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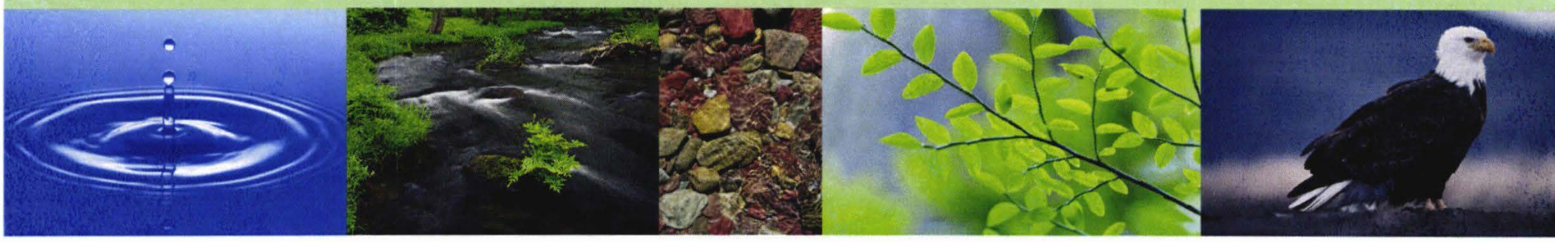
FINAL SAMPLING AND ANALYSIS PLAN FOR PHASE I RCRA FACILITY INVESTIGATION SOLID WASTE MANAGEMENT UNIT 21 (SWMU 21) DRMO STORAGE LOT NSA CRANE IN
8/1/2010
TETRA TECH

261

Comprehensive Long-term Environmental Action Navy

CONTRACT NUMBER N624707-08-D-1001



Rev. 0
08/10

FINAL

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

For

Phase I RCRA Facility Investigation SWMU 21 – DRMO Storage Lot

Naval Support Activity Crane
Crane, Indiana

Contract Task Order F274

August 2010

NAVFAC
Naval Facilities Engineering Command

Naval Facilities Engineering Command
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201 Decatur Avenue
Building 1A, Code EV
Great Lakes, Illinois 60088

TETRA TECH NUS, Inc.

SAP Worksheet No. 1 -- Title and Approval Page

(UFP-QAPP Manual Section 2.1)

FINAL

SAMPLING AND ANALYSIS PLAN
(Field Sampling Plan and Quality Assurance Project Plan)
August 2010

PHASE I RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION

SWMU 21 – DRMO STORAGE LOT
NAVAL SUPPORT ACTIVITY CRANE
CRANE, INDIANA

Prepared for:
Naval Facilities Engineering Command Midwest
201 Decatur Ave., Building 1A
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Prepared under:
Contract No. N62470-08-D-1001
Contract Task Order F274

Review Signatures:

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Tetra Tech NUS, Inc.

Approval Signatures:

Thomas J. Brent/RPM/Date
NSA Crane Environmental Restoration Site Manager

Doug Griffin/RPM/Date
Indiana Department of Environmental Management

Note: The June 2010 Draft-Final, Revision C, SWMU 21 UFP-SAP was approved by the Navy Chemist and the *Title and Approval Page* signed by the Navy Chemist on July 1, 2010. The July 2010 Draft-Final, Revision C, UFP–SAP was approved without comment by the regulatory agency (IDEM) the *Title and Approval Page* signed by a representative of IDEM on August 5, 2010; other approvals and signatures were obtained on that page on August 6 to 9, 2010. Copies of those signed approval pages are presented on the following pages. No technical changes have been made to the SWMU 21 UFP-SAP since approval by the Navy Chemist.

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

DRAFT-FINAL

SAMPLING AND ANALYSIS PLAN
(Field Sampling Plan and Quality Assurance Project Plan)
June 2010

PHASE I RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION

SWMU 21 – DRMO STORAGE LOT
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CRANE, INDIANA

Prepared for:
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201 Decatur Ave., Building 1A
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Indiana Department of Environmental Management

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DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USN, cn=TUCKER.JONATHAN.P.1239524180
Date: 2010.07.01 13:54:39 -04'00'

Government Chemist/Date
NAVFAC QA Review

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

DRAFT-FINAL

SAMPLING AND ANALYSIS PLAN
(Field Sampling Plan and Quality Assurance Project Plan)
July 2010

PHASE I RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION

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CRANE, INDIANA

Prepared for:
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Contract No. N62470-08-D-1001
Contract Task Order F274

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NSA Crane Environmental Restoration Site Manager

8/5/10
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Indiana Department of Environmental Management

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EXECUTIVE SUMMARY

Tetra Tech NUS, Inc. (Tetra Tech) has prepared this Sampling and Analysis Plan (SAP) for the Phase I Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at Solid Waste Management Unit (SWMU) 21 – Defense Reutilization Marketing Office (DRMO) Storage Lot at Naval Support Activity (NSA) Crane, Indiana under Contract Task Order (CTO) F274, Contract N62470-08-D-1001, Comprehensive Long-Term Environmental Action Navy (CLEAN).

SWMU 21 is an approximate 20-acre material recycling facility that is currently and was historically used for processing of scrap metal, wood, lead, cardboard, and paper. The site has been in operation since the late 1940s. Current physical structures at the site include two processing buildings, an office and restroom building, abandoned paper baler building, two truck/railroad scales and one scale house, an inactive oil/water separator (OWS), and paved and unpaved storage areas. Formerly, separated water from the inactive OWS was discharged into Haynes Branch, a creek located immediately east of SWMU 21. The OWS is no longer functional. Two inactive metals balers and a second scale house were demolished and removed from the site in 2009.

Scrap metal processed at the site includes shells, bomb casings, gun mounts, barrels, and other ordnance materials that were cleaned of ordnance residues prior to delivery to SWMU 21. Historically, pentachlorophenol (PCP)-coated wood pallets and empty ammunitions cases were stored in bulk at the DRMO Storage Lot. Wooden railroad ties or other wood materials process at SWMU 21 may also have contained wood preservative mixtures of copper chromium arsenate (CCA) or creosote. SWMU 21 operations also involved short-term storage of materials with waste oils, including metal shavings, some of which may have contained polychlorinated biphenyls (PCBs). Historical site drawings show a concrete slab for lead storage; however, Crane personnel reported that all lead stored at the SWMU 21 was containerized, typically in drums, and batteries were never processed at SWMU 21.

Multiple environmental investigations including visual site inspections and collection and analysis of surface soil samples, subsurface soil samples, and liquid samples from an on-site sump were conducted from March 1987 to March 2009. Concentrations of total organic halides (TOX) and Target Analyte List (TAL) metals in some samples exceeded the Indiana Department of Environmental Management (IDEM) Risk Integrated System of Closure (RISC) Industrial Default Closure Level (I-DCL), and concentrations of total PCBs exceeded the IDEM RISC Residential Default Closure Level (R-DCL).

The primary purpose of the Phase I RFI described in this SAP is to conduct an initial site investigation of potential contaminants at the site. This information will be used in the remedial decision process. The Phase I RFI will include the collection and analysis of surface and subsurface soil, surface water, and sediment samples to provide representative coverage of the site for use in human health and ecological risk screening. Human health and/or ecological risk assessments will be conducted in Phase II, if necessary based on the analytical results obtained during Phase I.

Surface and subsurface soil, sediment, surface water, and groundwater (in Phase II, if deemed necessary) samples will be analyzed for one or more of the following groups of analytes: select volatile organic compounds (VOCs), low-level Target Compound List (TCL) polycyclic aromatic hydrocarbons (PAHs) by Selected Ion Monitoring (SIM), the seven TCL PCB Aroclors and total PCBs, and TAL metals. Sediment samples will additionally be analyzed for total organic carbon (TOC) to support site-specific risk calculations. The subsurface soil sample depths will be chosen based on direct (visual or olfactory) evidence of contamination or maximum flame ionization detector (FID) screening responses. All surface and subsurface soil, sediment, surface water, and groundwater samples will be analyzed by analytical methods with sufficient sensitivity such that the results can be compared to appropriate human health and ecological risk screening values and IDEM RISC R-DCLs.

The SAP contained herein was generated for and complies with applicable Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP), IDEM, and United States Environmental Protection Agency (USEPA) Region 5 requirements, regulations, guidance, and technical standards, as appropriate.

This SAP outlines the organization, project management, objectives, planned activities, measurement, data acquisition, assessment, oversight, and data review procedures associated with the planned investigations at SWMU 21. Protocols for sample collection, handling, and storage, chain-of-custody, laboratory and field analyses, data validation, and reporting are also addressed in this SAP. The investigation procedures utilized will comply with the site-specific field Standard Operating Procedures (SOPs), which are included in Appendix A, and the laboratory analytical procedures utilized will comply with the laboratory SOPs, which are included in Appendix B. The field work and sampling are scheduled to begin in early 2010. A complete schedule is detailed in SAP Worksheet No. 16.

The field activities conducted under this SAP will meet the requirements of the NSA Crane Site-Specific Health and Safety Plan (Tetra Tech, 2008).

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Acronyms and Abbreviations

°C	degrees Celsius
%D	percent difference or percent drift
%R	percent recovery
%RSD	percent relative standard deviation
ABG	Ammunitions Burning Grounds
amu	atomic mass unit
AST	aboveground storage tank
bgs	below ground surface
CCA	copper chromium arsenate
CCB	Continuing Calibration Blank
CCC	Calibration Check Compound
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Program
CMS	Corrective Measures Study
CompuChem	CompuChem, a Division of Liberty Analytical Corp., Inc.
COPC	Chemical of Potential Concern
CSM	conceptual site model
CTO	Contract Task Order
CVAA	Cold Vapor Atomic Absorption
CWAP	Comprehensive Work Approval Process
DAF	dilution attenuation factor
DCA	dichloroethane
DCE	dichloroethene
DO	dissolved oxygen
DoD	Department of Defense
DPT	direct-push technology
DQI	Data Quality Indicator
DQO	Data Quality Objective
DRMO	Defense Reutilization and Marketing Office
DVM	Data Validation Manager
Eco SSL	Ecological Soil Screening Level
ELAP	Environmental Laboratory Accreditation Program
EPC	exposure point concentration
ERA	Ecological Risk Assessment
ERSM	Environmental Restoration Site Manager

Acronyms and Abbreviations
(Continued)

ESL	Ecological Screening Level
EU	exposure unit
FD	field duplicate
FID	flame ionization detector
FOL	Field Operations Leader
FTMR	Field Task Modification Request
g	gram
GC/ECD	Gas Chromatograph/Electron Capture Detector
GC/MS	Gas Chromatograph/Mass Spectrometer
G-DCL	Groundwater Default Closure Level
GPS	global positioning system
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HCl	hydrochloric acid
HDOP	horizontal dilution of precision
HHRA	Human Health Risk Assessment
HI	hazard index
HNO_3	nitric acid
HQ	hazard quotient
HSM	Health and Safety Manager
IA	Investigation Area
ICAL	Initial Calibration
ICP-AES	Inductively Coupled Plasma - Atomic Emission Spectrometer
ICP-MS	Inductively Coupled Plasma - Mass Spectrometer
ICS	Interference Check Standard
ICV	Initial Calibration Verification
I-DCL	Industrial Default Closure Level
IDEM	Indiana Department of Environmental Management
IDEM SW	Indiana Minimum Surface Water Quality Standards
IDQTF	Intergovernmental Data Quality Task Force
IDW	investigation-derived waste
ILCR	incremental lifetime cancer risk
IRCDQM	Installation Restoration Chemical Data Quality Manual
IS	Internal Standard
IUPPS	Indiana Underground Plant Protection Services
L	liter
LBGR	lower bound of the gray region

Acronyms and Abbreviations
(Continued)

LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUC	land use control
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
mg/kg	milligram per kilogram
mg/L	milligram per liter
mL	milliliter
MPC	Measurement Performance Criterion
MS	Matrix Spike
MSD	Matrix Spike Duplicate
msl	mean sea level
NA	not applicable
NAVFAC	Naval Facilities Engineering Command
NDIRD	non-dispersive infrared detector
NFA	No Further Action
NIRIS	Naval Installation Restoration Information Solutions
NOAA	National Oceanic and Atmospheric Administration
NSA	Naval Support Activity
NTU	nephelometric turbidity unit
ORP	oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
OWS	oil/water separator
oz	ounce
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PCP	Pentachloropenol
PDF	Portable Document Format
PID	Photoionization Detector
PM	Project Manager
PPE	personal protective equipment
ppm	part per million
PQO	project quality objective
PSL	Project Screening Level

Acronyms and Abbreviations
(Continued)

PT	Proficiency Test
QA	quality assurance
QAM	Quality Assurance Manager
QC	quality control
QSM	Quality Systems Manual for Environmental Laboratories
r	linear least squares regression correlation coefficient
RCRA	Resource Conservation and Recovery Act
R-DCL	Residential Default Closure Level
RF	Response Factor
RFI	Resource Conservation and Recovery Act Facility Investigation
RISC	Risk Integrated System of Closure
RPD	Relative Percent Difference
RPM	Remedial Project Manager
RSL	Regional Screening Level
R-RSL	Residential Regional Screening Level
RWQC	Recommended Water Quality Criteria
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SDG	Sample Delivery Group
SIM	Selected Ion Monitoring
SMC	System Monitoring Compound
SOP	Standard Operating Procedure
SPCC	System Performance Check Compound
SQL	Structured Query Language
SQuiRT	Screening Quick Reference Table
SSL	Soil Screening Level
SSO	Site Safety Officer
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
TBD	To Be Determined
TCA	trichloroethane
TCE	trichloroethene
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TOC	total organic carbon

Acronyms and Abbreviations
(Continued)

TOX	total organic halides
T-RSL	Tapwater Regional Screening Level
Tetra Tech	Tetra Tech NUS, Inc.
UCL	upper confidence limit
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plans
UFP-SAP	Uniform Federal Policy for Sampling Analysis Plans
µg/kg	microgram per kilogram
µg/L	microgram per liter
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
VSP	Visual Sample Plan

SAP Worksheet No. 2 -- SAP Identifying Information

(UFP-QAPP Manual Section 2.2.4)

Site Name/Number:	Naval Support Activity (NSA) Crane
Operable Units:	Solid Waste Management Unit (SWMU) 21
Contractor Name:	Tetra Tech NUS, Inc. (Tetra Tech)
Contract Number:	N62470-08-D-1001
Contract Title:	Comprehensive Long-Term Environmental Action Navy (CLEAN)
Work Assignment Number:	Contract Task Order (CTO) F274

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

2. Identify regulatory program: The Indiana Department of Environmental Management (IDEM) Hazardous Waste Closure and Corrective Action Programs, which implement and enforce the Resource Conservation and Recovery Act (RCRA), and related state laws and rules.

3. This SAP is a project-specific SAP.

4. List dates of scoping sessions that were held:

Scoping Session	Date
Data Quality Objective (DQO) Meeting	July 22, 2009

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

Title	Date
Preliminary Review/Visual Site Inspection	March 1987
DRMO Scrap Yard Soil Sampling Report	December 1997
Soil Sampling Investigation for Structures Scheduled for Demolition at Naval Support Activity Crane	March 2009

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

IDEM (lead regulatory agency), USEPA Region 5 (regulatory oversight), Naval Facilities Engineering Command (NAVFAC) Midwest, Naval Support Activity (NSA) Crane, (property owner), Tetra Tech (Navy contractor)

7. Lead organization: NAVFAC Midwest

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

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

SAP Worksheet No. 3 -- Distribution List

(UFP-QAPP Manual Section 2.3.1)

Name of SAP Recipient	Title/Role	Organization	Telephone Number	E-Mail Address or Mailing Address	Document Control Number
Howard Hickey	NAVFAC Remedial Project Manager (RPM)	NAVFAC Midwest	847-688-2600 X243	howard.hickey@navy.mil	NA
Tom Brent	Environmental Restoration Site Manager (ERSM)	NAVFAC MW PWD Crane	812-854-6160	thomas.brent@navy.mil	NA
To Be Determined (TBD)	Government Chemist	NAVFAC Atlantic	TBD	TBD	NA
Bonnie Capito (final cover letter only)	NAVFAC Atlantic Administrative Record Librarian	NAVFAC Atlantic	757-322-4785	bonnie.capito@navy.mil	NA
Peter Ramanauskas	USEPA RPM	USEPA Region 5	312-866-7890	USEPA Region 5 77 West Jackson Blvd. Chicago, Illinois 60604	NA
Doug Griffin	State RPM	IDEM	317-233-2710	dgriffin@idem.in.gov	NA
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Matt Soltis [Health and Safety Plan (HASP) only]	Health and Safety Manager (HSM)	Tetra Tech	412-921-8912	matt.soltis@tetratech.com	NA
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George Ten Eyck	Field Operations Leader (FOL) and Site Safety Officer (SSO)	Tetra Tech	513-557-5043	george.teneyck@tetratech.com	NA

Name of SAP Recipient	Title/Role	Organization	Telephone Number	E-Mail Address or Mailing Address	Document Control Number
Mark Traxler (electronic copy only)	Project Chemist	Tetra Tech	610-382-1171	mark.traxler@tetratech.com	NA
Driller (TBD) (electronic copy only)	Drilling Subcontractor PM	TBD	TBD	TBD	NA
Cathy Dover (electronic copy only)	Laboratory PM	CompuChem, a Division of Liberty Analytical Corp., Inc. (CompuChem)	919-379-4089	cdover@compuchemlabs.com	NA

SAP Worksheet No. 4 -- Project Personnel Sign-Off Sheet

(UFP-QAPP Manual Section 2.3.2)

Name [1]	Organization/Title/Role	Telephone Number	Signature/E-Mail Receipt	SAP Section Reviewed	Date SAP Read
Navy and Regulator Project Team Personnel					
Howard Hickey	Navy RPM	847-688-2600 X243		All	
Tom Brent	ERSM	812-854-6160	See Worksheet #1 for signature	All	
Doug Griffin	State RPM	317-233-2710	See Worksheet #1 for signature	All	
Peter Ramanauskas	USEPA RPM	312-866-7890		TBD	
Tetra Tech Project Team Personnel					
Tony Klimek, P.E.	Tetra Tech PM	513-557-5057	See Worksheet #1 for signature	All	
Tom Johnston	Tetra Tech QA Manager	412-21-8615	See Worksheet #1 for signature	All	
George Ten Eyck	Tetra Tech FOL/SSO	513-557-5043		All	
Matt Soltis	Tetra Tech HSM	412-921-8912		HASP only	
Joe Samchuck	Tetra Tech DVM	412-921-8510		Worksheet Nos. 12, 14, 15, 19, 20, 23-28, 30, and 34-37	
Mark Traxler	Tetra Tech Project Chemist	610-382-1171		All	
Subcontractor Personnel					
TBD	Drilling Subcontractor PM	TBD		Worksheet Nos. 6, 10, 11, 14, and 17	
Cathy Dover	CompuChem Laboratory PM	919-379-4089		Worksheet Nos. 6,12,14,15,19,20,23-28,30 and 34-36	

1 Persons listed on this worksheet will be responsible for distributing the SAP to the appropriate people within their organization.

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

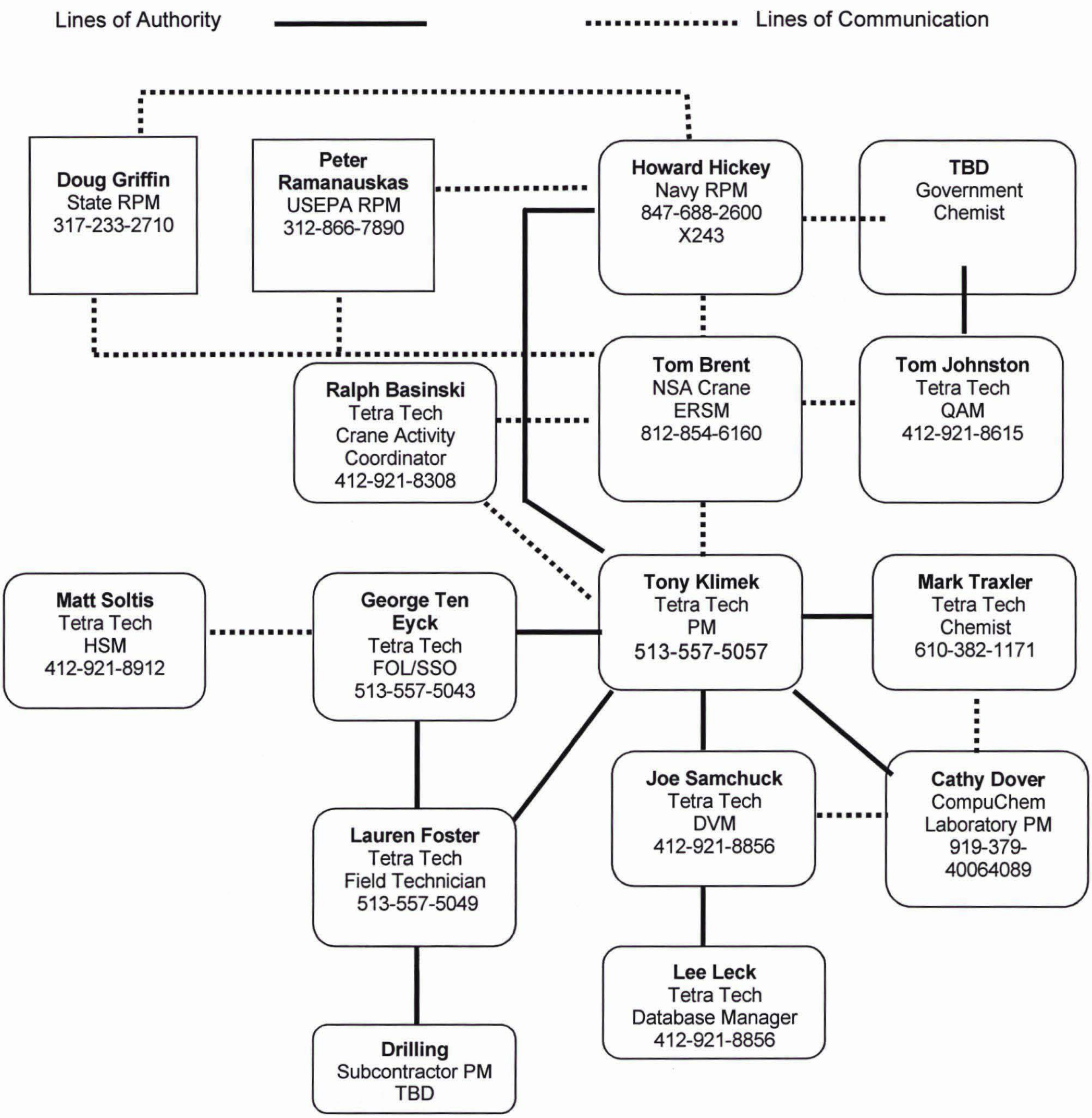
1. In the case of regulatory agency personnel with oversight authority, approval letters or e-mails will constitute verification that applicable sections of the SAP have been reviewed. Copies of regulatory agency approval letters / e-mails will be retained in the project files and are listed in Worksheet No. 29 as project records.

2. E-mails will be sent to the Navy, Tetra Tech, and subcontractor project personnel whom 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 No. 29.

A copy of the signed Worksheet No. 4 will be retained in the project files and is identified as a project document in Worksheet No. 29.

SAP Worksheet No. 5 -- Project Organizational Chart

(UFP-QAPP Manual Section 2.4.1)



SAP Worksheet No. 6 -- Communication Pathways

(UFP-QAPP Manual Section 2.4.2UFP-QAPP Manual Section 2.4.2)

Communication Driver	Responsible Affiliation	Name	Phone Number and/or E-Mail	Procedure
SAP Amendments	Tetra Tech FOL/SSO Tetra Tech PM Navy RPM	George Ten Eyck Tony Klimek Howard Hickey	513-557-5043 513-557-5057 847-688-2600 x243	Tetra Tech FOL will verbally inform Tetra Tech PM within 24 hours of realizing a need for an amendment. Tetra Tech PM 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 Tetra Tech PM to NAVFAC Midwest Program Management Office for review and approval. Tetra Tech PM will send scope changes to Project Team via e-mail within one business day.
Changes in field work schedule	Tetra Tech PM NSA Crane ERSM	Tony Klimek Tom Brent	513-557-5057 812-854-6160	Tetra Tech PM will verbally inform the NSA Crane ERSM on the day that a schedule change is known and will document via schedule impact letter within one business day of when the impact is realized.
Issues in the field that result in changes in scope of field work	Tetra Tech FOL/SSO Tetra Tech PM NSA Crane ERSM	George Ten Eyck Tony Klimek Tom Brent	513-557-5043 513-557-5057 812-854-6160	Tetra Tech FOL will inform Tetra Tech PM within one business day of when an issue is discovered; Tetra Tech PM will inform NSA Crane ERSM by close of the next working day; NSA Crane ERSM will issue scope change if warranted. The scope change is to be implemented before further work is executed. Tetra Tech PM will document the changes within two days of identifying the need for change on a FTMR form and obtain required approvals within five days of initiating the form.

Communication Driver	Responsible Affiliation	Name	Phone Number and/or E-Mail	Procedure
Recommendations to stop work and initiate work upon corrective action	Tetra Tech FOL/SSO Tetra Tech PM Tetra Tech QAM Tetra Tech Project Chemist Tetra Tech HSM NSA Crane ERSM	George Ten Eyck Tony Klimek Tom Johnston Mark Traxler Matt Soltis Tom Brent	513-557-5043 513-557-5057 412-921-8615 610-382-1171 412-921-8912 812-854-6160	If Tetra Tech is the responsible party for a stop work command, the Tetra Tech FOL will inform onsite personnel, subcontractor(s), NSA Crane ERSM, 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 Tetra Tech FOL within 15 minutes, and the Tetra Tech FOL will then follow the procedure listed above.
Field data quality issues	Tetra Tech FOL/SSO Tetra Tech PM	George Ten Eyck Tony Klimek	513-557-5043 513-557-5057	Tetra Tech FOL will inform Tetra Tech PM verbally or by e-mail on the same day that a field data quality issue is discovered.
Analytical data quality issues	CompuChem Laboratory PM Tetra Tech Project Chemist Tetra Tech PM NSA Crane ERSM	Cathy Dover Mark Traxler Tony Klimek Tom Brent	919-379-4089 610-382-1171 513-557-5057 812-854-6160	Laboratory PM will notify the Tetra Tech Project Chemist within one business day of when an issue related to laboratory data is identified. Tetra Tech Project Chemist will notify (verbally or by e-mail) the data validation staff and Tetra Tech PM within one business day. Tetra Tech PM will notify (verbally or via e-mail) the NSA Crane ERSM of significant analytical data quality issues within one business day of resolution.

SAP Worksheet No. 7 -- Personnel Responsibilities and Qualifications Table

(UFP-QAPP Manual Section 2.4.3)

Name	Title/Role	Organizational Affiliation	Responsibilities
Doug Griffin	RPM	IDEM	Participates in scoping, conducts data review and evaluation, and approves the SAP.
Peter Ramanauskas	RPM	USEPA Region 5	Oversees project implementation, including scoping, and data review and evaluation.
Tom Brent	ERSM	NSA Crane	Oversees site activities, participates in scoping, conducts data review and evaluation, and approves the SAP.
Howard Hickey	RPM	NAVFAC Midwest	Oversees project implementation including scoping and data review and evaluation.
Ralph Basinski	Crane Activity Coordinator	Tetra Tech	Oversees project implementation including scoping and data review and evaluation.
Tony Klimek	PM	Tetra Tech	Oversees project, financial, schedule, and technical day-to-day management of the project, including the following: • Ensures timely resolution of project-related technical, quality, and safety questions associated with Tetra Tech operations. • Functions as the primary Tetra Tech interface with the Navy RPM, NSA Crane ERSM, Tetra Tech field and office personnel, and laboratory points of contact. • Ensures that Tetra Tech health and safety issues related to this project are communicated effectively to all personnel and the off-site laboratory, CompuChem. • Monitors and evaluates all Tetra Tech subcontractor performance. • Coordinates and oversees work performed by Tetra Tech field and office technical staff (including data validation, data interpretation, and report preparation). • Coordinates and oversees maintenance of all Tetra Tech project records. • Coordinates and oversees review of Tetra Tech project deliverables. • Prepares and issues final Tetra Tech deliverables to the Navy.
George Ten Eyck	FOL/SSO	Tetra Tech	Supervises, coordinates, and performs field sampling activities, including the following: • Ensures that health and safety requirements are implemented. • Functions as the on-site communications link between field staff members, the NSA Crane ERSM, and Tetra Tech PM. • Alerts CompuChem 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 Tetra Tech PM.

