinse PE, PVC, and associated tubing with solvents –~~
> ~~Use the procedures defined in the project specific planning documents. If they are not defined, contact the FOL for guidance. The solvent rinse described in Step 7 may be omitted if groundwater does not contain oil, grease, PAHs, PCBs, or other hard to remove organic materials.~~

7. ~~If groundwater contains or is suspected to contain oil, grease, PAHs, PCBs, or other hard to remove organic materials, rinse the equipment to be cleaned with pesticide-grade isopropanol.~~

8. ~~Pass deionized water through the hose to flush out the tap water and solvent residue as applicable.~~

9. ~~Drain residual deionized water to the extent possible.~~

10. ~~Allow components of the equipment to air dry.~~

11. ~~For bladder pumps, disassemble the pump and wash the internal components with soap and water, then rinse with tap water, isopropanol, and deionized water and allow to dry. After the parts are dry, conduct a visual inspection and a monitoring instrument scan to ensure that potential contaminants and all decontamination solvent have been removed. Collect a rinsate blank in accordance with the project-specific planning documents to ensure that the decontamination process is functioning as intended. The typical frequency of collection for rinsate blanks is 1 per 20 field samples. In addition, wipe samples or field tests such as UV light may be used.~~

12. ~~Wrap pump/bailer in aluminum foil or a clear clean plastic bag for storage.~~

> ***SAFETY REMINDER***
> Remember when handling powered equipment to disconnect the power source and render the equipment to a zero energy state (both potential and kinetic) before opening valves, disconnecting lines, etc.

7.2.1.2 ~~Electronic Water Level Indicators/Sounders/Tapes~~

~~During water level measurements, rinsing the extracted tape and probe with deionized water and wiping the surface of the extracted tape between locations is acceptable. However, periodic full decontamination should be conducted as follows:~~

1. ~~Wash with soap and water~~
2. ~~Rinse with tap water~~
3. ~~Rinse with deionized water~~

> ~~***NOTE***~~
> ~~In situations where oil, grease, free product, other hard to remove materials are encountered, probes and exposed tapes should be washed in hot soapy water. If probes or tapes cannot be satisfactorily decontaminated (they are still stained, discolored, etc.), they should be removed from service.~~

7.2.1.3 Miscellaneous Equipment

Miscellaneous equipment including analytical equipment (water quality testing equipment) shall be cleaned per manufacturers' instructions. This generally includes wiping the sensor housing and rinsing with tap and deionized water.

Coolers/shipping containers employed to ship samples are received from the laboratory in a variety of conditions including marginal to extremely poor. Coolers shall be evaluated prior to use for the following:

- Structural integrity – Coolers missing handles or having breaks in the outer housing should be removed and not used. Notify the laboratory that the risk of shipping samples in the cooler(s) provided is too great and request a replacement unit.

- Cleanliness – As per protocol, only volatile organic samples are accompanied by a trip blank. If a cooler's cleanliness is in question (visibly dirty/stained) or if there are noticeable odors, the cooler should be decontaminated prior to use as follows:

  1. Wash with soap and water
  2. Rinse with tap water
  3. Dry

If these measures fail to clean the cooler to an acceptable level, remove the unit from use as a shipping container and ask the cooler provider (e.g., the analytical laboratory) to provide a replacement unit.

7.2.2 ~~Downhole Drilling Equipment~~

~~This includes any portion of the drill rig that is over the borehole, including auger flights, drill stems, rods, and associated tooling that would extend over the borehole. The following procedure is to be employed prior to initiating the drilling/sampling activity, then between locations:~~

CAUTION
Exercise care when using scrapers to remove soil and debris from downhole drilling equipment. Inadvertent slips of scrapers have resulted in cuts, scrapes, and injured knuckles, so use scrapers carefully when removing soil from these items.

1. ~~Remove loose soil using shovels, scrapers, etc.~~

2. ~~Through a combination of scrubbing using soap and water and/or steam cleaning or pressure washing, remove visible dirt/soil from the equipment being decontaminated.~~

~~CAUTION~~
~~In Step 3, do not rinse PE, PVC, and associated tubing with solvents. The appropriate procedures should be defined within the project-specific planning documents. If they are not defined, contact the FOL for guidance. The solvent rinse described in Step 4 may be omitted if groundwater does not contain oil, grease, PAHs, PCBs, or other hard to remove organic materials.~~

3. ~~Rinse the equipment with tap water, where applicable (steam cleaning and pressure washing incorporate rinsing as part of the process).~~

4. ~~If the equipment has directly or indirectly contacted contaminated sample media and is known or suspected of being contaminated with oil, grease, PAHs, PCBs, or other hard to remove organic materials, rinse equipment with pesticide-grade isopropanol~~

5. ~~To the extent possible, allow components to air dry.~~

6. ~~If the decontaminated equipment is to be used immediately after decontamination, screen it with a calibrated photoionization detector (PID)/flame ionization detector (FID) to ensure that all contaminants and possible decontamination solvents (if they were used) have been adequately removed.~~

7. ~~Wrap or cover equipment in clear plastic until it is time to be used.~~

SAFETY REMINDER

Even when equipment is disconnected from power sources, dangers such as the following may persist:

Falls - An auger flight standing on its end may fall and injure someone. Secure all loose articles to prevent heavy articles from falling onto people or equipment.

Burns - Steam cleaner water is heated to more than 212 ˚F and exhibits thermal energy that can cause burns. Prevent contact of skin with hot water or surfaces.

High water pressure - Pressure washer discharge can have 2,000 to 4,000 psi of water pressure. Water under this amount of pressure can rupture skin and other human tissues. Water at 4,000 psi exiting a 0˚ tip can be dangerous because of its relatively high cutting power. The exit velocity and cutting power of the water are reduced when exiting a 40˚ fan tip, but damage to soft tissues is still possible.

In general, follow the rules below to avoid injury, equipment damage, or incomplete decontamination:

1. Read the operating manual and follow the manufacturers' recommended safety practices before operating pressure washers and steam cleaners.

2. Never point the pressure washer or steam cleaner at another person or use to clean your boots or other parts of your body. Water lacerations and burns may appear to be minor at first but can be life threatening. Do not attempt to hold small parts in your hand while washing them with high-temperature or high-pressure water.

3. Always wear PPE as specified in the HASP such as:

   - Hard hat, safety glasses, splash shield, impermeable apron or splash suit, and hearing protection. Remember that excessive noise is a hazard when operating gas-powered engines and electrically driven pressure washers. PPE will be identified in your project specific planning documents.

4. Inspect each device before use. An inspection checklist will be provided in the project-specific planning documents. If it is a rented device, safety measures are typically provided by the vendor. In all cases, if you are not familiar with the operation of a pressure washer/steam cleaner, do not operate it until you obtain and thoroughly review operating instructions and recommended safety practices.

5. Do not modify equipment unless the manufacturer has approved the modifications.

7.2.3 Soil/Sediment Sampling Equipment

This section applies to soil sampling equipment including but not limited to hand augers, stainless steel trowels/spoons, bowls, dredges, scoops, split spoons, Macro Core samplers, etc.

1. Remove all loose soil from the equipment through manual means.

2. Through a combination of scrubbing using soap and water and/or steam cleaning or pressure washing, remove visible dirt/soil from the equipment.

3. Rinse the equipment with tap water.

> ***CAUTION***
> Do not rinse PE, PVC, and associated tubing with solvents. The appropriate procedures should be defined within the project-specific planning documents. If they are not defined, contact the FOL for guidance. The solvent rinse described in Step 4 may be omitted if groundwater does not contain oil, grease, PAHs, PCBs, or other hard to remove organic materials.

4. If the equipment is contaminated or suspected to be contaminated with oil, grease, PAHs, PCBs, or other hard to remove organic materials, rinse the equipment with pesticide-grade isopropanol.

5. Rinse the equipment with deionized water.

6. To the extent possible, allow components to air dry.

7. If the equipment is to be used immediately after decontamination, screen it with a calibrated PID/FID to ensure that all solvents (if they were used) and trace contaminants have been adequately removed.

8. After the equipment has dried, wrap it in aluminum foil for storage until use.

Dredges employed in sediment sampling are typically decontaminated as follows:

- Remove the sediment sample from the sampling device

- If sufficient associated surface water is available at the sampling site, place the dredge in the water and flush to remove visible sediment.

- Extract the dredge and wash it in soap and water per the project-specific planning documents.

> ***CAUTION***
> When handling dredges, the primary safety concern is trapping fingers or extremities in the larger dredge samplers within the jaws or pinch points of the mechanical jaws. Keep hands, fingers, and extremities away from these pinch and compression points. Either handle the device by the rope or preferably lock the jaws in place to control the potential for closing during maintenance and/or cleaning.

7.3 Contact Waste/Materials

During the course of field investigations, disposable/single-use equipment becomes contaminated. These items include tubing, trowels, PPE (gloves, overboots, splash suits, etc.), and broken sample containers.

With the exception of the broken glass, single-use articles should be cleaned (washed and rinsed) of visible materials and disposed as normal refuse. The exception to this rule is that extremely soiled materials that cannot be cleaned shall be containerized for disposal in accordance with applicable federal, state, and local regulations.

7.3.1 Investigation-Derived Wastes - Decontamination Wash Waters and Sediments

NOTE
Requirements for waste storage may differ from one facility to the next. Facility-specific directions for waste storage areas will be provided in project-specific documents, or separate direction will be provided by the Project Manager.

1. Assume that all investigation-derived waste (IDW) generated from decontamination activities contains the hazardous chemicals associated with the site unless there are analytical or other data to the contrary. Waste solution volumes could vary from a few gallons to several hundred gallons in cases where large equipment required cleaning.

2. Where possible, use filtering systems to extend the use of water within a closed system wash unit to recycle water and to reduce possible waste amounts.

NOTE
Containerized waste rinse solutions are best stored in 55-gallon drums (or equivalent containers) that can be sealed until ultimate disposal at an approved facility.

3. Label waste storage containers appropriately labeled (see Attachment A).

4. Ensure that the IDW storage area is configured to meet the following specifications to permit access to the containers and to conduct spill/leak monitoring, sampling, and extraction when the disposal route is determined:

   - Enclose areas accessible by the general public using construction fencing and signs.

   - Stored materials in 55-gallon drums on pallets with four (or fewer) drums per pallet.

   - Maintain the retaining bolt and label on the outside of storage containers where readily visible.

   - Provide at least 4 feet of room between each row of pallets to allow access to containers for sampling, drum removal, and spill response.

   - As directed in project-specific planning documents, maintain an IDW Inventory List and provide the list to the site Point of Contact at the termination of each shift.

   - Maintain spill response equipment at the IDW storage area in case it is required for immediate access.

- Where possible, use equipment for moving containers. Where not possible, obtain help to manipulate containers.

CAUTION

Each container of water can weigh up to 490 pounds. Each 55-gallon drum of wet soil can weigh more than 750 pounds. Fill drums and temporary containers to 80 percent capacity to minimize spill and handling difficulties. Use drum carts to move filled drums.

See safe lifting techniques provided in Section 4.4 of the Tetra Tech NUS, Inc. Health and Safety Guidance Manual.

When placing drums, keep your fingers out of pinch and smash points such as between the drums. In some cases such as well development and/or purge water, you can place the drums to be filled on the pallet and transport materials in smaller easier to handle containers.

7.4 Decontamination Evaluation

Upon decontamination of equipment, determine the effectiveness of the decontamination process in the following manner:

- Visual evaluation – A visual evaluation will be conducted to ensure the removal of particulate matter. This shall be done to ensure that the washing/rinsing process is working as intended.

- Instrument Screening – A properly calibrated PID/FID should be used to evaluate the presence of site contaminants and solvents used in the cleaning process. The air intake of the instrument shall be passed over the article to be evaluated. Avoid placing the instrument probe into residual waters. A PID/FID reading greater than the daily established background level requires a repeat of the decontamination process, followed by rescreening with the PID/FID. This sequence must be repeated until no instrument readings greater than the daily established background level are observed. It should be noted that the instrument scan is only viable if the contaminants are detectable within the instrument's capabilities.

NOTE

When required by project-specific planning documents, collection of rinsate blanks (see next step) shall be completed without exception unless approval to not collect these samples is obtained from the Project Manager.

- Collection of Rinsate Blanks – It is recommended that rinsate samples be collected to:

  - Evaluate the decontamination procedure representing different equipment applications (pumps versus drilling equipment) and different decontamination applications.

  - Single-use disposable equipment – The number of samples should represent different types of equipment as well as different lot numbers of single-use articles.

  - The collection and the frequency of collection of rinsate samples are as follows unless specified differently in the project-specific planning documents:

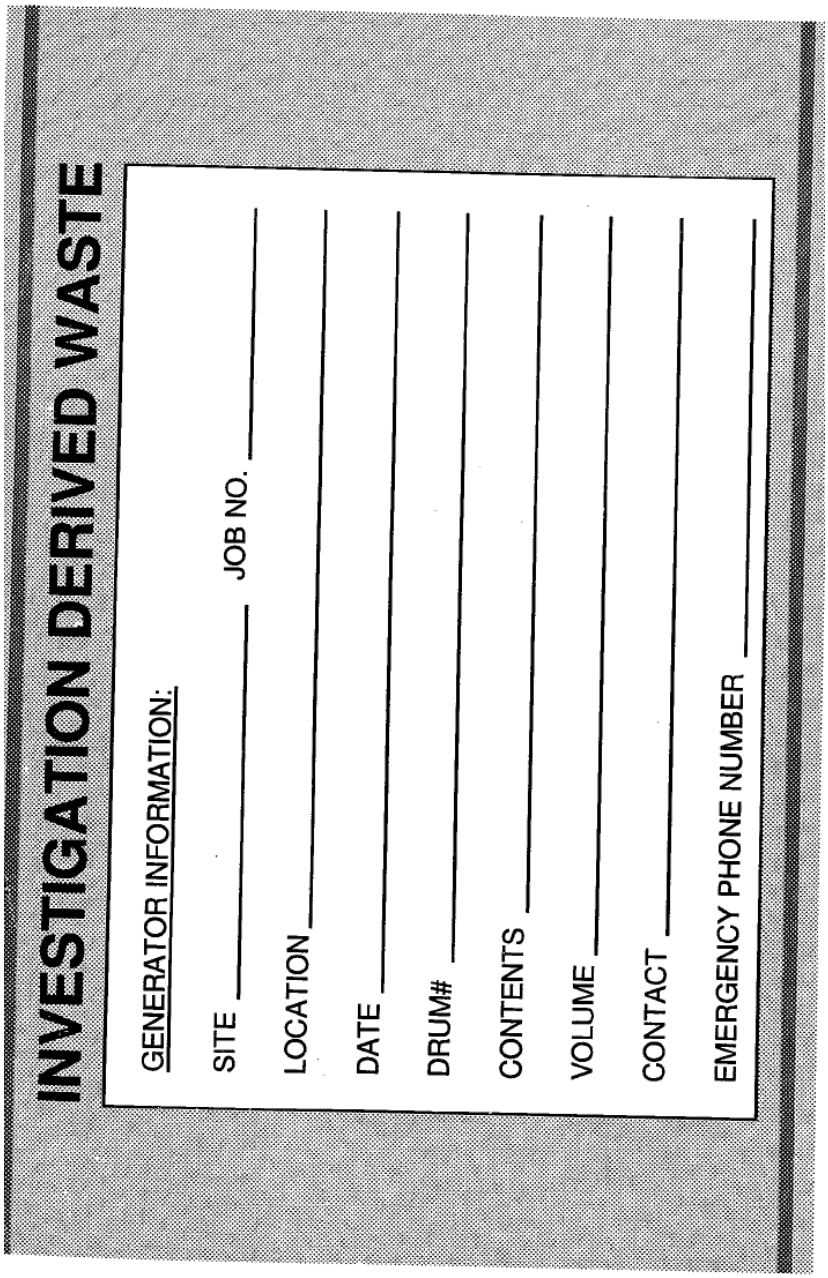
    - Per decontamination method
    - Per disposable article/batch number of disposable articles

NOTE

It is recommended that an initial rinsate sample be collected early in the project to ensure that the decontamination process is functioning properly and to avoid using a contaminated batch of single-use articles. It is recommended that a follow-up sample be collected later during the execution of the project to ensure that those conditions do not change.

Rinsate samples collection may be driven by types of and/or levels of contaminant. Difficult to remove contaminants, oils/greases, some PAHs/PCBs, etc. may also support the collection of additional rinsates due to the obvious challenges to the decontamination process. This is a field consideration to be determined by the FOL.

Attachment A
iDW Label



APPENDIX B

LABORATORY STANDARD OPERATING PROCEDURES AND DoD ELAP ACCREDITATION

LABORATORY ACCREDITATION BUREAU

Certificate # L2226

Scope of Accreditation For Empirical Laboratories, LLC

621 Mainstream Drive, Suite 270
Nashville, TN 37228
Marcia K. McGinnity
1-877-345-1113

In recognition of a successful assessment to ISO/IEC 17025:2005 and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM v4.1) based on the National Environmental Laboratory Accreditation Conference Chapter 5 Quality Systems Standard (NELAC Voted Revision June 5, 2003), accreditation is granted to Empirical Laboratories, LLC to perform the following tests:

Accreditation granted through: **November 30, 2012**

Testing - Environmental

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8260B	1,1,1-Trichloroethane (1,1,1-TCA)
GC/MS	8260B	1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113; Freon 113)
GC/MS	8260B	1,1,2-Trichloroethane
GC/MS	8260B	1,1,2,2-Tetrachloroethane
GC/MS	8260B	1,1,1,2-Tetrachloroethane
GC/MS	8260B	1,1-Dichloroethane (1,1-DCA)
GC/MS	8260B	1,1-Dichloroethene (1,1-DCE)
GC/MS	8260B	1,2,3-Trichlorobenzene
GC/MS	8260B	1,2,4-Trichlorobenzene
GC/MS	8260B	1,2,3-Trichloropropane
GC/MS	8260B	1,2,4-Trimethylbenzene
GC/MS	8260B	1,3,5-Trimethylbenzene
GC/MS	8260B	1,2-Dibromoethane (EDB)
GC/MS	8260B	1,2-Dibromo-3-chloropropane (DBCP)
GC/MS	8260B	1,2-Dichlorobenzene
GC/MS	8260B	1,2-Dichloroethane (EDC)
GC/MS	8260B	1,2-Dichloropropane
GC/MS	8260B	1,3-Dichlorobenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8260B	1,4-Dichlorobenzene
GC/MS	8260B	1,1-Dichloropropene
GC/MS	8260B	1,3-Dichloropropane
GC/MS	8260B	2,2-Dichloropropane
GC/MS	8260B	2-Butanone (Methyl ethyl ketone; MEK)
GC/MS	8260B	2-Hexanone (Methyl butyl ketone; MBK)
GC/MS	8260B	4-Methyl-2-pentanone (Methyl isobutyl ketone; MIBK)
GC/MS	8260B	Acetone
GC/MS	8260B	Benzene
GC/MS	8260B	Bromochloromethane
GC/MS	8260B	Bromodichloromethane
GC/MS	8260B	Bromobenzene
GC/MS	8260B	Bromoform
GC/MS	8260B	Bromomethane
GC/MS	8260B	n-Butylbenzene
GC/MS	8260B	sec-Butylbenzene
GC/MS	8260B	tert-Butylbenzene
GC/MS	8260B	Carbon Disulfide
GC/MS	8260B	Carbon Tetrachloride
GC/MS	8260B	Chlorobenzene
GC/MS	8260B	Chloroethane
GC/MS	8260B	Chloroform
GC/MS	8260B	Chloromethane
GC/MS	8260B	2-Chlorotoluene
GC/MS	8260B	4-Chlorotoluene
GC/MS	8260B	cis-1,2-Dichloroethene (cis-1,2-DCE)
GC/MS	8260B	cis-1,3-Dichloropropene
GC/MS	8260B	Cyclohexane
GC/MS	8260B	Dibromochloromethane
GC/MS	8260B	Dibromomethane
GC/MS	8260B	Dichlorodifluoromethane (CFC-12)
GC/MS	8260B	Ethylbenzene
GC/MS	8260B	Hexachlorobutadiene
GC/MS	8260B	Isopropylbenzene (Cumene)
GC/MS	8260B	p-Isopropyltoluene
GC/MS	8260B	Methyl Acetate
GC/MS	8260B	Methyl Tertiary Butyl Ether (MTBE)
GC/MS	8260B	Methylcyclohexane
GC/MS	8260B	Methylene Chloride, or Dichloromethane

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8260B	Naphthalene
GC/MS	8260B	n-Propylbenzene
GC/MS	8260B	Styrene
GC/MS	8260B	Tetrachloroethene (PCE; PERC)
GC/MS	8260B	Toluene
GC/MS	8260B	trans-1,2-Dichloroethene (trans-1,2-DCE)
GC/MS	8260B	trans-1,3-Dichloropropene
GC/MS	8260B	Trichloroethene (TCE)
GC/MS	8260B	Trichlorofluoromethane (CFC-11)
GC/MS	8260B	Vinyl Chloride (VC)
GC/MS	8260B	Xylenes (Total)
GC/MS	8260B	Acrolein
GC/MS	8260B	Acrylonitrile
GC/MS	8260B	Di-isopropyl ether
GC/MS	8260B	ETBE
GC/MS	8260B	Ethyl methacrylate
GC/MS	8260B	Iodomethane
GC/MS	8260B	Methyl methacrylate
GC/MS	8260B	t-Butyl alcohol
GC/MS	8260B	tert-Amyl methyl ether
GC/MS	8260B	Vinyl acetate
GC/MS	8270C/D	Bis(2-chloroisopropyl)ether, or 2,2'-oxybis (1-Chloropropane)
GC/MS	8270C/D	1,2-Dichlorobenzene
GC/MS	8270C/D	1,3-Dichlorobenzene
GC/MS	8270C/D	1,4-Dichlorobenzene
GC/MS	8270C/D	2,4,5-Trichlorophenol
GC/MS	8270C/D	2,4,6-Trichlorophenol (TCP)
GC/MS	8270C/D	2,4-Dichlorophenol (DCP)
GC/MS	8270C/D	2,4-Dimethylphenol
GC/MS	8270C/D	2,4-Dinitrophenol
GC/MS	8270C/D	2,4-Dinitrotoluene (DNT)
GC/MS	8270C/D	2,6-Dichlorophenol
GC/MS	8270C/D	2,6-Dinitrotoluene
GC/MS	8270C/D	1,2-Diphenylhydrazine
GC/MS	8270C/D	2-Chloronaphthalene
GC/MS	8270C/D	2-Chlorophenol
GC/MS	8270C/D	2-Methylnaphthalene
GC/MS	8270C/D	2-Methylphenol (o-Cresol)
GC/MS	8270C/D	2-Nitroaniline

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8270C/D	2-Nitrophenol (ONP)
GC/MS	8270C/D	3,3'-Dichlorobenzidine (DCB)
GC/MS	8270C/D	3-Methylphenol
GC/MS	8270C/D	3-Nitroaniline
GC/MS	8270C/D	4,6-Dinitro-2-methylphenol (DNOC)
GC/MS	8270C/D	4-Bromophenyl phenyl ether
GC/MS	8270C/D	4-Chloro-3-methylphenol
GC/MS	8270C/D	4-Chloroaniline
GC/MS	8270C/D	4-Chlorophenyl phenyl ether
GC/MS	8270C/D	4-Methylphenol (p-Cresol)
GC/MS	8270C/D	4-Nitroaniline (PNA)
GC/MS	8270C/D	4-Nitrophenol (PNP)
GC/MS	8270C/D	Acenaphthene
GC/MS	8270C/D	Acenaphthylene
GC/MS	8270C/D	Acetaphenone
GC/MS	8270C/D	Anthracene
GC/MS	8270C/D	Benzo(a)anthracene
GC/MS	8270C/D	Benzo(a)pyrene
GC/MS	8270C/D	Benzo(b)fluoranthene
GC/MS	8270C/D	Benzo(g,h,i)perylene
GC/MS	8270C/D	Benzo(k)fluoranthene
GC/MS	8270C/D	Benzyl alcohol
GC/MS	8270C/D	Benzoic Acid
GC/MS	8270C/D	bis(2-Chloroethoxy)methane
GC/MS	8270C/D	bis(2-Chloroethyl)ether (BCEE)
GC/MS	8270C/D	bis(2-Ethylhexyl)phthalate (BEHP)
GC/MS	8270C/D	Butyl benzyl phthalate (BBP)
GC/MS	8270C/D	Carbazole
GC/MS	8270C/D	Chrysene
GC/MS	8270C/D	Di-n-butyl phthalate (DBP)
GC/MS	8270C/D	Di-n-octyl phthalate (DNOP)
GC/MS	8270C/D	Dibenz(a,h)anthracene
GC/MS	8270C/D	Dibenzofuran (DBF)
GC/MS	8270C/D	Diethyl phthalate (DEP)
GC/MS	8270C/D	Dimethyl phthalate (DMP)
GC/MS	8270C/D	Fluoranthene
GC/MS	8270C/D	Fluorene
GC/MS	8270C/D	Hexachlorobenzene (HCB)
GC/MS	8270C/D	Hexachlorobutadiene (HCBD)

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8270C/D	Hexachlorocyclopentadiene (HCCPD)
GC/MS	8270C/D	Hexachloroethane (HCE)
GC/MS	8270C/D	Indeno(1,2,3-cd)pyrene
GC/MS	8270C/D	Isophorone
GC/MS	8270C/D	N-Nitrosodimethylamine
GC/MS	8270C/D	N-Nitroso-di-n-propylamine (NDPA)
GC/MS	8270C/D	N-nitrosodiphenylamine (NDPHA)
GC/MS	8270C/D	Naphthalene
GC/MS	8270C/D	Nitrobenzene
GC/MS	8270C/D	Pentachlorophenol
GC/MS	8270C/D	Phenanthrene
GC/MS	8270C/D	Phenol
GC/MS	8270C/D	Pyrene
GC/MS	8270C/D	Pyridine
GC/MS	8270C/D	1,2,4-Trichlorobenzene
GC/MS	8270C/D	1,1'-Biphenyl
GC/MS	8270C/D	1,2,4,5-Tetrachlorobenzene
GC/MS	8270C/D	1,4-Dioxane
GC/MS	8270C/D	1-Methylnaphthalene
GC/MS	8270C/D	2,3,4,6-Tetrachlorophenol
GC/MS	8270C/D	Aniline
GC/MS	8270C/D	Atrazine
GC/MS	8270C/D	Benzaldehyde
GC/MS	8270C/D	Benzidine
GC/MS	8270C/D	Caprolactam
GC/ECD	8081A/B	4,4'-DDD
GC/ECD	8081A/B	4,4'-DDE
GC/ECD	8081A/B	4,4'-DDT
GC/ECD	8081A/B	Aldrin
GC/ECD	8081A/B	alpha-BHC (alpha-HCH)
GC/ECD	8081A/B	alpha-Chlordane
GC/ECD	8081A/B	beta-BHC (beta-HCH)
GC/ECD	8081A/B	delta-BHC (delta-HCH)
GC/ECD	8081A/B	Dieldrin
GC/ECD	8081A/B	Endosulfan I
GC/ECD	8081A/B	Endosulfan II
GC/ECD	8081A/B	Endosulfan sulfate
GC/ECD	8081A/B	Endrin

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/ECD	8081A/B	Endrin aldehyde
GC/ECD	8081A/B	Endrin ketone
GC/ECD	8081A/B	gamma-BHC (Lindane; gamma-HCH)
GC/ECD	8081A/B	gamma-Chlordane
GC/ECD	8081A/B	Heptachlor
GC/ECD	8081A/B	Heptachlor epoxide
GC/ECD	8081A/B	Methoxychlor
GC/ECD	8081A/B	Chlordane
GC/ECD	8081A/B	Toxaphene
GC/ECD	8082 /A	Aroclor-1016
GC/ECD	8082 /A	Aroclor-1221
GC/ECD	8082 /A	Aroclor-1232
GC/ECD	8082 /A	Aroclor-1242
GC/ECD	8082 /A	Aroclor-1248
GC/ECD	8082 /A	Aroclor-1254
GC/ECD	8082 /A	Aroclor-1260
GC/ECD	8151A	2,4,5-T
GC/ECD	8151A	2,4,5-TP (Silvex)
GC/ECD	8151A	2,4-D
GC/ECD	8151A	2,4-DB
GC/ECD	8151A	Dalapon
GC/ECD	8151A	Dicamba
GC/ECD	8151A	Dichlorprop
GC/ECD	8151A	Dinoseb
GC/ECD	8151A	MCPA
GC/ECD	8151A	MCPP (Mecoprop)
HPLC/UV	8330A	1,3,5-Trinitrobenzene
HPLC/UV	8330A	1,3-Dinitrobenzene
HPLC/UV	8330A	2,4,6-Trinitrophenylmethylnitramine (Tetryl)
HPLC/UV	8330A	2,4,6-Trinitrotoluene (TNT)
HPLC/UV	8330A	2,4-Dinitrotoluene (DNT)
HPLC/UV	8330A	2,6-Dinitrotoluene
HPLC/UV	8330A	2-Amino-4,6-dinitrotoluene
HPLC/UV	8330A	2-Nitrotoluene (ONT)
HPLC/UV	8330A	3-Nitrotoluene
HPLC/UV	8330A	4-Amino-2,6-dinitrotoluene
HPLC/UV	8330A	4-Nitrotoluene (PNT)
HPLC/UV	8330A	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
HPLC/UV	8330A	Nitroglycerin

Non-Potable Water		
Technology	**Method**	**Analyte**
HPLC/UV	8330A	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)
HPLC/UV	8330A	3,5-Dinitroaniline
HPLC/UV	8330A	PETN
GC/FID	8015B	TPH DRO
GC/FID	8015B	TPH GRO
GC/FID	RSK-175	Methane
GC/FID	RSK-175	Ethane
GC/FID	RSK-175	Ethene
GC/ECD	8011	1,2-Dibromoethane (EDB)
GC/ECD	8011	1,2-Dibromo-3-chloropropane (DBCP)
HPLC/MS	6850	Perchlorate
ICP	6010B/C	Aluminum
ICP	6010B/C	Antimony
ICP	6010B/C	Arsenic
ICP	6010B/C	Barium
ICP	6010B/C	Beryllium
ICP	6010B/C	Cadmium
ICP	6010B/C	Calcium
ICP	6010B/C	Chromium, total
ICP	6010B/C	Cobalt
ICP	6010B/C	Copper
ICP	6010B/C	Iron
ICP	6010B/C	Lead
ICP	6010B/C	Magnesium
ICP	6010B/C	Manganese
CVAA	7470A	Mercury
ICP	6010B/C	Nickel
ICP	6010B/C	Potassium
ICP	6010B/C	Selenium
ICP	6010B/C	Silver
ICP	6010B/C	Sodium
ICP	6010B/C	Thallium
ICP	6010B/C	Vanadium
ICP	6010B/C	Zinc
ICP	6010B/C	Molybdenum
ICP	6010B/C	Tin
ICP	6010B/C	Titanium
IC	300.0	Chloride
IC	300.0	Fluoride

Non-Potable Water		
Technology	**Method**	**Analyte**
IC	300.0	Nitrate
IC	300.0	Nitrite
IC	300.0	Sulfate
IC	9056A	Chloride
IC	9056A	Fluoride
IC	9056A	Nitrate
IC	9056A	Nitrite
IC	9056A	Sulfate
Titration	SM 2320B 20th ed.	Alkalinity
ISE	SM 4500 B, D, 20th ed.	Ammonia
UV/Vis	7196A	Hexavalent Chromium
Colorimetric	353.2	Nitrate/Nitrite
Titration	Chap.7, Sect. 7.3.4 Mod.	Reactive Sulfide
Titration	SM 4500 S-2CF, 20th edition	Sulfide
UV/Vis	SM 4500 P B5, E, 20th edition	Total Phosphorus
UV/Vis	SM 4500 PE, 20th edition	Ortho-Phosphorus
TOC	9060A/SM5310C, 20th edition	Total Organic Carbon
Gravimetric	SM 2540C, 20th edition	TDS
Colorimetric	9012A/B	Cyanide
Physical	1010A	Ignitability
Physical	9095B	Paint Filter
Probe	9040B/C	pH
Preparation	**Method**	**Type**
Preparation	1311	TCLP
Preparation	3005A	Metals digestion
Preparation	3010A	Metals digestion
Preparation	3510C	Organics Liquid Extraction
Preparation	5030A/B	Purge and Trap Water

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8260B	1,1,1-Trichloroethane (1,1,1-TCA)
GC/MS	8260B	1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113; Freon 113)
GC/MS	8260B	1,1,2-Trichloroethane
GC/MS	8260B	1,1,2,2-Tetrachloroethane
GC/MS	8260B	1,1,1,2-Tetrachloroethane
GC/MS	8260B	1,1-Dichloroethane (1,1-DCA)
GC/MS	8260B	1,1-Dichloroethene (1,1-DCE)
GC/MS	8260B	1,2,3-Trichlorobenzene
GC/MS	8260B	1,2,4-Trichlorobenzene
GC/MS	8260B	1,2,3-Trichloropropane
GC/MS	8260B	1,2,4-Trimethylbenzene
GC/MS	8260B	1,3,5-Trimethylbenzene
GC/MS	8260B	1,2-Dibromoethane (EDB)
GC/MS	8260B	1,2-Dibromo-3-chloropropane (DBCP)
GC/MS	8260B	1,2-Dichlorobenzene
GC/MS	8260B	1,2-Dichloroethane (EDC)
GC/MS	8260B	1,2-Dichloropropane
GC/MS	8260B	1,3-Dichlorobenzene
GC/MS	8260B	1,4-Dichlorobenzene
GC/MS	8260B	1,1-Dichloropropene
GC/MS	8260B	1,3-Dichloropropane
GC/MS	8260B	2,2-Dichloropropane
GC/MS	8260B	2-Butanone (Methyl ethyl ketone; MEK)
GC/MS	8260B	2-Hexanone (Methyl butyl ketone; MBK)
GC/MS	8260B	4-Methyl-2-pentanone (Methyl isobutyl ketone; MIBK)
GC/MS	8260B	Acetone
GC/MS	8260B	Benzene
GC/MS	8260B	Bromochloromethane
GC/MS	8260B	Bromodichloromethane
GC/MS	8260B	Bromobenzene
GC/MS	8260B	Bromoform
GC/MS	8260B	Bromomethane
GC/MS	8260B	n-Butylbenzene
GC/MS	8260B	sec-Butylbenzene
GC/MS	8260B	tert-Butylbenzene
GC/MS	8260B	Carbon Disulfide
GC/MS	8260B	Carbon Tetrachloride
GC/MS	8260B	Chlorobenzene
GC/MS	8260B	Chloroethane

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8260B	Chloroform
GC/MS	8260B	Chloromethane
GC/MS	8260B	2-Chlorotoluene
GC/MS	8260B	4-Chlorotoluene
GC/MS	8260B	cis-1,2-Dichloroethene (cis-1,2-DCE)
GC/MS	8260B	cis-1,3-Dichloropropene
GC/MS	8260B	Cyclohexane
GC/MS	8260B	Dibromochloromethane
GC/MS	8260B	Dibromomethane
GC/MS	8260B	Dichlorodifluoromethane (CFC-12)
GC/MS	8260B	Ethylbenzene
GC/MS	8260B	Hexachlorobutadiene
GC/MS	8260B	Isopropylbenzene (Cumene)
GC/MS	8260B	p-Isopropyltoluene
GC/MS	8260B	Methyl Acetate
GC/MS	8260B	Methyl Tertiary Butyl Ether (MTBE)
GC/MS	8260B	Methylcyclohexane
GC/MS	8260B	Methylene Chloride, or Dichloromethane
GC/MS	8260B	Naphthalene
GC/MS	8260B	n-Propylbenzene
GC/MS	8260B	Styrene
GC/MS	8260B	Tetrachloroethene (PCE; PERC)
GC/MS	8260B	Toluene
GC/MS	8260B	trans-1,2-Dichloroethene (trans-1,2-DCE)
GC/MS	8260B	trans-1,3-Dichloropropene
GC/MS	8260B	Trichloroethene (TCE)
GC/MS	8260B	Trichlorofluoromethane (CFC-11)
GC/MS	8260B	Vinyl Chloride (VC)
GC/MS	8260B	Xylenes (Total)
GC/MS	8260B	Acrolein
GC/MS	8260B	Acrylonitrile
GC/MS	8260B	Ethyl methacrylate
GC/MS	8260B	Iodomethane
GC/MS	8260B	Methyl methacrylate
GC/MS	8260B	Vinyl acetate
GC/MS	8270C/D	Bis(2-chloroisopropyl)ether, or 2,2'-oxybis (1-Chloropropane)
GC/MS	8270C/D	1,2-Dichlorobenzene
GC/MS	8270C/D	1,3-Dichlorobenzene
GC/MS	8270C/D	1,4-Dichlorobenzene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8270C/D	2,4,5-Trichlorophenol
GC/MS	8270C/D	2,4,6-Trichlorophenol (TCP)
GC/MS	8270C/D	2,4-Dichlorophenol (DCP)
GC/MS	8270C/D	2,4-Dimethylphenol
GC/MS	8270C/D	2,4-Dinitrophenol
GC/MS	8270C/D	2,4-Dinitrotoluene (DNT)
GC/MS	8270C/D	2,6-Dichlorophenol
GC/MS	8270C/D	2,6-Dinitrotoluene
GC/MS	8270C/D	1,2-Diphenylhydrazine
GC/MS	8270C/D	2-Chloronaphthalene
GC/MS	8270C/D	2-Chlorophenol
GC/MS	8270C/D	2-Methylnaphthalene
GC/MS	8270C/D	2-Methylphenol (o-Cresol)
GC/MS	8270C/D	2-Nitroaniline
GC/MS	8270C/D	2-Nitrophenol (ONP)
GC/MS	8270C/D	3,3'-Dichlorobenzidine (DCB)
GC/MS	8270C/D	3-Methylphenol
GC/MS	8270C/D	3-Nitroaniline
GC/MS	8270C/D	4,6-Dinitro-2-methylphenol (DNOC)
GC/MS	8270C/D	4-Bromophenyl phenyl ether
GC/MS	8270C/D	4-Chloro-3-methylphenol
GC/MS	8270C/D	4-Chloroaniline
GC/MS	8270C/D	4-Chlorophenyl phenyl ether
GC/MS	8270C/D	4-Methylphenol (p-Cresol)
GC/MS	8270C/D	4-Nitroaniline (PNA)
GC/MS	8270C/D	4-Nitrophenol (PNP)
GC/MS	8270C/D	Acenaphthene
GC/MS	8270C/D	Acenaphthylene
GC/MS	8270C/D	Acetaphenone
GC/MS	8270C/D	Anthracene
GC/MS	8270C/D	Benzo(a)anthracene
GC/MS	8270C/D	Benzo(a)pyrene
GC/MS	8270C/D	Benzo(b)fluoranthene
GC/MS	8270C/D	Benzo(g,h,i)perylene
GC/MS	8270C/D	Benzo(k)fluoranthene
GC/MS	8270C/D	Benzyl alcohol
GC/MS	8270C/D	Benzoic Acid
GC/MS	8270C/D	bis(2-Chloroethoxy)methane
GC/MS	8270C/D	bis(2-Chloroethyl)ether (BCEE)

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8270C/D	bis(2-Ethylhexyl)phthalate (BEHP)
GC/MS	8270C/D	Butyl benzyl phthalate (BBP)
GC/MS	8270C/D	Carbazole
GC/MS	8270C/D	Chrysene
GC/MS	8270C/D	Di-n-butyl phthalate (DBP)
GC/MS	8270C/D	Di-n-octyl phthalate (DNOP)
GC/MS	8270C/D	Dibenz(a,h)anthracene
GC/MS	8270C/D	Dibenzofuran (DBF)
GC/MS	8270C/D	Diethyl phthalate (DEP)
GC/MS	8270C/D	Dimethyl phthalate (DMP)
GC/MS	8270C/D	Fluoranthene
GC/MS	8270C/D	Fluorene
GC/MS	8270C/D	Hexachlorobenzene (HCB)
GC/MS	8270C/D	Hexachlorobutadiene (HCBD)
GC/MS	8270C/D	Hexachlorocyclopentadiene (HCCPD)
GC/MS	8270C/D	Hexachloroethane (HCE)
GC/MS	8270C/D	Indeno(1,2,3-cd)pyrene
GC/MS	8270C/D	Isophorone
GC/MS	8270C/D	N-Nitrosodimethylamine
GC/MS	8270C/D	N-Nitroso-di-n-propylamine (NDPA)
GC/MS	8270C/D	N-nitrosodiphenylamine (NDPHA)
GC/MS	8270C/D	Naphthalene
GC/MS	8270C/D	Nitrobenzene
GC/MS	8270C/D	Pentachlorophenol
GC/MS	8270C/D	Phenanthrene
GC/MS	8270C/D	Phenol
GC/MS	8270C/D	Pyrene
GC/MS	8270C/D	Pyridine
GC/MS	8270C/D	1,2,4-Trichlorobenzene
GC/MS	8270C/D	1,1'-Biphenyl
GC/MS	8270C/D	1,2,4,5-Tetrachlorobenzene
GC/MS	8270C/D	1,4-Dioxane
GC/MS	8270C/D	1-Methylnaphthalene
GC/MS	8270C/D	2,3,4,6-Tetrachlorophenol
GC/MS	8270C/D	Aniline
GC/MS	8270C/D	Atrazine
GC/MS	8270C/D	Benzaldehyde
GC/MS	8270C/D	Benzidine
GC/MS	8270C/D	Caprolactam

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/ECD	8081A/B	4,4'-DDD
GC/ECD	8081A/B	4,4'-DDE
GC/ECD	8081A/B	4,4'-DDT
GC/ECD	8081A/B	Aldrin
GC/ECD	8081A/B	alpha-BHC (alpha-HCH)
GC/ECD	8081A/B	alpha-Chlordane
GC/ECD	8081A/B	beta-BHC (beta-HCH)
GC/ECD	8081A/B	delta-BHC (delta-HCH)
GC/ECD	8081A/B	Dieldrin
GC/ECD	8081A/B	Endosulfan I
GC/ECD	8081A/B	Endosulfan II
GC/ECD	8081A/B	Endosulfan sulfate
GC/ECD	8081A/B	Endrin
GC/ECD	8081A/B	Endrin aldehyde
GC/ECD	8081A/B	Endrin ketone
GC/ECD	8081A/B	gamma-BHC (Lindane; gamma-HCH)
GC/ECD	8081A/B	gamma-Chlordane
GC/ECD	8081A/B	Heptachlor
GC/ECD	8081A/B	Heptachlor epoxide
GC/ECD	8081A/B	Methoxychlor
GC/ECD	8081A/B	Chlordane
GC/ECD	8081A/B	Toxaphene
GC/ECD	8082 /A	Aroclor-1016
GC/ECD	8082 /A	Aroclor-1221
GC/ECD	8082 /A	Aroclor-1232
GC/ECD	8082 /A	Aroclor-1242
GC/ECD	8082 /A	Aroclor-1248
GC/ECD	8082 /A	Aroclor-1254
GC/ECD	8082 /A	Aroclor-1260
GC/ECD	8151A	2,4,5-T
GC/ECD	8151A	2,4,5-TP (Silvex)
GC/ECD	8151A	2,4-D
GC/ECD	8151A	2,4-DB
GC/ECD	8151A	Dalapon
GC/ECD	8151A	Dicamba
GC/ECD	8151A	Dichlorprop
GC/ECD	8151A	Dinoseb
GC/ECD	8151A	MCPA
GC/ECD	8151A	MCPP (Mecoprop)

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
HPLC/UV	8330A	1,3,5-Trinitrobenzene
HPLC/UV	8330A	1,3-Dinitrobenzene
HPLC/UV	8330A	2,4,6-Trinitrophenylmethylnitramine (Tetryl)
HPLC/UV	8330A	2,4,6-Trinitrotoluene (TNT)
HPLC/UV	8330A	2,4-Dinitrotoluene (DNT)
HPLC/UV	8330A	2,6-Dinitrotoluene
HPLC/UV	8330A	2-Amino-4,6-dinitrotoluene
HPLC/UV	8330A	2-Nitrotoluene (ONT)
HPLC/UV	8330A	3-Nitrotoluene
HPLC/UV	8330A	4-Amino-2,6-dinitrotoluene
HPLC/UV	8330A	4-Nitrotoluene (PNT)
HPLC/UV	8330A	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
HPLC/UV	8330A	Nitroglycerin
HPLC/UV	8330A	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)
HPLC/UV	8330A	PETN
GC/FID	8015B	TPH DRO
GC/FID	8015B	TPH GRO
HPLC/MS	6850	Perchlorate
ICP	6010B/C	Aluminum
ICP	6010B/C	Antimony
ICP	6010B/C	Arsenic
ICP	6010B/C	Barium
ICP	6010B/C	Beryllium
ICP	6010B/C	Cadmium
ICP	6010B/C	Calcium
ICP	6010B/C	Chromium, total
ICP	6010B/C	Cobalt
ICP	6010B/C	Copper
ICP	6010B/C	Iron
ICP	6010B/C	Lead
ICP	6010B/C	Magnesium
ICP	6010B/C	Manganese
CVAA	7471A/B	Mercury
ICP	6010B/C	Nickel
ICP	6010B/C	Potassium
ICP	6010B/C	Selenium
ICP	6010B/C	Silver
ICP	6010B/C	Sodium
ICP	6010B/C	Thallium

LABORATORY ACCREDITATION BUREAU

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Solid and Chemical Materials		
Technology	**Method**	**Analyte**
ICP	6010B/C	Vanadium
ICP	6010B/C	Zinc
ICP	6010B/C	Molybdenum
ICP	6010B/C	Tin
ICP	6010B/C	Titanium
UV/Vis	7196A	Hexavalent Chromium
TOC	Lloyd Kahn	Total Organic Carbon
Colorimetric	9012A/B	Cyanide
Titration	Chap.7, Sect. 7.3.4 Mod.	Reactive Sulfide
Titration	9034	Sulfide
Probe	9045D	pH
Preparation	**Method**	**Type**
Preparation	1311	TCLP
Preparation	1312	SPLP
Preparation	NJ Modified 3060A	Hexavalent Chromium
Preparation	3050B	Metals Digestion
Preparation	3546	Organics Microwave Extraction
Preparation	3541	Organics Soxhlet Extraction
Preparation	3550B	Organics Sonication
Preparation	SM 2540B 20th edition	Percent Solids (Percent Moisture)
Preparation	5035 /A	Purge and Trap Solid

Notes:

1) This laboratory offers commercial testing service.

Approved By: _____ Date: November 30, 2009

R. Douglas Leonard
Chief Technical Officer

Issued: 11/30/09

EMPIRICAL LABORATORIES, LLC
STANDARD OPERATING PROCEDURE

ORGANICS: SOP 201 REVISION #: 20 EFFECTIVE DATE: 042610

GC/MS SEMIVOLATILES and LOW-CONCENTRATION PAHs BY EPA METHOD 625 AND SW846 METHOD 8270C AND 8270D INCLUDING ADDITIONAL APPENDIX IX COMPOUNDS

APPROVALS:

Lab Director: _____ Date: 4/27/10

Data Quality Manager: _____ Date: 4/27/10

Section Supervisor: _____ Date: 4/27/10

Changes Summary

Revision 20, 4/13/10

- The SOP is an update from Revision 19 dated 4/11/2010
- The SOP is formatted to simplify the text and place all method/program specifications in the SOP tables.

Revision 19, 4/11/10

- The SOP is an update from Revision 18 dated 9/16/08
- The SOP is formatted to include all 22-elements required per the NELAC standards
- The laboratory's revision of all technical SOPs now includes a Table of Contents that provides the map of the technical information contained within the SOP.
- Additional requirements, based upon the DOD QSM 4.1, have been integrated into the routine sample flow; however, if the requirement is different from routine sample flow, then the requirement is outlined and documented as such to be followed only when DOD samples are analyzed.

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1.0 Identification of the Test Method

This SOP is based primarily on SW-846 Methods 8000B/8000C/8270C/8270D. Methods *Federal Register* Method 625 and CLP Method for Semi-volatiles have also been used in the development of this SOP.

2.0 Applicable Matrix or Matrices

This SOP is used for the analysis of semi-volatile organic compounds (including low concentration PAHs) in a variety of matrices (soils, sediments, waters, etc.).

3.0 Detection Limits – Reporting Limits

See Table 1

4.0 Scope of Application, Including Components to Be Analyzed

4.1 Each parameter that is routinely analyzed and reported under the scope of this SOP is listed in the Appendix of this SOP. This table also lists the associated Detection Limit, Limit of Detection and Reporting Limit (also defined as the Limit of Quanititation).

4.2 Extreme care should be taken when working with pure standard and stock standard solutions of these compounds and all handling of standards should be done in a hood. These compounds have been classified as known or suspected human or mammalian carcinogens.

5.0 Summary of the Test Method

5.1 After sample preparation using the appropriate extraction technique, the sample is introduced into the GC/MS using direct injection. The analytes are separated in the gas chromatograph by a combination of the temperature program, the pressure program and the capillary column. The analytes are then detected by the mass spectrometer. Analytes are identified by comparing the mass spectra of known standards with the mass spectra from the sample. Analytes are quantitated relative to known standards using the internal standard method.

6.0 Definitions –

Laboratory Quality System SOP QS08 **"**Technical / Operational Definitions, Minimum Essential Quality Control Elements, and Laboratory Calibration Procedures" provides information on the commonly used definitions.

7.0 Interferences

7.1 All raw data (samples & QC) must be evaluated for interferences. If contamination occurs, determine whether the source of interference is in the preparation or clean-up of the samples and take corrective action to eliminate the problem.

7.2 Contamination by carryover can occur when samples of high-concentration and low-concentration are analyzed sequentially. To reduce carryover, the sample syringe must be rinsed with solvent between injections. If an unusually high sample is detected, a solvent blank should be analyzed for cross contamination or the subsequent sample should be evaluated for cross-contamination.

8.0 Safety

8.1 Laboratory SOP QS13 "Safety Program & Chemical Hygiene Plan" discusses the safety program that is to be followed lab-wide.

8.2 Care should be used in handling all samples. Safety glasses must be worn in the lab at all times. The use of gloves and lab coats is highly recommended.

8.3 Research into expected sample content and concentration should be done in order to be prepared for additional safety considerations. Generally, any samples which need special consideration have applicable notes on the sample logs.

8.4 MSDS sheets are available for all reagents and standards which have been purchased. These are located on the bookshelf outside the office supply storage room.

9.0 Equipment & Supplies

a HP 5890/6890/7890GC complete with electronic pressure control and temperature programmable gas chromatograph suitable for split-less injection.

b Column: RTX-5MS (or equivalent) 30 m x 0.25 mm I.D. x 0.25 µm film thickness fused silica capillary column.

c HP 5971/5973/5975 mass spectrometer capable of scanning from 35 to 500 amu every second or less, using 70 volts electron energy in electron impact ionization mode. The mass spectrometer is capable of producing a mass spectrum for decafluorotriphenylphosphine, DFTPP, which meets all the tuning criteria of the EPA methods.

d HP 7673/7683 autosampler capable of reproducibility from one injection to another proven by meeting QC and calibration criteria.

e HP GC/MS interface that gives acceptable calibration points at 50 ng per injection for each compound of interest and achieves acceptable tuning performance criteria.

f Acquisition Software: HP Chemstation system is interfaced to the GC/MS. The system acquires and stores data throughout the chromatographic programs.

g Data Processing Software: Target DB on Windows NT server data system is interfaced to the HP Chemstation. The system accepts and stores acquired data. It plots by extracted ion current profile (EICP). The system is also capable of integrating the abundances in any EICP between specified times or scan-number limits.

h Micro syringes – gas tight 5uL and larger.

i Liners – 2mm or 4mm single goose-neck.

j Septa 11mm.

k Seals- dual vespel stainless steel or gold plated 0.8mm.

l Vials- 2ml and larger amber.

m Volumetric flasks- 10ml and larger class A with glass stopper.

10.0 Reagents and Standards –

10.1 The laboratory's LIMS system allows for complete documentation and for the traceability of reagents and standards used within the laboratory.

10.2 Reagent grade chemicals shall be used in all tests unless otherwise specified. All reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

10.3 Methylene chloride (Please read SOP-336 before handling this solvent in our laboratory.) – Trace analysis grade.

10.4 Stock standards are purchased in mixtures from reputable vendors. The date they are received is noted on the label and recorded on the certificate of analysis sheet. The date they are opened is noted on the label and recorded in LIMS. Each standards label is completed with the standard number, name, preparation date, expiration date, solvent and analyst initials. All stocks and standards are stored in the freezer at a temperature of -15°C ± 5°C from the date they are received/prepared. Standards are brought to room temperature before being used to make standards. Sonication is used if precipitation is observed after bringing to room temperature. The refrigerator and freezer temperature are monitored daily with an annually calibrated thermometer and recorded with calibration correction in the Extraction temperature/calibration logbook.

10.5 Individual standard makeup is recorded in LIMS with specific details concerning the standard being used, concentration, amount, solvent and expiration date.

11.0 Sample Collection, Preservation, Shipment, and Storage

Section 3.0 and table 3-1 of the Empirical Laboratories' Quality Assurance Manual include details concerning sample preservation, containers and handling of semi-volatile samples and extracts. All water and soil samples are stored in the appropriate walk-in coolers at a temperature of 4°C. All extracts are stored in the Hobart in the Extraction lab at a temperature of 4°C. Water samples have a holding time of 7 days from date of sampling while soil samples have a holding time of 14 days from date of sampling (unless otherwise specified for the project). Extracts have 40 days from date of extraction to be analyzed.

12.0 Quality Control

12.1 Internals - All samples and QC are spiked with internal standards prior to analysis.

12.2 Surrogates - All samples and QC are spiked with surrogates prior to extraction. See **Table 2** for criteria and corrective action.

12.3 LCS Sample - The LCS is extracted 1 per extraction batch of up to 20 samples to provide accuracy results. It is spiked using an alternate source or lot number than the calibration standards. See **Table 2** for criteria and corrective action.

12.4 Method Blanks - The Method Blank is extracted 1 per extraction batch of up to 20 samples. See **Table 2** for criteria and corrective action.

12.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD) Sample - 1 in 20 samples are spiked for a MS/MSD, if sample is available. If no sample is available, an LCSD must be extracted to provide precision results. See **Table 2** for criteria and corrective action. Some factors that may affect MS/MSD results are:

12.5.1 Sample matrix - If the sample is a soil, grab sample or sequentially collected water sample it may affect the %R and RPD of the MS/MSD. Corrective action must be taken in the form of reanalysis if a method problem is indicated.

12.5.2 Original sample concentration - If a spiked compound has a problem and the concentration of that compound in the original sample was four or more times the concentration of the spike, no further corrective action may be necessary other than the generation of a corrective action report to document the problem.

12.5.3 MS vs. MSD - If a spiked compound has a similar problem in both the MS and MSD and is not traced to a method problem, no further action may be necessary other than the generation of a non-conformance report to document the problem.

12.5.4 Non-target Interference - The presence of significant non-target interference should be brought to the immediate attention of your supervisor who should discuss the problem with the client/project manager to determine the action to be taken.

12.6 Demonstration of Capability (DOC) – Each new analyst must complete a demonstration of capability by analyzing four LCSs with acceptable precision and accuracy. This also must be done when a new instrument is installed or a significant change to the method has been made.

13.0 Calibration and Standardization

13.1 Quality Systems **SOP QS08** "Technical / Operational Definitions, Minimum Essential Quality Control Elements, and Laboratory Calibration Procedures" related to Calibration Procedures provides laboratory wide protocols for calibration and standardization.

13.2 Initial Calibration - An initial multi-point calibration curve must be analyzed and shown to meet the initial calibration criteria before any sample analyses may be performed. See **Table 2** for criteria and corrective action. The lowest standard must be less than or equal to the reported quantitation limit and the highest standard must not exceed the linear range of the detector. Generally, levels for the curve range from 1.0ug/mL to 100ug/mL for regular SVOCs and 0.1µg/mL to 50µg/mL for low-concentration PAHs.. Any manual integrations are documented by inclusion of the integrated signals (**before and after manual integration**) initialed, reason indicated and dated with the quantitation report and chromatogram. All integrations are second-checked for acceptability by a senior analyst. Refer to SOP-QS07 for guidance.

13.3 Initial Calibration Verification (ICV) - A second source standard at the continuing calibration verification (CCV) level must be analyzed and calculated against the initial calibration curve, then shown to meet the ICV criteria before any sample analyses may be performed. See **Table 2** for criteria and corrective action. For ICV standard preparation, refer to LIMS. Any manual integrations are documented by inclusion of the integrated signals (**before and after manual integration**) initialed, reason indicated and dated with the quantitation report and chromatogram. All integrations are second-checked for acceptability by a senior analyst. Refer to SOP-QS07 for guidance.

13.4 Continuing Calibration Verification (CCV) - Every 12 hours, a CCV must be analyzed and calculated against the initial calibration curve, then shown to meet the calibration check criteria before any sample analyses may be performed. See **Table 2** for criteria and corrective action. For ICV standard preparation, refer to LIMS. Any manual integrations are documented by inclusion of the integrated signals (**before and after manual integration**) initialed, reason indicated and dated with the quantitation report and chromatogram. All integrations are second-checked for acceptability by a senior analyst. Refer to SOP-QS07 for guidance.

14.0 Procedure

Prior to analysis the samples are prepared for chromatography using the appropriate sample preparation and clean up methods (generally SW-846 methods 3510, 3520, 3541, 3546 3550, 3580, EPA method 625 or CLP).

14.1 Chromatographic conditions: Refer to corresponding instrument maintenance log for current gas chromatograph and mass spectrometer conditions.

14.2 Tuning - Prior to any calibration or analysis, DFTPP tuning criteria must be met for a 50 ng injection of the tuning standard. The injection port performance compounds (pentachlorophenol, benzidine and 4,4'-DDT) are also injected to verify the performance of the injection port . See **Table 2** for criteria and corrective action.

14.3 Extracts - Prior to analysis, 1.0 mL extracts are prepared by verifying volume and spiking with 20uL of the internal standard solution.

14.5 Instrument sequence-The instrument sequence log is filled out prior to sample analyses. An example of a typical instrument sequence log follows:

1-SEQ-TUN1 (12:00 am)
2-SEQ-CCV1
3-SEQ-BS1
4-SEQ-BLK1
5-Sample
6-Sample
7-Sample
8-Sample
9-Sample
10-Sample
11-Sample
12-Sample
13-Sample
14-SEQ-MS1
15-SEQ-MSD1
16-SEQ-TUN2 (12:00pm - 12 hours since last DFTPP/CCV)
17-SEQ-CCV2
18-Sample
19-Sample
20-Sample

14.6 Data Reduction/Evaluation - Each sample analysis sequence is documented using the computer run log generated on the Chemstation. This run log is signed, dated and paginated then placed in a 3 ring binder for that instrument. After the sample has been analyzed, the data is processed through Target DB on the Windows NT data system. The following must be checked to determine if the sample will need reanalysis or dilution. Criteria and corrective action are found in Table 2. Formal data evaluation is detailed in SOP QS05 and documented using the Analyst Data Review Checklist (see Appendix). Manual integration guidance is found in SOP QS07.

14.6.1 Internal Standard Area Counts and Retention Times

14.6.2 Surrogate Recoveries and Retention Times

14.6.3 Analyte concentration.
14.6.4 Analyte identification based on spectrum and retention time.
14.6.5 Analyte quantitation verification.

15.0 Data Analysis and Calculations

15.1 Quality Systems SOP QS09 "General and Commonly used Laboratory Calculations" provides details on general calculations used throughout the laboratory.

15.2 The RF is calculated as follows:

$$RF = \frac{A_s \times C_{is}}{A_{is} \times C_s}$$

where:
A_s = Peak area (or height) of the analyte or surrogate.
A_{is} = Peak area (or height) of the internal standard.
C_s = Concentration of the analyte or surrogate.
C_{is} = Concentration of the internal standard.

15.2 Calibration verification involves the calculation of the percent drift (linear or quadratic) or the percent difference (average) of the instrument response between the initial calibration and each subsequent analysis of the verification standard. Use the equations below to calculate % Drift or % Difference, depending on the calibration procedure used.

$$\% \text{ Drift} = \frac{(\text{Calculated concentration} - \text{Theoretical concentration}) * 100}{\text{Theoretical Concentration}}$$

where:
Calculated concentration is determined from the initial calibration.
Theoretical concentration is the concentration at which the standard was prepared.

$$\% \text{ Difference} = \frac{(\text{CCV RF} - \text{Average RF}) * 100}{\text{Average RF}}$$

where:
CCV RF is the response factor from the analysis of the verification standard
Average RF is the average of the response factors from the initial calibration.

15.3 Concentration in water samples is calculated as follows: [Note: Using the units specified here for these terms will result in a concentration in units of ng/mL, which is equivalent to µg/L.]

$$\text{Concentration } (\mu g/L) = \frac{(A_s)(C_{is})(D)(V_i)}{(A_{is})(\overline{RF})(V_s)(1000)}$$

where:
A_s = Area (or height) of the peak for the analyte in the sample.
A_{is} = Area (or height) of the peak for the internal standard.
C_{is} = Concentration of the internal standard in the volume extracted in ug/L.
D = Dilution factor, if the sample was diluted prior to analysis. If no dilution was made, D = 1. The dilution factor is always dimensionless.
V_i = Volume of the extract injected (µL). The nominal injection volume for samples and calibration standards must be the same.

$\overline{RF}$ = Mean response factor from the initial calibration.

V_s = Volume of the aqueous sample extracted (mL). If units of liters are used for this term, multiply the results by 1000.

The 1000 in the denominator represents the number of µL in 1 mL. If the injection (V_i) is expressed in mL, then the 1000 may be omitted.

15.4 Concentration in non-aqueous samples is calculated as follows: [Note: Using the units specified here for these terms will result in a concentration in units of ng/g, which is equivalent to µg/kg.]

$$\text{Concentration } (\mu\text{g/kg}) = \frac{(A_s)(C_{is})(D)(V_i)}{(A_{is})(\overline{RF})(W_s)(1000)}$$

where: A_s,

A_{is}, C_{is}, D, and $\overline{RF}$ are the same as for aqueous samples, and

W_s = Weight of sample extracted (g). Either a dry weight or wet weight may be used, depending upon the specific application of the data. If units of kilograms are used for this term, multiply the results by 1000.

The 1000 in the denominator represents the number of µL in 1 mL. If the injection (V_i) is expressed in mL, then the 1000 may be omitted.

15.3 Any questions left unanswered by this SOP should be clarified by reading the referenced method. If questions still remain unanswered, check with the Section Manager, Technical Director and/or Data Quality Manager.

16.0 Method Performance

See SOP QS08 and Table 2 for criteria and corrective actions associated to the following method performance items:

16.1 Method Detection Limit Study or Detection Limit Determination
16.2 Limit of Detection Verification
16.3 Limit of Quantitation or Reporting Limit Verification
16.4 Demonstration of Capability (DOC)
16.5 PT Studies

17.0 Pollution Prevention

Quantity of chemicals purchased should be based on expected usage during its shelf-life and the disposal cost of unused material. Actual reagent preparation volumes should reflect anticipated usage and reagent stability.

18.0 Data Assessment and Acceptance Criteria for Quality Control Measures

Quality Control SOP QS05, "Data Deviations / Interpretations / Exceptions: Laboratory Non-Conformance / Corrective Action Procedures, Decision Making Guidelines for Evaluating Laboratory Analytical Sample and Quality Control Results", provides details on data assessment and acceptance criteria for Quality Control Measures. **Table 2** of this SOP provides information on QC samples, frequency, and the associated criteria specific to the performance of this method.

19.0 Contingencies for Handling out-of-control or unacceptable data

Quality Control SOP QS05, "Data Deviations / Interpretations / Exceptions: Laboratory Non-Conformance / Corrective Action Procedures, Decision Making Guidelines for Evaluating Laboratory Analytical Sample and Quality Control Results", provides details on handling out of control data. **Table 2** within this SOP also lists corrective actions associated with the failure of the various QC samples employed for the performance of this method.

20.0 Waste Management

Laboratory SOP QS14 on Waste Handling discusses general guidelines for the appropriate handling of wastes and the laboratory program on waste management.

21.0 References

40 CFR, Part 136; Appendix A
Test Methods for Evaluating Solid Waste, SW-846
National Environmental Laboratory Accreditation Conference; CH. 5, 2003
USACE, EM 200-1-3; Appendix 1; Shell, 2/2001
DOD Quality Systems Manual for Environmental Laboratories,

22.0 Tables, Diagrams, Flowcharts and Validation Data

22.1 Table 1, all applicable parameters with the applicable DL(MDL)/LOD/LOQ(MRL).
22.2 Table 2, QA/QC summary table
22.3 Table 3, Technical Completeness / Accuracy Checklist
22.4 Table 4, Data Reviewers Checklist(s)
22.5 Table 5, 625 QC Limits
22.6 Table 6, Standards Used
22.7 Table 7, INTERNAL STANDARD ASSOCIATION / QUANT MASS – Standard SVOC analysis
22.8 Table 8, LOW CONCENTRATION PAH INTERNAL STANDARD/SURROGATE SPECIFICATIONS
22.9 Figure 1, Tailing Factor Calculation
22.10 Table 9, DFTPP Tuning Criteria

TABLE 1

Analyte (Water)	DL	LOD	MRL/LOQ	Units
1,1'-Biphenyl	1.25	2.50	5.00	ug/L
1,2,4,5-Tetrachlorobenzene	1.25	2.50	5.00	ug/L
1,2,4-Trichlorobenzene	1.25	2.50	5.00	ug/L
1,2-Dichlorobenzene	1.25	2.50	5.00	ug/L
1,3-Dichlorobenzene	1.25	2.50	5.00	ug/L
1,4-Dichlorobenzene	1.25	2.50	5.00	ug/L
2,3,4,6-Tetrachlorophenol	1.25	2.50	5.00	ug/L
2,4,5-Trichlorophenol	1.25	2.50	5.00	ug/L
2,4,6-Trichlorophenol	1.25	2.50	5.00	ug/L
2,4-Dichlorophenol	1.25	2.50	5.00	ug/L
2,4-Dimethylphenol	5.00	10.0	20.0	ug/L
2,4-Dinitrophenol	12.5	25.0	50.0	ug/L
2,4-Dinitrotoluene	1.25	2.50	5.00	ug/L
2,6-Dinitrotoluene	1.25	2.50	5.00	ug/L
2-Chloronaphthalene	1.25	2.50	5.00	ug/L
2-Chlorophenol	1.25	2.50	5.00	ug/L
2-Methylnaphthalene	1.25	2.50	5.00	ug/L
2-Methylphenol	1.25	2.50	5.00	ug/L
2-Nitroaniline	5.00	10.0	20.0	ug/L
2-Nitrophenol	1.25	2.50	5.00	ug/L
3,3´-Dichlorobenzidine	1.25	2.50	5.00	ug/L
3-Nitroaniline	5.00	10.0	20.0	ug/L
4,6-Dinitro-2-methylphenol	5.00	10.0	20.0	ug/L
4-Bromophenyl phenyl ether	1.25	2.50	5.00	ug/L
4-Chloro-3-methylphenol	1.25	2.50	5.00	ug/L
4-Chloroaniline	1.25	2.50	5.00	ug/L
4-Chlorophenyl phenyl ether	1.25	2.50	5.00	ug/L
4-Methylphenol	1.25	2.50	5.00	ug/L
4-Nitroaniline	5.00	10.0	20.0	ug/L
4-Nitrophenol	5.00	10.0	20.0	ug/L
Acenaphthene	1.25	2.50	5.00	ug/L
Acenaphthylene	1.25	2.50	5.00	ug/L
Acetophenone	1.25	2.50	5.00	ug/L
Anthracene	1.25	2.50	5.00	ug/L
Atrazine	1.25	2.50	5.00	ug/L
Benzaldehyde	1.25	2.50	5.00	ug/L
Benzo (a) anthracene	1.25	2.50	5.00	ug/L
Benzo (a) pyrene	1.25	2.50	5.00	ug/L
Benzo (b) fluoranthene	1.25	2.50	5.00	ug/L
Benzo (g,h,i) perylene	1.25	2.50	5.00	ug/L
Benzo (k) fluoranthene	1.25	2.50	5.00	ug/L
Bis(2-chloroethoxy)methane	1.25	2.50	5.00	ug/L
Bis(2-chloroethyl)ether	1.25	2.50	5.00	ug/L
Bis(2-chloroisopropyl)ether	1.25	2.50	5.00	ug/L
Bis(2-ethylhexyl)phthalate	1.25	2.50	5.00	ug/L
Butyl benzyl phthalate	1.25	2.50	5.00	ug/L
Caprolactam	1.25	2.50	5.00	ug/L
Carbazole	1.25	2.50	5.00	ug/L
Chrysene	1.25	2.50	5.00	ug/L
Dibenz (a,h) anthracene	1.25	2.50	5.00	ug/L
Dibenzofuran	1.25	2.50	5.00	ug/L
Diethyl phthalate	1.25	2.50	5.00	ug/L
Dimethylphthalate	1.25	2.50	5.00	ug/L
Di-n-butyl phthalate	1.25	2.50	5.00	ug/L

Table 1 (Continued)

Analyte (Water)	DL	LOD	MRL/LOQ	Units
Di-n-octyl phthalate	1.25	2.50	5.00	ug/L
Fluoranthene	1.25	2.50	5.00	ug/L
Fluorene	1.25	2.50	5.00	ug/L
Hexachlorobenzene	1.25	2.50	5.00	ug/L
Hexachlorobutadiene	1.25	2.50	5.00	ug/L
Hexachlorocyclopentadiene	1.25	2.50	5.00	ug/L
Hexachloroethane	1.25	2.50	5.00	ug/L
Indeno (1,2,3-cd) pyrene	1.25	2.50	5.00	ug/L
Isophorone	1.25	2.50	5.00	ug/L
Naphthalene	1.25	2.50	5.00	ug/L
Nitrobenzene	1.25	2.50	5.00	ug/L
N-Nitrosodi-n-propylamine	1.25	2.50	5.00	ug/L
N-Nitrosodiphenylamine	1.25	2.50	5.00	ug/L
Pentachlorophenol	5.00	10.0	20.0	ug/L
Phenanthrene	1.25	2.50	5.00	ug/L
Phenol	1.25	2.50	5.00	ug/L
Pyrene	1.25	2.50	5.00	ug/L
Analyte (Soil)	**DL**	**LOD**	**MRL/LOQ**	**Units**
1,1'-Biphenyl	83.3	167	333	ug/Kg
1,2,4,5-Tetrachlorobenzene	83.3	167	333	ug/Kg
1,2,4-Trichlorobenzene	83.3	167	333	ug/Kg
1,2-Dichlorobenzene	83.3	167	333	ug/Kg
1,3-Dichlorobenzene	83.3	167	333	ug/Kg
1,4-Dichlorobenzene	83.3	167	333	ug/Kg
2,3,4,6-Tetrachlorophenol	83.3	167	333	ug/Kg
2,4,5-Trichlorophenol	83.3	167	333	ug/Kg
2,4,6-Trichlorophenol	83.3	167	333	ug/Kg
2,4-Dichlorophenol	83.3	167	333	ug/Kg
2,4-Dimethylphenol	333	667	1330	ug/Kg
2,4-Dinitrophenol	833	1670	3330	ug/Kg
2,4-Dinitrotoluene	83.3	167	333	ug/Kg
2,6-Dinitrotoluene	83.3	167	333	ug/Kg
2-Chloronaphthalene	83.3	167	333	ug/Kg
2-Chlorophenol	83.3	167	333	ug/Kg
2-Methylnaphthalene	83.3	167	333	ug/Kg
2-Methylphenol	83.3	167	333	ug/Kg
2-Nitroaniline	333	667	1330	ug/Kg
2-Nitrophenol	83.3	167	333	ug/Kg
3,3´-Dichlorobenzidine	83.3	167	333	ug/Kg
3-Nitroaniline	333	667	1330	ug/Kg
4,6-Dinitro-2-methylphenol	833	1670	3330	ug/Kg
4-Bromophenyl phenyl ether	83.3	167	333	ug/Kg
4-Chloro-3-methylphenol	83.3	167	333	ug/Kg
4-Chloroaniline	83.3	167	333	ug/Kg
4-Chlorophenyl phenyl ether	83.3	167	333	ug/Kg
4-Methylphenol	83.3	167	333	ug/Kg
4-Nitroaniline	333	667	1330	ug/Kg
4-Nitrophenol	333	667	1330	ug/Kg
Acenaphthene	83.3	167	333	ug/Kg
Acenaphthylene	83.3	167	333	ug/Kg
Acetophenone	83.3	167	333	ug/Kg
Anthracene	83.3	167	333	ug/Kg
Atrazine	83.3	167	333	ug/Kg
Benzaldehyde	83.3	167	333	ug/Kg
Benzo (a) anthracene	83.3	167	333	ug/Kg

Table 1 (Continued)

Analyte (Soil)	DL	LOD	MRL/LOQ	Units
Benzo (a) pyrene	83.3	167	333	ug/Kg
Benzo (b) fluoranthene	83.3	167	333	ug/Kg
Benzo (g,h,i) perylene	83.3	167	333	ug/Kg
Benzo (k) fluoranthene	83.3	167	333	ug/Kg
Bis(2-chloroethoxy)methane	83.3	167	333	ug/Kg
Bis(2-chloroethyl)ether	83.3	167	333	ug/Kg
Bis(2-chloroisopropyl)ether	83.3	167	333	ug/Kg
Bis(2-ethylhexyl)phthalate	83.3	167	333	ug/Kg
Butyl benzyl phthalate	83.3	167	333	ug/Kg
Caprolactam	83.3	167	333	ug/Kg
Carbazole	83.3	167	333	ug/Kg
Chrysene	83.3	167	333	ug/Kg
Dibenz (a,h) anthracene	83.3	167	333	ug/Kg
Dibenzofuran	83.3	167	333	ug/Kg
Diethyl phthalate	83.3	167	333	ug/Kg
Dimethylphthalate	83.3	167	333	ug/Kg
Di-n-butyl phthalate	83.3	167	333	ug/Kg
Di-n-octyl phthalate	83.3	167	333	ug/Kg
Fluoranthene	83.3	167	333	ug/Kg
Fluorene	83.3	167	333	ug/Kg
Hexachlorobenzene	83.3	167	333	ug/Kg
Hexachlorobutadiene	83.3	167	333	ug/Kg
Hexachlorocyclopentadiene	83.3	167	333	ug/Kg
Hexachloroethane	83.3	167	333	ug/Kg
Indeno (1,2,3-cd) pyrene	83.3	167	333	ug/Kg
Isophorone	83.3	167	333	ug/Kg
Naphthalene	83.3	167	333	ug/Kg
Nitrobenzene	83.3	167	333	ug/Kg
N-Nitrosodi-n-propylamine	83.3	167	333	ug/Kg
N-Nitrosodiphenylamine	83.3	167	333	ug/Kg
Pentachlorophenol	333	667	1330	ug/Kg
Phenanthrene	83.3	167	333	ug/Kg
Phenol	83.3	167	333	ug/Kg
Pyrene	83.3	167	333	ug/Kg
Analyte Low PAH (Water)	**DL**	**LOD**	**MRL/LOQ**	**Units**
1-Methylnaphthalene	0.0500	0.100	0.200	ug/L
2-Methylnaphthalene	0.0500	0.100	0.200	ug/L
Acenaphthene	0.0500	0.100	0.200	ug/L
Acenaphthylene	0.0500	0.100	0.200	ug/L
Anthracene	0.0500	0.100	0.200	ug/L
Benzo (a) anthracene	0.0500	0.100	0.200	ug/L
Benzo (a) pyrene	0.0500	0.100	0.200	ug/L
Benzo (b) fluoranthene	0.0500	0.100	0.200	ug/L
Benzo (g,h,i) perylene	0.0500	0.100	0.200	ug/L
Benzo (k) fluoranthene	0.0500	0.100	0.200	ug/L
Chrysene	0.0500	0.100	0.200	ug/L
Dibenz (a,h) anthracene	0.0500	0.100	0.200	ug/L
Fluoranthene	0.0500	0.100	0.200	ug/L
Fluorene	0.0500	0.100	0.200	ug/L
Indeno (1,2,3-cd) pyrene	0.0500	0.100	0.200	ug/L
Naphthalene	0.0500	0.100	0.200	ug/L
Phenanthrene	0.0500	0.100	0.200	ug/L
Pyrene	0.0500	0.100	0.200	ug/L
Analyte Low PAH (Soil)	**DL**	**LOD**	**MRL/LOQ**	**Units**
1-Methylnaphthalene	1.67	3.33	6.67	ug/Kg

Table 1 (Continued)

Analyte Low PAH (Soil)	DL	LOD	MRL/LOQ	Units
2-Methylnaphthalene	1.67	3.33	6.67	ug/Kg
Acenaphthene	1.67	3.33	6.67	ug/Kg
Acenaphthylene	1.67	3.33	6.67	ug/Kg
Anthracene	1.67	3.33	6.67	ug/Kg
Benzo (a) anthracene	1.67	3.33	6.67	ug/Kg
Benzo (a) pyrene	1.67	3.33	6.67	ug/Kg
Benzo (b) fluoranthene	1.67	3.33	6.67	ug/Kg
Benzo (g,h,i) perylene	1.67	3.33	6.67	ug/Kg
Benzo (k) fluoranthene	1.67	3.33	6.67	ug/Kg
Chrysene	1.67	3.33	6.67	ug/Kg
Dibenz (a,h) anthracene	1.67	3.33	6.67	ug/Kg
Fluoranthene	1.67	3.33	6.67	ug/Kg
Fluorene	1.67	3.33	6.67	ug/Kg
Indeno (1,2,3-cd) pyrene	1.67	3.33	6.67	ug/Kg
Naphthalene	1.67	3.33	6.67	ug/Kg
Phenanthrene	1.67	3.33	6.67	ug/Kg
Pyrene	1.67	3.33	6.67	ug/Kg
Analyte (TCLP)	**DL**	**LOD**	**MRL/LOQ**	**Units**
1,4-Dichlorobenzene	0.00125	0.00250	0.00500	mg/L
2,4,5-Trichlorophenol	0.00125	0.00250	0.00500	mg/L
2,4,6-Trichlorophenol	0.00125	0.00250	0.00500	mg/L
2,4-Dinitrotoluene	0.00125	0.00250	0.00500	mg/L
2-Methylphenol	0.00125	0.00250	0.00500	mg/L
3-Methylphenol	0.00125	0.00250	0.00500	mg/L
4-Methylphenol	0.00125	0.00250	0.00500	mg/L
Hexachlorobenzene	0.00125	0.00250	0.00500	mg/L
Hexachlorobutadiene	0.00125	0.00250	0.00500	mg/L
Hexachloroethane	0.00125	0.00250	0.00500	mg/L
Nitrobenzene	0.00125	0.00250	0.00500	mg/L
Pentachlorophenol	0.0050	0.0100	0.0200	mg/L
Pyridine	0.00125	0.00250	0.00500	mg/L

Table 2. Organic Analysis by Gas Chromatography/Mass Spectrometry (Methods 625/8270)					
QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Demonstrate acceptable analytical capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, test method, or sample matrix.	QC acceptance criteria published by DoD, if available; otherwise, method-specific criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see Section C.1.f of DoD QSM 4.1).	NA.	This is a demonstration of analytical ability to generate acceptable precision and bias per the procedure in Appendix C of DoD QSM 4.1. No analysis shall be allowed by analyst until successful demonstration of capability is complete.
MDL determination	Initial method demonstration required for some states – not required for DoD	Refer to SOP QS09.			
LOD determination and verification	Prior to initial analysis then quarterly verification.	See Box D-13 of DoD QSM 4.1			
LOQ establishment and verification	Prior to initial analysis then quarterly verification.	See Box D-14 of DoD QSM 4.1			
Tuning	Prior to ICAL and at the beginning of each 12-hour period.	Refer to table 8 of this SOP.	Retune instrument and verify. Rerun affected samples.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be accepted without a valid tune.
Breakdown check (DDT Method 8270 only)	At the beginning of each 12-hour period, prior to analysis of samples.	Degradation ≤ 20% for DDT. Benzidine and pentachlorophenol should be present at their normal responses, and should not exceed a tailing factor of 2. [Method 625 – benzidine and pentachlorophenol tailing limits are 3 and 5, respectively, when benzidine or acids are target analytes. Benzidine tailing is specific to benzidine analysis and pentachlorophenol tailing is specific to acid analyte analyses according to 625.]	Correct problem then repeat breakdown checks.	Flagging criteria are not appropriate.	No samples shall be run until degradation ≤ 20%. **Not applied when low concentration PAHs are the only target analytes.**

Table 2. Organic Analysis by Gas Chromatography/Mass Spectrometry (Methods 625/8270) (continued)					
QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Minimum five-point initial calibration (ICAL) for all analytes	ICAL prior to sample analysis.	**1.** Average response factor (RF) for SPCCs: SVOCs ≥ 0.050 [2,4-dinitrophenol, hexachlorocyclopentadiene, N-Nitrosodi-n-propylamine, 4-nitrophenol] Note 1: See table 4 of 8270D SPCC analytes and limits. Note 2: ≥ 0.050 for all low-level PAHs **2.** RSD for RFs for CCCs: SVOCs ≤ 30% and one option below: **Option 1:** RSD for each analyte ≤ 15%; [≤ 20% for non-DoD 8270D; or, ≤35% for non-DoD 625] **Option 2:** linear least squares regression r ≥ 0.995 or $r^2 \geq 0.990$; [r ≥ 0.990 for non-DoD analyses] **Option 3:** non-linear regression–coefficient of determination (COD) $r^2 \geq 0.990$ (6 points shall be used for second order, 7 points shall be used for third order).	Correct problem then repeat ICAL.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed. Calibration may not be forced through the origin for DoD projects.
Second source calibration verification (ICV)	Once after each ICAL.	All project analytes within ± 20% of true value [± 25% for non-DoD 8270C; or, ± 30% for non-DoD 8270D]	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL.	Flagging criteria are not appropriate.	Problem must be corrected. No samples should be run until calibration has been verified.
Retention time window position establishment for each analyte and surrogate	Once per ICAL.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the sequence CCV is used.	NA.	NA.	

Table 2. Organic Analysis by Gas Chromatography/Mass Spectrometry (Methods 625/8270) (continued)					
QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Evaluation of relative retention times (RRT)	With each sample.	RRT of each target analyte within ± 0.06 RRT units. Note - retention times may be updated based on the CCV to account for minor performance fluctuations or after routine system maintenance (such as column clipping).	Correct problem, then rerun ICAL.	Flagging criteria are not appropriate.	With each sample, the RRT shall be compared with the most recently updated RRT. If the RRT has changed by more than ±0.06 RRT units since the last update, this indicates a significant change in system performance and the laboratory must take appropriate corrective actions as required by the method and rerun the ICAL to reestablish the retention times.
Continuing calibration verification (CCV)	Daily before sample analysis and every 12 hours of analysis time.	**1.** Average RF for SPCCs: SVOCs ≥ 0.050 [2,4-dinitrophenol, hexachlorocyclopentadiene, N-Nitrosodi-n-propylamine, 4-nitrophenol] Note 1: See table 4 of 8270D SPCC analytes and limits. Note 2: ≥ 0.050 for all low-level PAHs **2.** %Difference/Drift for all target compounds and surrogates: SVOCs ≤ 20%D (Note: D = difference when using RFs or drift when using least squares regression or non-linear calibration). [± 20% for CCCs only non-DoD 8270C]	DoD project level approval must be obtained for each of the failed analytes or corrective action must be taken. Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since last acceptable CCV.	If reanalysis cannot be performed, data should be qualified and explained in the case narrative. Apply qualifier to all results for the specific analyte(s) in all samples since last acceptable CCV. [For non-DoD 8270C, if CCCs exceed, evaluate all analytes for 20%D and qualify as above]	Problem should be corrected. Results should not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed, holding time has been exceeded or client has approved reporting.
Internal standards verification	Every field sample, standard, and QC sample.	Retention time ± 30 seconds from retention time of the midpoint standard in the ICAL or daily CCV; EICP area within -50% to +100% of ICAL midpoint standard or daily CCV.	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory.	If corrective action fails in field samples, apply qualifier to analytes associated with the non-compliant IS. Flagging criteria are not appropriate for failed standards.	Sample results are not acceptable without a valid IS verification.

Table 2. Organic Analysis by Gas Chromatography/Mass Spectrometry (Methods 625/8270) (continued)					
QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Method blank	One per preparatory batch.	No analytes detected > ½ RL/LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL/LOQ.	Correct problem. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
LCS containing all analytes to be reported, including surrogates	One per preparatory batch.	QC acceptance criteria specified by client or DoD (appendix G), if available. AFCEE 4.0.02 limits are applied for low concentration PAHs as they are not addressed by DoD. Otherwise, use in-house control limits. In-house control limits may not be greater than ± 3 times the standard deviation of the mean LCS recovery. Low concentration PAH limits	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Matrix Spike (MS)	One per preparatory batch per matrix	Use LCS criteria, above.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply qualifier if acceptance criteria are not met.	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.
Matrix spike duplicate (MSD) or sample duplicate	One per preparatory batch per matrix	MSD: For matrix evaluation, use LCS acceptance criteria above. MSD or sample duplicate: RPD ≤ 30% or client specified limit (between MS and MSD or sample and sample duplicate).	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply qualifier if acceptance criteria are not met.	The data shall be evaluated to determine the source of difference.

Table 2. Organic Analysis by Gas Chromatography/Mass Spectrometry (Methods 625/8270) (continued)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Surrogate spike	All field and QC samples.	**Surrogate** / **Water** / **Solid** Nitrobenzene-d5: 40-110 / 35-100 2-Fluorobiphenyl: 50-110 / 45-105 Terphenyl-d14: 50-135 / 30-125 Phenol-d6: 10-115 / 40-100 2-Fluorophenol: 20-110 / 35-105 2,4,6-Tribromophenol: 40-125 / 35-125 QC acceptance criteria specified by DoD (above) or Client. Low PAH surrogate limits are 14%-129% soil and 34%-167% water. Otherwise, in-house control limits may be used. No limits specified for Method 625.	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.	Apply qualifier to all associated analytes if acceptance criteria are not met. For acid surrogate, qualify acid analytes, for base/neutral surrogates, qualify base/neutral analytes.	
Results reported between DL and LOQ	NA.	NA.	NA.	Apply J-flag to all results between DL and LOQ.	

Table 3, Technical Completeness / Accuracy Checklist

1. Were all the QC check elements analyzed – refer to Table 2 of the SOP
2. Were the QC criteria met
3. In cases of failures, was there an NCR written
4. Were all manual integrations signed
5. Were dilution factors applied correctly
6. Was there supervisory or senior-scientist approval for manual integrations on standards and batch QC samples
7. Was the data uploaded into LIMS via direct upload (i.e. datatool) – if yes, then was a cross check subset of the uploaded values performed
8. If the data was entered into LIMS manually, was a check of all entered values performed
9. Was the red marked data in LIMS checked for accuracy and the corresponding hard copy data documented appropriately
10. Were proper data qualifiers applied to the data in LIMS
11. Was the hard copy package checked for completeness to include all data for the sequence such that the data reviewer could reconstruct sample analyses and validate / approve the data

Table 4, Data Reviewers Checklist (Prior to approving data)

1. Does the hard copy raw data (or electronic raw data) package look complete and include all data points
2. Were QA objectives met and for failures were the appropriate actions taken
3. For direct uploads to LIMS, did a subset cross check match the raw data
4. Did all the manual entries into LIMS match the raw data
5. Were there appropriate signatures and documentation on the raw data
6. Were appropriate LIMS flags used
7. Were manual integrations signed
8. Were manual integrations for calibration and QC samples approved by supervisor
9. Were manual calculations verified

ANALYST DATA REVIEW CHECKLIST

Sample Number(s):
Batch Number(s):
Method: 8260B/624/8270C/8270D/625 (Circle One)

QA/QC Item	Yes	No	NA	Second Level Review
1. Is the BFB/DFTPP tune performed every 12 hours and is the tuning criteria met?				
Are the RRFs and % RSDs within QC limits for appropriate analytes for the initial calibration? Check the retention times for compounds with the same spectra. Check compounds with different conc.(e.g. m/p-xylene, ketones, etc.).				
3. Was the initial calibration curve verified by a second source calibration standard (ICV) and have criteria been met?				
4. Does the Continuing Calibration Standard (CCV) meet the criteria for the CCCs, SPCCs and/or 20%D for all analytes.				
5. Is the Method Blank run at the desired frequency and is its concentration for target analytes less than the MDLs?				
6. Are the LCS, MS, MSD within control limits and run at the desired frequency?				
7. Are all sample holding times met, analytes within calibration range, IS areas and surrogate recoveries within QC limits?				
8. Were the Method Blank, LCS, MS, MSD and samples uploaded to the LIMS and verified (at least one calculation per batch uploaded)?				

Comments on any "No" response:

_____

_____

_____

_____

Primary-Level Review: _____ Date: _____

Second-Level Review: _____ Date: _____

Table 5 - 625 QC limits

COMPOUND	SPIKE ADDED (ug/L)	SAMPLE CONCENTRATION (ug/L)	LCS CONCENTRATION (ug/L)	LCS % REC #	QC. LIMITS REC.
Acenaphthene	100.00	0.0000	100.00	100	47-145
Acenaphthylene	100.00	0.0000	100.00	100	33-145
Anthracene	100.00	0.0000	100.00	100	27-133
Benzidine	100.00	0.0000	100.00	100	D-110
Benzo(a)anthracene	100.00	0.0000	100.00	100	33-143
Benzo(b)fluoranthene	100.00	0.0000	100.00	100	24-159
Benzo(k)fluoranthene	100.00	0.0000	100.00	100	11-162
Benzo(g,h,i)perylene	100.00	0.0000	100.00	100	D-219
Benzo(a)pyrene	100.00	0.0000	100.00	100	17-163
bis(2-Chloroethoxy)meth	100.00	0.0000	100.00	100	33-184
bis(2-Chloroethyl)ether	100.00	0.0000	100.00	100	12-158
bis(2-Chloroisopropyl)e	100.00	0.0000	100.00	100	36-166
Bis(2-ethylhexyl)phthal	100.00	0.0000	100.00	100	8-158
4-Bromophenyl-phenyleth	100.00	0.0000	100.00	100	53-127
Butylbenzylphthalate	100.00	0.0000	100.00	100	D-152
4-Chloro-3-methylphenol	100.00	0.0000	100.00	100	22-147
2-Chloronaphthalene	100.00	0.0000	100.00	100	60-118
2-Chlorophenol	100.00	0.0000	100.00	100	23-134
4-Chlorophenyl-phenylet	100.00	0.0000	100.00	100	25-158
Chrysene	100.00	0.0000	100.00	100	17-168
Dibenz(a,h)anthracene	100.00	0.0000	100.00	100	D-227
1,2-Dichlorobenzene	100.00	0.0000	100.00	100	32-129
1,3-Dichlorobenzene	100.00	0.0000	100.00	100	D-172
1,4-Dichlorobenzene	100.00	0.0000	100.00	100	20-124
3,3'-Dichlorobenzidine	100.00	0.0000	100.00	100	D-262
2,4-Dichlorophenol	100.00	0.0000	100.00	100	39-135
Diethylphthalate	100.00	0.0000	100.00	100	D-114
2,4-Dimethylphenol	100.00	0.0000	100.00	100	32-119
Dimethylphthalate	100.00	0.0000	100.00	100	D-112
Di-n-butylphthalate	100.00	0.0000	100.00	100	1-118
4,6-Dinitro-2-methylphe	100.00	0.0000	100.00	100	D-181
2,4-Dinitrophenol	100.00	0.0000	100.00	100	D-191
2,4-Dinitrotoluene	100.00	0.0000	100.00	100	39-139
2,6-Dinitrotoluene	100.00	0.0000	100.00	100	50-158
Di-n-octylphthalate	100.00	0.0000	100.00	100	4-146
Fluoranthene	100.00	0.0000	100.00	100	26-137
Fluorene	100.00	0.0000	100.00	100	59-121
Hexachlorobenzene	100.00	0.0000	100.00	100	D-152
Hexachlorobutadiene	100.00	0.0000	100.00	100	24-116
Hexachlorocyclopentadie	100.00	0.0000	100.00	100	15- 70
Hexachloroethane	100.00	0.0000	100.00	100	40-113
Indeno(1,2,3-cd)pyrene	100.00	0.0000	100.00	100	D-171
Isophorone	100.00	0.0000	100.00	100	21-196
Naphthalene	100.00	0.0000	100.00	100	21-133
Nitrobenzene	100.00	0.0000	100.00	100	35-180
2-Nitrophenol	100.00	0.0000	100.00	100	29-182
4-Nitrophenol	100.00	0.0000	100.00	100	D-132
N-Nitroso-di-methylamin	100.00	0.0000	100.00	100	29- 66
N-Nitrosodiphenylamine	100.00	0.0000	100.00	100	23-100
N-Nitroso-di-n-propylam	100.00	0.0000	100.00	100	D-230
Pentachlorophenol	100.00	0.0000	100.00	100	14-176
Phenanthrene	100.00	0.0000	100.00	100	54-120
Phenol	100.00	0.0000	100.00	100	5-112
Pyrene	100.00	0.0000	100.00	100	52-115
1,2,4-Trichlorobenzene	100.00	0.0000	100.00	100	44-142
2,4,6-Trichlorophenol	100.00	0.0000	100.00	100	37-144

Table 6 - BNA STANDARDS USED

base/neutral mix (2000ppm)		**acids mix (2000ppm)**
bis(2-Chloroethyl)ether		2,4-Dinitrophenol
bis(2-Chloroisopropyl)ether		2-Methylphenol
1,3-Dichlorobenzene		4-Methylphenol
1,2-Dichlorobenzene		Benzoic acid
1,4-Dichlorobenzene		4,6-Dinitro-2-methylphenol
Hexachloroethane		4-Nitrophenol
N-Nitroso-di-methylamine		2,4,5-Trichlorophenol
N-Nitroso-di-n-propylamine		2,4,6-Trichlorophenol
2,4-Dinitrotoluene		Phenol
2,6-Dinitrotoluene		Pentachlorophenol
Fluorene		2-Nitrophenol
Dimethylphthalate		4-Chloro-3-methylphenol
Hexachlorocyclopentadiene		2,4-Dichlorophenol
Anthracene		2,4-Dimethylphenol
4-Bromophenyl-phenylether		Benzoic acid
Di-n-butylphthalate		
bis(2-Chloroethoxy)methane		
1,2-Diphenylhydrazine		**semivoa misc. mix(2000ppm)**
Fluoranthene		Aniline
Hexachlorobenzene		Benzyl alcohol
N-Nitrosodiphenylamine		Carbazole
Phenanthrene		4-Chloroaniline
Hexachlorobutadiene		Dibenzofuran
Isophorone		2-Methylnaphthalene
Naphthalene		2-Nitroaniline
Nitrobenzene		3-Nitroaniline
1,2,4-Trichlorobenzene		4-Nitroaniline
Acenaphthene		Pyridine
Acenaphthylene		
2-Chloronaphthalene		
4-Chlorophenyl-phenylether		**Benzidine mix (2000ppm)**
Diethylphthalate		Benzidine
Benzo(a)anthracene		3,3'-Dichlorobenzidine
Bis(2-ethylhexyl)phthalate		
Butylbenzylphthalate		
Chrysene		**Individual or misc. mixes (2000/5000/20,000ppm)**
p-(Dimethylamino)azobenzene		Caprolactam
Pyrene		Benzaldehyde
Benzo(b)fluoranthene		Atrazine
Benzo(k)fluoranthene		1,1'-Biphenyl
Benzo(g,h,i)perylene		1,4-Dioxane
Benzo(a)pyrene		1-methylnapthalene
Dibenz(a,h)anthracene		2,6-dichlorophenol
Di-n-octylphthalate		2,3,4,6-tetrachlorophenol
Indeno(1,2,3-cd)pyrene		

BNA internals (2000ppm)		Acid surrogate (7500ppm)
1,4-Dichlorobenzene-d4 (I.S)(1)		2-Fluorophenol (S)
Naphthalene-d8 (I.S)(35)		Phenol-d6 (S)
Acenaphthene-d10 (I.S) (59)		2,4,6-Tribromophenol (S)
Phenanthrene-d10 (I.S) (79)		2,-Chlorophenol-d4 (S)
Chrysene-d12 (I.S) (92))		BN surrogate (5000ppm)
Perylene-d12 (I.S) (101)		Nitrobenzene-d5 (S)
		Terphenyl-d14 (S)
		2-Fluorobiphenyl (S)
		1,2-Dichlorobenzene-d4 (S)

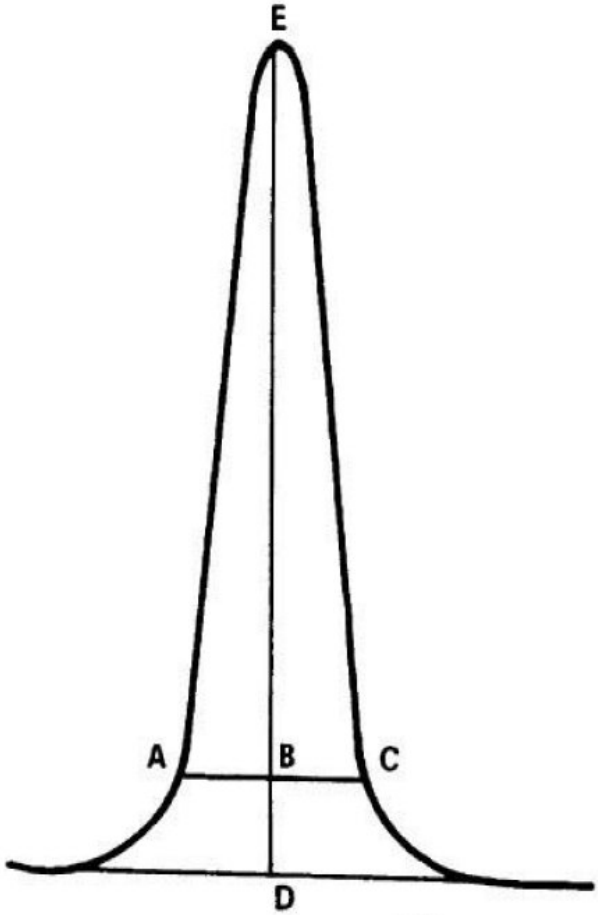
Table 7 INTERNAL STANDARD ASSOCIATION / QUANT MASS – Standard SVOC analysis					
COMPOUND	***I.S**	**Q.M**	**COMPOUND**	***I.S**	**Q.M**
1,4-Dichlorobenzene-d4 **(I.S)(1)**		152	Dimethylphthalate	59	163
Acetophenone	1	105	Hexachlorocyclopentadiene	59	237
Aniline	1	93	2,4-Dinitrophenol	59	184
Benzaldehyde	1	106	2,4-Dinitrotoluene	59	165
Benzyl alcohol	1	108	2,6-Dinitrotoluene	59	165
bis(2-Chloroethyl)ether	1	93	Fluorene	59	166
bis(2-Chloroisopropyl)ether	1	45	2-Nitroaniline	59	65
1,3-Dichlorobenzene	1	146	3-Nitroaniline	59	138
1,2-Dichlorobenzene	1	146	4-Nitroaniline	59	138
1,4-Dichlorobenzene	1	146	4-Nitrophenol	59	65
2-Methylphenol	1	108	2,4,5-Trichlorophenol	59	196
4-Methylphenol	1	108	2,4,6-Trichlorophenol	59	196
3-Methylphenol	1	108	2-Fluorobiphenyl (S)	59	172
Phenol	1	94	Phenanthrene-d10 **(I.S) (79)**		188
Pyridine	1	79	Anthracene	79	178
Hexachloroethane	1	117	Atrazine	79	200
N-Nitroso-di-methylamine	1	42	4-Bromophenyl-phenylether	79	248
N-Nitroso-di-n-propylamine	1	70	Carbazole	79	167
2-Fluorophenol (S)	1	112	Di-n-butylphthalate	79	149
Phenol-d6 (S)	1	99	4,6-Dinitro-2-methylphenol	79	198
Naphthalene-d8 **(I.S)(35)**		136	1,2-Diphenylhydrazine	79	77
Benzoic acid	35	105	Fluoranthene	79	202
bis(2-Chloroethoxy)methane	35	93	Hexachlorobenzene	79	284
Caprolactam	35	113	N-Nitrosodiphenylamine	79	169
4-Chloroaniline	35	127	Pentachlorophenol	79	266
4-Chloro-3-methylphenol	35	107	Phenanthrene	79	178
2,4-Dichlorophenol	35	162	2,4,6-Tribromophenol (S)	79	330
2,4-Dimethylphenol	35	107	Chrysene-d12 **(I.S) (92)**		240
Hexachlorobutadiene	35	225	Benzidine	92	184
Isophorone	35	82	Benzo(a)anthracene	92	228
2-Methylnaphthalene	35	141	Bis(2-ethylhexyl)phthalate	92	149
Naphthalene	35	128	Butylbenzylphthalate	92	149
Nitrobenzene	35	77	Chrysene	92	228
2-Nitrophenol	35	139	3,3'-Dichlorobenzidine	92	252
1,2,4-Trichlorobenzene	35	180	p-(Dimethylamino)azobenzene	92	225
Catechol	35	110	Pyrene	92	202
Nitrobenzene-d5 (S)	35	82	Terphenyl-d14 (S)	92	244
Acenaphthene-d10 **(I.S) (59)**		164	Perylene-d12 **(I.S) (101)**		264
Acenaphthene	59	153	Benzo(b)fluoranthene	101	252
Acenaphthylene	59	152	Benzo(k)fluoranthene	101	252
1,1'-Biphenyl	59	154	Benzo(g,h,i)perylene	101	276
2-Chloronaphthalene	59	162	Benzo(a)pyrene	101	252
4-Chlorophenyl-phenylether	59	204	Dibenz(a,h)anthracene	101	278
Dibenzofuran	59	168	Di-n-octylphthalate	101	149
Diethylphthalate	59	149	Indeno(1,2,3-cd)pyrene	101	276
I.S=internal standard, Q.M=quant mass, S=surrogate					

Table 7 INTERNAL STANDARD ASSOCIATION / QUANT MASS – Standard SVOC analysis (contd)					
COMPOUND	***I.S**	**Q.M**	**COMPOUND**	***I.S**	**Q.M**
1,4-Dichlorobenzene-d4 **(I.S)(1)**		152	Diphenylamine	59	169
Pentachloroethane	1	167	Thionazin	59	107
2-Picoline	1	93		59	
N-Nitrosomethylethylamine	1	88		59	
Methyl methanesulfonate	1	80		59	
N-Nitrosodiethylamine	1	102		59	
Ethyl methanesulfonate	1	79		59	
N-Nitrosopyrrolodine	1	100		59	
N-Nitrosomorpholine	1	56		59	
0-Toluidine	1	106		59	
	1		Phenanthrene-d10 **(I.S) (79)**		188
	1		4-Nitroquinoline-1-oxide	79	190
	1		Phenacetin	79	108
	1		4-Aminobiphenyl	79	169
	1		Pentachloronitrobenzene	79	237
	1		Sulfotepp	79	97
	1		Phorate	79	75
Naphthalene-d8 **(I.S)(35)**		136	Diallate	79	86
1- Methylnaphthalene	35	141	Dimethoate	79	87
N-Nitrosopiperidine	35	114	Pronamide	79	173
a,a-Dimethylphenethylamine	35	58	Disulfoton	79	88
O,O,O-Triethylphosphorothioate	35	97	Dinoseb	79	211
Hexachloropropene	35	213		79	
2,6-Dichlorophenol	35	162		79	
p-Phenylenediamine	35	108	Chrysene-d12 **(I.S) (92)**		240
N-Nitrosodi-n-butylamine	35	84	Methapyrilene	92	97
Safrole	35	162	p-(Dimethylamino)azobenzene	92	225
1,2,4,5-Tetrachlorobenzene	35	216	Chlorobenzilate	92	251
	35		3,3'- Dimethylbenzidine	92	212
	35		2- Acetylaminofluorene	92	181
	35		7,12-Dimethylbenz[a]anthracene	92	256
	35		Aramite	92	185
	35		Methyl parathion	92	109
	35		Parathion	92	109
Acenaphthene-d10 **(I.S) (59)**		164	Isodrin	92	193
Isosafrole	59	162	Kepone	92	272
1,4-Naphthoquinone	59	158	Famphur	92	218
Pentachlorobenzene	59	250	Perylene-d12 **(I.S) (101)**	101	
2-Naphthylamine	59	143	3-Methylcholanthrene	101	268
1-Naphthylamine	59	143	Hexachlorophene	101	196
2,3,4,6-Tetrachlorophenol	59	232		101	
5-Nitro-o-toluidine	59	152		101	
I.S=internal standard, Q.M=quant mass, S=surrogate					

Table 8: LOW CONCENTRATION PAH INTERNAL STANDARD/SURROGATE SPECIFICATIONS

INTERNAL STD ASSOCIATION
Phenanthrene-d10 (IS)
Naphthalene
2-Methylnaphthalene
1-Methylnaphthalene
2-Fluorobiphenyl(SUR)
Acenaphthylene
Acenaphthene
Fluorene
Phenanthrene
Anthracene
Fluoranthene
Pyrene
Perylene-d12 (IS)
Terphenyl-d14(SUR)
Benzo(a)anthracene
Chrysene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Indeno(1,2,3-cd)pyrene
Dibenz(a,h)anthracene
Benzo(g,h,i)perylene

FIGURE 1
TAILING FACTOR CALCULATION



$$\text{TAILING FACTOR} = \frac{BC}{AB}$$

Example calculation: Peak Height = DE = 100 mm
10% Peak Height = BD = 10 mm
Peak Width at 10% Peak Height = AC = 23 mm
AB = 11 mm
BC = 12 mm

Therefore: Tailing Factor $= \frac{12}{11} = 1.1$

Table 9, DFTPP Tuning Criteria

Mass	Ion Abundance Criteria
51	30-60% of mass 198
68	<2% of mass 69
70	<2% of mass 69
127	40-60% of mass 198
197	<1% of mass 198
198	Base peak, 100% relative
199	5-9% of mass 198
275	10-30% of mass 198
365	>1% of mass 198
441	Present, but less than mass 443
442	>40% of mass 198
443	17-23% of mass 442

Note: While 8270D table 3 indicates different criteria, section 11.3.1.2 allows the use of alternate criteria.

EMPIRICAL LABORATORIES, LLC
STANDARD OPERATING PROCEDURE

ORGANICS: SOP100 REVISION #: 20 EFFECTIVE DATE: 042710

METALS DIGESTION/PREPARATION

References:
Methods 3005A/USEPA CLPILM0 4.1 Aqueous, 3010A, 3030C, 3050B
USEPA CLPILM0 4.1 (Soil/Sediment), 200.7, Standard Methods 3030C
See Addendum for USEPA CLPILM 05.2 (Aqueous & Soil/Sediment)

APPROVALS:

Lab Director: _____ Date: 4/28/10

Data Quality Manager: _____ Date: 4/28/10

Section Supervisor: _____ Date: 4/28/10

Changes Summary

Revision 20, 4/27/10

- The SOP is an update from Revision 19 dated 04/20/09.
- References to oil sample preparation have been removed.
- Extraction volumes for TCLP have been updated.

METALS DIGESTION/PREPARATION

References:
Methods 3005A/USEPA CLPILM0 4.1 Aqueous, 3010A, 3030C, 3050B
USEPA CLPILM0 4.1 (Soil/Sediment), 200.7, Standard Methods 3030C
See Addendum for USEPA CLPILM 05.2 (Aqueous & Soil/Sediment)

I. SCOPE AND APPLICATION

A. AQUEOUS

1. Method 3005A and USEPA CLP ILM0 4.1, "Acid Digestion of Waters for Total Recoverable or Dissolved Metals for Analysis by ICP Spectroscopy".
   a. This method is used to prepare surface water, ground water, drinking water and wastewater samples for analysis by inductively coupled argon plasma spectroscopy (ICP).
2. Method 200.7, "Determination of Metals and Trace Metals in Water and Wastes by Inductively Coupled Plasma-Atomic Emission Spectrometry"
   a. This method is used to prepare surface water, ground water, drinking water and wastewater samples for analysis by inductively coupled argon plasma spectroscopy (ICP).
3. Method 3010A, "Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by ICP Spectroscopy".
   a. This method is used to prepare aqueous samples, EP and mobility-procedure extracts, and wastes that contain suspended solids for analysis by ICP. The procedure is used to determine total metals.
4. Method 3030C (Standard methods), "Preliminary Treatment for Acid-Extractable Metals".
   a. This method is used to prepare ground water samples from North Carolina for analysis by ICP.

B. SOLIDS

1. Method 3050B, "Acid Digestion of Sediments, Sludges and Soils".
   a. This method is used to prepare sediments, sludges and soil samples for analysis by ICP. Since certain matrices may result in poor recovery, the method of standard additions may be used when analyzed.
   b. It should be noted that some metals could be biased high with the soil digestion when dilution is necessary. Take necessary measures to ensure that dilutions are made as accurately as possible.
2. USEPA CLP ILM0 4.1, “Acid Digestion of Soil/Sediment”
   a. This method is used to prepare sediments and soil samples for analysis by ICP. Since certain matrices may result in poor recovery, the method of standard additions may be used when analyzed.

D. **NOTES:**

1. "Total Metals" includes all metals, inorganically and organically bound and both dissolved and particulate.
2. "Dissolved metals" includes all metals present in a sample after filtration through a 0.45 micron filter followed by digestion.

II. SUMMARY OF METHODS

A. A representative sample of water or soil is put into an acid medium and exposed to heat for a certain amount of time. This allows for reduction of interferences by organic matter and converts metals bound to particulates to form the free metal that can be determined by ICP-Atomic Emission Spectrometry.

NOTE: When a reporting limit is required for a project lower than is customary, a four times concentration or alternate soil digestion ratio must be used in order to reach that lower level. Care must be taken to matrix match this concentrated aliquot. A blank and laboratory control sample (at a reduced concentration) are required with this concentration. A matrix spike (not at reduced concentration) and duplicate or matrix spike and matrix spike duplicate is needed per 20 samples or per batch.

III. SAMPLE HANDLING AND PRESERVATION

A. AQUEOUS
   1. Samples are taken in high density polyethylene, one liter bottles. Samples should be preserved with concentrated HNO_3 to a pH <2 immediately once sampled. If dissolved metals are to be analyzed the sample should be filtered before the HNO_3 is added. The samples should be maintained at 4°C until analysis. The holding time for metals samples is 180 days or approximately 6 months.

B. SOLIDS
   1. Samples are taken in high density polyethylene(CLP only) or glass bottles. The samples should be maintained at 4°C until analysis. The holding time for metals samples is 180 days or approximately 6 months.

IV. INTERFERENCES

A. AQUEOUS
   1. Solvents, reagents, glassware, and other sample processing hardware may yield artifacts and/or interferences to sample analysis. All these materials must be demonstrated to be free from interferences under the conditions of the analysis by analyzing method blanks.

B. SOLIDS
   1. Sludge samples can contain diverse matrix types, each of which may present its own analytical challenge. Spiked samples and any relevant standard reference material should be processed to aid in determining whether this method is applicable to a given waste.

V. SAFETY

A. Normal accepted laboratory safety practices should be followed while performing this analysis.
B. Be certain the exhaust hood is functioning before you begin the digestion procedure.
C. Hot acids can be extremely corrosive. Avoid inhalation or contact with skin.

VI. EQUIPMENT/APPARATUS

A. Fume hood, Labconco or equivalent.
B. Hot plate, Thermolyne cimarec-3 or equivalent source for use at 95°C. The temperature of the hot plate must be monitored via the use of a temperature blank.
C. Thermometer capable of reading 80 to 120 degrees C – ERTCO cat# 611-3-SC or equivalent.

D. Vacuum pump for filtering dissolved metals- Gast or equivalent.
E. Analytical balance capable of weighing to 0.01 gram. Mettler model BB300 or equivalent.
F. Beckman CS-6R centrifuge.
G. Various class A volumetric glassware and ribbed watchglasses, Pyrex or equivalent.
H. Whatman No. 41 filter paper or equivalent.
I. Whatman No. 42 filter paper or equivalent.
J. Whatman 0.45 micron filter paper or equivalent.
K. 250 mL beaker or other appropriate vessel such as polypropylene block digester tubes, watch glasses and caps.
L. Stirring device, e.g. magnetic stirrer, glass rod or equivalent.
M. Manual Sample Mill
N. Wiley Sample Mill
O. Clippers for cutting vegetation

NOTE: All glassware should be acid washed.

VII. REAGENTS AND STANDARD PREPARATION

A. REAGENTS

1. Metals grade Nitric acid (HNO_3). Reagent should be analyzed to determine level of impurities. If method blank is <MDL, then the reagent can be used.
2. Metals grade Hydrochloric acid (HCl). Reagent should be analyzed to determine level of impurities. If method blank is <MDL, then the reagent can be used.
3. 30% hydrogen peroxide reagent, ACS Grade. Reagent should be analyzed to determine level of impurities. If method blank is <MDL, then the reagent can be used.
4. Metals grade Sulfuric acid (H_2SO_4). Reagent should be analyzed to determine level of impurities. If method blank is <MDL, then the reagent can be used.
5. Reagent water (Deionized water).
6. Potassium Permanganate - Ultra pure grade. Reagent should be analyzed to determine level of impurities. If method blank is <MDL, then the reagent can be used.
7. Ammonium hydroxide, concentrated, reagent grade. Reagent should be analyzed to determine level of impurities. If method blank is <MDL, then the reagent can be used.
8. Ammonium phosphate, reagent grade- Reagent should be analyzed to determine level of impurities. If method blank is <MDL, then the reagent can be used.

B. STANDARDS

1. Traceability

a. A LIMS record shall be maintained on all reference materials. The record shall include date of receipt, source, purity, all compositional information, storage conditions and expiration date. These materials/solutions are to be identified by a unique number in the LIMS as well as on the container's label.

b. All working standards made from reference materials shall be labeled with a unique ID number with complete information on preparation date, concentration of each compound, solvent, preparer's name, expiration date and the information is recorded in LIMS. Reagents shall be labeled with date received and expiration date, if applicable. All of the information described above shall also be recorded in LIMS. Measurements made during standards preparation (e.g., from weighing operations, volume diluted to, etc.) shall also be recorded. There should be no container with sample, sample extract, standard solution, etc. that is not correctly labeled and properly stored.

c. The analyst must initial and date each entry made in a logbook. Each analyst must be sure to "Z" out and initial/date the unused area of each logbook page.

2. PREPARATION

A. Laboratory control sample

1. Aqueous

a. This solution is prepared as follows: 50 mL concentrated HCl, 20 mL concentrated HNO_3, 1 mL of CLP-CAL-1, Solution A, 1 mL of CLP-CAL-1 Solution B, 0.25 mL of CLP-CAL-2, and 0.25 mL of CLP-CAL-3 diluted to 1 L in a volumetric flask. Use 50 mL (100 mL for strict CLPIlM0 4.1) for digestion. This solution is given a unique identifier and recorded in sample digestion logbook/LIMS.

b. For four times concentrated samples: The solution is prepared as follows: 50 mL concentrated HCl, 20 mL concentrated HNO_3, 1mL CLPP-SPK-4 (Inorganic Ventures) (This solution contains 10 mg/L Selenium, 100 mg/L Antimony, 50 mg/L Cadmium and Thallium, 40 mg/L Arsenic and 20 mg/L Lead) to 1 L in a volumetric flask. This solution is given a unique identifier. Use 12.5 mLs to 50 mLs and prepare two aliquots. Heat at 90 to 95°C to reduce the volume in each vessel to ten mLs and then combine each 10 mL aliquot into one vessel and take to a final volume of 25 mLs. Take care to matrix match acids so that the final 25 mL portion will contain 2% HNO_3 and 5% HCl. Use 0.125 mLs HNO_3 and 0.3125 mLs HCl to each 50 mL vessel.

2. Solids:

a. 1.0 ±0.02 (or 2.0 ±0.02) gram aliquot of teflon chips is weighed and spiked using the same spiking solution used for matrix spikes. This sample is given a unique identifier according to the Lot# for the teflon chips used and when digested is given the descriptor. i.e. LCSS(date)A and then B etc. plus the unique identifier number assigned. Alternatively a solid matrix standard reference material is obtained from the manufacturer. This sample is given a unique identifier and the weight is recorded in a bound logbood and transfer to LIMS.

B. Spiking solution

1. Sample is spiked using 0.1 mL of CLP-CAL-1, Solution A, 0.1 mL of CLP-CAL-1 Solution B, 0.025 mL of CLP-CAL-2 and 0.025 mL of CLP-CAL-3 for a final volume of 100 mL. If only 50 mL is used, decrease amount used appropriately. These solutions are given unique identifiers. Record the amount spiked and the unique identifier of the standard.

2. CLP sample is spiked using 0.1 mL CLPP-SPK-1 and 0.1 mL CLPP-SPK-4 for a final volume of 100 mL. If only 50 mL is used, decrease amount used appropriately. These solutions are given unique identifiers.

3. For samples that require four times concentration, the sample is spiked using 0.0125 mLs of CLPP-SPK-4 to each of two vessels with 50 mLs of sample in each. The volume of each of the vessels is lowered to less then 10 mLs and combined and the final volume of this concentrated sample is 25mLs.

VIII. CALIBRATION

A. The temperature of the samples must be maintained at 95°C and monitored via a temperature blank. Record on LIMS batch sheet for later transfer into LIMS.

IX. PROCEDURE

A. Glassware preparation for digestion or when the hot-block can not be used:
   1. Wash glassware with hot soapy water and rinse thoroughly. (Beakers must be washed as soon as possible after being used, dirty beakers must not be allowed to sit overnight.)
   2. Rinse glassware with reagent water that contains 5% HNO_3 and 5% HCl followed by a rinse with reagent water.
   3. Prior to use, all glassware must be confirmed clean via a glassware check. Otherwise, repeat step "2" until the glassware check passes.

B. Aqueous sample filtration (for dissolved metals):
   1. Thoroughly clean a flask and funnel with hot soapy water. Next, rinse the flask and funnel with 1:5 HNO_3 followed by a thorough D.I. water rinsing. This step is very important because the filters contain some metals (namely Zn) which could contaminate the samples.
   2. Rinse a 0.45 micron filter with 1:5 HNO_3 thoroughly, followed by D.I. water.
   3. Filter the unpreserved sample. If dissolved Hg analysis is requested for the sample, filter at least 200 mL.
   4. Discard the first 50 to 100 mL.
   5. A preparation blank must be taken through the filtration step and analyzed with the sample.
   6. Preserve the sample with HNO_3 to pH<2.
   7. Soluble samples that are clean and clear do not have to be digested. Use 100 mL sample, add 5 mL of concentrated HCl and 2 mL of concentrated HNO_3. **Samples must be digested unless approval for analysis without digestion is received from the project manager.**

C. Aqueous sample preparation
   1. Method 3005A and USEPA CLP ILM0 4.1, "**Acid digestion procedure for total recoverable or dissolved metals for analysis by ICP ".**
      a. Shake sample thoroughly and pour 50 mL of the well-mixed sample into a digestion vessel. For samples which require concentration pour 50 mLs of the well-mixed sample into two digestion vessels.
      b. Add 0.50 mL (1 mL of (1+1) when strict CLP ILM0 4.1 is required) concentrated HNO_3 to the sample. For samples which require concentration, add 0.125 mL (0.25 mL of (1+1) when strict CLP ILM0 4.1 is required) concentrated HNO_3 to the sample.
      c. Add 2.5 mL (5 mL of 1+1) when strict CLP ILM0 4.1 is required) concentrated HCl to the sample. For samples which require concentration, add 0.3125 mL (0.625 mL of (1+1) when strict CLP ILM0 4.1 is required) concentrated HCl to the sample.
      d. Cover the sample with a ribbed watch glass or equivalent source.
      e. Transfer the digestion vessel to a pre-heated hot plate or hot block at 90 to 95°C. A temperature blank will assure correct temperature. The temperature must be recorded in the digestion log book. Take the volume down to between 5 to 10 mL, (

12 to 25 mLs when strict CLP ILM0 4.1 is required) **making certain that the sample does not boil**. **This is extremely important. Boiling may lead to vaporization of certain analytes.** Remove the sample from the hot plate and cool

f. When necessary, filter or centrifuge the sample to remove insoluble material that could clog the nebulizer. The filtering apparatus must be thoroughly cleaned with dilute nitric acid prior to filtration.
g. Bring sample to its predigestion volume (or when samples require concentration, to a volume four times lower then what was started with) with DI water in the digestion vessel. The final volume must be recorded in the digestion log book.
h. The sample is now ready for analysis.
i. The digestion log must contain the date, analyst, sample number, client, sample mass/volume, final volume of digestate, lot # of acids used and the preparation and ID of standards plus identification #'s for standards used for spiking and the volume spiked into the sample.

2 Method 200.7, "**Acid digestion procedure for total recoverable metals**".

a. Shake sample thoroughly and pour 50 mL of the well-mixed sample into the digestion vessel. If sample contains undissolved solids >1% refer to Section 11.3 of Method 200.7 for subsequent procedures.
b. Add 1.0 mL concentrated HNO_3 to the sample.
c. Add 2.50 mL concentrated HCl to the sample.
d. Cover the sample with a ribbed watch glass or equivalent source.
e. Transfer the digestion vessel to a pre-heated hot plate or equivalent source at 85°C. Take the volume down to between 10 to 15 mL, **making certain that the sample does not boil**. **This is extremely important. Boiling may lead to vaporization of certain analytes.**
f. Leave sample on hot plate and gently reflux for 30 minutes. Remove from hot plate and cool.
g. Bring sample to its predigestion volume with DI water in the digestion vessel.
h. When necessary, filter or centrifuge the sample to remove insoluble material that could clog the nebulizer. The filtering apparatus must be thoroughly cleaned with dilute nitric acid prior to filtration.
i. The sample is now ready for analysis.
j. The digestion log must contain the date, analyst, sample number, client, sample mass/volume, final volume of digestate, lot # of acids used and the preparation and ID of standards.

3. Method 3010A, "**Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by ICP Spectroscopy**".

a. Shake sample thoroughly and pour 50 mL (5ml diluted to 50mL for TCLP, full 50ml volume for SPLP) of the well-mixed sample into the digestion vessel.
b. Add 1.5 mL concentrated HNO_3 to the sample.
c. Cover the sample with a ribbed watch glass.
d. Transfer the digestion vessel to a pre-heated hot plate or hot block at 90 to 95°C. A temperature blank must be used, with the temperature being recorded in the log book. Take the volume down to a low volume (~5 mL), **making certain that the sample does not boil**. **This is extremely important. Boiling may lead to vaporization of certain analytes. Also make certain that no portion of the**

bottom of the digestion vessel is allowed to go dry. This may lead to low recoveries. Remove the sample from the hot plate and cool.

e. Add another 1.5 mL portion of concentrated HNO_3 to the sample.
f. Cover the sample with a ribbed watch glass.
g. Transfer the vessel to the hotblock or equivalent source. Increase the temperature so a gentle reflux occurs. Continue heating, adding additional acid as necessary, until the digestion is complete (generally indicated when the digestate is light in color or does not change in appearance with continued refluxing).
h. Uncover the vessel and evaporate to a low volume (~3 mL) **making certain that no portion of the bottom of the digestion vessel is allowed to go dry.** Remove and cool.
i. Add 2.5 ml of 1:1 HCl (10 mL/100 mL of final solution).
j. Cover the digestion vessel and reflux for an additional 15 minutes.
k. Bring sample to its predigestion volume in digestion vessel.
l. When necessary, filter or centrifuge the sample to remove insoluble material that could clog the nebulizer. The filtering apparatus must be thoroughly cleaned with dilute nitric acid prior to filtration.

   Note: When preparing DoD project samples, if any sample in a digestion batch requires filtration, all samples (including QC samples) must be treated in the same manner.

m. The sample is now ready for analysis.
n. The digestion log must contain the date, analyst, sample number, client, sample mass/volume, final volume of digestate, lot # of acids used and the preparation and ID of standards.

4 Method 3030C (Standard Methods), "**Preliminary treatment for Acid-Extractable Metals"**

a. Shake sample thoroughly and pour 50 mL of the well-mixed sample into a 50 mL digestion vessel.
b. Add 2.5 mL 1:1 HCl to the sample.
c. Heat 15 minutes in a hot bath.
d. Filter through a membrane filter.
e. Adjust filtrate volume to 50 mL with DI water.
f. Transfer to ICP analyst.

D. Solid sample preparation

It is extremely important that waste (when appropriate), soil and sediment samples be mixed thoroughly to ensure that the sample is as representative as possible of the sample media. The most common method of mixing is referred to as quartering. The quartering procedure should be performed as follows:

- *The material in the sample pan(inorganic-plastic/organic-aluminum) should be divided into quarters and each quarter should be mixed individually.*
- *Two quarters should then be mixed to form halves.*
- *The two halves should be mixed to form a homogenous matrix.*

This procedure should be repeated several times until the sample is adequately mixed.

NOTE: Samples that are clay type materials should be handled in a different manner. Due to these type sample matrices having an affinity to stick to most anything that touches it, another approach must be followed. Obtain a representative sub-sample aliquot from the center or middle section of the sample container.

Grinding of Vegetation Samples

Remove sample from shipping container and brush off dirt particles. Chop sample into about half inch pieces with clippers or other cutting tool. Place the sample in an aluminum pan and air-dry in an exhaust hood to the appropriate dryness for grinding. It should be dry enough where it won't stick to the inside of the mill. Grind the dried sample to fineness in either the manual sample mill or the Wiley mill or both if needed. Place the ground sample in a container and label immediately.

1. USEPA CLP ILM0 4.1, **"Acid digestion of Soil/Sediment"**
   a. Mix the sample thoroughly to achieve homogenity. For each digestion procedure, weigh (to the nearest 0.01 g) a 1.0 to 1.5 g portion of sample and transfer to a digestion vessel.
   b. Add 10 mL of 1:1 nitric acid (HNO_3), mix the slurry, and cover with a watch glass or equivalent source. Heat the sample to 92 to 95°C and reflux for 10 minutes without boiling. Allow the sample to cool, add 5.0 mL of concentrated HNO_3, replace with watch glass or equivalent source, as appropriate, and reflux for 30 minutes. Do not allow the volume to be reduced to less than 5 mL while maintaining a covering of solution over the bottom of the heating vessel.
   c. After the second reflux step has been completed and the sample has cooled, add 2 mL of Type II water and 3.0 mL of 30% hydrogen peroxide (H_2O_2). Return the heating vessel to the hot plate or equivalent heating source for warming to start the peroxide reaction. Care must be taken to ensure that losses do not occur due to excessively vigorous effervescence. Heat until effervescence subsides, and cool the heating vessel.
   d. Continue to add 30% H_2O_2 in 1 mL aliquots with warming until the effervescence is minimal or until the general sample appearance is unchanged. (NOTE: Do not add more than a total of 10 mL 30% H_2O_2.)
   e. If the sample is being prepared for ICP analysis of Al, As, Sb, Ba, Be, Ca, Cd, Cr, Co, Cu, Fe, Pb, Mg, Mn, Ni, K, Se, Ag, Na, Tl, V, and Zn, add 5 mL of 1:1 HCl and 10 mL of Type II water, return the covered heating vessel to the hot plate or equivelent heating source, and heat for an additional 10 minutes. After cooling, filter through Whatman No. 42 filter paper (or equivalent) and dilute to 50 mL with Type II water. NOTE: In place of filtering, the sample (after dilution and mixing) may be centrifuged or allowed to settle by gravity overnight to remove insoluble material. Dilute the digestate to 144 mL with DI water, add 5 mLs concentrated HCl and 1 mL of concentrated HNO_3, mix well and place into the appropriate container. The diluted sample has an approximate acid concentration of 2.5% (v/v) HCl and 5% (v/v) HNO_3. The sample is now ready for analysis.
   f. The digestion log must contain the date, analyst, sample number, client, sample mass/volume, final volume of digestate, lot # of acids used and the preparation and ID of standards and ID of matrix spikes and the amounts used for spiking.
2. Method 3050B, **"Acid digestion of Sediments, Sludges and Soils"**

a. Mix the sample thoroughly for 5 minutes using a plastic spatula or Teflon coated spatula in a glass or plastic weigh boat to achieve homogeneity.
b. Weigh approximately (to the nearest 0.01 g) a 1 to 1.5 g portion of the sample directly into a digestion vessel. For samples with low percent solids a larger sample size may be used as long as digestion is completed. Record the exact mass in the digestion log.

   NOTE: To achieve the lowest reporting limit possible, use a 2.0 g portion of sample with an ending volume of 100 mLs.
c. Add 5 mL D.I. water and 5 mL concentrated HNO_3(1:1), mix the slurry and cover with a watch glass. Place the sample in a preheated hot block and reflux at 95°C for 10 to 15 minutes being certain that the sample does not boil. Record temperature in digestion log book
d. Allow the sample to cool. Add 5 mL concentrated HNO_3, replace the watch glass and heat/reflux again for 30 minutes. If brown fumes are generated, indicating oxidation of the sample by HNO_3, repeat this step (addition of 5 mL of concentrated HNO_3) over and over until <u>no</u> brown fumes are given off by the sample indicating the complete reaction with HNO_3. Using a watch glass or equivalent allow the solution to evaporate to approximately 5 mL without boiling at 95°C $\pm$ 5°C for approximately two hours. Maintain a covering of solution over the bottom of the vessel at all times. Do not allow the volume to be reduced to less than 5 mL while maintaining a covering of solution over the bottom of the beaker. If the volume does get low, add 2.5 mL of D.I. water to bring volume back up.
e. Take the sample off the hot block and allow it to cool. Next, add 2 mL of D.I. water and 3 mL of 30% Hydrogen Peroxide. (The sample will bubble upon the addition of H_2O_2 if it is still warm.) Cover the vessel with a watch glass and return the sample to the hot block or equivalent source and heat until the bubbling subsides. Care must be taken to ensure that losses do not occur due to excessively vigorous effervescence. Heat until effervescence subsides and cool the beaker. Add two more 3 mL portions of H_2O_2 to the sample in the same manner as before. (NOTE: Do not add more than a total of 10 mL 30% H_2O_2.)
f. Cover the sample with a ribbed watch glass and continue heating the acid-peroxide digestate at 95°C $\pm$ 5°C without boiling for approximately two hours until the volume has been reduced to approximately 2.5 mL. Maintain covering of solution over the bottom of the vessel at all times.
g. Add 2.5 mL of DI water and 2.5 mL of concentrated HCl and 10 mL of DI water, cover the sample with a ribbed watch glass and continue refluxing for an additional 10 minutes without boiling
h. When necessary, filter or centrifuge the sample to remove insoluble material that could clog the nebulizer. The filtering apparatus must be thoroughly cleaned with dilute nitric acid prior to filtration.
i. Bring sample up to 50 mL with D.I. water in the vessel. Add 150 ml of DI water to a 250 ml sample bottle. Invert the 50 ml sample digestion vessel several times to mix the sample and pour sample into the 150 ml of the sample bottle. Pour some sample back into the 50 ml sample digestion vessel to rinse and pour back into the 250 ml sample bottle and cap and mix.

NOTE1: When preparing DoD project samples, if any sample in a digestion batch requires filtration , all samples (including QC samples) must be treated in the same manner.

NOTE2: To achieve the lowest reporting limit possible use 2.0 grams of sample with an ending volume of 100 mLs.

j. The sample is now ready for analysis.

k. The digestion log must contain the date, analyst, sample number, client, sample mass/volume, final volume of digestate, lot # of acids used and the preparation and ID of standards.

X. CALCULATIONS

A. The analyst must be supplied with both beginning sample masses/volumes and final digestate volumes. This information must be recorded in the digestion log.

XI. QUALITY CONTROL

A. Digestion

1. Temperature blank
   a. The temperature of the hot plate/hot block must be monitored for temperature during the digestion process.
   b. The thermometer must be tagged with annual calibration information. Record the thermometer reading, correction factor and the corrected temperature in the digestion log.
2. Blanks
   a. Digest a blank with every batch of samples digested (20 sample maximum). The blank is prepared by adding all the same reagents added to the samples to a clean dry beaker and taking it through the same process as the samples.
   b. Also, there must be a blank for every different method of digestion that is set up that day, every 20 samples.
   c. There must also be a blank for every different matrix of samples that is to be digested, every 20 samples.
   d. Sample is given a unique identifier in the digestion log.
3. Laboratory Control Samples
   a. For water samples, one LCS is digested with every batch of samples digested (20 sample maximum).
   b. For water samples, a LCS is digested every day for each type of digestion, every 20 samples.
   c. For soil/sediment samples, a soil matrix standard reference material (SRM) must be digested per batch (20 samples maximum) or alternatively a spiked teflon chip sample.
   d. Sample is given a unique identifier in the digestion log.
4. Duplicates
   a. A duplicate is prepared every 20 samples. This usually takes the form of a matrix spike duplicate.

      NOTE: Certain projects require a sample duplicate and a matrix spike duplicate with each set of twenty samples.
5. Blank Spike
   a. This is required for certain projects.

B. Sample Matrix

NOTE: Field blanks/duplicates, trip blanks, or equipment blanks are not to be used for sample matrix QC samples.

1. Matrix spike
   a. Digest a spike and spike duplicate every 20 samples where sample volume is adequate to do so. Choose a sample (if possible) that has a lot of metals requested to be analyzed.

      NOTE: For some projects, a sample duplicate and sample spike may be required instead of a spike and spike duplicate. Your supervisor should make you aware of these projects.

   b. The following metals do not get digested spikes when using CLP spike.
      Calcium
      Magnesium
      Sodium
      Potassium
   c. For TCLP samples, a spike must be digested for every matrix. You should inspect the sample (original sample prior to extraction) or check the log book to determine matrix type. (Also the matrix spike aliquot must be added to the extract after filtration but before preservation.)
   d. The CLH project requires that a high and a low spike be prepared and analyzed. Spikes shoud be prepared at 40 mg/Kg and 400 mg/Kg for soil samples and 200 ug/L and 2000 ug/L for aqueous samples.

XII. CORRECTIVE ACTIONS

A. Sample boils during digestion.
   1. Redigest another sample aliquot.

B. Sample goes dry or portion of beaker bottom is exposed due to excess evaporation during digestion.
   1. Redigest another sample aliquot.
   2. Glass beaker dry for an extended period of time? Discard beaker.

XIII. SPECIAL NOTES

A. **Never** take for granted how a sample should be digested. If the sample looks strange or unusual, or if you are not sure what metals the sample gets, what detection limits are required, whether the sample is total or dissolved, or even what method of digestion should be used, always ask your supervisor or the person who is to analyze the sample. How metals need to be digested changes too often to take it for granted.

B. **Antimony (Sb) soils** should be analyzed within 48 hours of digestion whenever possible. When a soil requesting Antimony analysis is received, you must coordinate with the person who will be analyzing it to be sure that they can analyze it on the same day that it is digested.

C. Labels for the digested sample must be written in a neat and legible manner. The labels must include such information as sample number, client name, the date digested, and the volume or mass digested.

D. There are several precautions that must be taken to minimize the possibility of contamination.
   1. All metals glassware must be kept separate from all other laboratory glassware.

2. Metals glassware must be washed as soon as possible after being used. **Dirty metals beakers must not be left overnight.**
3. Acid to be used for metals digestions must be kept separate from all other laboratory acid.

E. Samples must be digested in a timely manner to ensure ICP analysis remains on schedule for data generation. Samples received on or before Wednesday of week X must be prepared for ICP digestion by the end of week X. Your supervisor must be consulted if this schedule can not be met at a particular time.

F. Please consult Waste Disposal SOP-QS14, for information concerning disposal of waste generated from this area. Quantity of chemicals purchased should be based on expected usage during its shelf-life and the disposal cost of unused material. Actual reagent preparation volumes should reflect anticipated usage and reagent stability.

Addendum for USEPA CLPILM 05.2 AQUEOUS & SOIL/SEDIMENT

The following is a list of changes for sample preparation when the 5.2 statement of work is required:

1. Soluble samples are required to be digested unless the chain of custody specifically states that digestion is not required. An MDL study must be done on the unprepared MDL solution in order to provide MDL levels for samples that are not digested. When digestion is not required an LCSW and post digestion spike are not required.
2. Digestates must be stored until 365 days after delivery of a complete, reconciled data package.
3. Preparation codes are used on form 13's. They are found in the 5.2 statement of work page B-39 3.4.12.2.4.

DEFINITIONS – Refer to SOP-QS08 for common environmental laboratory definitions.

EMPIRICAL LABORATORIES, LLC
STANDARD OPERATING PROCEDURE

METALS: SOP 105 REVISION #: 16 EFFECTIVE DATE: 041110

METALS
BY INDUCTIVELY COUPLED PLASMA-ATOMIC EMISSION SPECTROMETRY (ICP-AES) TECHNIQUE

References: SW-846, Method 6010B, December 1996; SW-846, Method 6010C, Revision 3 February 2007; USEPA, Method 200.7, June 1991; Standard Methods 19th Edition 2340B; 1995 USEPA CLP, ILM 04.1. See Addendum for USEPA CLPILM 05.2

APPROVALS:

Lab Director: _____ Date: 4/12/10

Data Quality Manager: _____ Date: 4/11/10

Section Supervisor: Betty DeVille Date: 4/13/10

Changes Summary

Revision 16, 04/11/10

- The SOP is an update from Revision 15 dated 05/08/09
- The SOP is formatted to include all 22-elements required per the NELAC standards
- The laboratory's revision of all technical SOPs now includes a Table of Contents that provides the map of the technical information contained within the SOP.
- Additional requirements, based upon the DoD QSM 4.1, have been integrated into the routine sample flow; however, if the requirement is different from routine sample flow, then the requirement is outlined and documented as such to be followed only when DoD samples are analyzed.

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1. Identification of the Test Method

This SOP is compliant with methods – SW846 6010B, SW846 6010C, EPA 200.7, (SM 19th Edition 2340B) Hardness Calculation, (USEPA CLP) ILMO 4.1 (NJDEP does not accept CLPILM 04.1 after June, 2003) and Addendum for USEPA CLPILM 05.2.

2. Applicable Matrix or Matrices

This SOP is applicable to all matrices, including ground water, aqueous samples, TCLP, SPLP and EP extracts, industrial and organic wastes, soils, sludge samples, sediments, and other solid wastes, require digestion prior to analysis.

3. Detection Limit: Detection limits, sensitivity, and optimum ranges of the metals may be found in the ICP method file.

4. Scope of Application, Including components to be Analyzed

Each parameter that is analyzed and reported under the scope of this SOP is listed in **Table 1** of this SOP. This table also lists the associated Method Detection Limit and the Reporting Limit (also defined as the Limit of Quantitation).

5. Summary of the Test Method

5.1 Prior to analysis, samples must be solubilized or digested using appropriate Sample Preparation Methods (e.g., Methods 3005-3050 and SOW ILM 04.1/05.2). When analyzing for dissolved constituents, acid digestion is not always necessary if the samples are filtered and acid preserved prior to analysis. If particulates form after filtration and preservation the sample must be digested prior to analysis.

NOTE: When selenium is required soluble samples must always be digested.

5.2 This method describes the simultaneous multi-elemental determination of elements by ICP. The method measures element-emitted light by optical spectrometry. Samples are nebulized and the large droplets are removed by a spray chamber and the small droplets then pass through to the plasma. The solvent is evaporated. The residual sample decomposed to atoms and ions that become excited and emit characteristic light which is measured, giving a measurement of the concentration of each element type in the original sample. Background correction is required for trace element determination. Background must be measured adjacent to analyte lines on samples during analysis. The position selected for the background-intensity measurement, on either or both sides of the analytical line, will be determined by the complexity of the spectrum adjacent to the analyte line. The position used must be free of spectral interference and reflect the same change in background intensity as occurs at the analytic wavelength measured. Background correction is not required in cases of line broadening where a background correction measurement would actually degrade the analytical result. Control of the spectrometer is provided by PC based *iTEVA* software.

5.3 Inductively Coupled Argon Plasma (ICAP) primary advantage is that it allows simultaneous determination of any elements in a short time. The primary disadvantage of ICP is background radiation from other elements and the plasma gases. Although all ICP instruments

utilize high-resolution optics and background correction to minimize these interferences, analysis for traces of metals in the presence of a large excess of a single metal is difficult. Examples would be traces of metals in an alloy or traces of metals in a limed (high calcium) waste. ICP and Flame AA have comparable detection limits (within a factor of 4) except that ICP exhibits greater sensitivity for refractories (Al, Ba, etc.). Furnace AA, in general, will exhibit lower detection limits than either ICP or FAA.

5.4 It is standard procedure to use an internal standard (scandium) with samples to increase the stability of the instrument as recommended by the manufacturer (Thermo Fisher). (When samples are suspected of containing scandium, internal standard cannot be used.)

6. Definitions

Laboratory Quality System SOP QS08 "Technical / Operational Definitions, Minimum Essential Quality Control Elements, and Laboratory Calibration Procedures" provides information on the commonly used definitions.

Additional definitions specific to this SOP are listed below:

6.1 **ICP or ICAP**- Inductively Coupled Plasma or Inductively Coupled Argon Plasma.
6.2 **Inter-element correction (IEC)**- Defined as a correction factor applied by the instrument when there is an overlap of the spectrum from the plasma gases or from another metal into the spectrum of another metal causing that metals concentration to either be inflated or deflated.

7. Interferences

7.1 Spectral interferences are caused by background contribution from continuum or recombination phenomena, stray light from the line emission of high- concentration elements, overlap of a spectral line from another element, or unresolved overlap of molecular band spectra.