Name	Title/Role	Organizational Affiliation	Responsibilities
			• Ensures the proper maintenance of site logbooks, field logbooks, and field recordkeeping. • Initiates FTMRs when necessary. • Identifies and resolves problems in the field, resolving difficulties via consultation with the NSA Crane ERSM, implementing and documenting corrective action procedures, and providing communication between the field team and project management. • As SSO, is responsible for training and monitoring site conditions related to personnel safety. Details of the SSO's responsibilities are presented in the HASP.
Tom Johnston	QAM	Tetra Tech	Reviews the SAP, oversees preparation of the laboratory scope, coordinates with CompuChem, and conducts data quality review. Ensures quality aspects of the CLEAN program, including the following: • Develops, maintains, and monitors quality assurance (QA) and quality control (QC) policies and procedures. • Provides training to Tetra Tech staff in QA/QC policies and procedures. • Conducts systems and performance 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 Tetra Tech, Navy, and IDEM requirements. • Prepares QA reports for management.
Mark Traxler	Project Chemist	Tetra Tech	Coordinates analyses with laboratory chemists, ensures that the laboratory scope is followed and that QA has been performed for data packages, and communicates with Tetra Tech staff. • Ensures that the project meets objectives from the standpoint of laboratory performance. • Provides technical advice to the Project Team on project chemistry matters. • Monitors and evaluates CompuChem's performance. • Ensures timely resolution of laboratory-related technical, quality, or other issues effecting project goals. • Functions as the primary interface with CompuChem and Tetra Tech PM. • Coordinates and oversees work performed by CompuChem. • Oversees the completion of Tetra Tech data validation. • Coordinates and oversees review of laboratory deliverables. • Recommends appropriate laboratory corrective actions.
Joseph Samchuck	DVM	Tetra Tech	Ensures the QA of data validation deliverables. • Oversees data validation activities. • Serves as a communication link between Tetra Tech and CompuChem on data validation and electronic data posting activities.

Name	Title/Role	Organizational Affiliation	Responsibilities
			• Establishes Tetra Tech data validation protocols in support of projects.
Lee Leck	Data Manager	Tetra Tech	Manages Tetra Tech databases and ensures input of data.
Matt Soltis	HSM	Tetra Tech	Oversees the CLEAN Program Health and Safety Program • Provides technical advice to the Tetra Tech PM on matters of health and safety. • Oversees development and review of the HASP. • Conducts health and safety audits. • Prepares health and safety reports for management.
TBD	Driller	TBD	Performs Direct-Push Technology (DPT) soil borings according to scope of work. Installs temporary groundwater wells, if necessary. Installs permanent monitoring wells, if necessary.
Cathy Dover	Laboratory PM	CompuChem	• Ensures that the scope is followed. • Coordinates analyses with laboratory chemists. • Performs QA on data packages. • Communicates with Tetra Tech staff.

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

SAP Worksheet No. 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 Hazardous Waste Operations and Emergency Response (HAZWOPER) course (and 8-hour refresher training, 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 HASP.

SAP Worksheet No. 9 -- Project Scoping Session Participants Sheet

(UFP-QAPP Manual Section 2.5.1)

Project Name: NSA Crane SWMU 21 Phase I RCRA Facility Investigation (RFI) **Projected Date(s) of Sampling**: Early 2010 **Project Manager**: Tony Klimek				**Site Name**: SWMU 21 – Defense Reutilization and Marketing Office (DRMO) Storage Lot **Site Location**: Crane, Indiana	
Date of Session: July 22, 2009 **Scoping Session Purpose:** DQO Meeting					
Name	**Title**	**Affiliation**	**Phone #**	**E-Mail Address**	**Project Role**
Tony Klimek	PM	Tetra Tech	513-557-5057	tony.klimek@tetratech.com	Management
Tom Brent	ERSM	NSA Crane	812-854-6160	thomas.brent@navy.mil	Management
Doug Griffin	RPM	IDEM	317-233-2710	dgriffin@idem.in.gov	State RPM
Tom Johnston	QAM	Tetra Tech	412-921-8615	tom.johnston@tetratech.com	Quality Assurance Management /DQO Facilitator
Ralph Basinski	Crane Activity Coordinator	Tetra Tech	412-921-8308	ralph.basinski@tetratech.com	Management /Oversight
Mark Traxler	Project Chemist	Tetra Tech	610-382-1171	mark.traxler@tetratech.com	Chemist

Comments/Decisions: Discussed SWMU 21 historical use and available data. Discussed the steps for the Phase I RFI in accordance with the UFP-SAP format.

Action Items: Tetra Tech assigned the task to preparing preliminary draft UFP-SAP.

Consensus Decisions: See meeting minutes in Appendix C. The meeting participants developed project quality objectives (PQOs) using USEPA's seven-step DQO process. Consensus decisions included the following:

- Limit Phase I activities to a site investigation; potential nature and extent delineation, risk assessments, and corrective measures will be addressed in later phases, if necessary.
- Collect surface soil samples (from 0 to 2 feet below the bottom of the gravel) from across the Gravel Pad Area (as identified in Worksheet No. 17) to address the main area of the site; collect limited additional surface and subsurface soil samples from seven Investigation Areas (IAs) (as identified in Worksheet No. 18); and collect surface water and co-located sediment samples from Haynes Branch.
    - Collect 30 random surface soil samples in the Gravel Pad Area.
    - Collect three biased surface soil samples in each of the seven IAs except the Open Grass Area (IA-6), where six samples will be collected. Additionally, subsurface soil samples will be collected below each surface sample collected at IA-2, IA-3, IA-4, and IA-7, where potential subsurface contamination is believed to be more likely.
    - Collect five surface water samples and five co-located sediment samples from Haynes Branch.
    - These quantities were deemed to be sufficient by the IDEM RPM to meet the PQOs for Phase I activities.
- Analyze collected samples for a specific list of analytes based on historical use within each particular area. It was agreed that the specific list of analytes will include certain chlorinated and non-chlorinated volatile organic compounds (VOCs), certain polycyclic aromatic hydrocarbons (PAHs), Target Compound List (TCL) polychlorinated biphenyls (PCBs) (and Total Aroclor PCBs), and the full list of

Target Analyte List (TAL) Metals, but will not include any semivolatile organic compounds (SVOCs) associated with various wood preservatives.

- If any of the risk screening criteria are exceeded, the Project Team will evaluate the distribution, magnitude, and significance of the exceedance(s) to determine the most appropriate path forward with the ideal goal of clean closure under IDEM residential default closure criteria, if possible and cost-effective.
- The Project Team planned for Phase II and Phase III (permanent groundwater well installation and long-term monitoring) RFI field activities in the event they are required, based on the results of the previous phase. The data collection design and performance criteria to be applied to data collected during the Phase I RFI will support screening-level human health and ecological risk assessments and will assist in developing the Phase II RFI sampling design and rationale to further evaluate risk and to complete the delineation of any identified contamination. Phase III would include long-term monitoring of groundwater, if deemed necessary based on groundwater data from Phase II. Details of Phase III activities were not presented in this UFP-SAP because they would likely be addressed separately as part of a selected remedy.

SAP Worksheet No. 10 -- Conceptual Site Model

(UFP-QAPP Manual Section 2.5.2)

This worksheet presents general background information about SWMU 21 - DRMO Storage Lot and the conceptual site model (CSM) that describes potential contamination routes and possible exposure pathways to humans and to ecological receptors. The CSM serves as the basis for developing the sampling and analysis program.

10.1 PHYSICAL SITE DESCRIPTION

SWMU 21 - DRMO Storage Lot is located on the northern side of Route H-58 in the central part of the NSA Crane facility (see Figure 10-1). The site is triangular shape with a north-south orientation and is located in a wooded area, as shown on Figure 10-2. The site is an active material recycling facility that covers approximately 20 acres and is approximately 600 feet wide on the southern side along Route H-58 and extends approximately 1,700 feet north into a wooded area. SWMU 21 is bounded on the east by Haynes Branch and to the west by a set of railroad tracks. Further east of Haynes Branch is a wooded area. Further west of the railroad tracks is a wooded hillside. To the south and across Road H-58 is a small (less than 1 acre) storage yard and gravel parking area, which are not included in the SWMU 21 boundary.

As shown on Figure 10-3, the site is located in a valley bottom and slopes from west to east with an elevation change from 570 feet above mean sea level (msl) in the western portion of the site to 520 feet above msl in the eastern portion of the site. The site also slopes gently from the north to the south. Most of the site is occupied by a fairly level gravel pad at an approximate elevation of 530 feet above msl. The elevation of Haynes Branch is between 510 and 520 feet above msl.

Runoff from the site drains south and east into Haynes Branch, which flows north to south along the eastern side of the site. Haynes Branch joins with Boggs Branch approximately 1,000 feet south of the site and flows south and off of the NSA Crane facility approximately 3 miles south of the site.

Physical structures at the site (as of June 2009) are shown on Figure 10-3. The site contains two processing buildings (3248 and 3249), an office and restroom building (2703), an abandoned paper baler building (2704), two truck/railroad scales and a scale house (2943), an inactive oil/water separator (OWS) (3058), a paved storage yard northwest of the OWS, and a paved storage area in the southwestern corner of the site. A leach field is located on a portion of the hillside that forms the western boundary of the site. The two metals balers (2918 and 2705) as well as a second scale house (1940) shown on Figure 10-3 were demolished and removed from the site in 2009.

The DRMO Storage Lot is bounded by a chain-link fence on all sides. A set of railroad tracks and a paved road extend north to south through the middle of the site. The tracks extend to within 100 feet south of the northern end of the site; however, at the northern end, the ties have been removed from under the rails and this part the tracks is not operational. The main paved road through the site is just west of the railroad and extends north approximately halfway across the site.

On the eastern side of the site between the railroad tracks and the eastern fence line is a gravel pad (shown on Figure 10-3) that extends the length in the site from north to south. The majority of material processing occurs on the gravel pad. According to personnel at the site, approximately 100 to 200 tons of gravel are added to this gravel pad every year. Therefore, the gravel cover may be of significant thickness in parts of the site.

As shown on Figure 10-3, an inactive in-ground OWS is located along the eastern fence line in the center area of the site. It was originally designed to collect liquids from the Old Metals Baler (2705) and runoff from the northern end of the site and the Paved Storage Yard. A concrete-lined ditch (also shown on Figure 10-3) just east of the eastern fence line along the southern side of the site also was designed to collect surface water runoff from the gravel pad on the southern side of the site and convey it to the OWS. The ditch appears to be flat or at a slight slope that drains north to the OWS According to design drawings, a 4-inch vitrified tile pipe drained liquids from Old Metals Baler 2705 to the OWS, and a similar pipe conveyed discharge from the OWS to Haynes Branch. Reportedly, the OWS has not been functional for approximately 10 years.

Design drawings indicate that numerous drains, metal pipes, and concrete pipes are located throughout the site. Although it was reported that there were plans to remove many of the pipes, there is no confirmation that these pipes were removed. A pipe from the Metals Baler 2918, reported to be blocked, ran to a sump in the middle of the gravel pad. In the area of the Paved Storage Yard, a slotted surface grate and drain at the edge of the pad appears to collect runoff from material on the pad and convey it to the nearby OWS.

NSA Crane is in the unglaciated Crawford Upland physiographic province of southern Indiana, which is a rugged dissected plateau bordered on the west by the Wabash Lowland and on the east by the Mitchell Plain. Bedrock geology is mapped as Pennsylvanian and Mississippian sandstones, limestones, and shales overlain by Quaternary-age deposits. Groundwater flow in the area most likely mimics topography and is assumed to flow east-southeast toward Haynes Branch. Depth to groundwater is unknown; however, based on other site investigations in the area, it is expected to be less than 15 feet below ground surface (bgs). The site appears to have been created by cutting material from the western side and placing it on the eastern side to create a flat surface that is covered by a layer of gravel.

The site is near the center of NSA Crane. The nearest off-site residence is approximately 4 miles west of the site.

The NSA Crane facility was a rural, forested, and farmed area when it was commissioned as a Navy facility in 1941; the site has been part of the Navy facility since that time. There are no known historical or cultural concerns such as Native American burial grounds or historic landmarks on or in the vicinity of the site. There are no land use controls (LUCs) associated with the site.

10.2 SWMU 21 HISTORY

The site has been in operation since the late 1940s as a material processing center and is expected to continue similar operations for the foreseeable future. Materials processed at the site include scrap metal, wood, cardboard, and paper. The exact startup date of activities at the site is unknown, but it appears to have been shortly after startup of the NSA Crane facility in the 1940s. It has been reported that in the 1940s, the site contained a concrete batch plant to support construction of buildings and facilities across the NSA Crane facility. Design drawings from 1951 show an office, replacement buildings for metal and paper bailing, storage building, concrete slab for lead storage, and shear house in the area of current Structure 2704.

Scrap metal processed at the site included shells, bomb casings, gun mounts, barrels, and other ordnance materials that were cleaned of ordnance residues by burning at the Ammunitions Burning Grounds (ABG) or other off-site processes. Historically, pentachlorophenol (PCP)-coated wood pallets and empty ammunitions cases were stored in bulk on the gravel pad prior to disposal or reuse. Wooden railroad ties or other wood materials may also have contained wood preservative mixtures of copper chromium arsenate (CCA) or creosote. Operations involving materials with waste oils, some of which may have contained PCBs, have also taken place. Metal shavings containing cutting oil were also stored on site. Prior to the late 1960s, the oil associated with the metal shavings drained onto the ground in certain areas of the site. All containers and equipment brought to the site for processing were reportedly drained of liquids prior to arrival.

Three different metal baler buildings have been located at the site since at least the late 1940s. The first baler (identified as Building 1944) was located just north of current Building 2704. This baler was removed in 1951/1952. Old Metals Baler 2705 was installed prior to 1969, and Metals Baler 2918 was constructed in 1969. Both balers (2705 and 2918) were removed in 2009. The construction date for the OWS that collected liquids from Old Metals Baler 2705 is unknown.

A 1951 drawing shows a concrete slab for lead storage northeast of Building 2703 and southwest of Building 2704. Although operational details are limited, personnel at the site reported that all lead stored at the DRMO Storage Lot was containerized, typically in drums. It was further reported that batteries were never processed at the site. The operational period for the concrete slab is unknown.

In 1969, the southern truck and railroad scale and scale house (Building 2943) were constructed. The construction date for the northern scale and scale house (Building 1940) is unknown. Both scales had sumps that originally drained to Haynes Branch to the east. It has been reported that the drain line for Building 2943 has been blocked and that the sump is now pumped out approximately twice a year. No report was provided about the drainage or pumping of the Building 1940 sump.

In 1971, design drawings provided evidence that the site was re-graded by excavating material from the southwestern area of the site that is now identified as the Paved Storage Area, and using the material as fill on the eastern side of the site. The bulk of the fill was placed in the area between the set of railroad tracks through the center of the site and the current location of the chain-link fence along eastern side of the gravel pad. It is not considered likely that the previously ungraded areas were used significantly prior to 1971, so it is not expected that the filled areas were contaminated by on-site activities and then covered up or that contamination existed in the southwestern area and then was moved and used as fill. The design drawings included a dike along the western side of Haynes Branch between Haynes Branch and the grass area, which may have provided a conduit for contaminant migration toward Haynes Branch. In 1976, the concrete ditch was constructed on the eastern side of the site that drains to the OWS to reduce the potential for off-site migration of surface contaminants from the northern half of the site.

Building 2703 is shown on a 1951 drawing as a storage building. The building has been remodeled and still contains restrooms. Wastewater from the restrooms is pumped to the leach field on the western side of the site. There is no sanitary sewer service in this area. This building was originally heated with fuel oil stored in an on-site aboveground storage tank (AST). In 1989 or 1990, the 275-gallon AST was removed from the southwestern corner of Building 2703. Site buildings are now heated with natural gas.

Currently, the site is used for recycling and processing metal, wood pallets, and cardboard. During a May 14, 2009, site reconnaissance, a small pile (approximately 5 to 10 feet tall) of railroad ties was observed in the southeastern corner of the site; a large pile of pallets and other scrap wood (approximately 20 feet tall) was observed in the area between the South Processing Building and the fence; and a pile of wood pallets was observed just west of the South Processing Building. Metal debris and parts were observed throughout the site.

10.3 PREVIOUS ENVIRONMENTAL INSPECTIONS AND INVESTIGATIONS

Previous environmental inspections and investigations conducted at the site include a Preliminary Review/Visual Site Inspection in 1987 and four soil and water sampling events performed between December 1997 and March 2009. The results of these inspections and investigations are summarized below.

In March 1987, A.T. Kearny issued a *Preliminary Review/Visual Site Inspection Report* that identified the site as SWMU 74 (currently known as SWMU 21). The site was described as a storage lot for scrap metal parts and old tires that were separated into piles according to metal or material type and ultimate destination - recycling or resale. The report stated that the DRMO Salvage Lot was fenced but that there were no other release controls. The report concluded that the potential for release into soil/groundwater, surface water, and air or generation of subsurface gas was low due to the nature of wastes handled at the site and suggested No Further Action (NFA) for this unit.

In December 1997, Comarco Systems, Inc. issued a *DRMO Scrap Yard Soil Sampling Report* that reported the results of a sampling program that included collection of soil from eight locations across the site. Six surface soil and eight subsurface soil samples were collected. The samples were analyzed for the eight RCRA metals following the Toxicity Characteristic Leaching Procedure (TCLP) method and for PCBs. The surface soil samples were collected at depths of 0 to 2 inches bgs. Seven of the subsurface samples were collected at depths between 6 and 20 inches, and one was collected from 4 to 5 feet deep. All samples had detectable levels of barium in the TCLP leachate. Some subsurface samples also had detectable levels of cadmium in the TCLP leachate and Aroclor-1254 or Aroclor-1260. The maximum

PCB concentration of 2.9 milligrams per kilogram (mg/kg) was detected in a surface soil sample collected near the OWS.

In June 2000, a liquid sample was collected from a baler sump at the DRMO Storage Lot and analyzed by Synergic Analytics, Inc. for PCBs, the eight RCRA TCLP metals, and total organic halides (TOX). No PCBs were detected, but the sample contained the following TCLP metals: barium (27 milligrams per liter [mg/L]), lead (5.9 mg/L), and mercury (0.0059 mg/L). The sample had a TOX level of 290 mg/L. Details concerning the location of this sample are unknown.

In February 2007, Test America analyzed a liquid sample collected from a baler sump at the DRMO Storage Lot and analyzed it for PCBs, eight RCRA TCLP metals, and TCLP volatiles. Only barium was detected in excess of the reporting limit for the TCLP analysis. It is not clear from the laboratory report from which baler sump these samples were collected; however, it is assumed that the samples were collected from Metals Baler 2918 because it is not associated with an OWS.

On March 6, 2009, Science Applications International Corporation (SAIC) issued a *Soil Sampling Investigation for Structures Scheduled for Demolition at Naval Support Activity Crane.* The report presented the results of sampling and analyses performed on six soil samples collected from the vicinity of the two balers (2918 and 2705) to support demolition and removal of the balers. Three soil samples were collected on the western, southern, and eastern sides of Metals Baler 2918, and three soil samples were collected on the western, northern, and eastern sides of Old Metals Baler 2705. Samples were collected using a hand auger to a depth of 24 inches bgs. Soils at both buildings were heavily laden with gravel. All of the soil samples were analyzed for the eight RCRA metals following EPA Methods 6010/6020 and for PCBs following EPA Method 8082. According the report, the soil sample east of Metals Baler 2918 contained arsenic at a concentration of 31.6 mg/kg, which is greater than the IDEM Risk Integrated System of Closure (RISC) Industrial Default Closure Level (I-DCL) of 20 mg/kg. Five of the six samples collected contained PCBs at concentrations ranging from 0.12 to 1.91 mg/kg. The current IDEM RISC Residential Default Closure Level (R-DCL) for total PCBs is 1.8 mg/kg.

10.4 CONCEPTUAL SITE MODEL

Spills and releases from general site activities at SWMU 21 are the likely sources of potential contamination. The historical operations at the site and analytical results from previous site investigations indicate that releases likely occurred directly onto the surface and potentially have migrated into site soil. The site has been used primarily to process scrap metal, wood, and paper products. Previous limited analytical results provide evidence that PCBs and three of the eight RCRA metals exist in soil at the site. Based on site operational data and historical information from similar DRMO sites, certain metals, certain chlorinated and non-chlorinated VOCs, certain SVOCs – limited to PAHs, and PCBs may have been released from processes at the site. A CSM schematic is presented on Figure 10-4.

PCP, creosote, and associated SVOCs and CCA are common wood treatment chemicals that are not listed as target analytes for this investigation. SWMU 21 operated as a recycling facility for old treated wood pallets, railroad ties, and other wood scrap materials, rather than as a manufacturing facility. Thus, these analytes are expected to be present at the site only in negligible concentrations, if at all.

These releases and potential releases to the soil may (1) present complete exposure pathways to human and ecological receptors and/or (2) serve as a source of contamination to groundwater and surface water and present complete exposure pathways to human and ecological receptors through those routes. The impacts of contamination reaching Haynes Branch may present direct exposure risk to receptors in and along the creek. Releases to site soil and the gravel pad may act as contaminant reservoirs for migration to groundwater. Potential human exposure pathways are illustrated on Figure 10-5, and potential ecological exposure pathways are illustrated on Figure 10-6.

Human receptors include persons currently employed at the site or future site construction workers who could interact with contaminated media. The area is rural, and there are no identified residences within 1 mile of the site. However, because future land use is unknown, it is customary to conservatively evaluate future use of a property for residential and recreational purposes. Therefore, potential future receptors include residents and people recreating at the site. Human receptors may be exposed to different media following various pathways based on their specific activities. These media include surface and subsurface soil, groundwater, surface water, and sediment.

Ecological receptors include animal and plant species that could be affected by contaminants at the site. Typically, ecological receptors can be exposed only to surface media – surface soil, surface water, and the upper layers of wetland sediments. Exposure of ecological receptors to groundwater and subsurface soil is not anticipated; however, contamination in subsurface soil or groundwater may serve as sources of contamination to sediment or surface water through subsurface transport or diffuse flow to streams. The exposure media for ecological receptors are surface soil, sediment, and surface water. Terrestrial plants, invertebrates, and vertebrates are exposed to surface soil by direct contact and ingestion of soil and other food items. Aquatic and semi-aquatic vegetation, benthic invertebrates, and aquatic organisms are exposed to surface water and sediment by direct contact and/or ingestion of sediment and surface water and other food items. Benthic invertebrates or other aquatic organisms may be consumed by wildlife. Although terrestrial vertebrates may be exposed to chemicals found in the air via inhalation, this is not considered a significant exposure pathway at the site and will not be evaluated.

SAP Worksheet No. 11 -- Project Quality Objectives/Systematic Planning Process Statements

(UFP-QAPP Manual Section 2.6.1)

This section describes the development of PQOs using EPA's seven-step DQO/Systematic Planning Process.

11.1 PROBLEM DEFINITION

Based on the site history and CSM, it is likely that site-related contaminants are present in environmental media at SWMU 21 at concentrations that exceed applicable risk-based human health or ecological screening values, including IDEM R-DCLs. The SWMU 21 RFI will be conducted in phases, with the location(s) and extent of Phase II activities based on the Phase I data and the decisions that are made by the Project Team. A Phase I RFI must be conducted to identify areas of the site with elevated levels of contaminants. If concentrations of a target analyte exceed the screening values and/or RCRA site closure criteria, then the target analyte will be identified as a Chemical of Potential Concern (COPC). Phase II of the RFI will follow to assess the nature and extent of contamination, and conduct human health and/or ecological risk assessments to determine whether unacceptable risks could be incurred from exposure of receptors to the COPCs identified across the entire site. The outcome of the Phase II delineation and risk assessment(s) will be used to determine if the level of risk is unacceptable and if further investigations or corrective actions are warranted.

11. 2 IDENTIFY THE INPUTS TO THE DECISIONS

The data from Phase I of this investigation will be used with supplemental investigation data from Phase II to conduct a Human Health Risk Assessment (HHRA) and/or Ecological Risk Assessment (ERA), if the Phase I results support a need to conduct one or both of these risk assessments.

The following chemical and physical data are needed to attain project objectives:

1. Chemical: Surface and subsurface soil, sediment, and surface water chemical data will be collected and analyzed to determine if target analytes are present in site media at concentrations greater than risk-based screening criteria, which are identified as the Project Screening Levels (PSLs). Surface and subsurface soil samples will be collected using DPT cores. Due to the compacted gravel layer that occupies most of the site, additional equipment, including but not limited to a Geoprobe with auger capability or a backhoe, may be employed to assist in collection of the samples. The list of chemical analytes and associated PSLs for each matrix are presented in Worksheet No. 15. The sampling methods are presented in Worksheet No. 18, and the analytical methods are presented in Worksheet No. 19.

2. Subsurface soil screening: A flame ionization detector (FID) will be used to measure VOC and PAH levels in subsurface soil samples, and visual screening will also be used to assist in the identification of subsurface soil with the greatest potential to have contamination. Subsurface soil samples will be biased toward collection of samples at depths that exhibit the greatest potential to be impacted

3. Project Screening Levels: This SWMU 21 RFI requires chemical data that can be used to characterize the site and to conduct a screening-level HHRA and ERA. The surface soil, subsurface soil, sediment, surface water, and groundwater PSLs are set at the lowest matrix-specific risk-based or regulatory human health and ecological screening criteria appropriate for the site. A comprehensive listing of the relevant environmental and medium-specific PSLs for the target analytes is provided in Appendix D.

   The risk and regulatory criteria applicable for the DRMO Storage Lot includes the IDEM RISC R-DCLs and I-DCLs; EPA Regions 3, 6, and 9 Residential Regional Screening Levels (R-RSLs) and Risk-Based Migration-to-Groundwater Soil Screening Levels (SSLs); and appropriate ecological criteria. Several sources of ecological risk criteria may be considered. Support documentation for the PSLs is provided in Appendix D.

To conduct comparisons of site data to screening values for surface soil, subsurface soil, sediment, surface water, and groundwater, the subcontracted laboratory should be able to achieve Limits of Quantitation (LOQs) that are low enough to measure constituent concentrations at less than the PSLs. In some cases, this may not be achievable. The rationale for allowing these deviations is described in the footnotes to Worksheet No. 15. The Project Team will accept the laboratory analytical results for these parameters when the PSL is greater than the laboratory's LOQ. Also, in cases where the PSL is between the laboratory's Method Detection Limit (MDL) or Limit of Detection (LOD) and LOQ, the Project Team will accept these analytical results as long as the results are "J" qualified. When the PSL is less than the MDL or LOD for a particular analyte or analytes, an evaluation of detection limits and the impact on data usability will be discussed in the RFI Report. Any limitations on the data will be documented at that time and, if significant data gaps remain, additional data will be collected during the next phase of the investigation, which may require additional sample concentration or alternative methods that provide lower detection limits.

4. Physical: Soil and sediment samples will also be analyzed for pH and total organic carbon (TOC), and well stabilization parameters will be measured during groundwater sampling to support risk calculations, if they become necessary.

5. Background: The background data set for various media at NSA Crane will also be used to determine whether metals present on-site are naturally occurring or are site-related. Background data for the various soil types identified at NSA Crane are described in the *Final Base-Wide Background Soil Investigation Report for NSWC Crane* (Tetra Tech, 2001).

11.3 DEFINE THE STUDY BOUNDARIES

The study will be performed in a phased manner and will address the entire area of SWMU 21 and the adjoining stream, Haynes Branch, as shown on Figure 11-1. One of the objectives of the RFI will be to define the boundaries of the contamination, which will require that both contaminated and non-contaminated media be sampled (i.e., the perimeter of the impacted area must be established).

Phase I

The following items address the horizontal, vertical, and temporal boundaries for Phase I of the study:

1. Horizontal: The horizontal boundary of the study is defined as the outer perimeter of the area where certain process operations took place, based on information from aerial photographs and previous investigations, as identified on Figure 11-1. Horizontally, the entire area of SWMU 21 and Haynes Branch will be investigated. Lateral expansion of this horizontal study boundary may be necessary in Phase II if any target analyte concentrations the Phase I samples collected along this boundary exceed the PSLs.

2. Vertical: The vertical boundary of the study is defined as soil from the surface to the top of the water table, which is estimated at less than 15 feet bgs at the site. Vertically, both surface and subsurface soil will be assessed. The interval of interest for surface soil is 0 to 2 feet bgs. Surface soil samples will be used for direct contact soil risk screening. Subsurface soil samples will be collected at greater than 2 feet bgs and will be used for migration-to-groundwater soil risk screening. The Phase I and Phase II interval of interest for subsurface soil is the biased 1-foot interval between 2 to 15 feet bgs (or the top of the water table, whichever is shallower) that demonstrates the highest FID reading or is selected by the sampler based on visual observations. If there are no elevated FID readings or visual observations that cause a subsurface depth to be selected in a biased manner, then the 4- to 5-foot bgs depth interval will be selected. Vertical expansion (deeper depths) may be necessary if target analyte concentrations in subsurface soil exceed the PSLs. If subsurface soil contamination is observed, samples may be collected into the vadose zone just above the water table, estimated to be less than 15 feet bgs.

3. Surface Water and Sediment: Surface water and co-located sediment are other populations of interest. In particular, surface water at 60 percent of the surface water depth will be targeted for collection. Sediment throughout the stream bed is of interest; however, if sediment is not widely available, depositional areas will be targeted for sampling. Surface water and co-located sediment samples will be collected from Haynes Branch at locations both upstream and downstream of the site. Upstream surface water and co-located sediment is of interest to represent background or upgradient conditions and to assist in the delineation of elevated levels of contaminants, if present.

4. Temporal: All target analyte concentrations are anticipated to be relatively unchanged (stable) over the course of time needed to conduct the environmental investigations and into the foreseeable future; therefore, no temporal constraints exist. SWMU 21 RFI Phase I field activities are scheduled for early 2010. Phase II activities, if deemed necessary, will be conducted in a timely manner.