7.1.1. Background emission and stray light can usually be compensated for by subtracting the background emission determined by measurements adjacent to the analyte wavelength peak. Spectral scans of samples or single element solutions in the analyte regions may indicate when alternate wavelengths are desirable because of severe spectral interference. These scans will also show whether the most appropriate estimate of the background emission is provided by an interpolation from measurements on both sides of the wavelength peak or by measured emission on only one side. The locations selected for the measurement of background intensity will be determined by the complexity of the spectrum adjacent to the wavelength peak. The locations used for routine measurement must be free of off-line spectral interference (inter-element or molecular) or adequately corrected to reflect the same change in background intensity as occurs at the wavelength peak. For multivariate methods

using whole spectral regions, background scans should be included in the correction algorithm. Off-line interferences are handled by including spectra on interfering species in the algorithm.

7.1.2. To determine the appropriate location for off-line background correction, the user must scan the area on either side adjacent to the wavelength and record the apparent emission intensity from all other method analytes. This spectral information must be documented and kept on file. The location selected for background correction must be either free of off-line inter-element spectral interference or a computer routine must be used for automatic correction on all determinations. If a wavelength other than the recommended wavelength is used, the analyst must determine and document both the overlapping and nearby spectral interference effects from all method analytes and common elements and provide for their automatic correction on all analyses. Tests to determine spectral interference must be done using analyte concentrations that will adequately describe the interference. Normally, 100 mg/L single element solutions are sufficient; however, for analytes such as iron that may be found at high concentration, a more appropriate test would be to use a 200 mg/L or 500 mg/L concentration near the upper analytical range limit.

7.1.3. Spectral overlaps may be avoided by using an alternate wavelength or can be compensated by equations that correct for inter-element contributions. Instruments that use equations for inter-element correction require the interfering elements be analyzed at the same time as the element of interest. When operative and uncorrected, interferences will produce false positive determinations and be reported as analyte concentrations. More extensive information on interferant effects at various wavelengths and resolutions is available in reference wavelength tables and books. Users may apply inter-element correction equations determined on their instruments with tested concentration ranges to compensate (off line or on line) for the effects of interfering elements. Some potential spectral interferences observed for the recommended wavelength are listed in the method in table 2. For multivariate methods using whole spectral regions, spectral interferences are handled by including spectra of the interfering elements in the algorithm. The interferences listed are only those that occur between method analytes. Only interferences of a direct overlap nature are listed. These overlaps were observed with a single instrument having a working resolution of 0.035 nm.

7.1.4. When using inter-element correction equations, the interference may be expressed as analyte concentration equivalents (i.e. false analyte concentrations) arising from 100 mg/L of the interference element. For example, assume that Arsenic is to be determined (at 193.696 nm) in a sample containing approximately 10 mg/L of Aluminum. According to Table 2 from the method, 100 mg/L of Aluminum would yield a false signal for Arsenic equivalent to approximately 1.3 mg/L. Therefore, the presence of 10 mg/L of Aluminum would result in a false signal for Arsenic equivalent to approximately 0.13 mg/L. The user is cautioned that other instruments may exhibit somewhat different levels of interferences than that shown in Table 2 from the method. The

interference effects must be evaluated for each individual instrument since the intensities will vary.

7.1.5. Inter-element corrections will vary for the same emission line among instruments because of differences in resolution, as determined by the grating, the entrance and exit slit widths, and by the order of dispersion. Inter-element corrections will also vary depending upon the choice of background correction points. Selecting a background correction point where an interfering emission line may appear should be avoided when practical. Inter-element corrections that constitute a major portion of an emission signal may not yield accurate data. Users should not forget that some samples may contain uncommon elements that could contribute spectral interferences.

7.1.6. The interference effects must be evaluated for each individual instrument. For each instrument, intensities will vary not only with optical resolution but also with operating conditions (such as power, viewing height and argon flow rate). When using the recommended wavelengths, the analyst is required to determine and document for each wavelength the effect from referenced interferences as well as any other suspected interferences that may be specific to the instrument or matrix. The instrument utilizes a computer routine for automatic correction on all analyses.

7.1.7. If the correction routine is operating properly, the determined, apparent analyte(s) concentration from analysis of each interference solution should fall within a specific concentration range around the calibration blank. The concentration range is calculated by multiplying the concentration of the interfering element by the value of the correction factor being tested and divided by 10. If after the subtraction of the calibration blank the apparent analyte concentration falls outside of this range in either a positive or negative direction, a change in the correction factor of more than 10% should be suspected. The cause of the change should be determined and corrected and the correction factor updated. The interference check solutions should be analyzed more than once to confirm a change has occurred. Adequate rinse time between solutions and before analysis of the calibration blank will assist in the confirmation.

7.1.8 When inter-element corrections are applied, their accuracy should be verified, daily, by analyzing spectral interference check solutions (IFA/IFB). If the correction factors or multivariate correction matrices tested on a daily basis are found to be within 20% criteria for 5 consecutive days, the required verification frequency of those factors in compliance may be extended to a weekly basis. Also, if the nature of the samples analyzed is such they do not contain concentrations of the interfering elements at ± one reporting limit from zero, daily verification is not required. All inter-element spectral correction factors or multivariate correction matrices must be verified and updated every six months or when an instrumentation-change, such as in the torch, nebulizer, injector, or plasma conditions occurs.

Standard solution should be inspected to ensure that there is no contamination that may be perceived as a spectral interference.

7.2. Physical interferences are effects associated with the sample nebulization and transport processes. Changes in viscosity and surface tension can cause significant inaccuracies, especially in samples containing high dissolved solids or high acid concentrations. If physical interferences are present, they must be reduced by diluting the sample or by using a peristaltic pump, by using an internal standard or by using a high solids nebulizer. Another problem that can occur with high dissolved solids is salt buildup at the tip of the nebulizer, affecting aerosol flow rate and causing instrumental drift. The problem can be controlled by wetting the argon prior to nebulization, using a tip washer, using a high solids nebulizer or diluting the sample. Also it has been reported that better control of the argon flow rate, especially to the nebulizer, improves instrument performance: this may be accomplished with the use of mass flow controllers.

7.3. Memory interferences result when analytes in a previous sample contribute to the signals measured in a new sample. Memory effects can result from sample deposition on the uptake tubing to the nebulizer and from the build-up of sample material in the plasma torch and spray chamber. The site where these effects occur is dependent on the elements and can be minimized by flushing the system with a rinse blank between samples. The possibility of memory interferences should be recognized

7.4 Users are advised that high salt concentrations can cause analyte signal suppressions and confuse interference tests. When the instrument displays negative values, dilution of the samples may be necessary.

8. Safety

Laboratory SOP QS13 "Safety Program & Chemical Hygiene Plan" discusses the safety program that is to be followed lab-wide.

8.1 Normal accepted laboratory safety practices should be followed while performing this analysis.

8.1.1. Care should be used in handling all samples. Safety glasses must be worn in the lab at all times. The use of appropriate safety gloves and lab coats is highly recommended.

8.1.2 Research into expected sample content and concentration should be done in order to be prepared for additional safety considerations. Generally, any samples that need special consideration have applicable notes on the sample logs.

8.1.3 MSDS sheets are available for all reagents and standards that have been purchased. These are located in the bookshelves in the Quality Assurance Officers office.

9. Equipment & Supplies

9.1. Inductively coupled argon plasma emission spectrometer: Thermo Scientific 6500 DUO.

9.2. Computer-controlled emission spectrometer with background correction: Thermo Scientific 6500 DUO or equivalent.

9.3. Radio frequency generator compliant with FCC regulations: Thermo Fisher or equivalent.

9.4. Auto-sampler: Thermo Fisher or equivalent.

9.5. Printer capable of printing results every 4 minutes.

9.6. Cooling Water recycler.

9.7. *Iteva* software.

9.8. Argon gas supply – Liquid Argon

9.9. Class A volumetric flasks

9.10. Analytical balance - capable of accurate measurement to a minimum of three significant figures (0.001gm).

9.11. Variable Eppendorf Pipettes 1000µL; 5000µL

9.12. Disposable beakers 10, 20 and 50 mL size.

9.13. Hood system capable of venting the heat from the system off of the instrument during analysis.

10. Reagents and Standards

The laboratory's LIMS system allows for complete documentation and for the traceability of reagents and standards used within the laboratory. The following information relates to the specific reagents and standards used for the performance of the method:

10.1. Reagent Water. All references to water in the method refer to reagent grade water unless otherwise specified. Reagent water will be interference free.

10.2. Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination. If the purity of a reagent is in question analyze for contamination. If the concentration is less than the MDL then the reagent is acceptable.

10.3. Hydrochloric acid (concentrated), HCl. A method blank is digested and analyzed before a new lot number of HCl is put into use, to ascertain purity. The lot # is logged into Element and the data kept on file.

10.4. Nitric acid (concentrated), HNO_3. A method blank is digested and analyzed before a new lot number of HNO3 is put into use, to ascertain purity. The lot # is logged into Element and the data kept on file.

10.5. Calibration standards

10.5.1. All standards have an acid matrix of 2% HNO_3 and 5% HCl and should be prepared using class A volumetric flasks and calibrated Eppendorfs).

10.5.2. CAL1 is the calibration blank: Reagent grade water **matrix matched as in 10.5.1. Note: when this standard is analyzed the intensities should be compared to a previous run to make sure that no contamination has occurred. Prepare this solution fresh daily.**

10.5.3. Stock QC21 solution: (100 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element and includes the following metals - Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Li, Mg, Mn, Mo, Ni, Se, Sr, Tl, Ti, V, and Zn.

10.5.4. Stock QC7 solution: Order from the manufacturer already prepared. This solution is given a unique identifier within Element and includes the following metals- (50 ug/mL)- silver; (100 ug/mL)- aluminum, boron, barium and sodium; (1000 ug/mL)- potassium; (500 ug/mL or 100 ug/mL note we use two sources of this standard and each have different concentrations for Si) –Silica.

10.5.5. Boron solution: (1000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element.

10.5.6. Stock Tin solution: (10000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element. Note: Two sources are needed.

10.5.7. Stock Silver solution: (1000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element.

10.5.8. Stock Aluminum solution: (10000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element. Note: Two sources are needed.

10.5.9. Stock Calcium solution: (10000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier. Note: Two sources are needed.

10.5.10. Stock Magnesium solution: (10000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element. Note: Two sources are needed.

10.5.11. Stock Iron solution: (10000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element. Note: Two sources are needed.

10.5.12. Stock Potassium solution: (10000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element. Note: Two sources are needed.

10.5.13. Stock Barium solution: (10000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element.

10.5.14. Stock Sodium solution: (10000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element. Note: Two sources are needed.

10.5.15. Stock Arsenic solution: (1000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element.

10.5.16. Stock Cobalt solution: (1000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element.

10.5.17. Stock Chromium solution: (1000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element.

10.5.18. Stock Copper solution: (1000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element.

10.5.19. Stock Manganese solution: (1000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element.

10.5.20. Stock Nickel solution: (1000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element.

10.5.21. Stock Lead solution: (1000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element.

10.5.22. Stock Selenium solution: (1000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element.

10.5.23. Stock Thallium solution: (1000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element.

10.5.24. Stock Beryllium solution: (1000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element.

10.5.25. Stock Cadmium solution: (1000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element.

10.5.26. Stock Antimony solution: (1000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element.

10.5.27. Stock Molybdenum solution: (1000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element.

10.5.28. Stock Strontium solution: (1000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element.

10.5.29. Stock Titanium solution: (1000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element.

10.5.30. Stock Vanadium solution: (1000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element.

10.5.31. Stock Zinc solution: (1000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element.

10.5.32. Stock Scandium solution (10000 ug/mL). Order from the manufacturer already prepared. This solution is given a unique identifier within Element.

10.6. Calibration and Calibration Verification standards

10.6.1. The calibration standards and calibration verification standards preparations are recorded in Element. Please find method of preparation in Appendix I.

10.6.2. The CRL solution is analyzed to check the accuracy of the instrument at the reporting limit. The stock standard solutions A and B are prepared from single element standards listed in 10.5 above. Please find method of preparation in Appendix I. This solution is stable for 6 months. The working solutions are made up as needed or every 3 months as follows: Prepared by adding 1.0 ml of RL Stock solution A and 1.0 ml of RL Stock Solution B to de-ionized water with 2% HNO3 and 5% HCL matrix and diluting to 100 mLs , mix well. This solution is stable for 3 months.

10.6.3. The interference check standard solutions (IFA and IFB) are prepared to provide an adequate test of the IECs. A purchased solution containing 500

ug/mL Al, Ca, Mg and 200 ug/mL Fe is diluted 10x to prepare the IFA. The IFB is prepared by diluting 100x a purchased solution containing 10 ug/mL of As and Tl; 20 ug/mL Ag; 50 ug/mL Ba, Be, Cr, Co, Cu, Mn, and V; 100 ug/mL Cd, Ni and Zn; 5 ug/mL Pb and Se; and 60 ug/L Sb. Add to this a purchased solution containing 500 ug/mL Al, Ca, Mg and 200 ug/mL Fe diluted 10x. These solutions are prepared as needed or monthly and assigned an Element # for traceability.

10.7 Digestion standards

10.7.1 The Blank Spike (BS) is prepared from High Purity solutions CLP-CAL-1 solution A and B; CLP-CAL-2 and CLP-CAL-3. 0.50 mL of CLP-CAL-1 A and B; and 0.50 mLs of the 1000 ug/mL single element standards for Molybdenum, Boron, Titanium and Strontium is diluted to 500 mL with 0.125 mL of CLP-CAL-2 and CLP-CAL-3 and 0.050 mLs of 10000 ug/mL Tin. 25 mL of HCl and 10 mL of HNO3 are added for preservation. This solution is stored in a Teflon bottle. A portion is reserved in case of a problem with digestion. When there is a problem with the analysis of the BS the solution is checked first before action is taken to make sure that it was made properly and has not deteriorated since it was made up. This solution is given a unique identifier within Element. The BS is prepared from a source independent from that used in the calibration standards. This solution is prepared daily or as needed. 50 mLs of this solution is used for digestion for normal level water samples and the sample is brought back to 50 mLs after digestion. Low level water samples start with two 50 mLs vials with only 1.0 mL of the stock blank spike solution in each taken to 50 mLs. The samples are cooked down to below 25 mLs and combined and then cooked down to below 25 mLs again and then brought back to 25 mLs. This low level BS is given a unique identifier in Element.

10.7.2. The solid BS used with soil samples is prepared by weighing up 1.0 gram of Teflon chips for regular level and 2.0 grams of Teflon chips for low level and spiking using the same spiking solutions used to spike the sample matrix. This standard is given a unique identifier i.e. Batch #-BS1. Note: Amount of spiking solution used varies according to whether the samples are being digested for normal level or low level soils. See spiking solutions in 10.7.3.1 for how to prepare the BS for a solid sample, it is prepared the same way that a soil spike is prepared only the known amounts of metals are added to laboratory water.

10.7.3. The spiking solutions are prepared as follows:

10.7.3.1.Stock Multi-element Spiking Solutions: High Purity <u>CLP-CAL-1 solution A</u>: 2000 ug/mL Al and Ba; 50 ug/mL Be; 200 ug/mL Cr; 500 ug/mL Co, Mn, Ni, V and Zn; 250 ug/mL Cu; 1000 ug/mL Fe; 5000 ug/mL Ca, Mg, K and Na; <u>solution B</u>: 250 ug/mL Ag; <u>CLP-CAL-2</u>: 1000 ug/L Sb; <u>CLP-CAL-3</u>: 1000 ug/mL As, Pb, Se, Tl; 500 ug/mL Cd. Order from the manufacturer already prepared. These solutions are given a unique identifier within Element. Add 0.050 mL for water samples and 0.20 mL for normal level soil samples and 0.10 for low

level soil samples of CLP-CAL-1 solutions A and B, and 0.0125 mL for water samples and 0.05 mLs for normal level soil samples and 0.025 mLs for low level soil samples of CLP-CAL-2 and 3 to 50 mL of sample for water samples and 1gram of sample for normal level soils and 2 grams of sample for low level soils for the following spike values: 2000 ug/L Al and Ba; 50 ug/L Be; 200 ug/L Cr; 500 ug/L Co, Mn, Ni, V and Zn; 250 ug/L Cu; 1000 ug/L Fe; 5.0 mg/L Ca, Mg, K and Na, 250 ug/L Ag, Sb, As, Pb, Se and Tl; 125 ug/L Cd. A blank spike should be prepared at the time the samples are spiked to check the actual spike value and accuracy.

10.7.3.2. TCLP Spiking Solution: Use 0.50 mL diluted to 50 mL for digestion:
2.5 mL 10000 mg/L Ba stock standard diluted to 100 mL; 2.5 mL Cr, Pb and As 1000 mg/L stock standard diluted to 100 mL; 0.50 mL Cd and Se diluted to 100 mL . Store in a Teflon bottle. A blank spike should always be prepared at the same time a sample is being spiked. This solution should produce a spike value of 2500 ug/L Ba; 250 ug/L Cr, Pb and As; and 50 ug/L of Cd and Se. Note: Since the samples are diluted 10x when digested the spike value will appear to be 10x greater when analyzed.

10.7.3.3. TCLP Silver Spiking Solution: Use 5.0 mL diluted to 50 mL for digestion:
0.40 mL of 1000 mg/L stock Ag solution diluted to 200 mL. Store this solution in a Teflon bottle. A blank spike should always be prepared at the same time a sample is being spiked. This solution should produce a spike value of 200 ug/L. Note: Since the samples are diluted 10x when digested the spike value will appear to be 10x greater when analyzed. Also this solution is not very stable and may require fresh preparation at least weekly.

11. Sample Collection, Preservation, Shipment, and Storage

Quality Systems SOP QS10 related to Sample Receipt, Handling, & Processing provides details for collection, preservation, shipment, and storage.

11.1. Preliminary treatment of most matrices is necessary because of the complexity and variability of sample matrices. Water samples which have been pre-filtered and acidified will not need acid digestion as long as the samples and standards are matrix matched and particulates do not form after the filtration and preservation take place. Solubilization and digestion procedures are presented in Sample Preparation Methods (Methods 3005A-3050A).

11.2. Sample digestates are stored at room temperature for at least 2 months unless a longer time is requested by the client. The samples contain an acid matrix of 3:1. All metal samples are neutralized before disposal in the receiving section of the laboratory.

11.3. **The appropriate SOPs should be consulted regarding sample preparation.** The following is a brief summary of the methods we use for metals preparation.

11.3.1. Method 3005A prepares groundwater and surface water samples for total recoverable and dissolved metals determination by ICP. The unfiltered or filtered sample is heated with dilute HCl and HNO_3 prior to metal determination.

11.3.2. Method 3010A prepares waste samples for total metal determination by ICP. The samples are vigorously digested with a mixture of nitric acid and hydrochloric acid followed by dilution with laboratory water. The method is applicable to aqueous samples, TCLP and mobility-procedure extracts.

11.3.3. Standard Methods 19th Edition Method 3030C prepares ground-waters and surface water samples for acid extractable metals: (lead and chromium.) This preparation has a holding time of 72 hours. The samples are preserved at collection with 5mL/L of HNO3, in the laboratory 5 mL/100mL of 1+1 HCl is added and the sample is heated for 15 minutes in a block digester. The sample is filtered through a membrane filter and the filtrate is carefully transferred to a volumetric flask and brought back to 100 mLs.

11.3.4. Method 3050B prepares wastes samples for total metals determination by ICP. The samples are vigorously digested in nitric acid and hydrogen peroxide followed by dilution with either laboratory water or hydrochloric acid and laboratory water. The method is applicable to soils, sludges, and solid waste samples.

12. Quality Control

Quality Systems SOP QS08 "Technical / Operational Definitions, Minimum Essential Quality Control Elements, and Laboratory Calibration Procedures" outlines details related to laboratory wide protocols on quality control.

12.1. **Daily run and batch QC**

12.1.1. Calibration is required daily. Either a blank and a high standard or a client specific three standard concentration points and a blank calibration is required daily.

12.1.2. IEC correction standards for aluminum and iron are required daily.

12.1.3. ICV within ±5% for 200.7 and within ±10% for all other methods.

12.1.4. ICB/CCB less than two times ± MDL or less than ± LOD for DOD. The ICB/CCB must immediately follow the ICV/CCV.

12.1.5. RL standard run against the curve within ±20% initially and client specific requirement of ±30% at the end of the analysis.

12.1.6. IFA/IFB analyzed daily. IFA must be less than two times ±MDL or less than ±LOD unless verified standard contamination for DOD. The IFB must recover within ±20% for all analytes in the IFB standard solution. If the IFA/IFB solution is not within the required limits- if possible reanalyze all associated samples, if not possible to reanalyze all associated samples must be flagged with an "Q" on the final report for DOD.

12.1.7. CCV must be analyzed every ten samples or at the end of the analysis within ±10% or the samples are reanalyzed if possible. If samples cannot be reanalyzed, all samples are flagged with a "Q" for DOD.

12.1.8. CCB must be analyzed every ten samples immediately following the CCV or at the end of the analysis less than two times ±MDL or <±LOD for DOD. If the CCB is out of the allowable range the samples are flagged with "B".

12.1.9. *The following should be analyzed with each preparation batch containing a matrix spike.*

- Serial dilution: If the analyte concentration is sufficiently high (minimally, a factor of 50 above the instrumental detection limit after dilution), an analysis of a 1:4 dilution (volumetric glassware must be used) should agree within ±10% of the original determination. If not, a chemical or physical interference effect should be suspected. The analyst and or section manager must note this situation on the final analytical report.

- Post digestion spike addition: An analyte spike added to a portion of a prepared sample, or its dilution, should be recovered to within 75% to 125% of the known value for SW6010B and 80 to 120% for SW6010C and is required especially if the pre-digestion matrix spike is outside of control limits. The spike addition should produce a minimum level of 10 times and a maximum of 100 times the instrumental detection limit. If the spike is not recovered within the specified limits, a matrix effect should be suspected. Run all associated samples in the preparatory batch by method of standard additions (MSA) or apply "J" flag. The analyst and or section manager must note this situation on the final analytical report. Apply "J" flag if the post spike is outside the range of 75 to 125% for 6010B or 80 to 120% for 6010C.

12.2 Quarterly and/or every six months

12.2.1. Linear range standards must be analyzed at a frequency no less than once every six months. The linear range standard is required for verification that samples are actually linear to the degree claimed. The analyst is responsible for completing this task in a timely manner. The linear range standard must be within +/-10% of true value. This standard can be analyzed as the linear dynamic range.

12.2.2. The inter-element correction factors (IEC) should be verified at the time the linear range standards are analyzed or whenever there is any question about whether an IEC is correcting correctly.

12.2.3. IDL's, linear range and IEC checks must be performed quarterly if straight CLP work is required.

12.3. Digested Batch QC

12.3.1. All quality control data should be maintained and available for easy reference or inspection.

12.3.2. Employ a minimum of one method blank per sample batch to determine if contamination or any memory effects are occurring. A method blank (BLK), sometimes referred to as the preparation blank is a volume of reagent water acidified with the same amounts of acids as were the standards and samples. These blanks are taken through the same digestion/preparation steps as the sample being tested. The result for the method blank should not indicate contamination greater than ± ½ RL for DOD or ±RL/CRDL for other or CLP. If exceeded, the impact upon the data should be evaluated and the associated sample(s) should be either re-digested or the data should be qualified. The extracted blank associated with TCLP batches must be less than 100 X the regulatory limit for barium.

12.3.3. Employ a minimum of one blank spike (BS) for aqueous samples or one Teflon chip spiked sample per sample batch to verify the digestion procedure. These blank spikes are taken through the same digestion/preparation steps as the sample being tested. The control limits are ±15% method 200.7 - aqueous and soil samples or ±20% for all other methods aqueous and soil samples. If the BS is not in control, the impact upon the client data should be evaluated and the associated sample(s) should be re-digested. Consult your supervisor for further action. Qualifying the associated data may not be permissible for some clients.

12.4. Sample

12.4.1. Analyze one replicate sample for every twenty samples or per analytical batch, whichever is more frequent. A replicate sample is a sample brought through the whole sample preparation and analytical process in duplicate. It is acceptable to substitute a matrix spike duplicate for the sample replicate. Project specific requirements will take precedence in these situations. NJDEP demands that this requirement be met with a client specific duplicate rather than a spike duplicate. The control limits are less than or equal to 20% RPD (if both are >5x RL) or ± the RL (if either are <5X RL). Supervisor must be notified if the control limit is not met. Supervisor will dictate corrective action if required. The final analytical report must document this situation. Apply "J" flag for DOD if acceptance criteria are not met. Apply "*" flag for CLP and other work if acceptance criteria are not met.

12.4.2. Analyze a minimum of one spiked sample and/or spiked sample duplicate for every twenty samples or per analytical batch, whichever is more frequent. Project

specific requirements will take precedence in determining whether a matrix spike duplicate is employed in these situations. If the analyte level in the sample is not greater than 4X the spiking level, the spike recoveries should be within ±20% of the true value. If not, and sufficient sample volume exist, a post digestion spike should be analyzed. Apply "J" flag for DOD if acceptance criteria are not met. Apply "N" flag or CLP and other work if acceptance criteria are not met.

13. Calibration and Standardization

Quality Systems **SOP QS08 "**Technical / Operational Definitions, Minimum Essential Quality Control Elements, and Laboratory Calibration Procedures" related to Calibration Procedures provides laboratory wide protocols for calibration and standardization.

13.1. Set up the instrument with proper operating parameters. The instrument must be allowed to become thermally stable before beginning (usually requiring at least 30 minutes of operation prior to calibration).

13.2. Operating conditions - **The instrument settings can be found in method file within the iTEVA software.** For operation with organic solvents, use of the auxiliary argon inlet is recommended, as are solvent-resistant tubing, increased plasma (coolant) argon flow, decreased nebulizer flow, and increased RF power to obtain stable operation and precise measurements. Sensitivity, instrumental detection limit, precision, linear dynamic range, and interference effects must be established for each individual analyte line on that particular instrument. The analyst must (1) verify that the instrument configuration and operating conditions satisfy the analytical requirements and (2) maintain quality control data confirming instrument performance and analytical results.

13.3. Auto-peak when some change has been made to the introductory system and calibrate the instrument according to the instrument manufacturers recommended procedures, using the specified calibration standard solutions. Flush the system with 2% HNO_3 / 5% HCl between each standard or as the manufacturer recommends. (Use the average intensity of multiple exposures for both standardization and sample analysis to reduce random error.) The calibration curve consists of a blank and three standards ($r \geq 0.998$). If a three point calibration curve is not required for the client samples being analyzed by Empirical Laboratories may use a blank and one standard as referenced in USEPA - CLP protocols.

13.4. Before beginning the sample run, analyze single element Iron and Aluminum standards at their linear range to check for IEC drifts. Analyze these standards first as QC samples with an IEC check table and action taken should be to calculate IECs using the iTEVA software. Make sure to rinse thoroughly after running these linear range standards, they can cause carry over into the initial QC samples which are analyzed next. The analysis order follows as: ICV (± 10%) for 200.7 (± 5%) and ICB (< ±2xMDL, <±LOD-DOD or ±RL/CRDL for others or CLP, first, then analyze a reporting limit standard (a standard at the concentration of the reporting limit). This standard should be within ±20% for DOD projects and ±30% for samples analyzed for 6010C. Then reanalyze the

highest mixed calibration standard(s) as if it were a sample. Concentration values obtained should not deviate from the actual values by more than 5%. If they do, follow the recommendations of the instrument manufacturer to correct for this condition. Note: Supervisor must be notified if the control limit is not met. Supervisor will dictate corrective action if required. The final analytical report must document this situation.

13.5. For **CLP projects**, verify the validity of the curve in the region of 2x the contract required detection limit (CRDL) before and after each batch of 20 samples in the specific order of CRI, ICSA, ICSAB, CCV and CCB (CCB criteria: < ±MDL or ±RL/CRDL for others or CLP, or twice during every 8-hour work shift, whichever is more frequent. Results should be within ±20%. Supervisor must be notified if the control limit is not met. Supervisor will dictate corrective action if required. The final analytical report must document this situation. (For Internal QC)

13.6. Verify the inter-element and background correction factors at the beginning of the sequence in the specific order of IFA, IFB, CCV and CCB (IFA criteria: non-spiked analytes < ±2xMDL or <±LOD for DOD beginning of sequence**.** Do this by analyzing the interference check solution IFA and IFB. Absolute value of concentration for all non-spiked analytes in the IFA must be <LOD (unless they are verified trace impurity from one of the spiked analytes) for DOD. Results must be within ±20% of the true value for IFB. If corrective action fails, apply Q-flag to all results for specific analyte(s) in all samples associated with the ICS. (CRI, ICSA and ICSAB required at the end for CLP projects only).

Note: Supervisor must be notified if the control limit is not met. Supervisor will dictate corrective action if required. The final analytical report must document this situation.

13.7. The instrument must be calibrated once every 24 hours.

13.8. Instrument Autosampler Report example:

Calibration Rack (used by instrument software to insert QC)

1) Cal Std 1 (blank)
2) Cal Std 2 (Low Cal)
3) Cal Std 3 (Mid Cal)
4) Cal Std 4 (Ba @ 5000 ppb)
5) Cal Std 5 (QC5)
6) Cal Std 6 (QC 21)
7) Cal Std 7 (NAK 100)
8) Cal Std 8 (QC3)
9) Cal Std 9 (Ag)
10) Al IEC-(correction using ITEVA software)
11) Fe IEC-(correction using ITEVA software)

Sample Sequence RACK 1

1) SEQ-ICV
2) SEQ-ICB
3) SEQ-CRL1-reporting limit standard 1
4) SEQ-CRL2-reporting limit standard 2
5) Ba@ 5000 ppb (readback)
6) QC5
7) NAK High-(readback)
8) QC 21 High-(readback)
9) Salt Cal at 500 ppm (readback)
10) Rinse
11) SEQ-IFA1
12) SEQ-IFB1
13) Rinse
14) SEQ-CCV
15) SEQ-CCB
16) Method Blank (*Batch #* -BLK1)
17) Blank Spike (*Batch #* -BS1)
18) Sample 1
19) Sample 2
20) Sample 3
21) Sample 4
22) Sample 5
23) Sample 6
24) Sample 7
25) Sample 8
26) Sample 9
27) Sample 10
28) SEQ-CCV
29) SEQ-CCB
30) Sample 11
31) Sample 12
32) Sample 13
33) Sample 14
34) Sample 15
35) Sample 16
36) Sample 17
37) Sample 18
38) Sample 19
39) Sample 20
40) Sample matrix spike (*batch#*- MS1)
41) Sample matrix spike duplicate (*batch#* -MSD1)
42) Sample post digestion spike (*batch#* -PS1)
43) Sample serial dilution (*batch#* -DUP1)
44) SEQ-CCV

45) SEQ-CCB
46) Preparation Blank (*batch#* -BLK1)
47) Blank Spike (*batch#* -BS1)
48) Sample 1
49) Sample 2
50) Sample 3
51) Sample 4
52) Sample 5
53) Sample 6
54) Sample 7
55) Sample 8
56) Sample 9
57) Sample10
58) SEQ-CCV
59) SEQ-CCB
60) Sample 11

RACK 2

1) Sample 12
2) Sample 13

Etcetera…

Each rack holds 60 samples and there are 4 racks that are used for samples, CCVs and CCBs and run QC.

14. Procedure

14.1. Once the instrument has been calibrated, begin the analysis of samples.

14.2. If particulates are visible in the digestate, the sample must be filtered prior to analysis. If filtration is required, a filter blank must be prepared by filtering reagent grade water which has been properly acidified. **In the event USACE samples are filtered, all USACE samples and the QC samples in that QC batch must be filtered. All USACE solid samples and their associated batch QC samples must be filtered prior to analysis.**

14.3. Flush the system with 2% HNO_3 / 5% HCl for at least 1 minute before the analysis of each sample.

14.4. Dilute and reanalyze samples that are more concentrated than the linear calibration limit or, for 200.7, $\pm$ 10% of the linear range standard. **In the case of USACE samples, the criterion changes and requires dilution and reanalysis of all samples which produce a concentration that exceeds the highest calibration standard. Sample results detected between the MDL and LOQ are flagged as estimated with a "J" flag.**

14.5. Verify calibration every 10 samples or every 2 hours, whichever is more frequent and at the end of the analytical run, using a continuing calibration verification (CCV) sample and a continuing calibration blank (CCB) sample.

14.5.1. The results of the CCV are to agree within ±10% for 6010 (5% for 200.7) on initial verification of the expected value, with relative standard deviation (RSD) < 5% from 3 replicates (minimum of three integrations). If not, terminate the analysis, correct the problem, and reanalyze the previous ten samples. The analyst may continue the analytical run, and after conferring with the section manager it may be necessary to reanalyze a group of samples. The analyst must notify the section manager within 24 hours.

14.5.2. The results of the calibration blank (this is not the method/preparation blank) are to be < 2x ±MDL, for CLP <RL, for **DOD no analytes detected >±LOD**. If the calibration blank is not in control, evaluate the impact upon the previous 10 samples. Reanalysis may be required after an evaluation of the data. If the blank < 1/10 the concentration of the action level of interest and no sample is within 10% of the action limit, samples need not be reanalyzed. One must also evaluate the reporting limit (RL) as it relates to 3X the IDL/MDL. If the RL is significantly above 3X IDL or MDL then reanalysis may not be required (Na, K, Mg and Ca are good examples of this situation).

14.6. Demonstration of Capability (DOC) – Each analyst must perform a DOC to demonstrate proficiency with this method. Refer to SOP-413 for guidance.

15. Data Analysis and Calculations

Quality Systems SOP QS09 "General and commonly used Laboratory Calculations" provides details on general calculations used throughout the laboratory.

15.1. Total hardness is reported from HNO_3 preserved sample. The final concentration is calculated from the calcium and magnesium results as follows: Ca mg/L x 2.5 + Mg mg/L x 4.1 = total Hardness in mg/L as $CaCO_3$.

15.2. The instrument will generate data results in mg/L or µg/L (labeled appropriately). Each result represents an average of three individual readings per metal channel.

15.3. For aqueous samples, if a post/pre-digestion dilution is performed, the result must be multiplied by this factor or the dilution factor must be entered into the instrument data table in which case the instrument will generate data corrected for the dilution.

15.4. For solid samples, if a post-digestion dilution is performed, the result must be multiplied by this factor or the dilution factor must be entered into the instrument data table in which case the instrument will generate data corrected for the dilution. Also, the result must be converted to reporting units which are usually mg/kg.

SR (ug/g or mg/kg) = IR*DF*FED/SM

SR = Sample result
IR = Instrument result (µg/L)
DF = Dilution factor (post digestion)
FED = Final volume of digestate (L)
SM = Sample mass digested (g)

16. Method Performance

Demonstration of Capability (DOC): Each analyst must perform a DOC prior to reporting data. The analyst must prepare (for prep technicians) and analyze (analysts reviewing and reporting data) 4-LCS samples. The data is calculated for accuracy and precision requirements. The DOC form, as listed within section 2.5 of the Quality Manuel is completed by each analyst and then provided to the supervisor for further processing and approval.
DOC LCS Preparation: See BS preparation under 10.7.1 through10.7.3 above.
DOC Accuracy and Precision Criteria: The LOD is analyzed at 2 times the MDL and must result in an concentration 3 times the noise. The LOQ is analyzed at the RL or 2 times the RL and must be recovered within ±50%.

17. Pollution Prevention:
Quantity of chemicals purchased should be based on expected usage during its shelf-life and the disposal cost of unused material. Actual reagent preparation volumes should reflect anticipated usage and reagent stability.

18. Data Assessment and Acceptance Criteria for Quality Control Measures

Quality Control SOP QS05, "Data Deviations / Interpretations / Exceptions: Laboratory Non-Conformance / Corrective Action Procedures, Decision Making Guidelines for Evaluating Laboratory Analytical Sample and Quality Control Results", provides details on data assessment and acceptance criteria for Quality Control Measures. Table 2 of this SOP provides information on QC samples, frequency, and the associated criteria specific to the performance of this method.

19. Contingencies for Handling out-of-control or unacceptable data
Quality Control SOP QS05, "Data Deviations / Interpretations / Exceptions: Laboratory Non-Conformance / Corrective Action Procedures, Decision Making Guidelines for Evaluating Laboratory Analytical Sample and Quality Control Results", provides details on handling out of control data. Table 2 within this SOP also lists corrective actions associated with the failure of the various QC samples employed for the performance of this method.

CORRECTIVE ACTIONS

19.1. INSTRUMENT RELATED

19.1.1. ICV not within ± 10% or ± 5% for 200.7
a. Is the problem with the solution?
i. Re-prepare or obtain new stock.

b. Is the problem with the calibration?
   i. Recalibrate through analysis of appropriate standards and recheck ICV.

19.1.2. ICB not ±MDL or within ± 3X IDL or CRDL for CLP, **DOD no analytes detected >LOD**

a. Is the problem with the solution?
   i. Re-prepare
b. Is the problem with the calibration?
   i. Recalibrate with the blank solution or the low level standard. Restart analysis with the ICV.

19.1.3. Check standards not within ± 5%
a. Is the problem with the solution?
   i. Re-pour, re-prepare or obtain new stock.
b. Is the problem with the calibration?
   i. Recalibrate thru analysis of appropriate standards. Restart analysis with the ICV.

19.1.4. CLP only-CRI not within ± 20% (Internal QC, only required for CLP work).
a. Is the problem with the solution?
   i. Re-prepare or obtain new stock.
b. Is the problem with the calibration?
   i. Recalibrate thru analysis of appropriate standards. Restart analysis with the ICV.

19.1.5. IFA metals not present are not less than the detection limit for that metal, **for IFA DOD, absolute value of concentration for all non-spiked analytes <±LOD.**
a. Is the problem with the solution?
   i. Re-prepare or obtain new stock.
b. Is the problem with the calibration?
   i. Recalibrate thru analysis of appropriate standards. Restart analysis with the ICV.

19.1.6. IFB not within ± 20%
a. Is the problem with the solution?
   i. Re-prepare or obtain new stock.
b. Is the problem with the calibration?
   i. Recalibrate thru analysis of appropriate standards. Restart analysis with the ICV.

19.1.7. CCV not within ± 10%
a. Is the problem with the solution?
   i. Re-prepare or obtain new stock.
b. Is the problem with the calibration?
   i. If appropriate, continue the analysis. Discuss effect of the out of control situation with your supervisor. The samples will be reanalyzed or the data will be qualified.

19.1.8.. CCB not ±2xMDL or CRDL for CLP, DOD no analytes detected >±LOD.

a. Is the problem with the solution?
   i. Re-prepare
b. Is the problem with the calibration?
   i. Re-calibrate and reanalyze.

19.2. DIGESTION RELATED

19.2.1. Preparation blank (BLK) not within ± ½ RL and ± RL for common contaminants DOD or RL/CRDL for other or CLP

a. Is the problem with the instrument?
   i. Evaluate with respect to instrumental bias or reanalyze when instrument is in control.
b. Is the problem with the digestion?
   i. If associated samples are less than 10X the level of the preparation blank but above the RL, the sample must be re-digested or the data must be qualified on the final report.

19.2.2. BS not within control limits

a. Is the problem with the instrument?
   i. Evaluate with respect to instrumental bias or reanalyze when instrument is in control.
b. Is the problem with the digestion?
   i. If biased low, associated samples must be re-digested.
   ii. If biased high, the impact upon the data user must be evaluated. The samples will be re-digested or the data will be qualified on the final report.

19.3. SAMPLE MATRIX RELATED

19.3.1. Replicate analysis RPD not within ±20% (if both are >5X CRDL) or ± the CRDL (if either are <5X CRDL).

a. The associated sample data must be qualified on the final report.

19.3.2. Spike analysis recovery not within ±20%.

a. Is the analyte level in the sample greater than 4X the spiking level?
   i. If yes, the spike recovery is not evaluated.
   ii. If no, a post digestion spike must be analyzed and the associated sample data must be qualified on the final report.

19.3.3. When required, post digestion spike analysis recovery not within ±25% for SW6010B, DOD or ± 20% SW6010C.

a. The associated sample data must be qualified on the final report.
b. For USACE analysis by MSA is required.

19.3.4. Serial dilution analysis percent difference not within ±10%

a. Is the analyte concentration a factor of 50 above the instrumental detection limit after dilution?

i. If no, the serial dilution data can not be evaluated.

iii. If yes, a chemical or physical interference effect should be suspected. The analyst and or section manager must note this situation on the final analytical report.

20. **Waste Management**

Laboratory SOP QS14 on Waste Handling discusses general guidelines for the appropriate handling of wastes and the laboratory program on waste management.

21. **References**

21.1. *Test Methods for Evaluating Solid Waste Physical/Chemical Methods, SW-846; Third Edition (Update III)*; Method 6010B and Method 6010C.

21.2. USEPA *Code of Federal Requlations, 40, CH 1,PT 136;* Method 200.7; APX-B.

21.3. USEPA *Contract Laboratory Program (CLP) for Inorganics ILM04.1; ILM05.2*

21.4. DOD Quality Systems Manual for Environmental Laboratories Version 4.1. (Based on NELAC Voted Revision June 5, 2003. 4/22/09

22. **Tables, Diagrams, Flowcharts and Validation Data**

Table 1 contains all applicable parameters with the applicable RL/LOQ, LOD and Detection Limit.

Table 1A, contains a list of the wavelengths used for each analyte.

Table 2, for all technical methods, contains the QA/QC summary table.

Table 3, Technical Completeness / Accuracy Checklist

Table 4, Data Reviewers Checklist

Table 1 Water				
Analyte	MDL	LOD	MRL	Units
Aluminum	50.0	100	200	ug/L
Antimony	5.00	8.00	15.0	ug/L
Arsenic	3.00	6.00	10.0	ug/L
Barium	5.00	10.0	40.0	ug/L
Beryllium	1.00	2.00	5.00	ug/L
Boron	10.0	20.0	30.0	ug/L
Cadmium	1.00	2.00	5.00	ug/L
Calcium	1000	2000	5000	ug/L
Chromium	2.00	4.00	10.0	ug/L
Cobalt	5.00	10.0	12.5	ug/L
Copper	4.00	8.00	10.0	ug/L
Iron	30.0	60.0	100	ug/L
Lead	1.50	3.00	3.00	ug/L
Magnesium	1000	3000	5000	ug/L
Manganese	3.00	6.00	15.0	ug/L
Molybdenum	5.00	10.0	15.0	ug/L
Nickel	3.00	6.00	10.0	ug/L
Potassium	1000	3000	5000	ug/L
Selenium	3.00	5.00	6.00	ug/L
Silver	1.00	2.00	10.0	ug/L
Sodium	1000	3000	5000	ug/L
Thallium	3.00	4.00	8.00	ug/L
Tin	10.0	20.0	30.0	ug/L
Titanium	5.00	10.0	15.0	ug/L
Vanadium	5.00	10.0	12.5	ug/L
Zinc	5.00	10.0	20.0	ug/L

Table 1 TCLP				
Analyte	MDL	LOD	MRL	Units
Antimony	0.00500	0.00800	0.0150	mg/L
Arsenic	0.00300	0.00600	0.0100	mg/L
Barium	0.00500	0.0100	0.0400	mg/L
Cadmium	0.00100	0.00200	0.00500	mg/L
Chromium	0.00200	0.00400	0.0100	mg/L
Copper	0.00400	0.00800	0.0100	mg/L
Lead	0.00150	0.00300	0.00300	mg/L
Selenium	0.00300	0.00500	0.00600	mg/L
Silver	0.00100	0.00200	0.0100	mg/L

Table 1 Soil				
Analyte	MDL	LOD	MRL	Units
Aluminum	10.0	20.0	40.0	mg/Kg
Antimony	1.00	1.60	3.00	mg/Kg
Arsenic	0.600	1.20	2.00	mg/Kg
Barium	1.00	2.00	8.00	mg/Kg
Beryllium	0.200	0.400	1.00	mg/Kg
Boron	2.00	4.00	6.00	mg/Kg
Cadmium	0.200	0.400	1.00	mg/Kg
Calcium	200	400	1000	mg/Kg
Chromium	0.400	0.800	2.00	mg/Kg
Cobalt	1.00	2.00	2.50	mg/Kg
Copper	0.800	1.60	2.00	mg/Kg
Iron	6.00	12.0	20.0	mg/Kg
Lead	0.300	0.600	0.600	mg/Kg
Magnesium	200	600	1000	mg/Kg
Manganese	0.600	1.20	3.00	mg/Kg
Molybdenum	1.00	2.00	3.00	mg/Kg
Nickel	0.600	1.20	2.00	mg/Kg
Potassium	200	600	1000	mg/Kg
Selenium	0.600	1.00	1.20	mg/Kg
Silver	0.200	0.400	2.00	mg/Kg
Sodium	200	600	1000	mg/Kg
Thallium	0.600	0.800	1.60	mg/Kg
Tin	2.00	4.00	6.00	mg/Kg
Titanium	1.00	2.00	3.00	mg/Kg
Vanadium	1.00	2.00	2.50	mg/Kg
Zinc	1.00	2.00	4.00	mg/Kg

TABLE 1A

METAL	WAVELENGTH
Aluminum	396.1
Antimony	206.8
Arsenic	189.0
Barium	233.5
Beryllium	313.0
Boron	249.7
Cadmium	228.8
Calcium	317.9
Chromium	267.7
Cobalt	228.6
Copper	324.7
Iron	261.1
Lead	220.3
Magnesium	279.0
Manganese	257.6
Molybdenum	202.0
Nickel	231.6
Potassium	766.4
Selenium	196.0
Silver	328.0
Sodium	589.5
Strontium	421.5
Thallium	190.8
Tin	189.9
Titanium	334.9
Vanadium	292.4
Zinc	206.2

Table 2 - Method Quality Control Requirements Summary			
QC Check	**Minimum Frequency / Requirements**	**Acceptance Criteria**	**Corrective Action for Failures / Data Useability**
Interference Check	• once per calibration	• IFA less than LOD if not verified contamination of standard. IFB must be within ±20%.	• Check IEC corrections for metals in the IFA.
Calibration Curve	• Prior to analyzing any samples • A minimum of a blank and 3-points for linear fits client specific requirement or a blank and high standard. • Low standard at the RL level run against the curve within 20% initially and within 30% for subsequent analysis (6010C).	• Linear calibration Corr. of 0.998 • Must follow curve processing requirements from SOP QS08	• Re-evaluate curve mix and makeup • Re-run curve • Check instrument for maintenance needs • Re-prep the curve standards Samples cannot be analyzed until there is a passing calibration
ICB	At the beginning of every sequence	Must meet the <±LOD for DOD or < 2xMDL	Re-run
ICV	Alternate source standard to be analyzed after every calibration curve	• Must be in the range 90 to 110% for 6010B&C, or 95 to 115% for 200.7.	• Re-analyze an ICV from a different source • Re-prep and re-analyze the ICV • Re-calibrate and verify standard preps and sources
CCV	• At the beginning of every sequence • For every 10-client samples	• Must be in the range 90 to 110%	• Samples must be reanalyzed if possible, if not samples are flagged with a "Q".
Closing CCV	• At the end of every sequence	• Must be in the range 90 to 110%	• Samples must be reanalyzed if possible, if not samples are flagged with a "Q".
BLK	One per prep batch	• Must be less than ½ ±RL.	• Re-analysis to confirm the positive value • Ascertain if there are any samples within the batch that meet the MB criteria and provide the information for the decision makers • If results are between the LOD or RL/LOQ, then assess the data and notify the PM for further action • Re-prep of samples associated with the MB • NCR will be required for data reported • Final Report data flagging will be required

Table 2 - Method Quality Control Requirements Summary			
QC Check	**Minimum Frequency / Requirements**	**Acceptance Criteria**	**Corrective Action for Failures / Data Useability**
BS	One per prep batch	Must be in the range of 80 to 120% for 6010B, DOD; or 85 to 115% for 200.7.	• Rerun to confirm problem. • All samples associated with the LCS must be re-digested, reanalyzed if possible. • NCR will be required for data reported • If samples cannot be re-digested or re-analyzed Final Report data flagging will be required
MS	One per prep batch	Must be in the range of 80 to 120%	Final Report data flagging will be required
MSD	One per prep batch	Must be in the range of 80 to 120%	Final Report data flagging will be required
Sample Duplicate	One per prep batch	20%	Flag samples
Post Digestion Spike	One per batch	±25% for DOD/6010B, ±20% 6010C	If possible MSA required, Flag samples
DOC Study	• Initially per analyst prior to reporting data • Annually • Follow specific guidelines from section 16 for the preparation and analysis of DOC samples	• Must meet the criteria of the BS for average accuracy	• Re-prep and / or • Re-analysis
MDL Study	Once per year		
LOD Verification	Every quarter		
LOQ Verification	Every quarter		
Linear Dynamic Range Study (LDR)	Every six months		

Table 3, Technical Completeness / Accuracy Checklist

1. Were all the QC check elements analyzed – refer to Table 2 of the SOP
2. Were the QC criteria met
3. In cases of failures, was there an NCR written
4. Were dilution factors applied correctly
5. Was the data uploaded into LIMS via direct upload – if yes, then was a cross check subset of the uploaded values performed
6. Was the red marked data in LIMS checked for accuracy and the corresponding hard copy data documented appropriately
7. Were proper data qualifiers applied to the data in LIMS
8. Was the hard copy package checked for completeness to include all data for the sequence such that the data reviewer could reconstruct sample analyses and validate / approve the data

Table 4, Data Reviewers Checklist (Prior to approving data)

1. Does the hard copy raw data (or electronic raw data) package look complete and include all data points
2. Were QA objectives met and for failures were the appropriate actions taken
3. For direct uploads to LIMS, did a subset cross check match the raw data
4. Did all the manual entries into LIMS match the raw data
5. Were there appropriate signatures and documentation on the raw data
6. Were appropriate LIMS flags used
7. Were manual calculations verified

ANALYST DATA REVIEW CHECKLIST Sample Number(s):
Batch Number(s):
Method: 6010B or 6010C (ICP)

QA/QC Item	Yes	No	NA	Second Level Review
1. Were samples analyzed within USACE holding times?				
2. Was initial calibration curve QC criteria met?				
3. Was all continuing calibration criteria in control?				
4. Did any sample exceed the highest calibration standard? (If yes, were appropriate dilutions made to generate samples concentration within calibration range?)				
5. Did BS or blank spike meet control limits?				
6. Did MS/MSD meet control limits?				
7. Was the preparation (Method) Blank (BLK) below the project required detection limits?				
8. Did you return samples back to cold storage immediately after use?				
9. Was hot plate temperature monitored/documented and did you apply the thermometer correction factor?				
10. Sample preparation information is correct and complete.				
11. Analytical results are correct and complete.				
12. The appropriate SOP's have been used and followed.				
14. "Raw data" including all manual integration's have been correctly interpreted.				
15. "Special" sample preparation and analytical requirements have been met.				
16. Documentation complete (e.g., all anomalies in the analytical sequence have been documented, corrective action forms are complete.				

Comments on any "No" response:

_____

_____

_____

_____

_____

_____

Analyst: _____ Date: _____

SYNTHETIC PRECIPITATION LEACHING PROCEDURE

METHOD 1312

SOP NUMBER: **SOP-147**

REVISION NUMBER: **0**

APPROVED BY:

SECTION MANAGER

TECHNICAL DIRECTOR

EFFECTIVE DATE: **10/22/02**

DATE OF LAST REVIEW: **06/19/08**

METHOD 1312

SYNTHETIC PRECIPITATION LEACHING PROCEDURE

1.0 SCOPE AND APPLICATION

1.1 The SPLP is designed to determine the mobility of both organic and inorganic analytes present in liquids, soils, and wastes.

2.0 SUMMARY OF METHOD

2.1 For liquid samples, (i.e., those containing less than 0.5% dry solid material), the sample, after filtration through a 0.6 to 0.8 um glass fiber filter, is defined as the 1312 extract.

2.2 For samples containing greater than 0.5% solids, the liquid phase, if any, is separated from the solid phase and stored for later analysis; the particle size of the solid phase is reduced, if necessary. The solid phase is extracted with an amount of extraction fluid equal to 20 times the weight of the solid phase. The extraction fluid employed is a function of the region of the country where the sample site is located if the sample is a soil. If the sample is a waste or wastewater, the extraction fluid employed is a pH 4.2 solution. A special extractor vessel is used when testing for volatile analytes. Following extraction, the liquid extract is separated from the solid phase by filtration through a 0.6 to 0.8 um glass fiber filter.

2.3 If compatible (i.e., multiple phases will not form on combination), the initial liquid phase of the waste is added to the liquid extract, and these are analyzed together. If incompatible, the liquids are analyzed separately and the results are mathematically combined to yield a volume-weighted average concentration.

3.0 INTERFERENCES

3.1 Potential interferences that may be encountered during analysis are discussed in the individual analytical methods and related SOPs. (See section 2.2)

4.0 APPARATUS AND MATERIALS

4.1 Agitation apparatus: The agitation apparatus must be capable of rotating the extraction vessel in an end-over-end fashion at 30 $\pm$ 2 rpm. This rate is measured and recorded with each extraction to ensure accuracy of the equipment.

4.2 Extraction Vessels

4.2.1 Zero-Headspace Extraction Vessel (ZHE). This device is for use only when the sample is being tested for the mobility of volatile analytes. The ZHE allows for liquid/solid

separation within the device, and effectively precludes headspace. This type of vessel allows for initial liquid/solid separation, extraction, and final extract filtration without opening the vessel. These vessels shall have an internal volume of 500-600 mL, and be equipped to accommodate a 90-110 mm filter. The devices contain VITON®[1] O-rings which should be replaced frequently.

For the ZHE to be acceptable for use, the piston within the ZHE should be able to be moved with approximately 15 psig or less. If it takes more pressure to move the piston, the O-rings in the device should be replaced. If this does not solve the problem, the ZHE is unacceptable for 1312 analyses and the manufacturer should be contacted.

The ZHE should be checked for leaks after every extraction. If the device contains a built-in pressure gauge, pressurize the device to 50 psig, allow it to stand unattended for 1 hour, and recheck the pressure. If the device does not have a built-in pressure gauge, pressurize the device to 50 psi, submerge it in water, and check for the presence of air bubbles escaping from any of the fittings. If pressure is lost, check all fittings and inspect and replace O-rings, if necessary. Retest the device. If leakage problems cannot be solved, the manufacturer should be contacted.

Some ZHEs use gas pressure to actuate the ZHE piston, while others use mechanical pressure. Whereas the volatiles procedure refers to pounds per square inch (psi), for the mechanically actuated piston, the pressure applied is measured in torque-inch-pounds.

4.2.2 Bottle Extraction Vessel. When the sample is being evaluated using the nonvolatile extraction, a jar with sufficient capacity to hold the sample and the extraction fluid is needed. Headspace is allowed in this vessel.

The extraction bottles may be constructed from various materials, depending on the analytes to be analyzed and the nature of the waste. It is recommended that borosilicate glass bottles be used instead of other types of glass, especially when inorganics are of concern. Plastic bottles, other than polytetrafluoroethylene, shall not be used if organics are to be investigated.

4.3 Filtration Devices: It is recommended that all filtrations be performed in a hood or well ventilated area.

4.3.1 Zero-Headspace Extractor Vessel (ZHE): When the sample is evaluated for volatiles, the zero-headspace extraction vessel is used for filtration. The device shall be capable of supporting and keeping in place the glass fiber filter and be able to withstand the pressure needed to accomplish separation (50 psig).

NOTE: When it is suspected that the glass fiber filter has been ruptured, an in-line glass fiber filter may be used to filter the material within the ZHE.

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[1] VITON® is a trademark of Du Pont.

4.3.2 Filter Holder: When the sample is evaluated for other than volatile analytes, a filter holder capable of supporting a glass fiber filter and able to withstand the pressure needed to accomplish separation may be used. Suitable filter holders range from simple vacuum units to relatively complex systems capable of exerting pressures of up to 50 psi or more. Vacuum filtration can only be used for wastes with low solids content (<10%) and for highly granular, liquid-containing wastes. All other types of wastes should be filtered using positive pressure filtration.

4.3.3 Materials of Construction: Extraction vessels and filtration devices shall be made of inert materials which will not leach or absorb sample components of interest. Glass, polytetrafluoroethylene (PTFE), or type 316 stainless steel equipment may be used when evaluating the mobility of both organic and inorganic components.

4.4 Filters: Filters shall be made of borosilicate glass fiber, shall contain no binder materials, and shall have an effective pore size of 0.6 to 0.8 µm (Whatman GF/F), or equivalent. **Pre-filters must not be used. When evaluating the mobility of metals**, filters shall be acid-washed prior to use by rinsing with 1N nitric acid followed by three consecutive rinses with deionized distilled water (a minimum of 1 L per rinse is recommended). Glass fiber filters are fragile and should be handled with care.

4.5 pH Meters: The meter should be accurate to ± 0.05 units at 25°C.

4.6 ZHE Extract Collection Devices: VOA vials are used to collect the initial liquid phase and the final extract of the waste when using the ZHE device.

4.7 ZHE Extraction Fluid Transfer Devices: Any device capable of transferring the extraction fluid into the ZHE without changing the nature of the extraction fluid is acceptable (e.g., a positive displacement or peristaltic pump, a gas tight syringe, pressure filtration unit (see Section 4.3.2), or other ZHE device).

4.8 Laboratory Balance: Accurate to within ± 0.01 grams may be used (all weight measurements are to be within ± 0.1 grams).

4.9 Beaker or Erlenmeyer flask, glass, various sizes.

4.10 Watchglass

4.11 Magnetic stirrer.

5.0 REAGENTS

5.1 Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

5.2 Reagent Water. Reagent water is defined as water in which an interferant is not observed at or above the method's detection limit of the analyte(s) of interest. For nonvolatile extractions, ASTM Type II water or equivalent meets the definition of reagent water. For volatile extractions, it is recommended that reagent water be generated by any of the following methods.
Reagent water should be monitored periodically for impurities.

5.2.1 A water purification system may also be used to generate reagent water for volatile extractions.

5.2.2 Reagent water for volatile extractions may also be prepared by boiling water for 15 minutes. Subsequently, while maintaining the water temperature at 90 $\pm$ 5 degrees C, bubble a contaminant-free inert gas (e.g. nitrogen) through the water for 1 hour. While still hot, transfer the water to a narrow mouth screw-cap bottle under zero-headspace and seal with a Teflon-lined septum and cap.

5.3 Sulfuric acid/nitric acid (60/40 weight percent mixture) H_2SO_4/HNO_3. Cautiously mix 60 g of concentrated sulfuric acid with 40 g of concentrated nitric acid. If preferred, a more dilute H_2SO_4/HNO_3 acid mixture may be prepared and used in steps 5.4.1 and 5.4.2 making it easier to adjust the pH of the extraction fluids.

5.4 **Extraction fluids.**

5.4.1 Extraction fluid #1: This fluid is made by adding the 60/40 weight percent mixture of sulfuric and nitric acids (or a suitable dilution) to reagent water until the pH is 4.20 ± 0.05. The fluid is used to determine the leachability of soil from a site that is east of the Mississippi River, and the leachability of wastes and wastewaters. Determine the pH and record in appropriate reagent log (RL) notebook.

NOTE: Solutions are unbuffered and exact pH may not be attained.

5.4.2 Extraction fluid #2: This fluid is made by adding the 60/40 weight percent mixture of sulfuric and nitric acids (or a suitable dilution) to reagent water until the pH is 5.00 ±0.05. The fluid is used to determine the leachability of soil from a site that is west of the Mississippi River. Record in appropriate reagent log (RL) notebook.

5.4.2 Extraction fluid #3: This fluid is reagent water and is used to determine cyanide and volatiles leachability.

NOTE: These extraction fluids should be monitored frequently for impurities. The pH should be checked prior to use to ensure that these fluids are made up accurately. If impurities are found or the pH is not within the above specifications, the fluid shall be discarded and fresh extraction fluid prepared.

5.5 Analytical standards shall be prepared according to the appropriate analytical method.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

6.1 All samples shall be collected using an appropriate sampling plan.

6.2 There may be requirements on the minimal size of the field sample, depending upon the physical state or states of the waste and the analytes of concern. An aliquot is needed for the preliminary evaluations of the percent solids and the particle size. An aliquot may be needed to conduct the nonvolatile analyte extraction procedure. If volatile organics are of concern, another analyte may be needed. Quality control measures may require additional aliquots. Further it is always wise to collect more sample just in case something goes wrong with the initial attempt to conduct the test.

6.3 Preservatives shall not be added to samples before extraction.

6.4 Samples may be refrigerated unless refrigeration results in irreversible physical change tot the waste. If precipitation occurs the entire sample (including precipitate) should be extracted.

6.5 When the sample is to be evaluated for volatile analytes, care shall be taken to minimize the loss of volatiles. Samples shall be collected and stored in a manner intended to prevent the loss of volatile analytes (e.g., samples should be collected in Teflon -lined septum capped vials and stored at 4°C. Samples should be opened only immediately prior to extraction.

6.4 For volatiles, the samples shall be collected and stored in a manner intended to prevent the loss of volatile analytes (e.g., samples should be collected in Teflon-lined septum capped vials and stored at 4°C. Samples should be opened only immediately prior to extraction).

6.5 1312 extracts should be prepared for analysis and analyzed as soon as possible following extraction. **Extracts or portions of extracts for metallic analyte determinations must be acidified with nitric acid to a pH < 2, unless precipitation occurs (see Section 7.2.14 if precipitation occurs).** Extracts should be preserved for other analytes according to the guidance given in the individual analysis methods. Extracts or portions of extracts for organic analyte determinations shall not be allowed to come into contact with the atmosphere (i.e., no headspace) to prevent losses. See step 8.0 (Quality Control) for acceptable sample and extract holding times.

7.0 PROCEDURE

Care should be used in handling all samples. Safety glasses must be worn in the lab at all times. The use of blue nitrile gloves and lab coats is highly recommended.

Research into expected sample content and concentration should be done in order to be prepared for additional safety considerations. Generally, any samples which need special consideration have applicable notes on the sample logs.

MSDS are available for all reagents and standards, which have been purchased. These are located in the office next to the technical director.

7.1 Preliminary Evaluations

Perform preliminary 1312 evaluations on a minimum 100 gram aliquot of sample. This aliquot may not actually undergo 1312 extraction. These preliminary evaluations include: (1) determination of the percent solids (Step 7.1.1); (2) determination of whether the waste contains insignificant solids and is, therefore, its own extract after filtration (Step 7.1.2); (3) determination of whether the solid portion of the waste requires particle size reduction. (Step 7.1.3).

7.1.1 Preliminary determination of percent solids: Percent solids is defined as that fraction of a waste sample (as a percentage of the total sample) from which no liquid may be forced out by an applied pressure as described below.

7.1.1.1 If the sample will obviously yield no free liquid when subjected to pressure filtration, weigh out a representative subsample (100 g minimum) and proceed to Step 7.1.3.

7.1.1.2 If the sample is liquid or multiphasic, liquid/solid separation to make a preliminary determination of percent solids is required. This involves the filtration device discussed in Section 4.3.2 and is outlined in Sections 7.1.1.3 through 7.1.1.9.

7.1.1.3 Pre-weigh the filter and the container that will receive the filtrate.

7.1.1.4 Assemble the filter holder and filter following the manufacturer's instructions. Place the weighed filter in the buchner funnel.

7.1.1.5 Mix the sample and weigh out a representative subsample of (100gram minimum) and record exact weight.

7.1.1.6 Allow sludges to stand to permit the solid phase to settle. Samples that settle slowly may be centrifuged prior to filtration. Centrifugation is to be used only as an aid to filtration. If used, the liquid should be decanted and filtered followed by filtration of the solid portion of the waste through the same filtration system.

7.1.1.7 Quantitatively transfer the sample to the filter holder (liquid and solid phases). Spread the waste sample evenly over the surface of the filter. If filtration of the waste at 4°C reduces the amount of expressed liquid over what would be

expressed at room temperature, then allow the sample to warm up to room temperature in the device before filtering.

Gradually apply vacuum or gentle pressure of 1-10 psi, until air or pressurizing gas moves through the filter. If this point is not reached under 10 psi, and if no additional liquid has passed through the filter in any 2 minute interval, slowly increase the pressure in 10 psi increments to a maximum of 50 psi. After each incremental increase of 10 psi, if the pressurizing gas has not moved through the filter, and if no additional liquid has passed through the filter in any 2 minute interval, proceed to the next 10 psi increment. When the pressurizing gas begins to move through the filter, or when liquid flow has ceased at 50 psi (i.e., filtration does not result in any additional filtrate within any 2 minute period), stop the filtration.

NOTE: If sample material (>1% of original sample weight) has obviously adhered to the container used to transfer the sample to the filtration apparatus, determine the weight of this residue and subtract it from the sample weight determined in Section 7.1.1.5 to determine the weight of the waste sample that will be filtered.

7.1.1.8 The material in the filter holder is defined as the solid phase of the waste, and the filtrate is defined as the liquid phase.

NOTE: Some samples, such as oily wastes and some paint wastes, will obviously contain some material that appears to be a liquid but even after applying vacuum or pressure filtration, as outlined in Step 7.1.1.7, this material may not filter. If this is the case, the material within the filtration device is defined as a solid. Do not replace the original filter with a fresh filter under any circumstances. Use only one filter.

7.1.1.9 Determine the weight of the liquid phase by subtracting the weight of the filtrate container (see section 7.1.1.3) from the total weight of the filtrate-filled container. Determine the weight of the solid phase of the sample by subtracting the weight of the liquid phase from the weight of the total sample, as determined in Section 7.1.1.5 or 7.1.1.7.

Record the weight of the liquid and solid phases. Calculate the percent solids as follows:

$$\text{Percent solids} = \frac{\text{Weight of solid}}{\text{Total weight of waste}} \times 100$$

7.1.2 If the percent solids determined in Step 7.1.1.9 is equal to or greater than 0.5%, then proceed either to Step 7.1.3 to determine whether the solid material requires particle size reduction or to Step 7.1.2.1 if it is noticed that a small amount of the filtrate is entrained in wetting of the filter. If the percent solids is less than 0.5%, then proceed to Step 7.2.9 if the

nonvolatile 1312 analysis is to be performed and to Section 7.3 with a fresh portion of the waste if the volatile 1312 is to be performed.

7.1.2.1 Remove the solid material and filter from the filtration apparatus.

7.1.2.2 Dry the filter and solid material at 100 ± 20°C until 2 successive weighings yield the same value within ±1%. Record the final weight.

Caution: should be taken to ensure that the subject solid will not flash upon heating. It is recommended that the drying oven be vented to a hood or other appropriate device.

7.1.2.3 Calculate the percent dry solids as follows:

$$\text{Percent dry solids} = \frac{\text{(Wt. of dry waste + filter) - tared wt. of filter}}{\text{Initial wt. of waste}} \times 100$$

7.1.2.4 If the percent dry solids is less than 0.5%, then proceed to Step 7.2.9 if the nonvolatile 1312 analysis is to be performed, and to Step 7.3 if the volatile 1312 is to be performed. If the percent dry solids is greater than or equal to 0.5%, and if the nonvolatile 1312 analysis is to be performed, return to the beginning of this Step (7.1) and, with a fresh portion of sample, determine whether particle size reduction is necessary (Step 7.1.3).

7.1.3 Determination of whether the sample requires particle-size reduction: Using the solid portion of the sample, evaluate the solid for particle size. Particle size reduction is required, unless the solid passes through a 9.5 mm (0.375 inch) standard sieve). If the surface area is smaller or the particle size larger than described above, prepare the solid portion of the waste for extraction by crushing, cutting, or grinding the waste to a surface area or particle size as described above. If the solids are prepared for organic volatiles extraction, special precautions must be taken. (see Step 7.3.6).

NOTE: Surface area criteria are meant for filamentous (e.g., paper, cloth, and similar) waste materials. Actual measurement of surface area is not required, nor is it recommended. For materials that do not obviously meet the criteria, sample-specific methods would need to be developed and employed to measure the surface area. Such methodology is currently not available.

7.1.4 Determination of appropriate extraction fluid:

7.1.4.1 For soils, if the sample is from a site that is east of the Mississippi River, extraction fluid #1 should be used. If the sample is from a site that is west of the Mississippi River, extraction fluid #2 should be used.

7.1.4.2 For wastes and wastewater, extraction fluid #1 should be used.

7.1.4.3 For cyanide containing wastes and/or soils, extraction fluid #3 (reagent water) must be used because leaching of cyanide containing samples under acidic conditions may result in the formation of hydrogen cyanide gas.

7.1.5 If the aliquot of the waste used for the preliminary evaluation was determined to be 100% solid, then it can be used for the Step 7.2 extraction (assuming at least 100 grams remain), and the Step 7.3 extraction (assuming at least 25 grams remain). If the aliquot was subjected to the procedure in Step 7.1.1.7, then another aliquot shall be used for the volatile extraction procedure in step 7.3. The aliquot of the waste subjected to the procedure in step 7.1.1.7. might be appropriate for use for the Step 7.2 extraction if an adequate amount of solid (as determined by Step 7.1.1.9) was obtained. The amount of solid necessary is dependent upon whether a sufficient amount of extract will be produced to support the analyses. If an adequate amount of solid remains, proceed to Step 7.2.10 of the nonvolatile 1312 extraction.

7.2 Procedure When Volatiles Are Not Involved

A minimum sample size of 100 grams (solid and liquid phases) is recommended. If less than the specified amount is used, proportion extraction fluid accordingly and notify manager. In some cases, a larger sample size may be appropriate, depending on the solids content of the waste sample, whether the initial liquid phase of the waste will be miscible with the aqueous extract of the solid, and whether inorganics, semivolatile organics, pesticides, and herbicides are all analytes of concern. Enough solids should be generated for extraction such that the volume of 1312 extract will be sufficient to support all of the analyses required. If the amount of extract generated by a single 1312 extraction will not be sufficient to perform all of the analyses, more than one extraction may be performed and the extracts from each combined and aliquoted for analysis.

7.2.1 If the sample will obviously yield no liquid when subjected to pressure filtration (i.e., is 100% solid, see step 7.1.1), weigh out a subsample of the sample (100 gram minimum) and proceed to step 7.2.9.

7.2.2 If the sample is liquid or multiphasic, liquid/solid separation is required. This involves the filtration device described in step 4.3.2 and is outlined in steps 7.2.3 to 7.2.8.

7.2.3 Pre-weigh the container that will receive the filtrate.

7.2.4 Assemble the filter holder and filter following the manufacturer's instructions. Place the filter on the support screen and secure. Acid wash the filter if evaluating the mobility of metals (see step 4.4).

<u>NOTE</u>: Acid washed filters may be used for all nonvolatile extractions even when metals are not of concern.

7.2.5 Weigh out a subsample of the sample (100 gram minimum) and record the weight. If the waste contains <0.5% dry solids (step 7.1.2), the liquid portion of the waste, after filtration, is defined as the 1312 extract. Therefore, enough of the sample should be filtered so that the amount of filtered liquid will support all of the analyses required of the 1312 extract. For wastes containing >0.5% dry solids (Steps 7.1.1 or 7.1.2), use the percent solids information obtained in Step 7.1.1 to determine the optimum sample size (100 gram minimum) for filtration. Enough solids should be generated by filtration to support the analyses to be performed on the 1312 extract.

7.2.6 Allow slurries to stand to permit the solid phase to settle. Samples that settle slowly may be centrifuged prior to filtration. Use centrifugation only as an aid to filtration. If the sample is centrifuged, the liquid should be decanted and filtered followed by filtration of the solid portion of the waste through the same filtration system.

7.2.7 Quantitatively transfer the sample (liquid and solid phases) to the filter holder (see step 4.3.2). Spread the waste sample evenly over the surface of the filter. If filtration of the waste at 4 °C reduces the amount of expressed liquid over what would be expressed at room temperature, then allow the sample to warm up to room temperature in the device before filtering.

Gradually apply vacuum or gentle pressure of 1-10 psig, until air or pressurizing gas moves through the filter. If this point if not reached under 10 psig, and if no additional liquid has passed through the filter in any 20minute interval, slowly increase the pressure in 10-psig increments to maximum of 50 psig. After each incremental increase of 10 psig, if the pressurizing gas has not moved through the filter, and if no additional liquid has passed through the filter in any 2-minute interval, proceed to the next 10-psig increment. When the pressurizing gas begins to move through the filter, or when the liquid flow has ceased at 50 psig (i.e., filtration does not result in any additional filtrate within a 2-minute period) a stop the filtration.

<u>NOTE</u>: If waste material (>1 % of the original sample weight) has obviously adhered to the container used to transfer the sample to the filtration apparatus, determine the weight of this residue and subtract it from the sample weight determined in step 7.2.5, to determine the weight of the waste sample that will be filtered.

<u>NOTE</u>: Instantaneous application of high pressure can degrade the glass fiber filter and may cause premature plugging.

7.2.8 The material in the filter holder is defined as the solid phase of the sample, and the filtrate is defined as the liquid phase. Weigh the filtrate. The liquid phase

may now be either analyzed (see Step 7.2.12) or stored at 4°C until time of analysis.

NOTE: Some wastes, such as oily wastes and some paint wastes, will obviously contain some material which appears to be a liquid. Even after applying vacuum or pressure filtration, as outlined in Step 7.2.7, this material may not filter. If this is the case, the material within the filtration device is defined as a solid, and is carried through the extraction as a solid. Do not replace the original filter with a fresh filter under any circumstances. Use only one filter.

7.2.9 If the sample contains <0.5% dry solids (see Step 7.1.2), proceed to Step 7.2.13. If the sample contains >0.5% dry solids (see Step 7.1.1 or 7.1.2), and if particle-size reduction of the solid was needed in step 7.1.3, proceed to Step 7.2.10. If the sample as received passes a 9.5 mm sieve, quantitatively transfer the solid material into the extractor bottle along with the filter used to separate the initial liquid from the solid phase, and proceed to Step 7.2.11.

7.2.10 Prepare the solid portion of the sample for extraction by crushing, cutting, or grinding the waste to a surface area or particle-size as described in Step 7.1.3. When the surface area or particle-size has been appropriately altered, quantitatively transfer the solid material into an extractor bottle. Include the filter used to separate the initial liquid from the solid phase.

NOTE: Sieving of the waste is not normally required. Surface area requirements are meant for filamentous (e.g. paper, cloth) and similar waste materials. Actual measurement of surface area is not recommended. If sieving is necessary, a Teflon-coated sieve should be used to avoid contamination of the sample.

7.2.11 Determine the amount of extraction fluid to add to the extractor vessel as follows:

$$\text{Weight of extraction fluid} = \frac{20 \text{ x percent wet solids x weight of waste fltered}}{100}$$

Slowly add this amount of appropriate extraction fluid (see Step 7.1.4) to the extractor vessel. Close the extractor bottle tightly (it is recommended that Teflon tape be used to ensure a tight seal), secure in rotary extractor device, and rotate at 30 ±2 rpm for 18 ± 2 hours. Ambient temperature (i.e., temperature of room in which extraction takes place) shall be maintained at 23 ± 2°C during the extraction period.

NOTE: As agitation continues, pressure may build up within the extractor bottle for some types of sample (e.g. limed or calcium carbonate-containing sample may evolve gases such as carbon dioxide). To relieve excess pressure, the extractor bottle may be periodically opened (e.g., after 15 minutes, 30 minutes, and 1 hour) and vented into a hood.

7.2.12 Following the 18 (±2) hour extraction, separate the material in the extractor vessel into its component liquid and solid phases by filtering through a new glass fiber filter, as outlined in Step 7.2.7. For final filtration of the 1312 extract, the glass fiber filter may be changed, if necessary, to facilitate filtration. Filter(s) shall be acid-washed (see Step 4.4) if evaluating the mobility of metals.

7.2.13 Prepare the 1312 extract as follows:

7.2.13.1 If the sample contained no initial liquid phase, the filtered liquid material obtained form Step 7.2.12 is defined as the 1312 extract. Proceed to Step 7.2.14.

7.2.13.2 If compatible (e.g., multiple phases will not result on combination), combine the filtered liquid resulting from Step 7.2.12 with the initial liquid phase of the sample obtained in Step 7.2.7. This combined liquid is defined as the 1312 extract. Proceed to Step 7.2.14.

7.2.13.3 If the initial liquid phase of the waste, as obtained from Step 7.2.7, is not or may not be compatible with the filtered liquid resulting from Step 7.2.12, do not combine these liquids. Analyze these liquids, collectively defined as the 1312 extract, and combine the results mathematically, as described in Step 7.2.14.

7.2.14 Following collection of the 1312 extract, the pH of the extract must be recorded in the TCLP/SPLP logbook. Immediately aliquot and preserve the extract for analysis. Metals aliquots must be acidified with nitric acid to pH <2. If precipitation is observed upon addition of nitric acid to a small aliquot of the extract, then the remaining portion of the extract for metals analyses shall not be acidified and the extract shall be analyzed as soon as possible. All other aliquots must be stored under refrigeration (4°C) until analyzed. The 1312 extract shall be prepared and analyzed according to appropriate analytical methods. 1312 extracts to be analyzed for metals shall be acid digested by SW846 method 3010A except in those instances where digestion causes loss of metallic analytes. If an analysis of the undigested extract shows that the concentration of any regulated metallic analyte exceeds the regulatory level, then the waste is hazardous and digestion of the extract is not necessary. However, data on undigested extracts alone cannot be used to demonstrate that the waste is not hazardous. If the individual phases are to be analyzed separately, determine the volume of the individual phases (to ± 0.5%), conduct

the appropriate analyses, and combine the results mathematically by using a simple volume-weighted average:

$$\text{Final Analyte Concentration} = \frac{(V_1)(C_1) + (V_2)(C_2)}{V_1 + V_2}$$

where:

V_1 = The volume of the first phase (L).
C_1 = The concentration of the analyte of concern in the first phase (mg/L).
V_2 = The volume of the second phase (L).
C_2 = The concentration of the analyte of concern in the second phase (mg/L).

7.2.15 Compare the analyte concentrations in the 1312 extract with the levels identified in the appropriate regulations. Refer to Section 8.0 for quality assurance requirements.

7.3 Procedure When Volatiles Are Involved

Use the ZHE device to obtain 1312 extract for analysis of volatile compounds only. Extract resulting from the use of the ZHE shall not be used to evaluate the mobility of non-volatile analytes (e.g., metals, pesticides, etc.).

The ZHE device has approximately a 500 mL internal capacity. The ZHE can thus accommodate a maximum of 25 grams of solid (defined as that fraction of sample from which no additional liquid may be forced out by an applied pressure of 50 psig), due to the need to add an amount of extraction fluid equal to 20 times the weight of the solid phase.

Charge the ZHE with sample only once and do not open the device until the final extract (of the solid) has been collected. Repeated filling of the ZHE to obtain 25 grams of solid is not permitted.

Do not allow the sample, the initial liquid phase, or the extract to be exposed to the atmosphere for any more time then is absolutely necessary. Any manipulation of these materials should be done when cold (4°C) to minimize loss of volatiles.

All glassware and equipment must be thoroughly cleaned before use. A hot soapy water wash and rinse with tap water, then repeat following with a DI water rinse. Rinse with methanol and a final rinse with DI water.

7.3.1 Preweigh the (evacuated) filtrate collection container (see Step 4.6)
7.2.2 If the sample is liquid or multiphasic, liquid/solid separation is required. This involves the filtration device described in Section 4.3.2 and is outlined in Sections 7.2.3 to 7.2.8.

7.2.3 Pre-weigh the container that will receive the filtrate.

7.2.4 Assemble the filter holder and filter following the manufacturer's instructions. Place the filter on the support screen and secure. Acid wash the filter if evaluating the mobility of metals (see Section 4.4).

7.2.5 Weigh out a subsample of the waste (100 gram minimum) and record the weight. If the waste contains <0.5% dry solids, the liquid portion, after filtration, is defined as the TCLP extract. Therefore, enough of the sample should be filtered so that the amount of filtered liquid will support all of the analyses required. For wastes containing >0.5% dry solids use the percent solids information to determine the optimum sample size (100 gram minimum) for filtration.

7.2.6 Allow sludges to stand to permit the solid phase to settle. Wastes that settle slowly may be centrifuged prior to filtration. Use centrifugation only as an aid to filtration. If the waste is centrifuged, the liquid should be decanted and filtered followed by filtration of the solid portion of the waste through the same filtration system.

7.2.7 Refer to Section 7.1.1.7.

7.2.8 Refer to Section 7.1.1.8.

7.2.9 If the waste contains <0.5% dry solids, proceed to Section 7.2.13. If the waste contains >0.5% dry solids, and if particle size reduction of the solid was needed in Section 7.1.3, proceed to Section 7.2.10. If the waste as received passes a 9.5 mm sieve, quantitatively transfer the solid material into the extractor bottle along with the filter used to separate the initial liquid from the solid phase, and proceed to Section 7.2.11.

7.2.10 Prepare the solid portion of the waste for extraction by crushing, cutting, or grinding the waste to a surface area or particle size as described in Section 7.1.3. When the surface area or particle size has been appropriately altered, quantitatively transfer the solid material into an extractor bottle. Include the filter used to separate the initial liquid from the solid phase.

NOTE: Sieving of the waste is not normally required. Surface area requirements are meant for filamentous (e.g., paper, cloth) and similar waste materials. Actual measurement of surface area is not recommended. If sieving is necessary, a Teflon coated sieve should be used to avoid contamination of the sample.

7.2.11 Determine the amount of extraction fluid to add to the extractor vessel as follows:

$$\text{Weight of extraction fluid} = \frac{20 \text{ x percent wet solids x weight of waste fltered}}{100}$$

Slowly add this amount of appropriate extraction fluid to the extractor vessel. Close the extractor bottle tightly (it is recommended that Teflon tape be used to ensure a tight seal), secure in rotary agitation device, and rotate at 30 $\pm$ 2 rpm for 18 $\pm$ 2 hours. Ambient

temperature shall be maintained at 23 ± 2 □C during the extraction period. Record both tumble rate and room temperature.

NOTE: As rotation continues, pressure may build up within the extractor bottle for some types of wastes. To relieve excess pressure, the extractor bottle should be periodically opened (e.g., after 15 minutes, and 30 minutes) and vented into a hood.

7.2.12 Following the 18 ± 2 hour extraction, separate the material in the extractor vessel into its component liquid and solid phases by filtering through a new glass fiber filter, as outlined in Section 7.2.7. For final filtration of the TCLP extract, the glass fiber filter may be changed, if necessary, to facilitate filtration. Filter(s) shall be acid-washed.

7.2.13 Prepare the TCLP extract as follows:

7.2.13.1 If the sample contained no initial liquid phase, the filtered liquid material obtained is defined as the TCLP extract. Proceed to Section 7.2.14.

7.2.13.2 If compatible (e.g., multiple phases will not result on combination), combine the filtered liquid resulting from Section 7.2.12 with the initial liquid phase of the waste obtained in Section 7.2.7. This combined liquid is defined as the TCLP extract. Proceed to Section 7.2.14.

7.2.13.3 If the initial liquid phase of the waste, as obtained from Section 7.2.7, is not or may not be compatible with the filtered liquid resulting from Section 7.2.12, do not combine these liquids. Analyze these liquids, collectively defined as the TCLP extract, and combine the results mathematically, as described in Section 7.2.14.

7.2.14 Following collection of the TCLP extract, the pH of the extract must be recorded. Immediately split aliquots, give to appropriate analyst for spiking and preservation of the extract for analysis. Metal aliquots must be acidified with nitric acid to pH <2. (If precipitation is observed upon addition of nitric acid to a small aliquot of the extract, then the remaining portion of the extract for metals analyses shall not be acidified and the extract shall be analyzed as soon as possible.) All other aliquots must be stored under refrigeration (4°C) until analyzed. TCLP extracts to be analyzed for metals shall be acid digested except in those instances where digestion causes loss of metallic analytes. Refer also to sections 2.2 and 6.5.

If the individual phases are to be analyzed separately, determine the volume of the individual phases (to ± 0.5%), conduct the appropriate analyses, and combine the results mathematically by using a simple volume-weighted average:

$$\text{Final Analyte Concentration} = \frac{(V_1)(C_1) + (V_2)(C_2)}{V_1 + V_2}$$

where:

V_1 = The volume of the first phase (L).
C_1 = The concentration of the analyte of concern in the first phase (mg/L).
V_2 = The volume of the second phase (L).
C_2 = On next page
C_2 = The concentration of the analyte of concern in the second phase (mg/L).

7.3 Volatiles Extraction Procedure

Use ZHE device to obtain TCLP extract for analysis of volatile compounds only.

The ZHE device has approximately a 500 mL internal capacity. The ZHE can thus accommodate a maximum of 25 grams of solid due to the need to add an amount of extraction fluid equal to 20 times the weight of the solid phase.

Charge the ZHE with sample only once and do not open the device until the final extract has been collected. Repeated filling of the ZHE to obtain 25 grams of solid is not permitted.

Do not allow the waste, the initial liquid phase, or the extract to be exposed to the atmosphere for any more time than is absolutely necessary. Any manipulation of these materials should be done when cold (4°C) to minimize loss of volatiles.

All glassware and equipment must be thoroughly cleaned before use. A hot soapy water wash and rinse with tap water, then repeat following with a DI water rinse. Rinse with methanol and a final rinse with DI water.

7.3.1 Pre-weigh the (evacuated) filtrate collection container (Step 4.6) and set aside. If using a TEDLAR® bag, express all liquid from the ZHE device into the bag, whether for the initial or final liquid/solid separation, and take an aliquot from the liquid in the bag for analysis.

7.3.2 Place the ZHE piston within the body of the ZHE (it may be helpful first to moisten the piston O-rings slightly with extraction fluid). Adjust the piston within the ZHE body to a height that will minimize the distance the piston will have to move once the ZHE is charged with sample (based upon sample size requirements determined from Section 7.3, Section 7.1.1 and/or 7.1.2). Secure the gas inlet/outlet flange (bottom flange) onto the ZHE body in accordance with the manufacturer's instructions. Secure the glass fiber filter between the support screens and set aside. Set liquid inlet/outlet flange (top flange) aside.

7.3.3 If the sample is 100% solid, weigh out a subsample (25 gram maximum) of the waste, record weight, and proceed to Section 7.3.5.

7.3.4 If the sample contains < 0.5% dry solids, the liquid portion of waste, after filtration, is defined as the 1312 extract. Filter enough of the sample so that the amount of filtered liquid will support all of the volatile analyses required. For samples containing ≥ 0.5% dry

solids, use the percent solids information obtained in Step 7.1.1 to determine the optimum sample size to charge into the ZHE. The recommended sample size is as follows:

7.3.4.1 For samples containing < 5% solids, weigh out a 500 gram subsample of waste and record the weight.

7.3.4.2 For samples containing >5% solids, determine the amount of waste to charge into the ZHE as follows:

$$\text{Weight of waste to charge ZHE} = \frac{25}{\text{percent wet solids}} \times 100$$

Weigh out a subsample of the waste of the appropriate size and record the weight.

7.3.5 If particle size reduction of the solid portion of the waste was required in Section 7.1.3, proceed to Section 7.3.6. If particle size reduction was not required in Section 7.1.3, proceed to Section 7.3.7.

7.3.6 Prepare the sample for extraction by crushing, cutting, or grinding the solid portion of the waste to a surface area or particle size as described in Section 7.1.3.1. The means used to effect particle size reduction must not generate heat in and of itself. If reduction of the solid phase of the waste is necessary, exposure of the waste to the atmosphere should be avoided to the extent possible.

NOTE: Sieving of the waste is not recommended due to the possibility that volatiles may be lost. The use of an appropriately graduated ruler is recommended as an acceptable alternative. Surface area requirements are meant for filamentous (e.g., paper, cloth) and similar waste materials. Actual measurement of surface area is not recommended.

When the surface area or particle size has been appropriately altered, proceed to Section 7.3.7.

7.3.7 Waste slurries need not be allowed to stand to permit the solid phase to settle. Do not centrifuge wastes prior to filtration.

7.3.8 Quantitatively transfer the entire sample (liquid and solid phases) quickly to the ZHE. Secure the filter and support screens into the top flange of the device and secure the top flange to the ZHE body in accordance with the manufacturer's instructions. Tighten all ZHE fittings and place the device in the vertical position (gas inlet/outlet flange on the bottom). Do not attach the extract collection device to the top plate.

NOTE: If sample material (>1% of original sample weight) has obviously adhered to the container used to transfer the sample to the ZHE, determine the weight of this residue and

subtract it from the sample weight determined in Section 7.3.4 to determine the weight of the waste sample that will be filtered.

Attach a gas line to the gas inlet/outlet valve (bottom flange) and, with the liquid inlet/outlet valve (top flange) open, begin applying gentle pressure of 1-10 psi (or more if necessary) to force all headspace slowly out of the ZHE device into a hood. At the first appearance of liquid from the liquid inlet/outlet valve, quickly close the valve and discontinue pressure. If filtration of the waste at 4°C reduces the amount of expressed liquid over what would be expressed at room temperature, then allow the sample to warm up to room temperature in the device before filtering. If the waste is 100% solid (see Section 7.1.1), slowly increase the pressure to a maximum of 50 psig to force most of the headspace out of the device and proceed to Section 7.3.12.

7.3.9 Attach the evacuated pre-weighed filtrate collection container to the liquid inlet/outlet valve and open the valve. Begin applying gentle pressure of 1-10 psig to force the liquid phase of the sample into the filtrate collection container. If no additional liquid has passed through the filter in any 2 minute interval, slowly increase the pressure in 10 psig increments to a maximum of 50 psig. After each incremental increase of 10 psig, if no additional liquid has passed through the filter in any 2 minute interval, proceed to the next 10 psig increment. When liquid flow has ceased such that continued pressure filtration at 50 psig does not result in any additional filtrate within a 2 minute period, stop the filtration. Close the liquid inlet/outlet valve, discontinue pressure to the piston, and disconnect and weigh the filtrate collection container.

NOTE: Instantaneous application of high pressure can degrade the glass fiber filter and may cause premature plugging.

7.3.10 The material in the ZHE is defined as the solid phase of the waste and the filtrate is defined as the liquid phase.

NOTE: Some samples, such as oily wastes and some paint wastes, will obviously contain some material that appears to be a liquid. Even after applying pressure filtration, this material will not filter. If this is the case, the material within the filtration device is defined as a solid and is carried through the 1312 extraction as a solid.

If the original waste contained <0.5% dry solids, this filtrate is defined as the 1312 extract. Proceed to Section 7.3.15.

7.3.11 The liquid phase may now be either analyzed immediately or preserved and stored at 4°C under minimal headspace conditions until time of analysis. Determine the weight of extraction fluid #3 to add to the ZHE as follows:

$$\text{Weight of extraction fluid} = \frac{20 \text{ x percent wet solids x weight of waste filtered}}{100}$$

7.3.12 The following details how to add the appropriate amount of extraction fluid to the solid material within the ZHE and agitation of the ZHE vessel. Extraction fluid #3 is used in all cases.

7.3.12.1 With the ZHE in the vertical position, attach a line from the extraction fluid reservoir to the liquid inlet/outlet valve. The line used shall contain fresh extraction fluid and should be preflushed with fluid to eliminate any air pockets in the line. Release gas pressure on the ZHE piston (from the gas inlet/outlet valve), open the liquid inlet/outlet valve, and begin transferring extraction fluid (by pumping or similar means) into the ZHE. Continue pumping extraction fluid into the ZHE until the appropriate amount of fluid has been introduced into the device.

7.3.12.2 After the extraction fluid has been added, immediately close the liquid inlet/outlet valve and disconnect the extraction fluid line. Check the ZHE to ensure that all valves are in their closed positions. Manually rotate the device in an end-over-end fashion 2 or 3 times. Reposition the ZHE in the vertical position with the liquid inlet/outlet valve on top. Pressurize the ZHE to 5-10 psig (if necessary) and slowly open the liquid inlet/outlet valve to bleed out any headspace that may have been introduced due to the addition of extraction fluid. This bleeding shall be done quickly and shall be stopped at the first appearance of liquid from the valve. Re-pressurize the ZHE with 5-10 psig and check all ZHE fittings to ensure that they are closed.

7.3.12.3 Place the ZHE in the rotary agitation apparatus and rotate at 30 $\pm$ 2 rpm for 18 $\pm$ 2 hours. Ambient temperature (i.e., temperature of room in which extraction occurs) shall be maintained at 23 $\pm$ 2°C during agitation. Record both tumble rate and temperature.

7.3.13 Following the 18 $\pm$ 2 hour period, check the pressure behind the ZHE piston by quickly opening and closing the gas inlet/outlet valve and noting the escape of gas. If the pressure has not been maintained (i.e., no gas release observed), the device is leaking. Check the ZHE for leaking as specified in Section 4.2.1, and perform the extraction again with a new sample of waste. If the pressure within the device has been maintained, the material in the extractor vessel is once again separated into its component liquid and solid phases. If the waste contained an initial liquid phase, the liquid may be filtered directly into the same filtrate collection container (i.e., TEDLAR® bag or VOC vials) holding the initial liquid phase of the waste. A separate filtrate collection container must be used if combining would create multiple phases, or there is not enough volume left within the filtrate collection container. Filter through the glass fiber filter, using the ZHE device as discussed in Section 7.3.9. All extract shall be filtered and collected if the TEDLAR® bag is used, if the extract is multiphasic, or if the waste contained an initial liquid phase.

NOTE: An in-line glass fiber filter may be used to filter the material within the ZHE if it is suspected that the glass fiber filter has been ruptured.

7.3.14 If the original sample contained no initial liquid phase, the filtered liquid material obtained from above is defined as the 1312 extract. If the sample contained an initial liquid phase, the filtered liquid material obtained from above and the initial liquid phase (Section 7.3.9) are collectively defined as the 1312 extract.

7.3.15 Following collection of the 1312 extract, immediately prepare the extract for analysis and store with minimal headspace at 4°C HCI until analyzed. Analyze the 1312 extract according to the appropriate analytical methods. If the individual phases are to be analyzed separately (i.e., are not miscible), determine the volume of the individual phases (to 0.5%), conduct the appropriate analyses, and combine the results mathematically by using a simple volume-weighted average:

$$\text{Final Analyte Concentration} = \frac{(V_1)(C_1) + (V_2)(C_2)}{V_1 + V_2}$$

where:

V_1 = The volume of the first phases (L).
C_1 = The concentration of the analyte of concern in the first phase (mg/L).
V_2 = The volume of the second phase (L).
C_2 = The concentration of the analyte of concern in the second phase (mg/L).

8.0 QUALITY ASSURANCE

8.1 A minimum of one blank (using the same extraction fluid as used for the samples) must be analyzed for every 20 extractions that have been conducted in an extraction vessel. No bias correction is to be taken into consideration (Fr 57, 227).

8.2 A matrix spike shall be performed for each waste type (e.g., wastewater treatment sludge, contaminated soil, etc.) unless the result exceeds the regulatory level and the data is being used solely to demonstrate that the waste property exceeds the regulatory level, the spike concentration may be as low as one half of the analyte concentration, but may not be less than five times the method detection limit. In order to avoid differences in matrix effects, the matrix spikes must be added to the same nominal volume of 1312 extract as that which was analyzed for the unspiked sample.

8.2.1 Matrix spikes are to be added after filtration of the 1312 extract and before preservation. Matrix spikes should not be added prior to 1312 extraction of the sample.

8.2.2 The matrix spikes should be added at a concentration equivalent to the corresponding regulatory level. If the analyte concentration is less than one half the regulatory level, the spike concentration may be as low as one half of the analyte concentration, but may not be less than five times the method detection limit. In order to avoid differences in matrix

effects, the matrix spikes must be added to the same nominal volume of 1312 extract as that which was analyzed for the unspiked sample.

8.2.3 The matrix spike is to monitor the performance of the analytical methods used, and to determine whether matrix interferences exist. Use of other internal calibration methods, modification of the analytical methods, or use of alternate analytical methods may be needed to accurately measure the analyte concentration in the 1312 extract when the recovery of the matrix spike is below the expected analytical method performance.

8.2.4 Matrix spike recoveries are calculated by the following formula:

$$\%R\ (\%Recovery) = 100\ (X_s - X_u)/K$$

where:

X_s = measured value for the spiked sample,
X_u = measured value for the unspiked sample, and
K = known value of the spike in the sample.

8.3 All quality control measures described in each analytical methods must be followed.

8.4 The use of internal calibration quantitation methods shall be employed for a metallic contaminant if: (1) Recovery of the contaminant from the 1312 extract is not at least 50% and the concentration does not exceed the appropriate regulatory level, and (2) The concentration of the contaminant measured in the extract is within 20% of the appropriate regulatory level.

8.4.1 The method of standard addition (MSA) shall be employed as the internal calibration quantitation method for each metallic contaminant.

8.4.2 The method of standard additions requires preparing calibration standards in the sample matrix rather than reagent water or blank water or blank solution. It requires taking four identical aliquots of the solution and adding known amounts of standard to three of these aliquots. The forth aliquot is the unknown. Preferably, the first addition should be prepared so that the resulting concentration is approximately 50% of the expected concentration of the sample. The second and third additions should be prepared so that the concentrations are approximately 100% and 150% of the expected concentration of the sample. All four aliquots are maintained at the same final volume by adding reagent water or a blank solution, and may need dilution adjustment to maintain the signals in the linear range of the instrument technique. Analyze all four aliquots.

8.4.3 Prepare a plot, or subject data to linear regression, of instrument signals or external-calibration-derived concentrations as the dependant variable (y-axis) versus concentrations of the additions of standards as the independent variable (x-axis). Solve for the intercept of the abscissa (the independent variable, x-axis) which is the concentration in the unknown.

8.4.4 Alternately, subtract the instrumental signal or external-calibration-derived concentration of the unknown (unspiked) sample from the instrumental signals or external-calibration-derived concentrations of the standard additions. Plot r subject to linear regression of the corrected instrument signals or external-calibration-derived concentrations as the dependant variable versus the independent variable. Derive concentrations for the unknowns using the internal calibration curve as if it were an external calibration curve.

8.5 Samples must undergo 1312 extraction within the following time periods:

SAMPLE MAXIMUM HOLDING TIMES [DAYS]

	From: Field collection To: 1312 extraction	From: 1312 extraction To: Preparative extraction	From: Preparative extraction To: Determinative analysis	Total elapsed time
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

If holding times are exceeded, the values obtained will be considered minimal concentrations. Exceeding the holding time is not acceptable in establishing that a waste does not exceed the regulatory level. Of course, exceeding the holding time will not invalidate characterization if the waste exceeds the regulatory level.

9.0 HEALTH AND SAFETY

9.1 Care should be used in handling all samples. Safety glasses must be worn in the lab at all times. The use of blue nitrile gloves and lab coats is highly recommended.

9.2 Research into expected sample content and concentration should be done in order to be prepared for additional safety considerations. Generally, any samples which need special consideration have applicable notes on the sample logs.

9.3 MSDS are available for all reagents and standards, which have been purchased. These are located in the administrative section next to the break room.

9.4 Please see *Waste Disposal; SOP-405* for proper disposal of the waste generated from this area.

EMPIRICAL LABORATORIES, LLC
STANDARD OPERATING PROCEDURE

ORGANICS: SOP 211 **REVISION #: 21** **EFFECTIVE DATE: 041110**

GAS CHROMATOGRAPHY/ELECTRON CAPTURE DETECTOR (GC/ECD) ORGANOCHLORINE PESTICIDES/POLYCHLORINATED BIPHENYLS (PCB) BY EPA METHOD 608/608.2 or SW846 METHOD 8081A/8082 or 8081B/8082A

APPROVALS:

Lab Director: _____ Date: 4/12/10

Data Quality Manager: _____ Date: 4/11/10

Section Supervisor: _____ Date: 4/13/10

Changes Summary

Revision 21, 04/11/10

- The SOP is an update from Revision 20 dated 04/27/09
- The SOP is formatted to include all 22-elements required per the NELAC standards
- The laboratory's revision of all technical SOPs now includes a Table of Contents that provides the map of the technical information contained within the SOP.
- Additional requirements, based upon the DoD QSM 4.1, have been integrated into the routine sample flow; however, if the requirement is different from routine sample flow, then the requirement is outlined and documented as such to be followed only when DoD samples are analyzed.

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1.0 Identification of the Test Method

This SOP is compliant with SW-846 Methods 8000B/8081A/8082 and 8000C/8081B/8082A. *Federal Register* Method 608/608.2 and CLP Method for Pesticides have also been used in the development of this SOP.

2.0 Applicable Matrix or Matrices

This Standard Operating Procedure, SOP, is used for the analysis of Pesticide/PCB organic compounds in a variety of matrices (soils, sediments, waters, etc.).

3.0 Detection Limit

See Table1

4.0 Scope of Application, Including Components to Be Analyzed

4.1 Each parameter that is analyzed and reported under the scope of this SOP is listed in **Table 1** of this SOP. This table also lists the associated Detection Limit/Method Detection Limit, Limit of Detection and Reporting Limit/Limit of Quantitation for each analyte.

4.3 Extreme care should be taken when working with pure standard and stock standard solutions of these compounds. These compounds have been classified as known or suspected human or mammalian carcinogens.

5.0 Summary of the Test Method

After sample preparation using the appropriate extraction technique, the sample is introduced into the GC using direct injection. The analytes are separated in the gas chromatograph by a combination of the temperature program and the capillary column. The analytes are then detected by the ECD. Pesticide analytes are identified and confirmed based on the retention time of known standards. PCB and multi-component pesticide analytes are identified based on pattern recognition. Analytes are quantitated relative to known standards using the external standard method.

6.0 Definitions

Laboratory Quality System SOP QS08 **"**Technical / Operational Definitions, Minimum Essential Quality Control Elements, and Laboratory Calibration Procedures" provides information on the commonly used definitions.

7.0 Interferences

Section 3.0 of SW-846 Methods 8081A/8082 and Section 4.0 of Methods 8081B/8082A details interferences and potential problems which may be encountered when dealing with pesticide/PCB analyses. Please see sample clean-up SOPs (307, 308, 309 and 330) to evaluate possible clean-up options for any encountered interferences.

8.0 Safety

8.1 Laboratory SOP QS13 "Safety Program & Chemical Hygiene Plan" discusses the safety program that is to be followed labwide.

8.2 Care should be used in handling all samples. Safety glasses must be worn in the lab at all times. The use of latex gloves and lab coats is highly recommended.

8.3 Research into expected sample content and concentration should be done in order to be prepared for additional safety considerations. Generally, any samples that need special consideration have applicable notes on the sample logs.

8.4 MSDS sheets are available for all reagents and standards that have been purchased. These are located on the bookshelves in the Quality Assurance Officer's office.

9.0 Equipment & Supplies

9.1 GC's:

9.1.1 Agilent 6890N- complete with temperature programmable gas chromatograph suitable for split/splitless injection.

9.2 Columns:

9.2.1 RTX-CLP (or equivalent): 30 meter x 0.32 mm ID x 0.5 µm film thickness fused silica column.

9.2.2 RTX-CLP II (or equivalent): 30 meters x 0.32 mm ID x 0.5 µm film thickness fused silica column.

9.3 Autosamplers:

9.3.1 Agilent 7683 autosamplers capable of reproducibility from one injection to another, proven by meeting QC and calibration criteria.

9.4 Acquisition Software: HP Chemstation system is interfaced to the GC. The system acquires and stores data throughout the chromatographic program.

9.5 Data Processing Software: Target DB Windows NT data system is interfaced to the HP Chemstation. The system accepts, processes and stores acquired data.

10.0 Reagents and Standards

10.1 The laboratory's LIMS system allows for complete documentation and for the traceability of reagents and standards used within the laboratory. The following information relates to the specific reagents and standards used for the performance of the method:

10.2 Stock standards are purchased in mixtures from reputable vendors. The date they are received is noted on the COA and recorded in the LIMS. The date they are opened is recorded in the LIMS along with their lot number and vendor and given a sequential number. Each standard that is prepared is recorded in the LIMS and given a sequential number. The following are noted in the LIMS: standard makeup, solvent used, date received, date opened, date prepared, expiration date and analyst. Each standard label is completed with the standard number, name, concentration, expiration date, and analyst initials. All stocks and standards are stored in the refrigerator at a temperature of 1°C-4.4°C from the date they are received/prepared. The refrigerator and freezer temperature is monitored daily with an annually calibrated thermometer and recorded with calibration correction in the GC refrigerator temperature logbook. See the LIMS system for makeup of intermediate and calibration standards.

10.2.1 The Initial Calibration Verification (ICV) intermediate standard is prepared from the vendor stock standards in the same manner as the Calibration intermediate standards above and is stored in the refrigerator at a temperature of 1°C-4.4°C for up to 6 months. The ICV standard is then prepared at a concentration near the midpoint in the same manner as the Calibration standards above.

10.3 List of Reagents:

Hexane - pesticide quality or equivalent.

11.0 Sample Collection, Preservation, Shipment, and Storage

Section 3.0 and Table 3-1 of the Empirical Laboratories, LLC Quality Assurance Manual includes details concerning sample preservation, containers and handling of samples and extracts. All water and soil samples are stored in the appropriate walk-in cooler in sample storage at a temperature of 1°C – 4.4°C. All extracts are stored in the Hobart in Semivolatile laboratory at a temperature of 1°C – 4.4°C. Water samples have a holding time of 7 days from date of sampling to extraction. Soil samples have a holding time of 14 days from date of sampling to extraction (unless otherwise specified for the project). Extracts have a holding time of 40 days from extraction to analysis.

12.0 Quality Control

12.1 Quality Systems SOP QS08 "Technical / Operational Definitions, Minimum Essential Quality Control Elements, and Laboratory Calibration Procedures" outlines details related to laboratory wide protocols on quality control.

12.2 An initial demonstration must be performed by each analyst performing this method. Four LCSs are analyzed at 0.10ug/L. See **Table 2** for acceptance criteria.

12.3 Surrogates - All samples and QC are spiked with surrogates. The surrogate recoveries from method blanks and LCS are charted to generate control ,limits and charts for diagnostic purposes. See section 14.9.5 for criteria and corrective action.

12.4 LCS Sample - The LCS is extracted with every extraction batch - up to 20 samples. To prepare the LCS, a blank is spiked with standards prepared from an alternate vendor or lot number than the calibration standards. The recoveries are charted to generate control charts and limits. See the LCS report form in the appendix for the laboratory generated limits. These limits default to method limits if generated limits are wider. If the LCS compound has a recovery above the upper limit, but the same compound is not detected in any of the batch samples, no corrective action is required. For all other situations, the LCS should be reanalyzed for the failed analytes only or results for that analyte should be flagged. If the second analysis fails, all associated samples should be reextracted/reanalyzed for the failed analytes only. **DOD limits will be used for DOD QSM projects.**

12.5 Method Blanks - The concentration of all method target analytes should be below the MDL **(< ½ RL, all other compounds or client/authority specified)** for each method target analyte. If contamination exceeds the requirement, the following corrective actions must be taken. The first step is to assess the effect on the samples. If an analyte is found only in the method blank, but not in any batch samples, no further corrective action may be necessary. Steps should be taken to find/reduce/eliminate the source of this contamination in the method blank. If an analyte is found in the method blank and some, or all, of the other batch samples, then corrective action is required. The source of contamination must be investigated and appropriate action taken and documented to find/reduce/eliminate the source of this contamination. The method blank, and any samples containing the same contaminant, would likely be reextracted/reanalyzed. Random cases of contamination are difficult to control, however, daily contamination is not acceptable and corrective action is essential. If a contaminant is found in the method blank and the samples, the compound concentration must be flagged with a 'B' on the final report unless the concentration is greater than 10x that found in the method blank.

12.6 Matrix Spike/Matrix Spike Duplicate (MS/MSD) Sample - 1 in 20 samples are spiked for a MS/MSD (for 608 projects, 1 in 10 samples are spiked for MS). The LCS standard is used for spiking. Both the percent recoveries (%R) and relative percent differences (RPDs) are the same as the LCS limits. Samples that do not meet these criteria due to

matrix should be evaluated for placing a flag on the final report due to QC problems. The associated LCS results should be used to verify method performance (Section 8.4.3 Method 8081A). MS data evaluation must include the consideration of the following factors.

12.6.1 Sample matrix - If the sample is a soil, grab sample or sequentially collected water sample it may affect the %R and RPD of the MS/MSD. Corrective action must be taken in the form of reanalysis if a method problem is indicated.

12.6.2 Original sample concentration - If a spiked compound has a problem and the concentration of that compound in the original sample was more than four times the concentration of the spike, no further corrective action may be necessary other than the generation of a corrective action report to document the problem. In this case, the MS/MSD may be evaluated as sample duplicates.

12.6.3 MS vs. MSD - If a spiked compound has a similar problem in both the MS and MSD and is not traced to a method problem, no further action may be necessary other than the generation of a corrective action report to document the problem.

12.6.4 Non-target Interference - The presence of significant non-target interference should be brought to the immediate attention of your supervisor who should discuss the problem with the client/project manager to determine the action to be taken.

12.6.5 Documentation of capability (DOC) – Each analyst must perform a DOC to demonstrate proficiency with this method. Refer to SOP-413 for guidance.

13.0 Calibration and Standardization

13.1 Quality Systems **SOP QS08 "**Technical / Operational Definitions, Minimum Essential Quality Control Elements, and Laboratory Calibration Procedures" related to Calibration Procedures provides laboratory wide protocols for calibration and standardization.

13.2 See Section 14.4 for Calibration details.

14.0 Procedure

14.1 The GC/ECD should be primed by injecting a pesticide standard at 200-500 µg/L and/or PCB standard at 2,500 µg/L, 10 times more concentrated than the mid-level standard. Inject this prior to beginning initial or daily calibration.

14.2 Chromatographic conditions:

ZB MR1/MR2 columns:

GC	ECD3
Purge on	0.50 min.
Injector/Detector temperature	250/350°C
Column flow	@3.4 mL/min
Initial column temperature	100°C for 0.5 minutes
Temperature ramp	15°C/min
Intermediate column temperature	220°C for 5.0 minutes

Second Temperature Ramp	35°C/min
Final Column Temperature	340°C for 2.0 minutes
RTX-CLP/RTX CLPII columns:	ECD4
GC	
Purge on	0.50 min.
Injector/Detector temperature	250/350°C
Column flow	@3.4 mL/min
Initial column temperature	100°C for 0.5 minutes
Temperature ramp	15°C/min
Final column temperature	340°C for 2.0 minutes

14.3 Eval Mix – Before pesticide calibration and/or sample analysis, a degradation check standard (evaluation mix) of endrin and 4,4-DDT must be injected. Degradation of either compound must not exceed 15 percent. If 15 percent degradation is exceeded, then corrective action must be taken (GC system maintenance, see SOP-222). P.E.M. is analyzed every 12 hours for DoD QSM projects.

14.4 Calibration - (See SW-846 Method 8000B Section 7.4.2).

14.4.1 Initial Calibration

A. For single component pesticides and surrogates, a six point calibration is injected and analyzed for each analyte of interest. For Toxaphene and Technical Chlordane a single point standard is analyzed unless they are expected then a five point calibration is injected and analyzed. Injection volume for standards and samples is equal to 2 µL using the same injection technique to introduce both standards and samples (use of auto-injectors makes this a constant). All calibration integrations must be evaluated and any manual integrations are documented by the inclusion of the before and after chromatograms (which includes peak integrations) with the quantitation report. The percent relative standard deviation (RSD) of the calibration factor must be <20% over the working range for each analyte of interest. When the 20% criteria is exceeded for an analyte, a linear calibration may be used if the correlation coefficient (r) is $\geq$0.995, coefficient of determination (r^2) $\geq$0.99 for quadratic with 6 points. Otherwise, a new standard curve should be prepared for each analyte that exceeded the criteria.

B. Initial calibration for Aroclors may be accomplished by using a six-point curve that contains Aroclors 1016 and 1260. The mixture of these two Aroclors contains many of the peaks represented in the other five Aroclor mixtures(1221, 1232, 1242, 1248, 1254, 1262 & 1268). The curves for Aroclors 1016 and 1260 are used to show the linearity of the detector and can be used to demonstrate that a sample does not contain peaks that represent any one of the Aroclors. The 1016/1260 curve may also be used to quantitate any 1016 or 1260 hits that may be

seen in the samples. The analyst has the choice of running a curve for the other five Aroclor mixtures or when the calibration factor for the curve for 1016/1260 is <20% a single point calibration at the midpoint level concentration can be used for the other Aroclors. The injection procedure for Aroclors is the same as single component pesticides. The percent relative standard deviation (RSD) of the calibration factor must be <20% but this applies to the average of the quantitation peaks. When the 20% criteria is exceeded for an analyte, a linear calibration may be used if the correlation coefficient factor (r) is ≥0.995, ≥0.99 for quadratic with 6 points. Otherwise, a new standard curve should be prepared for each analyte that exceeded the criteria.

14.4.2 Initial Calibration Verification - A second source standard at the midpoint level is used to check the validity of the curve. The standard recovery for all analytes must be between 85 and 115% (**80-120% DOD QSM and 8081B/8082A**). If the second source recovery is above 115%, it is possible that the main standard has deteriorated for that compound. That standard should be remade and reevaluated. If that does not correct the problem, the standard should probably be replaced and a new curve generated. If the second source recovery is below 85%, the second source standard may have deteriorated for that compound. This standard should be remade and reanalyzed. If this does not correct the problem, the standard should be replaced. All calibration integrations must be evaluated and any manual integrations are documented by the inclusion of the before and after chromatograms (which includes peak integrations) with the quantitation report.

14.4.3 Continuing Calibration Verification (CCV) - A mid-level standard must be analyzed every 12 hours (not to exceed 20 samples and cannot exceed 15 percent difference (%D), (**at the beginning and end of sequence and after every 10 field samples, 20%D no average DOD QSM and 8081B/8082A**) from the average calibration factor of the calibration curve. A CCV must also be analyzed at the end of the analysis sequence. If a CCV fails, GC maintenance may be necessary (see SOP-222), reanalysis may be required (for samples analyzed since the last valid CCV) and a non-conformance report must be completed. Alternatively, analytes may be flagged depending on their concentration and the status of the analyte in the mid-level standard. No reanalysis is necessary if the analyte is undetected in the samples and recovered high in the CCV. All calibration integrations must be evaluated and any manual integrations are documented by the inclusion of the chromatogram (which includes peak integrations) with the quantitation report. Samples are then quantitated against the initial calibration curve.

14.5 RT Windows - Retention time criteria set forth in SW-846 method 8000B Section 7.6 are used to set retention time windows. New in-house retention time windows are established after every major change to the system (new column or temperature program) and at initial calibration using the midpoint standard RTs. If the established retention time window is less than +/-0.03 minutes, the window defaults to +/-0.03 minutes. Retention times are updated with the first CCV of the day or the mid-level standard of the curve if samples are analyzed directly after a curve.

14.6 Laboratory Control Sample (LCS) - The LCS is extracted 1 per extraction batch of up to 20 samples. The LCS is spiked with standards prepared from an alternate vendor or lot number than the calibration standards. See Section 15.3 below for criteria and corrective action.

14.7 Method Blank - Method blanks are extracted at a minimum of 1 per extraction batch – up to 20 samples. See Section 12.5 below for criteria and corrective action.

14.8 Samples - Prior to using Method 608, SW-846 8081A, 8081B/8082, 8082A or CLP (pesticide method) the samples are prepared for chromatography using the appropriate sample preparation and clean up methods (generally SW-846 methods 3510, 3541, 3640, 3550, 3580, EPA method 608 or CLP).

14.8.1 Example of a sequence run log:

1-Primer A/B Mix-1000 or Primer PCB-10,000
2- EVAL Mix (Pest only)
3- CCV A/B Mix
4- CCV Toxaphene (single point)
5-CCV Chlordane (single point)
6- CCV PCB 1660
7- Method Blank
8-LCS A/B Mix
9-LCS PCB
10-Sample
11-Sample
12-Sample
13-Sample
14-Sample
15-Sample
16-Sample
17-Sample
18-Sample
19-Sample
20-Sample
21-Sample-MS
22-Sample-MSD
23-Sample
24-Sample
25-Sample
26-Sample
27-Sample
28-Sample
29- CCV A/B Mix
30-CCV PCB

14.9 Data Reduction/Evaluation - Each sample analysis sequence is documented in the run logbook for the instrument. After the sample has been analyzed, the data is processed through the Target DB Windows NT data system. Quantitative measurements are performed as described in SW-846 8081A Section 7.5.6, and Section 11.5.6.1 8081B. Rounding is performed using CLP odd/even rounding rules. The following must be checked to determine if the sample will need any reanalysis, cleaning or dilution. Formal data evaluation is detailed in SOP-216 (documented using the USACE Analyst Data Review Checklist for USACE projects).

14.9.1 Analyte concentration after rounding to 2 significant figures must be within the range of the calibration curve. If an analyte exceeds the curve, a dilution must be performed and the next sample must be checked for carryover. Any dilution should keep the concentration of the analyte in question within the mid-range to the top half of the curve.

14.9.2 If the sample shows signs of sulfur contamination in the time range where sulfur compounds elute a sulfur cleanup is required [see SOP-307].

14.9.3 If the sample has extraneous peaks eluting in the chromatogram an acid cleanup is required for PCB samples and may be applicable for certain pesticides, (acid clean-up may be required for all PCB samples, check with your supervisor), [see SOP-308].

14.9.4 If the sample has extraneous peaks that are not removed by acid (PCB samples) and is not a sulfur interference, a florisil cleanup is recommended [see SOP-309]. A silica cleanup may also be used [see SOP-331].

14.9.5 Surrogates – Control and warning limits are determined by using all blank spikes in the calculation, (LCSs and method blanks). All limits used are generated in-house or client specified (with the exception that if the in-house limit's highest lower limit would be 90 and the lowest upper limit would be 110 examples: 98-120 would be 90-120 or 45-75 would be 45-110). Surrogate standard recovery must be checked to determine if it is within these limits. Two surrogates are added to each sample for pesticides and PCBs. Only one surrogate, DCB, is used to evaluate each PCB sample. Corrective action should be evaluated when any surrogate(s) is outside the action limits for a sample. When only one surrogate for pesticides exceed control limits on the primary and/or confirmation column corrective action may not be required. If both surrogates for pesticides (or DCB for PCB analyses) exceed control limits on the primary and/or confirmation column corrective action is required. A non-performance report should be filled out and given to the organic lab manager when both surrogates for pesticides (or DCB for PCB analyses) are outside the action or warning limits. The organic lab manager will then make suggestions as to what action should be taken, for example: the sample may need to be reanalyzed, reextracted, or flagged on the report for a QC problem. **DOD limits will be used for DOD QSM projects.**

	WATER	SOIL/SEDI	
Surrogate	In-House	In-House	In-House
TCMX	25-120	30-120	80-143
DCB	25-130	35-140	73-142

14.10 Identification/Quantitation [See SW-846 method 8081A Section 7.6 or method 8082 Sections 7.7-7.9].

14.10.1 Single peak components are identified by retention time on a primary column with confirmation by retention time on a secondary or confirmation column. Which column is used for primary/confirmation is determined by the chromatography in the region of the compound. The control limit for percent difference (%D) of compounds that confirmed from the primary column on the confirmation column is 40%. If both columns are equivalent, the highest concentration is reported. If a compound result is >40% difference, it should be

flagged with a "P". (**May be "J" flagged for DOD QSM projects**)

A. Due to coelution of certain compounds confirmation for all analytes may not be achieved. The analyst must use experience and judgment to decide if the compound is there. If a call is made, the data should be flagged appropriately.

B. If a compound is outside of it's window on one column but in the window on the other column, the analyst will need to use their judgment or seek guidance from the organic lab manager or another experienced analyst to decide if the analyte is there.

14.10.2 Multi-peak components (PCB's, Toxaphene and Technical Chlordane) are identified by pattern recognition using an on scale standard chromatogram to compare to an on scale sample chromatogram enabling the analyst to judge whether the sample pattern matches a standard pattern. Confirmation of multi-peak components is required by the method and may be accomplished in several ways. If the sample is from a source known to contain specific Aroclors then this information may be used as a confirmation. Documentation of this approach must meet the requirements outlined in Sec. 7.7.3 of SW-846 Method 8082. Another approach is to use a column of dissimilar stationary phase and compare the pattern to a known Aroclor standard. Finally if the concentration is high enough GC/MS may be used as confirmation.

A. Generally, five unique peaks representing the full range of the multi-peak component are used in the quantitation of the multi-peak components. Note: for USACE projects, five peaks are necessary for the quantitation of multi-peak components.

B. Multi-peak components that still have matrix interference after appropriate sample cleanup steps have been taken may need to be hand calculated using peaks that do not have interference. This should be brought to the organic lab manager's attention.

C. Multi-peak components that exhibit a weathered pattern may need to be hand calculated by the analyst. The analyst will need to use peaks that exhibit the full range of weathering. The number of peaks used to quantitate the multi-peak component will depend on the analyst's judgment of what it will take to achieve the truest concentration of the component. This should be brought to the organic lab manager's attention.

14.10.3 Quantitation – Once a compound has been identified qualitatively, the concentration must then be quantitated. If the RSD of the compound's response factor is 20% or less, then the concentration may be determined using the mean calibration factor, CF, from the initial calibration data. Otherwise, the analyst must use either a calibration curve or a non-linear calibration model such as polynomial equation for quantitation. Calculations follow in Section 15.0. **Refer to SOP-224 for guidance for manual integrations.**

15.0 Data Analysis and Calculations

15.1 Quality Systems SOP QS09 "General and Commonly used Laboratory Calculations" provides details on general calculations used throughout the laboratory.

15.2 Calculate the calibration factor (CF) for each analyte at each concentration as:

$$CF = \frac{\text{Peak Area (or Height) of the Compound in the Standard}}{\text{Mass of the Compound Injected (in nanograms)}}$$

15.3 The mean CF is calculated as follows:

$$\overline{CF} = \frac{\sum_{i-1}^{n} CFi}{n}$$

$$\text{AvgCF} = \frac{\Sigma(\text{CF for each standard})}{\text{N}}$$

15.4 The standard deviation (SD) and the relative standard deviation (RSD) of the calibration factors for each analyte are calculated as follows:

$$SD = \sqrt{\frac{\sum_{i-1}^{n} (CFi - \overline{CF})^2}{n-1}}$$

$$RSD = \frac{SD}{CF} \times 100$$

15.5 Calibration verification involves the calculation of the percent drift (linear or quadratic) or the percent difference (average) of the instrument response between the initial calibration and each subsequent analysis of the verification standard. Use the equations below to calculate % Drift or % Difference, depending on the calibration procedure used.

$$\%\ \text{Drift} = \frac{(\text{Calculated concentration} - \text{Theoretical concentration}) * 100}{\text{Theoretical Concentration}}$$

where the calculated concentration is determined from the initial calibration and the theoretical concentration is the concentration at which the standard was prepared.

$$\%\ \text{Difference} = \frac{(\text{CCV CF} - \text{Average CF}) * 100}{\text{Average CF}}$$

where CCV CF is the calibration factor from the analysis of the verification standard and mean CF is the average calibration factor from the initial calibration. The % difference or % drift calculated for the calibration verification standard must be within ±15% for each analyte before any sample analyses may take place. (DoD limits will be used to DoD QSM projects.)

15.6 Concentration in water samples is calculated as follows:
[Note: Using the units specified here for these terms will result in a concentration in units of ng/mL, which is equivalent to µg/L.]

$$\text{Concentration } (\mu\text{g/L}) = \frac{(A_x)(V_t)(D)}{(\overline{CF})(V_i)(V_s)}$$

where:

A_x = Area (or height) of the peak for the analyte in the sample.

V_t = Total volume of the concentrated extract (µL).

D= Dilution factor, if the sample was diluted prior to analysis.
If no dilution was made, D = 1. The dilution factor is always dimensionless.

V_i = Volume of the extract injected (µL). The nominal injection volume for samples and calibration standards must be the same.

CF = Mean response factor from the initial calibration.

V_s = Volume of the aqueous sample extracted (mL). If units of liters are used for this term, multiply the results by 1000.

The 1000 in the denominator represents the number of µL in 1 mL. If the injection (V_i) is expressed in mL, then the 1000 may be omitted.

15.7 Concentration in non-aqueous samples is calculated as follows:
[Note: Using the units specified here for these terms will result in a concentration in units of ng/g, which is equivalent to µg/kg.]

$$\text{Concentration } (\mu\text{g/kg}) = \frac{(A_x)(V_t)(D)}{(\overline{CF})(V_i)(W_s)}$$

where:

A_x, V_t, D, and CF are the same as for aqueous samples, and

W_s = Weight of sample extracted (g). Either a dry weight or wet weight may be used, depending upon the specific application of the data. If units of kilograms are used for this term multiply the results by 1000.

The 1000 in the denominator represents the number of µL in 1 mL. If the injection (V_i) is expressed in mL, then the 1000 may be omitted.

16.0 Method Performance

Demonstration of Capability (DOC): Each analyst must perform a DOC prior to reporting data. The analyst must prepare (for prep technicians) and analyze (analysts reviewing and reporting data) 4-LCS samples. The data is calculated for accuracy and precision requirements. The DOC form, as listed within Section 2.5 of the Quality Manual is completed by each analyst and then provided to the supervisor for further processing and approval. See **Table 2** for acceptance criteria. **When analyzing DOCs for DOD QSM Version 4.1, DOD limits will be used.**

17.0 Pollution Prevention

Quantity of chemicals purchased should be based on expected usage during its shelf-life and the disposal cost of unused material. Actual reagent preparation volumes should reflect anticipated usage and reagent stability.

18.0 Data Assessment and Acceptance Criteria for Quality Control Measures

Quality Control SOP QS05, "Data Deviations / Interpretations / Exceptions: Laboratory Non-Conformance / Corrective Action Procedures, Decision Making Guidelines for Evaluating Laboratory Analytical Sample and Quality Control Results", provides details on data assessment and acceptance criteria for Quality Control Measures. **Table 2** of this SOP provides information on QC samples, frequency, and the associated criteria specific to the performance of this method.

19.0 Contingencies for Handling out-of-control or unacceptable data

Quality Control SOP QS05, "Data Deviations / Interpretations / Exceptions: Laboratory Non-Conformance / Corrective Action Procedures, Decision Making Guidelines for Evaluating Laboratory Analytical Sample and Quality Control Results", provides details on handling out of control data. **Table 2** within this SOP also lists corrective actions associated with the failure of the various QC samples employed for the performance of this method.

20.0 Waste Management

Please see Waste Disposal, SOP QS14 for proper disposal of waste coming from this area within our laboratory. Quantity of chemicals purchased should be based on expected usage during its shelf-life and the disposal cost of unused material. Actual reagent preparation volumes should reflect anticipated usage and reagent stability.

21.0 References

21.1 Test Methods for Evaluating Solid Waste Physical/Chemical Methods, SW-846; Method 8081A, 8081B, 8082, 8082A

21.2 USEPA Code of Federal Requlations, 40, CH 1,PT 136; Method 608, 608.2; APX-B

21.3 USEPA Contract Laboratory Program(CLP) for Organics ILM04.2; ILM04.3

21.4 DOD Quality Systems Manual, Ver. 3/4.1

22.0 Tables, Diagrams, Flowcharts and Validation Data

22.1 Table 1, all applicable parameters, including the surrogates and internals with the applicable RL and lowest calibration standard.

22.2 Table 2, for all technical methods, should always be the QA/QC summary table and I am including a format for this at the end.

22.3 Table 3, Technical Completeness / Accuracy Checklist

22.4 Table 4, Data Reviewers Checklist

Table1- Detection limits

Analyte (water)	MDL/DL	LOD	LOQ/RL	Units
4,4'-DDD	0.00500	0.0100	0.0200	ug/L
4,4'-DDE	0.00500	0.0100	0.0200	ug/L
4,4'-DDT	0.00500	0.0100	0.0200	ug/L
Aldrin	0.00330	0.0100	0.0200	ug/L
alpha-BHC	0.00330	0.0100	0.0200	ug/L
alpha-Chlordane	0.00330	0.0100	0.0200	ug/L
beta-BHC	0.00330	0.0100	0.0200	ug/L
Chlordane (tech)	0.0170	0.0250	0.0500	ug/L
delta-BHC	0.00330	0.0100	0.0200	ug/L
Dieldrin	0.00500	0.0100	0.0200	ug/L
Endosulfan I	0.00330	0.0100	0.0200	ug/L
Endosulfan II	0.00500	0.0100	0.0200	ug/L
Endosulfan sulfate	0.00500	0.0100	0.0200	ug/L
Endrin	0.00500	0.0100	0.0200	ug/L
Endrin aldehyde	0.00500	0.0100	0.0200	ug/L
Endrin ketone	0.00500	0.0100	0.0200	ug/L
gamma-BHC (Lindane)	0.00330	0.0100	0.0200	ug/L
gamma-Chlordane	0.00330	0.0100	0.0200	ug/L
Heptachlor	0.00330	0.0100	0.0200	ug/L
Heptachlor epoxide	0.00330	0.0100	0.0200	ug/L
Methoxychlor	0.00330	0.0100	0.0200	ug/L
Toxaphene	0.330	0.667	1.00	ug/L
Aroclor-1016	0.125	0.250	0.500	ug/L
Aroclor-1221	0.125	0.250	0.500	ug/L
Aroclor-1232	0.125	0.250	0.500	ug/L
Aroclor-1242	0.125	0.250	0.500	ug/L
Aroclor-1248	0.125	0.250	0.500	ug/L
Aroclor-1254	0.125	0.250	0.500	ug/L
Aroclor-1260	0.125	0.250	0.500	ug/L
Aroclor-1262	0.125	0.250	0.500	ug/L
Aroclor-1268	0.125	0.250	0.500	ug/L
Analyte (Soil)	**MDL/DL**	**LOD**	**LOQ/RL**	**Units**
4,4'-DDD	0.170	0.340	0.670	ug/Kg
4,4'-DDE	0.170	0.340	0.670	ug/Kg
4,4'-DDT	0.170	0.340	0.670	ug/Kg
Aldrin	0.110	0.340	0.670	ug/Kg
alpha-BHC	0.110	0.340	0.670	ug/Kg
alpha-Chlordane	0.110	0.340	0.670	ug/Kg
beta-BHC	0.110	0.340	0.670	ug/Kg
Chlordane (tech)	0.570	0.370	1.70	ug/Kg
delta-BHC	0.110	0.340	0.670	ug/Kg
Dieldrin	0.170	0.340	0.670	ug/Kg
Endosulfan I	0.110	0.340	0.670	ug/Kg
Endosulfan II	0.170	0.340	0.670	ug/Kg
Endosulfan sulfate	0.170	0.340	0.670	ug/Kg
Endrin	0.170	0.340	0.670	ug/Kg
Endrin aldehyde	0.170	0.340	0.670	ug/Kg
Endrin ketone	0.170	0.340	0.670	ug/Kg

Analyte (Soil)	**MDL/DL**	**LOD**	**LOQ/RL**	**Units**
gamma-BHC (Lindane)	0.110	0.340	0.670	ug/Kg
gamma-Chlordane	0.110	0.340	0.670	ug/Kg
Heptachlor	0.110	0.340	0.670	ug/Kg
Heptachlor epoxide	0.110	0.340	0.670	ug/Kg
Methoxychlor	0.110	0.340	0.670	ug/Kg
Toxaphene	11.0	22.0	33.0	ug/Kg
Aroclor-1016	4.17	8.33	16.7	ug/Kg
Aroclor-1221	4.17	8.33	16.7	ug/Kg
Aroclor-1232	4.17	8.33	16.7	ug/Kg
Aroclor-1242	4.17	8.33	16.7	ug/Kg
Aroclor-1248	4.17	8.33	16.7	ug/Kg
Aroclor-1254	4.17	8.33	16.7	ug/Kg
Aroclor-1260	4.17	8.33	16.7	ug/Kg
Aroclor-1262	4.17	8.33	16.7	ug/Kg
Aroclor-1268	4.17	8.33	16.7	ug/Kg
Analyte (TCLP)	**MDL/DL**	**LOD**	**LOQ/RL**	**Units**
Chlordane (tech)	0.000170	0.000250	0.000500	mg/L
Endrin	0.0000500	0.000100	0.000200	mg/L
gamma-BHC (Lindane)	0.0000330	0.000100	0.000200	mg/L
Heptachlor	0.0000330	0.000100	0.000200	mg/L
Heptachlor epoxide	0.0000330	0.000100	0.000200	mg/L
Methoxychlor	0.0000330	0.000100	0.000200	mg/L
Toxaphene	0.00330	0.00670	0.0100	mg/L

Table 2 - Method Quality Control Requirements Summary

QC Check	Minimum Frequency / Requirements	Acceptance Criteria	Corrective Action for Failures / Data Useability
Calibration Curve	• Prior to analyzing any samples • A minimum of 5-points for linear fits • A minimum of 6-points for quadratic fits • Low standard at the RL/LOD level	• For Linear or Quadratic calibration fits a RF of 0.995 • Average RSD ≤ 20% (504.1) • Average RSD ≤ 10% (8011) • Manual integrations on curve standards must have supervisory approval • Must follow curve processing requirements from SOP QS08	• Re-evaluate curve mix and makeup • Re-run curve • Check instrument for maintenance needs • Re-prep the curve standards Samples cannot be analyzed until there is a passing calibration
ICV	Alternate source standard to be analyzed after every calibration curve	Must meet the criteria of the CCV	• Re-analyze an ICV from a different source • Re-prep and re-analyze the ICV • Re-calibrate and verify standard preps and sources
CCV	• At the beginning of every sequence • For every 10-client samples • The concentration should be varied from low to mid range	• ≤ 20% drift or difference for all analytes	• Follow guidelines for SOP QS05
Closing CCV	• At the end of every sequence	• ≤ 20% drift or difference for all analytes	• Follow guidelines for SOP QS05
MB	One per prep batch	• Must be less than the LOD	• Re-analysis to confirm the positive value • Ascertain if there are any samples within the batch that meet the MB criteria and provide the information for the decision makers • If results are between the LOD or RL/LOQ, then assess the data and notify the PM for further action • Re-prep of samples associated with the MB • NCR will be required for data reported • Final Report data flagging will be required
LCS	One per prep batch	Most stringent criteria listed within the LIMS.	• Follow guidelines from SOP QS05
LCSD	One per prep batch, when MS/MSD not included.	Criteria listed within LIMS or specified by client.	• Follow guidelines from SOP QS05
MS	One per prep batch, if sample volume available.	Criteria listed within LIMS or specified by client.	• Follow guidelines from SOP QS05
MSD	One per prep batch, if sample volume available.	Criteria listed within LIMS or specified by client.	• Follow guidelines from SOP QS05

Table 2 - Method Quality Control Requirements Summary

QC Check	Minimum Frequency / Requirements	Acceptance Criteria	Corrective Action for Failures / Data Useability
Surrogates	• A mix is used per sample prior to sample prep	Criteria listed within LIMS or specified by client.	• If holding time is expired, fill out a NCR and follow directions from PM • Evaluate sample matrix and other applicable results to determine if re-analysis is required at a dilution • Re-injection or analysis • Re-prep followed by re-analysis • Follow guidelines from SOP QS05
DOC Study	• Initially per analyst prior to reporting data • Annually • Follow specific guidelines from Section 16 for the preparation and analysis of DOC samples	• Average percent recovery should be between 70-130%, with a 20% standard deviation.	• Re-prep and / or re-analysis
MDL Study	Once per year	• Calculated value must be greater than 10% of the Spike Level • Calculated value must be less than the Spike level • Percent recovery must be between 60-140% of the true value of each analyte.	• Re-prep and / or re-analysis • Follow guidelines from SOP QS05
LOD Verification	Every quarter	• Parameter must be detected • 2nd column / detector confirmation is required • the response must be 3-times the noise level	• Re-prep and / or re-analysis • Follow guidelines from SOP QS05
LOQ Verification	Every quarter	• Bias Requirement: Organics 10-150% • The LOQ value must be greater than the LOD value	• Re-prep and / or re-analysis • Follow guidelines from SOP QS05

Table 3, Technical Completeness / Accuracy Checklist

1. Were all the QC check elements analyzed – refer to Table 2 of the SOP
2. Were the QC criteria met
3. In cases of failures, was there an NCR written
4. Were all manual integrations signed
5. Were dilution factors applied correctly
6. Was there supervisory approval for manual integrations on standards and QC samples
7. Was the data uploaded into LIMS via direct upload – if yes, then was a cross check subset of the uploaded values performed
8. If the data was entered into LIMS manually, was a check of all entered values performed
9. Was the red marked data in LIMS checked for accuracy and the corresponding hard copy data documented appropriately
10. Were proper data qualifiers applied to the data in LIMS
11. Was the hard copy package checked for completeness to include all data for the sequence such that the data reviewer could reconstruct sample analyses and validate / approve the data

Table 4, Data Reviewers Checklist (Prior to approving data)

ANALYST DATA REVIEW CHECKLIST

Sample Number(s):	
Batch Number(s):	
Method:	**8081/8082**

QA/QC Item	Yes	No	NA	Second Level Review
A. Initial Calibration				
1. Did the evaluation mix pass criteria?				
2. Does the curve consist of at least five Calibration Standards?				
3. Is the low standard near, but above the MDL?				
4. Are the % RSDs within QC limits for all analytes?				
B. Second Source Verification				
1. Was the initial calibration curve verified by a second source calibration standard (ICV) and have criteria been met?				
C. Continuing Calibration				
1. Are the Continuing Calibration Verification (CCV) standards analyzed every 20 samples or every 12 hours and at the end of the sequence?				
2. Are the % differences within QC limits for all analytes?				
D. Sample Analysis				
1. Did the evaluation mix pass criteria?				
2. Are all sample holding times met?				
3. Are all samples with concentrations > the highest standard used for initial calibration diluted and reanalyzed?				
4. For single peak analytes - are all compounds identified on the primary column confirmed on the secondary column?				
5. For multi-peak analytes - does the pattern of the analyte in the sample match the pattern of the standard?				
6. Are surrogate recoveries within QC limits? (one surrogate both columns)				

ANALYST DATA REVIEW CHECKLIST, cont.

E. QC Samples

1. Is the Method Blank extracted at the desired frequency and is its concentration for target analytes less than the MDLs? _____ _____ _____ _____
2. Is the Laboratory Control Sample and its percent recovery within QC limits? _____ _____ _____ _____
3. Is the Matrix Spike/Matrix Spike Duplicate extracted at the desired frequency and is the percent recovery/RPD within QC limits? _____ _____ _____ _____

F. Others

1. Are all nonconformances included and noted? _____ _____ _____ _____
2. Are all calculations checked at the minimum frequency? _____ _____ _____ _____
3. Did analyst initial/date the appropriate printouts and report _____ _____ _____ _____
4. Are all sample IDs and units checked for transcription _____ _____ _____ _____
5. Are all manual integrations checked by a second reviewer to verify they were performed correctly? _____ _____ _____ _____

Comments on any "No" response:

_____

_____

_____

_____

_____

_____

Analyst: _____ Date: _____

Second-Level Review: _____ Date: _____

EMPIRICAL LABORATORIES, LLC
STANDARD OPERATING PROCEDURE

ORGANICS: SOP 300 **REVISION #: 18** **EFFECTIVE DATE: 042610**

GC/MS SEMI-VOLATILE BNA-AQUEOUS MATRIX EXTRACTION USING SW-846 METHOD 3510C FOR 8270/625 ANALYSIS

APPROVALS:

Lab Director: _____ Date: 4/27/10

Data Quality Manager: _____ Date: 4/27/10

Section Supervisor: _____ Date: 4/27/10

Changes Summary

Revision Date: 042610

- The SOP is formatted to include all 22-elements required per the NELAC standards
- The laboratory's revision of all technical SOPs now includes a Table of Contents that provides the map of the technical information contained within the SOP.
- Additional requirements, based upon the DoD QSM 4.1, have been integrated into the routine sample flow; however, if the requirement is different from routine sample flow, then the requirement is outlined and documented as such to be followed only when DoD samples are analyzed.

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20. Waste Management
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22. Tables, Diagrams, Flowcharts and Validation Data

1.0 Identification of the Test Method

1.1 This SOP is compliant with SW-846 Method 3510C and Method 625.

2.0 Applicable Matrix or Matrices

2.1 This SOP is applicable to aqueous samples.

3.0 Detection Limit

Not Applicable to this SOP

4.0 Scope of Application, including components to be analyzed

Not Applicable to this SOP

5.0 Summary of the Test Method

5.1 Aqueous samples are extracted with methylene chloride. The extracts are dried through sodium sulfate and concentrated to an appropriate final volume.

6.0 Definitions

6.1 Laboratory Quality System SOP QS08 "Technical/Operational Definitions, Minimum Essential Quality Control Elements, and Laboratory Calibration Procedures" provides information on the commonly used definitions.

7.0 Interferences

7.1 Solvents, reagents, glassware, and other sample processing apparatus can add interferences to sample analysis. Method blanks must be extracted under the same conditions as samples to demonstrate freedom from interferences.

7.2 Phthalate esters commonly found in plastics can interfere with the analysis. Plastics should be avoided.

7.3 Soap residue can degrade certain analytes such as aldrin and heptachlor. Glassware should be solvent rinsed to avoid this problem.

8.0 Safety

8.1 Laboratory SOP QS13 "Safety Program & Chemical Hygiene Plan" discusses the safety program that is to be followed labwide.