Phase II

If any results from Phase I samples exceed a PSL and the Project Team deems it necessary, an addendum to this UFP-SAP will be submitted identifying the specific Phase II boundaries based on the Phase I data. The Phase II (second round of sampling) for this RFI is anticipated to potentially include an evaluation of:

- Surface and subsurface soil data from "step-out" locations to define the nature and extent of COPC impact at the site.
- Additional surface and subsurface soil data from random grid locations to support the HHRA and/or ERA at the site.
- Upgradient and downgradient groundwater data within 100 feet of the site.
- Additional surface water and co-located sediment data in Haynes Branch.

Groundwater samples will be collected from temporary wells on the site during the Phase II sampling round, if deemed necessary by the Project Team based on the Phase I data.

The following items address the horizontal, vertical, and temporal boundaries for Phase II of the study:

1. Horizontal: "Step-out" expansion of the original study boundary may be necessary if target analyte concentrations in Phase I samples exceed PSLs.

2. Vertical: The Phase II interval of interest for subsurface soil is the 1-foot interval that is 3 feet below any Phase I surface soil or subsurface soil sample with a PSL exceedance, as long as that depth is above the water table. Additional vertical expansion (deeper depths) may be necessary if target analyte concentrations are detected in subsurface soil at concentrations that exceed PSLs.

3. Additional surface water and co-located sediment samples may be required, if the Phase I samples exceed PSLs, to define the nature and extent of COPCs and to support risk calculations.

4. The groundwater population of interest is groundwater that may have been contaminated by releases from the DRMO Storage Lot, including leaks and other releases from operations. This is generally groundwater located downgradient of the known releases and other operations areas. Upgradient groundwater is also of interest to provide a reference population and to help delineate contamination. Groundwater will be assessed at the site via temporary wells installed during the Phase II sampling round based on the Phase I soil samples that exceed PSLs. Because there are no known monitoring wells in the vicinity, depth to groundwater is not currently known, but it is presumed to be less than 15 feet bgs based on the proximity of surface water in Haynes Branch. If target analytes are identified in groundwater in excess of PSLs, then the need for permanent monitoring wells will be evaluated by the Project Team.

Risk Assessment(s) – Phase II

Risk exposure units (EUs) will be established within areas of SWMU 21 to define where each receptor would be exposed to the various media. Definition of EUs is critical for evaluating exposure to soil by potential human or ecological receptors and will be agreed to by the Project Team based on the Phase I results and incorporated into the Phase II sampling design and rationale. SWMU 21 is approximately 20 acres in size and is too large to represent the area over which, for example, a typical resident might be exposed. The entire area, however, would not be unreasonable as an EU for a trespasser who might roam over large areas.

Specific boundaries for determining exposure point concentrations (EPCs) for soil will be drawn and agreed to by the Project Team to make the 20-acre DRMO Storage Lot site more manageable for assessing potential risk to human health and/or ecological receptors. Known areas of contamination (as determined from Phase I), topographic features, and conclusions drawn from historical records provided the basis for the locations of the EU boundaries. For SWMU 21, the boundaries for soil EUs will be presented in an addendum to this UFP-SAP.

For the purpose of the risk assessment(s), surface soil is defined as soil collected from 0 to 2 feet bgs, and subsurface soil is defined as soil collected between 2 and 15 feet bgs or to the top of the water table, whichever is shallower. For contamination delineation, subsurface soil includes all depths below 2 feet bgs to the top of the water table.

Two general soil populations must be represented in the risk assessment(s). One population is the soil that either represents or could represent risks to humans or ecological receptors as a result of past site activities. This would typically include soil that may have been contaminated directly by site operations or by the subsequent migration of contaminants. The other population is soil that has not been contaminated and therefore represents naturally occurring conditions.

The groundwater population of greatest interest is groundwater that may become or has been impacted by site-related releases. This is generally groundwater located downgradient of locations where chemicals (such as metals, cutting oils, solvents, or PCBs) were known to have leached or leaked into the ground. Upgradient groundwater is also of interest to provide a reference population representing naturally occurring metal concentrations and to also help delineate metals and organic contamination. Groundwater exposure is generally evaluated as a point-source exposure; therefore, to evaluate potential risk associated with exposure to groundwater, the groundwater concentration at any or all given location(s) within the EU will represent the EPC.

Sediment from 0 to 6 inches bgs is the sediment population of interest. Sediment throughout the stream bed is of interest; however, if sediment is not widely available, depositional areas will be targeted for sampling. Upgradient sediment to a depth of 6 inches bgs is also a target population because it represents background or upgradient conditions.

Surface water co-located with sediment is another population of interest. In particular, surface water at 60 percent of the surface water depth is the targeted depth. Upgradient surface water is also of interest to represent background or upgradient conditions.

To evaluate potential risk associated with exposure to surface water and sediment, data collected from all surface water bodies (both surface water and sediment) will be jointly considered to provide the basis for determining the EPCs for these two populations of interest. A limited amount of investigation is also required in areas that are not expected to be contaminated to assist and support delineation of the nature and extent of contamination.

If target analytes in temporary groundwater samples collected during Phase II are detected in excess of PSLs, then the need for permanent monitoring wells will be evaluated by the Project Team as a corrective measure that could include LUCs and long-term monitoring of the site as requirements of a Corrective Measures Study (CMS). Groundwater samples would be collected from a minimum of three permanent wells on the site, if CMS groundwater sampling is deemed necessary.

11.4 DEVELOP THE ANALYTIC APPROACH

The decision statements for each phase of the study are as follows:

Phase I

During Phase I, determine whether chemical concentrations in site media (surface and subsurface soil, sediment, and surface water) exceed the most conservative (lowest) applicable risk-based human health or ecological screening values within and around certain process areas that, based on historical site knowledge and the CSM, are the most likely areas to have been impacted by chemicals at SWMU 21. If chemical concentrations in site media are less than the lowest risk-based screening values, then the Project Team will recommend NFA for the site.

If the applicable risk-based human health or ecological screening values are exceeded but risks are not unacceptable, as determined through the human health and ecological risk screening process, the Project Team will meet to discuss a path forward. Such a path would involve one or more of the following:

- Evaluating Industrial or Non-Default Closure (less conservative) criteria as potential options.
- Developing DQOs for further investigation.
- Addressing exceedances as uncertainties in the risk assessment and CMS.

If any analyte is detected in site media at a maximum concentration that exceeds a risk-based screening value and is greater than the site-specific background concentration (for metals), then the Project Team will meet to discuss a path forward. The Project Team will review the data to determine the tasks that must be performed during Phase II to complete delineation of the nature and extent of contamination and to determine if there is a need to conduct a human health and/or ecological risk assessment. The Project Team will review the analytes that exceed the risk-based screening values based on specific factors that include the following:

- The environmental media that is identified with an exceedance.
- The particular compound(s) that is identified with an exceedance.
- The magnitude of any exceedance, in frequency, distribution of samples, and concentrations as compared to the screening value.

If the lowest risk-based screening criteria are exceeded and the risks are determined to be unacceptable (based on a Project Team decision utilizing the criteria listed above), then proceed with additional work to delineate the nature and extent of contamination. If concentrations exceed the PSLs (or alternative Project Team-selected criteria) on the exterior of the sampling pattern, then recommend additional "step-out" sampling horizontally and vertically from the original sampling pattern to locate the boundaries of concentrations exceeding the Project Team-selected criteria.

The decision rules for Phase I of this investigation are as follows:

1. If target analyte concentrations in all surface soil, subsurface soil, sediment, and surface water samples in the initial round of sampling are less than PSLs, then recommend NFA; otherwise, advance to Rule 2. The target analytes include a specific list of VOCs, PAHs, PCBs, and metals (see Worksheet No. 15).

2. For each target analyte, if the maximum measured concentration in any medium exceeds its human health screening value, then classify the chemical as a human health COPC for that medium and risk type; otherwise, exclude the chemical from further consideration in the risk screening. For each target analyte, if the maximum measured concentration in any medium exceeds its ecological screening value, then classify the chemical as an ecological COPC for that medium and risk type; otherwise, exclude the chemical from further consideration in the risk screening.

3. If any concentrations of a target analyte in the Phase I round of biased (higher potential for impact) and random (perimeter) surface and subsurface soil samples exceed a PSL, then the

Tetra Tech PM will determine in concert with the Project Team the degree to which "step-out" samples (vertical or horizontal) are necessary in Phase II to define the vertical and/or horizontal extent of COPC contamination. Ideally, "step-out" samples should be collected until perimeter sample concentrations are less than PSLs; however, professional judgment will be used to determine if such samples are needed in all cases. Factors considered will include the specific target analyte, magnitude of the exceedance(s), spatial distribution, and overall estimated risk level. The results of Phase I sampling and any professional judgments made regarding the need for "step-out" samples will be reviewed with the Project Team prior to submitting an addendum to this UFP-SAP that will outline the necessary Phase II activities. If "step-out" samples are deemed necessary, collect additional samples as necessary to delineate the nature and extent of contamination as part of Phase II and additional samples as necessary to support a baseline HHRA and/or baseline ERA, and then advance to Rules 4, 5, and 6; otherwise, complete the Phase I RFI Report.

The following rules govern data use for contaminant delineation:

4. If a constituent concentration in any subsurface soil sample on the exterior of the sampling pattern covering the area of interest exceeds IDEM RISC R-DCLs and site-specific background concentrations (for metals), then additional sampling outward will be necessary in Phase II to delineate the contamination. Otherwise, delineation is adequate, and no additional sampling is needed for delineation of the area of interest.

5. If a measured constituent concentration in any surface water or sediment sample on the downstream side or exterior of the sampling pattern exceeds IDEM RISC R-DCLs and site-specific background concentrations (for metals), then additional sampling outward will be recommended to delineate the contamination in Phase II. Otherwise, no additional sampling is needed for delineation of the area of interest.

6. Comparisons to background concentrations will only be used to evaluate metals contamination because the organic target analytes are assumed not to occur naturally. The comparative method will be used, as outlined in the Final Base-Wide Background Soil Investigation Report for NSWC Crane (Background Study), when the soil type present at the site can be determined or matched to a particular soil type considered in the Background Study. The geochemical method will be used as outlined in the Background Study when the soil type present is unknown or cannot be matched to a particular soil type considered in the Background Study.

Phase II

<u>COPC Delineation</u>

During Phase II, determine the nature and extent of COPCs in the site media (surface and subsurface soil, sediment, surface water, and groundwater) that were identified in Phase I. An addendum to this UFP-SAP will be submitted identifying the specific Phase II boundaries based on Phase I data, if any results from the Phase I samples exceed a PSL. Phase II (second round of sampling) of this RFI is anticipated to potentially include an evaluation of:

- Surface and subsurface soil data from "step-out" locations to define the nature and extent of impact at the site.
- Additional surface and subsurface soil data from random grid locations to support the HHRA and/or ERA at the site.
- Upgradient and downgradient groundwater data within 100 feet of the site.
- Additional surface water and co-located sediment data in Haynes Branch

Groundwater samples will be collected from temporary wells during Phase II sampling, if deemed necessary by the Project Team based on Phase I data.

Risk Assessment

To evaluate potential risk associated with exposure to soil, soil data collected across the defined EUs will be used to define EPCs, depending on the receptor for which the risk is being evaluated. For industrial and residential receptors, the soil data collected from subdivided EUs will provide the basis for determining the EPCs. These smaller subunits are more representative of the potential exposure associated with industrial and residential receptors. Trespasser, construction worker, and recreational user EUs will be defined as the entire area encompassed by the fence line surrounding the DRMO Storage Lot. Therefore, data collected across the entire site will provide the basis for determining the EPCs for those receptors.

Soil and sediment are significantly more heterogeneous than surface water or groundwater; consequently, each soil and sediment sample can only be considered representative of the specific sample location from which it was collected. Water samples, because of mixing during movement, are expected to represent the area in which they are collected and areas upgradient of the sample location. Nevertheless, site activities were such that concentration gradients are expected to have developed in all media. Therefore, even though individual samples may only represent a small volume of any particular environmental medium, the concentration gradients are expected to become evident after data collection. These gradients will be used to estimate concentrations between sampling locations, as necessary.

Specific decision statements and details regarding the sampling locations and analytical testing requirements for Phase II and the specific protocols that will be used to complete the HHRA and/or ERA (if deemed necessary based on the results from Phase I) will be tailored to the results from Phase I and will be provided in an addendum to this UFP-SAP.

Data that are considered to be representative of current site conditions, which will include all Phase I samples and any supplemental Phase II samples that are needed to adequately define the levels of risk present on site from target analytes will be used in the risk assessment(s). Human health risks will be developed in accordance with USEPA Risk Assessment Guidance (1989), and ecological risks will be developed in accordance with USEPA Ecological Risk Assessment Guidance (1997).

For soil, average concentrations, as represented by the 95-percent upper confidence limit (UCL) of the mean, will be determined for each EU, specific to the human receptor which it represents. The UCL will be determined using USEPA's ProUCL software (Version 4.00.04, or most current) and will be used to represent the EPC for soil. Surface soil and combined surface and subsurface soil concentrations will be computed for the HHRA. For groundwater, maximum detected concentrations will be used to represent EPCs. For surface water and sediment, average concentrations will be used to represent EPCs.

Contaminant concentrations in subsurface soil samples and sediment samples will be compared directly to IDEM RISC R-DCLs and the site-specific background concentrations.

The decision rules for Phase II of the RFI are as follows:

1. Human receptor EUs will be defined in an addendum to this UFP-SAP based on Phase I results. If target analyte concentrations in the receptor EUs defined for any medium represent an unacceptable human health risk, then proceed to a CMS; otherwise, recommend NFA from a human health perspective. Unacceptable human health risk is defined for this project as an incremental lifetime cancer risk (ILCR) estimate exceeding $1x10^{-4}$ or a non-cancer risk (i.e., hazard index [HI]) exceeding 1 (on a target-organ specific basis). The 95-percent UCL on the arithmetic mean will be calculated for the EU and compared to the applicable PSL. If the ILCR for any human health receptor in any EU is greater than 1×10^{-6} but less than 1×10^{-4}, and the HI is less than 1.0, then site-specific assumptions and exposure factors will be considered to further evaluate the risks and further evaluate the estimated size of the affected area (e.g., hot spots, constituents of concern) to determine the cost-effectiveness of risk mitigation. If it is cost-effective to mitigate risk within this range, then the risk will be mitigated. Otherwise, NFA will be needed to satisfy IDEM requirements. The Project Team will use professional judgment when making this decision.

2. Ecological receptor EUs will be defined in an addendum to this UFP-SAP based on Phase I results. For the ERA, average concentrations (arithmetic means) of surface soil data or sediment data will be used in food-chain modeling. If risks for defined ecological receptor EUs are determined to be unacceptable based on an evaluation of several lines of evidence (e.g., number of exceedances of screening criteria, magnitude of the exceedances of screening criteria, spatial distribution of data, home range, background concentrations, etc.), then the Project Team will evaluate the potential risks with respect to remedial actions and proceed to a CMS; otherwise, recommend NFA from an ecological perspective.

    - If the screening-level ERA indicates that the hazard quotient (HQ) is less than 1, NFA is needed to protect ecological receptors. If the HQ is greater than 1 but less than 10, site-specific factors will be considered by the Project Team when evaluating the potential for mitigation. If it is cost-effective to mitigate risk within this range, then risk will be mitigated. Otherwise, the baseline ERA will be conducted.
    - If after completing a baseline ERA, the risks are acceptable, then NFA is needed to protect ecological receptors. Otherwise, another work plan will be developed to define additional data needs for derivation of site-specific preliminary ecological remediation goals.
    - If there is no unacceptable risk but contaminant concentrations in subsurface soil or sediment exceed the IDEM RISC R-DCLs, then the Project Team will to discuss a path forward. Applicability of RCRA and IDEM rules and regulations will need to be determined based on the concentrations of contaminants present.
    - If measured contaminant concentrations in groundwater suggest that a contaminant source exists in the soil (as evident by detectable organic chemicals with spatial patterns pointing upgradient to a point of origin, or metals concentrations that appear to exceed background concentrations), then additional soil sampling will be recommended to delineate the source areas as a later step. Otherwise, no additional sampling is needed.

3. For target analytes detected in groundwater in Phase II, if the maximum measured concentration of any target analyte exceeds the PSL, then the need to install permanent groundwater monitoring wells to assess and monitor long-term groundwater conditions at the site will be considered by the Project Team as part of a corrective remedy.

Contaminant concentrations for each sample location will be plotted on a map of EUs, and concentrations exceeding IDEM RISC R-DCLs and site-specific background concentrations (for metals) will be identified.

11.5 SPECIFY PERFORMANCE OR ACCEPTANCE CRITERIA

Phase I

Because Phase I sample locations depend heavily on biased sampling, probability limits for false positive and false negative decision errors were not established for Phase I. Simple comparisons of measured concentrations to PSLs and background concentrations (for metals) will be used. Sample locations were selected to determine the nature of surface and subsurface soil contamination from areas most likely to be contaminated. This biased selection of sample locations does not support the use of quantitative statistics to estimate decision performance as specified in the USEPA QA/G-4, QA/G-5, and QA/G-5S DQO guidance documents (USEPA, 2006, 2002a, and 2002b, respectively). Instead, the Project Team will use the results of the Phase I activities to determine whether the amount and type of data collected are sufficient to support the attainment of the PQOs. This will involve an evaluation of contaminant concentrations and an evaluation of uncertainty for those contaminants that have PSLs less than MDLs to ensure that contaminants are likely to have been detected if present.

Phase II

Phase II performance and acceptance criteria will be defined in an addendum to this UFP-SAP. The Phase II RFI will include a sampling program to determine the nature and extent of any COPCs, as identified as a result of Phase I activities. If necessary, Phase II will also include a sampling program that is designed to collect sufficient data to perform a baseline HHRA and/or baseline ERA. The following information is provided as an example of the details that will be addressed more completely in the UFP-SAP Addendum.

Setting the Baseline and Alternate Conditions. The null hypothesis (i.e., baseline condition) assumes that the defined EUs, based on current conditions, would result in unacceptable risks (e.g., the EPCs are greater than PSLs; the site is "dirty"). The alternate hypothesis assumes that the defined exposure conditions, based on current conditions, would result in acceptable risks (e.g., the EPCs are not greater than PSLs; the site is not "dirty"). Unless there is conclusive information from the collected data to reject the null hypothesis (i.e, the site is "dirty") for the alternative hypothesis (i.e., the site is "clean"), it is assumed that the baseline condition is true.

Determining the Impact of Decision Errors. A "false acceptance decision error" corresponds to deciding that the site condition is unacceptable (i.e., null hypothesis is not rejected) when in reality it is not (i.e., null hypothesis is false). In contrast, a "false rejection decision error" corresponds to deciding that the site condition is not unacceptable (i.e., null hypothesis is rejected in favor of the alternate hypothesis) when in reality it is (i.e., null hypothesis it true). The following consequences of each decision error are:

- The primary consequence of making a false acceptance decision error (Type II Error, β) is the additional cost associated with remediating a site that is not "dirty".
- The primary consequence of making a false rejection decision error (Type I Error, α) is that NFA would occur at the site when in fact there is an unacceptable risk associated with exposure to contaminated media. This could result in potential harm to human and ecological receptors.

Because a potential risk to human health and ecological receptors outweighs the consequences of having to pay for more remediation than is necessary, it was concluded that when the true risk (or true constituent concentrations) is near the target risk (or action levels), making a false rejection decision error would lead to more severe consequences than making a false acceptance decision error, so there is typically less tolerance for this type of decision error.

Specifying the "Gray Region" for the Problem's Decision Performance Curve. A gray region was designated as that area immediately below and adjacent to the target risk (or action level) where it is considered that the consequences of a false acceptance decision error would be minimal. The DQO planning team may decide that the lower bound of the gray region would be at 80 percent of the action level. Within this region, it is more cost-effective to accept that remedial action is necessary than to collect more samples to discriminate between the site mean and the action level.

Completing the Decision Performance Curve by Setting Tolerable Decision Error Limits. As a starting point, the DQO planning team may decide that the ideal false rejection decision error limit would be 0.05 (5 percent) at the target risk level (or action level). The DQO planning team may also decide that the ideal false acceptance decision error limit would be 0.20 (20 percent) for possible values of the true risk (or true contaminant concentrations) being less than 80 percent of the target risk (or action level). It is recognized that these ideals may be unrealistic in terms of cost of sampling. Also recognized, however, is that reduced sampling leads to less confidence that the correct decision is made even though a decision error might not have been made. It is impossible to know whether a decision error has been made; it is only possible to recognize the potential for making an error and to control that potential by establishing tolerable decision error limits.

Determining the Minimum Number of Samples. The process of determining a minimum sample size relies on an estimate of total variability in the data to be collected. If an existing study can provide a reasonable estimate of variability, this helps to reduce the number of samples required to achieve the decision error tolerances established above. If only a reasonable guess can be made to estimate the variability, the estimate should be conservative (i.e., larger than the actual variability) to ensure against underestimating the sample size. This estimate of total variability is used as an input to formulas and tables that would provide minimum sample sizes necessary to achieve desired statistical power. The results from the Phase I sampling event will be used to estimate the variability in the data for each target analyte that exceeded a PSL.

The most current version of Visual Sample Plan (VSP), a software tool developed by USEPA and the Department of Energy (located at http://vsp.pnl.gov/) for estimating the minimum number and locations of environmental samples such that the results of statistical analyses of the resulting data have the desired confidence for decision making, will be used in the UFP-SAP Addendum to determine the number of soil samples necessary in Phase II, based on the COPC data obtained from Phase I, to adequately investigate the nature and extent of contamination at SWMU 21 and to support the baseline HHRA and/or ERA, if necessary. The following key assumptions and performance/acceptance criteria will be used to determine the number of soil samples:

- For purposes of statistical analysis, the "null hypothesis" is that the site is "dirty" (i.e., the mean target analyte concentration at the site exceeds the action level selected for statistical analysis).

- S (Sigma) = the standard deviations for each Decision Unit will be estimated by querying the database of Phase I results and calculating actual standard deviations for each target analyte based on groups of samples that were within ½-acre plots. The highest (most conservative) standard deviation for a Decision Unit will be determined based on an evaluation of Phase I data.

- Delta = the width of the gray region is the difference between the expected mean concentration and action level. Based on querying the database of Phase I results and calculating mean concentrations, the expected mean concentration will be determined and used to calculate this variable.

- Alpha = the tolerance for concluding that the site is "clean" when the site is actually "dirty." If an incorrect decision is to be made, the Project Team prefers to incorrectly take action to remediate a "clean" site rather than to fail to take action at a "dirty" site. Therefore, the tolerance for concluding that this site is "clean" when the concentration is actually greater than the action level is set at 10 percent.

- Beta = the tolerance for concluding that the site is "dirty" when the site is actually "clean" is also established considering the tolerance for incorrectly concluding that the site mean is greater than the action level when it is actually less than the action level and is set to 20 percent. This beta value is greater than the alpha value because there is more tolerance for this type of error than for the error of not taking action when a site is "dirty."

- The lower bound of the gray region (LBGR) presented in terms of a percentage of the action level: 80 percent.

- The action level of each target analyte that has one or more Phase I results that exceed an applicable PSL will be used for this statistical analysis to determine the most conservative value.

The results of the statistical analysis will be provided in the SAP Addendum for Phase II activities to demonstrate the minimum of samples that should be collected across each of the designated area(s) to be sampled and for which a decision must be made. The sampling design will be based on this recommended number of samples and samples necessary to determine the boundaries of contamination and potential remedial areas. All analytical data collected per the sampling design should meet the QA criteria established in Worksheet Nos. 19 through 37 and the prescribed detection limit requirements for each COPC.

11.6 DEVELOP THE PLAN FOR OBTAINING DATA

Based on the information presented above, a detailed plan was developed to obtain the necessary data to answer the problem for the Phase I RFI. The sampling design and rationale for all Phase I samples that will be collected are provided in Worksheet No. 17.

SAP Worksheet No. 12 -- Measurement Performance Criteria Table – Field Quality Control 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)
Trip Blank	VOCs	One per cooler of VOC samples shipped to laboratory	Accuracy/Bias/ Contamination	No analytes > ½ LOQ, except common laboratory contaminants, which must be < LOQ.	S & A
Field Blank	All analytical groups	One per analysis per lab	Accuracy/Bias/ Contamination	No analytes > ½ LOQ, except common laboratory contaminants, which must be < LOQ.	S & A
Equipment Rinsate Blank	All analytical groups	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
Filtered Rinsate Blank	Dissolved Metals (if necessary due to high turbidity)	One per filter brand[2]	Accuracy/Bias/ Contamination	No analytes > ½ LOQ, except common laboratory contaminants, which must be < LOQ.	S & A
Field Duplicate (FD)	All analytical groups	One per 10 field samples per matrix	Precision	Values > 5X LOQ: Relative Percent Difference (RPD) ≤30% [3,4].	S & A
Temperature Indicator	All analytical groups	One per cooler	Representativeness	Temperature must be between 0 and 6 degrees Celsius (0 to 6 °C).	S

1 Equipment rinsate blanks will be collected if non-dedicated submersible pumps or other equipment are used.
2 A filtered rinsate blank will be collected if filtered samples (i.e., dissolved metals) are collected.
3 If duplicate values for non-metals are < 5x LOQ, the absolute difference should be < 2x LOQ.
4 If duplicate values for metals are < 5x LOQ, the absolute difference should be < 4x LOQ.

SAP Worksheet No. 13 -- Secondary Data Criteria and Limitations Table

(UFP-QAPP Manual Section 2.7)

Secondary Data	**Data Source** (originating organization, report title and date)	**Data Generator(s)** (originating organization, data types, data generation/ collection dates)	**How Data Will Be Used**	**Limitations on Data Use**
Preliminary Review/Visual Site Inspection	A.T. Kearny, *Preliminary Review/Visual Site Inspection Report,* March 1987.	A.T. Kearny, Site Description, March 1987.	Background Information, Development of CSM	Only used to provide historical data on site; conclusions in report were found to be unreliable.
Soil Sampling Report	Comarco Systems, *DRMO Scrap Yard Soil Sampling Report,* December 1997	Comarco Systems, Six surface soil and eight subsurface soil sampling locations, December 1997	Background Information, Development of CSM and COPCs	Used to provide historical data on the site; samples were analyzed only for the eight RCRA metals and for PCBs.
Soil Sampling Investigation	SAIC, *Soil Sampling Investigation for Structures Scheduled for Demolition at Naval Support Activity Crane,* March 2009	SAIC, Six soil samples to support removal of metals balers, March 2009	Background information, Development of CSM and COPCs	Used to provide historical data on the site; samples were collected only in areas surrounding two metals balers and were analyzed only for the eight RCRA metals and for PCBs.

SAP Worksheet No. 14 -- Summary of Project Tasks

(UFP-QAPP Manual Section 2.8.1)

14.1 FIELD INVESTIGATION TASK PLAN

The field tasks are summarized below. A short description of these tasks is also provided.

- Mobilization/Demobilization
- Site-Specific Health and Safety Training
- Utility Clearance
- Monitoring Equipment Calibration
- Sample Collection Tasks
- Surface and Subsurface Soil Sampling
- Surface Water and Sediment Sampling
- Groundwater Well Installation and Development
- Groundwater Sampling
- Investigation-Derived Waste (IDW) Management
- Global Positioning System (GPS) Locating
- Field Decontamination Procedures
- Field Documentation Procedures

Mobilization/Demobilization

Mobilization will consist of the delivery of all equipment, materials, and supplies to the site, complete assembly in satisfactory working order of all such equipment at the site, and satisfactory storage at the site of all such materials and supplies. Tetra Tech will coordinate with the Navy to identify appropriate locations for the storage of equipment and supplies. Site-specific health and safety training for all Tetra Tech subcontractors will be provided as part of site mobilization.

Demobilization will consist of the prompt and timely removal of all equipment, materials, and supplies from the site following completion of the work.

Site-Specific Health and Safety Training

There are no specialized/non-routine project-specific training requirements or certifications needed by personnel to successfully complete the project or tasks. All field personnel will have appropriate training to conduct the field activities to which they are assigned. Each site worker will be required to have completed the OSHA 40-hour course (and 8-hour refresher, if applicable) in health and safety training. Safety requirements are addressed in greater detail in the site-specific HASP.

Utility Clearance

Prior to commencing any work at NSA Crane, the Comprehensive Work Approval Process (CWAP) will be followed. The CWAP will identify constraints in the work area, such as the locations of eagle's nests, archaeological sites, wetlands, etc., that may affect work at the site and other requirements that must be met prior to commencing work. One week prior to the commencement of any subsurface intrusive activities, the Tetra Tech FOL or designee will contact Indiana Underground Plant Protection Services (IUPPS) to complete a utility clearance ticket for the areas under investigation. Work permits, if required by the facility, will be obtained prior to conducting field activities. The Tetra Tech FOL will be responsible for coordinating these activities.

Monitoring Equipment Calibration

Monitoring equipment calibration procedures are described in Worksheet No. 22.

Sample Collection Tasks

Site-specific Standard Operating Procedures (SOPs) have been developed for field activities at NSA Crane, including sample collection tasks, which are located in Appendix A. Sample labeling will be in accordance with SOP-02 (Sample Labeling, Appendix A), and the sample numbering scheme will be in accordance with SOP-03 (Sample Identification and Nomenclature, Appendix A). Methods for recording data will be in accordance with SOP-04 (Sample Custody and Documentation of Field Activities, Appendix A), and the selection of sample containers, sample preservation, packaging, and shipping will be in accordance with SOP-05 (Sample Preservation, Packaging, and Shipping, Appendix A).

The sampling and analysis program is outlined in Worksheet No. 18, and the sampling requirements for each type of analyses (i.e., bottleware, preservation, holding time) are listed in Worksheet No. 19. Field and laboratory QC samples will also be collected as outlined in Worksheet No. 20.

Surface and Subsurface Soil Sampling

Surface soils at NSA Crane are identified as the top two feet of soil (from 0 to 2 feet bgs). Surface soil does not include surface pavement and the ground surface will begin at the bottom of a pavement or gravel layer. At the gravel layer area of the DRMO Storage Lot site, the surface soil of interest consists of the native soil immediately below the imported gravel that has been placed on top of the soil to make the surface usable for its intended purpose. Due to an unknown and expected to be variable depth of gravel, the top of the surface soil boundary will be determined in the field on a location-specific basis. "Ground" will begin where more than two-thirds of the material is soil or small particle material, based on a visual assessment by the sampler. This depth will be recorded by the sampler in the logbook. Surface soil is expected to begin approximately 6" to 18" below the top (surface) of the pavement or gravel layer at the DRMO Storage Lot, and extend 2 feet below that depth. If an HHRA or an ERA is deemed necessary, the Risk Assessment Report will discuss how these particular samples were addressed in the assessment(s) with regard to potential exposure and actual risk.

Soil samples will be collected in accordance with SOP-07 (Soil Coring and Sampling Using Hand Auger Techniques, Appendix A) and SOP-11 (Subsurface Soil Sampling Using DPT, Appendix A). Surface soil samples (from 0 to 2 feet bgs) will be collected with a hand auger, backhoe, or DPT, depending on site conditions. Sample jars will be filled using either a decontaminated stainless steel trowel or dedicated disposable plastic trowel. Because of the unknown thickness and quality of the gravel layer, a backhoe may be used to excavate the gravel layer and expose the surface soil layer for sampling. Subsurface soil samples will be collected using a DPT rig, DPT rig with auger, or backhoe, and stainless steel or disposable trowel. The subsurface soil borings will be described by the Site Geologist in accordance with SOP-08 (Soil Sample Logging, Appendix A) and will be screened for evidence of contamination with an FID. Use of the FID will be in accordance with the manufacturer's instructions. Any qualitative visual signs of potential contamination (such as soil staining) will be noted on the soil boring log.

Surface Water and Sediment Sampling

The surface water sampling procedures discussed in SOP-18 (Surface Water Sampling, Appendix A) and the sediment sampling procedures discussed in SOP-09 (Sediment Sampling, Appendix A), will be followed.

Groundwater Well Installation and Development

The groundwater well installation procedure discussed in SOP-11 (Subsurface Soil Sampling Using DPT, Appendix A), SOP-12 (Monitoring Well Installation, Appendix A) and the groundwater development procedure discussed in SOP-13 (Monitoring Well Development, Appendix A), will be followed if groundwater well installation is necessary.

Groundwater Sampling

The groundwater sampling procedures discussed in SOP-14 (Measurement of Water Levels, Appendix A), SOP-15 (Low Flow Well Purging and Stabilization, Appendix A), SOP-16 (Monitoring Well Sampling, Appendix A), and SOP-17 (Calibration and Care of Water Quality Meters, Appendix A), will be followed, if groundwater sampling is necessary.

Investigation-Derived Waste Management

It is not anticipated that significant volumes of solid or semi-solid IDW in the form of soil or sediment will be generated during field activities, including installation of temporary groundwater monitoring wells or collection of subsurface samples using DPT or backhoe excavations. Soil will be replaced into the excavation from which it was excavated. If gross contamination is encountered (e.g., any non-soil contaminated material such as free product or soil with FID readings greater than 100 parts per million [ppm]), then excavation will cease. Any grossly contaminated material that is brought to the surface will not be returned to the excavation but will be segregated from other excavated soil and placed on a plastic liner. The grossly contaminated material will be securely staged until arrangements are made for proper off-site disposal.

IDW that is generated, including personal protective equipment (PPE) and decontamination fluids, will be handled in accordance with SOP-10 (Management of Investigation-Derived Waste, Appendix A).

Global Positioning System Locating

A GPS unit will be used to locate all sampling points in accordance with SOP-01 (Global Positioning System, Appendix A). The GPS equipment will be checked on control monuments before and after day's use, and these checks will be documented in the field notebook. To ensure sub-meter accuracy, the GPS SOP requires a minimum of six satellites to capture a position.

Field Decontamination Procedures

Sample containers will be provided certified clean (I-Chem 300 or equivalent) from CompuChem. Decontamination of sampling equipment will not be necessary for this project if only dedicated and disposable hand trowels will be used. However, if decontamination is necessary, the requirements outlined in this section will apply. Decontamination of reusable sampling equipment (e.g., non-disposable hand trowels, hand augers, or DPT or backhoe equipment) will be conducted prior to sampling and between samples at each location. Decontamination of equipment will be conducted according to the sequence established in SOP-06 (Decontamination of Field Sampling Equipment, Appendix A).

If a backhoe is used, decontamination of the excavator bucket will be performed over the completed backfilled excavation using a high-pressure spray washer with water supplied by the base. All decontamination water will be allowed to infiltrate to the excavation. If free product is encountered, the excavator bucket wash water will be captured and containerized for sampling and appropriate disposal according to the analysis results.

Field Documentation Procedures

Field documentation will be performed in accordance with SOP-04 (Sample Custody and Documentation of Field Activity, Appendix A).

A summary of all field activities will be properly recorded in a bound logbook with consecutively number 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 form numbers, air bill numbers, carriers, times, and dates.
- Descriptions of borehole activities and operations.
- Descriptions of monitoring well installation activities and operations, if monitoring wells are deemed necessary.
- Health and safety issues.
- Description of photographs including date, time, photographer, picture number, location, and compass direction of each photograph.

All logbook 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, and the person making the correction will initial and date the change.

Sample Custody and Shipment Tasks

Sample custody and shipment tasks are defined in SOP-05 (Sample Preservation, Packaging, and Shipping, Appendix A) and are discussed in Worksheet No. 27.

14.2 ADDITIONAL PROJECT-RELATED TASKS

Additional project-related tasks include:

- Analytical tasks
- Data generation procedures
- Data handling and management
- Data tracking and control
- Assessment and oversight
- Data review
- Project reports

Analytical Tasks - Chemical analyses for select VOCs, PAHs, PCBs, metals, and TOC will be performed by CompuChem, which is a DoD Environmental Laboratory Accreditation Program (ELAP) laboratory. A copy of the DoD ELAP accreditation for CompuChem is included in Appendix B. Analyses will be performed in accordance with the analytical methods identified in Worksheet No. 30. CompuChem will meet the PSLs specified in Worksheet No. 15 and will perform the chemical analyses following laboratory-specific SOPs (see Worksheet Nos. 19 and 23) that were developed based on the methods listed in Worksheet Nos. 19 and 30. Copies of 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 associated electronic data deliverables (EDDs). 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 RFI Report.

The analytical data packages will be fully validatable and contain raw data, summary forms for all sample and laboratory method blank data, and summary forms containing all method specific quality control (results, recoveries, relative percent differences, relative standard deviations, and/or percent differences etc.).

Data Generation Procedures

- Project documentation and records include the following:
  - Field sample collection and field measurement records as described in Worksheet Nos. 27 and 29.
  - Laboratory data package deliverables as described in the analytical specifications.
  - Data assessment documents and records as listed in Worksheet No. 29.
- Data recording formats are described in Worksheet No. 27.

Data Handling and Management - After the RFI is completed, the field sampling log sheets will be organized by date and medium and filed in the project files. The field logbooks for this project will be used only for this site 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 CompuChem will meet the requirements of the technical specifications. The electronic data results will be automatically downloaded into the Tetra Tech database in accordance with the proprietary Tetra Tech processes.

Data Tracking and Control - The Tetra Tech PM (or designee) is responsible for the overall tracking and control of data generated for the project.

- **Data Tracking**. Data are tracked from generation to archiving in the Tetra Tech project-specific files. The Tetra Tech Project Chemist (or designee) is responsible for tracking the samples collected and shipped to CompuChem. Upon receipt of the data packages from CompuChem, the Tetra Tech 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 CompuChem.

- **Data Storage, Archiving, and Retrieval**. The data packages received from CompuChem are tracked in the data validation logbook. After the data are validated, the data packages are entered into the Tetra Tech Navy CLEAN file system and archived in secure files. The field records including field log books, sample logs, chain-of-custody records, and field calibration logs will be submitted by the Tetra Tech FOL to be entered into the Navy 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 Tetra Tech.

- **Data Security**. Access to Tetra Tech project files is restricted to designated personnel only. Records can only be borrowed temporarily from the project file using a sign-out system. The Tetra Tech Data Manager maintains the electronic data files, and 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 No. 32 for assessment findings and corrective actions and to Worksheet No. 33 for QA Management Reports.

Data Review - Data verification is described in Worksheet No. 34, data validation is described in Worksheet Nos. 35 and 36, and usability assessment is described in Worksheet No. 37.

Project Reports – Draft and final versions of project reports will be prepared and submitted to the Navy and IDEM for review. The reports will include the following sections:

- Executive Summary – will include a brief description of the work conducted and the findings.

- Introduction and Background – will include a description of the history of operations and activities at the site and a summary of any previous investigations and removal actions.

- Description of Field Investigations – will include a summary of the work performed in accordance with the approved UFP-SAP and any field modifications as documented by the Tetra Tech FOL. This section will include maps showing the sampling locations and tables summarizing the data collected.

- Data Quality – will include a summary of quantitative analytical performance indicators such as completeness, precision, bias, and sensitivity and qualitative indicators such as representativeness and comparability. This section includes a reconciliation of project data with the DQOs and an identification of deviations from this UFP-SAP.

  A data usability assessment will be used to identify significant deviations in analytical performance that could affect the ability to meet project objectives. The elements of this review are presented in Worksheet No. 37.

- Nature and Extent of Contamination – will include a discussion of the contamination detected in each medium sampled in relation to the CSM of the site. This section will note the removals previously conducted (if applicable), contamination addressed, and any additional contaminants found during this field effort. Detected contaminant concentrations will be tabulated for each medium and depicted on maps.

- Contaminant Fate and Transport – will include a description of the contaminants detected and their behavior in soil, bedrock, groundwater, surface water, and sediment, particularly with emphasis on the future migration of these contaminants to any possible exposure areas.

- Summary and Conclusions – includes a summary of the findings, conclusions as to whether delineation of contamination is adequate, and recommendations for further investigations, if needed.

Tetra Tech will submit the draft report and respond to comments received on the draft report before any additional sampling begins. The final version of the report will submitted in hardcopy and electronic format to the project stakeholders.

SAP Worksheet No. 15 -- Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

Matrix: Surface Soil (depth: 0 to 2 feet)
Analytical Group: Select VOCs

Analyte	CAS Number	Project Screening Levels (µg/kg)		Project Screening Level References[1]	Project Quantitation Limit Goal (µg/kg)	CompuChem	
		HHRA	ERA	HHRA / ERA		LOQ (µg/kg)	MDL (µg/kg)
Benzene	71-43-2	34	255	IDEM R-DCL / R5 ESL	11	5.0	1.00
Toluene	108-88-3	12,000	5,450	IDEM R-DCL / R5 ESL	1,800	5.0	1.00
Ethylbenzene	100-41-4	5,700	5,160	R-RSL / R5 ESL	1,700	5.0	1.00
Xylenes (total)	1330-20-7	60,000	10,000	R-RSL / R5 ESL	3,300	5.0	1.00
Chloromethane	74-87-3	12,000	10,400	R-RSL / R5 ESL	3,400	5.0	1.09
Vinyl chloride	75-01-4	13	646	IDEM R-DCL / R5 ESL	4.3	5.0	1.09
Chloroethane	75-00-3	650	None	IDEM R-DCL / ---	210	5.0	1.00
1,1-Dichloroethene	75-35-4	58	8,280	IDEM R-DCL / R5 ESL	29	5.0	1.00
trans-1,2-Dichloroethene	156-60-5	680	784	IDEM R-DCL / R5 ESL	220	5.0	1.00
1,1-Dichloroethane	75-34-3	3,400	20,100	R-RSL / R5 ESL	1,100	5.0	1.00
cis-1,2-Dichloroethene	156-59-2	400	784	IDEM R-DCL / R5 ESL	130	5.0	1.00
1,1,1-Trichloroethane	71-55-6	1,900	29,800	IDEM R-DCL / R5 ESL	630	5.0	1.00
1,2-Dichloroethane	107-06-2	24	21,200	IDEM R-DCL / R5 ESL	8.0	5.0	1.00
Trichloroethene	79-01-6	57	12,400	IDEM R-DCL / R5 ESL	19	5.0	1.00
1,1,2-Trichloroethane	79-00-5	30	28,600	IDEM R-DCL / R5 ESL	10	5.0	1.00
Tetrachloroethene	127-18-4	58	9,920	IDEM R-DCL / R5 ESL	29	5.0	1.64
1,1,2,2-Tetrachloroethane	79-34-5	7	127	IDEM R-DCL / R5 ESL	2.3	5.0	1.00

1 Surface soil screening references: R-RSL – USEPA Regions 3, 6 and 9 Regional Screening Level (RSL), Direct Contact Residential (2009a); IDEM R-DCL – IDEM Residential Default Closure Level (2009); R5 ESL – USEPA Region 5 Ecological Screening Level (2003a). Refer to Appendix D for further explanation and justification of PSLs.
µg/kg – Micrograms per kilogram.

Matrix: Surface Soil (depth: 0 to 2 feet)
Analytical Group: Low-Level TCL PAHs by Selected Ion Monitoring (SIM)

Analyte	CAS Number	Project Screening Levels (µg/kg)		Project Screening Level References(1)	Project Quantitation Limit Goal (µg/kg)	CompuChem	
		HHRA	ERA	HHRA / ERA		LOQ (µg/kg)	MDL (µg/kg)
Naphthalene	91-20-3	700	29,000	IDEM R-DCL / Eco SSL	230	8.3	0.72
2-Methylnaphthalene	91-57-6	3,100	29,000	IDEM R-DCL / Eco SSL	1,000	8.3	0.68
Acenaphthylene	208-96-8	18,000	29,000	IDEM R-DCL / Eco SSL	6,000	8.3	0.53
Acenaphthene	83-32-9	130,000	29,000	IDEM R-DCL / Eco SSL	9,600	8.3	0.60
Fluorene	86-73-7	170,000	29,000	IDEM R-DCL / Eco SSL	9,600	8.3	0.45
Phenanthrene	85-01-8	13,000	29,000	IDEM R-DCL / Eco SSL	4,300	8.3	1.3
Anthracene	120-12-7	1,700,000	29,000	R-RSL / Eco SSL	9,600	8.3	0.43
Fluoranthene	206-44-0	230,000	29,000	R-RSL / Eco SSL	9,600	8.3	1.3
Pyrene	129-00-0	170,000	1,100	R-RSL / Eco SSL	370	8.3	0.57
Benzo(a)anthracene	56-55-3	150	1,100	R-RSL / Eco SSL	50	8.3	0.55
Chrysene	218-01-9	15,000	1,100	R-RSL / Eco SSL	370	8.3	0.63
Benzo(b)fluoranthene	205-99-2	150	1,100	R-RSL / Eco SSL	50	8.3	0.57
Benzo(k)fluoranthene	207-08-9	1,500	1,100	R-RSL / Eco SSL	370	8.3	0.43
Benzo(a)pyrene	50-32-8	15	1,100	R-RSL / Eco SSL	5.0	8.3	0.38
Indeno(1,2,3,-cd)pyrene	193-39-5	150	1,100	R-RSL / Eco SSL	50	8.3	0.37
Dibenzo(a,h)anthracene	53-70-3	15	1,100	R-RSL / Eco SSL	5.0	8.3	0.33
Benzo(g,h,i)perylene	191-24-2	170,000	1,100	R-RSL / Eco SSL	370	8.3	0.38

1 Surface soil screening references: R-RSL – USEPA Regions 3, 6 and 9 Regional Screening Level, Direct Contact Residential (2009a); IDEM R-DCL – IDEM Residential Default Closure Level (2009); Eco SSL – USEPA's Ecological Soil Screening Levels (2008). Refer to Appendix D for further explanation and justification of PSLs.

µg/kg – Micrograms per kilogram.

Matrix: Surface Soil (depth: 0 to 2 feet)
Analytical Group: TCL PCB Aroclors and Total PCBs

Analyte	CAS Number	Project Screening Levels (µg/kg)		Project Screening Level References[1]	Project Quantitation Limit Goal (µg/kg)	CompuChem	
		HHRA	ERA	HHRA / ERA		LOQ (µg/kg)	MDL (µg/kg)
Aroclor-1016	**12674-11-2**	390	**0.332**	R-RSL / **R5 ESL**	**0.11**	**75**	**23.7**
Aroclor-1221	**11104-28-2**	170	**0.332**	R-RSL / **R5 ESL**	**0.11**	**60**	**20.3**
Aroclor-1232	**11141-16-5**	170	**0.332**	R-RSL / **R5 ESL**	**0.11**	**25**	**7.50**
Aroclor-1242	**53469-21-9**	220	**0.332**	R-RSL / **R5 ESL**	**0.11**	**35**	**11.2**
Aroclor-1248	**12672-29-6**	220	**0.332**	R-RSL / **R5 ESL**	**0.11**	**25**	**7.50**
Aroclor-1254	**11097-69-1**	110	**0.332**	R-RSL / **R5 ESL**	**0.11**	**20**	**6.67**
Aroclor-1260	**11096-82-5**	220	**0.332**	R-RSL / **R5 ESL**	**0.11**	**30**	**10.0**
Total PCBs	NA	1,800	---	IDEM R-DCL / ---	600	NA	NA

1 Surface soil screening references: R-RSL – USEPA Regions 3, 6 and 9 Regional Screening Level, Direct Contact Residential (2009a); IDEM R-DCL – IDEM Residential Default Closure Level (2009); R5 ESL – USEPA Region 5 Ecological Screening Level (2003a). Refer to Appendix D for further explanation and justification of PSLs.

Bolded compounds indicate that the lowest PSL is between the laboratory LOQ and MDL. Bolded and shaded compounds indicate that the lowest PSL is less than both the laboratory LOQ and the MDL. All results will be reported to detection limits and any limitations on data use that result from having detection limits that are greater than PSLs will be described in the Phase I RFI Report.

µg/kg – Micrograms per kilogram.

Matrix: Surface Soil (depth: 0 to 2 feet)
Analytical Group: TAL Metals

Analyte	CAS Number	Project Screening Levels (mg/kg)		Project Screening Level References[1]	Project Quantitation Limit Goal (mg/kg)	CompuChem	
		HHRA	ERA	HHRA / ERA		LOQ (mg/kg)	MDL (mg/kg)
Aluminum	7429-90-5	7,700	None	R-RSL / ---	25,000	20	3.5
Antimony	**7440-36-0**	3.1	**0.27**	R-RSL / **Eco SSL**	**0.047**	**1**	**0.18**
Arsenic	**7440-38-2**	**0.39**	18	**R-RSL** / Eco SSL	**0.13**	**1**	**0.21**
Barium	7440-39-3	1,500	330	R-RSL / Eco SSL	110	20	0.097
Beryllium	7440-41-7	16	21	R-RSL / Eco SSL	5.3	0.5	0.037
Cadmium	**7440-43-9**	7.0	**0.36**	R-RSL / **Eco SSL**	**0.12**	**0.5**	**0.023**
Calcium	7440-70-2	None	None	--- / ---	---	500	4.3
Chromium	7440-47-3	23	26	R-RSL / Eco SSL	8.6	1	0.049
Cobalt	7440-48-4	2.3	13	R-RSL / Eco SSL	0.76	0.5	0.140
Copper	7440-50-8	310	28	R-RSL / Eco SSL	9.3	0.5	0.150
Iron	7439-89-6	5,500	None	R-RSL / ---	2,800	10	1.3
Lead	7439-92-1	81	11	IDEM R-DCL / Eco SSL	3.6	0.3	0.12
Magnesium	7439-95-4	None	None	--- / ---	---	500	0.610
Manganese	7439-96-5	180	220	R-RSL / Eco SSL	60	1	0.043
Mercury	7439-97-6	2.1	0.10	IDEM R-DCL / R5 ESL	0.033	0.1	0.011
Nickel	7440-02-0	150	38	R-RSL / Eco SSL	12	0.5	0.062
Potassium	7440-09-7	None	None	--- / ---	---	500	0.97
Selenium	7782-49-2	5.2	0.52	IDEM R-DCL / Eco SSL	0.17	0.5	0.3
Silver	7440-22-4	31	4.2	IDEM R-DCL / Eco SSL	1.4	0.5	0.053
Sodium	7440-23-5	None	None	--- / ---	---	500	17.9
Thallium	**7440-28-0**	**0.51**	**0.0569**	**R-RSL / R5 ESL**	**0.019**	**1**	**0.77**
Vanadium	7440-62-2	39	7.8	R-RSL / Eco SSL	2.6	2	0.04
Zinc	7440-66-6	2,300	46	R-RSL / Eco SSL	15	2	0.73

1 Surface soil screening references: R-RSL – USEPA Regions 3, 6 and 9 Regional Screening Level , Direct Contact Residential (2009a); IDEM R-DCL – IDEM Residential Default Closure Level (2009); Eco SSL – USEPA's Ecological Soil Screening Levels (2008); R5 ESL – USEPA Region 5 Ecological Screening Level (2003a). Refer to Appendix D for further explanation and justification of PSLs.

Bolded compounds indicate that the lowest PSL is between the laboratory LOQ and MDL. Bolded and shaded compounds indicate that the lowest PSL is less than both the laboratory LOQ and the MDL. All results will be reported to detection limits and any limitations on data use that result from having detection limits that are greater than PSLs will be described in the Phase I RFI Report.

mg/kg – Milligrams per kilogram.

Matrix: Subsurface Soil (depth: greater than 2 feet)
Analytical Group: Select VOCs

Analyte	CAS Number	Project Screening Levels (µg/kg)	Project Screening Level Reference[1]	Project Quantitation Limit Goal (µg/kg)	CompuChem	
					LOQ (µg/kg)	MDL (µg/kg)
		HHRA	HHRA			
Benzene	**71-43-2**	**4.6**	**USEPA SSL**	**1.5**	**5.0**	**1.00**
Toluene	108-88-3	12,000	IDEM R-DCL	4,000	5.0	1.00
Ethylbenzene	100-41-4	38	USEPA SSL	12	5.0	1.00
Xylenes (total)	1330-20-7	32,000	USEPA SSL	10,000	5.0	1.00
Chloromethane	74-87-3	980	USEPA SSL	320	5.0	1.09
Vinyl chloride	**75-01-4**	**0.112**	**USEPA SSL**	**0.037**	**5.0**	**1.09**
Chloroethane	75-00-3	650	IDEM R-DCL	210	5.0	1.00
1,1-Dichloroethene	75-35-4	58	IDEM R-DCL	19	5.0	1.00
trans-1,2-Dichloroethene	156-60-5	680	USEPA SSL	220	5.0	1.00
1,1-Dichloroethane	75-34-3	14	USEPA SSL	4.6	5.0	1.00
cis-1,2-Dichloroethene	156-59-2	400	IDEM R-DCL	130	5.0	1.00
1,1,1-Trichloroethane	71-55-6	1,900	IDEM R-DCL	630	5.0	1.00
1,2-Dichloroethane	**107-06-2**	**0.88**	**USEPA SSL**	**0.29**	**5.0**	**1.00**
Trichloroethene	79-01-6	12.2	USEPA SSL	4.0	5.0	1.00
1,1,2-Trichloroethane	**79-00-5**	**0.16**	**USEPA SSL**	**0.053**	**5.0**	**1.00**
Tetrachloroethene	**127-18-4**	**1.04**	**USEPA SSL**	**0.34**	**5.0**	**1.64**
1,1,2,2-Tetrachloroethane	**79-34-5**	**0.56**	**USEPA SSL**	**0.18**	**5.0**	**1.00**

1 Subsurface soil screening references: USEPA SSL – USEPA Regions 3, 6 and 9 Soil Screening Level, Migration to Groundwater, Dilution Attenuation Factor (DAF) = 20 (2009a); IDEM R-DCL – IDEM Residential Default Closure Level (2009). Refer to Appendix D for further explanation and justification of PSLs.

Bolded compounds indicate that the PSL is between the laboratory LOQ and MDL. Bolded and shaded compounds indicate that the PSL is less than both the laboratory LOQ and the MDL. All results will be reported to detection limits and any limitations on data use that result from having detection limits that are greater than PSLs will be described in the Phase I RFI Report.

There is a PSL for human health only (there is no ecological PSL because there is no complete exposure path for ecological receptors).

µg/kg – Micrograms per kilogram.

Matrix: Subsurface Soil (depth: greater than 2 feet)
Analytical Group: Low-Level TCL PAHs by SIM

Analyte	CAS Number	Project Screening Level (µg/kg)	Project Screening Level Reference[1]	Project Quantitation Limit Goal (µg/kg)	CompuChem	
		HHRA	HHRA		LOQ (µg/kg)	MDL (µg/kg)
Naphthalene	91-20-3	11	USEPA SSL	3.6	8.3	0.72
2-Methylnaphthalene	91-57-6	3,100	IDEM R-DCL	1,000	8.3	0.68
Acenaphthylene	208-96-8	18,000	IDEM R-DCL	6,000	8.3	0.53
Acenaphthene	83-32-9	130,000	IDEM R-DCL	43,000	8.3	0.60
Fluorene	86-73-7	170,000	IDEM R-DCL	56,000	8.3	0.45
Phenanthrene	85-01-8	13,000	IDEM R-DCL	4,300	8.3	1.3
Anthracene	120-12-7	2,000,000	IDEM R-DCL	660,000	8.3	0.43
Fluoranthene	206-44-0	880,000	IDEM R-DCL	290,000	8.3	1.3
Pyrene	129-00-0	2,000,000	IDEM R-DCL	660,000	8.3	0.57
Benzo(a)anthracene	56-55-3	280	USEPA SSL	93	8.3	0.55
Chrysene	218-01-9	25,000	IDEM R-DCL	8,300	8.3	0.63
Benzo(b)fluoranthene	205-99-2	940	USEPA SSL	310	8.3	0.57
Benzo(k)fluoranthene	207-08-9	9,200	USEPA SSL	3,000	8.3	0.43
Benzo(a)pyrene	50-32-8	92	USEPA SSL	30	8.3	0.38
Indeno(1,2,3,-cd)pyrene	193-39-5	3,200	USEPA SSL	1,000	8.3	0.37
Dibenzo(a,h)anthracene	53-70-3	300	USEPA SSL	100	8.3	0.33
Benzo(g,h,i)perylene	191-24-2	3,000,000	USEPA SSL	1,000,000	8.3	0.38

1 Subsurface soil screening references: USEPA SSL – USEPA Regions 3, 6 and 9 Soil Screening Level, Migration to Groundwater, DAF = 20 (2009a); IDEM R-DCL – IDEM Residential Default Closure Level (2009). Refer to Appendix D for further explanation and justification of PSLs.
There is a PSL for human health only (there is no ecological PSL because there is no complete exposure path for ecological receptors).
µg/kg – Micrograms per kilogram.

Matrix: Subsurface Soil (depth: greater than 2 feet)
Analytical Group: TCL PCB Aroclors and Total PCBs

Analyte	CAS Number	Project Screening Level (µg/kg)	Project Screening Level Reference[(1)]	Project Quantitation Limit Goal (µg/kg)	CompuChem	
		HHRA	HHRA		LOQ (µg/kg)	MDL (µg/kg)
Aroclor-1016	12674-11-2	1,040	USEPA SSL	340	75	23.7
Aroclor-1221	**11104-28-2**	**2.8**	**USEPA SSL**	**0.93**	**60**	**20.3**
Aroclor-1232	**11141-16-5**	**2.8**	**USEPA SSL**	**0.93**	**25**	**7.50**
Aroclor-1242	53469-21-9	60	USEPA SSL	20	35	11.2
Aroclor-1248	12672-29-6	60	USEPA SSL	20	25	7.50
Aroclor-1254	11097-69-1	102	USEPA SSL	34	20	6.67
Aroclor-1260	11096-82-5	280	USEPA SSL	93	30	10.0
Total PCBs	NA	1,800	IDEM R-DCL	600	NA	NA

1 Subsurface soil screening references: USEPA SSL – USEPA Regions 3, 6 and 9 Soil Screening Level, Migration to Groundwater, DAF = 20 (2009a); IDEM R-DCL – IDEM Residential Default Closure Level (2009). Refer to Appendix D for further explanation and justification of PSLs.

Bolded compounds indicate that the PSL is between the laboratory LOQ and MDL. Bolded and shaded compounds indicate that the PSL is less than both the laboratory LOQ and the MDL. All results will be reported to detection limits and any limitations on data use that result from having detection limits that are greater than PSLs will be described in the Phase I RFI Report.