9.0 Equipment and Supplies

9.1 Separatory Funnel – 2L with Teflon stopcock

9.2 Beaker – 250mL or 400mL

9.3 Drying/Chromatographic column – 20mm I.D. x 300mm

9.4 Filter funnel

9.5 Turbo-Vap evaporation tube – 200mL tube made by Zymark or equivalent

9.6 Metal rack – capable of holding six glass evaporation tubes

9.7 Turbo-Vap Evaporator – heated and capable of temperature control (+5˚C); the bath should be vented into a hood
9.8 Vials, 2.0 mL glass with Teflon-lined screw cap
9.9 pH indicator paper – wide range (1.0-12.0)
9.10 Syringe – 1mL
9.11 Graduated cylinder – 1000mL, 500mL, and 100mL, glass, Class A
9.12 Pasteur pipette – length 9”
9.13 Pasteur pipette bulb
9.14 Labels – DYMO
9.15 Teflon Bottles – 500mL
9.16 Volumetric Flasks – 500mL, 100mL, 50mL, and 10mL, glass, Class A
9.17 Ring Stand – 3-prong
9.18 Burette clamp – double
9.19 Aluminum foil – heavy duty
9.20 Nitrogen tank – equipped with pressure regulator
9.21 Boiling chips – Teflon
9.22 Glass Wool – Roving, 9989 purchased from Fisher #11-388 or equivalent

10.0 Reagents and Standards

10.1 Reagent Water - Reagent water is gathered in a carboy from source in the instrument lab as needed.
10.2 Sodium Hydroxide Solution - (10N). Weigh 800g NaOH (purchased in a fiber drum from Tennessee Reagents # 2-31825-25lb or equivalent) into a 2000mL volumetric flask and add approximately 1000mL of reagent water. Swirl until pellets are mostly dissolved. Add a stir bar and place on stir plate. This mixture will get very hot. Continue to add reagent water while mixture is being stirred until a final volume of 2000mL is attained. Let stand until cool. Transfer to 1000mL Teflon containers.
10.3 Sodium Sulfate – Granular, anhydrous, trace pure 10-60 mesh (purchased in 200lb bulk fiber drum from Fisher #S415-200lb or equivalent). For low level tests, place an aliquot in a 1500mL heavy duty Pyrex beaker and bake in muffle furnace at 400°C for a minimum of 4 hours. Remove and cool in open air and place in designated “Baked Sodium Sulfate” container at room temperature
10.4 Glass Wool – Roving , 9989 Glass (purchased from Fisher #11-388 or equivalent).
10.5 Sulfuric Acid Solution - (1:1), slowly add 500mL of H2SO4 (Fisher, suitable for trace metal analysis #A300C-212 or equivalent) to 500mL of reagent water in a 1000mL Teflon container. This mixture will get very warm. Allow to cool before use.
10.6 Extraction Solvent - Methylene Chloride (purchased from Fisher #D151-4 or equivalent) Please read SOP-336 before handling this solvent in our laboratory.
10.7 The extraction analyst makes up surrogates and spikes. Verify the amount of surrogate/spike to add to the sample prior to addition. It can change if a different detection limit is required or the volume of sample being analyzed changes.
10.7.1 BNA Surrogate – The base neutral and acid surrogate are mixed together in one solution (purchased from NSI #WL-371-C at concentrations of 100-200ug/mL). The expiration for this standard is 6 months from the date opened. Use 0.5mL of this solution per 1000mL of aqueous sample.

10.7.2 BNA Spiking Solution – The base neutral and acid spiking solutions are mixed together in one solution called BNA LCS#1 (This spiking solution contains all the compounds that are normally calibrated by GC/MS). This solution, with a final concentration of 100ug/mL, is prepared in Methanol by making a dilution of stock purchased from reputable vendors (BNA LCS #1 spike kit #K-943 and 1-methylnapthalene #1288-01-08 are purchased from NSI, 2,6 Dichlorophenol #95591 is purchased from Absolute Standards and 1,4 Dioxane #30287 is purchased from Restek). Use 0.5mL of this solution per 1000mL of aqueous sample. Another spiking solution is also used, called BNA LCS#2. This solution contains short or matrix spike list base extractable compounds. This solution, with a final concentration of 100ug/mL,is prepared in Methanol by making a dilution of stock purchased from NSI #Q-6104-0. Use 0.5mL of this solution in combination with BNA LCS#1 for all full list BNA requirements. BNA LCS #2 may be omitted from samples requiring PAH analysis. (For low level PAHs, use 1.0mL of a 1.0ug/mL solution made from BNA LCS #1, called "LLPAH spiking solution.) All standards expire 6 months from the date they are made.

10.7.3 BNA TCLP Spike – 0.5mL of BNA LCS#1 and BNA LCS#2 is added per 100mL volume. This volume is provided by Wet Chemistry in a 1L glass amber bottle. 100mL is removed from this container and measured using a graduated cylinder.

11.0 Sample Collection, Preservation, Shipment, and Storage

11.1 Quality Systems SOP QS10 related to Sample Receipt, Handling, & Processing provides details for collection, preservation, shipment, and storage.

11.2 Aqueous samples have a hold time of 7 days from the date of sampling.

12.0 Quality Control

12.1 Quality Systems SOP QS08 "Technical/ Operational Definitions, Minimum Essential Quality Control Elements, and Laboratory Calibration Procedures" outlines details related to laboratory wide protocols on quality control.

13.0 Calibration and Standardization

Not Applicable to this SOP

14.0 Procedure

14.1 All waters have a seven-day holding time counted from the day they are sampled. Determine the samples necessary to extract from the following sources (Note: never extract samples of unknown origin without discussion with supervisor):

14.1.1 Each day the extractions group leader will generate a sample backlog using LIMS.

14.1.2 This backlog is used to determine extraction priorities based on hold times and due dates.

14.1.3 Samples requiring RUSH turn around time may be logged in throughout the day, which will require immediate attention. Sample receiving personnel will generally communicate this need.

14.1.4 Samples are placed in LIMS “batches” based on parameter and extracted accordingly.

14.2 Wearing lab coat, gloves and safety glasses, get samples from refrigerator. Samples must be signed out of the walk-in refrigerator. Enter the sample numbers, your initials and the date and time removed on the log provided. Inspect as to whether they are in glass amber jar and have a Teflon lid. Find out if any special dilutions need to be made for this client. Routine procedures for difficult matrices are listed below:

14.2.1 SLUDGE - use only 100mL and dilute to 1000mL with reagent water.

14.2.2 TCLP EXTRACT - use only 100mL and dilute to 1000mL with reagent water. A separate matrix spike of 100mLs should be set up at the same time. Dilute to 1000mL with reagent water.

14.2.3 1BAD MATRIX – for example a liquid that is partially sediment, see your supervisor to find out what dilution, if any should be made. SPLP extract-use 1 liter.

14.2.4 NPDES client - a special list of compounds is required including benzidine. Method 625 requires that there be a spike every ten samples. The sample must be extracted and concentrated in the same day. A GC/MS screen is recommended; therefore this extraction should be coordinated with the GC/MS operator. 1mL is added to the LCS and the matrix spike.

14.2.5 ACID EXTRACT WITH BAD MATRIX - a cleanup step is added. Samples are taken to a high pH, extracted with 60mL methylene chloride one time as explained below in the BASE NEUTRAL EXTRACTION section. This extract is discarded. The samples are then taken to a low pH and extracted as an acid extraction. Acid extractions may be concentrated in the TurboVap.

14.3 LOW LEVEL POLYAROMATIC HYDROCARBONS (PAHs) – Samples require a BNA extraction. Use the surrogate and spiking solution specified.

14.4 Mark the amber glass container of each sample at the water meniscus with "white out" for later determination of sample volume. Check the pH by inverting the sample and touching the wide range pH paper to the portion that remains on the lid. Record this pH on the LIMS bench sheet and, later, in LIMS.

14.5 Get out enough separatory funnels to extract the number of samples you have plus any additional spikes and a method blank. A method blank and an LCS must be processed with each set of samples. If the sample is a TCLP, blank fluid may be provided along with the extracted TCLP sample(s). Use only 100mL and dilute to 1000mL with reagent water. Process a matrix spike and matrix spike duplicate on aqueous samples if requested by client. If not, a LCSD must be processed. Rinse separatory funnels with methanol. Place label from sample bottle onto separatory funnel as samples are poured into funnels to ensure proper identification. Use Avery labels to properly identify method blank, LCS, and LCSD.

14.6 Using the 1000mL glass graduated cylinder marked NANO PURE WATER ONLY, measure 1000mL of reagent water from the carboy and transfer it to a separatory funnel for the method blank and LCS. Transfer sample to separatory funnel that corresponds to the lab # on the sample bottle.

14.7 Verify the amount of surrogate/spike to add to the sample prior to addition. It can change if a different detection limit is required or the volume of sample being analyzed changes. Set out the surrogate/spike at least ten minutes before use to allow it to warm to room temperature.

14.8 Generally 0.5mL of BNA surrogate is added to each sample, spike, and blank with a syringe designated for BNA surrogate**.** Someone must verify that the surrogate has been added by initialing LIMS bench sheet.

14.8.1 NOTE: Be sure to invert syringe and eliminate air bubble when obtaining surrogate solution and spiking solution.

14.9 For the sample in each analytical batch selected for spiking, use the 0.5mL glass syringe designated for BNA spike, to add 0.5mL of BNA spiking solution. **For low level PAHs use 1.0mL of the 1.0ppm LLPAHs spiking solution**. Someone must verify that the spike has been added by initialing the LIMS bench sheet. For DOD QSM projects, all target compounds will be spiked into the LCS and MS/MSD.

14.10 Enter the ID# of the surrogate/spike used on the LIMS bench sheet and, later, in LIMS.

14.11 ACID EXTRACTION: Adjust the pH to between 1.0 and 2.0, using 2mL of 1:1 H2SO4. Add to each sample, spike and method blank. Stopper and shake to insure that pH throughout the sample is changed. Check the drop of liquid hanging from the lid with short-range pH paper. Compare the color to the chart on the pH paper. If the color is not within range add more H2SO4 solution in small increments, as required to attain the proper pH.

14.12 Add 40mL of Methylene Chloride to each empty sample bottle and to the LCS, method blank and MS/MSD funnels. Swirl the 40mL of methylene chloride that you added to the empty sample bottle and transfer to the corresponding separatory funnel.

14.13 Seal and shake the separatory funnel vigorously for 2 minutes with periodic venting to release excess pressure. Alternatively, Teflon funnels may be used and placed in the shaker apparatus with the stopcocks slightly open. When this apparatus is used, the shake should be for 3 minutes.

14.13.1 NOTE: Methylene chloride creates excessive pressure very rapidly; therefore, initial venting should be done immediately after the separatory funnel has been sealed and shaken once.

14.14 Allow the sample to sit for 10 minutes, if necessary, after it has been shaken. It will separate into two layers with the solvent layer on the bottom. If it forms an emulsion (thick, cloudy, viscous, mixture that you cannot see through), drain what you believe to be 40mL into a 250mL centrifuge bottle. If the layers are clearly separated, drain the solvent layer into a 250mL glass beaker.

14.15 Following Steps 14.12 through 14.14, extract two more times with 40mL of methylene chloride. Combine the three solvent extracts into the same 250mL beaker.

14.16 BASE NEUTRAL EXTRACTION: Adjust the pH to 11 or slightly greater, using 10N NaOH. Start by adding 5.0mL to each sample, spike, and method blank. Stopper and shake to insure that pH throughout the sample is changed. Check the drop of liquid hanging from the lid with short-range pH paper. Compare the color to the chart on the pH paper. If the color is not within range add more 10N NaOH in

small increments, as required to attain the proper pH. BNA extraction is necessary when doing low level PAHs.

14.16.1 NOTE: This step is critical to the extraction procedure. Too much NaOH solution could cause you to lose certain Base Neutral compounds. Be careful on this step.

14.17 FOR 8270 extraction: Extract one more time with 40mL of methylene chloride following Step 14.16. Do not combine BN and Acid extracts in a same 250mL beaker. However, you may filter BN and Acid extracts through the same sodium sulfate filter and combine into the same turbo in order to concentrate BN and acid extracts for one final extract.

14.17.1 NOTE: It has been demonstrated that two acid and one BN extraction can be used for normal 8270 samples. This procedure cannot be used for DOD or 625 samples.

14.18 For 625 extractions: extract 3 more times with 40 mL methylene chloride following steps 14.12 through 14.14. Combine BN extracts in the empty 250mL sample beaker as the acid portion concentrates in the turbo vap. Following step 14.24, concentrate the acid extract to ~5mL and then filter the BN extract into the same turbo.

14.19 Prepare to dry the sample by either of the following methods:

14.19.1 Get a ring stand with a double burette clamp attached to it. Cover the burette clamp ends with aluminum foil to prevent the possibility of solvent touching the plastic coated ends and dripping into the extract. Place a drying column into the burette clamp and transfer a small amount of glass wool to the top of it. Tamp it to the bottom with a glass rod so that it adequately covers the hole at the bottom. Add approximately 10 cm of Sodium Sulfate to the column. Rinse with 20 to 30 mL of methylene chloride and discard this rinse into the Chlorinated Waste container in the hood. OR

14.19.2 Set up a ring stand with funnels. Place a small amount of glass wool in the bottom of it, add ~2” sodium sulfate to the column and rinse with 20-30 mL methylene chloride. Discard this rinse into the Chlorinated Waste container in the hood.

14.20 If the extract was drained into a centrifuge bottle, at this point you will need to take it to the centrifuge. Push the "ON" button to turn the centrifuge on. Be sure that the large holders are available for the 250-mL centrifuge bottles. The sample must always be balanced. If necessary use a dummy bottle making it similar weight using reagent water. Set the rpm at 2500 and the temperature at 0°C. Close the lid and be sure to press it down until you hear it click. Move the lever at the front of the lid to the "LOCK" position. Turn the time to approximately 15 minutes and bring it back to 10 minutes. As the rotor begins to move, you will be able to see the rpm's in the digital readout. Stay with the centrifuge until it has come up to the rpm's set to insure that it does not become unbalanced. This looks like 8888 on the digital readout. Should this occur, refer to the manual. When the cycle is complete, the digital readout will read 0000. Push the "OPEN" button and the lid will pop up. Move the lever at the front of the lid to the "UNLOCK" position. Open lid and remove sample. The sample will usually be in two layers with the extract on the bottom.

14.21 Remove any water layer from the extract in the beaker or centrifuge bottle, by one of two methods. Remove with a Pasteur pipette by carefully pulling up the water layer, on top, and not the solvent. Discard this layer in the sink. Use the smallest amount possible of Na2SO4 by sprinkling the top layer with Na2SO4 until it hardens, separates, and drops to the bottom.

14.22 Determine the original sample volume by refilling the sample bottle to the mark made with "white out." Transfer the liquid to a plastic 1000-mL graduated cylinder and record the sample volume on the LIMS bench sheet to the nearest 10-mL and record, later, in LIMS.

14.23 Prepare sample vial tray using labels printed off from LIMS that identify sample numbers, initial/final volumes, client, parameter, and date extracted.

14.24 TURBO-VAP CONCENTRATION

14.24.1 Rinse a Turbo-Vap tube with methylene chloride and arrange it underneath a rinsed, packed drying column or funnel. Pour the extract through the column so that it will collect in the tube. Rinse the 400-mL beaker, which contained the solvent extract twice with 10 to 15 mL of methylene chloride and add each rinse to the column to complete the quantitative transfer. After all the extract has passed through the column, rinse the column with 10 to 15 mL of methylene chloride. Total volume in the glass evaporator tube should not exceed 200 mLs to avoid splattering on the lid of the Turbo-Vap.

14.24.2 Record the numbers of the Turbo-Vap tube on the LIMS bench sheet and place the tube in a metal holder.

14.24.3 Turbo-Vap Operation: Adjust the pressure of nitrogen gas tank to >30 psi. Make sure the tank has 200 psi or more on the main valve. The temperature of the bath should be approximately 40°C -50°C.

14.24.4 Place the glass evaporator tube in the Turbo-Vap. Be sure to push tube down so the tip slides into the sensor well. Close the lid to start concentration. Check that each position with a tube has an orange light showing. If the orange light is not steady, bubbles may be in the sensor and need removal. (See Turbo-Vap manual).

14.24.5 When the beep sounds indicating the end of concentration, the extract will be at approximately one half mL (half way up tip of tube). Remove the tube from the bath. Use a 9" Pasteur pipette to draw up the sample and transfer it to the 2-mL vial. THIS IS THE MOST CRITICAL PART OF THE ENTIRE OPERATION!!! A single drop represents about 10 percent of the total sample. Before you move the tip of the pipette from the tube to the vial, be sure that a drop will not form on the end and fall off.

14.24.6 Draw ~0.25 mL of methylene chloride into a 9’’ Pasteur pipette and add this aliquot to the turbo-vap. Draw the methylene chloride into a pipette and rinse the sides of the tube several times. Transfer this rinse to the appropriately labeled 2-mL vial. Add methylene chloride from the designated clean pipette and repeat the rinsing process until you have ~ 1 mL in the sample extract vial. Compare this volume to a 2-mL dummy vial containing 1 mL of solvent to insure that you have not exceeded 1 mL. The methylene chloride rinse volume must be adjusted to achieve this final volume. Cover the extract with a Teflon-sealed screw cap.

14.25 The extract is now ready to be analyzed. Refrigerate at 4°C or carry directly to the instrument operator. Samples must be signed into the Sample Extract refrigerator. On log provided, enter the sample numbers, the analyst initials, and the date and time the samples were placed into the refrigerator.

14.26 Transfer handwritten extraction details from bench sheet to LIMS and archive bench sheet for future reference.

15.0 Data Analysis and Calculations

Not Applicable to this SOP

16.0 Method Performance

16.1 Demonstration of Capability (DOC): Each analyst must perform a DOC prior to independently extracting samples and yearly thereafter. The analyst must prepare 4 LCS samples. The data is calculated for accuracy and precision requirements.

17.0 Pollution Prevention

17.1 Quantity of chemicals purchased should be based on expected usage during its shelf life and the disposal cost of unused material. Actual reagent preparation volumes should reflect anticipated usage and reagent stability.

18.0 Data Assessment and Acceptance Criteria for Quality Control Measures

Not Applicable to this SOP

19.0 Contingencies for Handling out of control or unacceptable data

Not Applicable to this SOP

20.0 Waste Management

20.1 Laboratory SOP QS14 on Waste Handling discusses general guidelines for the appropriate handling of wastes and the laboratory program on waste management.

21.0 References

21.1 Test Methods for Evaluating Solid Waste, SW-846, Third Edition

21.2 40 CFR, Method 625.

22.0 Tables, Diagrams, Flowcharts, and Validation Data

Not Applicable to this SOP

EMPIRICAL LABORATORIES, LLC
STANDARD OPERATING PROCEDURE

ORGANICS: SOP 302 **REVISION #: 17** **EFFECTIVE DATE: 042610**

PESTICIDE/PCBs
AQUEOUS MATRIX EXTRACTION
FOR EPA METHOD 608/608.2 AND
SW846 METHOD 8081/8082
USING SW846 METHOD 3510C

APPROVALS:

Lab Director: _____ Date: 4/27/10

Data Quality Manager: _____ Date: 4/27/10

Section Supervisor: _____ Date: 4/27/10

Changes Summary

Revision Date: 042610

- The SOP is formatted to include all 22-elements required per the NELAC standards
- The laboratory's revision of all technical SOPs now includes a Table of Contents that provides the map of the technical information contained within the SOP.
- Additional requirements, based upon the DoD QSM 4.1, have been integrated into the routine sample flow; however, if the requirement is different from routine sample flow, then the requirement is outlined and documented as such to be followed only when DoD samples are analyzed.

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1.0 Identification of the Test Method

1.1 This SOP is compliant with SW-846 Method 3510C and Method 608/608.2

2.0 Applicable Matrix or Matrices

2.1 This SOP is applicable to aqueous samples

3.0 Detection Limit

Not Applicable to this SOP

4.0 Scope of Application, including components to be analyzed

Not Applicable to this SOP

5.0 Summary of the Test Method

5.1 Aqueous samples are extracted with methylene chloride. The extracts are dried through sodium sulfate and concentrated and exchanged to hexane.

6.0 Definitions

6.1 Laboratory Quality System SOP QS08 "Technical/Operational Definitions, Minimum Essential Quality Control Elements, and Laboratory Calibration Procedures" provides information on the commonly used definitions.

6.2 Additional definitions specific to this SOP are listed below:

6.2.1 PCBs- polychlorinated biphenyls

6.2.2 Pest- pesticides

6.2.3 TCMX- tetrachloro-m-xylene

7.0 Interferences

7.1 Solvents, reagents, glassware, and other sample processing apparatus can add interferences to sample analysis. Method blanks must be extracted under the same conditions as samples to demonstrate freedom from interferences.

7.2 Phthalate esters commonly found in plastics can interfere with the analysis. Plastics should be avoided.

7.3 Soap residue can degrade certain analytes such as aldrin and heptachlor. Glassware should be solvent rinsed to avoid this problem.

8.0 Safety

8.1 Laboratory SOP QS13 "Safety Program & Chemical Hygiene Plan" discusses the safety program that is to be followed labwide.

9.0 Equipment and Supplies

9.1 Separatory Funnel – 2L with Teflon stopcock
9.2 Beaker – 250mL or 400mL
9.3 Drying/Chromatographic column – 20mm I.D. x 300mm
9.4 Filter funnel
9.5 Turbo-Vap evaporation tube – 200mL tube made by Zymark or equivalent
9.6 Metal rack – capable of holding six glass evaporation tubes
9.7 Turbo-Vap Evaporator – heated and capable of temperature control (±5˚C); the bath should be vented into a hood
9.8 Vials, 10mL glass with Teflon-lined screw cap
9.9 pH indicator paper – wide range (1.0-12.0)
9.10 Syringe – 1mL
9.11 Graduated cylinder – 1000mL, 500mL, and 100mL, glass, Class A
9.12 Pasteur pipette – length 9”
9.13 Pasteur pipette bulb
9.14 Labels – Avery
9.15 Teflon Bottles – 500mL
9.16 Volumetric Flasks – 500mL, 100mL, 50mL, and 10mL, glass, Class A
9.17 Ring Stand – 3-prong
9.18 Burette clamp – double
9.19 Aluminum foil – heavy duty
9.20 Nitrogen tank – equipped with pressure regulator
9.21 Boiling chips – Teflon
9.22 Glass Wool – Roving, 9989 purchased from Fisher #11-388 or equivalent

10.0 Reagents and Standards

10.1 Reagents

10.1.1 Reagent water – Reagent water is gathered in a carboy from source in the instrument lab daily.

10.1.2 Sodium Sulfate – Granular, anhydrous, trace pure 10-60 mesh purchased in 200lb bulk fiber drum from Fisher #S415-200lb or equivalent. Place an aliquot in a 1500mL heavy-duty Pyrex beaker and bake in muffle furnace at 400˚C for a minimum of 4 hours. Remove and cool in open air and place in designated “Baked Sodium Sulfate” container at room temperature.

10.1.3 Sulfuric Acid Solution (1:1) – Slowly add 500mL concentrated Sulfuric Acid, purchased from Fisher #A300C-212 or equivalent, to 500mL of reagent water in a 1000mL Teflon container. This mixture will get very warm. Let stand until cool.

10.1.4 Sodium Hydroxide Solution (10N) – Weigh 800g NaOH, purchased in a fiber drum from Tennessee Reagents #2-31825-25lb or equivalent, into a 2000mL volumetric flask and add approximately 1000mL of reagent water. Swirl until pellets are mostly dissolved. Add a stir bar and place on stir plate. This mixture will get very hot. Continue to add reagent water while mixture is being stirred until a final volume of 2000mL is attained. Let stand until cool. Transfer to 1000mL Teflon containers.

10.1.5 Methylene Chloride - purchased from Fisher #D151-4 or equivalent. **Please see SOP 336 before handling this solvent in our laboratory.**

10.1.6 Hexane – suitable for gas chromatography, purchased from Fisher #H303-4

10.2 Standards – The extraction analyst makes up surrogates and spikes. Verify the amount of surrogate/spike to add to the sample prior to addition. It can change if a different detection limit is required or the volume of sample being analyzed changes.

10.2.1 TCMX/DCB (2,4,5,6-Tetrachloro-meta-xylene/Decachlorobiphenyl) – Surrogate solution is prepared, with a final concentration of 0.5ug/mL, by diluting a stock solution (purchased from Restek #32000) in acetone. This solution is named "Pesticide Surrogate for Extractions 500ppb" and expires 6 months after the date it is made. Use 1.0mL of this solution per 1000mL of aqueous sample.

10.2.2 PCB Spiking Solution – For all standard extractions, a mixture of 1016/1260 is prepared and used. The stock standards (purchased by Accustandard 1016 #APP-9-158-10X and 1260 #C260S-H-10X) are diluted in acetone to a final concentration of 5ug?mL. This solution is named "PCB 1660 LCS for Extractions 5ppm" and expires 6 months after the date it is made. Use 1.0mL of this solution per 1000mL of aqueous sample. The Laboratory Director and/or Organic Manager will determine if another PCB mixture is necessary, such as 1242, 1258, or 1254.

10.2.3 Pesticide Spiking Solution – A spiking solution, with a final concentration of 1ug/mL, is prepared by making a dilution of the Pesticide AB ICV Intermediate (this is made in-house by GC operators) in acetone. This solution is named "Pesticide AB LCS for Extractions 1.0ppm" and expires 2 weeks after the date it is made. Use 1.0mL of this solution per 1000mL of aqueous sample. For 608 samples, 1 out of every 10 samples must be spiked

10.2.4 TCLP- When necessary to set up a TCLP, in addition to setting up the sample, two matrix spikes must be set up and should include the following:

A. TCLP Spike 1 – This matrix spike must include a solution containing Chlordane at a concentration of 100ug/mL and Toxaphene at a concentration 10ug/mL. Both compounds are diluted in acetone from stock standards purchased from reputable vendors (Chlordane from Ultra Scientific #EPA-1086, Toxaphene from AccuStandard #P-0935-H). This solution is named "Tox/Chlor LCS for Extractions 10-100ppm" and expires 6 months from the date it is made. Add 1.0mL of leachate.

B. TCLP Spike 2 – This matrix spike must include the Pesticide Spiking Solution known as "Pesticide AB LCS for Extractions 10ppm." Add 1.0mL of this solution per 100mL of leachate.

11.0 Sample Collection, Preservation, Shipment, and Storage

11.1 Quality Systems SOP QS10 related to Sample Receipt, Handling, & Processing provides details for collection, preservation, shipment, and storage.

11.2 Aqueous samples have a hold time of 7 days from the date of sampling.

12.0 Quality Control

12.1 Quality Systems SOP QS08 "Technical/ Operational Definitions, Minimum Essential Quality Control Elements, and Laboratory Calibration Procedures" outlines details related to laboratory wide protocols on quality control.

13.0 Calibration and Standardization

Not applicable to this SOP

14.0 Procedure

14.1 All waters have a seven-day holding time counted from the day they are sampled. Determine the samples necessary to extract from the following (Note: never extract samples of unknown origin without discussion with supervisor):

- 14.1.1 Each day the extractions group leader will generate a sample backlog using LIMS
- 14.1.2 This backlog is used to determine extraction priorities based n hold times and due dates.
- 14.1.3 Samples requiring RUSH turn around time may be logged in throughout the day, which will require immediate attention. Sample receiving personnel will generally communicate this need.
- 14.1.4 Samples are placed in LIMS "batches" based on parameter and extracted accordingly.

14.2 Wearing lab coat, gloves, and safety glasses, get samples from cooler. Samples must be signed out of the walk-in refrigerator. Enter the sample numbers, your initials, and the date and time removed on the log provided. Inspect as to whether they are in glass amber jars and have a Teflon lid.

14.3 Find out if any special dilutions need to be made for client. Routine procedures for difficult matrices are listed below:

- 14.3.1 Sludge – use only 100mL and dilute to 1000mL with reagent water
- 14.3.2 TCLP Extract – use only 100mL for the sample and dilute to 1000mL with reagent water. There must be two matrix spikes of 100mL as well that are also diluted to 1000mL with reagent water.
- 14.3.3 Bad Matrix – e.g. a liquid that is partially sediment. See Organics Supervisor to find out what dilution, if any, should be made.
- 14.3.4 NPDES client – Samples for method 608/608.2 are checked by login to make sure the pH of the sample is in the range of 5.0-9.0. If the sample is not in this range, extraction personnel will be notified. At that time, it is the responsibility of the extraction lab to adjust the pH of the sample to the appropriate range (pH of 5-9 using NaOH solution or Sulfuric Acid, as necessary) or to extract the sample within 72 hours of sampling. If a pH adjustment is made, the details of the adjustment must be recorded on the sample COC and in LIMS. Set up one full list matrix spike for every ten samples.

14.4 Mark the amber glass container of each sample at the water meniscus with "white out" for later determination of sample volume.

14.5 Check the pH by inverting the sample and touching the wide range pH paper to the portion that remains on the lid. Record this pH on the bench sheet and later, in LIMS.

14.6 Get out enough separatory funnels to extract the number of samples you have plus any additional spikes and a method blank. A method blank and a LCS must be processed with each set of samples. If the sample is a TCLP, blank fluid may be provided along with the extracted TCLP sample(s). Follow instructions for TCLP in section 14.3.2 of this SOP. Process a matrix spike and matrix spike duplicate on aqueous samples if requested by client. If not, a LCSD must be processed.

14.7 Rinse separatory funnels with methanol and discard of waste according to SOP QS14.

14.8 Pour samples into separatory funnel, placing the label from the sample bottle on the designated separatory to ensure proper identification. Use Avery labels to properly identify method blank, LCS, LCSD, any TCLPs, and TCLP spikes. If a sample requires both Pesticide and PCB analysis, a Pesticide LCS/MS/MSD (if client specified) or LCS/LCSD and a PCS LCS/MS/MSD (if client specified) or LCS/LCSD must be processed to satisfy QC requirements for the batch.

14.8.1 Due to limited volume received, it is usually necessary to use 500mL of sample to do a matrix spike so that a matrix spike duplicate can also be extracted. If only one sample container is provided for spiking purposes, use a 500mL glass cylinder to measure out half of the sample for extraction. Add half of the normal amount of spiking solution and half of the normal amount of surrogate.

14.9 Add 50mL of methylene chloride to the empty sample container, swirl, and pour into the designated separatory funnel.

14.10 Using the 1L glass graduated cylinder marked “DIH20 WATER ONLY” measure 1L of reagent water from the carboy and transfer it to the designated separatory funnels for method blank, LCS, and LCSD.

14.11 Add 50mL of methylene chloride to the method blank, LCS, and LCSD.

14.12 Verify the amount of surrogate/spike to add to the sample prior to addition. It can change if a different detection limit is required or the volume of sample being analyzed changes. Set the surrogate/spike out at least ten minutes before use to allow it to warm to room temperature.

14.13 Using the 1.0mL glass syringe marked “TCMX/DCB” surrogate, add 1.0mL of TCMX/DCB surrogate to each sample, method blank, and spike. A second analyst must verify that the surrogate has been added. Enter the ID# of the standard, amount, and the initials of the analysts on the LIMS generated bench sheet and later in LIMS.

14.14 Determine if the sample will require a Pesticide spike, PCB spike, or both and proceed as follows:

14.14.1 Pesticide and PCB – Refer to 14.8 for instructions on how to determine QC requirements. To all Pesticide QC, add 1.0mL of Pesticide AB LCS with a glass syringe dedicated for that particular spike. To all PCB QC, add 1.0mL of PCB 1660 LCS using a glass syringe dedicated for that particular spike.

14.14.2 Pesticide only – To all Pesticide QC, add 1.0mL of Pesticide AB LCS with a glass syringe dedicated for that particular spike.

14.14.3 PCB only – To all PCB QC, add 1.0mL of PCB 1660 LCS with a glass syringe dedicated for that particular spike. 1660 is the standard PCB that we analyze for, if client specifies another PCB the extraction analyst will need to prepare another spike mix accordingly.

14.14.4 Enter the LIMS generated spike mix ID#, amount added, and the initials of the extraction and verifying analysts on the bench sheet and, later, in LIMS.

14.15 If the pH is not within 5.0-9.0 range, it must be adjusted using either the NaOH solution or Sulfuric Acid solution. If a pH adjustment is made, the details of the adjustment must be recorded in LIMS.

14.16 Seal and shake the separatory funnel vigorously for 3 minutes in the shaker apparatus with the stopcock open.

14.16.1 Methylene chloride creates excessive pressure very rapidly; therefore, initial venting should be done immediately after the separatory funnel has been sealed and shaken once.

14.17 Allow the sample to set for a few minutes, if needed, after it has been shaken. It will separate into two layers with the solvent layer on the bottom.

14.17.1 If it forms an emulsion (thick, cloudy, viscous mixture that you cannot see through), drain what you believe to be 50mL into a 250mL centrifuge bottle.

14.17.2 Save and drain into this centrifuge bottle until the extraction is complete.

14.17.3 The emulsion must be centrifuged at 2500rpm for a good separation of the water from solvent.

14.18 Drain solvent layer into an appropriately labeled 250mL beaker.

14.19 Following steps 14.16 through 14.18, extract two more times with 40mL of methylene chloride combining all solvent extracts into the same appropriately labeled 250mL beaker.

14.20 Prepare a sample vial tray with 12mL vials and vial labels printed from LIMS. These labels contain the sample number, client name, initial/final volume, parameter, and date extracted.

14.21 Remove any water layer from the extract in the beaker or centrifuge bottle, by either or both of the following two methods.

14.21.1 Remove with a Pasteur pipette by carefully pulling up the water layer, on top, and not solvent. Discard this layer.

14.21.2 Use the smallest amount possible of Sodium Sulfate by sprinkling the top layer until it hardens, separates, and drops to the bottom.

14.22 Turbo-Vap Concentration

14.22.1 Rinse a Turbo-Vap tube and arrange it underneath a methylene chloride rinsed sodium sulfate filled filter funnel.

14.22.2 Using a sharpie, label the Turbo-Vap with the sample IDs

14.22.3 Pour the extract through the filter funnel into the appropriately labeled Turbo-Vap tube.

14.22.4 Rinse the beaker three times with methylene chloride and pour through funnel.

14.22.5 Rinse the filter funnel with methylene chloride once more and allow the funnels to sit until there is no more solvent dripping.

14.22.6 For solvent exchange purposes, add 50mL of hexane to each tube. Total volume in the Turbo-Vap tube should not exceed 200mL to avoid splattering

on the lid of the Turbo-Vap. If there is a large volume of methylene chloride extract, allow the sample to condense in Turbo-Vap until 75mL-100mL are left in the turbo tube.

14.22.7 Adjust pressure of nitrogen gas tank to >30psi, making sure that the tank has 200psi or more on the main valve.

14.22.8 Record the water bath temperature in the logbook located beside the TurboVap, making sure that it is 40˚C-50˚C.

14.22.9 Place turbo-vap tube in the Turbo-Vap. Be sure to push the tube down so the tip slides into the sensor well.

14.22.10 Close the lid and push corresponding well light to start concentration.

14.23 For PCBs Only – Some wastewater samples will form a gel like substance when the hexane is concentrated. Proceed with these samples as follows:

14.23.1 Add just enough methylene chloride to make the gel go back into solution

14.23.2 Acid clean the extract and reconcentrate.

14.23.3 Exchange with hexane again

14.23.4 If gel forms again, add enough methylene chloride to get gel back into solution

14.23.5 Transfer to a suitable container and record the final volume on the label and on bench sheet. Make sure to note the percentage of methylene chloride in sample.

14.24 When the samples reach a volume of 3mL-5mL, remove the tube from the batch

14.25 Hold the sample vial and tube in one hand at ~45˚ angle and 9" Pasteur pipette equipped with a latex bulb in the other.

14.26 Draw up sample and transfer into appropriately labeled 12mL sample vial. Be careful not to spill a drop during transfer.

14.27 Add 2-3mL of hexane to the tube and rinse several times using the pipette. Transfer this rinsate to sample vial and bring sample up to 10mL with hexane and cover the extract with a Teflon-sealed screw cap.

14.28 Take sample batch to GC Hobart sample refrigerator and log the sample numbers, analyst initials, and the date and time the samples were placed into the Hobart in the sample logbook located beside the refrigerator.

14.29 Transfer handwritten extraction details from bench sheet to LIMS and archive bench sheet for future reference.

15.0 Data Analysis and Calculations

Not applicable to this SOP

16.0 Method Performance

16.1 Demonstration of Capability (DOC): Each analyst must perform a DOC prior to independently extracting samples and yearly thereafter. The analyst must prepare 4 LCS samples. The data is calculated for accuracy and precision requirements.

17.0 Pollution Prevention

17.1 Quantity of chemicals purchased should be based on expected usage during its shelf life and the disposal cost of unused material. Actual reagent preparation volumes should reflect anticipated usage and reagent stability.

18.0 Data Assessment and Acceptance Criteria for Quality Control Measures

Not applicable to this SOP

19.0 Contingencies for Handling out-of-control or unacceptable data

Not applicable to this SOP

20.0 Waste Management

20.1 Laboratory SOP QS14 on Waste Handling discusses general guidelines for the appropriate handling of wastes and the laboratory program on waste management.

21.0 References

21.1 *Test Methods for Evaluating Solid Waste*, SW-846, Third Edition

21.2 40 CFR, Method 608

22.0 Tables, Diagrams, Flowcharts, and Validation Data

Not applicable to this SOP.

SOP Title:

BNA & Pesticide/PCBs & TPH NON-AQUEOUS MATRIX (MICROWAVE EXTRACTION) USING SW-846 METHOD 3546

SOP NUMBER: SOP-343

REVISION NUMBER: 0

APPROVED BY:

SECTION MANAGER

QUALITY ASSURANCE OFFICER

EFFECTIVE DATE: 08/01/09

DATE OF LAST REVIEW: 08/01/09

BNA & Pesticide/PCB & TPH NON-AQUEOUS MATRIX
(Microwave Extraction)
Using SW846 METHOD 3546

1. SCOPE AND APPLICATION

a. This SOP describes the extraction of BNAs, pesticides/PCBs, and TPHs from soil, sediment, sludges and waste solids by an automated method (3546).

2. SUMMARY

a. Soil and solid samples are mixed with sodium sulfate and extracted with solvent in a Microwave extractor for BNAs, Pesticides/PCBs, or TPHs. The extracts are then concentrated by a Turbo Vap concentrator.

3. INTERFERENCES

a. Solvents, reagents, glassware, and other sample processing apparatus can add interferences to sample analysis. Method blanks must be extracted under the same conditions as samples to demonstrate freedom from interferences.
b. Phthalate esters commonly found in plastics can interfere with the analysis. Plastics should be avoided.
c. Soap residue can degrade certain analytes such as aldrin and heptachlor. Glassware should be solvent rinsed to avoid this problem.

APPARATUS AND MATERIALS

d. Stainless Steel spatula
e. Microwave extractor unit with 40 position carousel, electronic components, and ample ventilation
f. Microwave extraction Teflon tubes, capacity approximately 75mL
g. Suitable Teflon cap and screw-top lid
h. Drying column (Chromatographic column) – 20mm I.D. x 300mm
i. Vial – 2mL clear with Teflon-lined screw cap
j. Vial – 12mL clear with Teflon-lined screw cap
k. Syringe – 1mL, 500uL
l. Pasteur pipet – 9" length
m. Pasteur pipet bulb
n. Labels – Dymo
o. Aluminum foil – heavy duty
p. Nitrogen tank – equipped with pressure regulator
q. TurboVap Concentrator with 200mL concentrator tubes
r. Teflon funnels for pouring off
s. Balance – capable of weighing to 0.1grams
t. Aluminum pie pans for mixing samples
u. Filter paper – 185mm

4. REAGENTS

a. Sodium Sulfate (Na2SO4) – Granular, anhydrous, trace pure 10-60 mesh (purchased in bulk containers from Fisher #S415-10S or equivalent)
b. Methylene Chloride (Please read SOP – 336 before handling this solvent in our laboratory) (Dichloromethane) – suitable for spectrophotometry and gas chromatography (Fisher #D151-4 or equivalent)
c. Hexane – suitable for spectrophotmetry and gas chromatography (Fisher #H303-4)
d. Surrogate/Spike Solutions – Verify the amount of surrogate/spike to add to the sample prior to addition. It can change if a different detection limit is required or the volume of sample being analyzed changes or if the initial concentration of stock is different than that listed below:
    i. **BNA Surrogate (100ug/mL)** – The base neutral and acid surrogates are mixed together in one solution. This solution is prepared in methanol by making a dilution of stock purchased from a reputable vendor. Use 0.5mL of this solution per 15g of non-aqueous sample. **(For low-level PAHs use 1.0mL of 1.0ug/mL BN Surrogate spiking solution.)**
    ii. **BNA Spiking Solution #1 & #2 (100 ug/mL)** – The base neutral and acid spiking solutions are mixed together in one solution. This solution is prepared in methanol by making a dilution of stock purchased from a reputable vendor with same compounds as for calibration. Use 0.5 mL of this solution per 15g of non-aqueous sample. **(For low-level PAHs use 1.0mL of 1.0 ug/mL PAH spiking solution.) The BNA Spiking solutions contain all targets that are calibrated for GC/MS. DOD QSM requires all targets to be spiked in the LCS and MS/MSD.**
    iii. **TCMX/DCB (2,4,5,6-Tetrachloro-meta-xylene/Decachlorobiphenyl) Surrogate solution is** prepared in acetone by making a cut on stock purchased from a reputable vendor. 0.5mL at 0.5 ug/mL of this solution is added per 15g of non-aqueous sample.
    iv. **PCB Spiking Solution** – Arochlor 1016/1260 or the PCB of choice (1242, 1248, 1254, or 1260 are the most common) is prepared in acetone at a concentration of 5.0ug/mL. PCB stock is usually purchased from RESTEK or equivalent. The PCB to use may be determined by viewing historical data or asking the GC operator. Use 0.5mL per 15.0g of non-aqueous sample.
    v. **Pesticide Spiking Solution** – A spiking solution is prepared at 1.0 ug/mL. Use 0.5mL per 15g of non-aqueous sample.
    vi. **TPH Surrogate** – Surrogate solution is prepared in acetone by diluting stock ortho-terphenyl standard to a final concentration of 20 ug/mL. Use 1mL per 15 grams of sample.
    vii. **TPH Spike** – A spiking solution is prepared by extractions analyst that has a concentration of 1000 ug/mL in acetone.

5. SAMPLE COLLECTION, PRESERVATION, AND HOLDING TIMES

a. Samples are collected in an appropriate size wide-mouth glass jar (4oz. or 8 oz.) with a Teflon-lined cap.
b. Samples are preserved by cooling to 4°C.
c. Holding time is 14 days from collection date to extraction.

6. PROCEDURE

a. All soils have a 14-day holding time counted from the day they are sampled. Determine the samples necessary to extract using the following information (DO NOT extract samples for which you have no information.):
    i. Each day a backlog is generated in ELEMENT providing all relevant sample information, including samples numbers and respective analysis required.
    ii. Samples requiring RUSH turn around time may be logged in throughout the day which will require your immediate attention. Log-in personnel will generally communicate this need.
    iii. Check the backlog throughout the day to re-evaluate priority if needed.
b. Wearing lab coat, gloves, and safety glasses, get samples from cooler. Samples must be signed out of the walk-in refrigerator. Enter the sample numbers, your initials, and the date and time removed on the log provided. Inspect as to whether they are in glass and have a Teflon lid. Find out if any special dilutions need to be made for this client. If the sample has a particularly bad matrix or a strange matrix, see your supervisor to find out if a microwave extraction is truly necessary.
c. Get twice the number of aluminum pie pans to prepare the number of samples you have plus any additional spikes of LCSs and a method blank. A method blank and LCS must be processed with each set of samples. A matrix spike, a duplicate or a matrix spike duplicate and a LCS must be processed for each analytical batch (up to a maximum of 20 samples). Using the LIMS, create a batch of samples and print off sample labels. The LIMS will create a unique batch sequence number.
d. Decant and discard any water layer on a sediment sample by carefully pouring this off into a trashcan.
e. Dump the entire sample into an aluminum pie pan and mix sample thoroughly with a spatula until mixture is homogenous. Discard any foreign objects such as sticks, leaves, and rocks.

It is extremely important that waste (when appropriate), soil and sediment samples be mixed thoroughly to ensure that the sample is as representative as possible of the sample media. The most common method of mixing is referred to as quartering. The quartering process should be performed as follows:

- *The material in the sample pan (inorganic-plastic/organic-aluminum) should be divided into quarters and each quarter should be mixed individually.*
- *Two quarters should then be mixed to form halves.*
- *The two halves should be mixed to form a homogenous matrix.*

This procedure should be repeated several times until the sample is adequately mixed.

NOTE: Samples that are clay type materials should be handled in a different manner. Due to these type sample matrices having an affinity to stick to most anything that touches it, another approach must be followed. Obtain a representative sub-sample aliquot from the center or middle section of the sample container

f. Place an aluminum pie pan on the balance and zero it. Calibrate balance with ASTM class-1 Troemner weights or equivalent, bracketing desired weight (50g, 20g, 10g, 5g, 1g). Record calibration in the Extraction calibration/temperature logbook. Using a spatula, transfer the **appropriate weight, {10-20 grams depending upon client or project specific Detection Limits (DL) and/or Reporting Limits (RL)}**, of a representative sample to the nearest 0.1 gram. Normally 10 or 15g sample weights are used. Record this amount on your label. Put your label on the side of the 400-mL beaker. For spiking purposes, weigh 3 aliquots of the appropriate sample. Pick a sample with a good matrix, one that mixes well, non-oily, etc.

g. Add ~ 15 grams of sodium sulfate to the aluminum pie pan. Using a spatula and/or a glass rod, mix the sample thoroughly with the sodium sulfate until it becomes a sandy texture. If necessary, add additional sodium sulfate. When removing the spatula or glass rod from the mixed sample, leave behind all the sample possible. Cover the aluminum pie pan with foil and continue to weigh up the remaining samples. For the method blank and LCS, weigh up 15 grams of sodium sulfate. The matrix used for the method blank and LCS must be free of the analytes of interest and processed through the same analytical steps as the samples.

h. Verify the amount of surrogate/spike to add to the sample prior to addition. It can change if a different detection limit is required or the volume of sample being analyzed changes. Set out the surrogate/spike at least ten minutes before use to allow it to warm to room temperature. Someone must verify that the surrogate/spike has been added by watching and signing off on bench sheet.

NOTE: Surrogate and spike should be added just prior to extraction.

i. Using the 1-mL glass syringe designated for BNA surrogate, add 0.5 mL of BNA surrogate to each sample, spike, and blank. **(For low level PAHs use 1.0 ml of the 1.0 µg/mL BN Surrogate spiking solution.)** or using the 1.0-mL glass syringe marked TCMX/DCB surrogate, add 0.5 mL of TCMX/DCB surrogate to each sample, blank and spike. TPH samples will need 1.0 mL of appropriate.

   For the BNA sample in each analytical batch selected for spiking, use the 0.5-mL glass syringe marked Base Neutral Acid Spiking to add 0.5 mL of the Base Neutral Acid Spiking solution. **(For low level PAHs use 1.0 ml of the 1.0µg/mL PAH spiking solution.)**
   For Pest/PCB samples, determine if the sample will require a Pesticide Spike and/or a PCB Spike. Proceed as follows:
   Pesticide and PCB - set up two LCS's – one for Pesticide getting an AB MIX spike and one for PCB, which should be spiked with PCB 1660. In addition to the LCSs, a matrix spike/matrix spike duplicate is necessary for the pesticide. Prepare a PCB matrix spike/ matrix spike duplicate if requested by the client.
   Pesticide only – To the sample in each analytical batch selected for spiking, add 0.5 mL of Pesticide Spike (Mix A&B) with a glass syringe dedicated for Pesticide Spike.
   PCB only - To the sample in each analytical batch selected for spiking, add 0.5 mL of PCB 1016/1260 (unless otherwise specified, 1248 for BB&L) using a 1.0 mL glass syringe dedicated to that PCB. Add 20 grams of Na2SO4.

j. Place a Teflon cap and Teflon screw top on the Teflon microwave tube. Using the cap tightener station, tighten the caps and invert sample to insure proper mixing and check for leaks in cap.

k. Place microwave tubes in microwave carousel making sure they are in order and spaced evenly throughout the carousel to insure proper heating while in microwave.

l. Place microwave carousel in microwave making sure the carousel is properly lined up with the turning mechanism.

m. Choose saved program option based on total number of samples to extract and begin process by pressing the start button. The program is set to EPA method 3546 specifications.

   For 1-15 samples:
   Max power: 800W 100%
   Ramp time: 15:00
   Control temperature (in Celsius): 110
   Hold time: 10:00
   Cool down: 5:00

For 16-40 samples:
Max power: 1600W 100%
Ramp time: 15:00
Control temperature (in Celsius): 110
Hold time: 10:00
Cool down: 5:00

n. Allow samples to cool in the carousel for an additional 30 minutes before attempting to handle the extracts.
o. Transfer the extract to a pre-rinsed turbo vap tube by first passing through a funnel with P4filter paper sodium sulfate. All tubes and funnels should be pre-rinsed with Methylene Chloride. After pouring the extract into the turbo, rinse the microwave tube 3 times with Methylene Chloride and transfer the rinsate to the turbo. Finally, rinse the funnel with an adequate amount of Methylene Chloride using a Teflon squirt bottle. This ensures optimum transfer of all compounds of interest.
p. Now concentrate the extract to 1.0mL using the turbovap concentrator.
    i. **Turbo-Vap Operation:** Adjust the pressure of nitrogen gas tank to 50 psi. Make sure the tank has 200 psi or more on the main valve. The temperature of the bath should be approximately 50-55°C. The pressure target range should be about 20-25 psi.
    ii. Place the turbo vap tube in the Turbo-Vap. Be sure to push tube down so the tip slides into the sensor well. Close the lid to start concentration. Check that each position with a tube has an orange light showing. If the orange light is not steady, bubbles may be detected by the sensor and need removal. (See Turbo-Vap manual).
    iii. When the beep sounds indicating the end of concentration, the extract will be at approximately 1 mL. Remove the tube from the bath.
q. BNA and TPH samples need to be concentrated to ~1.0mL while Pesticides and PCB should be concentrated to ~5.0mL in turbo vap. Using clean solvent, rinse turbo with Pasteur pipet and bring sample to volume in sample vial.

7. DOCUMENTATION OF CAPABILITY (DOC)

a. Each analyst must perform a DOC to demonstrate proficiency with this method. Refer to SOP-413 for guidance.

8. WASTE MANAGEMENT AND POLLUTION PREVENTION

a. Please see Waste Disposal SOP-405 for the proper disposal of waste generated from this area.
b. Quantity of chemicals purchased should be based on expected usage during its shelf-life and the disposal cost of unused material. Actual reagent preparation volumes should reflect anticipated usage and reagent stability.

9. METHOD PERFORMANCE

a. Refer to SOP-201 SOP-211 and SOP-219 for method performance.

10. REFERENCES

a. EPA Methods SW-846, Method 3546

11. DEFINITIONS

a. Refer to SOP-431 for definitions.

12. HEALTH AND SAFETY

a. Wear appropriate personal protection equipment when working with chemicals or samples.
b. Use the lab hoods when working with solvents.
c. Use caution when mixing strong acids or bases. Solutions will become extremely hot when mixing with water. Avoid splashing these solutions so they won't come in contact with the skin or eyes. If this happens, flush with lots of water. Contact your supervisor if serious and medical attention is needed.

LABORATORY SAMPLE RECEIVING, LOG IN AND STORAGE STANDARD OPERATING PROCEDURES

SOP NUMBER: **SOP-404**

REVISION NUMBER: **13**

APPROVED BY:

SECTION MANAGER

TECHNICAL DIRECTOR

EFFECTIVE DATE: **06/29/09**

DATE OF LAST REVIEW : **06/29/09**

LABORATORY SAMPLE RECEIVING, LOG IN AND STORAGE

This SOP lists in as much detail as possible our daily procedures for sample receiving, log in and storage of laboratory samples. Keep in mind that there may be project specific requirements that are more strict or different than our routine procedures. In these instances, the project specific requirements must be met and followed. Although a few project specific requirements are detailed in this SOP, i.e. USACE certification issues, not every situation can be addressed. If there is ever any uncertainty on what procedures must be followed, please see the Testing Coordinator immediately. If ever in doubt, always go with the more stringent requirements. This document will constantly be reviewed and revised as necessary.

SAMPLE ACCEPTANCE CRITERIA

A sample may be rejected for compliance purposes if it does not meet the following criteria. Analyses may only proceed after notification and approval to proceed from the client or from the laboratory manager.

1. Sample must be properly preserved and in the proper container for the requested analysis.
2. Sample integrity must be maintained. The container shall be intact without cracks, leaks, or broken seals.
3. Adequate sample volume must be received for the requested analysis, including volume for any requested QA/QC (MS/MSD).
4. The sample ID on the bottle label must match the sample ID listed on the chain of custody.
5. The sample container label and the chain of custody must be completed with indelible ink. The sample label must be intact and list all necessary information; to include: sample date, sample time, sampler, and sample ID/location. The chain of custody shall also indicate sample date and time, requested analyses, and all necessary client information.
6. Sample temperature must be less than 6°C or received on ice.
7. Sample must be within holding time for the requested analysis.

These issues are discussed in more detail below under the "Sample Receiving" section of this document.

I. Sample Receiving

A. Samples are received at the Empirical Laboratories on 621 Mainstream Drive, Suite 270 Nashville, TN 37228.

1. The majority of samples are shipped in coolers by couriers such as Federal Express and UPS. All couriers are generally received in the Empirical Laboratories Sample Receiving (SR) area loading dock in back of the laboratory. The laboratory is located close to the Federal Express (FedEx) distribution station, therefore we do pick up our

coolers at the FedEx location and transport them back directly to the laboratory. Some coolers and/or samples are delivered directly to the SR area by the sampler and/or client.

2. Some coolers and/or samples may be received directly by Empirical Laboratories Sample Receiving personnel. If samples are hand delivered by the client make sure that necessary paperwork is included and that you sign and date the chain of custody, as well as record the temperature of the samples on the chain of custody as well. If the *Empirical Laboratories* ***Chain of Custody [Attachment II***] is used the white and yellow copy of the chain of custody is retained and the pink copy must be given to the client.

B. When going through the required steps for Sample Receiving and Sample Log In, keep in mind that a ***Corrective Action Report (CAR) for Sample Receiving [Attachment III]*** must be completed to document any problems, discrepancies, project changes, etc. encountered during the process. This includes but is not limited to incorrect sample containers, improper preservatives [chemical and temperature], chain of custody discrepancies, sample descriptions, etc. A CAR may be completed just to keep a record of a situation, which is not actually "out of compliance."

1. Make sure that all information on the CAR is stated clearly and very detailed. Many times it is necessary to refer to these documents a year or more after they were completed. Document all correspondence including name, date, company and response.

2. The CAR forms must be numbered starting with No. 001 at the beginning of the year (e.g. 01-001). No two forms should have the same number. All CARs must be forwarded to the Project Manager and/or receiving manager for approval and distribution. THIS MUST BE DONE ASAP OF WHEN THE PROBLEM/SITUATION IS DISCOVERED.

C. Visually inspect all coolers for tampering, custody seals present and intact (if applicable) leakage, etc. If a cooler has been damaged beyond repair, unpack the samples and discard the cooler as to not reuse it. If you suspect a cooler may be damaged or is extremely dirty this cooler must not be reused. If coolers were sent by Federal Express, examine the Federal Express airbills for the number of packages in the shipment and make sure that all the packages (coolers, boxes etc.) in a group have been received. If there are any problems the Project Manager must be contacted immediately. If anything looks unusual, take the time to check it out and document the situation and findings.

D. Open each cooler in order to quickly inspect the contents and to locate the chain of custody. Sample Receiving personnel should wear the following personal protection equipment: gloves, safety glasses and a laboratory coat. All coolers received from projects with the **US Army Corps of Engineering (USACE) and AFCEE** projects should be opened under the hood in the sample storage room. Sign then list the date and time received on the chain of custody. The time received <u>must</u> reflect the actual time the samples were received even though they may be logged into the system at a later time. Samples received on Saturday may be processed on the following Monday morning, or samples received late in the day during the week may be processed the next morning. All cooler(s) <u>must</u> be opened, examined for

leakage, breakage etc., the temperature measured and the chain of custody signed and dated to reflect the actual date and time which they were received. The samples must be delivered to the appropriate analytical department or put in cold storage as soon as possible.

1. Attach any shipping receipts, work orders, etc. to the chain of custody.

2. If a chain of custody or other paperwork is not sent, the client must be contacted and the samples temporarily placed on hold in cold storage. In some instances the log-in person may complete a chain of custody. The required information may be found on the sample containers or it may be necessary to call the client to get the missing information (i.e. sample ID, collection date and time, etc.). Note on the chain of custody that it was completed by laboratory personnel and record the name of the person with whom you spoke. All attempts to encourage our customers to complete a chain of custody or submit written information for samples must be made.

3. Project specific paperwork may be required. For all projects, a ***Cooler Receipt Form [Attachment IV]*** must be completed for each cooler received. Sample receiving personnel must begin completing this form as soon as a cooler is received and complete this form as samples go through the log in process.

E. The temperature of each cooler or set of samples must be measured as quickly as possible using a thermometer with 0.1°C increments. This thermometer must be calibrated against a NIST certified thermometer once a year and this information recorded in a bound notebook. The Certificate of Calibration for the NIST thermometer is kept on file at the QAO's desk. The thermometer must be tagged with the unique identification number of SR#1 and serial #; (Sample Receiving #1), the date calibrated and the correction factor. This information must also be recorded in a bound notebook. Only this thermometer can be used for recording the temperature of sample coolers upon receipt.

1. To measure the temperature, open the temperature control blank if supplied, point the IR thermometer at the liquid surface, wait 30 seconds for temperature to stabilize. Read the temperature to the nearest 0.1 °C. The corrected value temperature must also be recorded on the chain of custody. (This value will also be recorded into the LIMS at a later point.). All regulatory compliance samples received from North Carolina that do not meet the temperature requirement will be segregated and the client will be notified of the non-compliance. The samples will not be analyzed until we receive client notification to proceed with analyses.

2. If the temperature exceeds 6°C for any sample, the Project Manager or Sample Receiving personnel must contact the client immediately. There may be tighter temperature control limits for specific project requirements. The customer must make the decision to either continue with the analyses or resample. Make sure the client is aware that if the samples are analyzed, the following qualifier is normally included on the final report: "The shipping cooler temperature exceeded 6°C upon receipt to Empirical Laboratories. This may have an impact on the analytical results. The concentration may be considered as

estimated." Not all samples for the project will be flagged, just those samples received above 6°C.

Many times we are not able to get in touch with the client quickly and the best judgment on how to handle the samples must be made after discussion with the Testing Coordinator and/or Laboratory Director or Technical Director. The samples may still need to go through the log in process although it may be eventually determined that the samples will not be analyzed or the samples may temporarily be placed on hold and not logged in. Above all do not allow the samples to set out at room temperature for an extended period of time while waiting for a decision. **A CAR outlining the problem and all correspondence must be completed.**

The only exceptions to the 6°C rule are:

a. Water samples for all Metals, (except Chrome 6+ and mercury) that have been preserved with HNO_3 to a pH of ≤ 2. *Keep in mind that non-aqueous sample for Metals must be cooled.*

b. Samples for Fluoride, Chloride and Bromide.

c. Waste/Product samples for all parameters.

d. Samples generated in the Aquatic Toxicology laboratories and brought directly to Sample Receiving after they are collected. Sample receiving personnel should place these in cold storage as soon as possible.

e. Samples collected locally by Empirical Laboratories personnel or local customers that hand deliver their samples. In some instances these samples may not have had time to cool down; however, these samples should have been placed on ice in an attempt to cool them to the proper temperature. This exception is only applicable if the samples were collected the same day as the laboratory receives them. It should be noted if samples are "Received On Ice" (ROI).

f. Samples that are received on ice and it is evident that the client made a good faith attempt to properly cool the samples.

F. If several coolers are received at once, they must be inspected to determine the order in which the samples should be unpacked and logged in. The following priorities should be given:

1. Any analyses, which have a 24-72 hour holding, time. It is the log-in person's responsibility to notify the department manager or section group leader of such samples via e-mail and verbally.

2. Any sample which has almost exceeded its' holding time. (Especially watch for this with waters organic extractions, Solids and Sulfides, all of which have only 7 days). A list of parameters and holding times is posted in the log-in room.

   a. If a sample is received already out of holding time, the project manager must be contacted. The sample can be analyzed at the client's request, but it will be qualified on the final report as being analyzed out of holding time. The project manager must inform you of the client's need.

   b. If a sample is received with limited holding time remaining for any parameter it may be necessary to contact the project manager so that he/she can contact the client. If the sample has to be analyzed on a rush basis to meet the holding time a rush charge may apply. Also it may not be possible to analyze the sample within the holding time due to sample load, etc. A CAR must be completed.

3. Samples requiring rush turnaround.

   a. If sample(s) require 24-hour turnaround they will take first priority. Other rush requests also have high priority.

   b. The Project Manager and/or Section Manager must be contacted for approval concerning any unscheduled rush requests.

G. Unpack all samples from the cooler. If there are any known or suspected hazards this must be done under a hood. All coolers from USACE projects should be unpacked under a hood. It may be necessary to rinse off the outside of the containers in the sink and/or wipe them off with a paper towel.

   1. Visually inspect them for tampering and custody seals (if applicable). Sort and inventory the samples against the chain of custody by arranging them in the same order as they are listed on the chain of custody. Normally samples are assigned log numbers in the same order as they are listed on the chain of custody but for certain projects or situations it is acceptable to arrange them in a manner which will make them easiest to log in.

   2. Check for leakage as this could compromise the sample integrity. If any spillage occurred in the cooler make sure this is noted. Also list all the other samples in the cooler as cross contamination could occur. A CAR must be completed and the Project Manager and/or the customer may need to be notified in these situations. It may be necessary to resample.

H. Check the chain of custody information against the information recorded on the containers. If these do not agree, contact appropriate person (s) - Project Manager, sampler, client, etc. All problems must be documented with a CAR.

1. If major changes are made on the chain of custody received from an engineering job, then the PE should submit written confirmation of these changes or make the corrections and initial them directly on the chain of custody.

2. Any error found on the chain of custody must be marked through with one line, initialed and dated and the correction written in.

I. Note any unusual requests, methodology, hazards (known or suspected) to the Project Manager and/or Laboratory Section Manager or analysts before the samples are actually logged in. Keep notes of any problems (improper containers, preservatives, temperature, or descriptions, etc.) A CAR must be completed and the analyst or manager should be notified immediately. If ever in doubt, fill one out!

II. Sample Log In

A. After samples have been unpacked, sorted and reviewed, they are then ready to be assigned log numbers and continue through the log in process. Make sure that the parameters for the samples are clearly marked on the chain of custody. If we prepared the sample kits there should be a sample kit work order form. Contact the Project Manager if there are any questions, problems, etc.

B. Assign a work-order and sample number to each individual sample and record it on each sample container and the chain of custody.

1. All containers with the same description must have the same sample number even if they have different preservatives and require different tests. However, each different fraction (bottle type and/or preservative) should be designated with a letter (A, B, C, etc.)

2. Grab and composite samples from the same sample location must be considered as separate samples. It may be necessary to use "grab" or "composite" as part of the sample description to distinguish between the samples. Only assign different log numbers to them if the parameters are clearly marked as grab and as composite. Do not assume that VOC must be analyzed from grab samples so therefore the client must have taken a grab sample.

3. Sample numbers must begin with 001 at the beginning of each year (e.g. 0101001).

C. Check the following items and record this information on the cooler receipt form to further ensure sample integrity. A CAR must be completed if any of the following requirements are not met and it may be necessary to contact the client. We can perform the analyses in most cases and will do so with the client's approval, however the results may be qualified in some manner on the final report.

Preserving sample integrity throughout the log in procedure must be one of our section's top priorities. This includes not only ensuring that the proper chemical preservatives have been added but also that the samples are received and maintained at the proper temperature. ***When samples are unpacked they must be placed in cold storage within two hours even if they have not been through the entire log in procedure***. All samples for NPDES compliance monitoring from North Carolina will be stored at a temperature range of 1.0 to 4.4°C. All other NPDES samples will be stored at 4.0 ± 2.0°C. On the days we receive a large volume of samples, or are short handed, etc., we may not be able to completely log in all samples until late in the day or even the next day. Samples should not set out at room temperature if there is a delay. The samples must temporarily be placed in cold storage until you are able to complete the log in procedure. This should also be done when we take lunch breaks.

[Make sure the VOC containers are not temporarily stored in a non designated VOC only storage area.]

1. Determine if the samples were received at the proper temperature. (See section IC)

2. The sample descriptions on the bottle should match those on the chain of custody. (See section 1H)

3. Check to determine if the proper chemical preservatives were added to adjust the sample to the correct pH. All regulatory compliance samples received from North Carolina that do not meet the preservation requirement will be segregated and the client will be notified of non-compliance. The samples will not be analyzed until notification to proceed with analyses is received from the client. A list of parameters and the required chemical preservatives is posted in the log-in room. The verification of this preservation will be recorded on the Cooler Receipt Form for all projects. If Empirical Laboratories prepared and shipped out the sample containers they will have been pre-preserved unless instructed otherwise by the client. Complete traceability of the preservatives used to pre-preserve the sample containers and to preserve samples in the log-in area is required. A bound notebook must be used to trace this information and must include the following: Lot #, Type of preservative, Date Prepped, Amount and Analyst Name. This information must also be labeled on each container, re-pipetter, etc. that the preservative is stored in. Each lot of HNO3 used for Metals preservation must be tested prior to using them for preservation. These analyses are kept on file.

   a. The pH of each container (except VOA vials) which requires pH preservation must be checked. Do not open and check the pH of VOA vials in sample receiving/log-in.

   b. The pH of preserved samples is checked and confirmed using pH narrow range indicator paper. When the client request pH analysis on samples and they must be reported and measured for pH using the narrow range paper, rather then a pH meter, the accuracy of each batch of indicator paper must be calibrated to the nearest tenth versus certified pH buffer and recorded into a bound logbook in accordance with SW846 method 9041A pH Paper method.

c. When taking the pH reading, DO NOT PUT THE pH PAPER DIRECTLY INTO THE SAMPLE CONTAINER. Pour up a small aliquot and dispose of this volume after the pH is taken. For some samples (wastes) the indicator paper may not be accurate due to interferences. The observation of the appropriate color change is a strong indication that no interferences have occurred. If it appears as if there is interference, the pH must be measured using the pH meter. [See SOP ATSD-187 pH, Electrometric.]

4. The following guidelines must be followed to check pH preservation:

a. Water samples for Cyanide analyses must be preserved to a pH of >12 with NaOH upon collection. If the pH of these samples is between 11.0-12.0 upon receipt, and the samples are at the proper temperature and not over 48 hours old it will not be necessary to complete a CAR, however the sample should be adjusted to ≥12.0 unless project/client specific requirements are to contact the client first.

b. Water samples for Metals analyses must be preserved to a pH of ≤2.0 with HNO_3 upon collection. If the pH of these samples is between 2.0-.3.0 upon receipt, and the samples are not over 48 hours old it will not be necessary to complete a CAR, however the sample should be adjusted to ≤2.0. unless project/client specific requirements are to contact the client first.

c. Samples requiring analyses which are preserved with H_2SO_4 (i.e., Nitrogen compounds, Total Phenolics, Oil and Grease, Total Phosphorus, etc.) can be accepted up to a pH of 2.5 without a CAR, however the sample should be adjusted ≤2.0 unless project/client specific requirements are to contact the client first. Samples for sulfide analysis must have a pH >9.

d. If a sample is not properly preserved, log-in personnel must either do the following:

- To meet project specific requirements, including all USACE projects, the client must be notified before preserving or adding additional preservative to the sample unless otherwise instructed. If the client instructs us to add chemical preservatives to a sample, complete traceability of the preservatives used is required (See section IIC, #3). A CAR must be completed.

- For other projects it may be acceptable to preserve the sample accordingly before the sample is placed in storage. Complete traceability of the preservatives used is required (See section IIC, #3). A CAR outlining the project and the steps taken must be completed.

- All metals samples preserved upon receipt must be held 24 hours before proceeding with analysis. These samples must be CAR generated and the client notified to see if the lab is to proceed with analysis.

e. In some instances it may not be possible to adjust the sample to the proper pH due to matrix problems which cause excessive foaming or require an unusually large amount of acid. Do not continue to add acid if a few mL's of acid does not lower the pH. Notify the Project Manager, Metals Manager and/or analyst. They will make the decision if the sample will be diluted, not analyzed, etc. A CAR must be completed in these situations. Make sure you note on the container and in the LIMS notes that the sample is not at the proper pH as well as any useful information (i.e., foaming, strong odor, etc.).

f. A CAR may not be required for samples generated in the Aquatic Toxicology Laboratories and brought directly to Sample Receiving after they are collected but before they are preserved. Log-in personnel must preserve the samples accordingly before they are placed in storage. Complete traceability of the preservatives used is required (See section IIC, #3). A CAR outlining the project and the steps taken must be completed.

5. Check to make sure samples are in proper containers and that there is adequate volume for all the parameters requested and no leakage.

6. If VOA vials are present, each vial must be inverted and checked for head space. "Pea-sized" bubbles (i.e. bubbles not exceeding 1/4 inch or 6 mm in diameter) are acceptable and should be noted, however, a CAR is not required. Large bubbles or head space is not acceptable and a CAR must be completed. If this occurs, the client must be contacted. The samples can be analyzed with their approval, however the report will be qualified and the data may be questionable. All VOA vials will be preserved with $Na_2S_2O_3$ (0.2g) when chlorine is known to be, or suspected to be present.

7. All pesticide samples to be analyzed by method 608 will be checked by the sample receiving personnel for the correct pH range of 5.0 to 9.0. The pH of the sample(s) will be communicated via E-mail to the Section Manager and appropriate analyst.

8. All chlorinated effluent samples received for Cyanide must be checked for residual chlorine. The one liter sample container should initially contain 1 to 2g/L of Ascorbic Acid. <u>Potassium Iodide starch indicator paper will be used for detecting the presence of residual chlorine. DO NOT PUT THE TEST PAPER DIRECTLY INTO THE SAMPLE CONTAINER. Pour up a small aliquot, neutralize, test and dispose of this volume after the sample is checked.</u> If the test paper turns blue, the sample must be treated for residual chlorine. Add Ascorbic Acid, approximately 0.6g at a time and recheck the sample until there is no residual chlorine present. If the sample required this treatment this information must be included in the LIMS notes. This must be done by log-in personnel before leaving the receiving area. It may be necessary to notify the Inorganic Manager and/or analyst.

9. Be aware of holding time requirements. (See section 1D)

D. Once sample containers have been numbered, they must be checked by another laboratory individual to ensure that the log number on the container matches the log number and sample ID on the Chain of Custody. A ***Sample Receiving Custody and Disposal Form [Attachment VII]*** must be completed each day. Samples should not leave the log-in area until this has been completed. *[see IIC; it may be necessary to temporarily store samples in cold storage until the samples can be second checked, the amount of time that the samples are at room temperature must be minimized as much as possible.]* The original is to remain in Sample Receiving until the samples are disposed of. Once the document is complete, the original will be kept on file. The following information must be logged onto this form:

1. Client and Log #s
2. Date/Time Unpacked
3. Logged In/Numbered By (Initials)
4. 2nd Checked By (Initials)
5. Date/Time Placed in Cold Storage
6. Storage Area (Walk In, VOC Cooler, Quarantined Soils, Quarantined-VOC, Other)
7. Disposed of By/Date
8. Method of Disposal

E. Notify the proper analyst if samples have been logged in for analyses which have a 24-48 hour holding time or if a 1-2 day turnaround has been requested. The log number and description on sample (s) must be second checked before it is released to the analyst. (The analyst can second check the sample, but must initial the custody form.)