There is a PSL for human health only (there is no ecological PSL because there is no complete exposure path for ecological receptors).

µg/kg – Micrograms per kilogram.

Matrix: Subsurface Soil (depth: greater than 2 feet)
Analytical Group: TAL Metals

Analyte	CAS Number	Project Screening Level (mg/kg)	Project Screening Level Reference[(1)]	Project Quantitation Limit Goal (mg/kg)	CompuChem	
		HHRA	HHRA		LOQ (mg/kg)	MDL (mg/kg)
Aluminum	7429-90-5	1,100,000	USEPA SSL	360,000	20	3.5
Antimony	7440-36-0	5.4	IDEM R-DCL	1.8	1	0.18
Arsenic	**7440-38-2**	**0.026**	**USEPA SSL**	**0.0086**	**1**	**0.210**
Barium	7440-39-3	1,600	IDEM R-DCL	530	20	0.097
Beryllium	7440-41-7	63	IDEM R-DCL	21	0.5	0.037
Cadmium	7440-43-9	7.5	IDEM R-DCL	2.5	0.5	0.023
Calcium	7440-70-2	None	---	---	500	4.3
Chromium	7440-47-3	38	IDEM R-DCL	12	1	0.049
Cobalt	7440-48-4	9.8	USEPA SSL	3.2	0.5	0.140
Copper	7440-50-8	920	IDEM R-DCL	300	0.5	0.15
Iron	7439-89-6	12,800	USEPA SSL	4,200	10	1.3
Lead	7439-92-1	81	IDEM R-DCL	27	0.3	0.120
Magnesium	7439-95-4	None	---	---	500	0.61
Manganese	7439-96-5	1,140	USEPA SSL	370	1	0.043
Mercury	7439-97-6	0.6	USEPA SSL	0.20	0.1	0.011
Nickel	7440-02-0	950	IDEM R-DCL	310	0.5	0.062
Potassium	7440-09-7	None	---	---	500	0.610
Selenium	7782-49-2	5.2	IDEM R-DCL	1.7	0.5	0.300
Silver	7440-22-4	31	IDEM R-DCL	10	0.5	0.053
Sodium	7440-23-5	None	---	---	500	17.9
Thallium	7440-28-0	2.8	IDEM R-DCL	0.93	1	0.770
Vanadium	7440-62-2	3,600	USEPA SSL	1,200	2	0.04
Zinc	7440-66-6	10,000	IDEM R-DCL	3,300	2	0.73

1 Subsurface soil screening references: USEPA SSL – USEPA Regions 3, 6 and 9 Soil Screening Level, Migration to Groundwater, DAF = 20 (2009a); IDEM R-DCL – IDEM Residential Default Closure Level (2009). Refer to Appendix D for further explanation and justification of PSLs.

Bolded compounds indicate that the PSL is between the laboratory LOQ and MDL. Bolded and shaded compounds indicate that the PSL is less than both the laboratory LOQ and the MDL. All results will be reported to detection limits and any limitations on data use that result from having detection limits that are greater than PSLs will be described in the Phase I RFI Report.

There is a PSL for human health only (there is no ecological PSL because there is no complete exposure path for ecological receptors).

mg/kg – Milligrams per kilogram.

Matrix: Sediment
Analytical Group: Select VOCs

Analyte	CAS Number	Project Screening Levels (µg/kg)		Project Screening Level References[1]	Project Quantitation Limit Goal (µg/kg)	CompuChem	
		HHRA	ERA	HHRA / ERA		LOQ (µg/kg)	MDL (µg/kg)
Benzene	71-43-2	34	142	IDEM R-DCL / R5 ESL	11	5.0	1.00
Toluene	108-88-3	12,000	1,220	IDEM R-DCL / R5 ESL	400	5.0	1.00
Ethylbenzene	100-41-4	5,700	175	R-RSL / R5 ESL	58	5.0	1.00
Xylenes (total)	1330-20-7	60,000	433	R-RSL / R5 ESL	140	5.0	1.00
Chloromethane	74-87-3	12,000	None	R-RSL / ---	4,000	5.0	1.09
Vinyl chloride	75-01-4	13	202	IDEM R-DCL / R5 ESL	4.3	5.0	1.09
Chloroethane	75-00-3	650	None	IDEM R-DCL / ---	210	5.0	1.00
1,1-Dichloroethene	75-35-4	58	19.4	IDEM R-DCL / R5 ESL	6.4	5.0	1.00
trans-1,2-Dichloroethene	156-60-5	680	654	IDEM R-DCL / R5 ESL	210	5.0	1.00
1,1-Dichloroethane	**75-34-3**	3,400	**0.575**	R-RSL / **R5 ESL**	**0.19**	**5.0**	**1.00**
cis-1,2-Dichloroethene	156-59-2	400	209	IDEM R-DCL / R5 ESL	69	5.0	1.00
1,1,1-Trichloroethane	71-55-6	1,900	213	IDEM R-DCL / R5 ESL	71	5.0	1.00
1,2-Dichloroethane	107-06-2	24	260	IDEM R-DCL / R5 ESL	8.0	5.0	1.00
Trichloroethene	79-01-6	57	112	IDEM R-DCL / R5 ESL	19	5.0	1.00
1,1,2-Trichloroethane	79-00-5	30	518	IDEM R-DCL / R5 ESL	10	5.0	1.00
Tetrachloroethene	127-18-4	58	990	IDEM R-DCL / R5 ESL	19	5.0	1.64
1,1,2,2-Tetrachloroethane	79-34-5	7	850	IDEM R-DCL / R5 ESL	2.3	5.0	1.00

1 Sediment screening references: R-RSL – USEPA Regions 3, 6 and 9 Regional Screening Level, Direct Contact Residential (2009a); IDEM R-DCL – IDEM Residential Default Closure Level (2009); R5 ESL – USEPA Region 5 Ecological Screening Level (2003a). Refer to Appendix D for further explanation and justification of PSLs.
Bolded compounds indicate that the lowest PSL is between the laboratory LOQ and MDL. Bolded and shaded compounds indicate that the lowest PSL is less than both the laboratory LOQ and the MDL. All results will be reported to detection limits and any limitations on data use that result from having detection limits that are greater than PSLs will be described in the Phase I RFI Report.
µg/kg – Micrograms per kilogram.

Matrix: Sediment
Analytical Group: Low-Level TCL PAHs by SIM

Analyte	CAS Number	Project Screening Levels (µg/kg)		Project Screening Level References[1]	Project Quantitation Limit Goal (µg/kg)	CompuChem	
		HHRA	ERA	HHRA / ERA		LOQ (µg/kg)	MDL (µg/kg)
Naphthalene	91-20-3	700	29,000	R-RSL / Eco SSL	230	8.3	0.72
2-Methylnaphthalene	91-57-6	3,100	29,000	IDEM R-DCL / Eco SSL	1,000	8.3	0.68
Acenaphthylene	208-96-8	18,000	29,000	IDEM R-DCL / Eco SSL	6,000	8.3	0.53
Acenaphthene	83-32-9	130,000	29,000	IDEM R-DCL / Eco SSL	9,600	8.3	0.60
Fluorene	86-73-7	170,000	29,000	R-RSL / Eco SSL	9,600	8.3	0.45
Phenanthrene	85-01-8	13,000	29,000	R-RSL / Eco SSL	4,300	8.3	1.3
Anthracene	120-12-7	1,700,000	29,000	R-RSL / Eco SSL	9,600	8.3	0.43
Fluoranthene	206-44-0	230,000	29,000	R-RSL / Eco SSL	9,600	8.3	1.3
Pyrene	129-00-0	170,000	1,100	R-RSL / Eco SSL	360	8.3	0.57
Benzo(a)anthracene	56-55-3	150	1,100	R-RSL / Eco SSL	50	8.3	0.55
Chrysene	218-01-9	15,000	1,100	R-RSL / Eco SSL	360	8.3	0.63
Benzo(b)fluoranthene	205-99-2	150	1,100	R-RSL / Eco SSL	50	8.3	0.57
Benzo(k)fluoranthene	207-08-9	1,500	1,100	R-RSL / Eco SSL	360	8.3	0.43
Benzo(a)pyrene	50-32-8	15	1,100	R-RSL / Eco SSL	5.0	8.3	0.38
Indeno(1,2,3,-cd)pyrene	193-39-5	150	1,100	R-RSL / Eco SSL	50	8.3	0.37
Dibenzo(a,h)anthracene	53-70-3	15	1,100	R-RSL / Eco SSL	5.0	8.3	0.33
Benzo(g,h,i)perylene	191-24-2	170,000	1,100	R-RSL / Eco SSL	360	8.3	0.38

1 Sediment screening references: R-RSL – USEPA Regions 3, 6 and 9 Regional Screening Level, Direct Contact Residential (2009a); IDEM R-DCL – IDEM Residential Default Closure Level (2009); Eco SSL – USEPA's Ecological Soil Screening Levels (2008). Refer to Appendix D for further explanation and justification of PSLs.
µg/kg – Micrograms per kilogram.

Matrix: Sediment
Analytical Group: TCL PCB Aroclors and Total PCBs

Analyte	CAS Number	Project Screening Levels (µg/kg)		Project Screening Level References[1]	Project Quantitation Limit Goal (µg/kg)	CompuChem	
		HHRA	ERA	HHRA / ERA		LOQ (µg/kg)	MDL (µg/kg)
Aroclor-1016	**12674-11-2**	390	**59.8**	R-RSL **/ R5 ESL**	**19**	**75**	**23.7**
Aroclor-1221	**11104-28-2**	170	**59.8**	R-RSL **/ R5 ESL**	**19**	**60**	**20.3**
Aroclor-1232	11141-16-5	170	59.8	R-RSL / R5 ESL	19	25	7.50
Aroclor-1242	53469-21-9	220	59.8	R-RSL / R5 ESL	19	35	11.2
Aroclor-1248	12672-29-6	220	59.8	R-RSL / R5 ESL	19	25	7.50
Aroclor-1254	11097-69-1	110	59.8	R-RSL / R5 ESL	19	20	6.67
Aroclor-1260	11096-82-5	220	59.8	R-RSL / R5 ESL	19	30	10.0
Total PCBs	NA	1,800	None	IDEM R-DCL / ---	600	NA	NA

1 Sediment screening references: R-RSL – USEPA Regions 3, 6 and 9 Regional Screening Level, Direct Contact Residential (2009a); IDEM R-DCL – IDEM Residential Default Closure Level (2009); R5 ESL – USEPA Region 5 Ecological Screening Level (2003a). Refer to Appendix D for further explanation and justification of PSLs.

Bolded compounds indicate that the lowest PSL is between the laboratory LOQ and MDL. All results will be reported to detection limits and any limitations on data use that result from having detection limits that are greater than PSLs will be described in the Phase I RFI Report.

µg/kg – Micrograms per kilogram.

Matrix: Sediment
Analytical Group: TAL Metals

Analyte	CAS Number	Project Screening Levels (mg/kg)		Project Screening Level References[1]	Project Quantitation Limit Goal (mg/kg)	CompuChem	
		HHRA	ERA	HHRA / ERA		LOQ (mg/kg)	MDL (mg/kg)
Aluminum	7429-90-5	7,700	pH>5.5 [2]	R-RSL / Eco SSL	2,500	20	3.5
Antimony	**7440-36-0**	3.1	**0.27**	R-RSL / **Eco SSL**	**0.090**	**1**	**0.180**
Arsenic	**7440-38-2**	**0.39**	18	**R-RSL** / Eco SSL	**0.13**	**1**	**0.210**
Barium	7440-39-3	1,500	330	R-RSL / Eco SSL	110	20	0.097
Beryllium	7440-41-7	16	21	R-RSL / Eco SSL	5.3	0.5	0.037
Cadmium	**7440-43-9**	7.0	**0.36**	R-RSL / **Eco SSL**	**0.12**	**0.5**	**0.023**
Calcium	7440-70-2	None	None	--- / ---	---	500	4.3
Chromium	7440-47-3	23	26	R-RSL / Eco SSL	7.6	1	0.049
Cobalt	7440-48-4	2.3	13	R-RSL / Eco SSL	0.74	0.5	0.140
Copper	7440-50-8	310	28	R-RSL / Eco SSL	9.3	0.5	0.150
Iron	7439-89-6	5,500	5<pH<8 [2]	R-RSL / Eco SSL	1,800	10	1.3
Lead	7439-92-1	81	11	IDEM R-DCL / Eco SSL	3.6	0.3	0.120
Magnesium	7439-95-4	None	None	--- / ---	---	500	0.610
Manganese	7439-96-5	180	220	R-RSL / Eco SSL	60	1	0.043
Mercury	7439-97-6	2.1	0.174	IDEM R-DCL / R5 ESL	0.058	0.1	0.011
Nickel	7440-02-0	150	38	R-RSL / Eco SSL	7.5	0.5	0.062
Potassium	7440-09-7	None	None	--- / ---	---	500	0.970
Selenium	7782-49-2	5.2	0.52	IDEM R-DCL / Eco SSL	0.17	0.5	0.300
Silver	7440-22-4	31	4.2	IDEM R-DCL / Eco SSL	0.16	0.5	0.053
Sodium	7440-23-5	None	None	--- / ---	---	500	17.9
Thallium	**7440-28-0**	**0.51**	None	**R-RSL / ---**	**0.17**	**1**	**0.770**
Vanadium	7440-62-2	39	7.8	R-RSL / Eco SSL	2.6	2	0.040
Zinc	7440-66-6	2,300	46	R-RSL / Eco SSL	15	2	0.730

1 Sediment screening references: R-RSL – USEPA Regions 3, 6 and 9 Regional Screening Level, Direct Contact Residential (2009a); IDEM R-DCL – IDEM Residential Default Closure Level (2009); Eco SSL – USEPA's Ecological Soil Screening Levels (2008); R5 ESL – USEPA Region 5 Ecological Screening Level (2003a). Refer to Appendix D for further explanation and justification of PSLs.
2 The PSL for this analyte is pH-dependant and is considered protective of the environment when within the pH range specified.
Bolded compounds indicate that the lowest PSL is between the laboratory LOQ and MDL. Bolded and shaded compounds indicate that the lowest PSL is less than both the laboratory LOQ and the MDL. All results will be reported to detection limits and any limitations on data use that result from having detection limits that are greater than PSLs will be described in the Phase I RFI Report.
mg/kg – Milligrams per kilogram.

Matrix: Surface Water
Analytical Group: Select VOCs

Analyte	CAS Number	Project Screening Levels (µg/L)		Project Screening Level References[1]	Project Quantitation Limit Goal (µg/L)	CompuChem	
		HHRA	ERA	HHRA / ERA		LOQ (µg/L)	MDL (µg/L)
Benzene	71-43-2	4.1	114	T-RSL / R5 ESL	1.3	0.5	0.10
Toluene	108-88-3	2,300	253	T-RSL / R5 ESL	84	0.5	0.10
Ethylbenzene	100-41-4	15	14	T-RSL / R5 ESL	4.9	0.5	0.10
Xylenes (total)	1330-20-7	200	27	T-RSL / R5 ESL	9.0	0.5	0.10
Chloromethane	74-87-3	190	10.4	T-RSL / Lowest NOAA	3.4	0.5	0.10
Vinyl chloride	**75-01-4**	**0.16**	930	**T-RSL** / R5 ESL	**0.053**	**0.5**	**0.08**
Chloroethane	75-00-3	21,000	None	T-RSL / ---	7,000	0.5	0.13
1,1-Dichloroethene	**75-35-4**	**0.33**	65	**IDEM SW** / R5 ESL	**0.11**	**0.5**	**0.08**
trans-1,2-Dichloroethene	156-60-5	110	970	T-RSL / R5 ESL	36	0.5	0.05
1,1-Dichloroethane	75-34-3	24	47	T-RSL / R5 ESL	8.0	0.5	0.05
cis-1,2-Dichloroethene	156-59-2	370	590	T-RSL / R5 ESL	120	0.5	0.06
1,1,1-Trichloroethane	71-55-6	9,100	76	T-RSL / R5 ESL	25	0.5	0.05
1,2-Dichloroethane	107-06-2	1.5	910	T-RSL / R5 ESL	0.50	0.5	0.06
Trichloroethene	79-01-6	17	47	T-RSL / R5 ESL	5.6	0.5	0.06
1,1,2-Trichloroethane	79-00-5	2.4	500	T-RSL / R5 ESL	0.80	0.5	0.09
Tetrachloroethene	127-18-4	1.1	45	T-RSL / R5 ESL	0.36	0.5	0.11
1,1,2,2-Tetrachloroethane	79-34-5	0.67	380	T-RSL / R5 ESL	0.22	0.5	0.09

1 Surface water screening references: T-RSL – USEPA Regions 3, 6 and 9 Regional Screening Level for Tapwater (2009a); IDEM SW – Indiana Minimum Surface Water Quality Standards (2002); R5 ESL – USEPA Region 5 Ecological Screening Level (2003a); Lowest NOAA – Lowest corresponding surface water value from the National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Tables (SQuiRTs) (2008). Refer to Appendix D for further explanation and justification of PSLs.

Bolded compounds indicate that the lowest PSL is between the laboratory LOQ and MDL. All results will be reported to detection limits and any limitations on data use that result from having detection limits that are greater than PSLs will be described in the Phase I RFI Report.

µg/L – Micrograms per liter.

Matrix: Surface Water
Analytical Group: Low-Level TCL PAHs by SIM

Analyte	CAS Number	Project Screening Levels (µg/L)		Project Screening Level References[1]	Project Quantitation Limit Goal (µg/L)	CompuChem	
		HHRA	ERA	HHRA / ERA		LOQ (µg/L)	MDL (µg/L)
Naphthalene	91-20-3	1.4	13	T-RSL / R5 ESL	0.46	0.2	0.030
2-Methylnaphthalene	91-57-6	150	330	T-RSL / R5 ESL	50	0.2	0.15
Acenaphthylene	208-96-8	2,200	4,840	T-RSL / R5 ESL	730	0.2	0.010
Acenaphthene	83-32-9	2,200	38	T-RSL / R5 ESL	12	0.2	0.035
Fluorene	86-73-7	1,500	19	T-RSL / R5 ESL	6.3	0.2	0.045
Phenanthrene	85-01-8	1,100	3.6	T-RSL / R5 ESL	1.2	0.2	0.035
Anthracene	**120-12-7**	11,000	**0.035**	T-RSL **/ R5 ESL**	**0.011**	**0.2**	**0.020**
Fluoranthene	206-44-0	1,500	1.9	T-RSL / R5 ESL	0.63	0.2	0.010
Pyrene	129-00-0	1,100	0.3	T-RSL / R5 ESL	0.10	0.2	0.010
Benzo(a)anthracene	**56-55-3**	0.29	**0.025**	T-RSL **/ R5 ESL**	**0.0083**	**0.2**	**0.020**
Chrysene	218-01-9	29	None	T-RSL / ---	9.6	0.2	0.015
Benzo(b)fluoranthene	205-99-2	0.29	9.07	T-RSL / R5 ESL	0.096	0.2	0.010
Benzo(k)fluoranthene	207-08-9	2.9	None	T-RSL / ---	0.96	0.2	0.010
Benzo(a)pyrene	**50-32-8**	**0.029**	**0.014**	**T-RSL / R5 ESL**	**0.0046**	**0.2**	**0.010**
Indeno(1,2,3,-cd)pyrene	193-39-5	0.29	4.31	T-RSL / R5 ESL	0.096	0.2	0.010
Dibenzo(a,h)anthracene	**53-70-3**	**0.029**	None	**T-RSL / ---**	**0.0096**	**0.2**	**0.010**
Benzo(g,h,i)perylene	191-24-2	1,100	7.64	T-RSL / R5 ESL	2.5	0.2	0.010

1 Surface water screening references: T-RSL – USEPA Regions 3, 6 and 9 Regional Screening Level for Tapwater (2009a); R5 ESL – USEPA Region 5 Ecological Screening Level (2003a). Refer to Appendix D for further explanation and justification of PSLs.

Bolded compounds indicate that the lowest PSL is between the laboratory LOQ and MDL. All results will be reported to detection limits and any limitations on data use that result from having detection limits that are greater than PSLs will be described in the Phase I RFI Report.

µg/L – Micrograms per liter.

Matrix: Surface Water
Analytical Group: TAL Metals by Inductively Coupled Plasma – Atomic Absorption Spectrometer (ICP-AES)

Analyte	CAS Number	Project Screening Levels (µg/L)		Project Screening Level References[1]	Project Quantitation Limit Goal (µg/L)	CompuChem	
		HHRA	ERA	HHRA / ERA		LOQ (µg/L)	MDL (µg/L)
Aluminum	**7429-90-5**	37,000	**87**	T-RSL **/ RWQC**	**29**	**200**	**28.9**
Antimony	7440-36-0	15	80	T-RSL / R5 ESL	5.0	10	3.5
Calcium	7440-70-2	None	116,000	--- / R3 FW	38,000	5,000	35.6
Chromium	7440-47-3	50	11	IDEM SW / RWQC	3.6	10	1.1
Cobalt	7440-48-4	110	240	T-RSL / R5 ESL	36	10	0.84
Iron	7439-89-6	26,000	1,000	T-RSL / RWQC	330	100	24.6
Magnesium	7439-95-4	None	2,000	--- / R3 FW	660	5,000	31
Manganese	7439-96-5	880	120	T-RSL / R3 FW	40	10	0.16
Potassium	7440-09-7	None	53,000	--- / R3 FW	17,000	5,000	21.9
Sodium	7440-23-5	None	680,000	--- / R3 FW	220,000	5,000	87.5
Zinc	7440-66-6	11,000	120	T-RSL / RWQC	40	20	2.7

1 Surface water screening references: T-RSL – USEPA Regions 3, 6 and 9 Regional Screening Level for Tapwater (2009a); IDEM SW – Indiana Minimum Surface Water Quality Standards (2002); RWQC – USEPA National Recommended Water Quality Criteria (2005); R5 ESL – USEPA Region 5 Ecological Screening Level (2003a); R3 FW – USEPA Region 3 Biological Technical Assistance Group Freshwater Screening Benchmarks (2004b). Refer to Appendix D for further explanation and justification of PSLs.

Bolded compounds indicate that the lowest PSL is between the laboratory LOQ and MDL. All results will be reported to detection limits and any limitations on data use that result from having detection limits that are greater than PSLs will be described in the Phase I RFI Report.

µg/L – Micrograms per liter.

Matrix: Surface Water
Analytical Group: TAL Metals by Inductively Coupled Plasma – Mass Spectrometer (ICP-MS)

Analyte	CAS Number	Project Screening Levels (µg/L)		Project Screening Level References[1]	Project Quantitation Limit Goal (µg/L)	CompuChem	
		HHRA	ERA	HHRA / ERA		LOQ (µg/L)	MDL (µg/L)
Antimony	7440-36-0	15	80	T-RSL / R5 ESL	5.0	1	0.033
Arsenic	**7440-38-2**	**0.022**	150	**IDEM SW /** RWQC	**0.0073**	**1**	**0.066**
Barium	7440-39-3	1,000	220	IDEM SW / R5 ESL	73	10	0.021
Beryllium	**7440-41-7**	**0.068**	3.6	**IDEM SW** / R5 ESL	**0.022**	**1**	**0.021**
Cadmium	**7440-43-9**	10	**0.25**	IDEM SW **/ RWQC**	**0.083**	**1**	**0.035**
Chromium	7440-47-3	50	11	IDEM SW / RWQC	3.6	1	0.020
Cobalt	7440-48-4	110	240	T-RSL / R5 ESL	36	1	0.016
Copper	7440-50-8	1,500	9	T-RSL / RWQC	3.0	1	0.076
Lead	7439-92-1	50	2.5	IDEM SW / RWQC	0.83	1	0.011
Nickel	7440-02-0	13.4	52	IDEM SW / RWQC	4.3	1	0.021
Selenium	7782-49-2	10	5	IDEM SW / RWQC	1.6	5	0.13
Silver	7440-22-4	50	1.04	T-RSL / IDEM SW	0.040	1	0.015
Thallium	7440-28-0	2.4	10	T-RSL / R5 ESL	0.80	1	0.008
Vanadium	7440-62-2	180	12	T-RSL / R5 ESL	4.0	1	0.014

1 Surface water screening references: T-RSL – USEPA Regions 3, 6 and 9 Regional Screening Level for Tapwater (2009a); IDEM SW – Indiana Minimum Surface Water Quality Standards (2002); RWQC – USEPA National Recommended Water Quality Criterion (2005); R5 ESL – USEPA Region 5 Ecological Screening Level (2003a). Refer to Appendix D for further explanation and justification of PSLs.

Bolded compounds indicate that the lowest PSL is between the laboratory LOQ and MDL. Bolded and shaded compounds indicate that the lowest PSL is less than both the laboratory LOQ and the MDL. All results will be reported to detection limits and any limitations on data use that result from having detection limits that are greater than PSLs will be described in the Phase I RFI Report.

µg/L – Micrograms per liter.

Matrix: Surface Water
Analytical Group: TAL Metals - Mercury by Cold Vapor Atomic Absorption (CVAA)

Analyte	CAS Number	Project Screening Levels (µg/L)		Project Screening Level References[1]	Project Quantitation Limit Goal (µg/L)	CompuChem	
		HHRA	ERA	HHRA / ERA		LOQ (µg/L)	MDL (µg/L)
Mercury	**7439-97-6**	**0.14**	0.77	**IDEM SW** / RWQC	**0.046**	**0.2**	**0.088**

1 Surface water screening references: IDEM SW – Indiana Minimum Surface Water Quality Standards (2002); RWQC – USEPA National Recommended Water Quality Criteria (2005). Refer to Appendix D for further explanation and justification of PSLs.
Bolded compounds indicate that the lowest PSL is between the laboratory LOQ and MDL. All results will be reported to detection limits and any limitations on data use that result from having detection limits that are greater than PSLs will be described in the Phase I RFI Report.
µg/L – Micrograms per liter.

Matrix: Groundwater (if required in Phase II)
Analytical Group: Select VOCs

Analyte	CAS Number	Project Screening Level (µg/L)	Project Screening Level Reference[(1)]	Project Quantitation Limit Goal (µg/L)	CompuChem	
		HHRA	HHRA		LOQ (µg/L)	MDL (µg/L)
Benzene	71-43-2	5	USEPA MCL	1.6	0.5	0.10
Toluene	108-88-3	1,000	USEPA MCL	330	0.5	0.10
Ethylbenzene	100-41-4	700	USEPA MCL	230	0.5	0.10
Xylenes (total)	1330-20-7	10,000	USEPA MCL	3,300	0.5	0.10
Chloromethane	74-87-3	19	T-RSL	6.3	0.5	0.10
Vinyl chloride	75-01-4	2.0	USEPA MCL	0.66	0.5	0.08
Chloroethane	75-00-3	62	IDEM G-DCL	20	0.5	0.13
1,1-Dichloroethene	75-35-4	7.0	USEPA MCL	2.3	0.5	0.08
trans-1,2-Dichloroethene	156-60-5	100	USEPA MCL	33	0.5	0.05
1,1-Dichloroethane	75-34-3	990	IDEM G-DCL	330	0.5	0.05
cis-1,2-Dichloroethene	156-59-2	70	USEPA MCL	23	0.5	0.06
1,1,1-Trichloroethane	71-55-6	200	USEPA MCL	66	0.5	0.05
1,2-Dichloroethane	107-06-2	50	USEPA MCL	16	0.5	0.06
Trichloroethene	79-01-6	1.7	T-RSL	0.56	0.5	0.06
1,1,2-Trichloroethane	79-00-5	5.0	USEPA MCL	1.6	0.5	0.09
Tetrachloroethene	127-18-4	5.0	USEPA MCL	1.6	0.5	0.11
1,1,2,2-Tetrachloroethane	79-34-5	0.90	IDEM G-DCL	0.30	0.5	0.12

1 Groundwater screening references: T-RSL – USEPA Regions 3, 6 and 9 Regional Screening Level for Tapwater (2009a); USEPA MCL – National Primary Drinking Water Regulations, Maximum Contaminant Level (MCL) (2009b); IDEM G-DCL – IDEM Groundwater Default Closure Level (2009). Refer to Appendix D for further explanation and justification of PSLs.

There is a PSL for human health only (there is no ecological PSL because there is no complete exposure path for ecological receptors).

µg/L – Micrograms per liter.