III. Sample Storage

A. After samples have been correctly logged in they are then transferred to one of the following cold storage areas and arranged in numerical order by the assigned log in/LIMS sample number. ***Note that aqueous VOC samples must be segregated from all other samples.***

1. The Hobart refrigerator in the MS Lab: All aqueous VOC's must be stored in this refrigerator. Storage blanks consisting of organic free water from the laboratory may be required for specific projects. These will be analyzed for VOCs only. ***Storage blanks are required for all DOD projects.***

2. Walk In Refrigerator: All aqueous samples for all analyses must be stored in this refrigerator.

3. Soil Walk-In Refrigerator: All quarantined and non-quarantined soil samples for all analyses must be stored in this refrigerator.

B. Quarantined soils are those quarantined by the US Department of Agriculture. These soil samples must be segregated from other soil samples during storage. A separate disposal log must be maintained for these soils including the location, date and quantity of the soil received and processed. Soil residues from quarantined samples must be treated according to regulations after testing (see Sample Disposal SOP). Quarantined soils are defined as:

1. Soil taken from much of the southeastern US and parts of New York and Maryland at a depth of three feet or less. *Soils from three feet or more are not regulated provided they are stored separately.* A map of the regulated areas in the United States entitled ***Soil Movement Regulations [Attachment VIII]*** is posted in the log-in room.

2. All soils taken from foreign sources, US. Territories and Hawaii.

NOTE: All soils are treated as quarantined soils and are disposed of in accordance with USDA regulations. Above for information purposes only.

C. All samples must be stored in one of the three refrigerators detailed above with the following exceptions:

1. Matrices that may be adversely affected by the cold temperature. (e.g. surfactant samples, multi-phase samples)

2. Highly contaminated waste or product type samples that could jeopardize the integrity of other samples in the walk in cooler. Often these can be stored at room temperature. If these require refrigeration see the Project Manager for other options.

D. The temperature of each sample refrigerator must be monitored and recorded each day by Wet Chem personnel by the following method. A Mercury thermometer or digital min/max thermometer with 1° increments must be used. Each thermometer must be calibrated against a NIST certified thermometer once a year **(digital thermometers quarterly)** and this information recorded in a bound notebook. The Certificate of Calibration for the NIST thermometer is kept on file at the QAO's desk. The thermometers must be tagged with a unique identification, the date calibrated and the correction factor.

The tolerance range for all refrigerators is 1 to 6°C. This range and the range using the corrected reading must be posted on the outside of each cooler. If the temperature exceeds this range, corrective action measures must be put in place immediately. A CAR must be completed specifically noting the date and time the problem was discovered. The Project Manager, Laboratory Director and Technical Director will be notified in order to assess the situation. It may be necessary to put a service call in to the refrigeration repair service.

E. All personnel removing samples from any refrigerator must sign them in and out. This is done by completing the ***Sample Custody Form [Attachment IX]*** which is attached to the door of each refrigerator. These completed forms are kept on file [see section III, #4F]

F. The water walk in refrigerator in the sample room is the largest refrigerator and stores a large majority of the samples. A back up compressor is hooked into the system and scheduled to automatically come on if the main compressor fails. There is a digital min/max thermometer, which monitors the temperature 7 days a week. This thermometer will be calibrated quarterly against the NIST thermometer.

G. As stated above the temperatures for all refrigerators that samples are stored are checked each day Monday-Friday and monitored seven days a week with min/max thermometers. Pay close attention to these readings and watch for signs of possible problems.

H. A temperature maintenance record book is kept for each refrigerator.

I. Samples must be held for a minimum of 30 days after the final report unless specified otherwise. For USACE projects, samples must be held for a minimum of 60 days after the final report unless otherwise specified. See SOP ATSD 405 entitled Analytical Laboratory Waste Disposal SOP for guidance on disposal of samples.

IV. Laboratory Information Management System (LIMS)

A. Log the sample information into the LIMS for each sample. Every attempt should be made to get every sample logged into the LIMS by the end of the day. All information entered should be clearly stated and recorded on the COC provided. After opening the main menu of the LIMS, select the 'Work Orders' tab from the 'Sample Control' drop down menu. Now click on the 'Add' button to create a new Work Order. You will see the following:

1. ***Client*:**

   Select the client I.D. by clicking on the pull-down and choosing from the client list. This list is in alphabetical order. If the desired client is not on the list, a new client must be created by the project manager or I.T. director.

2. ***Projects*:**

   Click on 'Projects' and choose the project I.D. The projects will be client specific. After the project is chosen the "project information" areas should fill in. The 'Project Name,' 'Project Number,' 'TAT,' 'Client Project Manager,' 'Lab Project Manager,' and 'Comments' information should also appear. If there are no applicable project choices, a project must be created by the project manager or I.T. director. There are two types of projects:

a. Internal -- Empirical Laboratories projects;

b. External -- direct laboratory clients.

3. ***Comments:***

This area is to be used to note any information from the project manager for all work orders of this project. It can also be used to list any work order specific notes; this includes but is not limited to information concerning rush turnaround, deliverables or other QC requirements, analyte concentrations, safety issues, quarantined soils, CAR #s, preservation or matrix problems, etc.

4. ***Received By:***

Enter the name of the person who received the samples.

5. ***Logged In By:***

Enter the name of the person who logged in the samples.

6. ***Received:***

Enter the date and time received separated by a space and using military time.
Example: *08/02/2008 08:30*

7. ***Project/Package Date Due:***

After the date and time received have been entered, the date due for both of these fields will be calculated. If this information is not correct or needs to be amended later, check with the project manager before doing so.

8. ***Shipping Containers:***

Click on the 'Coolers' button and enter the temperature and condition upon receipt. If more than one cooler was received, each cooler must be assigned a different name. For example, if these came in by dedicated courier, enter the last four numbers of the Tracking Number as the name. After all of a cooler's information has been entered (received on ice, where custody seals present, preservation confirmed, COC/container labels agree, sample containers in-tact) click the 'Save' button. If more than one cooler was received, click the 'Add' button and repeat the process above, then click 'Done' after all the coolers' info has been saved.

9. ***COC Number:***

If an identifiable COC number is listed, record that ID here.

10. ***Shipped By:***

Enter the courier used to deliver the samples. If the samples were picked up by a lab employee or dropped of by the client/representative, enter 'Hand-Delivered.'

After these items have been completed, click 'Save,' then the 'Samples' button to continue. To begin entering information for a sample, click the 'Add' button on the bottom of the Samples screen.

11. ***Sample Name:***

a. Only abbreviate if description is too long for the spaces allotted in the LIMS. This information should come directly from the chain of custody. The sample ID entered into the LIMS will be the sample ID on the final report.

b. If no sample ID is provided, or is indistinguishable from other samples listed, contact the project manager to ascertain distinction in the samples. Include date as part of the description if this is the only way to differentiate the samples.

c. When logging in trip blanks that do not have an ID assigned by the client, list them as "Trip Blank # _____". This information should be on the containers. A log book must be kept in the sample kit room which lists all trip blanks and the date they were filled. This will ensure consistency with the descriptions for trip blanks. Make sure you record the trip blank on the chain of custody if it is not listed.

12. ***Collection Date:***

Enter the date and time the sample was collected. You must use military time and separate by a space. Often the time collected is not given. Although this is a sampling requirement, this information may not be crucial unless a parameter with a short holding time or a data deliverables package is required. In the event that a sample collection time is not listed on the COC or the sample container, a default time of 00:00 can be used temporarily until client verification. Once verified, then the correct sample collection time must be input into LIMS. If the COC and sample containers do not list a collection date and time, a CAR must be generated. All attempts should be made to get all our clients to supply this information.

13. ***Lab/Report Matrix:***

Click on pull down and select matrix. Many times it is difficult to discern the matrix if it is not specified on the COC, and log-in personnel must use their best judgment with

regard to analytes/methods requested. Keep in mind that the detection limits and units on the LIMS reports are linked to the matrix. In some cases it may be necessary to ask the Section Managers about the matrix selection. Log-in may do a dilution test to distinguish water samples from oil samples if the COC does not clarify a sample matrix if need be.

14. ***Sample Type:***

This is used to differentiate between special types of samples (i.e. Field Duplicates, Equipment Blanks, Trip Blanks, etc.). If there is no definite way to determine that a sample should be classified as something else, then "SAMP-Client Sample" will be selected as the sample type. Do not list a sample as anything other than a Client Sample unless noted on the COC of are instructed by the client to do so.

15. ***Container:***

Click on the drop down list and select the appropriate bottle type. If multiple bottles are received for the same sample, then move down to the next line and select all other containers as required. Repeat this process until all containers for the sample are listed. As each container is entered, an individual number is assigned to it by the LIMS system. This number is also listed on the container labels that are printed from the LIMS, and is placed on the corresponding bottle for container tracking purposes.

16. ***pH*** (Container Preservative)***:***

Use this to document the pH check information taken during sample unpacking. If no preservative was used, then nothing is required in this field.

17. ***Comments:***

Enter any information that is applicable at the sample level.

18. ***Field Analysis:***

Click on field analysis tab and enter field information when provided.

19. ***Work Analyses:***

Select all parameters requested for the sample from this list.

a. If the required test code is not listed, and the sample matrix is not a contributing factor, click the Work Analyses tab to open the All Analyses list. When selecting from this expanded list, be careful to select the proper method as all methods available for the current matrix will be selectable.

b. If any analyses are selected from the All Analyses list, the Project Manager in charge should be notified so that the correctness of methods and pricing can be checked and updated as needed.

c. All preparation codes for analytes are entered and stored by the system independently of the test codes selected, except in the cases of Dry Weight analysis, and TCLP/SPLP preparation (tumbling). In the case of the TCLP/SPLP prep codes, these are entered alongside the other required analyses automatically by the LIMS when a TCLP/SPLP analyte is selected. As for Dry Weight, it is required for all solids testing except in the cases of TCLP/SPLP analysis, Explosives only analysis, and/or any pure product/non-soil based sample when specified by the client.

20. ***Analyses Comments:***

These comments should be used for any notes that only apply to that particular test code.

21. ***RTAT:***

If the Rush Turn-Around Time for this sample is known at the time of log-in, this information should be updated here.

22. ***Save:***

Once all applicable information is entered for a sample, click the save button. At this time the LIMS applies the Laboratory Sample ID to the sample. This is a four part ID code composed of the following:

a. A 2-digit numeral of the year. Example (**08**11248-06)

b. A 2-digit numeral of the month. Example (08**11**248-06)

c. A 3-digit numeral of the work order number. This number reset to 001 at the beginning of each month. Example (0811**248**-06)

d. A 2-digit numeral of the sample number separated by a dash. Example (0811248-**06**). This number is different for each sample in a work order, and a single work order cannot contain more than 99 samples. If more sample numbers are needed, a new work order number will have to be assigned to the applicable set of sample.

23. ***Add/Edit/Copy:***

Use these selections to add more samples to the work order, or to change existing information prior to label printing.

Once all the tests have been selected and all samples have been added in the work order, a work order summary and all container labels are printed. Labels are checked for accuracy against the containers while being labeled. At this point log-in of this group of samples is complete.

B. After log-in of a work order is complete, the COC can then be scanned into the system, attached to the work order on the Work Order screen, and the work order can be updated to Available status so as to be seen by the analysts.

V. Daily Follow Up for Sample Receiving/Log In

A. Wipe out the inside of coolers and return all Empirical Laboratories coolers to the sample kit room. Discard any coolers that are cracked, broken or filthy.

B. If any samples were received for RUSH turnaround, then a ***RUSH SHEET [Attachment XII]*** must be completed and distributed to all laboratory personnel via e-mail. If ever in doubt of which analysts should be notified, pass them out to everyone. Always give copies to the Laboratory Director, Administrative Assistant and Section Managers. It may be necessary to send out two RUSH sheets per day (one around mid-day and the other at the end of the day).

C. Complete any required CARs.

D. At the end of the day organize all paperwork received and generated for the day. The following should be given to the Project Manager (section supervisor):

1. The original chains of custody and yellow original or copy of each. The CRF will accompany the COC for the project.

2. Any information (letters, regulatory limits, etc.) from a client which was received with any samples.

3. All CARs.

4. LIMS sample receiving logs.

5. Copies of any RUSH sheets which have been distributed

6. Sample Receiving Custody and Disposal Form.

7. Cooler receipt form.

E. All the above information from the day will be reviewed as soon as possible.

1. All LIMS logs must be 2nd checked by a different person than the person entering the information into the LIMS. Each set of logs must be initialed dated by the person 2nd checking. These will be kept on file at the Project Manager desk.

2. If any corrections or changes are required, all laboratory personnel will be notified by distributing a ***Sample Log Change Form [Attachment XIII]*** through email distribution. A ***Sample Log Change Form*** by the project manager will also be sent out if a client adds or deletes any parameters, changes sample IDs, etc.

F. The Testing Coordinator will distribute the following after they have been through the 2nd QA check:

1. Copies of the LIMS receiving reports to necessary laboratory personnel.

2. Original (white copy) chains of custody are given to the Project Manager. These will be sent with the final report to the client.

3. Finalized/approved CARs must be sent to the:

a. Organic Manager

b. Inorganic Manager

c. Laboratory Manager

d. Laboratory Director {optional}

e. Quality Assurance Officer

f. Administrative Assistant

g. Client {optional}

4. Copies of any project/sample specific information to the Section Manager and analysts.

G. Information will be filed as follows:

1. Chains of custody:

a. Original (white copy) is returned to the customer with the final report along with the CRF.

b. Pink copies should be retained by the sampler.

2. CARs

a. CARs can be found at V:\LAB\log-in\login (year)\logcar (year).

3. Sample Change Forms and RUSH Sheets

a. Sample Change Forms are distributed by email.

b. RUSH Sheets are found at V:\LAB\login\Rushsheets

4. At the end of each year, files for that year are boxed and archived. Make sure files are labeled properly and place them in banker's boxes. Complete a storage box file form with as much detailed information as possible. The Laboratory Administrative Assistant will label and number the boxes and incorporate the storage boxes into the laboratory file archive system. Boxes containing files from Sample Receiving are kept on site for 1-2 years and then may be moved to off site storage upon release from the Project Manager.

VI. Miscellaneous

A. All projects which require deliverables or other QC requirements should be listed in the notes section of the LIMS.

B. If samples are received from a new client or a new job number that is not in the LIMS, a new client code must be set up. This information should be on the chain of custody or it may be necessary to contact the customer if the information is incomplete.

C. Samples from the Aquatic Toxicity Laboratory (ATL) are logged into the LIMS for billing and long-term tracking purposes. The receiving information and proper assignment of tests are reviewed by the ATL Manager. The samples are then logged in by ATL personnel.

D. A flow chart outlining sample receiving and the flow of data, reporting and invoicing is attached as ***Attachment XIV.***

E. A ***Telephone Conversation Log [Attachment XV]*** may be required to document information and may be attached to or used as a CAR.

F. All log books used in the Sample Receiving and Sample Storage Areas are numbered. The following log books are presently maintained. All log books must be "Z"ed out. The Testing Coordinator will review the log books each week to check for completeness.

Log Book ID	**Log Book Description**
LI014	Trip Blank Prep Log Book
LI009	Tracking of VOC Trip Blanks Shipped
LI011	Quarantined Soil Treatment Log Book
LI012	Acid Neutralization Log Book
LI013	Sample Receiving and Disposal Log Book
LI010	Kit Room Preservation Preparation Log Book

Attachments to SOP 404

II	Chain of Custody Record
III	Corrective Action Report for Sample Receiving/Log In
IV	Cooler Receipt Form
V	List of Short Holding Time (Immediate-72 hrs.) Parameters
VII	Sample Receiving Custody and Disposal Form
VIII	Map of Quarantined Soil Areas in the US.
IX	Laboratory Sample Custody Form for Walk In Refrigerator
X	Container Codes for the LIMS
XI	Routine NPDES Clients
XII	RUSH Sheet
XIII	Sample Log Change Form (Green Sheet)
XIV	Flow Chart, Laboratory Sample Tracking System

[Attachments I and VI were removed during the editing process and not added to the SOP.]

EMPIRICAL LABORATORIES, LLC - CHAIN OF CUSTODY RECORD

SHIP TO: 227 French Landing Drive, Suite 550 ♦ Nashville, TN 37228 ♦ 615-345-1115 ♦ (fax) 615-846-5426

Send Results to:	**Send Invoice to:**	**Analysis Requirements:**	**Lab Use Only:**
Name _____	Name _____		VOA Headspace Y N NA
Company _____	Company _____		Field Filtered Y N NA
Address _____	Address _____		Correct Containers Y N NA
City _____	City _____		Discrepancies Y N NA
State, Zip _____	State, Zip _____		Cust. Seals Intact Y N NA
Phone _____	Phone _____		Containers Intact Y N NA
Fax _____	Fax _____		Airbill #: _____
E-mail _____	E-mail _____		CAR #: _____
Project No./Name:	**Sampler's (Signature):**		

Lab Use Only Lab #	Date/Time Sampled	Sample Description	Sample Matrix														Comments	No. of Bottles	*Lab Use Only* Containers/Pres.

Sample Kit Prep'd by: (Signature)	Date/Time	Received By: (Signature)
Relinquished by: (Signature)	Date/Time	Received By: (Signature)
Relinquished by: (Signature)	Date/Time	Received By: (Signature)
Received for Laboratory by: (Signature)	Date/Time	*Temperature*

REMARKS:

Details:

Page _____ of _____

Cooler No. ____ of _____

Date Shipped _____

Shipped By _____

Turnaround _____

Distribution: Original and yellow copies accompany sample shipment to laboratory; Pink retained by samplers.

Attachment III

CAR 09-

EMPIRICAL LABORATORIES

CORRECTIVE ACTION REPORT FOR SAMPLE RECEIVING/LOG-IN

Date Completed:

Form Completed By:

Date Samples Received:

Parameter(s):

Client/Job #:

Samples:

Problem(s):

Action Taken:

Action Taken to Prevent Reoccurrence of this Problem:

Approval of Section Leader: _____

Distributed to:

EMPIRICAL LABORATORIES
COOLER RECEIPT FORM

LIMS Number: _____ Number of Coolers: _____ of _____

Client: _____ Project: _____

Date/Time Received: Date cooler(s) opened:

Opened By (print): (signature): _____

Circle response below as appropriate

1. How did the samples arrive?: FedEx UPS DHL Hand Delivered

EL Courier Other: _____

If applicable, enter airbill number here: _____

2. Were custody seals on outside of cooler(s)? ..... Yes No

How many: _____ Seal date: _____ Seal Initials: _____

3. Were custody seals unbroken and intact at the date and time of arrival? ..... Yes No N/A
4. Were custody papers sealed in a plastic bag included in the sample cooler? ..... Yes No N/A
5. Were custody papers filled out properly (ink, signed, etc.)? ..... Yes No N/A
6. Did you sign custody papers in the appropriate place for acceptance? ..... Yes No N/A
7. Was project identifiable from custody papers? ..... Yes No N/A
8. If required, was enough ice present in the cooler(s)? ..... Yes No N/A

Type of Coolant: WET DRY BLUE NONE Temperature of Samples upon Receipt: _____

Dates samples were logged-in:

9. Initial this form to acknowledge login of sample(s): (Name): **WILLIAM SCHWAB** (Initial):_____
10. Were all bottle lids intact and sealed tightly? ..... Yes No N/A
11. Did all bottles arrive unbroken? ..... Yes No N/A
12. Was all required bottle label information complete? ..... Yes No N/A
13. Did all bottle labels agree with custody papers? ..... Yes No N/A
14. Were correct containers used for the analyses indicated? ..... Yes No N/A
15. Were preservative levels correct in all applicable sample containers? ..... Yes No N/A
16. Was residual chlorine present in any applicable sample containers? ..... Yes No N/A
17. Was sufficient amount of sample sent for the analyses required? ..... Yes No N/A
18. Was headspace present in any included VOA vials? ..... Yes No N/A

If Non-Conformance issues were present, list by sample ID: _____

_____ CAR#: _____

Short Holding Time Parameters

(Immediate-72 hours)

Parameter	Holding Time
pH	Immediate [a]
Sulfite	Immediate [a]
Temperature	Immediate [a]
Residual Chlorine	Immediate [a]
Coliform (Fecal and Total) RCRA/WW	6 hours
Hexavalent Chromium (Cr +6)	24 hours
Odor	24 hours
Coliform (Fecal and Total) *Drinking Water only*	30 hours
BOD	48 hours
Color	48 hours
Settleable Solids	48 hours
MBAS	48 hours
Orthophosphate	48 hours
Turbidity	48 hours
Nitrite	48 hours
Flashpoint	72 hours [b]

[a] Immediate generally means within 15 minutes of sample collection.

[b] This is an internal holding time. The method does not specify a holding time.

Attachment VII

Empirical Laboratories, LLC

SAMPLE RECEIVING CUSTODY AND DISPOSAL FORM

Date Samples Received _____

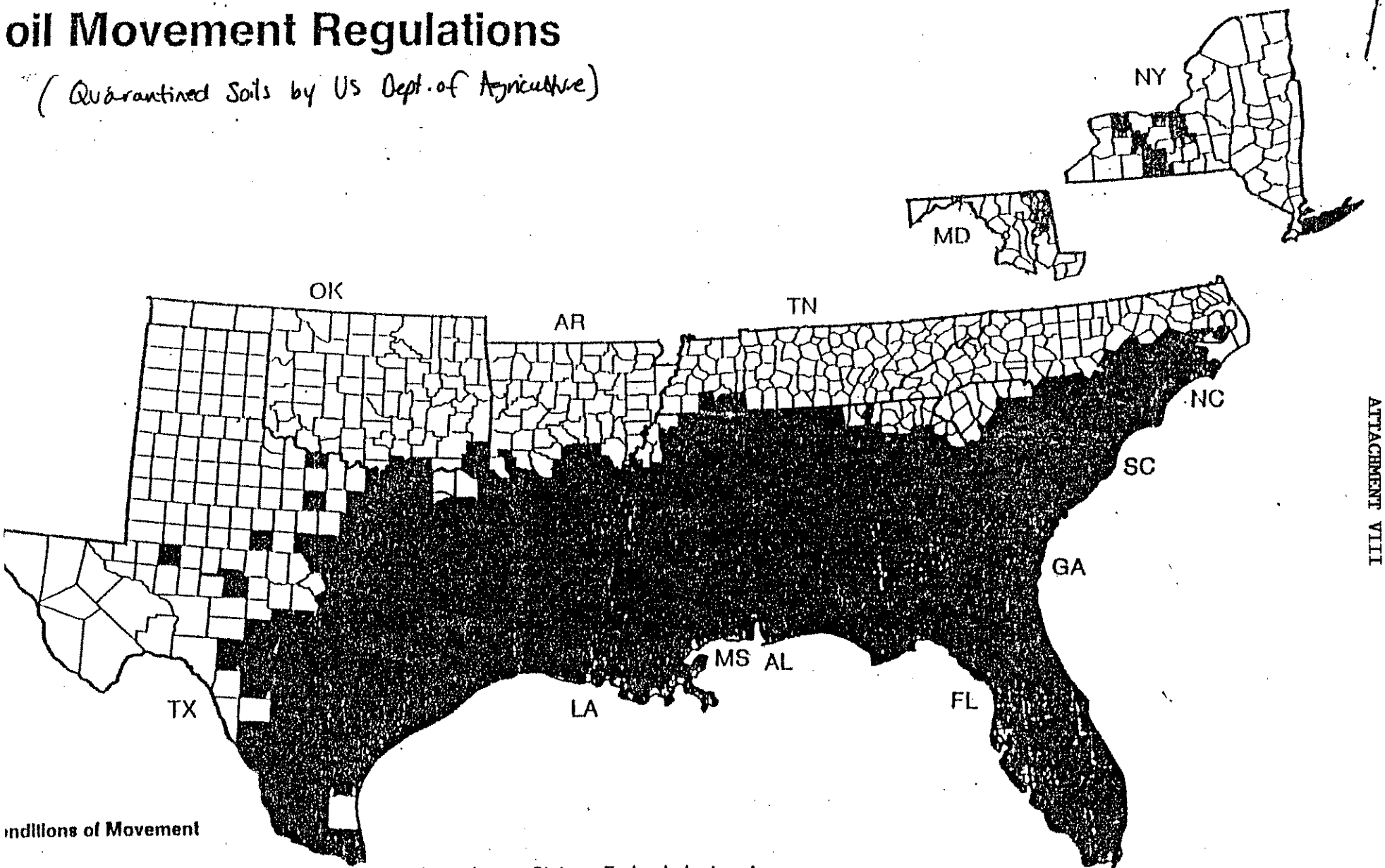
Client	Log #'s	Date Unpacked	Logged In/ Numbered By	2nd Checked By *	Placed in Storage By	Date Placed in Storage	Storage Area (1)	Disposed of By/Date	Method of Disposal

(1) W=Walk in Refrigerator
HV= Hobart Refrigerator, VOC samples only
Q= Refrigerator for Quarantined Soil Samples
QV= Refrigerator for Quarantined Soil, VOC samples only
O=Other (Must Specify)

***= MUST HAVE INITIALS OF THE PERSON WHO SECOND CHECKED AND MUST BE FILLED IN BY THAT PERSON IN INK .**

oil Movement Regulations

(Quarantined Soils by US Dept. of Agriculture)



nditions of Movement

strictions are imposed on the move-
nt of regulated articles from a regulated
a as follows:
om red areas into or through white
eas. Movement within red areas may be
gulated.

Consult your State or Federal plant protection inspector or your county agent for assistance regarding exact areas under regulation and requirements for moving regulated articles.

Regulated Area

ATTACHMENT VIII

Empirical Laboratories

EMPIRICAL LABORATORIES, LLC
LABORATORY SAMPLE CUSTODY FORM
WALK-IN REFRIGERATOR

Sample Log # (s)	Time/Date/Initials Removed	Time/Date/Initials Returned (Note if all Sample Used)	Notes/ Comments	Task Performed

Preservatives		Types of Container	
NI	*HNO3*	**A**	*1 LITER - PLASTIC*
NF	*HNO3 (Filtered)*	**B**	*500 mL - PLASTIC*
SU	*H2SO4*	**C**	*250 mL - PLASTIC*
SH	*NaOH*	**D**	*120 mL - PLASTIC*
ZN	*ZnAC / NaOH*	**EN**	*ENCORE PAK*
HY	*HCl*	**F**	*1 LITER - GLASS CLEAR WIDE MOUTH*
		G	*1 LITER - GLASS CLEAR BOSTON ROUND*
		H	*1 LITER - GLASS AMBER*
		I	*250 ml. - AMBER*
		J	*VOA VIALS - (40 ml.)*
		K	*500 ml. - (16 oz)*
		L	*250 ml. - (8 oz)*
		M	*125 ml. - (4 oz)*
		N	*60 ml. - (2 oz)*
		O	*OTHER*
		P	*PLASTIC BAG -1 Gallon*

ATTACHMENT XI

ROUTINE NPDES CLIENTS (Page 1 of 2)

ALCAN Ingot and Recycling
Amoco Oil
Armstrong (Pirelli)
Elf Atochem-Carrollton, KY
Auburn Hosiery Mill
Autostyle

Bando Manufacturing
Bowers Ink
Bowling Green Municipalities (City of)
BP Oil
Bremner, Inc.
Brentwood, City of
Brown Printing Central

Cargill Steel and Wire
Clarksville Products

E. I. Dupont
Eaton and Olsen
Emhart Pop Rivets

Fleet Design
Franklin, City of

Gatlinburg

Hennessey Co. (Coats)
H.I.S. Laundry
H.K. Bell (City of Hopkinsville Landfill Monthly Monitoring)
Hoover

International Paper
J. S. Technos

Ken Koat
King Industries

Lannom Tannery
Leonard Plating

:al Plate, Inc.
Morflex, Inc.

Nashville Wire
Norandal USA Inc.

Oak Ridge, City of

Plymouth Tube
Prime Colorants

RMI

Shared Hospital Services
Snap On Tools
Springfield, City of
Special Metals
te Industries

Tennessee Dickel Distillery
Tullahoma, City of

UCAR, Clarksville

Valmore Leather

Westvaco (Mayfield Creek Up/Down)
Woodbury

Revised 9/10/96

Date Distributed 1/01/02

RUSH

DATE RECEIVED	CLIENT	LOG # (S)	PARAMETERS	E-MAIL COPY DUE (DATE / TO)	FAX COPY DUE (DATE / TO)	*FINAL COPY DUE (DATE / TO)

*ALL FINAL REPORTS SHOULD BE DELIVERED TO TERESA WILLIAMS OR HERBIE JOHNSON THREE DAYS PRIOR TO FINAL DUE DATE TO CLIENT.

ATTACHMENT XII

ATTACHMENT XIII

96-0001

SAMPLE LOG CHANGE FORM

DATE:

TO:

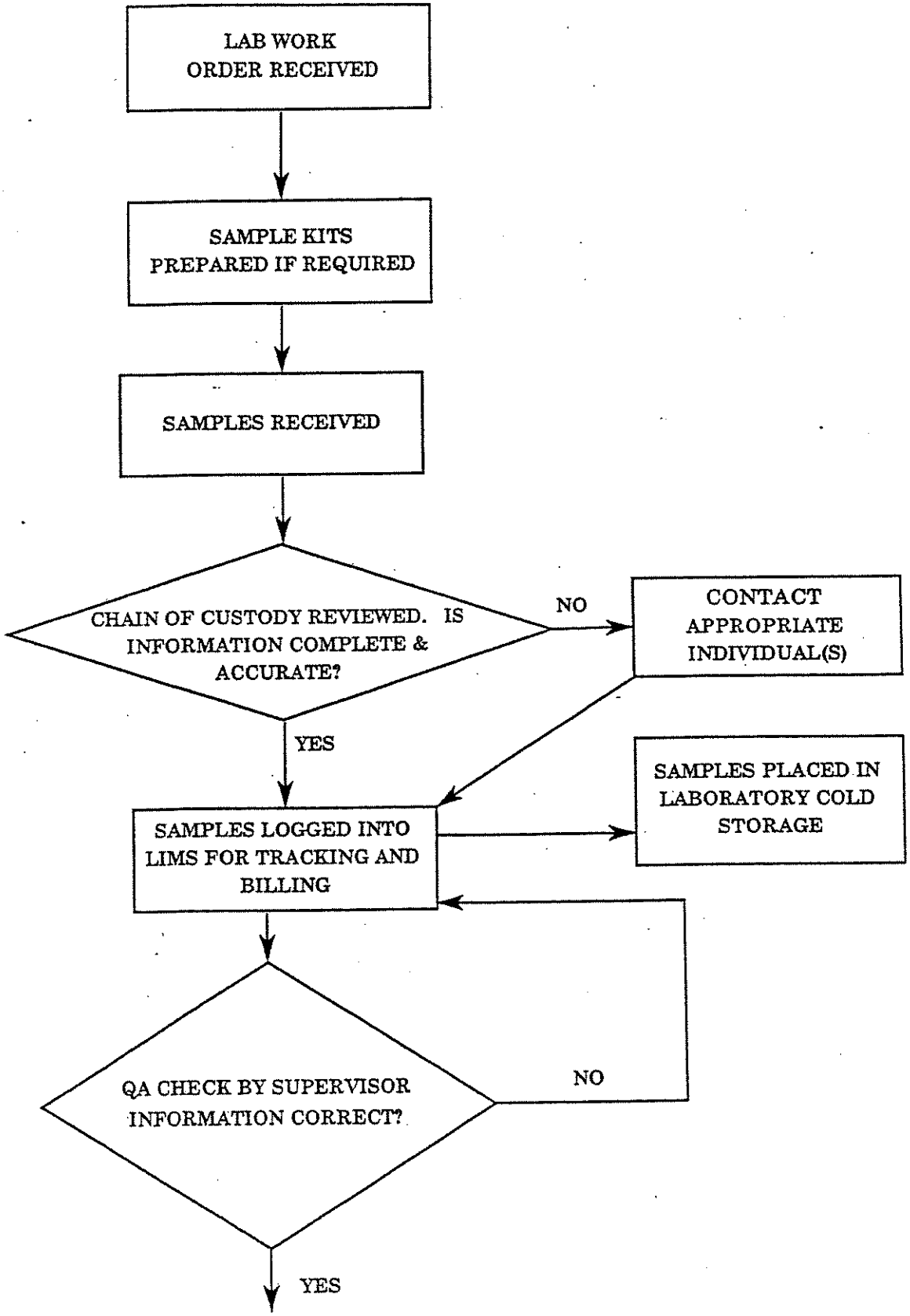
SAMPLE #(S):

CLIENT:

Changes:

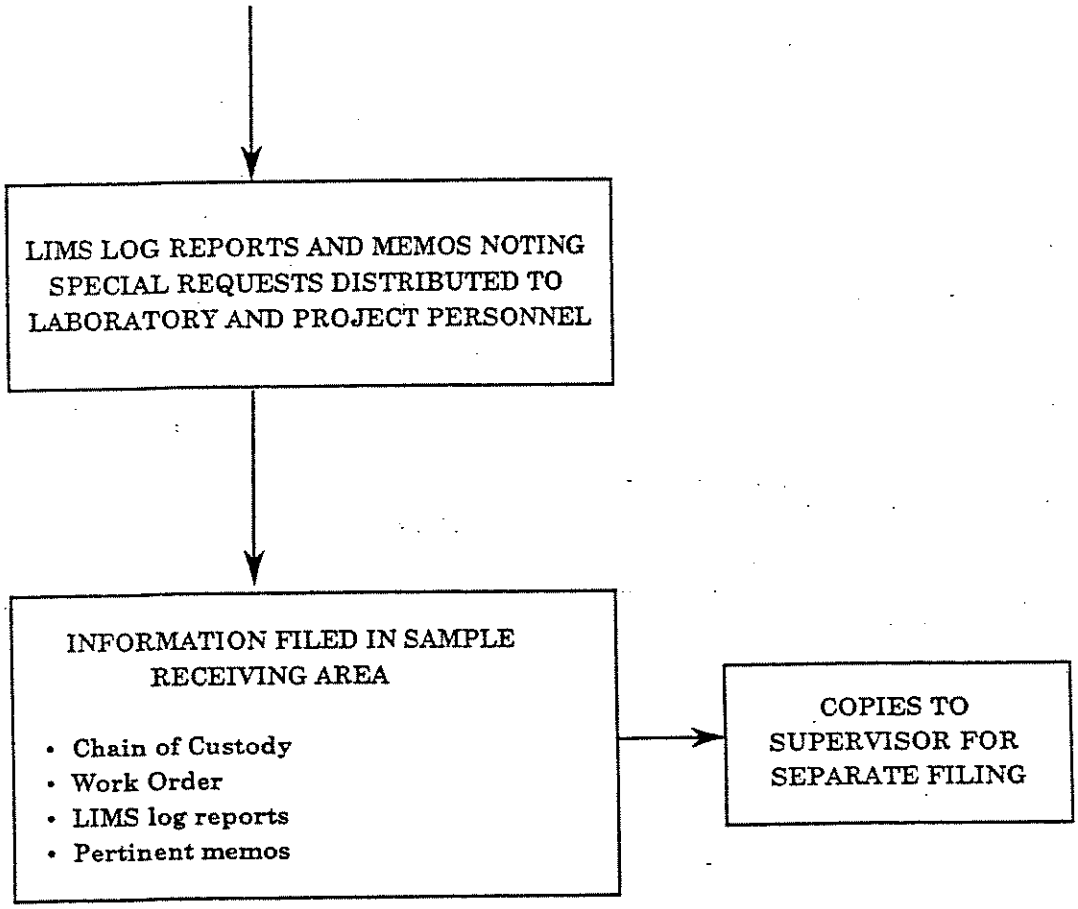
ATTACHMENT XIV

LABORATORY SAMPLE TRACKING SYSTEM
SAMPLE RECEIVING



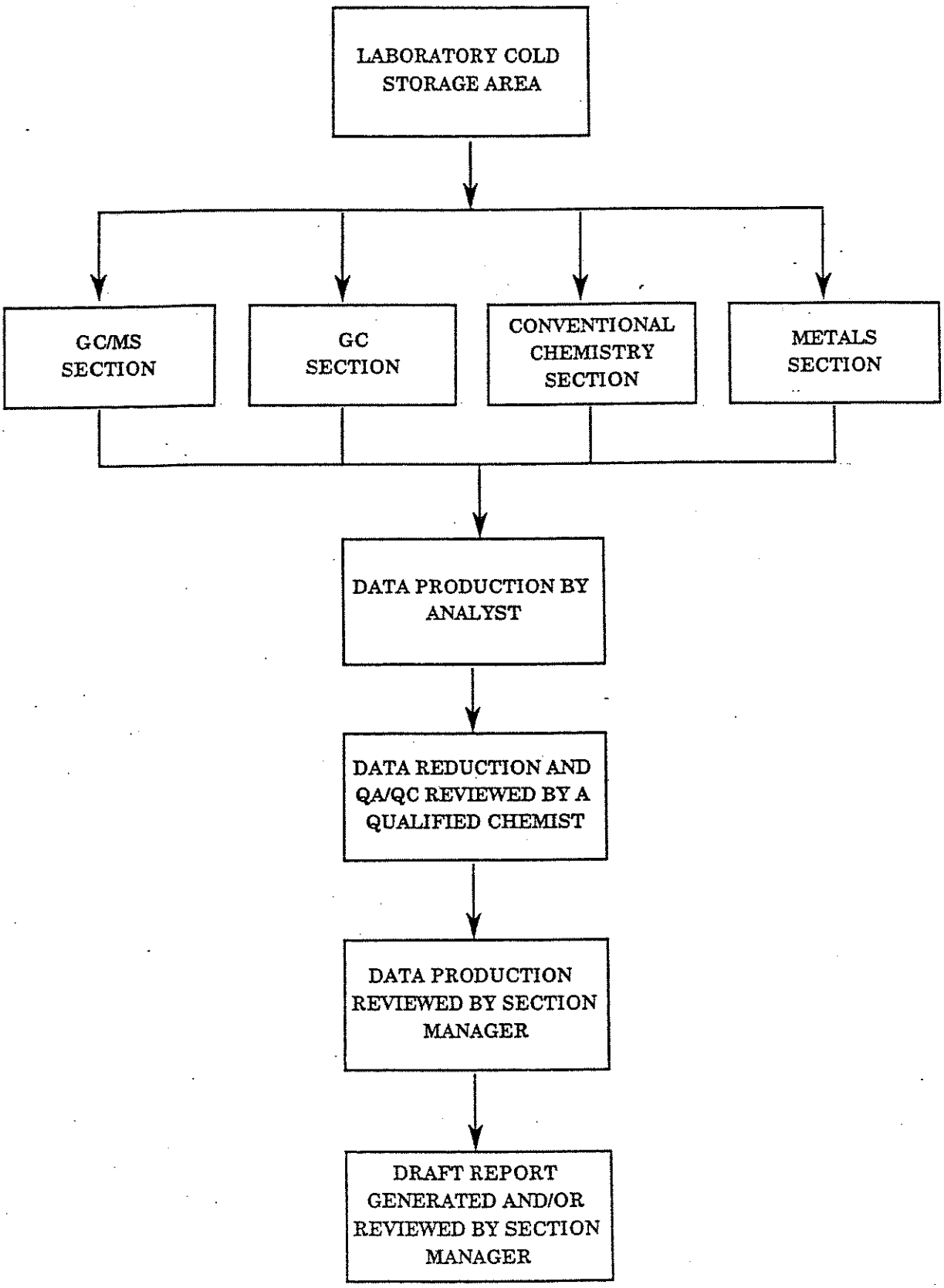
L:\QAM\SAMPTRAK.AF2

LABORATORY SAMPLE TRACKING SYSTEM
SAMPLE RECEIVING (continued)



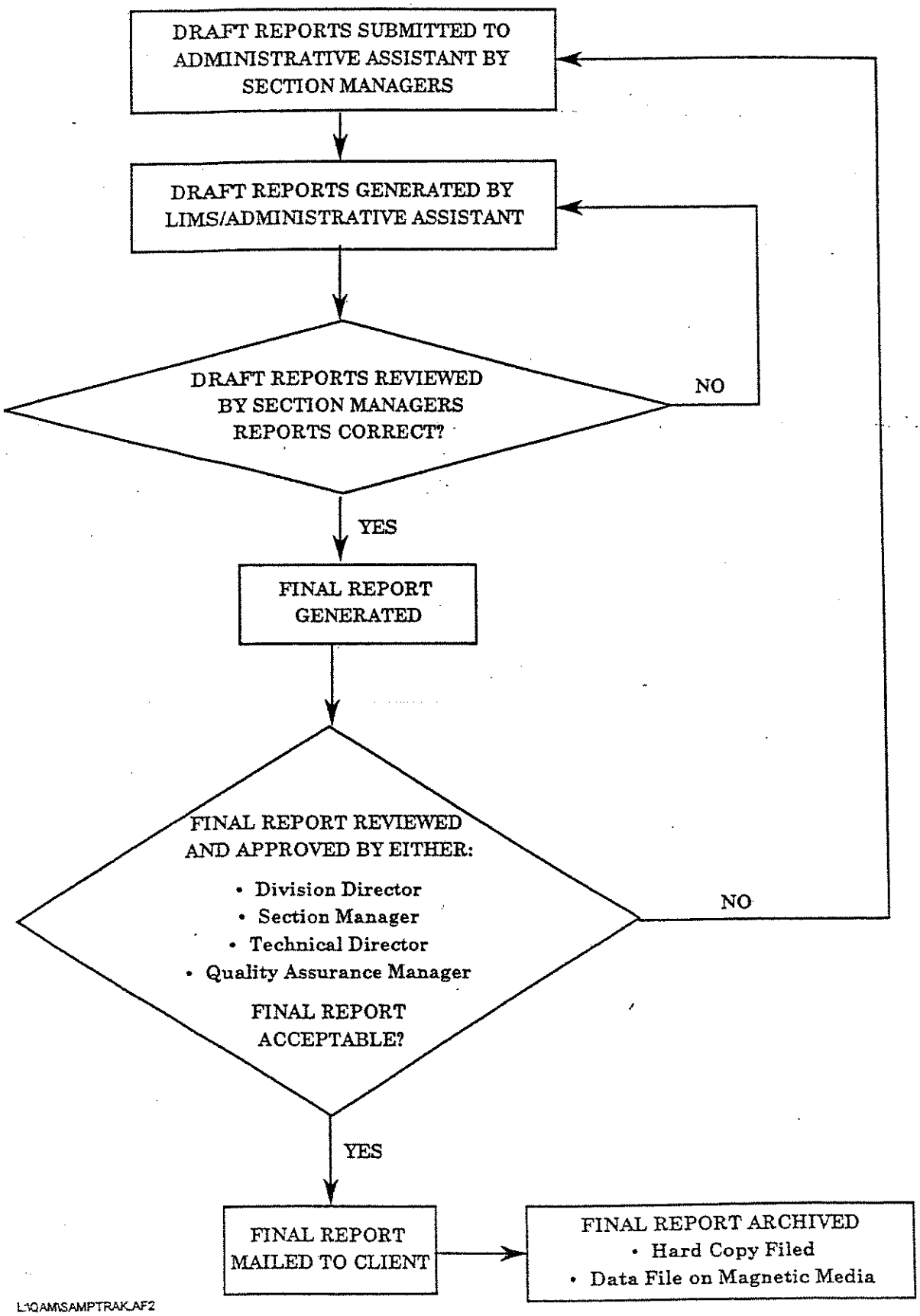
ATTACHMENT XIV (Continued)

LABORATORY SAMPLE TRACKING SYSTEM
DATA PRODUCTION AND REVIEW



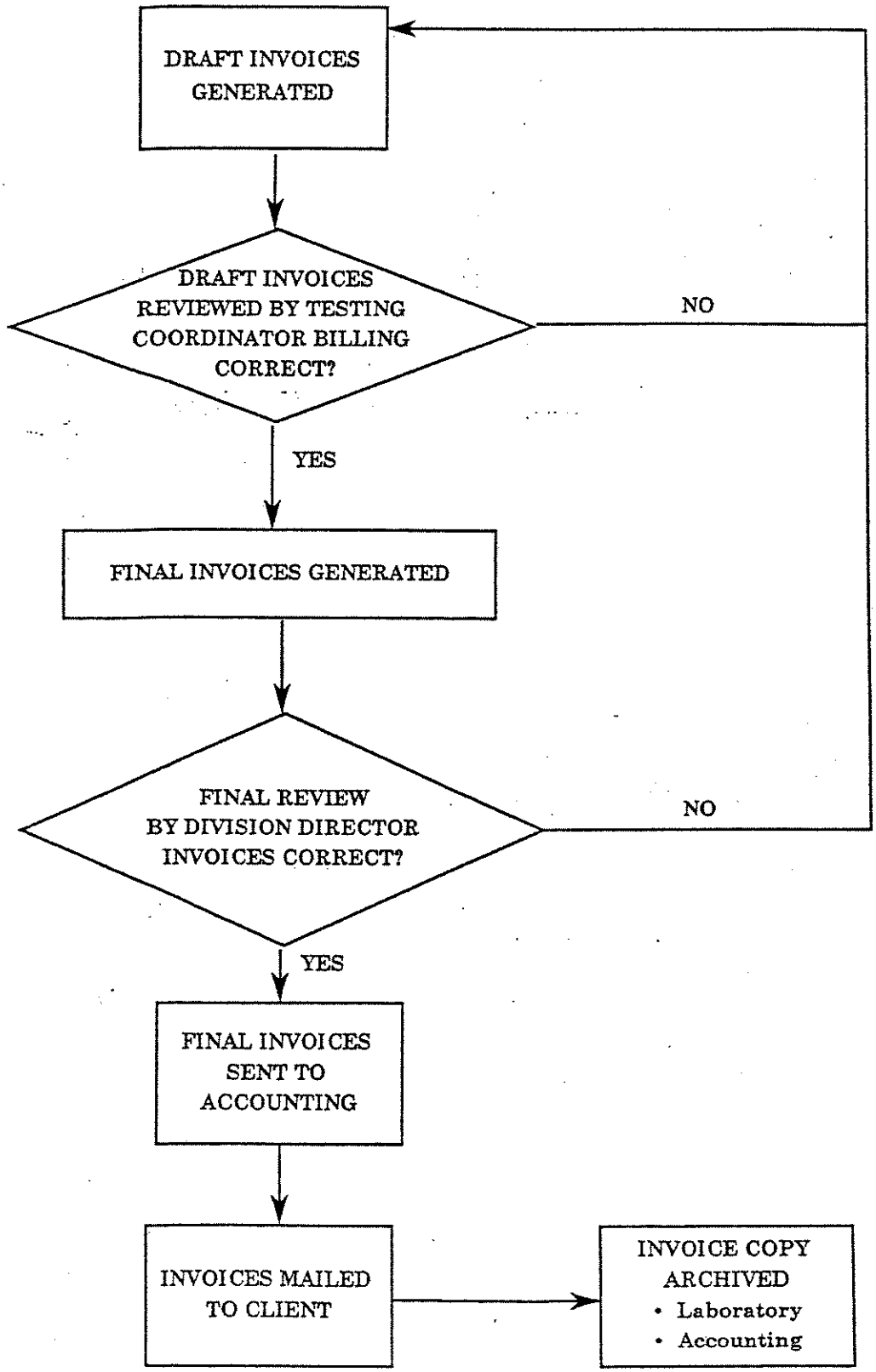
ATTACHMENT XIV (Continued)

LABORATORY SAMPLE TRACKING SYSTEM
DRAFT AND FINAL REPORT



L:\QAM\SAMPTRAK.AF2

LABORATORY SAMPLE TRACKING SYSTEM
INVOICING



DISTRIBUTION/TRAINING LOG

LABORATORY SAMPLE RECEIVING, LOGIN AND STORAGE STANDARD OPERATING PROCEDURES

SOP NUMBER: **SOP-404**

REVISION NUMBER: **13**

RECEIVED BY/DATE:

W. Schwab

F. Rivers

~~R. Townsend~~

Signature above signifies acknowledgement of responsibility to know and follow the contents of this document. It also signifies receipt of training covering all new aspects of the SOP.

TRAINED BY:

EFFECTIVE DATE: **06/29/09**

PLEASE COLLECT OLD SOPs AND RETURN WITH SIGNED FORM TO QAO

ANALYTICAL LABORATORY WASTE DISPOSAL

SOP NUMBER: **SOP-405**

REVISION NUMBER: **5**

APPROVED BY:

LAB DIRECTOR

QUALITY ASSURANCE OFFICER

EFFECTIVE DATE: **06/23/09**

DATE OF LAST REVIEW: **06/23/09**

Analytical Laboratory Waste Disposal
Standard Operating Procedure

I. SCOPE AND APPLICATION:

Empirical Laboratories, LLC laboratory waste includes excess client sample waste and waste that are generated while performing an array of analytical services, some of which are hazardous. These wastes must be disposed of in a manner that is safe, cost efficient and in accordance with hazardous waste regulations.

A. Wastes can be broken down into the following categories:

1. Unused portions of actual samples received from outside clients.

   a. Unused aliquots of completed water samples.

   b. Unused aliquots of completed non-aqueous samples.

2. Soils from quarantined areas

3. All other soils, sediments, building debris, wipes etc.

4. Hazardous waste generated within the laboratory as part of numerous analytical procedures.

II. SUMMARY OF PROCEDURES:

A. There are four options for disposing of unused sample portions:

1. Return completed samples and any generated waste from these samples to the client.

2. Throw the sample away after confirming that it is non-hazardous.

3. Disposal through a waste vendor in either a sealed drum or lab pack. This is normally done twice a year.

4. Treat the sample to make it non-hazardous and dispose of it as such. (Aqueous pH neutralization only.)

B. There are two options for disposing of laboratory generated waste:

1. Disposal through a waste vendor in either a sealed drum or lab pack. This is normally done twice a year. The waste must be stored properly until the waste is transported off site.

For example: Solvent waste must be stored in the vented flammable cabinet.

2. Treat the waste to make it non-hazardous and dispose of it as such. (Aqueous pH neutralization only.)

III. EQUIPMENT/APPARATUS:

A. Proper safety equipment in good working condition. This includes gloves, lab coat and safety glasses/goggles (voluntary use of cartridge respirator allowed see area manager or QAO).

B. USDOT approved drums for storing and shipping hazardous waste.

C. Fume hood vented outside the building.

D. Flammable storage cabinet which is vented to the outside

IV. PROCEDURE

Waste disposal is done under the management and coordination of the Sample Receiving Manager, Section Managers and the Health and Safety Officer.

A. Disposal of completed aqueous samples:

Completed samples are kept in cold storage for approximately three weeks after the final report has been mailed. Engineering support projects involving CLP work, litigation cases etc. may be saved for longer than three weeks at the request of the project manager.

No samples should be disposed of without approval from the responsible area manager or analyst. **At this point the area manager and/or analyst will communicate information about samples deemed as hazardous.**

1. The majority of the water samples (ground, surface and drinking) is non-hazardous and is disposed of by pouring them down the sink.

a. This must be done under the hooded area located near the sink in sample receiving. Make sure that the sash is closed far enough to produce sufficient ventilation. The tap water should be turned on to supply copious wash for sample disposal.

b. Proper safety equipment **must** be used including safety glasses (face shield if necessary), lab coat and gloves.

c. **be alert to potential problems: for example, separate Cyanide waste from acid waste. Neutralize acid waste that will be poured down the drain and don't mix waste/samples thought to contain Cyanide with samples that are acidified. Also, look for things such as phase separation, odd color, odor etc. Check with the area manager or Health and Safety Officer before disposing of any questionable samples.**

d. Tap water must be running during the time samples are poured out and for approximately 10 minutes after so sufficient flushing and dilution takes place.

e. All containers must be rinsed out, all identifying markings defaced or removed, and thrown into the trash.

f. All samples disposed of in this manner must be documented in the bound disposal log.

2. If water samples are hazardous (known or suspected), one of the following steps must be taken.

a. Samples may be returned to the client. If you plan to ship the unused portion back to the client check with shipping and receiving to make sure that the material can be shipped in accordance with USDOT regulations. **If the samples are not returned to the client they must be stored properly until picked up by a waste vender.**

b. Treat the sample to make it non-hazardous. One example of this is if the sample is highly corrosive, the pH may be adjusted.

c. Store the sample properly until either a sealed drum or lab pack is sent out.

d. All samples disposed of in this manner must be documented in the bound disposal log.

B. Disposal of completed non-aqueous samples:

The majority of non-aqueous samples are soils or sediments, although there may also be building debris, wipes, oils, and occasionally product type samples.

1. If samples are non-hazardous they must have all identifying markings defaced or removed, and thrown into the trash. On specific projects we may also opt to return the unused portions to the client even if they are non-hazardous.

2. If non-aqueous samples are hazardous (known or suspected), one of the following steps must be taken.

a. Samples may be returned to the client. If you plan to ship the unused portion back to the client check with shipping and receiving to make sure that the material can be shipped in accordance with USDOT regulations. **If the samples are not returned to the client they must be stored properly until picked up by a waste vender.**

b. Store the sample properly until a lab pack is sent out.

3. Soil samples taken at a depth of three feet or less from areas, which have been quarantined by the US Department of Agriculture (USDA), must first be treated at the laboratory to prevent the spread of any plant pests. The USDA has detailed proper treatment procedures of which we use the following:

a. The sample is heated to 180°C(356°F)in a vented oven for two hours.
b. After the heating the samples are placed close to a hood to cool and are marked as being ready for disposal.

4. Once the samples have undergone treatment they can then be disposed of by one of the procedures for non-aqueous samples. **All samples disposed of in this manner must be documented in the bound disposal logbook with the following information:**

a. Client
b. Sample #s

c. Date(s) treated
d. Treatment method used

C. Disposal of laboratory generated waste:

Generated waste is stored outside the building, inside the caged fence until a waste pick up occurs. This area must be maintained properly.

1. Waste handling and disposal within each laboratory section:

Each laboratory analyst and section manager is responsible to assure that **handling** operations within their area are being followed according to the laboratory requirement.

a. General Chemistry/Inorganic

Each analyst performing specific laboratory tests that generates waste is responsible to handle and dispose of the waste in a safe manner and under the guidelines listed below. If you have any questions left unanswered regarding waste disposal within your specific area contact the inorganic manager or the safety officer.

- Concentrated acid waste, **(>2% by volume) and** dilute mercury waste (mercury, chemical oxygen demand, total kjeldahl nitrogen and chloride analyses waste) are poured into the Acid Satellite Waste drum located outside the back of the building inside the caged fence. **Document the type and amount of waste in the acid waste logbook, then initial and date the entry**.
- Dilute acid waste **(<2% by volume or less)** are neutralized using concentrated amounts of sodium hydroxide and poured down a sink drain within hooded ventilation with copious amounts of tap water. The amounts of acid waste treated along with the amount of sodium hydroxide used to neutralize the acid waste, is then recorded into an acid waste neutralization log book that is kept in sample receiving.
- **All other non-hazardous sample waste, reagents and standards are poured down the drain with copious amounts of tap water.**

b. Metals

Each analyst performing specific laboratory tests that generates waste is responsible to handle and dispose of the waste in a safe manner and under the guidelines listed

below. If you have any questions left unanswered regarding waste disposal within your specific area contact the inorganic manager or the safety officer.

- Concentrated acid waste, aqueous sample waste digestates and old unused calibration standards **(>2% by volume)** are poured into the Acid Satellite Waste drum located outside the back of the building inside the caged fence.
- Non-aqueous sample digestate wastes are decanted off the soil/solid samples into the Acid Satellite Waste drum located outside the back of the building inside the caged fence. **Rinse the soil/solid with tap water several times and discard the first rinsate into the Acid Satellite Waste drum and the sequential rinsates decant down an acid drain with copious amounts of tap-water.**
- **Throw the soil/solids in the trash once the acid has been rinsed free.**
- **Cr6 digestates as with all concentrated metal/acid waste are poured into the Acid Satellite Waste drum.**

c. Organic Extraction Laboratory Area

Each analyst performing specific laboratory tests that generates waste is responsible to handle and dispose of the waste in a safe manner and under the guidelines listed below. If you have any questions left unanswered regarding waste disposal within your specific area contact the organic manager or the safety officer.

- Concentrated acid waste is discarded into the Acid Satellite Waste located outside the back of the building inside the caged fence.
- Non-chlorinated solvent waste (Acetone, Ether, Hexane, and Methanol ....etc...) pour into the Non-Chlorinated Waste labeled bottle located in the hood in the Organic Extraction Laboratory.
- Chlorinated solvent waste (Methylene Chloride, Chloroform, chlorinated standard and spike waste) pour into the Chlorinated Waste labeled bottle located in the hood in the Organic Extraction Laboratory.

****Note: Laboratory generated solvent waste is transferred to the appropriate Satellite Solvent Waste Drum (chlorinated or non-chlorinated) weekly or as deemed necessary. Disposal of solvent waste is done under the direction of the organic laboratory manager. These drums are located outside the back of the building inside the caged fence and only authorized laboratory staff are allowed to add waste solvent to these drums. The date of addition to the drum, type and quantity of solvent is entered into the '*Organic Solvent Waste Logbook*' located on the shelf next to the drums.**

- **Aqueous sample waste from extracted samples (once the extraction solvent has been removed) is poured down the drain and flush with copious amount of tap water.**
- Non-aqueous sample waste and sodium sulfate waste is dumped into a waste container under an extraction laboratory hood and left overnight or until the solvent is evaporated and then the waste is discarded into the trash.

d. Gas Chromatography (GC)/High Performance Liquid Chromatography (HPLC) Laboratory

- Autosampler vials are discarded into the appropriately labeled box located in the GC/HPLC Laboratory.

PCB Box – all samples/standards
Pesticide Box – all samples/standards
Herbicide Box – all samples/standards
8330 Box – all samples/standards
Methylene Chloride Box- all samples/standards that contain methylene chloride (Diesel Range Organics, DRO)

- Sample and spike extract vials are separated according to the contents in the vial. **Acid cleaned extracts** are combined into a separatory funnel and the acid layer separated from the solvent. The acid portion is discarded into the Acid Satellite Waste drum located outside the back of the building inside the caged fence. The solvent waste is discarded into the appropriate solvent waste bottle (chlorinated/non-chlorinated waste) located in the hood in the organic extraction laboratory.

Unused stock and working standards are discarded into the chlorinated solvent waste bottle located in the organic extraction laboratory. The empty vials are rinsed several (3) times with solvent and the solvent rinsate poured into the solvent waste and the vials with labels removed are discarded into the glassware waste container.

e. Gas Chromatography/Mass Spectrometry

- Volatile sample, standard and reagent waste

Waste from the instrument - Aqueous sample waste is collected in waste bottles via waste lines from the instrument. The bottles are emptied into buckets and poured down the drain(pH is < 2% by volume). A small amount of methanol used to clean glassware is also dumped into the bucket and poured down the drain. While disposing of sample waste always run the cold tap water 10-15 minutes. Non-aqueous waste from sample analyses is retained and dispose of in the same manner as the unused sample. Unused sample is held for sample disposal by the sample receiving area, see A and B listed above.

Standards - Unused stock and working standards are discarded into the chlorinated solvent waste bottle located in the organic extraction laboratory. The empty vials are rinsed several (3) times with solvent and the solvent rinsate poured into the solvent waste and the vials with labels removed are discarded into the glassware waste container.

In conjunction with section managers, the sample receiving area disposes of solid sample waste and unused aqueous and solid samples see procedures A and B listed above.

- Semivolatile sample and standard waste disposal

Methylene chloride waste solvent and standard waste in vials are poured into the chlorinated waste bottle in the hood in the organic extraction laboratory. The empty vials are rinsed with solvent and the solvent poured into the waste solvent bottle. The vials with labels removed are discarded into the glassware waste disposal container.

Auto sampler vials are collected in buckets and stored under the hood in the organic extraction laboratory. **Periodically the vials are consolidated in lab packs for disposal by a licensed waste disposal company**.

f. Bioassay Laboratory

- Aqueous sample waste and a small amount of methanol are poured down the drain with copious amounts of tap water. Larger amounts of methanol used for glassware cleaning are collected in beakers and evaporated at room temperature.

- Hazardous or product samples are returned to the client.

D. Consolidation of satellite waste for contractor disposal:

In conjunction with the Safety Officer, the sample receiving supervisor is responsible to coordinate waste disposal operations with outside waste disposal contractors.

1. Solvent waste from the areas discussed above is periodically consolidated into two drums located outside the back of the building inside the caged fence (c. *Organic Extraction Laboratory Area*, * **Note**). A drum designated either chlorinated or non-chlorinated solvent waste is available to receive the appropriate solvent waste. When the drums become full (fluid surface six inches below the top of the drum), an authorized hazardous waste contractor will be scheduled to remove them to proper waste disposal.

2. The Acid Satellite Waste drum is also disposed through the authorized hazardous waste contractor once the drum is full to the level of six inches below the top of the drum.

3. Consolidated autosampler and standard vials are periodically Lab-Packed in drums and disposed through the authorized hazardous waste contractor.

4. The Laboratory Health and Safety Officer will administer the Waste Disposal Program and maintain current information to track quantities of waste generated and stored on-site.

It is the continuous objective of our laboratory to find ways to decrease the amount of waste generated.

DISTRIBUTION/TRAINING LOG

ANALYTICAL LABORATORY WASTE DISPOSAL

SOP NUMBER: **SOP-405**

REVISION NUMBER: **5**

RECEIVED BY/DATE:

W. Schwab	WS
R. Townsend	Russell Townsend RET
F. Rivers	FK
J. Holliman	J.H.
B. DeVille	Betty DeVille
A. Monteiro	
B. Richard	

Signature above signifies acknowledgement of responsibility to know and follow the contents of this document. It also signifies receipt of training covering all new aspects of the SOP.

TRAINED BY: Randy H. Wood

EFFECTIVE DATE: **06/23/09**

PLEASE COLLECT OLD SOPs AND RETURN WITH SIGNED FORM TO QAO

STANDARD OPERATING PROCEDURE (SOP) FOR LABORATORY SAMPLE STORAGE, SECURE AREAS AND SAMPLE CUSTODY

SOP NUMBER: **SOP-410**

REVISION NUMBER: **7**

APPROVED BY:

SECTION MANAGER

TECHNICAL DIRECTOR

EFFECTIVE DATE: **06/23/09**

DATE OF LAST REVIEW: **06/23/09**

STANDARD OPERATING PROCEDURE (SOP) FOR LABORATORY SAMPLE STORAGE, SECURE AREAS AND SAMPLE CUSTODY

Empirical Laboratories, LLC is located at 621 Mainstream Dr. suite 270 Nashville, TN 37228 on the first floor. This building is locked and monitored by an alarm system after normal business hours. No unauthorized personnel are permitted within the facility without a proper escort and a visitor's badge. During non business hours, all doors to the building are locked and secured by an alarm system. All front and back doors are locked and only Empirical Laboratories, LLC personnel have a key to access the building. Upon unlocking the door and entering into the laboratory, then the employee is to deactivate the alarm system using the assigned 4 digit alarm code assigned to them by Human Resources. Each employee is assigned their own designated alarm code, with no code being assigned twice. There is a buzzer at the door to Login to allow entry for sample and supply deliveries.

The majority of samples are shipped in coolers by couriers such as Federal Express and UPS. All couriers are generally received in the Shipping/Sample Receiving (SR) area in back of the building. The laboratory is located close to Federal Express (FedEx) distribution station; therefore we pick up our coolers at the FedEx location daily and transport them directly to the laboratory. Some coolers and/or samples are delivered directly to the SR area by the sampler and/or client. The SR personnel must not leave any packages/cooler without authorized receipt from laboratory personnel. Samples must be accompanied by some type of chain of custody record. Sample receiving personnel sign, and list the date and time received on the chain of custody. The time received must reflect the actual time or validation date and time of receipt for the samples although they may be placed in cold storage and logged into the system at a later time. The method of delivery is listed on the cooler receipt form(CRF). The tracking # (if available) is attached to the chain of custody.

Once sample containers have been assigned a laboratory ID number, they must be checked by another laboratory individual to ensure that the log number on the container matches the log number and sample ID on the Chain of Custody. A Cooler Receipt Form also must be completed to accompany the cohesive Chain of Custody. Samples should not leave the log-in area until this has been completed. Log-in is also responsible for maintaining a Sample Receiving Custody and Disposal Form for samples received. This form is to be filled out before the actual disposing of any

sample in house. Once the document is complete, the original will be kept on file. The following information must be logged onto this form:

- Client and Log #s
- Date/Time Unpacked
- Logged In/Numbered By (Initials)
- 2nd Checked By (Initials)
- Date/Time Placed in Cold Storage
- Storage Area (Walk In, Blue Air-VOCs, Quarantined Soils, Quarantined-VOC, Other)
- Disposed of By/Date
- Method of Disposal

Original samples are stored in following areas of the laboratory.

1. Hobart Refrigerator in the VOC lab: All water VOCs must be stored in this refrigerator.

2. Walk In Refrigerator: All waters for all analyses except must be stored in this refrigerator.

3. Soil Walk in Refrigerator for all soils.

4. Sample Archive Room: All samples that have parameters where holding times have already expired may be kept in this room. This is only utilized when the water walk in refrigerator is completely full of samples within holding times that have not expired.

All soils are treated as quarantined.

All samples must be stored in one of the four locations detailed above with the following exceptions:

1. Matrices that may be adversely affected by the cold temperature. (e.g. surfactant samples, multi-phase samples)

2. Highly contaminated waste or product type samples which could jeopardize the integrity of other samples in the walk in cooler. Often these can be stored at room temperature. If these require refrigeration see the Testing Coordinator for other options.

Any person removing samples from the storage areas listed above, must sign them out on a laboratory custody sheet (attached). The individual performing the processing becomes responsible for the samples at this point. The samples are maintained in the secure possession of the individual processing the samples. When the processing is completed, the samples are returned and signed back into the appropriate storage area. It must be noted if the entire sample volume was used and that the container was discarded.

Sample extracts and digestates are stored in the following areas:

1. All metals digestates are stored in the metals instrument laboratory. The transfer from the digestion analysts to the ICAP analysts is documented in the metals digestion log book.

2. Non - ZHE TCLP extracts are returned to the refrigerator in which the original samples are stored. For ZHE samples, the extract is returned to the refrigerator in which the original VOC sample containers are stored.

3. Extracts from medium level VOC analyses are also stored in the Soil Walk – in or VOC sample freezer in the VOC Lab.

4. All Organic extracts are stored in a Beverage Air side by side refrigerator in the organic extraction laboratory.

The generation of all sample extracts/digests and their movement through the laboratory will also be tracked on a laboratory custody sheet or in a log book. The individual performing the processing becomes responsible for the samples at this point. The samples are maintained in the secure possession of the individual processing the samples. When the processing is completed, the extracts are returned and signed back into the appropriate storage area. The metals digestates are not removed from the metals instrument laboratory.

After the analytical results have been reported, the original samples, sample extracts, and digestates will remain in secure storage until they are disposed of in accordance with the Waste Disposal Standard Operating Procedure. Samples will be held for a minimum of 30 days after the final report unless specified otherwise. Sample extracts and digestates are held for a minimum of 60 days after the final report unless project specific requirements state otherwise. See SOP No. 405 entitled Laboratory Waste Disposal SOP for guidance on disposal of samples.

The following personnel as of June 23rd, 2009 have access to all sample storage areas:

James Dalton	Herbie Johnson
Ashley Bester	Dahae Kim
Roger Burr	Dustin Lynch
Janice Shilling	Marcia McGinnity
Rick Davis	Badeen Mekael
Jessica Sales	Antonio Montiero
Betty DeVille	Kelienne Verdier
Amanda Fei	Gino Moore
Kendra Gentry	Lorraine Norohna
Jason Goodman	Melanie Sams
Sonya Gordon	Brian Richard
Gwen Hallquist	Franklin Rivers
Veronica Mullen	William Schwab
William Lancaster	Russell Townsend
Jade Holliman	Christy Thompson
John Hughes	Renee Vogel
Karu Huka	Randy Ward

In the event that an employee is terminated, the supervisor is responsible for collecting the employee's keys.

For additional information see SOP No. 404 entitled Laboratory Sample Receiving, Log-In and Storage.