Matrix: Groundwater (if required in Phase II)
Analytical Group: Low-Level TCL PAHs by SIM

Analyte	CAS Number	Project Screening Level (µg/L)	Project Screening Level Reference(1)	Project Quantitation Limit Goal (µg/L)	CompuChem	
		HHRA	HHRA		LOQ (µg/L)	MDL (µg/L)
Naphthalene	91-20-3	8.3	IDEM G-DCL	2.7	0.2	0.030
2-Methylnaphthalene	91-57-6	31	IDEM G-DCL	10	0.2	0.15
Acenaphthylene	208-96-8	71	IDEM G-DCL	23	0.2	0.010
Acenaphthene	83-32-9	460	IDEM G-DCL	150	0.2	0.035
Fluorene	86-73-7	310	IDEM G-DCL	100	0.2	0.045
Phenanthrene	85-01-8	23	IDEM G-DCL	7.6	0.2	0.035
Anthracene	120-12-7	43	IDEM G-DCL	14	0.2	0.020
Fluoranthene	206-44-0	210	IDEM G-DCL	70	0.2	0.010
Pyrene	129-00-0	140	IDEM G-DCL	46	0.2	0.010
Benzo(a)anthracene	56-55-3	1.2	IDEM G-DCL	0.40	0.2	0.020
Chrysene	218-01-9	1.6	IDEM G-DCL	0.53	0.2	0.015
Benzo(b)fluoranthene	205-99-2	1.2	IDEM G-DCL	0.40	0.2	0.010
Benzo(k)fluoranthene	207-08-9	0.8	IDEM G-DCL	0.26	0.2	0.010
Benzo(a)pyrene	50-32-8	0.2	USEPA MCL	0.066	0.2	0.010
Indeno(1,2,3,-cd)pyrene	**193-39-5**	**0.022**	**IDEM G-DCL**	**0.0073**	**0.2**	**0.010**
Dibenzo(a,h)anthracene	**53-70-3**	**0.12**	IDEM G-DCL	**0.040**	**0.2**	**0.010**
Benzo(g,h,i)perylene	191-24-2	110	T-RSL	36	0.2	0.010

1 Groundwater screening references: T-RSL – USEPA Regions 3, 6 and 9 Regional Screening Level for Tapwater (2009a); USEPA MCL – National Primary Drinking Water Regulations, Maximum Contaminant Level (MCL) (2009b); IDEM G-DCL – IDEM Groundwater Default Closure Level (2009). Refer to Appendix D for further explanation and justification of PSLs.
Bolded compounds indicate that the PSL is between the laboratory LOQ and MDL. All results will be reported to detection limits and any limitations on data use that result from having detection limits that are greater than PSLs will be described in the Phase II RFI Report.
There is a PSL for human health only (there is no ecological PSL because there is no complete exposure path for ecological receptors).
µg/L – Micrograms per liter.

Matrix: Groundwater (if required in Phase II)
Analytical Group: TCL PCB Aroclors and Total PCBs

Analyte	CAS Number	Project Screening Level (µg/L)	Project Screening Level Reference[1]	Project Quantitation Limit Goal (µg/L)	CompuChem	
		HHRA	HHRA		LOQ (µg/L)	MDL (µg/L)
Aroclor-1016	**12674-11-2**	**0.034**	**T-RSL**	**0.011**	**1.25**	**0.36**
Aroclor-1221	**11104-28-2**	**0.0068**	**T-RSL**	**0.0022**	**3.75**	**1.25**
Aroclor-1232	**11141-16-5**	**0.0068**	**T-RSL**	**0.0022**	**1.75**	**0.58**
Aroclor-1242	**53469-21-9**	**0.034**	**T-RSL**	**0.011**	**1.0**	**0.32**
Aroclor-1248	**12672-29-6**	**0.034**	**T-RSL**	**0.011**	**1.25**	**0.42**
Aroclor-1254	**11097-69-1**	**0.034**	**T-RSL**	**0.011**	**0.63**	**0.16**
Aroclor-1260	**11096-82-5**	**0.034**	**T-RSL**	**0.011**	**0.93**	**0.28**
Total PCBs	**NA**	**0.5**	**IDEM G-DCL**	**NA**	**NA**	**NA**

1 Groundwater screening references: T-RSL – USEPA Regions 3, 6 and 9 Regional Screening Level for Tapwater (2009a); IDEM G-DCL – IDEM Groundwater Default Closure Level (2009). Refer to Appendix D for further explanation and justification of PSLs.

Bolded compounds indicate that the PSL is between the laboratory LOQ and MDL. Bolded and shaded compounds indicate that the PSL is less than both the laboratory LOQ and the MDL. All results will be reported to detection limits and any limitations on data use that result from having detection limits that are greater than PSLs will be described in the Phase II RFI Report.

There is a PSL for human health only (there is no ecological PSL because there is no complete exposure path for ecological receptors).

µg/L – Micrograms per liter.

Matrix: Groundwater (if required in Phase II)
Analytical Group: TAL Metals by ICP-AES

Analyte	CAS Number	Project Screening Level (µg/L)	Project Screening Level Reference[1]	Project Quantitation Limit Goal (µg/L)	CompuChem	
		HHRA	HHRA		LOQ (µg/L)	MDL (µg/L)
Aluminum	7429-90-5	3,700	T-RSL	1,200	200	28.9
Calcium	7440-70-2	None	---	---	5,000	0.65
Chromium	7440-47-3	100	USEPA MCL	3.6	10	1.1
Cobalt	7440-48-4	11	T-RSL	3.6	10	0.84
Iron	7439-89-6	2,600	T-RSL	860	100	24.6
Magnesium	7439-95-4	None	---	---	5,000	31
Manganese	7439-96-5	88	T-RSL	29	10	0.16
Potassium	7440-09-7	None	---	---	5,000	21.9
Sodium	7440-23-5	None	---	---	5,000	87.5
Zinc	7440-66-6	11,000	IDEM G-DCL	3,600	20	2.7

1 Groundwater screening references: T-RSL – USEPA Regions 3, 6 and 9 Regional Screening Level for Tapwater (2009a); USEPA MCL – National Primary Drinking Water Regulations, Maximum Contaminant Level (MCL) (2009b); IDEM G-DCL – IDEM Groundwater Default Closure Level (2009). Refer to Appendix D for further explanation and justification of PSLs.

There is a PSL for human health only (there is no ecological PSL because there is no complete exposure path for ecological receptors).

µg/L – Micrograms per liter.

Matrix: Groundwater (if required in Phase II)
Analytical Group: TAL Metals by ICP-MS

Analyte	CAS Number	Project Screening Level (µg/L)	Project Screening Level Reference[(1)]	Project Quantitation Limit Goal (µg/L)	CompuChem	
		HHRA	HHRA		LOQ (µg/L)	MDL (µg/L)
Antimony	7440-36-0	6	USEPA MCL	2.0	1	0.033
Arsenic	7440-38-2	10	USEPA MCL	3.3	1	0.066
Barium	7440-39-3	2,000	USEPA MCL	660	10	0.021
Beryllium	7440-41-7	4	USEPA MCL	1.3	1	0.021
Cadmium	7440-43-9	5	USEPA MCL	1.6	1	0.035
Chromium	7440-47-3	100	USEPA MCL	33	1	0.020
Cobalt	7440-48-4	11	T-RSL	3.6	1	0.016
Copper	7440-50-8	1,300	USEPA MCL	430	1	0.076
Lead	7439-92-1	15	USEPA MCL	5.0	1	0.011
Nickel	7440-02-0	730	IDEM G-DCL	240	1	0.021
Selenium	7782-49-2	50	USEPA MCL	16	5	0.13
Silver	7440-22-4	180	IDEM G-DCL	60	1	0.015
Thallium	7440-28-0	2	USEPA MCL	0.66	1	0.008
Vanadium	7440-62-2	18	T-RSL	6.0	1	0.014

1 Groundwater screening references: T-RSL – USEPA Regions 3, 6 and 9 Regional Screening Level for Tapwater (2009a); USEPA MCL – National Primary Drinking Water Regulations, Maximum Contaminant Level (MCL) (2009b); IDEM G-DCL – IDEM Groundwater Default Closure Level (2009). Refer to Appendix D for further explanation and justification of PSLs.

There is a PSL for human health only (there is no ecological PSL because there is no complete exposure path for ecological receptors).

µg/L – Micrograms per liter.

Matrix: Groundwater (if required in Phase II)
Analytical Group: TAL Metals – Mercury by CVAA

Analyte	CAS Number	Project Screening Level (µg/L)	Project Screening Level Reference[1]	Project Quantitation Limit Goal (µg/L)	CompuChem	
		HHRA	HHRA		LOQ (µg/L)	MDL (µg/L)
Mercury	7439-97-6	1.1	T-RSL	0.36	0.2	0.088

1 Groundwater screening references: T-RSL – USEPA Regions 3, 6 and 9 Regional Screening Level for Tapwater (2009a). Refer to Appendix D for further explanation and justification of PSLs.
There is a PSL for human health only (there is no ecological PSL because there is no complete exposure path for ecological receptors).
µg/L – Micrograms per liter.

SAP Worksheet No. 16 -- Project Schedule/Timeline Table

(UFP-QAPP Manual Section 2.8.2)

Activities	Organization	Dates (MM/DD/YYYY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Phase I - Soil, Sediment, and Surface Water Sampling	Tetra Tech	07/19/2010	07/30/2010	Phase I RFI Report, SWMU 21	12/10/2010 (draft) 02/04/2011 (final)
SAP Addendum for Phase II	Tetra Tech	10/1/2010	11/15/2010	Phase II SAP Addendum, SWMU 21	7/15/2010 (draft) 9/1/2010 (final)
Phase II - Soil, Sediment, Surface Water, and Groundwater[(1)] Sampling	Tetra Tech	12/1/2010	12/15/2010	Phase II RFI Report, SWMU 21	6/1/2011 (draft) 12/1/2011 (final)

1 Groundwater will be included if necessary, based on the results of Phase I sampling results and Project Team decisions. Long-term groundwater monitoring would be conducted as a separate project, if deemed necessary.

SAP Worksheet No. 17 -- Sampling Design and Rationale

(UFP-QAPP Manual Section 3.1.1)

Samples will be collected at SWMU 21 to determine whether chemical concentrations in site media (surface and subsurface soil, sediment, and surface water [and groundwater in Phase II, if needed]) exceed the most conservative (lowest) applicable risk-based human health or ecological screening values. If these screening values are exceeded, then the Project Team will evaluate human health and ecological risks and delineate the nature and extent of contamination at the site. Data from the Phase I sampling event will be used to determine whether unacceptable contamination exists in the following locations: surface or subsurface soil within the SWMU 21 area, surface soil along the grass area where surface runoff is expected to migrate toward nearby surface water in Haynes Branch, in the nearby surface water of Haynes Branch and associated sediment, or in groundwater below the site (Phase II). The planned sample locations are presented on Figure 17-1 and Figure 17-2.

Chemicals that may have been present at the DRMO Storage Lot over its operational history and have the potential to impact environmental media include the following:

- Metals: Various metals were processed on site, and the shearing, shaping, and baling processes may have released metals onto the ground, which may then have leached into the subsurface. Possible metals contaminants include aluminum, arsenic, antimony, barium, beryllium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, silver, thallium, vanadium, and zinc. At the specific request of the IDEM RPM at the DQO scoping meeting, analyses will include the full list of TAL Metals.

- Cutting oils: Cutting oils used with the balers may have contained various PAHs, which may have leaked onto the ground and leached into the subsurface.

- Hydraulic fluids: Hydraulic fluids associated with the balers may have contained various PAHs and PCBs (including the seven TCL Aroclors and Total PCBs), which may have leaked onto the ground and leached into the subsurface.

- Degreasing solvents: Chlorinated solvents that may have been used to clean metals include tetrachloroethene (PCE), trichloroethene (TCE), 1,1,1-trichloroethane (TCA), and associated daughter products formed in the environment as these compounds degrade, including cis-1,2-dichloroethene (DCE), trans-1,2 DCE, 1,1-DCE, 1,2-dichloroethane (DCA), 1,1-DCA, vinyl chloride, chloroethane, and chloromethane, which may have leaked onto the ground and leached into the subsurface. At the specific request of the IDEM RPM at the DQO scoping meeting, analyses will also include the non-chlorinated VOCs benzene, toluene, ethylbenzene and total xylenes.

Soil Sampling (Phase I and Phase II)

The area encompassed by the fence line surrounding the DRMO Storage Lot was divided into seven Investigation Areas (IAs) that have a greater potential for contamination than other areas of the site (based on site history) for investigation with judgmental (biased) soil sampling. Biased samples will be collected from these IAs from locations that appear most likely to have been impacted by site activities based on field observations of staining, discoloration, or measurements from field monitoring equipment; or in a triangular pattern if no discernable impact is evident in a particular IA. Three samples will be collected from each of these IAs, except the Open Grass Area (IA 6), where six samples will be collected from the swale. Also, the Gravel Pad Area will be sampled using a random approach. Phase I surface and subsurface samples will be collected from locations that have a greater potential to have subsurface contamination (based on site history). The planned Gravel Pad Area sample locations are presented on Figure 17-1, and the planned IA sample locations are presented on Figure 17-2. All surface and subsurface soil samples will be analyzed for select VOCs, PAHs, PCBs, and metals.

Random Sample Design – Although a systematic rectangular grid was initially selected as the sample design for the Gravel Pad Area, the long narrow shape of the area caused the grid to consist of two long lines of sample locations. Thus, the grid design proved inappropriate for the Gravel Pad Area, as it did not generate sample locations which would prove useful for delineating contamination patterns. As with many sampling designs, some adjustments to the sample point locations may be required depending on site conditions. The intent is to minimize relocation of sampling points because redistribution of the points affects the representativeness of the individual samples. To obtain reasonable spatial coverage over the entire Gravel Pad Area, the VSP (Version 5.4) software was used to randomly select 30 sample locations in the Gravel Pad Area.

Sample Depth – A hand auger and/or DPT rig will be used to collect subsurface soil samples to 15 feet bgs or the top of the water table, whichever is shallower, at each location. Samples for all applicable analytical groups will be collected from the 0- to 2-foot interval for surface soil, and for subsurface soil, the specific 2-foot boring interval with the greatest potential for impact based on visual and field instrument screening for the purposes of both risk assessment and delineation, as described in Section 11.2. If contaminant extent is not adequately delineated at this depth, additional sampling will be recommended in an addendum to this SAP for Phase II.

IA 1 contains the Paved Storage Yard where materials were historically staged. Soil near the Paved Storage Yard may be contaminated with residual VOCs, PAHs, PCBs, or metals. Based on the CSM, three surface soil samples will be collected from IA 1.

IA 2 contains the OWS – Structure 3058. Soil near and beneath the OWS may be contaminated with residual VOCs, PAHs, PCBs, or metals. Based on the CSM, three surface soil and three subsurface soil samples will be collected from IA 2.

IA 3 contains the Old Metals Baler - Structure 2705, where there was some evidence of metals and PCB contamination from previous activities. Soil near and beneath the Old Metals Baler may be contaminated with residual VOCs, PAHs, PCBs, or metals. Based on previous investigations and the CSM, three surface soil and three subsurface soil samples will be collected from IA 3.

IA 4 contains the Original Metals Baler location (Former Building 1944) — north of Structure 2704. Soil near and beneath the Original Metals Baler may be contaminated with residual VOCs, PAHs, PCBs, or metals. Based on the CSM, three surface soil and three subsurface soil samples will be collected from IA 4.

IA 5 contains the exposed surface soil around the Former Lead Storage Pad location southeast of Structure 2704 where lead-containing materials were historically staged. Soil near the Former Lead Storage Pad may be contaminated with residual PAHs, PCBs, or metals. Based on the CSM, three surface soil samples will be collected from IA 5.

IA 6 contains the Open Grass Area - between the fenced area and Haynes Branch. Soil near the swale of the Open Grass Area may be contaminated with residual PAHs, PCBs, or metals. Based on the CSM, six surface soil samples will be collected from IA 6 at approximately 200-foot intervals. This will include surface soil samples at the outlet areas of the two culverts to Haynes Branch.

IA 7 contains the Metals Baler – Structure 2918, where there was some evidence of metals and PCB contamination from previous activities. Soil near and beneath the Metals Baler may be contaminated with residual VOCs, PAHs, PCBs, or metals. Based on previous investigations and the CSM, three surface soil and three subsurface soil samples will be collected from IA 7.

Although scales (Structure 1940 and Structure 2943) are present on the site (Figure 10-2), they utilize mechanical rather than hydraulic systems. Because no hydraulic fluids are used in the operation of the scales, they do not pose a greater likelihood of contamination than the remainder of the site. Thus, no surface soil or subsurface soil samples will be collected near Structure 1940 or Structure 2943.

The Gravel Pad Area includes all areas other than the IAs within the fenced region of SWMU 21 that are covered by a layer of gravel. Soil beneath the gravel may be contaminated with residual VOCs, PAHs, PCBs, or metals. Prior to collecting a Gravel Pad Area sample, the top gravel layer must be removed to expose the surface soil beneath the gravel and the thickness of the gravel must be documented at each location. Based on previous investigations and the CSM, 30 exposed surface soil samples will be collected from the Gravel Pad Area and will be analyzed for VOCs, PAHs, PCBs, and metals.

Soil Sample Quantities

- Fifty-four surface soil samples (three samples from each of six IAs, six samples from IA 6, and 30 samples from the Gravel Pad Area), plus six field duplicate samples for QC purposes, and 12 subsurface samples (three samples from each of four IAs), plus two field duplicate samples for QC purposes, will be collected during Phase I and analyzed for potential target analytes based on the CSM and as described above. Additionally, at the discretion of the Tetra Tech FOL, the sampler may collect up to 12 "step-out" samples when areas of obvious or likely contamination are encountered. The flexibility to collect these additional samples extends both horizontally and vertically, and the action will proceed without preparation of a detailed SAP Addendum. Areas requiring additional sampling will be discerned by visual signs and the experience of the Tetra Tech FOL. Emphasis will be placed on collecting samples required to delineate contaminated areas. Additional "step-out" samples will be collected during Phase II at the boundaries of the area(s) to be sampled if target analyte concentrations greater than IDEM RISC R-DCLs are detected in Phase I surface and subsurface soil samples. Samples will be collected using hand augers, or a backhoe or DPT, if necessary. The gravel layer will not be analyzed as a soil sample.

If soil contamination is not sufficiently bounded after the Phase I and Phase II sampling events, further work will be conducted as necessary to define the extent of contamination.

Surface Water and Sediment Sampling (Phase I and Phase II)

Surface water and sediment sample locations have been selected to provide representative coverage of the nearby surface water and sediment in Haynes Branch that may have been impacted by SWMU 21 activities. A total of five co-located surface water and sediment samples will be collected from Haynes Branch at the locations shown on Figure 17-2. One sample will be collected upstream from the point where runoff from SWMU 21 discharges into Haynes Branch, approximately 100 feet north of the fence line, and the other four samples will be collected downstream (south) of the discharge point at approximately 400-foot intervals.

Surface water and sediment sampling from Haynes Branch will be limited to the confines of the stream channel. Sediment samples are proposed to be collected at specific intervals throughout the entire width of the stream bed; however, if sediment is not available, depositional areas will be targeted for sampling. Surface water samples will be co-located with sediment samples. An upstream location will also be sampled to represent background or upgradient conditions. The surface water samples will be analyzed for select VOCs, PAHs, and metals. Surface water will not be analyzed for PCBs because they are not expected to be present in surface water due to the low mobility of PCBs. Sediment samples will be analyzed for select VOCs, PAHs, PCBs, and metals. If PCBs are detected in sediment samples, the Project Team will evaluate the need to analyze co-located surface water samples for PCB analysis during Phase II. Sediment samples will also be analyzed for TOC to support site-specific risk calculations.

The proposed sediment sample location grid was adjusted to follow the stream path, and further adjustments may be necessary in the field if sediment is not available at the proposed locations. An attempt will be made to minimize relocation of sampling points because it affects the representativeness of individual samples; however, collecting the total number of proposed sediment samples is deemed more important to achieving project goals than strict adherence to the sampling grid. The planned surface water and co-located sediment sample locations are presented on Figure 17-2.

Surface water samples will be collected by directly filling the bottles from the stream. Water quality parameters (pH, specific conductivity, turbidity, temperature, oxidation-reduction potential [ORP], and dissolved oxygen [DO]) will be recorded at each sampling location. Sediment samples will be collected by filling the sample jars using either a decontaminated stainless steel trowel or dedicated disposable plastic trowel.

Surface Water and Co-located Sediment Sample Quantities

- Five surface water and five co-located sediment samples (plus one duplicate sample of each matrix for QC purposes) will be collected from Haynes Branch during Phase I. Based on Phase I results, additional samples may be necessary if any surface water or sediment target analyte exceeds an applicable PSL. Phase II samples will be identified in an addendum to this UFP-SAP.

Groundwater Sampling (Phase II)

The need to collect groundwater samples from temporary wells during Phase II will be evaluated based on an analysis of Phase I subsurface soil results and on the fate and transport properties of the detected contaminants. If groundwater samples are determined to be necessary based on Phase I results, three groundwater samples will be collected from temporary wells on the site during Phase II. Two samples will be collected from temporary wells located downgradient of potentially contaminated areas of the site, and one sample will be collected from a temporary well located upgradient of the site. The downgradient wells will be located downgradient of areas with the greatest potential for contamination based on historical data, field screening observations, and Phase I results. Installation of permanent monitoring wells will be determined based on the results of samples from these monitoring wells. If groundwater samples are necessary based on the results of Phase I, monitoring well locations will be provided in an addendum to this SAP.

If required, three groundwater samples (plus one duplicate sample for QC purposes) will be collected and analyzed for select VOCs, PAHs, PCBs, and total (and dissolved, if groundwater is highly turbid) metals. Groundwater samples will also be analyzed for field parameters including water levels, pH, specific conductivity, turbidity, temperature, ORP, and DO to support field sampling decisions and site-specific risk calculations.

Based on Phase II results, permanent groundwater monitoring wells may be deemed necessary as a selected remedy from a CMS and would be placed in areas where subsurface soil contamination concentrations and temporary well data indicate the greatest potential for groundwater contamination. This would not be part of the RFI and would be addressed in a separate work plan.

Field Quality Control Samples

Field QC samples will be collected as part of the investigation, including field duplicates, trip blanks, equipment rinsate blanks, and field blanks. Worksheet No. 20 presents the field QC sample summary. Also, additional sample volume will be collected as necessary for the laboratory QC of MS/MSD analyses (for select VOCs, PAHs, and PCBs) and MS/laboratory duplicate analyses (for metals).

SAP Worksheet No. 18 -- Sampling Locations and Methods/SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

Sampling Location	ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]
SWMU 21 IA1-1	21SS-IA101-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 IA1-2	21SS-IA102-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 IA1-3	21SS-IA103-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 IA2-1	21SS-IA201-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08, SOP-11
				PAHs	1	
				PCBs	1	
				Metals	1	
	21SB-IA201-XXXX[2]	Soil	> 2[3]	VOCs	1	
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 IA2-2	21SS-IA202-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08, SOP-11
				PAHs	1	
				PCBs	1	
				Metals	1	
	21SB-IA202-XXXX[2]	Soil	>2[3]	VOCs	1	
				PAHs	1	
				PCBs	1	
				Metals	1	

Sampling Location	ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference[(1)]
SWMU 21 IA2-3	21SS-IA203-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08, SOP-11
				PAHs	1	
				PCBs	1	
				Metals	1	
	21SB-IA203-XXXX[(2)]	Soil	>2[(3)]	VOCs	1	
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 IA3-1	21SS-IA301-0002 and 21SS-IA-DUP-01[4]	Soil	0 - 2	VOCs	1 + 1 FD	SOP-07, SOP-08, SOP-11
				PAHs	1 + 1 FD	
				PCBs	1 + 1 FD	
				Metals	1 + 1 FD	
	21SB-IA301-XXXX[(2)] and 21SB-IA-DUP-01[4]	Soil	>2[(3)]	VOCs	1 + 1 FD	
				PAHs	1 + 1 FD	
				PCBs	1 + 1 FD	
				Metals	1 + 1 FD	
SWMU 21 IA3-2	21SS-IA302-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08, SOP-11
				PAHs	1	
				PCBs	1	
				Metals	1	
	21SB-IA302-XXXX[(2)]	Soil	>2[(3)]	VOCs	1	
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 IA3-3	21SS-IA303-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08, SOP-11
				PAHs	1	
				PCBs	1	
				Metals	1	
	21SB-IA303-XXXX[(2)]	Soil	>2[(3)]	VOCs	1	
				PAHs	1	
				PCBs	1	
				Metals	1	

Sampling Location	ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]
SWMU 21 IA4-1	21SS-IA401-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08, SOP-11
				PAHs	1	
				PCBs	1	
				Metals	1	
	21SB-IA401-XXXX[2]	Soil	>2[3]	VOCs	1	
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 IA4-2	21SS-IA402-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08, SOP-11
				PAHs	1	
				PCBs	1	
				Metals	1	
	21SB-IA402-XXXX[2]	Soil	>2[3]	VOCs	1	
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 IA4-3	21SS-IA403-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08, SOP-11
				PAHs	1	
				PCBs	1	
				Metals	1	
	21SB-IA403-XXXX[2]	Soil	>2[3]	VOCs	1	
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 IA5-1	21SS-IA501-0002 and 21SS-IA-DUP-02[4]	Soil	0 - 2	PAHs	1	SOP-07, SOP-08
				PCBs	1	
				Metals	1	
SWMU 21 IA5-2	21SS-IA502-0002	Soil	0 - 2	PAHs	1	SOP-07, SOP-08
				PCBs	1	
				Metals	1	
SWMU 21 IA5-3	21SS-IA503-0002	Soil	0 - 2	PAHs	1	SOP-07, SOP-08
				PCBs	1	
				Metals	1	

Sampling Location	ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]
SWMU 21 IA6-1	21SS-IA601-0002 and 21SS-IA-DUP-03[4]	Soil	0 - 2	PAHs	1 + 1 FD	SOP-07, SOP-08
				PCBs	1 + 1 FD	
				Metals	1 + 1 FD	
SWMU 21 IA6-2	21SS-IA602-0002	Soil	0 - 2	PAHs	1	SOP-07, SOP-08
				PCBs	1	
				Metals	1	
SWMU 21 IA6-3	21SS-IA603-0002	Soil	0 - 2	PAHs	1	SOP-07, SOP-08
				PCBs	1	
				Metals	1	
SWMU 21 IA6-4	21SS-IA604-0002	Soil	0 - 2	PAHs	1	SOP-07, SOP-08
				PCBs	1	
				Metals	1	
SWMU 21 IA6-5	21SS-IA605-0002	Soil	0 - 2	PAHs	1	SOP-07, SOP-08
				PCBs	1	
				Metals	1	
SWMU 21 IA6-6	21SS-IA606-0002	Soil	0 - 2	PAHs	1	SOP-07, SOP-08
				PCBs	1	
				Metals	1	
SWMU 21 IA7-1	21SS-IA701-0002	Soil	0 - 2	VOCs	1 + 1 FD	SOP-07, SOP-08, SOP-11
				PAHs	1 + 1 FD	
				PCBs	1 + 1 FD	
				Metals	1 + 1 FD	
	21SB-IA701-XXXX[2] and 21SB-IA-DUP-02[4]	Soil	>2[3]	VOCs	1 + 1 FD	
				PAHs	1 + 1 FD	
				PCBs	1 + 1 FD	
				Metals	1 + 1 FD	
SWMU 21 IA7-2	21SS-IA702-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08, SOP-11
				PAHs	1	
				PCBs	1	
				Metals	1	
	21SB-IA702-XXXX[2]	Soil	>2[3]	VOCs	1	
				PAHs	1	
				PCBs	1	
				Metals	1	

Sampling Location	ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference(1)
SWMU 21 IA7-3	21SS-IA703-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08, SOP-11
				PAHs	1	
				PCBs	1	
				Metals	1	
	21SB-IA703-XXXX(2)	Soil	>2(3)	VOCs	1	
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-01	21SS-GP01-0002 and 21SS-GP-DUP-01(4)	Soil	0 - 2	VOCs	1 + 1 FD	SOP-07, SOP-08
				PAHs	1 + 1 FD	
				PCBs	1 + 1 FD	
				Metals	1 + 1 FD	
SWMU 21 Gravel Pad-02	21SS-GP02-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-03	21SS-GP03-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-04	21SS-GP04-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-05	21SS-GP05-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-06	21SS-GP06-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	

Sampling Location	ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference(1)
SWMU 21 Gravel Pad-07	21SS-GP07-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-08	21SS-GP08-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-09	21SS-GP09-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-10	21SS-GP10-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-11	21SS-GP11-0002 and 21SS-GP-DUP-02[4]	Soil	0 - 2	VOCs	1 + 1 FD	SOP-07, SOP-08
				PAHs	1 + 1 FD	
				PCBs	1 + 1 FD	
				Metals	1 + 1 FD	
SWMU 21 Gravel Pad-12	21SS-GP12-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-13	21SS-GP13-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-14	21SS-GP14-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	

Sampling Location	ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]
SWMU 21 Gravel Pad-15	21SS-GP15-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-16	21SS-GP16-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-17	21SS-GP17-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-18	21SS-GP18-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-19	21SS-GP19-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-20	21SS-GP20-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-21	21SS-GP21-0002 and 21SS-GP-DUP-03[4]	Soil	0 - 2	VOCs	1 + 1 FD	SOP-07, SOP-08
				PAHs	1 + 1 FD	
				PCBs	1 + 1 FD	
				Metals	1 + 1 FD	
SWMU 21 Gravel Pad-22	21SS-GP22-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	

Sampling Location	ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]
SWMU 21 Gravel Pad-23	21SS-GP23-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-24	21SS-GP24-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-25	21SS-GP25-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-26	21SS-GP26-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-27	21SS-GP27-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-28	21SS-GP28-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-29	21SS-GP29-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Gravel Pad-30	21SS-GP30-0002	Soil	0 - 2	VOCs	1	SOP-07, SOP-08
				PAHs	1	
				PCBs	1	
				Metals	1	

Sampling Location	ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference(1)
SWMU 21 Surface Water 01	21SW01 and 21SW-DUP-01[4]	Surface Water	60% of surface water depth	VOCs	1 + 1 FD	SOP-18
				PAHs	1 + 1 FD	
				Metals	1 + 1 FD	
SWMU 21 Surface Water 02	21SW02	Surface Water	60% of surface water depth	VOCs	1	SOP-18
				PAHs	1	
				Metals	1	
SWMU 21 Surface Water 03	21SW03	Surface Water	60% of surface water depth	VOCs	1	SOP-18
				PAHs	1	
				Metals	1	
SWMU 21 Surface Water 04	21SW04	Surface Water	60% of surface water depth	VOCs	1	SOP-18
				PAHs	1	
				Metals	1	
SWMU 21 Surface Water 05	21SW05	Surface Water	60% of surface water depth	VOCs	1	SOP-18
				PAHs	1	
				Metals	1	
SWMU 21 Sediment 01	21SD01-0000.5 and 21SD-DUP-01[4]	Sediment	0 - 0.5	VOCs	1 + 1 FD	SOP-09
				PAHs	1 + 1 FD	
				PCBs	1 + 1 FD	
				Metals	1 + 1 FD	
SWMU 21 Sediment 02	21SD02-0000.5	Sediment	0 - 0.5	VOCs	1	SOP-09
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Sediment 03	21SD03-0000.5	Sediment	0 - 0.5	VOCs	1	SOP-09
				PAHs	1	
				PCBs	1	
				Metals	1	
SWMU 21 Sediment 04	21SD04-0000.5	Sediment	0 - 0.5	VOCs	1	SOP-09
				PAHs	1	
				PCBs	1	
				Metals	1	

Sampling Location	ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference[(1)]
SWMU 21 Sediment 05	21SD05-0000.5	Sediment	0 - 0.5	VOCs	1	SOP-09
				PAHs	1	
				PCBs	1	
				Metals	1	

1 SOP or worksheet that describes the sample collection procedures (Worksheet No. 21).
2 XXXX represents depth of the sample from the top of the soil layer (if there is gravel on the surface of a sample location, the depth from the gravel surface to the top of the soil will also be documented). Depth will be determined in the field based on FID readings and visual and olafactory observations. For example, if sample is collected from 4 to 5 feet bgs, the depth will be recorded as 0405.
3 If there are no FID readings or visual observations that cause a subsurface depth to be selected in a biased manner, then the 4- to 5-foot bgs depth interval will be selected.
4 Field duplicate locations may change in the field based on visual and olfactory observations and FID readings.