APPENDIX C

SAMPLING DATA TABLES FROM PREVIOUS INVESTIGATIONS

Summary of Detections in Surface Soil Analytical Results
TAL Metals and TCL Organics
PSC 5
Naval Air Station Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	05S00101	05S00201	05B00401	05B0501	05S00601
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		14-Jul-97	14-Jul-97	7-Aug-97	7-Aug-97	19-Aug-97
Volatile Organics µg/kg										
Acetone	260,000	11,000,000	1,800,000	68,000,000	NC			17 J		32 J
Tetrachloroethene	12,000	8,800	28,000	18,000	NC			4 J		
Semivolatile Organics µg/kg										
Benzo(a)anthracene	1,400	NC	4,900	NC	NC					
Benzo(a)pyrene	100	**100**	500	700	NC					
Benzo(b)fluoranthene	1,400	NC	5,000	NC	NC					
Benzo(g,h,i)perylene	14,000	2,500,000	50,000	52,000,000	NC					
Benzo(k)fluoranthene	14,000	NC	48,000	NC	NC					
Carbazole	42,000	49,000	120,000	240,000	NC					
Chrysene	140,000	NC	500,000	NC	NC					
Di-n-octylphthalate	1,500,000	1,700,000	32,000,000	39,000,000	NC					
Fluoranthene	2,900,000	3,200,000	48,000,000	59,000,000	NC					
Indeno(1,2,3-cd)pyrene	1,400	NC	5,000	NC	NC					
Phenanthrene	1,700,000	2,200,000	21,000,000	36,000,000	NC					
Pyrene	2,200,000	2,400,000	41,000,000	4,500,000	NC					
Pesticides/PCBs µg/kg										
4,4'-DDD	4,500	4,200	17,000	22,000	NC				0.28 J	
4,4'-DDE	3,000	2,900	11,000	15,000	NC				0.78 J	
4,4'-DDT	3,100	2,900	12,000	15,000	NC					1.5 J
Aldrin	60	60	200	300	NC			0.46 J		
alpha-Chlordane	800	NC	3,000	NC	NC		0.17 J			
Aroclor-1254	900		3,500		NC		25 J	45 J	8 J	
Dieldrin	70	60	300	300	NC					
Endosulfan I	390,000	45,000	5,900,000	7,600,000	NC					
Endosulfan Sulfate	390,000	45,000	5,900,000	7,600,000	NC					
Endrin aldehyde	23,000	NC	480,000	NC	NC					
gamma-Chlordane	800	2,800	3,000	14,000	NC			0.31 J	0.16 J	

Summary of Detections in Surface Soil Analytical Results
TAL Metals and TCL Organics
PSC 5
Naval Air Station Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	05S00101	05S00201	05B00401	05B00501	05S00601
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		14-Jul-97	14-Jul-97	7-Aug-97	7-Aug-97	19-Aug-97
Inorganics mg/kg										
Aluminum	75,000	80,000	1,000,000	NC	**1,340**	**1930 J**	145 J	**1150 J**	**2880 J**	224 J
Antimony	26	27	220	370	NC					
Arsenic	0.8	**2**	3	12	**0.8**				**0.81 J**	
Barium	5,200	120	84,000	130,000	**11.2**	**21 J**		8.6 J	**14.6 J**	2.5 J
Beryllium	0.2	120	1	1,400	NC	0.09 J			0.33 J	
Cadmium	37	82	600	1,700	NC				0.42 J	
Calcium	NC	NC	NC	NC	**2,360**	**4420**	54.3 J	**13600**	**9390**	1550
Chromium	290	210	430	470	**6.6**	2.9	0.48 J	5.6	**8.8**	1.2 J
Cobalt	4,700	1,700	110,000	42,000	NC				0.78 J	
Copper	NC	150	NC	89,000	5.8	2.3 J		2 J	4 J	0.57 J
Iron	NC	53,000	NC	NC	**852**	**3730 J**	216 J	**998 J**	**4750 J**	390 J
Lead	500	400	1,000	1,400	**14.4**	6.2	1.5	7.9	**16.1**	1.5
Magnesium	NC	NC	NC	NC	**99.8**	**129 J**	16.9 J	**305 J**	**554 J**	36.9 J
Manganese	370	3,500	5,500	43,000	**18**	7.3	2.9 J	10.5	**21.7**	2.7 J
Nickel	1,500	340	26,000	35,000	NC			0.88 J	3.6 J	0.2 J
Potassium	NC	NC	NC	NC	NC	62 J		46 J	184 J	18.7 J
Selenium	390	440	9,900	11,000	NC					
Silver	390	410	9,000	8,200	NC					
Sodium	NC	NC	NC	NC	288			170 J	155 J	142 J
Vanadium	490	67	4,800	10,000	**3.8**	**6 J**	1.2 J	2.9 J	**6.9 J**	1.4 J
Zinc	23,000	26,000	560,000	630,000	15.2		4.4 J	9.2	12.6	3.8 J
Radiological pCi/g										
Gross alpha	NC	NC	NC	NC	NC	4.92	7.01	2.75	2.22	23.51
Gross beta	NC	NC	NC	NC	NC	9.2	6.8	5.93	12.98	8.86

Notes:
TAL = Target Analyte List
TCL = Target Compound List
SCG = Soil CleanupTarget Levels (SCTLs) for Florida Chapter 62-777, F.A.C.(Florida Department of Environmental Protection memorandum, February 2005).
Chromium values are for chromium (hexavalent). Arsenic values are from carcinogenic pathway
Aroclor-1254 value is from polychlorinated biphenyls.
NC = no criteria
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
pCi/g - picocuries per gram
J = Reported concentration is an estimated quantity
All inorganics results expressed in milligrams per kilogram (mg/kg) soil dry weight;
organics in micrograms per kilogram (µg/kg) soil dry weight.
Bold/shaded values indicate exceedance of both Residential SCTL and Background Concentration
Bolded value exceeds NAS Jacksonville Background Concentration
Bolded/gray shaded value indicate exceedance of Residential SCTL

Summary of Detections in Surface Soil Analytical Results
TAL Metals and TCL Organics
PSC 5
Naval Air Station Jacksonville
Jacksonville, Florida

Blank space indicates analyte/compound was not detected in the reporting limit

PSC 5 Surface Soil

Contaminant	Concentration (mg/kg)	Toxic Equivalency Factor	Benzo (a) pyrene Equivalents
Benzo(a)anthracene	0.15	0.1	0.0150
Benzo(a)pyrene	0.16	1.0	0.1600
Benzo(b)fluoranthene	0.29	0.1	0.0290
Benzo(k)fluoranthene	0.28	0.01	0.0028
Chrysene	0.12	0.001	0.0001
Dibenz(a,h)anthracene	0.185	1.0	0.1850
Indeno(1,2,3-cd)pyrene	0.14	0.1	0.0140

yellow is 1/2 laboratory MDL (non-detect)

Direct Exposure Industrial SCTL = 0.7 mg/kg; Total Benzo(a)pyrene Equivalents = 0.406

Direct Exposure Residential SCTL = 0.1 mg/kg; Total Benzo(a)pyrene Equivalents = 0.4059

The concentration shown does not exceed the Direct Exposure for Commercial/Industrial SCTL.
The concentration shown EXCEEDS THE Direct Exposure Residential SCTL!

Instructions: Calculate Total Benzo(a)pyrene Equivalents only if at least one of the carcinogenic PAH is detected in the sample at a concentration equal to or higher than the MDL, whether quantified with certainty (the concentration reported has no qualifier) or estimated (the concentration reported has a "J" or "M" qualifier). Enter the contaminant concetrations (in mg/kg) for all seven carcinogenic PAHs in the concentration boxes using the following criteria: if quantified with certainty enter the reported value; if not detected at the MDL (the concentration reported is the MDL followed by the "U" qualifier) enter 1/2 of the reported value; if detected at a concentration lower than the MDL and the concentration is estimated (has the "T" qualifier) enter the estimated value; if detected at a concentration equal to or higher than the MDL but lower than the PQL and the concentration is estimated (has the "I" qualifier) enter the estimated value; if detected at a concentration equal to or higher than MDL but lower than PQL and it is not estimated (the concentration reported is the PQL followed by the "M" qualifier) enter 1/2 of the reported value.

Summary of Detections in Surface Soil Analytical Results
TAL Metals and TCL Organics
PSC 5
Naval Air Station Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	05S00701	05S00801	05S00901	05S01001
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		19-Aug-97	19-Aug-97	19-Aug-97	19-Aug-97
Volatile Organics µg/kg									
Acetone	260,000	11,000,000	1,800,000	68,000,000	NC				
Tetrachloroethene	12,000	8,800	28,000	18,000	NC				
Semivolatile Organics µg/kg									
Benzo(a)anthracene	1,400	NC	4,900	NC	NC			150 J	78 J
Benzo(a)pyrene	100	**100**	500	700	NC	56 J		**160 J**	58 J
Benzo(b)fluoranthene	1,400	NC	5,000	NC	NC	96 J		290 J	120 J
Benzo(g,h,i)perylene	14,000	2,500,000	50,000	52,000,000	NC	74 J		170 J	58 J
Benzo(k)fluoranthene	14,000	NC	48,000	NC	NC	91 J		280 J	120 J
Carbazole	42,000	49,000	120,000	240,000	NC			39 J	
Chrysene	140,000	NC	500,000	NC	NC			120 J	61 J
Di-n-octylphthalate	1,500,000	1,700,000	32,000,000	39,000,000	NC	220 J			
Fluoranthene	2,900,000	3,200,000	48,000,000	59,000,000	NC			260 J	130 J
Indeno(1,2,3-cd)pyrene	1,400	NC	5,000	NC	NC	53 J		140 J	47 J
Phenanthrene	1,700,000	2,200,000	21,000,000	36,000,000	NC			150 J	68 J
Pyrene	2,200,000	2,400,000	41,000,000	4,500,000	NC	49 J		180 J	110 J
Pesticides/PCBs µg/kg									
4,4'-DDD	4,500	4,200	17,000	22,000	NC			3 J	
4,4'-DDE	3,000	2,900	11,000	15,000	NC		2.6 J	3.3 J	0.56 J
4,4'-DDT	3,100	2,900	12,000	15,000	NC	0.67 J			0.34 J
Aldrin	60	60	200	300	NC				0.17 J
alpha-Chlordane	800	NC	3,000	NC	NC		0.32 J		
Aroclor-1254	900		3,500		NC			120	
Dieldrin	70	60	300	300	NC		0.66 J		1.4 J
Endosulfan I	390,000	45,000	5,900,000	7,600,000	NC			0.09 J	
Endosulfan Sulfate	390,000	45,000	5,900,000	7,600,000	NC	0.27 J	0.65 J		
Endrin aldehyde	23,000	NC	480,000	NC	NC		0.43 J		
gamma-Chlordane	800	2,800	3,000	14,000	NC	0.14 J		2.1	0.21 J

Summary of Detections in Surface Soil Analytical Results
TAL Metals and TCL Organics
PSC 5
Naval Air Station Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	05S00701	05S00801	05S00901	05S01001
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		19-Aug-97	19-Aug-97	19-Aug-97	19-Aug-97
Inorganics mg/kg									
Aluminum	75,000	80,000	1,000,000	NC	**1,340**	1160 J	**6910 J**	**1560 J**	**2030 J**
Antimony	26	27	220	370	NC				0.4 J
Arsenic	0.8	**2**	3	12	**0.8**		**2 J**		**2.4**
Barium	5,200	120	84,000	130,000	**11.2**	9.9 J	**29.2 J**	**12.1 J**	**18.2 J**
Beryllium	0.2	120	1	1,400	NC		0.84 J		
Cadmium	37	82	600	1,700	NC	0.2 J	0.72 J	0.23 J	0.08 J
Calcium	NC	NC	NC	NC	**2,360**	**54300**	**4560**	**23100**	**20500**
Chromium	290	210	430	470	**6.6**	4.4	**22.1**	4	5.3
Cobalt	4,700	1,700	110,000	42,000	NC	0.35 J	1.6 J	0.48 J	0.58 J
Copper	NC	150	NC	89,000	5.8	5.3 J	8.5	3.9 J	3.6 J
Iron	NC	53,000	NC	NC	**852**	**1120 J**	**7100 J**	**1710 J**	**7750 J**
Lead	500	400	1,000	1,400	**14.4**	10.4	**21.2**	**27**	**27**
Magnesium	NC	NC	NC	NC	**99.8**	**815 J**	**1310 J**	**310 J**	**292 J**
Manganese	370	3,500	5,500	43,000	**18**	**36.7**	**27.7**	**20.4**	**41**
Nickel	1,500	340	26,000	35,000	NC	5 J	5.1 J	1.1 J	1.9 J
Potassium	NC	NC	NC	NC	NC	146 J	376 J	94.3 J	118 J
Selenium	390	440	9,900	11,000	NC		1.2 J		
Silver	390	410	9,000	8,200	NC		0.14 J		
Sodium	NC	NC	NC	NC	288	163 J	262 J	122 J	142 J
Vanadium	490	67	4,800	10,000	**3.8**	**4.7 J**	**12.3 J**	**4.4 J**	**6.6 J**
Zinc	23,000	26,000	560,000	630,000	15.2	14	22.3	20.3	24.1
Radiological pCi/g									
Gross alpha	NC	NC	NC	NC	NC	4.45	8.89	4.25	6.57
Gross beta	NC	NC	NC	NC	NC	9.75	15.91	7.34	10.83

Notes:
TAL = Target Analyte List
TCL = Target Compound List
SCG = Soil CleanupTarget Levels (SCTLs) for Florida Chapter 62-777, F.A.C.(Florida Department of Environmental Protection mer
Chromium values are for chromium (hexavalent). Arsenic values are from carcinogenic pathway
Aroclor-1254 value is from polychlorinated biphenyls.
NC = no criteria
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
pCi/g - picocuries per gram
J = Reported concentration is an estimated quantity
All inorganics results expressed in milligrams per kilogram (mg/kg) soil dry weight;
organics in micrograms per kilogram (µg/kg) soil dry weight.
Bold/shaded values indicate exceedance of both Residential SCTL and Background Concentration
Bolded value exceeds NAS Jacksonville Background Concentration
Bolded/gray shaded value indicate exceedance of Residential SCTL

Summary of Detections in Surface Soil Analytical Results
TAL Metals and TCL Organics
PSC 5
Naval Air Station Jacksonville
Jacksonville, Florida

Blank space indicates analyte/compound was not detected in the reporting limit

PSC 5 Surface Soil

Contaminant	Concentration (mg/kg)	Toxic Equivalency Factor	Benzo (a) pyrene Equivalents
Benzo(a)anthracene	0.15	0.1	0.0150
Benzo(a)pyrene	0.16	1.0	0.1600
Benzo(b)fluoranthene	0.29	0.1	0.0290
Benzo(k)fluoranthene	0.28	0.01	0.0028
Chrysene	0.12	0.001	0.0001
Dibenz(a,h)anthracene	0.185	1.0	0.1850
Indeno(1,2,3-cd)pyrene	0.14	0.1	0.0140

yellow is 1/2 laboratory MDL (non-d

Direct Exposure Industrial SCTL = 0.7 mg/kg; Total Benzo(a)pyrene Equivalents = 0.406

Direct Exposure Residential SCTL = 0.1 mg/kg; Total Benzo(a)pyrene Equivalents = 0.4059

The concentration shown does not exceed the Direct Exposure for Commercial/Industrial SCTL.
The concentration shown EXCEEDS THE Direct Exposure Residential SCTL!

Instructions: Calculate Total Benzo(a)pyrene Equivalents only if at least one of the carcinogenic PAH is detected in the sample at a concentration e higher than the MDL, whether quantified with certainty (the concentration reported has no qualifier) or estimated (the concentration reported has a ". qualifier). Enter the contaminant concetrations (in mg/kg) for all seven carcinogenic PAHs in the concentration boxes using the following criteria: if q certainty enter the reported value; if not detected at the MDL (the concentration reported is the MDL followed by the "U" qualifier) enter 1/2 of the rep if detected at a concentration lower than the MDL and the concentration is estimated (has the "T" qualifier) enter the estimated value; if detected at a concentration equal to or higher than the MDL but lower than the PQL and the concentration is estimated (has the "I" qualifier) enter the estimated v detected at a concentration equal to or higher than MDL but lower than PQL and it is not estimated (the concentration reported is the PQL followed b qualifier) enter 1/2 of the reported value.

Summary of Detections in Surface Soil Analytical Results
TAL Metals and TCL Organics
PSC 5
Naval Air Station Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial	
Volatile Organics µg/kg					
Acetone	260,000	11,000,000	1,800,000	68,000,000	NC
Tetrachloroethene	12,000	8,800	28,000	18,000	NC
Semivolatile Organics µg/kg					
Benzo(a)anthracene	1,400	NC	4,900	NC	NC
Benzo(a)pyrene	100	**100**	500	700	NC
Benzo(b)fluoranthene	1,400	NC	5,000	NC	NC
Benzo(g,h,i)perylene	14,000	2,500,000	50,000	52,000,000	NC
Benzo(k)fluoranthene	14,000	NC	48,000	NC	NC
Carbazole	42,000	49,000	120,000	240,000	NC
Chrysene	140,000	NC	500,000	NC	NC
Di-n-octylphthalate	1,500,000	1,700,000	32,000,000	39,000,000	NC
Fluoranthene	2,900,000	3,200,000	48,000,000	59,000,000	NC
Indeno(1,2,3-cd)pyrene	1,400	NC	5,000	NC	NC
Phenanthrene	1,700,000	2,200,000	21,000,000	36,000,000	NC
Pyrene	2,200,000	2,400,000	41,000,000	4,500,000	NC
Pesticides/PCBs µg/kg					
4,4'-DDD	4,500	4,200	17,000	22,000	NC
4,4'-DDE	3,000	2,900	11,000	15,000	NC
4,4'-DDT	3,100	2,900	12,000	15,000	NC
Aldrin	60	60	200	300	NC
alpha-Chlordane	800	NC	3,000	NC	NC
Aroclor-1254	900		3,500		NC
Dieldrin	70	60	300	300	NC
Endosulfan I	390,000	45,000	5,900,000	7,600,000	NC
Endosulfan Sulfate	390,000	45,000	5,900,000	7,600,000	NC
Endrin aldehyde	23,000	NC	480,000	NC	NC
gamma-Chlordane	800	2,800	3,000	14,000	NC

17 J =
remove text

Summary of Detections in Surface Soil Analytical Results
TAL Metals and TCL Organics
PSC 5
Naval Air Station Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial	
Inorganics mg/kg					
Aluminum	75,000	80,000	1,000,000	NC	**1,340**
Antimony	26	27	220	370	NC
Arsenic	0.8	**2**	3	12	**0.8**
Barium	5,200	120	84,000	130,000	**11.2**
Beryllium	0.2	120	1	1,400	NC
Cadmium	37	82	600	1,700	NC
Calcium	NC	NC	NC	NC	**2,360**
Chromium	290	210	430	470	**6.6**
Cobalt	4,700	1,700	110,000	42,000	NC
Copper	NC	150	NC	89,000	5.8
Iron	NC	53,000	NC	NC	**852**
Lead	500	400	1,000	1,400	**14.4**
Magnesium	NC	NC	NC	NC	**99.8**
Manganese	370	3,500	5,500	43,000	**18**
Nickel	1,500	340	26,000	35,000	NC
Potassium	NC	NC	NC	NC	NC
Selenium	390	440	9,900	11,000	NC
Silver	390	410	9,000	8,200	NC
Sodium	NC	NC	NC	NC	288
Vanadium	490	67	4,800	10,000	**3.8**
Zinc	23,000	26,000	560,000	630,000	15.2
Radiological pCi/g					
Gross alpha	NC	NC	NC	NC	NC
Gross beta	NC	NC	NC	NC	NC

Notes:
TAL = Target Analyte List
TCL = Target Compound List
SCG = Soil CleanupTarget Levels (SCTLs) for Florida Chapter 62-777, F.A.C.(Florida Department of Environmental Protection mer
Chromium values are for chromium (hexavalent). Arsenic values are from carcinogenic pathway
Aroclor-1254 value is from polychlorinated biphenyls.
NC = no criteria
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
pCi/g - picocuries per gram
J = Reported concentration is an estimated quantity
All inorganics results expressed in milligrams per kilogram (mg/kg) soil dry weight;
organics in micrograms per kilogram (µg/kg) soil dry weight.
Bold/shaded values indicate exceedance of both Residential SCTL and Background Concentration
Bolded value exceeds NAS Jacksonville Background Concentration
Bolded/gray shaded value indicate exceedance of Residential SCTL

Summary of Detections in Surface Soil Analytical Results
TAL Metals and TCL Organics
PSC 5
Naval Air Station Jacksonville
Jacksonville, Florida

Blank space indicates analyte/compound was not detected in the reporting limit

PSC 5 Surface Soil

Contaminant	Concentration (mg/kg)	Toxic Equivalency Factor	Benzo (a) pyrene Equivalents
Benzo(a)anthracene	0.15	0.1	0.0150
Benzo(a)pyrene	0.16	1.0	0.1600
Benzo(b)fluoranthene	0.29	0.1	0.0290
Benzo(k)fluoranthene	0.28	0.01	0.0028
Chrysene	0.12	0.001	0.0001
Dibenz(a,h)anthracene	0.185	1.0	0.1850
Indeno(1,2,3-cd)pyrene	0.14	0.1	0.0140

yellow is 1/2 laboratory MDL (non-d

Direct Exposure Industrial SCTL = 0.7 mg/kg; Total Benzo(a)pyrene Equivalents = 0.406

Direct Exposure Residential SCTL = 0.1 mg/kg; Total Benzo(a)pyrene Equivalents = 0.4059

The concentration shown does not exceed the Direct Exposure for Commercial/Industrial SCTL.
The concentration shown EXCEEDS THE Direct Exposure Residential SCTL!

Instructions: Calculate Total Benzo(a)pyrene Equivalents only if at least one of the carcinogenic PAH is detected in the sample at a concentration e higher than the MDL, whether quantified with certainty (the concentration reported has no qualifier) or estimated (the concentration reported has a ". qualifier). Enter the contaminant concetrations (in mg/kg) for all seven carcinogenic PAHs in the concentration boxes using the following criteria: if q certainty enter the reported value; if not detected at the MDL (the concentration reported is the MDL followed by the "U" qualifier) enter 1/2 of the rep if detected at a concentration lower than the MDL and the concentration is estimated (has the "T" qualifier) enter the estimated value; if detected at a concentration equal to or higher than the MDL but lower than the PQL and the concentration is estimated (has the "I" qualifier) enter the estimated v detected at a concentration equal to or higher than MDL but lower than PQL and it is not estimated (the concentration reported is the PQL followed b qualifier) enter 1/2 of the reported value.

Summary of Detections in Subsurface Soil Analytical Results
TAL Metals and TCL Organics
PSC 5
NAS Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	05B00301
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		7-Aug-97
Volatile Organics µg/kg						
Acetone	260,000	11,000,000	1,800,000	68,000,000	NC	25 J
Pesticides/PCBs µg/kg						
4,4'-DDD	4,500	4,200	17,000	22,000	NC	31 J
4,4'-DDE	3,000	2,900	11,000	15,000	NC	11 J
4,4'-DDT	3,100	2,900	12,000	15,000	NC	1 J
Dieldrin	70	60	300	300	NC	2 J
Inorganics mg/kg						
Aluminum	75,000	80,000	1,000,000	NC	6,823	1780
Arsenic	0.8	2	3	12	1.48	0.92 J
Barium	5,200	120	84,000	130,000	20.8	10.1 J
Beryllium	0.2	120	1	1,400	0.49	0.16 J
Cadmium	37	82	600	1,700	NC	0.33 J
Calcium	NC	NC	NC	NC	**668.3**	**10,100**
Chromium	290	210	430	470	14.1	8.1
Cobalt	4,700	1,700	110,000	42,000	NC	0.37 J
Copper	NC	150	NC	89,000	5.8	4.3 J
Iron	NC	53,000	NC	NC	5,818.2	2,710 J
Lead	500	400	1,000	1,400	**6.46**	**25.2**
Magnesium	NC	NC	NC	NC	500.25	252 J
Manganese	370	3,500	5,500	43,000	**6.90**	**24**
Nickel	1,500	340	26,000	35,000	NC	1.6 J
Potassium	NC	NC	NC	NC	450.67	104 J
Sodium	NC	NC	NC	NC	343.10	172 J
Vanadium	490	67	4,800	10,000	NC	4.4 J
Zinc	23,000	26,000	560,000	630,000	**14.49**	**15.5**
Radiological pCi/g						
Gross beta	NC	NC	NC	NC	NC	12.36

Notes:
NC = no criteria
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
pCi/g - picocuries per gram
J = Reported concentration is an estimated quantity
All inorganics results expressed in milligrams per kilogram (mg/kg) soil dry weight; organics in micrograms per kilogram (µg/kg) soil dry weight.
Blank space indicates analyte/compound was not detected in the reporting limit

PSC 5 Subsurface Soil

Contaminant	Concentration (mg/kg)	Toxic Equivalency Factor	Benzo (a) pyrene Equivalents
Benzo(a)anthracene	0.2	0.1	0.0200
Benzo(a)pyrene	0.2	1.0	0.2000
Benzo(b)fluoranthene	0.2	0.1	0.0200
Benzo(k)fluoranthene	0.2	0.01	0.0020
Chrysene	0.2	0.001	0.0002
Dibenz(a,h)anthracene	0.200	1.0	0.2000
Indeno(1,2,3-cd)pyrene	0.2	0.1	0.0200

All of these were non-detects

Direct Exposure Industrial SCTL = 0.7 mg/kg; Total Benzo(a)pyrene Equivalents = 0.462

Direct Exposure Residential SCTL = 0.1 mg/kg; Total Benzo(a)pyrene Equivalents = 0.4622

The concentration shown does not exceed the Direct Exposure for Commercial/Industrial SCTL.
The concentration shown EXCEEDS THE Direct Exposure Residential SCTL!

Summary of Detections in Groundwater Analytical Results
TAL Metals and TCL Organics
PSC 5
NAS Jacksonville
Jacksonville, Florida

Sample ID / Sampling Date	1997 FDEP GGC	FDEP GCTLs	1997 FED MCL	EPA MCLs	NAS Jacksonville Background Concentrations	05G00101 14-Jul-97	05G00201 11-Jul-97	05G00301 11-Jul-97	05G00401 11-Jul-97
Volatile Organics µg/L									
Methylene Chloride	5	5	5	NC	NC			**27**	
Toluene	1000	40	1,000	NC	NC				6 J
Semivolatile Organics µg/L									
4-Methylphenol	35	3.50	NC	NC	NC			4 J	
Pesticides µg/L									
delta-BHC	50	0.02	NC	NC	NC			0.01 J	
Inorganics µg/L									
Aluminum	200	**200**	200	**200**	147,318	89.9 J			**237**
Arsenic	50	**10**	50	**10**	**13.2**	5 J	6.2 J		**18**
Barium	2000	2,000	2,000	2,000	616	50.9 J	49.2 J	78.4 J	53.4 J
Calcium		NC	NC	NC	**59,066**	**178000**	**126000**	**71600**	**214000**
Chromium	100	100	100	100	208	2.3 J	1.4 J	3.1 J	9 J
Cobalt	NC	140	NC	NC	23				2.1 J
Copper	1,000	1,000	1,000	1,300	40.4	2.5 J	3.8 J	3.4 J	5.5 J
Iron	**300**	**300**	**300**	**300**	68,292	**51600**	**1910**	**6970**	**35900**
Lead	15	15	NC	15	45.8		2.8 J	1.9 J	
Magnesium	NC	NC	NC	NC	**19,316**	12600	9440	**34800**	**23100**
Manganese	**50**	**50**	**50**	**50**	**204**	**893**	**101**	**440**	**876**
Nickel	100	100	100	100	74.8		3.3 J	2.5 J	8.6 J
Potassium	NC	NC	NC	NC	9,038	3240 J	6990 J	7240 J	6520 J
Selenium	50	50	50	50	13.8	2.9 J			3.1 J
Sodium	160,000	160,000	NC	NC	**24,626**	11000	**28800**	**91200**	**149000**
Vanadium	49	49	NC	NC	294	1.8 J	4.9 J	1 J	10.2 J
Zinc	5,000	5,000	5,000	5,000	173.2	18.4 J	19.1 J	38.5 J	14.4 J
Radiological, pCi/L									
Gross alpha	NC	NC	15	NC	NC	-1.85	3.69	2.35	428
Gross Beta	NC	NC	NC	NC	NC	9.64	10.22	12.53	13.02

J = Reported concentration is an estimated quantity
NC = no criteria available
µg/L = micrograms per liter
pCi/L = picocuries per liter
Blank space indicates analyte/compound was not detected at the reporting limit.
Bold/shaded values indicate exceedance of both FDEP GCTL and EPA MCL
Bolded value exceeds NAS Jacksonville Background Concentration
Bolded/gray shaded value indicate exceedance of FDEP GCTL and Background Concentration
GCTL = Florida Department of Environmental Protection Groundwater Cleanup Target Level (Feb. 2005)
MCL = US Environmental Protection Agency Maximum Contaminant Level. Primary Drinking Water Regulations.

Summary of Detections in Surface Soil Analytical Results
TAL Metals and TCL Organics
PSC 8
Naval Air Station Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	08S00101	08S00201	08S00301	08S00401	08S00501	08S00202	08S00302	08S00502
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		20-May-97	21-May-97	22-May-97	21-May-97	22-May-97	21-May-97	21-May-97	22-May-97
Semivolatile Organics µg/kg													
Acenaphthene		2,400,000		20,000,000	NC			59 J					
Anthracene		21,000,000		300,000,000	NC			140 J					
Benzo(a)anthracene	1,400	NC	4,900	NC	NC			860				59 J	
Benzo(a)pyrene	**100**	**100**	**500**	**700**	NC			**1500**				100 J	
Benzo(b)fluoranthene	1,400	NC	5,000	NC	NC			2900 J		57 J		120 J	59 J
Benzo(g,h,i)perylene	14,000	2,500,000	50,000	52,000,000	NC							77 J	
Benzo(k)fluoranthene	14,000	NC	48,000	NC	NC			3000 J		59 J		130 J	61 J
bis(2-Ethylhexyl)phthalate		72,000		390,000	NC	54 J	75 J		250 J	79 J	59 J	410	
Chrysene	140,000	NC	500,000	NC	NC			1000				66 J	
Dibenz(a,h)anthracene		#		#	NC			150 J					
Fluoranthene	2,900,000	3,200,000	48,000,000	59,000,000	NC			1100					
Indeno(1,2,3-cd)pyrene	1,400	NC	5,000	NC	NC			470				55 J	
Phenanthrene	1,700,000	2,200,000	21,000,000	36,000,000	NC			150 J					
Pyrene	2,200,000	2,400,000	41,000,000	4,500,000	NC			1600				56 J	
Pesticides/PCBs µg/kg													
4,4'-DDD	4,500	4,200	17,000	22,000	NC			12 J		8 J			
4,4'-DDE	3,000	2,900	11,000	15,000	NC	2.6 J	5 J	240	1 J	7.1	1.6 J	3.4 J	12
4,4'-DDT	3,100	2,900	12,000	15,000	NC			280 J	22 J	6.5 J		12 J	21 J
Aldrin	60	60	200	300	NC		0.54 J	1.6 J					
alpha-Chlordane	800	NC	3,000	NC	NC	0.25 J	1.8 J	14 J	1.7 J	1.4 J		0.34 J	2.8 J
Aroclor-1260	500	500	2,100	2,600	NC		220		50	230	11 J		190
delta-BHC	22,000	24,000	420,000	490,000	NC	0.12 J		1.2 J	0.14 J		0.58 J		0.75 J
Dieldrin	70	**60**	300	300	NC	0.49 J	33	**180 J**		5.8 J	1.5 J	14	7.5 J
Endosulfan II	390,000	450,000	5,900,000	7,600,000	NC			6.9 J					7.6 J
Endosulfan Sulfate	390,000	450,000	5,900,000	7,600,000	NC		0.88 J	3.3 J	0.36 J	2.4 J			
Endrin	21,000	25,000	340,000	510,000	NC		1.1 J	6.4 J		0.31 J		0.25 J	
Endrin aldehyde	23,000	NC	480,000	NC	NC	0.25 J			0.76 J	5 J			6 J
Endrin ketone	NC	NC	NC	NC	NC			11 J					
gamma-Chlordane	800	2,800	3,000	14,000	NC	0.47 J	6.5 J	57 J	0.27 J	2 J	0.07 J	1.2 J	1.9 J
Heptachlor	200	200	900	1,000	NC			19 J					
Heptachlor epoxide	100	100	400	500	NC	0.13 J	0.46 J	13 J	0.28 J	1.5 J		1.5 J	2.1 J
Methoxychlor	375,000	420,000	7,500,000	8,800,000	NC			3 J					

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TAL Metals and TCL Organics
PSC 8
Naval Air Station Jacksonville
Jacksonville, Florida

Sample ID		Soil Cleanup Target Levels			NAS Jacksonville Background Concentrations	08S00101	08S00201	08S00301	08S00401	08S00501	08S00202	08S00302	08S00502
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		20-May-97	21-May-97	22-May-97	21-May-97	22-May-97	21-May-97	21-May-97	22-May-97
Inorganics mg/kg													
Aluminum	75000	80,000	1,000,000	NC	**1,340**	913	**3830 J**	**2880 J**	**16200 J**	**15100 J**	**2750 J**	829 J	**16300 J**
Arsenic	0.8	2	3	12	**0.8**				**7**	**5.2**	**0.91 J**		**6.7**
Barium	5200	120	84,000	130,000	**11.2**	7.2 J	**33.3 J**	**26.2 J**	**40.9 J**	**33.9 J**	**16.5 J**	7.1 J	**41.7 J**
Beryllium	0.2	120	1	1,400	NC		0.57 J		0.63 J	0.5 J	0.32 J		0.48 J
Cadmium	37	82	600	1,700	NC	0.63 J	1.2	0.83 J	4.5	1.5 J			1.3 J
Calcium	NC	NC	NC	NC	**2,360**	**17900**	**176000**	**49400**	3280	1740	**9180**	**33900**	695 J
Chromium	290	210	430	470	**6.6**	3.6	**15.7**	**7.3**	61.6	59	**6.8**	3.6	**66.7**
Cobalt	4700	1,700	110,000	42,000	NC	0.2 J	0.47 J	0.68 J	2.3 J	2 J	1 J	0.23 J	2.1 J
Copper	NC	150	NC	89,000	**5.8**	4 J	**10.9**	**19.6**	27.9	28.5	2.6 J	4.1 J	**28.3**
Iron	NC	53,000	NC	NC	**852**	**969 J**	**2280 J**	**3050 J**	26700 J	24500 J	**3870 J**	**1040 J**	**25100 J**
Lead	500	400	1,000	1,400	**14.4**	14.1	**114**	**44.3**	62.7	60.7	11.6	**26.1**	**66.1**
Magnesium	NC	NC	NC	NC	**99.8**	**350 J**	**2690**	**786 J**	1730	1790	**573 J**	**289 J**	**1730**
Manganese	370	3,500	5,500	43,000	**18**	**18.3 J**	**138**	**67.6**	78.3	154	**19.2**	8	**91.9**
Mercury	3000	3,000	26,000	17,000	NC		0.1 J		0.62	0.52			0.54
Nickel	1500	340	26,000	35,000	NC	2.5 J	4.6 J	2.8 J	10.5 J	9.7 J	2.3 J	2 J	8.3 J
Potassium	NC	NC	NC	NC	NC	120 J	312 J	279 J	1060 J	1220 J	313 J	95.7 J	1020 J
Selenium	390	440	9,900	11,000	NC				5.3	4.1			4.2
Silver	390	410	9,000	8,200	NC				1.4 J	1.3 J		0.23 J	1.5 J
Sodium	NC	NC	NC	NC	**288**					626 J			
Vanadium	490	67	4,800	10,000	**3.8**	**4 J**	**11**	**10 J**	**35**	**30**	**7 J**	3 J	**33**
Zinc	23000	26,000	560,000	630,000	**15.2**	9.9 J	**96 J**	**24 J**	**79.7 J**	**65.4 J**	9.5 J	7 J	**67.7 J**

Notes:
TAL = Target Analyte List
TCL = Target Compound List
SCG = Soil CleanupTarget Levels (SCTLs) for Florida Chapter 62-777, F.A.C.(Florida Department of Environmental Protection memorandum, February 2005).
Chromium values are for chromium (hexavalent). Arsenic values are from carcinogenic pathway
Aroclor-1254 value is from polychlorinated biphenyls.
NC = no criteria
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
pCi/g - picocuries per gram
J = Reported concentration is an estimated quantity
All inorganics results expressed in milligrams per kilogram (mg/kg) soil dry weight;
organics in micrograms per kilogram (µg/kg) soil dry weight.

- 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 February 2005 'Final Technical Report: Development of CTLs for Chapter 62-777, F.A.C.

Bold/shaded values indicate exceedance of both Residential SCTL and Background Concentration
Bolded value exceeds NAS Jacksonville Background Concentration
Bolded/gray shaded value indicate exceedance of Residential SCTL
Bolded/green shaded value indicate exceedance of Residential and Industrial SCTL
Blank space indicates analyte/compound was not detected in the reporting limit

Summary of Detections in Surface Soil Analytical Results
TAL Metals and TCL Organics
PSC 8
Naval Air Station Jacksonville
Jacksonville, Florida

PSC 8 Surface Soil

Contaminant	Concentration (mg/kg)	Toxic Equivalency Factor	Benzo (a) pyrene Equivalents
Benzo(a)anthracene	0.86	0.1	0.0860
Benzo(a)pyrene	1.5	1.0	1.5000
Benzo(b)fluoranthene	2.9	0.1	0.2900
Benzo(k)fluoranthene	3	0.01	0.0300
Chrysene	1	0.001	0.0010
Dibenz(a,h)anthracene	0.150	1.0	0.1500
Indeno(1,2,3-cd)pyrene	0.47	0.1	0.0470

Direct Exposure Industrial SCTL = 0.7 mg/kg; Total Benzo(a)pyrene Equivalents = 2.104

Direct Exposure Residential SCTL = 0.1 mg/kg; Total Benzo(a)pyrene Equivalents = 2.1040

The concentration shown EXCEEDS THE Direct Exposure Commercial/Industrial SCTL!
The concentration shown EXCEEDS THE Direct Exposure Residential SCTL!

Summary of Detections in Subsurface Soil Analytical Results
TAL Metals and TCL Organics
PSC 8
NAS Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	08S00102	08S00402
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		20-May-97	21-May-97
Volatile Organics µg/kg							
Methylene chloride		17000		26000	NC	3 J	1 J
Semivolatile Organics µg/kg							
Benzo(b)fluoranthene		NC		NC	NC	47 J	
Benzo(k)fluoranthene		NC		NC	NC	48 J	
Pesticides/PCBs µg/kg							
4,4'-DDD	4,500	4,200	17,000	22,000	NC	59	
4,4'-DDE	3,000	2,900	11,000	15,000	NC	18	
Aldrin	60	60	200	300	NC		0.1 J
Dieldrin	70	60	300	300	NC		0.53 J
Endosulfan I	410,000	450,000	6,700,000	7,600,000	NC	0.46 J	
Endosulfan Sulfate	390,000	450,000	5,900,000	7,600,000	NC	0.56 J	
Endrin	21,000	25,000	340,000	510,000	NC		0.36 J
Endrin aldehyde	23,000	NC	480,000	NC	NC	0.39 J	
gamma-BHC (Lindane)		700		2,500	NC		0.06 J
gamma-Chlordane	800	2,800	3,000	14,000	NC	0.24 J	
Inorganics mg/kg							
Aluminum	75,000	80,000	1,000,000	NC	**6,823**	308 J	**8120 J**
Arsenic	0.8	2	3	12	**1.48**		**1.8 J**
Barium	5,200	120	84,000	130,000	**20.8**	16.3 J	**26.2 J**
Beryllium	0.2	120	1	1,400	**0.49**		**0.92 J**
Calcium	NC	NC	NC	NC	**668.3**	**1,340**	**6,410**
Chromium	290	210	430	470	**14.1**	1.7 J	**18.8**
Cobalt	4,700	1,700	110,000	42,000	NC		5.5 J
Copper	NC	150	NC	89,000	**5.8**	1.9 J	**5.9 J**
Iron	NC	53,000	NC	NC	**5,818.2**	938 J	**13300 J**
Lead	500	400	1,000	1,400	**6.46**	**38.6**	**10.4**
Magnesium	NC	NC	NC	NC	**500.25**	42.8 J	**3150**
Manganese	370	3,500	5,500	43,000	**6.90**	**8.5**	**132**
Mercury	3000	3,000	26,000	17,000	NC		0.11 J
Nickel	1,500	340	26,000	35,000	NC	1.3 J	6.8 J
Potassium	NC	NC	NC	NC	**450.67**		**1100 J**
Sodium	NC	NC	NC	NC	**343.10**		**944 J**
Vanadium	490	67	4,800	10,000	NC	1 J	17
Zinc	23,000	26,000	560,000	630,000	**14.49**	**22.9 J**	**23.5 J**

Notes:
NC = no criteria
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
pCi/g - picocuries per gram
J = Reported concentration is an estimated quantity
All inorganics results expressed in milligrams per kilogram (mg/kg) soil dry weight;
organics in micrograms per kilogram (µg/kg) soil dry weight.
Bolded value exceeds NAS Jacksonville Background Concentration

Summary of Detections in Subsurface Soil Analytical Results
TAL Metals and TCL Organics
PSC 8
NAS Jacksonville
Jacksonville, Florida

Blank space indicates analyte/compound was not detected in the reporting limit

PSC 8 Subsurface Soil

Contaminant	Concentration (mg/kg)	Toxic Equivalency Factor	Benzo (a) pyrene Equivalents
Benzo(a)anthracene	0.2	0.1	0.0200
Benzo(a)pyrene	0.2	1.0	0.2000
Benzo(b)fluoranthene	0.047	0.1	0.0047
Benzo(k)fluoranthene	0.048	0.01	0.0005
Chrysene	0.2	0.001	0.0002
Dibenz(a,h)anthracene	0.200	1.0	0.2000
Indeno(1,2,3-cd)pyrene	0.2	0.1	0.0200

yellow was non-detect - 1/2 of laboratory MDL

Direct Exposure Industrial SCTL = 0.7 mg/kg; Total Benzo(a)pyrene Equivalents = 0.445

Direct Exposure Residential SCTL = 0.1 mg/kg; Total Benzo(a)pyrene Equivalents = 0.4454

The concentration shown does not exceed the Direct Exposure for Commercial/Industrial SCTL.
The concentration shown EXCEEDS THE Direct Exposure Residential SCTL!

Summary of Detections in Sediment Analytical Results
TAL Metals and TCL Organics
PSC 8
NAS Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	08D00101	08D00201	08D00301
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		29-May-97	28-May-97	29-May-97
Volatile Organics µg/kg								
Acetone	260,000	11,000,000	1,800,000	68,000,000	NC	42 J		
Methylene chloride		17000		26000	NC			64 J
Semivolatile Organics µg/kg								
Benzo(a)anthracene	1,400	NC	4,900	NC	NC	180 J		
Benzo(a)pyrene	100	**100**	500	700	NC	**210 J**		
Benzo(b)fluoranthene	1,400	NC	5,000	NC	NC	430 J		
Benzo(g,h,i)perylene	14,000	2,500,000	50,000	52,000,000	NC	120 J		
Benzo(k)fluoranthene	14,000	NC	48,000	NC	NC	450 J		
bis(2-Ethylhexyl)phthalate		72,000		390,000	NC	310 J		
Chrysene	140,000	NC	500,000	NC	NC	200 J		
Fluoranthene	2,900,000	3,200,000	48,000,000	59,000,000	NC	320 J		
Indeno(1,2,3-cd)pyrene	1,400	NC	5,000	NC	NC	110 J		
Phenanthrene	1,700,000	2,200,000	21,000,000	36,000,000	NC	91 J		
Pyrene	2,200,000	2,400,000	41,000,000	4,500,000	NC	310 J		
Pesticides/PCBs µg/kg								
4,4'-DDE	3,000	2,900	11,000	15,000	NC	2.3 J		
4,4'-DDT	3,100	2,900	12,000	15,000	NC	1.1 J	2.4 J	3.9 J
alpha-Chlordane	800	NC	3,000	NC	NC	5.4		
Aroclor-1260	500	500	2,100	2,600	NC	62		
delta-BHC	22,000	24,000	420,000	490,000	NC			4.4 J
Dieldrin	70	60	300	300	NC	2.9 J	1.5 J	
Endosulfan II	390,000	45,000	5,900,000	7,600,000	NC	1 J		
Endosulfan Sulfate	390,000	45,000	5,900,000	7,600,000	NC			5.7 J
Endrin	21,000	25,000	340,000	510,000	NC	0.47 J		
Endrin aldehyde	23,000	NC	480,000	NC	NC			3.8 J
gamma-Chlordane	800	2,800	3,000	14,000	NC		1.8 J	
Heptachlor	200	200	900	1,000	NC	0.27 J		
Heptachlor epoxide	100	100	400	500	NC	0.52 J		
Methoxychlor	375,000	420,000	7,500,000	8,800,000	NC		12 J	34 J
Inorganics mg/kg								
Aluminum	75000	80,000	1,000,000	NC	**1,190**	**1630 J**	**5080 J**	**5690 J**
Arsenic	0.8	2	3	12	**1.26**	**1.9 J**		**7.4 J**
Barium	5200	120	84,000	130,000	**9.8**	**17.3 J**	**31.9 J**	**40.3 J**
Beryllium	0.2	120	1	1,400	**0.48**		**0.59 J**	**0.92 J**
Cadmium	37	82	600	1,700	**0.6**	**0.61 J**	**5**	**9.8 J**
Calcium	NC	NC	NC	NC	**6,468**	3790	6140	**12200 J**
Chromium	290	210	430	470	**3.8**	**5.8**	**190**	**133**
Cobalt	4700	1,700	110,000	42,000	3.8	0.41 J	1.4 J	

Summary of Detections in Sediment Analytical Results
TAL Metals and TCL Organics
PSC 8
NAS Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	08D00101	08D00201	08D00301
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		29-May-97	28-May-97	29-May-97
Copper	NC	150	NC	89,000	**7**	6.7 J	**16.3 J**	**43.9 J**
Iron	NC	53,000	NC	NC	**2,300**	**13500 J**	**14800 J**	**25900 J**
Lead	500	400	1,000	1,400	**14.4**	**25.3**	**48**	**60.7**
Magnesium	NC	NC	NC	NC	**131**	**263 J**	**1520 J**	**2440 J**
Manganese	370	3,500	5,500	43,000	**6.8**	**20.2**	**46.4**	**143**
Mercury	3000	3,000	26,000	17,000	0.1	0.13 J	0.26 J	0.93 J
Nickel	1500	340	26,000	35,000	**6.2**	3.3 J	**13 J**	**19.5 J**
Potassium	NC	NC	NC	NC	**218**	106 J	**677 J**	**1010 J**
Selenium	390	440	9,900	11,000	0.42			13.8
Silver	390	410	9,000	8,200	NC		1.6 J	2.4 J
Sodium	NC	NC	NC	NC	**498**		**1580 J**	**4930 J**
Vanadium	490	67	4,800	10,000	**5.2**	**5.7 J**	**16.9 J**	**32.7 J**
Zinc	23000	26,000	560,000	630,000	**18.4**	**123 J**	**43.6 J**	**131 J**

Notes:
TAL = Target Analyte List
TCL = Target Compound List
SCG = Soil CleanupTarget Levels (SCTLs) for Florida Chapter 62-777, F.A.C.(Florida Department of Environmental Protection memorandum, February 2005).
Chromium values are for chromium (hexavalent). Arsenic values are from carcinogenic pathway
Aroclor-1254 value is from polychlorinated biphenyls.
NC = no criteria
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
pCi/g - picocuries per gram
J = Reported concentration is an estimated quantity
All inorganics results expressed in milligrams per kilogram (mg/kg) soil dry weight;
organics in micrograms per kilogram (µg/kg) soil dry weight.
Blank space indicates analyte/compound was not detected in the reporting limit
Bolded value exceeds NAS Jacksonville Background Concentration
Bolded/gray shaded value indicate exceedance of Residential SCTL

Summary of Detections in Sediment Analytical Results
TAL Metals and TCL Organics
PSC 8
NAS Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	08D00101	08D00201	08D00301
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		29-May-97	28-May-97	29-May-97

PSC 8 Sediment

Contaminant	Concentration (mg/kg)	Toxic Equivalency Factor	Benzo (a) pyrene Equivalents
Benzo(a)anthracene	0.18	0.1	0.0180
Benzo(a)pyrene	0.21	1.0	0.2100
Benzo(b)fluoranthene	0.43	0.1	0.0430
Benzo(k)fluoranthene	0.45	0.01	0.0045
Chrysene	0.2	0.001	0.0002
Dibenz(a,h)anthracene	0.285	1.0	0.2850
Indeno(1,2,3-cd)pyrene	0.11	0.1	0.0110

yellow was non-detect - 1/2 of laboratory MDL

Direct Exposure Industrial SCTL = 0.7 mg/kg; Total Benzo(a)pyrene Equivalents = 0.572

Direct Exposure Residential SCTL = 0.1 mg/kg; Total Benzo(a)pyrene Equivalents = 0.5717

The concentration shown EXCEEDS THE Direct Exposure Commercial/Industrial SCTL!
The concentration shown EXCEEDS THE Direct Exposure Residential SCTL!

Summary of Detections in Surface Water Analytical Results
TAL Metals and TCL Organics
PSC 8
NAS Jacksonville
Jacksonville, Florida

Sample ID / Sampling Date	1997 FDEP GGC	FDEP GCTLs	FDEP SWCTLs	1997 FED MCL	EPA MCLs	REGION 9 PRGs	NAS Jacksonville Background Concentrations	08W00101	08W00201	08W00301
Volatile Organics µg/L										
1,2-Dichloroethane		**3**	37		**5**		NC	**6 J**		
Acetone		6,300	1,700		NC		NC	9 J	16 J	
Trichloroethene		**3**	80.7		**5**		NC	**10**		
Pesticides µg/L										
4,4'-DDE		0.10	0.0003		NC	0.2	NC			0.0065 J
4,4'-DDT		0.10	**0.00059**		NC	0.2	NC	**0.0067 J**	**0.0093 J**	**0.0074 J**
alpha-BHC	0.006	0.006	**0.005**	NC	NC	0.011	NC	**0.0052 J**		
delta-BHC	50	0.02	NC	NC	NC	0.011	NC	0.0086 J	0.0097 J	0.0073 J
Dieldrin		**0.002**	0.00014		NC	**0.0042**	NC		**0.0064 J**	**0.0038 J**
Endosulfan II		42	0.056		NC	220	NC			0.015 J
Inorganics µg/L										
Barium	2000	2,000	NC	2,000	2,000		83	39.6 J	17.8 J	21.8 J
Calcium	NC	NC	NC	NC	NC		39,110	83100	38200	66300
Chromium	100	100	11	100	100		NC	1.5 J	2.9 J	3.6 J
Copper	NC	1,000	NC	1,000	1,300		7.6	4.5 J	4.8 J	3.6 J
Iron	**300**	**300**	**1,000**	**300**	**300**		**2,436**	**11100**	**2160**	**3630**
Lead	15	15	NC	15	15		6.6	2.2 J		
Magnesium	NC	NC	NC	NC	NC		6,126	9010	5770	13300
Manganese	**50**	**50**	NC	**50**	**50**		39.6	**131**	**117**	**417**
Nickel	100	100	NC	100	100		NC	2.3 J	1.7 J	2.3 J
Potassium	NC	NC	NC	NC	NC		1,792	1860 J	3360 J	5580
Sodium		160,000	NC	NC	NC		20,870	23100	20100	52100
Vanadium	49	49	NC	NC	NC		5.6	2 J	2 J	1 J
Zinc	5,000	5,000	NC	5,000	5,000		46.4	56.5	29.4	27.3

Notes:
J = Reported concentration is an estimated quantity
NC = no criteria available
µg/L = micrograms per liter
pCi/L = picocuries per liter
Blank space indicates analyte/compound was not detected at the reporting limit.
Bolded value exceeds NAS Jacksonville Background Concentration
Bold/gray shaded value indicate exceedance of FDEP GCTL.
Bold/shaded value indicate exceedance of FDEP GCTL and EPA MCL.
Bold/yellow shaded value indicate exceedance of FDEP SWCTL.
Bold/green shaded value indicate exceedance of FDEP GCTL and EPA Region 9 PRG.
Bold/orange shaded value indicate exceedance of all listed FDEP and EPA Criteria.
Bold/teal shaded value indicate exceedance of all listed FDEP and EPA Criteria and Background Concentration.
GCTL = Florida Department of Environmental Protection Groundwater Cleanup Target Level (Feb. 2005)
MCL = US Environmental Protection Agency Maximum Contaminant Level. Primary Drinking Water Regulations.
PRG = EPA Preliminary remediation goal
SWCTL = FDEP Surface Water Cleanup Target Level

Summary of Detections in Surface Soil Analytical Results
TAL Metals and TCL Organics
PSC 9
Naval Air Station Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	09B00101	09S00101	09S00102	09S00201	09S00301	09S00401	09S00501	09SBK101
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		7-Aug-97	20-Aug-97	30-Mar-99	20-Aug-97	20-Aug-97	20-Aug-97	20-Aug-97	30-Mar-99
Volatile Organics µg/kg													
Acetone	260,000	11,000,000	1,800,000	68,000,000	NC			NA	35 J	33 J	30 J		NA
Semivolatile Organics µg/kg													
Acenaphthene		2,400,000		20,000,000	NC				49 J				
Acenaphthylene		1,800,000		20,000,000			46 J						
Anthracene		21,000,000		300,000,000	NC				120 J				
Benzo(a)anthracene	**1,400**	NC	4,900	NC	NC	**1400**	200 J	600	810	76 J			
Benzo(a)pyrene	**100**	**100**	**500**	**700**	NC	**1400**	**590**	**860**	**560**	85 J			
Benzo(b)fluoranthene	1,400	NC	5,000	NC	NC	2300	870 J	890	1300	160 J			
Benzo(g,h,i)perylene	14,000	2,500,000	50,000	52,000,000	NC	860	520	410 J	320 J	89 J			
Benzo(k)fluoranthene	14,000	NC	48,000	NC	NC	900	780 J	380	1100	140 J			
bis(2-Ethylhexyl)phthalate		72,000		390,000	NC		130 J	NA	250 J	53 J		90 J	
Carbazole	42,000	49,000	120,000	240,000	NC	80 J			82 J				
Chrysene	140,000	NC	500,000	NC	NC	1600	260 J	590	710	75 J			
Di-n-butylphthalate		8,200,000		170,000,000	NC				82 J			180 J	
Dibenz(a,h)anthracene		#		#	NC		120 J		71 J				
Fluoranthene	2,900,000	3,200,000	48,000,000	59,000,000	NC	3200	180 J	1100	1700	68 J			
Fluorene					NC				39 J				
Indeno(1,2,3-cd)pyrene	1,400	NC	5,000	NC	NC	750 J	440	940	310 J	54 J			
Phenanthrene	1,700,000	2,200,000	21,000,000	36,000,000	NC		81 J		680				
Pyrene	2,200,000	2,400,000	41,000,000	4,500,000	NC	2600 J	330 J	1300 J	1100	130 J			
Pesticides/PCBs µg/kg													
4,4'-DDD	4,500	4,200	17,000	22,000	NC					1.4 J	51		1.2 J
4,4'-DDE	3,000	2,900	11,000	15,000	NC	0.71 J	4.6 J	6 J	1.9 J	3.4 J	41	0.77 J	3.7 J
4,4'-DDT	3,100	2,900	12,000	15,000	NC		10 J	7.7 J	4.9		41		1.5 J
alpha-Chlordane	800	NC	3,000	NC	NC	0.9 J	5	7.9 J	1.5 J		2		
Aroclor-1254	900		3,500		NC		7.4 J			26 J		16 J	
Aroclor-1260	500	500	2,100	2,600	NC								4.7 J
delta-BHC	22,000	24,000	420,000	490,000	NC				0.47 J		0.31 J		
Dieldrin	70	60	300	300	NC	11 J		5.3 J			2.7 J		0.37 J
Endosulfan I	390,000	45,000	5,900,000	7,600,000	NC					1.1 J	1.5 J		4.7 J
Endosulfan Sulfate	390,000	450,000	5,900,000	7,600,000	NC	2.2 J							0.3 J
Endrin	21,000	25,000	340,000	510,000	NC						1.5 J		
Endrin aldehyde	23,000	NC	480,000	NC	NC		1.6 J				0.4 J		
Endrin ketone	NC	NC	NC	NC	NC	7.4	0.39 J		1.3 J				
gamma-Chlordane	800	2,800	3,000	14,000	NC		5.1	6.8 J	2.4	0.72 J	2.7		2.4 J
Heptachlor	200	200	900	1,000	NC		0.3 J						0.27 J
Heptachlor epoxide	100	100	400	500	NC	0.35 J							0.96 J

Summary of Detections in Surface Soil Analytical Results
TAL Metals and TCL Organics
PSC 9
Naval Air Station Jacksonville
Jacksonville, Florida

Sample ID		Soil Cleanup Target Levels			NAS Jacksonville Background Concentrations	09B00101	09S00101	09S00102	09S00201	09S00301	09S00401	09S00501	09SBK101
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		7-Aug-97	20-Aug-97	30-Mar-99	20-Aug-97	20-Aug-97	20-Aug-97	20-Aug-97	30-Mar-99
Inorganics mg/kg													
Aluminum	75000	80,000	1,000,000	NC	**1,340**	**2480 J**	**4030 J**	NA	**2480 J**	**2140 J**	**1890 J**	**1660 J**	NA
Antimony	26	27	220	370	NC	0.76 J		NA					NA
Arsenic	**0.8**	**2**	3	12	**0.8**	1.2 J		NA	**2.6**				NA
Barium	5200	**120**	84,000	130,000	**11.2**	28.4 J	11.4 J	NA	**124 J**	11.8 J	11.9 J	14.1 J	NA
Beryllium	0.2	120	1	1,400	NC	0.33 J	0.31 J	NA	0.12 J	0.21 J	0.09 J	0.08 J	NA
Cadmium	37	82	600	1,700	NC	7.1	0.21 J	NA	2.9	0.3 J	0.71 J	0.29 J	NA
Calcium	NC	NC	NC	NC	**2,360**	**35500**	**2250 J**	NA	**22000 J**	**19100 J**	**20600 J**	**10300 J**	NA
Chromium	290	210	430	470	**6.6**	**35.3**	**9.9**	NA	**38.8**	**8.8**	**6.8**	5.9	NA
Cobalt	4700	1,700	110,000	42,000	NC	2.4 J	1.3 J	NA	1.1 J	0.73 J	0.65 J	0.46 J	NA
Copper	NC	150	NC	89,000	5.8	42.4	3.4 J	NA	24.8	3.3 J	5.2 J	6 J	NA
Iron	NC	53,000	NC	NC	**852**	**3830 J**	**6080 J**	NA	**12900 J**	**3610 J**	**1580 J**	**1860 J**	NA
Lead	500	400	1,000	1,400	**14.4**	**182**	7.1	NA	181	14.9	33.1	88.4	NA
Magnesium	NC	NC	NC	NC	**99.8**	**1350**	**1230**	NA	**582 J**	**597 J**	**763 J**	**281 J**	NA
Manganese	370	3,500	5,500	43,000	**18**	**73.9**	**34.7**	NA	**51.3**	**34.2**	**29.7**	**50**	NA
Mercury	3000	3,000	26,000	17,000	NC	1.3	0.54	NA	1.6 J	0.17	0.19	0.07 J	NA
Nickel	1500	340	26,000	35,000	NC	45.8	2.8 J	NA	6.6 J	2 J	3.4 J	2 J	NA
Potassium	NC	NC	NC	NC	NC	215 J	547 J	NA	192 J	299 J	123 J	102 J	NA
Selenium	390	440	9,900	11,000	NC			NA	1.2				NA
Silver	390	410	9,000	8,200	NC	1.3 J		NA	6.9	0.68 J	2 J		NA
Sodium	NC	NC	NC	NC	**288**	**194 J**		NA					NA
Vanadium	490	67	4,800	10,000	**3.8**	**6.4 J**	**10.5**	NA	**14.6**	**6.2 J**	**4.7 J**	**3.9 J**	NA
Zinc	23000	26,000	560,000	630,000	**15.2**	**151**	14.3 J	NA	**83.8 J**	14.9 J	**17.8 J**	**24.1 J**	NA
Radiological pCi/g													
Gross Alpha						2.5	-0.57	NA	7.44	-0.48	4.06	2.58	NA
Gross Beta						11.0	6.07	NA	12.86	10.11	12.87	10.51	NA

Notes:
Sample ID = Sample identifier
Sample 09SBK101 is a background surface soil sample taken upgradient of PSC 9.
TAL = Target Analyte List
TCL = Target Compound List
SCG = Soil CleanupTarget Levels (SCTLs) for Florida Chapter 62-777, F.A.C.(Florida Department of Environmental Protection memorandum, February 2005).
PCB = Polychlorinated biphenyls
Chromium values are for chromium (hexavalent). Arsenic values are from carcinogenic pathway
Aroclor-1254 value is from polychlorinated biphenyls.
NA = not analyzed
NC = no criteria
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
pCi/g - picocuries per gram
J = Reported concentration is an estimated quantity
All inorganics results expressed in milligrams per kilogram (mg/kg) soil dry weight;
organics in micrograms per kilogram (µg/kg) soil dry weight.
Bold/shaded values indicate exceedance of FDEP industrial soil cleanup goal

Bold/shaded values indicate exceedance of both Residential SCTL and Background Concentration
Bolded value exceeds NAS Jacksonville Background Concentration
Bolded/gray shaded value indicate exceedance of Residential SCTL
Bolded/green shaded value indicate exceedance of Residential and Industrial SCTL

- 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 February 2005 'Final Technical Report: Develop

Blank space indicates analyte/compound was not detected in the reporting limit

Summary of Detections in Surface Soil Analytical Results
TAL Metals and TCL Organics
PSC 9
Naval Air Station Jacksonville
Jacksonville, Florida

Contaminant	Concentration (mg/kg)	Toxic Equivalency Factor	Benzo (a) pyrene Equivalents
Benzo(a)anthracene	1.4	0.1	0.1400
Benzo(a)pyrene	1.4	1.0	1.4000
Benzo(b)fluoranthene	2.3	0.1	0.2300
Benzo(k)fluoranthene	1.1	0.01	0.0110
Chrysene	1.6	0.001	0.0016
Dibenz(a,h)anthracene	0.120	1.0	0.1200
Indeno(1,2,3-cd)pyrene	0.94	0.1	0.0940

Direct Exposure Industrial SCTL = 0.7 mg/kg; Total Benzo(a)pyrene Equivalents = 1.997

Direct Exposure Residential SCTL = 0.1 mg/kg; Total Benzo(a)pyrene Equivalents = 1.9966

The concentration shown EXCEEDS THE Direct Exposure Commercial/Industrial SCTL!
The concentration shown EXCEEDS THE Direct Exposure Residential SCTL!

Summary of Detections in Subsurface Soil Analytical Results
TAL Metals and TCL Organics
PSC 9
NAS Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	09B00102	09B00201	09B00202
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		7-Aug-97	7-Aug-97	7-Aug-97
Volatile Organics µg/kg								
Acetone	260,000	11,000,000	1,800,000	68,000,000	NC			15 J
Semivolatile Organics µg/kg								
Benzo(a)anthracene	1,400	NC	4,900	NC	NC		77 J	
Benzo(a)pyrene	100	100	500	700	NC		140 J	
Benzo(b)fluoranthene	1,400	NC	5,000	NC	NC		150 J	
Benzo(k)fluoranthene	14,000	NC	48,000	NC	NC		59 J	
Chrysene	140,000	NC	500,000	NC	NC		99 J	
Pesticides/PCBs µg/kg								
4,4'-DDD	4,500	4,200	17,000	22,000	NC		0.71 J	
4,4'-DDT	3,100	2,900	12,000	15,000	NC			0.58 J
Aldrin	60	60	200	300	NC			0.26 J
Aroclor-1254	900		3,500		NC	11 J	36 J	
Dieldrin	70	60	300	300	NC			0.94 J
Endosulfan Sulfate	390,000	450,000	5,900,000	7,600,000	NC		1.5 J	
Endrin	21,000	25,000	340,000	510,000	NC			0.67 J
gamma-BHC (Lindane)					NC			0.19 J
Heptachlor	200	200	900	1,000	NC		0.45 J	0.3 J
Inorganics mg/kg								
Aluminum	75,000	80,000	1,000,000	NC	6,823	4110 J	1810 J	1120 J
Antimony	26	27	220	370	NC		1.2 J	
Arsenic	**0.8**	**2**	**3**	12	**1.48**	**3.2**	1.7 J	1.5 J
Barium	5,200	120	84,000	130,000	20.8	21.9 J	16.1 J	6.5 J
Beryllium	**0.2**	120	1	1,400	**0.49**	**0.7 J**		
Cadmium	37	82	600	1,700	NC		0.56 J	
Calcium	NC	NC	NC	NC	**668.3**	**5,570**	**58,000**	**1,840**
Chromium	**290**	**210**	430	470	**14.1**	9.9	**366**	5.3
Cobalt	4,700	1,700	110,000	42,000	NC	2.36 J	1 J	0.41 J
Copper	NC	150	NC	89,000	5.8	3.5 J	9.4	1.5 J
Iron	NC	53,000	NC	NC	**5,818.2**	**7620 J**	**12800 J**	2420 J
Lead	500	400	1,000	1,400	6.46	11.6	18.3	3.4
Magnesium	NC	NC	NC	NC	**500.25**	**1400**	**878 J**	326 J
Manganese	370	3,500	5,500	43,000	6.90	75.7	107	20.4
Nickel	1,500	340	26,000	35,000	NC	4.5 J	15.5	17.2
Potassium	NC	NC	NC	NC	**450.67**	**814 J**	163 J	132 J
Sodium	NC	NC	NC	NC	**343.10**	**593 J**	165 J	185 J
Vanadium	490	67	4,800	10,000	NC	9.7 J	30.5	3.3 J
Zinc	23,000	26,000	560,000	630,000	14.49	19	14.9	8.8
Radiological pCi/g								
Gross Alpha						18.79	2.45	-2.94
Gross Beta						15.31	5.76	5.04

Notes:
Sample ID = Sample identifier
PCB = Polychlorinated biphenyls
NC = no criteria
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
pCi/g - picocuries per gram
J = Reported concentration is an estimated quantity
All inorganics results expressed in milligrams per kilogram (mg/kg) soil dry weight;
organics in micrograms per kilogram (µg/kg) soil dry weight.
Blank space indicates analyte/compound was not detected in the reporting limit

Bold/shaded values indicate exceedance of both Residential SCTL and Background Concentration
Bolded value exceeds NAS Jacksonville Background Concentration
Bolded/gray shaded value indicate exceedance of Residential SCTL
Bolded/green shaded value indicate exceedance of Residential and Industrial SCTL
Bold/orange shaded value indicate exceedance of Residential, Industrial SCTLs and Background Concentrations.

- 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 February 2005 'Final Technical Report: Develop

Summary of Detections in Subsurface Soil Analytical Results
TAL Metals and TCL Organics
PSC 9
NAS Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	09B00102	09B00201	09B00202
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		7-Aug-97	7-Aug-97	7-Aug-97
Contaminant	Concentration (mg/kg)	Toxic Equivalency Factor	Benzo (a) pyrene Equivalents					
Benzo(a)anthracene	0.077	0.1	0.0077					
Benzo(a)pyrene	0.14	1.0	0.1400					
Benzo(b)fluoranthene	0.15	0.1	0.0150					
Benzo(k)fluoranthene	0.059	0.01	0.0006					
Chrysene	0.099	0.001	0.0001					
Dibenz(a,h)anthracene	0.195	1.0	0.1950	yellow was non-detect - 1/2 of laboratory MDL				
Indeno(1,2,3-cd)pyrene	0.195	0.1	0.0195					

Direct Exposure Industrial SCTL = 0.7 mg/kg; Total Benzo(a)pyrene Equivalents = 0.378

Direct Exposure Residential SCTL = 0.1 mg/kg; Total Benzo(a)pyrene Equivalents = 0.3779

The concentration shown does not exceed the Direct Exposure for Commercial/Industrial SCTL.
The concentration shown EXCEEDS THE Direct Exposure Residential SCTL!

Summary of Detections in Groundwater Analytical Results
TAL Metals and TCL Organics
PSC 9
NAS Jacksonville
Jacksonville, Florida

Sample ID / Sampling Date	1997 FDEP GGC	FDEP GCTLs	1997 FED MCL	EPA MCLs	NAS Jacksonville Background Concentrations	09G00101 10-Jul-97	09G00201 10-Jul-97	09G00301 10-Jul-97
Volatile Organics µg/L								
Methylene Chloride	5	5	5	NC	NC			**21**
Pesticides µg/L								
Dieldrin		0.002		NC	NC	0.09 J	0.005 J	
Inorganics µg/L								
Aluminum	**200**	**200**	**200**	**200**	147,318	80.1 J	**448**	152 J
Antimony		6		6	43	8.2 J		**49.7 J**
Arsenic	50	10	50	10	13.2	7.3 J	5.2 J	6.2 J
Barium	2000	2,000	2,000	2,000	616	49.3 J	82.9 J	57.8 J
Cadmium		5		5	NC	0.4 J		2.1 J
Calcium		NC	NC	NC	**59,066**	**118000**	**194000**	**146000**
Chromium	100	100	100	100	208	1.5 J	4.2 J	23.1
Cobalt	NC	140	NC	NC	23	1.3 J		
Copper	1,000	1,000	1,000	1,300	40.4	11.2 J	7 J	49.4
Iron	**300**	**300**	**300**	**300**	68,292	247	**12400**	132
Lead	15	15	NC	15	45.8	1.7 J	1.8 J	22.8
Magnesium	NC	NC	NC	NC	19,316	7140	13800	9270
Manganese	**50**	**50**	**50**	**50**	**204**	92.2	**229**	6.5 J
Nickel	100	100	100	100	74.8	**5.1 J**	3.7 J	32 J
Potassium	NC	NC	NC	NC	**9,038**	**12500 J**	4890 J	6510 J
Sodium	160,000	160,000	NC	NC	24,626	10700	12200	20000
Vanadium	49	49	NC	NC	294	4.8 J	2.4 J	8.4 J
Zinc	5,000	5,000	5,000	5,000	**173.2**	29.7 J	49.5 J	**220 J**
Radiological pCi/L								
Gross Alpha						7.41	2.79	3.39
Gross Beta						19.53	8.79	10.04

Notes:
J = Reported concentration is an estimated quantity
NC = no criteria available
µg/L = micrograms per liter
pCi/L = picocuries per liter
Blank space indicates analyte/compound was not detected at the reporting limit.
Bolded value exceeds NAS Jacksonville Background Concentration
Bold/orange shaded value indicate exceedance of all listed FDEP and EPA Criteria.
Bold/blue shaded value indicate exceedance of all listed FDEP and EPA Criteria and Background Concentrations.
GCTL = Florida Department of Environmental Protection Groundwater Cleanup Target Level (Feb. 2005)
MCL = US Environmental Protection Agency Maximum Contaminant Level. Primary Drinking Water Regulations.

Summary of Detections in Surface Water Analytical Results
TAL Metals and TCL Organics
PSC 9
NAS Jacksonville
Jacksonville, Florida

Sample ID / Sampling Date	1997 FDEP GGC	FDEP GCTLs	FDEP SWCTLs	1997 FED MCL	EPA MCLs	REGION 9 PRGs	NAS Jacksonville Background Concentrations	09W00101 12-Aug-97	09W00301 29-Mar-99
Semivolatile Organics µg/L									
Di-n-buytlphthalate		700				3,600	NC	2 J	NA
Pesticides µg/L									
Aldrin	0.005	0.002	0.00014		NC	0.004	NC	0.01 J	
Aroclor-1254		0.5	0.000045		NC		NC	1.6	
alpha-BHC		0.006	0.005	NC	NC	0.011	NC		0.0022 J
delta-BHC	50	0.02	NC	NC	NC	0.011	NC		0.0061 J
Heptachlor	0.4	0.4	0.00021		0.4		NC		0.0019 J
Inorganics µg/L									
Aluminum	**200**	**200**	**13**	**200**	**200**		147,318	**2820**	NA
Barium	2000	2,000	NC	2,000	2,000		83	19 J	NA
Calcium	NC	NC	NC	NC	NC		39,110	31700	NA
Chromium	100	100	11	100	100		NC	9.6 J	NA
Cobalt		140	NC		NC		23	1.1 J	NA
Iron	**300**	**300**	**1,000**	**300**	**300**		**2,436**	**2610**	NA
Magnesium	NC	NC	NC	NC	NC		**6,126**	**14500**	NA
Manganese	**50**	**50**	NC	**50**	**50**		**39.6**	**54.1**	NA
Nickel	100	100	NC	100	100		NC	2.8 J	NA
Potassium	NC	NC	NC	NC	NC		**1,792**	**4590 J**	NA
Sodium		160,000	NC	NC	NC		20,870	85,400	NA
Vanadium	49	49	NC	NC	NC		5.6	7.9 J	NA
Zinc	5,000	5,000	NC	5,000	5,000		46.4	20 J	NA
Radiological pCi/L									
Gross Alpha								201	NA
Gross Beta								5.13	NA

Notes:
Sample ID = Sample identifier
PCB = Polychlorinated biphenyls
J = Reported concentration is an estimated quantity
NA = Not analyzed
NC = no criteria available
µg/L = micrograms per liter
pCi/L = picocuries per liter
Blank space indicates analyte/compound was not detected at the reporting limit.
Bold/shaded numbers indicate exceedance of groundwater guidance concentration.
Bolded value exceeds NAS Jacksonville Background Concentration
Bold/blue shaded value indicate exceedance of all listed FDEP and EPA Criteria and Background Concentrations.
Bold/orange shaded value indicate exceedance of all listed FDEP and EPA Criteria.
GCTL = Florida Department of Environmental Protection Groundwater Cleanup Target Level (Feb. 2005)
MCL = US Environmental Protection Agency Maximum Contaminant Level. Primary Drinking Water Regulations.