SAP Worksheet No. 19 -- Analytical SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	Analytical and Preparation Method/SOP Reference[1]	Containers (number, size, and type)	Sample volume (units)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation / analysis)
Surface Soil, Subsurface Soil, and Sediment	VOCs	SW-846 5035/8260B CompuChem 1.3.2.4	Three 5-gram (g) EnCore® samplers	15g	Sodium bisulfate in water; methanol Freeze to < -10 °C	48 hours from sampling to preparation; 14 days to analysis
	PAHs	SW-846 3550B/8270C Modified for SIM CompuChem 2.4.4.5	One 8-ounce (oz) wide-mouth glass jar	250g	Cool to (0 to 6) °C	14 days to extraction; 40 days to analysis
	PCBs	SW-846 3550B/8082 CompuChem 2.2.5.2, 2.2.5.3				
	Metals	SW-846 3050B/6010B/6020 CompuChem 3.2.1.5, 3.2.1.6, 3.2.1.7, 3.2.1.9	One 8-oz wide-mouth glass jar	250g	Cool to (0 to 6) °C	180 days to analysis
	Mercury	SW-846 7471A CompuChem 3.3.2, 3.3.4				28 days to analysis
	TOC	SW-846 9060/Lloyd Kahn CompuChem 3.6.2.2	One 4-oz wide-mouth amber glass jar	10g	Cool to (0 to 6) °C	28 days to analysis
Surface Water, Groundwater[2], and Aqueous Field QC Blanks	VOCs	SW-846 5030/8260B CompuChem 1.3.2.2	Three 40-milliliter (mL) clear glass vials	120mL	Cool to (0 to 6) °C Hydrochloric acid (HCl) to pH < 2	14 days to analysis
	PAHs	SW-846 3510C/8270C Modified for SIM CompuChem 2.4.4.5	Four 1-liter (L) amber glass bottles	4L	Cool to (0 to 6) °C	7 days for preparation; 40 days to analysis
	PCBs	SW-846 3510C/8082 CompuChem 2.2.5.1, 2.2.5.3				
	Metals (Total and Dissolved[3])	SW-846 3010A/6010B/6020 CompuChem 3.2.1.4, 3.2.1.6, 3.2.1.9, 3.2.1.13	One 1-L plastic bottle	1L	Cool to (0 to 6) °C; Nitric acid (HNO_3) to pH < 2	180 days to analysis
	Mercury (Total and Dissolved)	SW-846 7470A CompuChem 3.3.1, 3.3.4				28 days to analysis

1 Laboratory SOPs are included in Appendix B.
2 Groundwater not applicable in Phase I; may be applicable in Phase II (if necessary).
3 Dissolved metals for groundwater samples may be necessary, based on the turbidity of the groundwater.

SAP Worksheet No. 20 -- Field Quality Control Sample Summary Table

(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of MS/MSDs[(1)]	No. of Field Blanks	No. of Equip. Blanks	No. of VOC Trip Blanks	No. of PT[(2)] Samples	Total No. of Samples to Lab
Phase I									
Surface Soil	VOCs	45	5	3	1	1	5	0	57
	PAHs	54	6	3	1	3	0	0	64
	PCBs	54	6	3	1	3	0	0	64
	Metals	54	6	3	1	3	0	0	64
Subsurface Soil	VOCs	12	2	1	0	1	4	0	19
	PAHs	12	2	1	0	1	0	0	15
	PCBs	12	2	1	0	1	0	0	15
	Metals	12	2	1	0	1	0	0	15
Sediment	VOCs	5	1	1	0	0	1	0	7
	PAHs	5	1	1	0	0	0	0	6
	PCBs	5	1	1	0	0	0	0	6
	Metals	5	1	1	0	0	0	0	6
	TOC	5	1	1	0	0	0	0	6
Surface water	VOCs	5	1	1	0	0	1	0	7
	PAHs	5	1	1	0	0	0	0	6
	Total Metals	5	1	1	0	0	0	0	6
	Dissolved Metals	0 minimum, 5 maximum	1	1	0	1*	0	0	7
Phase II (if necessary)									
Groundwater	VOCs	3	1	1	0	0	1	0	5
Groundwater	PAHs	3	1	1	0	0	0	0	4
Groundwater	PCBs	3	1	1	0	0	0	0	4
Groundwater	Total Metals	3	1	1	0	0	0	0	4
Groundwater	Dissolved Metals	0 minimum, 3 maximum	1	1	0	1*	0	0	5

1 Although MS/MSDs are not typically considered field QC samples, they are included here because location determination is often established in the field. The MS/MSDs are not included in the total number of samples sent to the laboratory. For total and dissolved metals, a laboratory duplicate will be collected in place of an MSD.

2 PT – Proficiency Test samples.

* The equipment blank for dissolved metals, if collected, will be obtained by passing rinse water through a 0.45-micron filter.

SAP Worksheet No. 21 -- Project Sampling SOP References Table

(UFP-QAPP Manual Section 3.1.2)

Reference Number	Title, Revision Date, and/or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
SOP-01	Global Positioning System, 11/09, Rev. 0.	Tetra Tech	GPS unit	Y (project-specific SOP)	Contained in Appendix A
SOP-02	Sample Labeling, 11/09, Rev. 0.	Tetra Tech	NA	Y (project-specific SOP)	Contained in Appendix A
SOP-03	Sample Identification Nomenclature, 11/09, Rev. 0.	Tetra Tech	NA	Y (project-specific SOP)	Contained in Appendix A
SOP-04	Sample Custody and Documentation of Field Activities, 11/09, Rev. 0.	Tetra Tech	Field logbook, sample log sheets, boring logs	Y (project-specific SOP)	Contained in Appendix A
SOP-05	Sample Preservation, Packaging, and Shipping, 11/09, Rev. 0.	Tetra Tech	NA	Y (project-specific SOP)	Contained in Appendix A
SOP-06	Decontamination of Field Sampling Equipment, 11/09, Rev. 0.	Tetra Tech	Decontamination equipment, scrub brushes, 5-gallon buckets, spray bottles, phosphate free detergent, deionized water	Y (project-specific SOP)	Contained in Appendix A
SOP-07	Soil Coring and Sampling Using Hand Auger Techniques, 11/09, Rev. 0.	Tetra Tech	Stainless steel auger bucket, extension rods, and T-handle	Y (project-specific SOP)	Contained in Appendix A
SOP-08	Soil Sample Logging, 11/09, Rev. 0.	Tetra Tech	NA	Y (project-specific SOP)	Contained in Appendix A
SOP-09	Sediment Sampling, 11/09, Rev. 0.	Tetra Tech	Stainless steel or disposable trowels	Y (project-specific SOP)	Contained in Appendix A
SOP-10	Management of Investigation-Derived Waste, 11/09, Rev. 0.	Tetra Tech	NA	Y (project-specific SOP)	Contained in Appendix A
SOP-11	Subsurface Soil and Groundwater Sampling Using Direct Push Technology, 11/09, Rev. 0.	Tetra Tech	DPT rig	Y (project-specific SOP)	Contained in Appendix A
SOP-12	Monitoring Well Installation, 11/09, Rev. 0.	Tetra Tech	NA	Y (project-specific SOP)	Contained in Appendix A
SOP-13	Monitoring Well Development, 11/09, Rev. 0.	Tetra Tech	NA	Y (project-specific SOP)	Contained in Appendix A
SOP-14	Measurement of Water Levels, 11/09, Rev. 0.	Tetra Tech	NA	Y (project-specific SOP)	Contained in Appendix A
SOP-15	Low-Flow Well Purging and Stabilization, 11/09, Rev. 0.	Tetra Tech	NA	Y (project-specific SOP)	Contained in Appendix A
SOP-16	Monitoring Well Sampling, 11/09, Rev. 0.	Tetra Tech	NA	Y (project-specific SOP)	Contained in Appendix A
SOP-17	Calibration and Care of Water Quality Meters, 11/09, Rev. 0.	Tetra Tech	Multi-parameter water quality meter, such as a Horiba U-22	Y (project-specific SOP)	Contained in Appendix A
SOP-18	Surface Water Sampling, 11/09, Rev. 0.	Tetra Tech	NA	Y (project-specific SOP)	Contained in Appendix A

SAP Worksheet No. 22 -- Field Equipment Calibration, Maintenance, Testing, and Inspection Table

(UFP-QAPP Manual Section 3.1.2.4)

Field Equipment	Activity(1)	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference(2)	Comments
FID	Visual Inspection Calibration/ Verification	Daily Beginning and end of day	Manufacturer's guidance.	Replace	Tetra Tech FOL or designee	Rental equipment will be used – Operation according to manufacturer's instructions	To be used to determine the subsurface soil depth that is most impacted for biased sample collection.
GPS	Positioning	Beginning and end of each day used	Accuracy: sub-meter horizontal dilution of precision (HDOP) <3, number of satellites at least six.	Wait for better signal, replace unit, or choose alternate location technique	Tetra Tech FOL or designee	SOP-01	SOP located in Appendix A.
DPT Rig/ Backhoe/ Excavating Machinery	Inspection	Daily	Equipment inspection sheet criteria.	Replace	Tetra Tech FOL or designee	SOP-08	SOP located in Appendix A.
Disposable Hand Trowel	Inspection	Per use	NA.	Replace	Tetra Tech FOL or designee	SOP-08	SOP located in Appendix A.
Multi-Parameter Water Quality Meter	Visual Inspection Calibration/ Verification	Daily Beginning and end of day	Manufacturer's guidance.	Replace	Tetra Tech FOL or designee	SOP-17	SOP located in Appendix A.
Turbidity Meter	Visual Inspection Calibration/ Verification	Daily Beginning and end of day	Manufacturer's guidance; calibrations must bracket expected values. Initial Calibration Verification (ICV) must be <10 nephelometric turbidity units (NTUs).	Replace	Tetra Tech FOL or designee	SOP-17	SOP located in Appendix A.

1 Activities may include calibration, verification, testing, maintenance, and/or inspection.
2 From the Project Sampling SOP References table (Worksheet No. 21).

SAP Worksheet No. 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)
1.3.2.2	Analysis of Volatile Organic Compounds in Aqueous and Medium/High Concentration Soil Samples by SW-846 (Revision 14, 4/1/10)	Definitive	Surface water and aqueous field QC samples – VOCs	Gas chromatograph/ mass spectrometer (GC/MS)	CompuChem	N
1.3.2.4	GC/MS Analysis of Low Concentration Volatiles in Soil/Sediment/Sludge Samples by SW-846 Method 8260B (Revision 12, 4/1/10)	Definitive	Soil and sediment samples – VOCs	GC/MS	CompuChem	N
2.2.5.1	PCBs in Water Preparation Procedure (SW-846) (Revision 10, 3/31/10)	Definitive	Surface water and aqueous field QC samples – PCBs	None	CompuChem	N
2.2.5.2	Low-Level Preparation for Analysis of PCBs Only in Soil/Sediment/Sludge by SW-846 and NYSASP (Revision 9, 3/4/09)	Definitive	Soil and sediment samples – PCBs	None	CompuChem	N
2.2.5.3	GC/ECD Analysis of PCBs as Aroclors in Water and Soil Extracts by SW-846 Method 8082 and 8082A (Revision 9, 3/11/10)	Definitive	Soil and sediment samples – PCBs	Gas chromatograph/ electron capture detector (GC-ECD)	CompuChem	N
2.4.4.5	GC/MS SIM Semivolatile Analyses of Aqueous and Soil Samples using SW-846 and EPA CLP Methodologies (OLC03.2 and OLM04.3) (Revision 1, 6/20/06)	Definitive	Soil, sediment, surface water, and aqueous field QC samples – PAHs	GC/MS	CompuChem	N
2.5.2.1	Preparation of Water Samples for the Analysis of Semivolatiles by SW-846 Method 3510C and EPA 625 (Revision 13, 6/15/08)	Definitive	Surface water and aqueous field QC samples – PAHs	None	CompuChem	N
2.5.2.3	Preparation of Soil/Sediment/Sludge Samples by SW-846 Method 3550B and Method 3550C for the Analysis of Low-Level Semivolatiles by SW-846 (Revision 13, 10/13/09)	Definitive	Soil and sediment samples – PAHs	None	CompuChem	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)
2.5.2.4	Medium Level Preparation Procedure for Semivolatile Organics in Soil Samples by SW-846 and NYSASP (Revision 8, 3/4/09)	Definitive	Soil and sediment samples – PAHs	None	CompuChem	N
2.5.2.7	GC/MS Analysis of Extractible Semivolatiles in Aqueous and Solid Sample Extracts by SW-846 (Revision 14, 4/1/10)	Definitive	Soil, sediment, surface water, and aqueous field QC samples – PAHs	GC/MS	CompuChem	N
3.2.1.4	Digestion Block Preparation of Aqueous Samples for ICP Analysis of Total or Dissolved Metals by SW-846, MCAWW, and Standard Methods (Revision 4, 5/27/08)	Definitive	Surface water and aqueous field QC samples – metals	None	CompuChem	N
3.2.1.5	Digestion Block Preparation of Solid Samples for ICP Determination of Total Metals by SW-846 Method 3050B (Revision 7, 6/5/08)	Definitive	Soil and sediment samples – metals	None	CompuChem	N
3.2.1.6	Inductively Coupled Plasma Atomic Emission Spectroscopy by SW-846 Method 6010B and 6010C (Revision 18, 7/7/10)	Definitive	Soil, sediment, surface water, and aqueous field QC samples – metals	ICP-AES	CompuChem	N
3.2.1.7	Digestion Block Preparation of Solid Samples for ICP-MS Determination of Total Metals by SW-846 (Revision 0, 9/18/06)	Definitive	Soil and sediment samples – metals	None	CompuChem	N
3.2.1.9	Determination of Metals by ICP-MS by SW-846 Method 6020 (Revision 5, 7/7/10)	Definitive	Soil, sediment, surface water ,and aqueous field QC samples – metals	ICP-MS	CompuChem	N
3.2.1.13	Digestion Block Preparation of Aqueous Samples for ICP-MS Analysis of Total or Dissolved Metals by SW-846 Method 3005A (Revision 1, 10/5/06)	Definitive	Surface water and aqueous field QC samples – metals	None	CompuChem	N
3.3.1	Mercury in Water, Manual Digestion Procedure for EPA CLP, SW-846, and MCAWW (Revision 21, 3/31/10)	Definitive	Surface water and aqueous field QC samples – mercury	None	CompuChem	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)
3.3.2	Solid Sample Mercury Digestion by SW-846 Method 7471A and 7471B (Revision 17, 9/2/09)	Definitive	Soil and sediment samples – mercury	None	CompuChem	N
3.3.4	Automated Cold Vapor Determination for Mercury by CLP, SW-846, MCAWW, and NYSASP (Revision 23, 7/7/10)	Definitive	Soil, sediment, surface water,and aqueous field QC samples – mercury	CVAA	CompuChem	N
3.6.2.2	Analysis of Soil Samples for Total Organic Carbon (TOC) by SW-846 and Lloyd Kahn (Revision 15, 10/06/09)	Definitive	Soil and sediment samples – TOC	Non-dispersive infrared detector (NDIRD)	CompuChem	N
4.1	Receiving Samples (Revision 35, 2/17/09)	NA	NA	None	CompuChem	N
4.3	Checking and Recording pH of Metals, Cyanides, Phenols, and Wet Chemistry Samples (Revision 9, 2/17/09)	NA	NA	None	CompuChem	N
4.4	Sample Custody and Responsibilities of the Sample Custodian (Revision 4, 3/20/02)	NA	NA	None	CompuChem	N
4.5	Ensuring Sample Security (Revision 8, 2/25/09)	NA	NA	None	CompuChem	N
4.6	Storing Samples (Revision 20, 2/25/09)	NA	NA	None	CompuChem	N
4.7	Organizing and Designating Raw Samples for Disposal (Revision 10, 2/25/09)	NA	NA	None	CompuChem	N
4.8	Storing, Purging, and Preparing Extracts for Disposal (Revision 9, 7/31/08)	NA	NA	None	CompuChem	N

SAP Worksheet No. 24 -- Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference[1]
GC/MS VOCs	Tuning	Prior to Initial Calibration (ICAL) and 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.	Manual tuning; replacement of the ion source or filament.	Analyst/Laboratory Area Supervisor	1.3.2.2 1.3.2.4
	ICAL – A minimum of a 5-point calibration curve is analyzed	Perform after major instrument maintenance and when CCV is out of criteria, prior to sample analysis.	System Performance Check Compounds (SPCCs) average Response Factors (RFs) for 1,1,2,2-tetrachloroethane and chlorobenzene must be ≥0.30; and chloromethane, 1,1-dichloroethane and bromoform must be ≥0.10; Percent Relative Standard Deviation (%RSD) for RFs must be ≤30% for Calibration Check Compounds (CCCs); and: Option 1: %RSD must be ≤15% for each target analyte. If not met, Option 2: Linear least squares regression correlation coefficient (r) must be ≥ 0.995.	Repeat calibration if criterion is not met.	Analyst/Laboratory Area Supervisor	
	ICV - Second source	Once after each ICAL, prior to beginning a sample run.	The percent recovery (%R) for all analytes must be within 80-120% of true value.	Investigate problem and verify ICV. Rerun ICV. If that fails, correct the problem and reanalyze ICAL.	Analyst/Laboratory Area Supervisor	
	Continuing Calibration Verification (CCV)	Daily before analysis and every 12 hours after the analysis of the tuning standard.	All analytes must be ≤20 Percent Difference or Percent Drift (≤20%D). SPCC RFs must be ≥ 0.10 & 0.30 (compounds as listed above in ICAL acceptance criteria cell).	Investigate cause and repeat injection. Repeat ICAL and reanalyze all samples analyzed since the last successful CCV.	Analyst/Laboratory Area Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference(1)
GC/MS SIM PAHs	Tuning	Prior to ICAL and at the beginning of each 12-hour analytical sequence.	SIM: Must meet the mass drift and peak width criteria required by the SOP. No samples may be accepted without a valid tune.	Manual tuning; replacement of the ion source or filament.	Analyst/Laboratory Director	2.4.4.5 2.5.2.7
	Breakdown Check (DDT only)	At the beginning of each 12-hour analytical sequence.	The degradation must be ≤ 20% for DDT to verify inertness of the injection port.	Correct the problem then repeat breakdown check. No samples shall be run until degradation is ≤20% for DDT.	Analyst/Laboratory Director	
	ICAL – A minimum of a 5-point calibration curve is analyzed	After major maintenance; upon second consecutive failure of CCV standard.	SPCC RFs must be ≥0.050 (≥0.010 for SIM); %RSD must be ≤30% for the CCCs; and Option 1: %RSD must be ≤15% for each target analyte. If not met, Option 2: r must be ≥ 0.995.	Repeat calibration if criterion is not met.	Analyst/Laboratory Director	
	ICV - Second source	Once after each ICAL, prior to beginning a sample run.	The %R of all target analytes must be within 75-125% of the true value. SPCC RFs must be ≥0.050 (≥0.010 for SIM); CCCs must be ≤20%D (≤30%D for SIM).	Investigate problem and verify ICV. Rerun ICV. If that fails, correct the problem and reanalyze ICAL.	Analyst/Laboratory Director	
	CCV	Daily before analysis and every 12 hours after the analysis of the tuning standard.	SPCC RFs must be ≥0.050 (≥0.010 for SIM); All target analytes and surrogates must be ≤20%D (≤30%D for SIM).	Investigate cause and repeat injection. Repeat ICAL and reanalyze all samples analyzed since last successful CCV.	Analyst/Laboratory Director	
GC/ECD PCBs	ICAL – A minimum of a 5-point calibration curve of Aroclor 1660 (1016/1260 mixture) is analyzed	After major instrument maintenance; upon failure of second consecutive CCV.	Option 1 %RSD must be ≤20% for Aroclor 1016/1260. If not met, Option 2: r must be ≥ 0.995. Mid-point calibration of other Aroclors – if an Aroclor is detected in a sample, a 5-point ICAL must be performed and meet the above criteria.	Repeat calibration if criterion is not met.	Analyst/Laboratory Director	2.2.5.3
	ICV - Second source	Once after each ICAL, prior to beginning a sample run.	The %R of all target analytes must be within 80-120% of true value.	Investigate problem and verify ICV. Reanalyze ICAL.	Analyst/Laboratory Director	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference[1]
	CCV	After each 10 field samples and at the end of the analytical sequence.	All target analytes must be ≤20%D.	Investigate cause and repeat injection. Repeat ICAL and reanalyze all samples analyzed since last successful CCV.	Analyst/Laboratory Director	
ICP-AES Metals	ICAL – A minimum of a 1-point calibration is analyzed	Daily ICAL prior to sample analysis.	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.	Investigate and perform necessary equipment maintenance. Check calibration standards. Recalibrate.	Analyst /Laboratory Area Supervisor	3.2.1.6
	ICV - Second source	Once after each ICAL, prior to beginning a sample run.	The %R of all target analytes must be within 90-110 % of the true value.	Investigate and perform necessary equipment maintenance, verify standard and repeat. Recalibrate.	Analyst/Laboratory Area Supervisor	
	Initial Calibration Blank (ICB)	Before beginning a sample sequence.	No analytes detected > LOD.	Correct the problem, then re-prepare and reanalyze.	Analyst/Laboratory Area Supervisor	
	CCV	After each 10 field samples and at the end of the analytical sequence.	The %R of all target analytes must be within 90-110 % of the true value.	Investigate and perform necessary equipment maintenance. Recalibrate and reanalyze any samples not bracketed by passing CCVs.	Analyst/Laboratory Area Supervisor	
	Continuing Calibration Blank (CCB)	After the initial CCV, after every 10 samples, and at the end of the sequence.	No analyte detected > LOD.	Investigate the source of contamination, reanalyze, reanalyze any samples not bracketed by passing CCBs.	Analyst/Laboratory Area Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference[1]
	Low-Level Check Standard (if using 1-point ICAL)	Daily after ICAL and before samples.	The %R of all target analytes must be within 80-120 % of the true value.	Investigate and perform necessary equipment maintenance. Recalibrate and reanalyze all affected samples.	Analyst/Laboratory Area Supervisor	
	Interference Check Standards (ICS – ICS A and ICS B)	At the beginning of an analytical run.	The absolute value of ICS A recoveries for all non-spiked analytes must be < LOD and ICS B %Rs must be within 80-120 % of the true value.	Investigate and perform necessary equipment maintenance. Recalibrate and reanalyze all affected samples.	Analyst /Laboratory Area Supervisor	
ICP-MS Metals	Tuning	Prior to ICAL.	Mass calibration must be ≤ 0.1 atomic mass units (amu) from the true value over the mass range of 6-120 amu. Resolution must be within 0.6-0.8 amu peak width at 10% peak height. For stability, RSD must be ≤ 5% for five replicate analyses.	Retune and/or clean or replace source, then reanalyze tuning solutions. No samples may be accepted without a valid tune.	Analyst/Laboratory Area Supervisor	3.2.1.9
	ICAL – A minimum of a 6-point calibration curve (blank and 5 levels) is analyzed	Daily ICAL prior to sample analysis.	For Method 6020, r must be ≥ 0.995. For Method 6020A, r must be ≥ 0.998.	Investigate and perform necessary equipment maintenance. Check calibration standards. Recalibrate.	Analyst/Laboratory Area Supervisor	
	ICV - Second source	Once after each ICAL, prior to beginning a sample run.	The %R of all target analytes must be within 90-110 % of the true value.	Investigate and perform necessary equipment maintenance, verify standard and repeat. Recalibrate.	Analyst/Laboratory Area Supervisor	
	ICB	Before beginning a sample sequence.	No analytes detected > LOD.	Correct the problem, then re-prepare and reanalyze.	Analyst/Laboratory Area Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference[1]
	CCV	After each 10 field samples and at the end of the analytical sequence.	The %R of all target analytes must be within 90-110 % of the true value.	Investigate and perform necessary equipment maintenance. Recalibrate and reanalyze any samples not bracketed by passing CCVs.	Analyst/Laboratory Area Supervisor	
	CCB	After the initial CCV, after every 10 samples, and at the end of the sequence.	No analyte detected > LOD.	Investigate the source of contamination, reanalyze, reanalyze any samples not bracketed by passing CCBs.	Analyst/Laboratory Area Supervisor	
	Low-Level Check Standard	Daily after ICAL and before samples.	The %R of all target analytes must be within 80-120 % of the true value.	Investigate and perform necessary equipment maintenance. Recalibrate and reanalyze all affected samples.	Analyst/Laboratory Area Supervisor	
	ICS – ICS A & ICS B	At the beginning of an analytical run.	The absolute value of ICS A recoveries must be < LOD and ICS B %Rs must be within 80-120 % of the true value.	Investigate and perform necessary equipment maintenance. Recalibrate and reanalyze all affected samples.	Analyst/Laboratory Area Supervisor	
CVAA Mercury	ICAL – A minimum of a 5-point calibration curve is analyzed	Daily ICAL prior to sample analysis.	r must be ≥0.995.	Investigate and perform necessary equipment maintenance. Check calibration standards. Recalibrate.	Analyst/Laboratory Area Supervisor	3.3.4

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference[1]
	ICV - Second source	Once after each ICAL, prior to beginning a sample run.	The %R of mercury must be within 90-110 % of the true value.	Investigate and perform necessary equipment maintenance, verify standard and repeat. Recalibrate.	Analyst/Laboratory Area Supervisor	
	ICB	Before beginning a sample sequence.	No mercury detected > LOD.	Correct the problem, then re-prepare and reanalyze.	Analyst/Laboratory Area Supervisor	
	CCV	After each 10 field samples and at the end of the analytical sequence.	The %R of mercury must be within 80-120 % of the true value.	Investigate and perform necessary equipment maintenance. Recalibrate and reanalyze any samples not bracketed by passing CCVs.	Analyst/Laboratory Area Supervisor	
	CCB	After the initial CCV, after every 10 samples, and at the end of the sequence.	No mercury detected > LOD.	Investigate the source of contamination, reanalyze, reanalyze any samples not bracketed by passing CCBs.	Analyst/Laboratory Area Supervisor	
TOC Analyzer	ICAL	Daily prior to sample analysis.	r must be ≥0.995.	Recalibrate.	Laboratory Section Supervisor	3.6.2.2
	ICV - Second source	Once after each ICAL, prior to beginning a sample run.	The %R must be within 90-110 % of the true value.	Recalibrate.	Laboratory Section Supervisor	
	CCV	After each 10 field samples and at the end of the analytical sequence.	The %R must be within 90-110 % of the true value.	Recalibrate.	Laboratory Section Supervisor	

1 From the Analytical SOP References table (Worksheet No. 23).

SAP Worksheet No. 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	Replace/clean ion source; clean injector; replace liner; replace/clip capillary column. Flush/replace tubing on purge and trap devise; replace trap.	VOCs	Ion source, injector liner, column, column flow, purge lines, purge flow, trap	As needed	Must meet initial and/or continuing calibration criteria.	Repeat maintenance activity or remove from service.	Analyst/Laboratory Area Supervisor	1.3.2.2 1.3.2.4
	Replace/clean ion source; clean injector; replace liner; replace/clip capillary column. Flush/replace tubing on purge and trap devise; replace trap.	PAHs	Ion source, injector liner, column, column flow, purge lines, purge flow, trap	As needed	Must meet initial and/or continuing calibration criteria.	Repeat maintenance activity or remove from service.	Analyst/Laboratory Director	2.4.4.5 2.5.2.7
GC/ECD	ECD maintenance; replace/clip capillary column.	PCBs	ECD, injector, injector liner, column, adjust column flow	As needed	Must meet initial and/or continuing calibration criteria.	Repeat maintenance activity or remove from service.	Analyst/Laboratory Director	2.2.5.3
ICP-AES	Clean plasma torch; clean filters; clean spray and nebulizer chambers; replace pump tubing.	Metals	Torch, filters, nebulizer chamber, pump, pump tubing	As needed	Must meet initial and/or continuing calibration criteria.	Repeat maintenance activity or remove from service.	Analyst/Laboratory Area Supervisor	3.2.1.6
ICP-MS	Clean plasma torch; clean filters; clean spray and nebulizer chambers; replace pump tubing.	Metals	Torch, filters, nebulizer chamber, pump, pump tubing	As needed	Must meet initial and/or continuing calibration criteria.	Repeat maintenance activity or remove from service.	Analyst/Laboratory Area Supervisor	3.2.1.9
CVAA	Clean/replace dehydrator tubing and sample mixing coil tubing; replace sample probe; replace pump tubing; clean optical cell.	Mercury	Tubing, sample probe, optical cell	As needed	Must meet initial and/or continuing calibration criteria.	Repeat maintenance activity or remove from service.	Analyst/Laboratory Area Supervisor	3.3.4
TOC Analyzer	Replace sample tubing, clean sample boat, replace syringe.	TOC	Tubing, sample boat, syringe	As needed	Must meet initial and/or continuing calibration criteria.	Repeat maintenance activity or remove from service.	Laboratory Section Supervisor	3.6.2.2

1 From the Analytical SOP References table (Worksheet No. 23).

SAP Worksheet No. 26 -- Sample Handling System

(UFP-QAPP Manual Appendix A)

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): George Ten Eyck/Tetra Tech
Sample Packaging (Personnel/Organization): George Ten Eyck/Tetra Tech
Coordination of Shipment (Personnel/Organization): George Ten Eyck/Tetra Tech
Type of Shipment/Carrier: Overnight courier service (Federal Express)
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample custodian/CompuChem
Sample Custody and Storage (Personnel/Organization): Sample custodian/CompuChem
Sample Preparation (Personnel/Organization): Preparation laboratory staff/CompuChem
Sample Determinative Analysis (Personnel/Organization): GC/MS, GC/ECD, ICP-AES, ICP-MS, CVAA/CompuChem
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): 30 days from submittal of final report
Sample Extract/Digestate Storage (No. of days from extraction/digestion): 30 days from submittal of final report
Biological Sample Storage (No. of days from sample collection): Not applicable
SAMPLE DISPOSAL
Personnel/Organization: Sample custodian/CompuChem

SAP Worksheet No. 27 – Sample Custody Requirements Table

(UFP-QAPP Manual Section 3.3.3)

Field Sample Custody Procedures

Following sample collection into the appropriate bottleware, all samples will be immediately placed on ice in a cooler. Glass sample containers will be enclosed in bubble wrap to protect the bottleware 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 CompuChem for analysis. Samples will be preserved as appropriate based on the analytical method. The selected laboratory will provide pre-preserved sample containers for sample collection. Samples will be maintained at 0 to 6 °C until delivery to the laboratory. Proper custody procedures will be followed throughout all phases of sample collection and handling.