Summary of Detections in Sediment Analytical Results
TAL Metals and TCL Organics
PSC 9
NAS Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	09D00101
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		21-Aug-97
Pesticides/PCBs µg/kg						
Dieldrin	70	60	300	300	NC	0.83 J
Endrin	21,000	25,000	340,000	510,000	NC	0.66 J
Heptachlor	200	200	900	1,000	NC	0.46 J
Inorganics mg/kg						
Aluminum	75000	80,000	1,000,000	NC	**1,190**	**6810 J**
Barium	5200	120	84,000	130,000	**9.8**	**19.2 J**
Beryllium	0.2	120	1	1,400	**0.48**	**0.54 J**
Cadmium	37	82	600	1,700	0.6	0.35 J
Calcium	NC	NC	NC	NC	6,468	3780 J
Chromium	290	210	430	470	**3.8**	**16.6**
Cobalt	4700	1,700	110,000	42,000	3.8	2.2 J
Copper	NC	150	NC	89,000	7	5.5 J
Iron	NC	53,000	NC	NC	**2,300**	**10300 J**
Lead	500	400	1,000	1,400	14.4	11.9
Magnesium	NC	NC	NC	NC	**131**	**2090**
Manganese	370	3,500	5,500	43,000	**6.8**	**58.6**
Nickel	1500	340	26,000	35,000	6.2	4.6 J
Potassium	NC	NC	NC	NC	**218**	**923 J**
Vanadium	490	67	4,800	10,000	**5.2**	**17.8**
Zinc	23000	26,000	560,000	630,000	**18.4**	**23 J**
Radiological pCi/L						
Gross Alpha						14.26
Gross Beta						11.04

Notes:
TAL = Target Analyte List
TCL = Target Compound List
SCG = Soil CleanupTarget Levels (SCTLs) for Florida Chapter 62-777, F.A.C.(Florida Department of Environmental Protection memorandum, February 2005).
Chromium values are for chromium (hexavalent). Arsenic values are from carcinogenic pathway
Aroclor-1254 value is from polychlorinated biphenyls.
NC = no criteria
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
pCi/g - picocuries per gram
J = Reported concentration is an estimated quantity
All inorganics results expressed in milligrams per kilogram (mg/kg) soil dry weight;
organics in micrograms per kilogram (µg/kg) soil dry weight.
Bolded value exceeds NAS Jacksonville Background Concentration
Blank space indicates analyte/compound was not detected in the reporting limit

Summary of Detections in Sediment Analytical Results
TAL Metals and TCL Organics
PSC 9
NAS Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	09D00101
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		21-Aug-97

PSC 9 Sediment

Contaminant	Concentration (mg/kg)	Toxic Equivalency Factor	Benzo (a) pyrene Equivalents
Benzo(a)anthracene	0.295	0.1	0.0295
Benzo(a)pyrene	0.295	1.0	0.2950
Benzo(b)fluoranthene	0.295	0.1	0.0295
Benzo(k)fluoranthene	0.295	0.01	0.0030
Chrysene	0.295	0.001	0.0003
Dibenz(a,h)anthracene	0.295	1.0	0.2950
Indeno(1,2,3-cd)pyrene	0.295	0.1	0.0295

yellow was non-detect - 1/2 of laboratory MDL

Direct Exposure Industrial SCTL = 0.7 mg/kg; Total Benzo(a)pyrene Equivalents = 0.682

Direct Exposure Residential SCTL = 0.1 mg/kg; Total Benzo(a)pyrene Equivalents = 0.6817

The concentration shown does not exceed the Direct Exposure for Commercial/Industrial SCTL.
The concentration shown EXCEEDS THE Direct Exposure Residential SCTL!

Summary of Detections in Soil Analytical Results
TAL Metals and TCL Organics
PSC 29
NAS Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	29S01001	29S01101	29S01101D
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		20-Oct-97	20-Oct-97	20-Oct-97
Semivolatile Organics µg/kg								
Benzo(a)anthracene	1,400	NC	4,900	NC	NC	160 J	78 J	51 J
Benzo(a)pyrene	**100**	**100**	500	700	NC	**170 J**	67 J	54 J
Benzo(b)fluoranthene	1,400	NC	5,000	NC	NC	360 J	160 J	130 J
Benzo(g,h,i)perylene	14,000	2,500,000	50,000	52,000,000	NC	39 J		
Benzo(k)fluoranthene	14,000	NC	48,000	NC	NC	340 J	150 J	120 J
bis(2-Ethylhexyl)phthalate		72,000		390,000	NC	150 J	180 J	
Chrysene	140,000	NC	500,000	NC	NC	190 J	77 J	55 J
Fluoranthene	2,900,000	3,200,000	48,000,000	59,000,000	NC	340 J	97 J	
Indeno(1,2,3-cd)pyrene	1,400	NC	5,000	NC	NC	73 J		
Phenanthrene	1,700,000	2,200,000	21,000,000	36,000,000	NC	160 J		
Pyrene	2,200,000	2,400,000	41,000,000	4,500,000	NC	280 J	110 J	62 J

Notes:
NC = no criteria
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
J = Reported concentration is an estimated quantity
All inorganics results expressed in milligrams per kilogram (mg/kg) soil dry weight;
organics in micrograms per kilogram (µg/kg) soil dry weight.
Blank space indicates analyte/compound was not detected in the reporting limit
Bolded/gray shaded value indicate exceedance of Residential SCTL

PSC 29 Surface Soil

Contaminant	Concentration (mg/kg)	Toxic Equivalency Factor	Benzo (a) pyrene Equivalents
Benzo(a)anthracene	0.16	0.1	0.0160
Benzo(a)pyrene	0.17	1.0	0.1700
Benzo(b)fluoranthene	0.36	0.1	0.0360
Benzo(k)fluoranthene	0.34	0.01	0.0034
Chrysene	0.19	0.001	0.0002
Dibenz(a,h)anthracene	0.190	1.0	0.1900
Indeno(1,2,3-cd)pyrene	0.073	0.1	0.0073

yellow was non-detect - 1/2 of laboratory MDL

Direct Exposure Industrial SCTL = 0.7 mg/kg; Total Benzo(a)pyrene Equivalents = 0.423

Direct Exposure Residential SCTL = 0.1 mg/kg; Total Benzo(a)pyrene Equivalents = 0.4229

The concentration shown does not exceed the Direct Exposure for Commercial/Industrial SCTL.
The concentration shown EXCEEDS THE Direct Exposure Residential SCTL!

Summary of Detections in Surface Soil Analytical Results
TAL Metals and TCL Organics
PSC 29
Naval Air Station Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	29S00101	29S00101D	29S00201	29S00302	29S00401	29S00501	29S00602	29S00602D	29S00702	29S00802	29S00901
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		2-Jun-97	2-Jun-97	2-Jun-97	2-Jun-97	1-Jul-97	1-Jul-97	1-Jul-97	1-Jul-97	1-Jul-97	1-Jul-97	20-Oct-97
Semivolatile Organics µg/kg																
Acenaphthene		2,400,000		20,000,000	NC						120 J					
Anthracene		21,000,000		300,000,000	NC						230 J					
Benzo(a)anthracene	1,400	NC	4,900	NC	NC				170 J	260 J	1200	89 J	69 J	100 J		
Benzo(a)pyrene	**100**	**100**	**500**	**700**	NC				**350 J**	**250 J**	**1300**		71 J	**110 J**		
Benzo(b)fluoranthene	**1,400**	NC	5,000	NC	NC		54 J		370 J	560 J	**2700 J**	220 J	150 J	180 J		
Benzo(g,h,i)perylene	14,000	2,500,000	50,000	52,000,000	NC				250 J		690		65 J	65 J		
Benzo(k)fluoranthene	14,000	NC	48,000	NC	NC		45 J		430 J	540 J	2700 J	220 J	170 J	200 J		
bis(2-Ethylhexyl)phthalate		72,000		390,000	NC				200 J	270 J	150 J	77 J	74 J	78 J		
Butylbenzylphthalate		17,000,000		380,000,000												230 J
Carbazole	42,000	49,000	120,000	240,000	NC					65 J	380 J					
Chrysene	140,000	NC	500,000	NC	NC				210 J	290 J	1400	110 J	100 J	120 J		
Di-n-butylphthalate		8,200,000		170,000,000	NC						52 J		76 J		69 J	
Dibenz(a,h)anthracene		#		#	NC						210 J					
Dimethylphthalate		690,000,000		*								230 J	3200			
Fluoranthene	2,900,000	3,200,000	48,000,000	59,000,000	NC	50 J	64 J		260 J	600	3200	170 J	130 J	170 J		
Fluorene		2,600,000		33,000,000	NC						87 J					
Indeno(1,2,3-cd)pyrene	1,400	NC	5,000	NC	NC				100 J		690		54 J	60 J		
Phenanthrene	1,700,000	2,200,000	21,000,000	36,000,000	NC				110 J	330 J	1900		48 J	86 J		
Pyrene	2,200,000	2,400,000	41,000,000	4,500,000	NC	79 J	42 J		260 J	480 J	2400	150 J	120 J	150 J		
Pesticides/PCBs µg/kg																
4,4'-DDD	4,500	4,200	17,000	22,000	NC	8.2 J	7.9	1.3 J	88 J	9.6 J	2.8 J	5.3 J	5 J	0.92 J	3.8 J	NA
4,4'-DDE	3,000	2,900	11,000	15,000	NC	29	34	1 J		37	2.5 J	20	22	1.9 J	2.3 J	NA
4,4'-DDT	3,100	2,900	12,000	15,000	NC	10	6.5 J	2.4 J	140 J	51 J	5.3 J	8.9 J	11 J		1.6 J	NA
Aldrin		60		300	NC	4.4	3.4				0.46 J					NA
alpha-BHC		100		600	NC		0.12 J									NA
alpha-Chlordane	800	NC	3,000	NC	NC	7.8	7.6		17	110 J	1.4 J	23	29	2.9 J	0.29 J	NA
Aroclor-1260	500	500	2,100	2,600	NC	37 J	39 J							120		NA
beta-BHC	500	500	2,100	2,600	NC	1.4 J	0.85 J							0.28 J		NA
delta-BHC	22,000	24,000	420,000	490,000	NC	1.2 J	0.91 J	0.47 J								NA
Dieldrin	70	60	300	300	NC	5.1	4.3	1.1 J	27		2.6 J	3.1 J	1.1 J	1.9 J		NA
Endosulfan I	390,000	45,000	5,900,000	7,600,000	NC			0.47 J			1.5 J					NA
Endosulfan II	390,000	450,000	5,900,000	7,600,000	NC			0.18 J	2.3 J			0.42 J				NA
Endosulfan Sulfate	390,000	450,000	5,900,000	7,600,000	NC	0.74 J	0.27 J						0.27 J			NA
Endrin	21,000	25,000	340,000	510,000	NC				1.9 J	2.7 J	2.2 J	0.56 J		1.8 J		NA
Endrin aldehyde	23,000	NC	480,000	NC	NC	2.8 J	2.1 J	1.1 J	0.61 J	17 J	3.6 J	13 J	3.3 J			NA
Endrin ketone	NC	NC	NC	NC	NC			1.3 J								NA
gamma-BHC (Lindane)		700		2,500							0.34 J			0.18 J		NA
gamma-Chlordane	800	2,800	3,000	14,000	NC	18 J	16 J	0.45 J	15 J	100 J	3.7 J	19	25		0.14 J	NA
Heptachlor	200	200	900	1,000	NC	12	8.3				3.6 J					NA
Heptachlor epoxide	100	100	400	500	NC	0.5 J	0.75 J		0.86 J	3.4 J	1.7 J	0.88 J	0.93 J	0.37 J		NA
Methoxychlor		420,000		8,800,000	NC				19 J							NA

Summary of Detections in Surface Soil Analytical Results
TAL Metals and TCL Organics
PSC 29
Naval Air Station Jacksonville
Jacksonville, Florida

Sample ID		Soil Cleanup Target Levels			NAS Jacksonville Background Concentrations	29S00101	29S00101D	29S00201	29S00302	29S00401	29S00501	29S00602	29S00602D	29S00702	29S00802	29S00901
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		2-Jun-97	2-Jun-97	2-Jun-97	2-Jun-97	1-Jul-97	1-Jul-97	1-Jul-97	1-Jul-97	1-Jul-97	1-Jul-97	20-Oct-97
Inorganics mg/kg																
Aluminum	75000	80,000	1,000,000	NC	**1,340**	**2470**	**3010**	**2730**	**2070**	**1830 J**	**1470 J**	**1660 J**	**1470 J**	**1700 J**	163 J	NA
Antimony	26	27	220	370	NC					1.5 J	3.2 J	1 J	0.69 J			NA
Arsenic	**0.8**	**2**	**3**	**12**	**0.8**					**19.9**		**1.8 J**	**9.4**	**9.4**		NA
Barium	5200	120	84,000	130,000	**11.2**	8.4 J	8.6 J	**14.6 J**	**19.9 J**	**25.8 J**	**17.4 J**	**21.7 J**	**17 J**	**17.7 J**	2.5 J	NA
Beryllium	0.2	120	1	1,400	NC		0.05 J	0.11 J	0.17 J	0.09 J	0.09 J	0.09 J	0.07 J			NA
Cadmium	37	82	600	1,700	NC	0.23 J	0.35 J	0.25 J	1.3	1.2 J	1.3 J	2.1	1.4	1.2 J		NA
Calcium	NC	NC	NC	NC	**2,360**	**4490 J**	**4950 J**	**51500 J**	**54200 J**	**17900**	**5070**	**12500**	**9180**	**18300**	369 J	NA
Chromium	290	210	430	470	**6.6**	5.4	5.7	**9.1**	**15.1**	**64.8**	6.4	**7.3**	**15.3**	**11.3**	1.1 J	NA
Cobalt	4700	1,700	110,000	42,000	NC		0.25 J	0.56 J	0.45 J	0.36 J	0.27 J	0.43 J	0.41 J	0.33 J		NA
Copper	NC	150	NC	89,000	**5.8**	**12 J**	**7.3 J**	**62.7 J**	**25.7 J**	**59.6**	**10.5**	**38.5**	**51.6**	**14.8**	0.98 J	NA
Iron	NC	53,000	NC	NC	**852**	687 J	813 J	**3320 J**	**1760 J**	**1780**	**1980**	**2270**	**2200**	**1560**	206	NA
Lead	500	400	1,000	1,400	**14.4**	**26 J**	**28.4 J**	**29.7 J**	**102 J**	**77.2**	**60.4**	**95.7**	**76**	**61.3**	2.2	NA
Magnesium	NC	NC	NC	NC	**99.8**	**134 J**	**146 J**	**478 J**	**920 J**	**382 J**	**252 J**	**473 J**	**223 J**	**431 J**	28 J	NA
Manganese	370	3,500	5,500	43,000	**18**	13	14.2	**21.4**	**59.8**	**44.9**	17.1	**36.2**	**35.2**	**37.3**	5.1	NA
Mercury	3000	3,000	26,000	17,000	NC	0.07 J	0.07 J		0.09 J	0.11 J	0.08 J	0.1 J	0.12 J	0.12		NA
Nickel	1500	340	26,000	35,000	NC	2.9 J	1.9 J	3.4 J	4.1 J	4 J	2.1 J	2.9 J	5.1 J	2.2 J	0.33 J	NA
Potassium	NC	NC	NC	NC	NC	63.4 J	66.1 J	176 J	173 J	133 J	60.7 J	102 J	87.2 J	92 J		NA
Selenium	390	440	9,900	11,000	NC							0.71 J				NA
Silver	390	410	9,000	8,200	NC			0.3 J		0.13 J						NA
Vanadium	490	67	4,800	10,000	**3.8**	3.3 J	3.6 J	**8.9 J**	**5.7 J**	**5 J**	**6.4 J**	**6.3 J**	**4.7 J**	**4.7 J**	1.2 J	NA
Zinc	23000	26,000	560,000	630,000	**15.2**	**28.7 J**	**29.1 J**	**27.5 J**	**56.5 J**	**105 J**	**105 J**	**291 J**	**115 J**	**530 J**	1.8 J	NA

Notes:
Sample ID = Sample identifier
Sample 09SBK101 is a background surface soil sample taken upgradient of PSC 9.
TAL = Target Analyte List
TCL = Target Compound List
SCG = Soil CleanupTarget Levels (SCTLs) for Florida Chapter 62-777, F.A.C.(Florida Department of Environmental Protection memorandum, February 2005).
PCB = Polychlorinated biphenyls
Chromium values are for chromium (hexavalent). Arsenic values are from carcinogenic pathway
Aroclor-1254 value is from polychlorinated biphenyls.
NA = not analyzed
NC = no criteria
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
pCi/g - picocuries per gram
J = Reported concentration is an estimated quantity
All inorganics results expressed in milligrams per kilogram (mg/kg) soil dry weight;
organics in micrograms per kilogram (µg/kg) soil dry weight.
Bold/shaded values indicate exceedance of FDEP industrial soil cleanup goal

Bold/shaded values indicate exceedance of both Residential SCTL and Background Concentration
Bolded value exceeds NAS Jacksonville Background Concentration
Bolded/gray shaded value indicate exceedance of Residential SCTL
Bolded/green shaded value indicate exceedance of Residential and Industrial SCTL
Bold/orange shaded value indicate exceedance of Residential, Industrial SCTLs and Background Concentrations.

* Contaminant is not a health concern for this exposure scenario.

- 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 February 2005 'Final Technical Report: Develop

Blank space indicates analyte/compound was not detected in the reporting limit

Summary of Detections in Surface Soil Analytical Results
TAL Metals and TCL Organics
PSC 29
Naval Air Station Jacksonville
Jacksonville, Florida

PSC 29 Surface Soil (1)

Contaminant	Concentration (mg/kg)	Toxic Equivalency Factor	Benzo (a) pyrene Equivalents
Benzo(a)anthracene	1.2	0.1	0.1200
Benzo(a)pyrene	1.3	1.0	1.3000
Benzo(b)fluoranthene	2.7	0.1	0.2700
Benzo(k)fluoranthene	2.7	0.01	0.0270
Chrysene	1.4	0.001	0.0014
Dibenz(a,h)anthracene	0.210	1.0	0.2100
Indeno(1,2,3-cd)pyrene	0.69	0.1	0.0690

Direct Exposure Industrial SCTL = 0.7 mg/kg; Total Benzo(a)pyrene Equivalents = 1.997

Direct Exposure Residential SCTL = 0.1 mg/kg; Total Benzo(a)pyrene Equivalents = 1.9974

The concentration shown EXCEEDS THE Direct Exposure Commercial/Industrial SCTL!
The concentration shown EXCEEDS THE Direct Exposure Residential SCTL!

Summary of Detections in Groundwater Analytical Results
TAL Metals and TCL Organics
PSC 29
NAS Jacksonville
Jacksonville, Florida

Sample ID / Sampling Date	1997 FDEP GGC	FDEP GCTLs	1997 FED MCL	EPA MCLs	NAS Jacksonville Background Concentrations	29G00101 4-Aug-97	29G00201 4-Aug-97	29G00202 20-Oct-97
Volatile Organics µg/L								
Acetone		6,300		NC	NC		8 J	
Semivolatile Organics µg/L								
Acenaphthene		20		NC	NC	1 J		
Naphthalene		14		NC	NC	2 J		
Pesticides µg/L								
4,4'-DDD		0.10		NC	NC		0.0055 J	
Inorganics µg/L								
Aluminum	200	200	200	200	147,318			91.2 J
Arsenic	50	**10**	50	**10**	**13.2**	**14.2**	**13.7**	7 J
Barium	2000	2,000	2,000	2,000	616	187 J	163 J	200 J
Cadmium		5		5	NC		0.92 J	
Calcium		NC	NC	NC	**59,066**	**333000**	**347000**	**336000**
Chromium	100	100	100	100	208	4.2 J	3.7 J	3.3 J
Cobalt	NC	140	NC	NC	23		2.4 J	1.7 J
Copper	1,000	1,000	1,000	1,300	40.4		20.1 J	
Iron	**300**	**300**	**300**	**300**	68,292	**7180**	**11800**	**21000**
Lead	**15**	**15**	NC	**15**	45.8		**31.2**	
Magnesium	NC	NC	NC	NC	**19,316**	**29700**	**38800**	**44400**
Manganese	**50**	**50**	**50**	**50**	**204**	**1520 J**	**1490 J**	**1080**
Nickel	100	100	100	100	74.8		10.6 J	3.8 J
Potassium	NC	NC	NC	NC	**9,038**	**20600 J**	**22300 J**	**33300 J**
Sodium	160,000	160,000	NC	NC	**24,626**	7960	21000	**27400**
Vanadium	49	49	NC	NC	294		1.6 J	4.5 J
Zinc	5,000	5,000	5,000	5,000	**173.2**		**233**	1.5 J

Notes:
Sample ID = Sample Identifier
J = Reported concentration is an estimated quantity
NC = no criteria available
µg/L = micrograms per liter
Blank space indicates analyte/compound was not detected at the reporting limit.
Bolded value exceeds NAS Jacksonville Background Concentration
Bold/orange shaded value indicate exceedance of all listed FDEP and EPA Criteria.
Bold/blue shaded value indicate exceedance of all listed FDEP and EPA Criteria and Background Concentrations.
GCTL = Florida Department of Environmental Protection Groundwater Cleanup Target Level (Feb. 2005)
MCL = US Environmental Protection Agency Maximum Contaminant Level. Primary Drinking Water Regulations.

Summary of Detections in Soil Analytical Results
TAL Metals and TCL Organics
PSC 31
NAS Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	31S00101	31S00201	31S00301	31S00401	31S00501
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		9-May-97	13-May-97	13-May-97	13-May-97	13-May-97
Semivolatile Organics µg/kg										
Benzo(a)anthracene	1,400	NC	4,900	NC	NC	80 J				
Benzo(a)pyrene	**100**	**100**	500	700	NC	**130 J**				
Benzo(b)fluoranthene	1,400	NC	5,000	NC	NC	250 J		42 J	61 J	
Benzo(k)fluoranthene	14,000	NC	48,000	NC	NC	270 J		40 J	58 J	
Butylbenzylphthalate	15,000,000	17,000,000	310,000,000	380,000,000	NC			58 J		
Chrysene	140,000	NC	500,000	NC	NC	120 J			38 J	
Fluoranthene	2,900,000	3,200,000	48,000,000	59,000,000	NC	93 J				
Indeno(1,2,3-cd)pyrene	1,400	NC	5,000	NC	NC	43 J				
Pyrene	2,200,000	2,400,000	41,000,000	4,500,000	NC	150 J				
Pesticides/PCBs µg/kg										
4,4'-DDD	4,500	4,200	17,000	22,000	NC	6.1 J	15 J			
4,4'-DDE	3,000	2,900	11,000	15,000	NC	4.1 J	39	70	0.21 J	1.2 J
4,4'-DDT	3,100	2,900	12,000	15,000	NC		22 J	45 J		12 J
Aldrin	60	60	200	300	NC		34 J	2.6 J	0.2 J	0.18 J
alpha-Chlordane	800	NC	3,000	NC	NC	0.66 J	0.73 J	2.3 J	0.28 J	0.56 J
Aroclor-1260	500	**500**	2,100	2,600	NC		41 J	**1300 J**	**540**	390
delta-BHC	22,000	24,000	420,000	490,000	NC	0.56 J		0.72 J	0.17 J	0.42 J
Dieldrin	70	**60**	300	300	NC	0.89 J	**80 J**	11 J	0.2 J	0.3 J
Endosulfan II	390,000	45,000	5,900,000	7,600,000	NC	0.96 J				
Endosulfan Sulfate	390,000	450,000	5,900,000	7,600,000	NC			7.3 J		
Endrin aldehyde	23,000	NC	480,000	NC	NC	1 J	1.4 J			
gamma-Chlordane	800	2,800	3,000	14,000	NC	0.88 J	1.2 J	8.7 J	0.73 J	0.53 J
Heptachlor epoxide	100	100	400	500	NC	0.35 J				
Inorganics mg/kg										
Aluminum	75,000	80,000	1,000,000	NC	**1,340**	**2710 J**	1020 J	**1470 J**	**1790 J**	**2810**
Antimony	26	27	220	370	NC			0.57 J		
Barium	5,200	120	84,000	130,000	**11.2**	**34.4 J**	**11.6 J**	**36.7 J**	**26.2 J**	**39.9 J**
Beryllium	0.2	120	1	1,400	NC	0.48 J				0.49 J
Cadmium	37	82	600	1,700	NC	0.24 J	0.13 J	0.89 J	0.49 J	0.44 J
Calcium	NC	NC	NC	NC	**2,360**	**105,000**	**203,000**	**76,000**	**66,400**	**67,300**
Chromium	290	210	430	470	**6.6**	5.3	6.6	**24.6**	5.4	4.7
Cobalt	4,700	1,700	110,000	42,000	NC					0.24 J
Copper	NC	150	NC	89,000	**5.8**	4 J	2.6 J	**13.6**	4 J	3.1 J
Iron	NC	53,000	NC	NC	**852**	**1380**	769	**2580**	**1160**	**1190 J**
Lead	500	400	1,000	1,400	**14.4**	**22.4**	14	**102**	**17.2**	9.9
Magnesium	NC	NC	NC	NC	**99.8**	**1990**	**1640**	**1230**	**1640**	**2930**
Manganese	370	3,500	5,500	43,000	**18**	**85.8**	**42.6**	**60.9**	**108**	**131 J**

Summary of Detections in Soil Analytical Results
TAL Metals and TCL Organics
PSC 31
NAS Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	31S00101	31S00201	31S00301	31S00401	31S00501
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		9-May-97	13-May-97	13-May-97	13-May-97	13-May-97
Mercury	3000	3,000	26,000	17,000	NC		0.06 J	0.1 J		
Nickel	1,500	340	26,000	35,000	11	1.1 J	1.2 J	4.6 J	1.4 J	2 J
Potassium	NC	NC	NC	NC	NC	478 J	106 J	140 J	297 J	441 J
Selenium	390	440	9,900	11,000	NC					1 J
Silver	390	410	9,000	8,200	NC			0.26 J		
Vanadium	490	67	4,800	10,000	**3.8**	**5.4 J**	**5.3 J**	**6 J**	**4 J**	**4.9 J**
Zinc	23,000	26,000	560,000	630,000	**15.2**	13.1 J	**15.4 J**	**54.1 J**	**16 J**	8.9 J

Notes:
NC = no criteria
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
J = Reported concentration is an estimated quantity
All inorganics results expressed in milligrams per kilogram (mg/kg) soil dry weight;
organics in micrograms per kilogram (µg/kg) soil dry weight.
Blank space indicates analyte/compound was not detected in the reporting limit
Bolded value exceeds NAS Jacksonville Background Concentration
Bolded/gray shaded value indicate exceedance of Residential SCTL

PSC 31 Surface Soil

Contaminant	Concentration (mg/kg)	Toxic Equivalency Factor	Benzo (a) pyrene Equivalents
Benzo(a)anthracene	0.08	0.1	0.0080
Benzo(a)pyrene	0.13	1.0	0.1300
Benzo(b)fluoranthene	0.25	0.1	0.0250
Benzo(k)fluoranthene	0.27	0.01	0.0027
Chrysene	0.12	0.001	0.0001
Dibenz(a,h)anthracene	0.180	1.0	0.1800
Indeno(1,2,3-cd)pyrene	0.043	0.1	0.0043

yellow was non-detect - 1/2 of laboratory MDL

Direct Exposure Industrial SCTL = 0.7 mg/kg; Total Benzo(a)pyrene Equivalents = 0.350

Direct Exposure Residential SCTL = 0.1 mg/kg; Total Benzo(a)pyrene Equivalents = 0.3501

The concentration shown does not exceed the Direct Exposure for Commercial/Industrial SCTL.
The concentration shown EXCEEDS THE Direct Exposure Residential SCTL!

Summary of Detections in Subsurface Soil Analytical Results
TAL Metals and TCL Organics
PSC 31
NAS Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	31S00102	31S00202	31S00302
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		9-May-97	13-May-97	13-May-97
Semivolatile Organics µg/kg								
Benzo(a)anthracene	1,400	NC	4,900	NC	NC	170 J		
Benzo(a)pyrene	100	**100**	500	700	NC	**230 J**		
Benzo(b)fluoranthene	1,400	NC	5,000	NC	NC	510 J		
Benzo(g,h,i)perylene	14,000	2,500,000	50,000	52,000,000	NC	44 J		
Benzo(k)fluoranthene	14,000	NC	48,000	NC	NC	550 J		
bis(2-Ethylhexyl)phthalate		72,000		390,000	NC	60 J		
Butylbenzylphthalate	15,000,000	17,000,000	310,000,000	380,000,000	NC	19 J		
Carbazole	42,000	49,000	120,000	240,000	NC	26 J		
Chrysene	140,000	NC	500,000	NC	NC	280 J		
Di-n-butylphthalate		8,200,000		170,000,000	NC	23 J		
Dibenz(a,h)anthracene		#		#	NC	26 J		
Fluoranthene	2,900,000	3,200,000	48,000,000	59,000,000	NC	390		
Indeno(1,2,3-cd)pyrene	1,400	NC	5,000	NC	NC	90 J		
Phenanthrene	1,700,000	2,200,000	21,000,000	36,000,000	NC	81 J		
Pyrene	2,200,000	2,400,000	41,000,000	4,500,000	NC	320 J		
Pesticides/PCBs µg/kg								
4,4'-DDD	4,500	4,200	17,000	22,000	NC		19	59
4,4'-DDE	3,000	2,900	11,000	15,000	NC		25 J	47
4,4'-DDT	3,100	2,900	12,000	15,000	NC		210	46 J
Aldrin	60	60	200	300	NC		4 J	16 J
alpha-Chlordane	800	NC	3,000	NC	NC		4 J	
Aroclor-1260	500	500	2,100	2,600	NC			220 J
delta-BHC	22,000	24,000	420,000	490,000	NC	0.13 J		
Dieldrin	70	60	300	300	NC		9.2 J	19
Endosulfan I	390,000	45,000	5,900,000	7,600,000	NC			6.9 J
Endosulfan Sulfate	390,000	450,000	5,900,000	7,600,000	NC			2.7 J
Endrin	21,000	25,000	340,000	510,000	NC		6.2 J	8 J
Endrin aldehyde	23,000	NC	480,000	NC	NC	0.66 J	1.5 J	8.5 J
gamma-BHC (Lindane)	700	700	2,200	2,500	NC			0.6 J
gamma-Chlordane	800	2,800	3,000	14,000	NC	0.41 J	2.2 J	7.7 J
Heptachlor epoxide	100	100	400	500	NC			0.75 J
Inorganics mg/kg								
Aluminum	75,000	80,000	1,000,000	NC	6,823	857 J	2190 J	2660 J
Antimony	26	27	220	370	NC			1.9 J
Barium	5,200	**120**	84,000	130,000	**20.8**	10 J	**26.2 J**	**624**
Cadmium	37	82	600	1,700	NC		1.4	6.7
Calcium	NC	NC	NC	NC	**668.3**	**8,860**	**61,000**	**82,600**
Chromium	290	**210**	430	470	**14.1**	1.4 J	**15.3**	**277**
Cobalt	4,700	1,700	110,000	42,000	NC			1.3 J
Copper	NC	150	NC	89,000	**5.8**	1.2 J	**13.2**	**95.7**
Iron	NC	53,000	NC	NC	**5,818.2**	844	1620	**13100**
Lead	500	400	1,000	1,400	**6.46**	5.7	**67.1**	**351**
Magnesium	NC	NC	NC	NC	**500.25**	171 J	**1070 J**	**1360**
Manganese	370	3,500	5,500	43,000	**6.90**	5.8	**44.1**	**137**
Mercury	3000	3,000	26,000	17,000	NC		0.06J	0.17
Nickel	1,500	340	26,000	35,000	NC	1.3 J	3.3 J	36.7

Summary of Detections in Subsurface Soil Analytical Results
TAL Metals and TCL Organics
PSC 31
NAS Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	31S00102	31S00202	31S00302
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		9-May-97	13-May-97	13-May-97
Potassium	NC	NC	NC	NC	450.67		228 J	240 J
Silver	390	410	9,000	8,200	NC		0.18 J	0.76 J
Vanadium	490	67	4,800	10,000	NC	2 J	8.3 J	10.9 J
Zinc	23,000	26,000	560,000	630,000	**14.49**	5.3 J	**40.4 J**	**153 J**

Notes:
NC = no criteria
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
J = Reported concentration is an estimated quantity
All inorganics results expressed in milligrams per kilogram (mg/kg) soil dry weight;
organics in micrograms per kilogram (µg/kg) soil dry weight.
Blank space indicates analyte/compound was not detected in the reporting limit
Bold/shaded values indicate exceedance of both Residential SCTL and Background Concentration
Bolded value exceeds NAS Jacksonville Background Concentration
Bolded/gray shaded value indicate exceedance of Residential SCTL

- 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 February 2005 'Final Technical Report: Development of CTLs for Chapter 62-777, F.A.C.

Summary of Detections in Subsurface Soil Analytical Results
TAL Metals and TCL Organics
PSC 31
NAS Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	31S00102	31S00202	31S00302
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		9-May-97	13-May-97	13-May-97

PSC 31 Subsurface Soil

Contaminant	Concentration (mg/kg)	Toxic Equivalency Factor	Benzo (a) pyrene Equivalents
Benzo(a)anthracene	0.17	0.1	0.0170
Benzo(a)pyrene	0.23	1.0	0.2300
Benzo(b)fluoranthene	0.51	0.1	0.0510
Benzo(k)fluoranthene	0.55	0.01	0.0055
Chrysene	0.28	0.001	0.0003
Dibenz(a,h)anthracene	0.026	1.0	0.0260
Indeno(1,2,3-cd)pyrene	0.09	0.1	0.0090

Direct Exposure Industrial SCTL = 0.7 mg/kg; Total Benzo(a)pyrene Equivalents = 0.339

Direct Exposure Residential SCTL = 0.1 mg/kg; Total Benzo(a)pyrene Equivalents = 0.3388

The concentration shown does not exceed the Direct Exposure for Commercial/Industrial SCTL.
The concentration shown EXCEEDS THE Direct Exposure Residential SCTL!

Summary of Detections in Solid Material Analytical Results
TAL Metals and TCL Organics
PSC 31
NAS Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	31Z00101
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		13-May-97
Semivolatile Organics µg/kg						
4-Chloro-3-methyphenol					NC	46 J
Pyrene	2,200,000	2,400,000	41,000,000	4,500,000	NC	45 J
Pesticides/PCBs µg/kg						
4,4'-DDE	3,000	2,900	11,000	15,000	NC	0.17 J
Endosulfan II	390,000	45,000	5,900,000	7,600,000	NC	0.18 J
Inorganics mg/kg						
Aluminum	75,000	80,000	1,000,000	NC	**1,340**	**1890**
Barium	5,200	120	84,000	130,000	11.2	1.8 J
Calcium	NC	NC	NC	NC	2,360	546 J
Chromium	290	210	430	470	6.6	3.9
Copper	NC	150	NC	89,000	5.8	1.9 J
Iron	NC	53,000	NC	NC	852	163 J
Lead	500	400	1,000	1,400	14.4	1.8
Magnesium	NC	NC	NC	NC	99.8	34.2 J
Mercury	3000	3,000	26,000	17,000	NC	0.18 J
Nickel	1,500	340	26,000	35,000	11	0.77 J
Vanadium	490	67	4,800	10,000	3.8	0.79 J
Zinc	23,000	26,000	560,000	630,000	15.2	2.7 J

Notes:
NC = no criteria
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
J = Reported concentration is an estimated quantity
All inorganics results expressed in milligrams per kilogram (mg/kg) soil dry weight;
organics in micrograms per kilogram (µg/kg) soil dry weight.
Blank space indicates analyte/compound was not detected in the reporting limit

Background concentrations are for surface soil

Summary of Detections in Solid Material Analytical Results
TAL Metals and TCL Organics
PSC 31
NAS Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	31Z00101
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		13-May-97

PSC 31 Solid Material

Contaminant	Concentration (mg/kg)	Toxic Equivalency Factor	Benzo (a) pyrene Equivalents
Benzo(a)anthracene	0.205	0.1	0.0205
Benzo(a)pyrene	0.205	1.0	0.2050
Benzo(b)fluoranthene	0.205	0.1	0.0205
Benzo(k)fluoranthene	0.205	0.01	0.0021
Chrysene	0.205	0.001	0.0002
Dibenz(a,h)anthracene	0.205	1.0	0.2050
Indeno(1,2,3-cd)pyrene	0.205	0.1	0.0205

yellow was non-detect - 1/2 of laboratory MDL

Direct Exposure Industrial SCTL = 0.7 mg/kg; Total Benzo(a)pyrene Equivalents = 0.474

Direct Exposure Residential SCTL = 0.1 mg/kg; Total Benzo(a)pyrene Equivalents = 0.4738

The concentration shown does not exceed the Direct Exposure for Commercial/Industrial SCTL.
The concentration shown EXCEEDS THE Direct Exposure Residential SCTL!

Summary of Detections in Groundwater Analytical Results
TAL Metals and TCL Organics
PSC 32
NAS Jacksonville
Jacksonville, Florida

Sample ID / Sampling Date	1997 FDEP GGC	FDEP GCTLs	1997 FED MCL	EPA MCLs	NAS Jacksonville Background Concentrations	32G00101 30-Jul-97	32G00201 29-Jul-97
Semivolatile Organics µg/L							
Di-n-butylphthalate		NC		NC	NC	2 J	1 J
Pesticides µg/L							
Endrin		2.000		2	NC		0.01 J
Inorganics µg/L							
Arsenic	50	10	50	10	13.2	7.8 J	6.7 J
Barium	2000	2,000	2,000	2,000	616	128 J	228 J
Calcium		NC	NC	NC	**59,066**	**230,000**	**183,000**
Chromium	100	100	100	100	208	1.4 J	2.2 J
Cobalt	NC	140	NC	NC	23		1.9 J
Iron	**300**	**300**	**300**	**300**	68,292	**8,140**	**10,900**
Magnesium	NC	NC	NC	NC	**19,316**	19,000	**26,300**
Manganese	**50**	**50**	**50**	**50**	**204**	**626 J**	**284 J**
Potassium	NC	NC	NC	NC	9,038	6800 J	6190 J
Sodium	160,000	160,000	NC	NC	24,626	7,970	27,400
Vanadium	49	49	NC	NC	294	3.8 J	3.3 J

Notes:
Sample ID = Sample Identifier
J = Reported concentration is an estimated quantity
NC = no criteria available
µg/L = micrograms per liter
Blank space indicates analyte/compound was not detected at the reporting limit.
Bold/shaded numbers indicate exceedance of groundwater guidance concentration.
Bolded value exceeds NAS Jacksonville Background Concentration
Bold/orange shaded value indicate exceedance of all listed FDEP and EPA Criteria.
Bold/blue shaded value indicate exceedance of all listed FDEP and EPA Criteria and Background Concentrations.
GCTL = Florida Department of Environmental Protection Groundwater Cleanup Target Level (Feb. 2005)
MCL = US Environmental Protection Agency Maximum Contaminant Level. Primary Drinking Water Regulations.

Summary of Detections in Surface Soil Analytical Results
TAL Metals and TCL Organics
PSC 32
Naval Air Station Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	32S00101	32S00201	32S00301	32S00401	32S00401D	32S00501	32S00601	32S00701
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		15-May-97	15-May-97	15-May-97	15-May-97	15-May-97	16-May-97	16-May-97	16-May-97
Semivolatile Organics µg/kg													
Benzo(a)anthracene	1,400	NC	4,900	NC	NC			66 J	120 J		51 J	55 J	66 J
Benzo(a)pyrene	**100**	**100**	500	700	NC			**180 J**	**140 J**	74 J	63 J	**110 J**	79 J
Benzo(b)fluoranthene	1,400	NC	5,000	NC	NC			300 J	240 J	120 J	110 J	290 J	150 J
Benzo(g,h,i)perylene	14,000	2,500,000	50,000	52,000,000	NC			140 J	88 J	60 J	38 J	50 J	
Benzo(k)fluoranthene	14,000	NC	48,000	NC	NC			350 J	280 J	140 J	130 J	340 J	180 J
bis(2-Ethylhexyl)phthalate		72,000		390,000	NC			48 J					54 J
Chrysene	140,000	NC	500,000	NC	NC			88 J	110 J	43 J	53 J	93 J	66 J
Fluoranthene	2,900,000	3,200,000	48,000,000	59,000,000	NC			89 J	140 J	36 J	71 J	51 J	100 J
Indeno(1,2,3-cd)pyrene	1,400	NC	5,000	NC	NC			96 J	72 J	44 J		49 J	
Phenanthrene	1,700,000	2,200,000	21,000,000	36,000,000	NC				47 J				40 J
Pyrene	2,200,000	2,400,000	41,000,000	4,500,000	NC			99 J	120 J	44 J	63 J	59 J	79 J
Pesticides/PCBs µg/kg													
4,4'-DDD	4,500	4,200	17,000	22,000	NC						0.9 J		
4,4'-DDE	3,000	2,900	11,000	15,000	NC	0.22 J	0.6 J	2.1 J	6 J	2.9 J	3.4 J	3.6 J	21
4,4'-DDT	3,100	2,900	12,000	15,000	NC	3.5 J		4.8 J	3.5 J		4.3 J		36
Aldrin		60		300				0.12 J		0.37 J	0.21 J	0.5 J	
alpha-Chlordane	800	NC	3,000	NC	NC		0.12 J	17 J	2.6 J	7.5 J	3.4 J	9.7 J	2.5 J
Aroclor-1260	**500**	**500**	2,100	2,600	NC	110 J	7.6 J	**1100**	490 J	220	**3300**	290	62 J
delta-BHC	22,000	24,000	420,000	490,000	NC	0.27 J	0.15 J	0.69 J		0.28 J	0.45 J	0.42 J	0.84 J
Dieldrin	70	60	300	300	NC	0.36 J		4.6	3.3 J		2.6 J		0.97 J
Endosulfan I	390,000	45,000	5,900,000	7,600,000	NC	0.08 J	0.12 J					0.68 J	
Endosulfan Sulfate	390,000	450,000	5,900,000	7,600,000	NC			0.83 J	0.86 J	0.44 J		0.66 J	0.79 J
Endrin	21,000	25,000	340,000	510,000	NC			2.2 J	1.6 J	2.1 J		2.5 J	
Endrin aldehyde	23,000	NC	480,000	NC	NC		0.29 J			0.82 J			2.7 J
Endrin ketone	NC	NC	NC	NC	NC		1.5 J						
gamma-Chlordane	800	2,800	3,000	14,000	NC			19 J	4.2 J	7.7 J	3.5 J	9.6 J	0.76 J
Heptachlor	200	200	900	1,000	NC			0.62 J		2 J		2.5 J	
Heptachlor epoxide	100	100	400	500	NC			0.99 J		0.23 J		0.29 J	
Methoxychlor		420,000		8,800,000	NC						22 J		

Summary of Detections in Surface Soil Analytical Results
TAL Metals and TCL Organics
PSC 32
Naval Air Station Jacksonville
Jacksonville, Florida

Sample ID		Soil Cleanup Target Levels			NAS Jacksonville Background Concentrations	29S00101	29S00101D	29S00201	29S00302	29S00401	29S00501	29S00602	29S00602D
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		2-Jun-97	2-Jun-97	2-Jun-97	2-Jun-97	1-Jul-97	1-Jul-97	1-Jul-97	1-Jul-97
Inorganics mg/kg													
Aluminum	75000	80,000	1,000,000	NC	**1,340**		**1830**	1320	1130	1310	1070	**1460**	**1860**
Antimony	26	27	220	370	NC				0.8 J				
Barium	5200	120	84,000	130,000	**11.2**	**21.7 J**	9.8 J	**13.1 J**	8.9 J	9.5 J	10.6 J	**23.6 J**	**17.2 J**
Cadmium	37	82	600	1,700	NC			0.51 J	1.2	0.74 J	0.36 J	0.23 J	1.2
Calcium	NC	NC	NC	NC	**2,360**	**7880**	703 J	**63400**	**15800**	**14700**	**18800**	**11700**	**31000**
Chromium	290	210	430	470	**6.6**	5.2	2 J	**7.3**	**201**	**41.4**	4.6	3.8	**7.4**
Cobalt	4700	1,700	110,000	42,000	NC	0.41 J		0.28 J					
Copper	NC	150	NC	89,000	**5.8**	1.5 J	1.5 J	5.7	**10**	**6.9**	**6.6**	4.9 J	**17.4**
Iron	NC	53,000	NC	NC	**852**	**3440 J**	730 J	**1130 J**	**912 J**	**991 J**	**1000 J**	**1260 J**	**1580 J**
Lead	500	400	1,000	1,400	**14.4**	7.2	4.1	**55.8**	**32.3**	**30.7**	**35.5**	**54**	**38.2**
Magnesium	NC	NC	NC	NC	**99.8**	**338 J**	59.5 J	**554 J**	**203 J**	**218 J**	**271 J**	**286 J**	**532 J**
Manganese	370	3,500	5,500	43,000	**18**	5.5 J	1.8 J	**24.8 J**	12.8 J	17.4 J	15.4 J	**32.2 J**	**22.4 J**
Mercury	3000	3,000	26,000	17,000	NC			0.13	0.09 J	0.08 J			
Nickel	1500	340	26,000	35,000	NC	2.2 J	2 J	3.3 J	10.4	6 J	1.9 J	2.3 J	2.3 J
Potassium	NC	NC	NC	NC	NC	117 J		124 J	120 J	123 J	109 J	127 J	109 J
Selenium	390	440	9,900	11,000	NC							1.3 J	1.1 J
Silver	390	410	9,000	8,200	NC			0.34 J	2.3	1.4 J			0.23 J
Vanadium	490	67	4,800	10,000	**3.8**	**8.3 J**	2 J	**6 J**	**10.1 J**	**6.3 J**	**6.2 J**	**5.9 J**	**4.8 J**
Zinc	23000	26,000	560,000	630,000	**15.2**	5.3 J	3.7 J	**37.7**	**29.5 J**	**25.3 J**	**28.4 J**	**32.6 J**	**32.2 J**

Notes:
Sample ID = Sample identifier
Sample 09SBK101 is a background surface soil sample taken upgradient of PSC 9.
TAL = Target Analyte List
TCL = Target Compound List

Bolded value exceeds NAS Jacksonville Background Concentration
Bolded/gray shaded value indicate exceedance of Residential SCTL

SCG = Soil CleanupTarget Levels (SCTLs) for Florida Chapter 62-777, F.A.C.(Florida Department of Environmental Protection memorandum, February 2005).
PCB = Polychlorinated biphenyls
Chromium values are for chromium (hexavalent). Arsenic values are from carcinogenic pathway
Aroclor-1254 value is from polychlorinated biphenyls.
NA = not analyzed
NC = no criteria
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
pCi/g - picocuries per gram
J = Reported concentration is an estimated quantity
All inorganics results expressed in milligrams per kilogram (mg/kg) soil dry weight; organics in micrograms per kilogram (µg/kg) soil dry weight.
Bold/shaded values indicate exceedance of FDEP industrial soil cleanup goal

* Contaminant is not a health concern for this exposure scenario.

- 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 February 2005 'Final Technical Report: Develop

Blank space indicates analyte/compound was not detected in the reporting limit

Summary of Detections in Surface Soil Analytical Results
TAL Metals and TCL Organics
PSC 32
Naval Air Station Jacksonville
Jacksonville, Florida

PSC 32 Surface Soil

Contaminant	Concentration (mg/kg)	Toxic Equivalency Factor	Benzo (a) pyrene Equivalents
Benzo(a)anthracene	0.15	0.1	0.0150
Benzo(a)pyrene	0.18	1.0	0.1800
Benzo(b)fluoranthene	0.3	0.1	0.0300
Benzo(k)fluoranthene	0.35	0.01	0.0035
Chrysene	0.093	0.001	0.0001
Dibenz(a,h)anthracene	0.185	1.0	0.1850
Indeno(1,2,3-cd)pyrene	0.096	0.1	0.0096

yellow was non-detect - 1/2 of laboratory MDL

Direct Exposure Industrial SCTL = 0.7 mg/kg; Total Benzo(a)pyrene Equivalents = 0.423

Direct Exposure Residential SCTL = 0.1 mg/kg; Total Benzo(a)pyrene Equivalents = 0.4232

The concentration shown does not exceed the Direct Exposure for Commercial/Industrial SCTL.
The concentration shown EXCEEDS THE Direct Exposure Residential SCTL!

Summary of Detections in Subsurface Soil Analytical Results
TAL Metals and TCL Organics
PSC 32
NAS Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	32S00102	32S00302	32S00402	32S00502	32S00702	32B00101	32B00201
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		15-May-97	15-May-97	15-May-97	16-May-97	16-May-97	25-Aug-97	25-Aug-97
Volatile Organics µg/kg												
2-Butanone		16,000,000		110,000,000	NC					9 J		
Semivolatile Organics µg/kg												
Benzo(a)anthracene	1,400	NC	4,900	NC	NC		86 J	47 J	140 J			
Benzo(a)pyrene	**100**	**100**	500	700	NC		**150 J**	81 J	**170 J**			
Benzo(b)fluoranthene	1,400	NC	5,000	NC	NC		250 J	140 J	330 J			
Benzo(g,h,i)perylene	14,000	2,500,000	50,000	52,000,000	NC		70 J	60 J	83 J			
Benzo(k)fluoranthene	14,000	NC	48,000	NC	NC		290 J	160 J	390 J			
bis(2-Ethylhexyl)phthalate		72,000		390,000	NC		66 J				49 J	150 J
Chrysene	140,000	NC	500,000	NC	NC		100 J	43 J	140 J			
Fluoranthene	2,900,000	3,200,000	48,000,000	59,000,000	NC		80 J	73 J	190 J			
Indeno(1,2,3-cd)pyrene	1,400	NC	5,000	NC	NC		65 J	45 J	79 J			
Phenanthrene	1,700,000	2,200,000	21,000,000	36,000,000	NC				39 J			
Pyrene	2,200,000	2,400,000	41,000,000	4,500,000	NC		75 J	57 J	140 J			
Pesticides/PCBs µg/kg												
4,4'-DDD	4,500	4,200	17,000	22,000	NC				0.95 J	4.5	1.8 J	
4,4'-DDE	3,000	2,900	11,000	15,000	NC	2.6 J	2.3 J	6.9	3.2 J	10	6.9 J	
4,4'-DDT	3,100	2,900	12,000	15,000	NC				7.2 J		3.2 J	
Aldrin	60	60	200	300	NC	0.05 J			0.3 J			
alpha-Chlordane	800	NC	3,000	NC	NC	0.13 J	5.2 J	11 J	14 J	0.37 J		
Aroclor-1254	900		3,500		NC							14 J
Aroclor-1260	**500**	**500**	2,100	2,600	NC	5.2 J	**650 J**	420	**1500**			
delta-BHC	22,000	24,000	420,000	490,000	NC		0.38 J	0.38 J		0.23 J		
Dieldrin	70	60	300	300	NC	0.19 J	5.2 J	2.8 J	4.2	0.26 J		
Endosulfan I	390,000	45,000	5,900,000	7,600,000	NC						1.2 J	
Endosulfan Sulfate	390,000	450,000	5,900,000	7,600,000	NC	0.18 J	4.2 J	0.58 J			0.34 J	
Endrin	21,000	25,000	340,000	510,000	NC			1.4 J		0.2 J		
Endrin aldehyde	23,000	NC	480,000	NC	NC	0.32 J	18 J		24 J	1.1 J		
Endrin ketone	NC	NC	NC	NC	NC	0.58 J						
gamma-Chlordane	800	2,800	3,000	14,000	NC		6.2 J	12	16 J	0.16 J	0.11 J	
Heptachlor	200	200	900	1,000	NC			0.2 J				0.11 J
Heptachlor epoxide	100	100	400	500	NC		0.63 J	0.41 J	0.87 J			
Inorganics mg/kg												
Aluminum	75,000	80,000	1,000,000	NC	6,823	1670	1290	1480	1200	436	2130 J	351 J
Barium	5,200	120	84,000	130,000	**20.8**	11.8 J	**31.8 J**	12.5 J	13 J	10.9 J	**49 J**	2.9 J
Beryllium	**0.2**	120	1	1,400	0.49						0.25 J	
Cadmium	37	82	600	1,700	NC		0.44 J	0.17 J	0.47 J			
Calcium	NC	NC	NC	NC	**668.3**	**2,490**	**73,200**	**31,800**	**36,200**	**1,400**	**9370 J**	**566 J**
Chromium	290	210	430	470	14.1	1.8 J	10.2	5.4	5.5	1.5 J	2.7	1.1 J
Cobalt	4,700	1,700	110,000	42,000	NC		0.21 J	0.23 J				
Copper	NC	150	NC	89,000	**5.8**	1.4 J	**8.8**	3.7 J	**6.7**	3.2 J	1.8 J	
Iron	NC	53,000	NC	NC	5,818.2	982 J	971 J	1400 J	999 J	616 J	411 J	222 J

Summary of Detections in Subsurface Soil Analytical Results
TAL Metals and TCL Organics
PSC 32
NAS Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	32S00102	32S00302	32S00402	32S00502	32S00702	32B00101	32B00201
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		15-May-97	15-May-97	15-May-97	16-May-97	16-May-97	25-Aug-97	25-Aug-97
Lead	500	400	1,000	1,400	**6.46**	4.2	**56.3**	**26.2**	**46.9**	**14.3**	**8.8**	2.7
Magnesium	NC	NC	NC	NC	**500.25**	94.6 J	**814 J**	391 J	444 J	81.6 J	**1050 J**	30.1 J
Manganese	370	3,500	5,500	43,000	**6.90**	1.8 J	**29.8 J**	**20.5 J**	**21.8 J**	5.2 J	**46.8**	
Mercury	3000	3,000	26,000	17,000	NC		0.12	0.06 J				
Nickel	1,500	340	26,000	35,000	NC	2.1 J	6.1 J	1.8 J	1.8 J	2.2 J	0.8 J	
Potassium	NC	NC	NC	NC	450.67		119 J	134 J	93 J		195 J	0.64 J
Selenium	390	440	9,900	11,000	NC			1.2 J				32.6 J
Silver	390	410	9,000	8,200	NC		0.22 J	0.18 J				
Vanadium	490	67	4,800	10,000	NC	2.8 J	5.6 J	8.8 J	16.4 J	2.6 J	2.1 J	1.1 J
Zinc	23,000	26,000	560,000	630,000	**14.49**	4.7 J	**40.9 J**	**26.3 J**	**41.3 J**	8.1 J	8.6 J	3.3 J

Notes:
Sample ID = Sample identifier
PCB = Polychlorinated biphenyls
NC = no criteria
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
pCi/g - picocuries per gram
J = Reported concentration is an estimated quantity
All inorganics results expressed in milligrams per kilogram (mg/kg) soil dry weight;
organics in micrograms per kilogram (µg/kg) soil dry weight.
Blank space indicates analyte/compound was not detected in the reporting limit
- 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 February 2005 'Final Technical Report: Develop

Bolded value exceeds NAS Jacksonville Background Concentration
Bolded/gray shaded value indicate exceedance of Residential SCTL

Summary of Detections in Subsurface Soil Analytical Results
TAL Metals and TCL Organics
PSC 32
NAS Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	32S00102	32S00302	32S00402	32S00502	32S00702	32B00101	32B00201
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		15-May-97	15-May-97	15-May-97	16-May-97	16-May-97	25-Aug-97	25-Aug-97

PSC 32 Subsurface Soil

Contaminant	Concentration (mg/kg)	Toxic Equivalency Factor	Benzo (a) pyrene Equivalents
Benzo(a)anthracene	0.14	0.1	0.0140
Benzo(a)pyrene	0.17	1.0	0.1700
Benzo(b)fluoranthene	0.33	0.1	0.0330
Benzo(k)fluoranthene	0.39	0.01	0.0039
Chrysene	0.14	0.001	0.0001
Dibenz(a,h)anthracene	0.185	1.0	0.1850
Indeno(1,2,3-cd)pyrene	0.079	0.1	0.0079

yellow was non-detect - 1/2 of laboratory MDL

Direct Exposure Industrial SCTL = 0.7 mg/kg; Total Benzo(a)pyrene Equivalents 0.414

Direct Exposure Residential SCTL = 0.1 mg/kg; Total Benzo(a)pyrene Equivalents = 0.4139

The concentration shown does not exceed the Direct Exposure for Commercial/Industrial SCTL.

The concentration shown EXCEEDS THE Direct Exposure Residential SCTL!

Summary of Detections in Subsurface Soil Analytical Results
TAL Metals and TCL Organics
PSC 50
NAS Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	50B00101	50B00102	50B00103	50B00104	50B00105	50B00106	50B00107	50B00108	50B00201	50B00202	50B00306	50B00406
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		15-Apr-97	15-Apr-97	15-Apr-97	15-Apr-97	15-Apr-97	15-Apr-97	15-Apr-97	15-Apr-97	15-Apr-97	15-Apr-97	16-Apr-97	16-Apr-97
Volatile Organics µg/kg																	
2-Butanone		16,000,000		110,000,000	NC					30 J	160 J	250 J				33 J	
Acetone	260,000	11,000,000	1,800,000	68,000,000	NC						280 J	450 J			180 J	110 J	
Benzene		1,200		1,700	NC										2 J		
Carbon disulfide		270,000		1,500,000	NC										3 J		
Chlorobenzene		120,000		650,000	NC					5 J	50	190	2 J		74		
Ethylbenzene		1,500,000		9,200,000	NC						5 J	20 J			6 J		
Methylene chloride		17,000		26,000	NC										2 J		
Tetrachloroethene		8,800		18,000	NC	1 J	2 J								2 J		
Toluene		7,500,000		60,000,000	NC	1 J					3 J	10 J			4 J		
Trichloroethene		6,400		9,300	NC										1 J		
Xylene (total)		130,000		700,000	NC						10 J	65			7 J		
Semivolatile Organics µg/kg																	
1,4-Dichlorobenzene		6,400		9,900	NC					130 J		2500 J			300 J		
2-Methylnaphthalene		210,000		2,100,000	NC			820		790	11000	18000	42 J		2600	880	
4-Chloroaniline					NC		270 J		94 J								
Benzo(b)fluoranthene	1,400	NC	5,000	NC	NC	48 J				68 J					46 J		
Benzo(k)fluoranthene	14,000	NC	48,000	NC	NC	45 J				74 J					50 J		
bis(2-Ethylhexyl)phthalate		72,000		390,000	NC	50 J	110 J	48 J	49 J	610	2600 J	7400	52 J		580	490	
Chrysene	140,000	NC	500,000	NC	NC					48 J							
Dibenzofuran		320,000		6,300,000	NC										190 J		
Fluoranthene	2,900,000	3,200,000	48,000,000	59,000,000	NC		39 J			110 J	610 J	560 J			99 J	65 J	
Naphthalene		55,000		300,000	NC			280 J		270 J	3700 J	6300			810	140 J	
Phenanthrene	1,700,000	2,200,000	21,000,000	36,000,000	NC			55 J		96 J	700 J	840 J			160 J	68 J	
Pyrene	2,200,000	2,400,000	41,000,000	4,500,000	NC		43 J	50 J		87 J	500 J				72 J	49 J	
Pesticides/PCBs µg/kg																	
4,4'-DDD	4,500	4,200	17,000	22,000	NC	44 J	53 J	10 J	8.2 J		56 J	63 J		4 J		3.3 J	100 J
4,4'-DDE	3,000	2,900	11,000	15,000	NC	17 J	48	18 J	14 J	79 J	760	540	1.5 J	2 J	160	22	12 J
4,4'-DDT	3,100	2,900	12,000	15,000	NC	240		13 J	180 J		47 J	45 J	130	7.7 J			1600
Aldrin	60	60	200	300	NC		3.6 J	0.24 J									
alpha-Chlordane	800	NC	3,000	NC	NC	1.3 J					87 J						
Aroclor-1260	**500**	**500**	**2,100**	**2,600**	NC		**1100 J**	450	320	**710 J**	**4900**	**5800**			**1000 J**	150	
delta-BHC	22,000	24,000	420,000	490,000	NC			2.6						0.31 J			
Dieldrin	**70**	**60**	300	300	NC	2.1 J		40 J	6 J		**180 J**			0.74 J			
Endosulfan I	390,000	45,000	5,900,000	7,600,000	NC		2.9 J		0.26 J	2.5 J		42 J			4.2 J	0.54 J	
Endosulfan II	390,000	45,000	5,900,000	7,600,000	NC					32 J					43 J		
Endrin	21,000	25,000	340,000	510,000	NC								0.65 J	2.3 J			
Endrin aldehyde	23,000	NC	480,000	NC	NC	2.8 J			13 J					3 J			
gamma-Chlordane	800	2,800	3,000	14,000	NC	1.9 J	9 J	2.7 J	1.9 J	8 J				1.4 J	17 J	1.8 J	2.7 J
Heptachlor	200	200	900	1,000	NC								0.19 J				
Heptachlor epoxide	100	100	400	500	NC		5.6 J	2.4 J	1.8 J					0.08 J			
Methoxychlor	375,000	420,000	7,500,000	8,800,000	NC	7.8 J	10 J	3.1 J	1.1 J		14 J	13 J			4.2 J	0.58 J	
Inorganics mg/kg																	
Aluminum	75,000	80,000	1,000,000	NC	**6,823**	1040	894	1860	876 J	838 J	3090 J	4860 J	**11400 J**	1020 J	1420 J	1300 J	2950 J
Antimony	26	27	220	370	NC		4.8 J				6.9 J	18.3 J					
Arsenic	0.8	2	3	12	**1.48**				0.85 J		1.1 J	**1.8 J**	**1.9 J**				
Barium	5,200	120	84,000	130,000	**20.8**	9.5 J	**45.6**	19.3 J	15.1 J	16.4 J	**80.3**	**165**	**30.9 J**	8.8 J	**20.5 J**	13.9 J	11.2 J
Beryllium	0.2	120	1	1,400	0.49	0.07 J	0.06 J	0.14 J					0.23 J	0.07 J	0.07 J	0.05 J	
Cadmium	37	82	600	1,700	NC	1.2	15.4	4.2	3.5 J	6.1 J	29.8 J	67.3 J		0.86 J	5.1 J	2.2 J	
Calcium	NC	NC	NC	NC	**668.3**	**88800 J**	**2950 J**	**3820 J**	**2,140**	**2,740**	**5,400**	**10700**	630 J	**148000**	**5710**	**1060 J**	608 J
Chromium	290	**210**	430	470	**14.1**	11.3	**156**	**34.2**	**33.2**	**43.8**	**268**	**535**	**20**	11.6	**44.7**	**20.8**	5.3
Cobalt	4,700	1,700	110,000	42,000	NC	0.29 J	0.5 J	0.61 J	0.41 J	0.4 J	0.85 J	1.8 J	0.49 J	0.34 J	0.33 J		
Copper	NC	150	NC	89,000	**5.8**	**6.8**	**85.4**	**18.5**	**19.7 J**	**22.3 J**	**135 J**	**280 J**	2.3 J	5.1 J	**24.8 J**	**15 J**	2 J

Summary of Detections in Subsurface Soil Analytical Results
TAL Metals and TCL Organics
PSC 50
NAS Jacksonville
Jacksonville, Florida

Sample ID	Soil Cleanup Target Levels				NAS Jacksonville Background Concentrations	50B00101	50B00102	50B00103	50B00104	50B00105	50B00106	50B00107	50B00108	50B00201	50B00202	50B00306	50B00406
Sampling Date	1997 Residential	2005 Residential	1997 Industrial	2005 Industrial		15-Apr-97	15-Apr-97	15-Apr-97	15-Apr-97	15-Apr-97	15-Apr-97	15-Apr-97	15-Apr-97	15-Apr-97	15-Apr-97	16-Apr-97	16-Apr-97
Iron	NC	53,000	NC	NC	**5,818.2**	1100	2310	2020	3200 J	1580 J	5030 J	**10200 J**	**8550 J**	840 J	1770 J	1180 J	2110 J
Lead	500	400	1,000	1,400	**6.46**	**11.2**	**115**	**31.1**	**39 J**	**29.4 J**	**184 J**	**420 J**	**10.2 J**	**7.7 J**	**33.5 J**	**21.9 J**	4.1 J
Magnesium	NC	NC	NC	NC	**500.25**	**698 J**	177 J	461 J	171 J	143 J	488 J	**1010 J**	**662 J**	**1100**	271 J	143 J	188 J
Manganese	370	3,500	5,500	43,000	**6.90**	**17.8**	**15.2**	**42.6**	**22.5 J**	**13.8 J**	**25.5 J**	**67.8 J**	**7.9 J**	**22.6 J**	**14.5 J**	**8.6 J**	3.8 J
Mercury	3000	3,000	26,000	17,000	NC	0.14	1.7	0.39	0.35	1.8	3.7	9.1		0.17	0.19	0.06 J	
Nickel	1,500	340	26,000	35,000	NC		6.4 J		3.2 J	329 J	14.5 J	27.3 J	3.1 J	1.9 J	6.7 J	3.4 J	1.8 J
Potassium	NC	NC	NC	NC	450.67	132 J		144 J	85.4 J		140 J	231 J	388 J	221 J	106 J	76 J	104 J
Selenium	390	440	9,900	11,000	NC						1.5	1.4 J					
Silver	390	**410**	9,000	8,200	NC	10	217	35.4	41.8	47.1	330	**470**					
Vanadium	490	67	4,800	10,000	NC	4.2 J	3.1 J	4.6 J	4.4 J	2.6 J	6.2 J	11.2 J	31.3	4.6 J	4.2 J	2.8 J	4.9 J
Zinc	23,000	26,000	560,000	630,000	**14.49**	**19.6 J**	**173 J**	**61.5 J**	**67.9 J**	**68.2 J**	**453 J**	**940 J**	6 J	**14.8 J**	**75.2 J**	**38.5 J**	7.1 J

Notes:
NC = no criteria
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
J = Reported concentration is an estimated quantity
All inorganics results expressed in milligrams per kilogram (mg/kg) soil dry weight;
organics in micrograms per kilogram (µg/kg) soil dry weight.
Blank space indicates analyte/compound was not detected in the reporting limit

Bolded/green shaded value indicate exceedance of Residential and Industrial SCTL
Bolded/gray shaded value indicate exceedance of Residential SCTL
Bolded value exceeds NAS Jacksonville Background Concentration
Bold/shaded values indicate exceedance of both Residential SCTL and Background Concentration

- 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 February 2005 'Final Technical Report: Develop

PSC 50 Subsurface Soil

Contaminant	Concentration (mg/kg)	Toxic Equivalency Factor	Benzo (a) pyrene Equivalents
Benzo(a)anthracene	0.175	0.1	0.0175
Benzo(a)pyrene	0.175	1.0	0.1750
Benzo(b)fluoranthene	0.068	0.1	0.0068
Benzo(k)fluoranthene	0.074	0.01	0.0007
Chrysene	0.048	0.001	0.0000
Dibenz(a,h)anthracene	0.175	1.0	0.1750
Indeno(1,2,3-cd)pyrene	0.175	0.1	0.0175

yellow was non-detect - 1/2 of laboratory MDL

Direct Exposure Industrial SCTL = 0.7 mg/kg; Total Benzo(a)pyrene Equivale 0.393

Direct Exposure Residential SCTL = 0.1 mg/kg; Total Benzo(a)pyrene Equivalents = 0.3926

The concentration shown does not exceed the Direct Exposure for Commercial/Industrial SCTL.
The concentration shown EXCEEDS THE Direct Exposure Residential SCTL!

Summary of Detections in Groundwater Analytical Results
TAL Metals and TCL Organics
PSC 50
NAS Jacksonville
Jacksonville, Florida

Sample ID / Sampling Date	1997 FDEP GGC	FDEP GCTLs	1997 FED MCL	EPA MCLs	NAS Jacksonville Background Concentrations	50G00101 2-Apr-97	50G00201 2-Apr-97
Volatile Organics µg/L							
Acetone		6,300			NC	19 J	22 J
Chlorobenzene		100			NC		11
Semivolatile Organics µg/L							
1,4-Dichlorobenzene		75.00			NC		4 J
Di-n-butylphthalate		NC			NC		4 J
Diethylphthalate		5,600.00			NC		2 J
Phenol		10.00			NC	5 J	
Pesticides µg/L							
4,4'-DDD		0.10			NC		0.0095 J
4,4'-DDT		0.10			NC		0.004 J
Aldrin		**0.002**			NC		**0.0022 J**
alpha-Chlordane		NC			NC		0.0066 J
beta-BHC		0.02			NC		0.0082 J
Endosulfan I		42			NC		0.0011 J
Endosulfan II		42			NC		0.026 J
Endosulfan sulfate		42			NC		0.0031 J
Endrin aldehyde		NC			NC		0.0064 J
gamma-BHC		0.2			NC		0.0082 J
Inorganics µg/L							
Antimony		6			43		5 J
Arsenic	50	10	50	10	13.2		5.1 J
Barium	2000	2,000	2,000	2,000	616	70.9 J	64.3 J
Calcium		NC	NC	NC	59,066	85700	309000
Chromium	100	100	100	100	208	1.9 J	10.1
Cobalt	NC	140	NC	NC	23	2.5 J	6.6 J
Copper	1,000	1,000	1,000	1,300	40.4	1.7 J	5.7 J
Iron	**300**	**300**	**300**	**300**	68,292	**14900**	**2300**
Magnesium	NC	NC	NC	NC	19,316	14600	41300
Manganese	**50**	**50**	**50**	**50**	**204**	**245**	**210**
Mercury		2			0.98		0.12 J
Nickel	100	100	100	100	74.8	28 J	6.7 J
Potassium	NC	NC	NC	NC	**9,038**	2510 J	**13500**
Sodium	160,000	160,000	NC	NC	**24,626**	21100	**28200**
Vanadium	49	49	NC	NC	294	1.8 J	6 J
Zinc	5,000	5,000	5,000	5,000	173.2	20.9	144

Notes:
J = Reported concentration is an estimated quantity
NC = no criteria available
µg/L = micrograms per liter
pCi/L = picocuries per liter
Blank space indicates analyte/compound was not detected at the reporting limit.
Bold/shaded numbers indicate exceedance of groundwater guidance concentration.
Bold/gray shaded value indicate exceedance of FDEP GCTL.
Bolded value exceeds NAS Jacksonville Background Concentration
Bold/green shaded value indicate exceedance of FDEP GCTL and EPA MCL
Bold/orange shaded value indicate exceedance of all listed FDEP and EPA Criteria and Background Concentration.
GCTL = Florida Department of Environmental Protection Groundwater Cleanup Target Level (Feb. 2005)
MCL = US Environmental Protection Agency Maximum Contaminant Level. Primary Drinking Water Regulations.