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 off-site laboratory analysis will be preserved, packaged, and shipped in accordance with SOP-05 (Appendix A).

Chain-of-Custody Procedures

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, sampler's name, and 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. SOP-04 (Appendix A) provides further details on the chain-of-custody procedure.

Laboratory Sample Custody Procedures

Chain-of-custody requirements are also documented with instructions contained in each shipment from CompuChem. The CompuChem Laboratory SOPs are provided in Appendix B.

Sample Designation System

Each sample collected for analysis will be assigned a unique sample tracking number that will consist of a multi-segment alphanumeric code that identifies the site, sample type (sample medium or QC sample designation), sample location, and sample depth. SOP-03 addresses sample nomenclature (Appendix A). The alphanumeric coding system to be used is as follows:

Site Identifier:

21 = SWMU 21

Sample Medium:

SS = Surface Soil
SB = Subsurface Soil
SD = Sediment
SW = Surface Water
GW = Groundwater

QA/QC Sample Designation:

TB = Trip Blank
FB = Field Blank
RB = Equipment Rinsate Blank
DUP = Field Duplicate

Sample Location:

The names of all planned sample locations are identified in Worksheet No. 18.

For surface and subsurface soil samples, the soil sample depth will be indicated by a four-digit number. The first two digits will represent the upper limit of the sample depth interval (rounded to the nearest foot), and the bottom two digits will represent the lower limit of the depth interval.

Surface water and sediment samples will be assigned a two-digit consecutive number in the order of collection. Groundwater samples (in Phase II, if necessary) will be identified by the monitoring well ID (i.e., 21MW01).

QC Sample Number:

All QC samples will be assigned a sequential sample number. For example, the first trip blank will be assigned the tracking number 21TB-01. Field duplicate, MS, and MSD samples will be collected from the same location. The field duplicate will be given the same type of sample designation as the samples so that it will be "blind" to the laboratory. The sampling time recorded on the chain-of-custody form, labels and tags for the duplicate samples will be 0000. 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).

All pertinent information regarding sample identification will be recorded in the field logbooks and on sample log sheets where appropriate.

SAP Worksheet No. 28 -- Laboratory QC Samples Table

(UFP-QAPP Manual Section 3.4)

Matrix	Soil/Sediment/Surface Water/Groundwater[1] and Aqueous Field QC Samples
Analytical Group	VOCs
Analytical Method/ SOP Reference	SW-846 8260B CompuChem 1.3.2.2; 1.3.2.4

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 samples or less per matrix.	No analytes >½ LOQ except common lab contaminants, which must be <LOQ.	Reclean, retest, re-extract, reanalyze. If reanalysis cannot be performed, then qualify data.	Analyst, Laboratory Area Supervisor, Data Validator	Bias/ Contamination	Same as Method/SOP QC Acceptance Limits.
System Monitoring Compounds (SMCs)/ Surrogates	All field and QC samples. four per sample- Dibromofluoromethane 1,2-dichloroethane-d4 Toluene-d8 4-Bromofluorobenzene	DoD QSM QC acceptance criteria (see SOP in Appendix B).	Reprepare and reanalyze for confirmation of matrix interference when appropriate.	Analyst, Laboratory Area Supervisor, Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
Laboratory Control Sample (LCS) Laboratory Control Sample Duplicate (LCSD) (Not Required)	One per batch of 20 samples or less per matrix.	DoD QSM QC acceptance criteria (see SOP in Appendix B). RPD between LCS and LCSD must be ≤ 30%, if analyzed.	Evaluate and reanalyze, if possible. If an MS/MSD was performed in the same 12-hour clock and acceptable, then narrate. If the LCS recoveries are high but the sample results are <LOQ, then narrate; otherwise, reprepare and reanalyze.	Analyst, Laboratory Area Supervisor, Data Validator	Accuracy/Bias Precision also, if LCSD is analyzed	Same as Method/SOP QC Acceptance Limits.
Internal Standards (ISs)	Every field sample, standard, and QC sample. three per sample- Fluorobenzene Chlorobenzene-d5 1,4-dichlorobenzene-d4	Retention times for IS must be within ± 30 seconds and the response areas must be within -50% to +100% of ICAL mid-point standard.	Inspect MS or GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning.	Analyst, Laboratory Area Supervisor, Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
MS/MSD	One per batch of 20 or fewer samples per matrix.	DoD QSM QC acceptance criteria (see SOP in Appendix B). RPD between MS and MSD should be ≤30%.	Corrective action will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD are unacceptable, then reprepare the samples and QC. Examine the project DQOs and contact the client.	Analyst, Laboratory Director, Data Validator	Accuracy/Bias/ Precision	Same as Method/SOP QC Acceptance Limits.

1 Groundwater not applicable in Phase I; possibly applicable in Phase II (if necessary).

Matrix	Soil/Sediment/Surface Water/ Groundwater[1] and Aqueous Field QC Samples
Analytical Group	Low-Level PAHs
Analytical Method/ SOP Reference	SW-846 8270C CompuChem 2.5.2.7/2.4.4.5 (SIM)

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 or fewer samples per matrix.	No analytes >½ LOQ.	Reclean, retest, re-extract, reanalyze, and/or qualify data.	Analyst, Laboratory Director, Data Validator	Bias/ Contamination	Same as Method/SOP QC Acceptance Limits.
SMCs/Surrogates	All field and QC samples. For SIM PAHs, 2-Fluorobiphenyl and Terphenyl-d14 only	DoD QSM QC acceptance criteria (see SOP in Appendix B).	Re-prepare and reanalyze for confirmation of matrix interference when appropriate.	Analyst, Laboratory Director, Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
LCS	One per batch of 20 or fewer samples per matrix.	DoD QSM QC acceptance criteria (see SOP in Appendix B).	Evaluate and reanalyze, if possible. If an MS/MSD was performed in the same 12-hour clock and acceptable, then narrate. If the LCS recoveries are high, but the sample results are <LOQ, then narrate; otherwise, re-prepare and reanalyze.	Analyst, Laboratory Director, Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
IS	Every field sample, standard, and QC sample. six per sample – 1,4-Dichlorobenzene-d4 Naphthalene-d8 Acenaphthene-d10 Phenanthrene-d10 Chrysene-d12 Perylene-d12	Retention times for IS must be within ± 30 seconds and the response areas must be within -50% to +100% of ICAL mid-point standard.	Inspect MS or GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning.	Analyst, Laboratory Director, Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
MS/MSD	One per batch of 20 or fewer samples per matrix.	DoD QSM QC acceptance criteria (see SOP in Appendix B). RPD between MS and MSD should be ≤30%.	Corrective action will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD are unacceptable, then reprepare the samples and QC. Examine the project DQOs and contact the client.	Analyst, Laboratory Director, Data Validator	Accuracy/Bias/ Precision	Same as Method/SOP QC Acceptance Limits.

1 Groundwater not applicable in Phase I; possibly applicable in Phase II (if necessary).

Matrix	Soil/Sediment/ Surface Water/Groundwater[1] and Aqueous Field QC Samples
Analytical Group	PCBs
Analytical Method/ SOP Reference	SW-846 8082 CompuChem 2.2.5.3

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 or fewer samples per matrix.	No analytes >½ LOQ.	Reclean, retest, re-extract, reanalyze, and/or qualify data.	Analyst, Laboratory Director, Data Validator	Bias/ Contamination	Same as Method/SOP QC Acceptance Limits.
SMCs/Surrogates	All field and QC samples. One per sample-Decachlorobiphenyl	DoD QSM QC acceptance criteria (see SOP in Appendix B).	If both surrogates are out on both columns, then re-extract and reanalyze.	Analyst, Laboratory Director, Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
LCS	One per batch of 20 or fewer samples per matrix.	DoD QSM QC acceptance criteria (see SOP in Appendix B).	Evaluate and reanalyze all associated samples.	Analyst, Laboratory Director, Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
MS/MSD	One per batch of 20 or fewer samples per matrix.	DoD QSM QC acceptance criteria (see SOP in Appendix B). RPD between MS and MSD should be ≤ 30%.	Corrective action will not be taken for samples when recoveries are outside limits and SMC and LCS criteria are met. Examine the project DQOs and contact the client.	Analyst, Laboratory Director, 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 - RPD must be ≤ 40%. For Method 8082, report the higher of the two concentrations, unless there is interference.	None.	Analyst, Laboratory Director, Data Validator	Accuracy/Bias/ Precision	Same as Method/SOP QC Acceptance Limits.

1 Groundwater not applicable in Phase I; possibly applicable in Phase II (if necessary).

Matrix	Soil/Sediment/ Surface Water/ Groundwater(1) and Aqueous Field QC Samples
Analytical Group	Metals
Analytical Method/ SOP Reference	SW-846 6010B/6020 CompuChem 3.2.1.6, 3.2.1.9

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 or fewer samples per matrix.	No analytes >½ LOQ except common lab contaminants, which must be <LOQ.	Reclean, retest, re-extract, reanalyze, and/or qualify data.	Analyst, Laboratory Area Supervisor, Data Validator	Bias/ Contamination	Same as Method/SOP QC Acceptance Limits.
LCS	One per batch of 20 or fewer samples per matrix.	DoD QSM QC acceptance criteria (see SOP in Appendix B).	Investigate source of problem. Redigest and reanalyze all associated samples.	Analyst, Laboratory Area Supervisor, Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
MS	One per batch of 20 or fewer samples per matrix.	The %R should be within 80-120%, if sample < 4x spike added.	Prepare post-digestion spike for analytes outside limits.	Analyst, Laboratory Area Supervisor, Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
Duplicate Sample	One per batch of 20 or fewer samples per matrix.	RPD between duplicate samples should be ≤20%, if both results are >5x LOQ.	Flag results.	Analyst, Laboratory Area Supervisor, Data Validator	Precision	Same as Method/SOP QC Acceptance Limits.
ICP Serial Dilution	One per batch of 20 or fewer samples per matrix.	The 5-fold dilution result must agree within ± 10%D of the original sample result.	Flag result or dilute and reanalyzed sample to eliminate interference.	Analyst, Laboratory Area Supervisor, Data Validator	Accuracy/Bias/ Precision	Same as Method/SOP QC Acceptance Limits.
Post-Digestion Spike	When serial dilution test fails or when all analyte concentrations are <50 x LOD.	The %R must be within 75-125% of expected value to verify the absence of an interference. Spike addition should produce a concentration of 10-100x LOQ.	Narrate.	Analyst, Laboratory Area Supervisor, Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.

1 Groundwater not applicable in Phase I; possibly applicable in Phase II (if necessary).

Matrix	Soil/Sediment/ Surface Water/ Groundwater[1] and Aqueous Field QC Samples
Analytical Group	Mercury
Analytical Method/ SOP Reference	SW-846 7470A/7471A CompuChem 3.3.4

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 or fewer samples per matrix.	No analytes >½ LOQ.	Reclean, retest, re-extract, reanalyze, and/or qualify data.	Analyst, Laboratory Area Supervisor, Data Validator	Bias/ Contamination	Same as Method/SOP QC Acceptance Limits.
LCS	One per batch of 20 or fewer samples per matrix.	DoD QSM QC acceptance criteria (see SOP in Appendix B).	Redigest and/or reanalyze as necessary.	Analyst, Laboratory Area Supervisor, Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
MS	One per batch of 20 or fewer samples per matrix.	DoD QSM QC acceptance criteria (see SOP in Appendix B), if sample < 4x spike added.	Narrate exceedances.	Analyst, Laboratory Area Supervisor, Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
Duplicate Sample	One per batch of 20 or fewer samples per matrix.	RPD between duplicate samples should be ≤20%, if both results are >5x LOQ.	Report original result with notation or narration.	Analyst, Laboratory Area Supervisor, Data Validator	Precision	Same as Method/SOP QC Acceptance Limits.

1 Groundwater not applicable in Phase I; possibly applicable in Phase II (if necessary).

Matrix	Sediment
Analytical Group	TOC
Analytical Method/ SOP Reference	SW-846 9060 Lloyd Kahn CompuChem 3.6.2.2

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 or fewer samples per matrix.	No analyte > ½ LOQ.	Reclean, retest, re-extract, reanalyze, and/or qualify data.	Analyst, Laboratory Supervisor, Data Validator	Accuracy/Bias/ Contamination	Same as Method/SOP QC Acceptance Limits.
LCS	One per batch of 20 or fewer samples per matrix.	%R must be within 80-120% of the true value.	Reprepare and reanalyze samples.	Analyst, Laboratory Supervisor, Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
MS	One per batch of 20 or fewer samples per matrix.	%R should be within 80-120% of the true value, if sample <4x spike added.	Narrate.	Analyst, Laboratory Supervisor , Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
Duplicate Sample	One per batch of 20 or fewer samples per matrix.	%RPD should be $\leq$ 20%, if both results are >5x LOQ.	Narrate.	Analyst, Laboratory Supervisor , Data Validator	Precision	Same as Method/SOP QC Acceptance Limits.

SAP Worksheet No. 29 -- Project Documents and Records Table

(UFP-QAPP Manual Section 3.5.1)

Document	Where Maintained
Field Documents Field Logbook Field Sample Forms Chain-of-Custody Records Air Bills Sampling Instrument Calibration Logs Sampling Notes Drilling Logs Photographs FTMR Forms This SAP Health and Safety Plan	Field documents will be maintained in the project file located in the Tetra Tech project office.
Laboratory Documents Sample Receipt, Custody, and Tracking Record Standards Traceability Logs Equipment Calibration Logs Sample Preparation Logs Analysis Run Logs Equipment Maintenance, Testing, and Inspection Logs Corrective Action Forms Reported Field Sample Results Reported Results for Standards, QC Checks, and QC Samples Sample Storage and Disposal Records Telephone Logs Extraction/Clean-Up Records Raw Data Data Completeness Checklist	Laboratory documents will be included in the hard-copy and Portable Document Format (PDF) deliverables from the laboratory. Laboratory data deliverables will be maintained in the Tetra Tech project file and in long-term data package storage at a third-party professional document storage firm. Electronic data results will be maintained in a database on a password-protected Structured Query Language (SQL) server.
Assessment Findings Field Sampling Audit Checklist (if conducted) Analytical Audit Checklist (if conducted) Data Validation Memoranda (includes tabulated data summary forms)	All assessment documents will be maintained in the Tetra Tech project file.
Reports SWMU 21 Phase I RFI Report; SWMU 21 Phase II (if necessary) RFI Report	All versions of the SWMU 21 Phase I and Phase II (if necessary) RFI Reports and all support documents (e.g., data validation memoranda) will be stored in hard-copy format in the Tetra Tech project file and electronically in the server library.

SAP Worksheet No. 30 -- Analytical Services Table
(UFP-QAPP Manual Section 3.5.2.3)

Matrix	Analytical Group	Sample Location/ ID Number	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)
Surface Soil, Subsurface Soil, and Sediment	VOCs	See Worksheet No. 18	SW-846 8260B	21 days	CompuChem, a Division of Liberty Analytical Corp., Inc. 501 Madison Avenue Cary, NC 27513 Contact: Cathy Dover Laboratory PM 919-379-4089	NA
	PAHs	See Worksheet No. 18	SW-846 8270C SIM	21 days		
	PCBs	See Worksheet No. 18	SW-846 8082	21 days		
	Metals	See Worksheet No. 18	SW-846 6010B/6020	21 days		
	Mercury	See Worksheet No. 18	SW-846 7471A	21 days		
Sediment	TOC	See Worksheet No. 18	SW-846 9060 / Lloyd Kahn	21 days		
Surface Water, Groundwater[(1)], and Aqueous Field QC Samples	VOCs	See Worksheet No. 18	SW-846 8260B	21 days		
	PAHs	See Worksheet No. 18	SW-846 8270C SIM	21 days		
	PCBs	See Worksheet No. 18	SW-846 8082	21 days		
	Metals	See Worksheet No. 18	SW-846 6010B/6020	21 days		
	Mercury	See Worksheet No. 18	SW-846 7470A	21 days		

1 Groundwater not applicable in Phase I; possibly applicable in Phase II (if necessary).

SAP Worksheet No. 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 (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of Corrective Action (title and organizational affiliation)
Laboratory Systems Audit[(1)]	Every 2 years	External	DoD ELAP Accrediting Body	DoD ELAP Accrediting Body Auditor	Laboratory QAM, CompuChem	Laboratory QAM, CompuChem	Laboratory QAM, CompuChem
Field Sampling System Audit	One per contract year	Internal	Tetra Tech	Auditor, Tetra Tech	PM, Tetra Tech	Auditor and QAM, Tetra Tech	QAM, Tetra Tech

1 CompuChem has successfully completed the laboratory evaluation process required as part of the DoD QSM Version 4.1 under the DoD ELAP by a recognized Accrediting Body. The DoD ELAP accreditation letter is included in Appendix B.

SAP Worksheet No. 32 -- Assessment Findings and Corrective Action Responses

(UFP-QAPP Manual Section 4.1.2)

Assessment Type	**Nature of Deficiencies Documentation**	**Individual(s) Notified of Findings** (name, title, organization)	**Time Frame of Notification**	**Nature of Corrective Action Response Documentation**	**Individual(s) Receiving Corrective Action Response** (name, title, organization)	**Time Frame for Response**
Field Sampling System Audit [1]	Audit checklist (as per Navy Installation Restoration Chemical Data Quality Manual [IRCDQM]) and written audit finding summary	Tony Klimek, PM, Tetra Tech; George Ten Eyck, FOL, Tetra Tech; John Trepanowski, Program Manager; and Garth Glenn, Deputy Program Manager, Tetra Tech	Dependant on findings; if major, a stop work order maybe issued immediately; however, if minor, within 1 week of audit	Written memo	Tom Johnston, CLEAN QAM, Tetra Tech; Designee, Field Auditor, Tetra Tech; John Trepanowski, Program Manager, Tetra Tech; and Garth Glenn, Deputy Program Manager, Tetra Tech	Within 48 hours of notification
Laboratory System Audit	Written audit report	Laboratory QAM, CompuChem	Specified by DoD ELAP Accrediting Body	Letter	DoD ELAP Accrediting Body	Specified by DoD ELAP Accrediting Body

1 Audits are scheduled at the Tetra Tech program level and may not include this project.

SAP Worksheet No. 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 after receiving the data from the laboratory	Project Chemist or Data Validator, Tetra Tech	PM, Tetra Tech; project file
Major Analysis Problem Identification (Internal Memorandum)	When persistent analysis problems are detected	Immediately upon detection of problem – on the same day	QAM, Tetra Tech	PM, Tetra Tech; QAM, Tetra Tech; Program Manager, Tetra Tech; project file
Project Monthly Progress Report	Monthly for duration of the project	Monthly	PM, Tetra Tech	PM, Tetra Tech; QAM, Tetra Tech; Program Manager, Tetra Tech; project file
Laboratory QA Report	When significant plan deviations result from unanticipated circumstances	Immediately upon detection of problem – on the same day	Laboratory PM, CompuChem	PM, Tetra Tech; project file

SAP Worksheet No. 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 Tetra Tech FOL or designee (sampler) will review and sign each chain-of-custody form to verify that all samples listed are included in the shipment to the laboratory and that the sample information is accurate. The chain-of-custody forms will be signed by the sampler, and a copy will be retained for the project file, Tetra Tech PM, and Tetra Tech Data Validator. See Tetra Tech SOP-04 (Appendix A).	Internal	FOL and Field Crew, Tetra Tech
	The laboratory sample custodian will review the sample shipment for completeness and integrity and will sign accepting the shipment. The Tetra Tech Data Validator will check that the chain-of-custody form was signed and dated by the Tetra Tech FOL or designee relinquishing the samples and also by the laboratory sample custodian receiving the samples for analyses.	Internal/ External	1 - Laboratory Sample Custodian, CompuChem 2 – Project Chemist or Data Validator, Tetra Tech
Field SOPs/Field Logs/Sample Collection	Ensure that all sampling SOPs were followed. Verify that deviations have been documented and MPCs have been achieved. Particular attention should be given to verify that samples were correctly identified, that sampling location coordinates are accurate, and that documentation establishes an unbroken trail of documented chain-of-custody from sample collection to report generation. Verify that the correct sampling and analytical methods/SOPs were applied. Verify that the sampling plan was implemented and carried out as written and that any deviations are documented.	Internal	PM, FOL, or designee , Tetra Tech
Analytical SOPs	Ensure that all laboratory SOPs were followed. Verify that the correct analytical methods/SOPs were applied.	Internal	Laboratory QAM, CompuChem
Documentation of Method QC Results	Establish that all method QC samples were analyzed and in control as listed in the analytical SOPs. If method QA is not in control, the Laboratory QAM will contact the Tetra Tech PM for guidance prior to report preparation.	Internal	Laboratory QAM, CompuChem
Sample Tables	Proposed samples verified to have been collected.	Internal	FOL and Field Crew, Tetra Tech
Sample Log Sheets	Log sheets completed as samples are collected in the field are verified for completeness and are maintained at the project office.	Internal	PM, FOL, or designee, Tetra Tech

Verification Input	Description	Internal/ External	Responsible for Verification (name, organization)
Field QC Samples	Verify that field QC samples listed in Worksheet No. 20 were collected as required.	Internal	FOL or designee, Tetra Tech
Analytical Data Packages	All analytical data packages will be verified internally for completeness by the laboratory performing the work. The Laboratory QAM will sign the case narrative for each data package.	Internal	Laboratory QAM, CompuChem
	Verify that the data package contains all the elements required by the functional guidelines and scope of work. Missing information will be requested from the laboratory, and validation will be suspended until missing data is received. This occurs as part of the data validation process.	External	Project Chemist or Data Validator, Tetra Tech
Electronic Data Deliverables	The electronic data will be compared to the chain-of-custody form and hard-copy data package to verify accuracy and completeness.	External	Project Chemist or Data Validator, Tetra Tech

SAP Worksheet No. 35 -- Validation (Steps IIa and IIb) Process Table

(UFP-QAPP Manual Section 5.2.2) (Figure 37 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.	PM, FOL, or designee, Tetra Tech
IIa	Chain-of-Custody Forms	Ensure that the custody and integrity of the samples were maintained from collection to analysis and that custody records are complete and any deviations are recorded.	Project Chemist or Data Validator, Tetra Tech
IIa	Holding Times	Verify that the samples were shipped and store at the required temperature and that the sample pH values for chemically preserved samples meet the requirements listed in Worksheet No. 19. Verify that the analyses were performed within the holding times listed in Worksheet No. 19.	Project Chemist or Data Validator, Tetra Tech
IIa/IIb	Laboratory Data Results for Accuracy	Ensure that the laboratory QC samples listed in Worksheet No. 28 were analyzed and that the MPCs listed in Worksheet No. 12 were met for all field samples and QC analyses. Verify that specified field QC samples were collected and analyzed and that the analytical QC criteria established for this project were met.	Project Chemist or Data Validator, Tetra Tech
IIa/IIb	Field and Laboratory Duplicate Analyses for Precision	Verify field sampling precision by checking the RPD for each set of field duplicate samples. Verify laboratory precision by checking all RPDs or %D values for laboratory duplicate, MS/MSD, and LCS/LCSD analyses. Ensure compliance with the methods and project MPC accuracy goals listed in Worksheet No. 12.	Project Chemist or Data Validator, Tetra Tech
IIa/IIb	Sample Results for Representativeness	Verify that the laboratory recorded the temperature of each sample at sample receipt and the pH of chemically preserved samples to ensure sample integrity from sample collection to analysis.	Project Chemist or Data Validator, Tetra Tech
IIa/IIb	Project Screening Levels	Discuss the impact of matrix interferences or sample dilutions performed, because of the high concentration of one or more contaminants, on the other target compounds reported as not detected. Document this usability issue and inform the Tetra Tech PM.	Project Chemist or Data Validator, Tetra Tech

Step IIa/IIb	Validation Input	Description	Responsible for Validation (name, organization)
		Review and add PSLs to the laboratory electronic data deliverable. Flag samples and notify the Tetra Tech PM of any sample results that exceed the applicable PSLs as listed in Worksheet No. 15.	PM or designee, Tetra Tech
IIa/IIb	Data Validation Report	Summarize deviations from methods, procedures, or contracts. Qualify results based on method or QC deviation and explain all data qualifications. Print a copy of the project database, qualified data depicting data qualifiers, and data qualifiers codes that summarize the reasons for data qualifications. Determine if the data met the MPCs and determine the impact of any deviations on the technical usability of the data.	Project Chemist or Data Validator, Tetra Tech
IIa, IIb	SAP QC Sample Documentation	Verify that all QC samples specified in the SAP were collected and analyzed and that the associated results were within prescribed SAP acceptance limits. Verify 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 shall have contacted the Tetra Tech Project Chemist or Tetra Tech PM.	Project Chemist or Data Validator, Tetra Tech
IIa, IIb	Documentation of Analytical Reports for Completeness	Ensure that the required analytical samples have been collected, appropriate sample identifications have been used, and correct analytical methods have been applied. Verify that elements of the data packages required for validation are present, and if not, the laboratory will be contacted and the missing information will be requested. Validation will be performed in accordance with Worksheet No. 36. Verify all data have been transferred correctly and completely to the final SQL database.	Project Chemist or Data Validator, Tetra Tech
IIb	Project Quantitation Limits for Sensitivity	Verify that the LOQs listed in Worksheet No. 15 were achieved.	Project Chemist or Data Validator, Tetra Tech
IIb	Analytical Data Deviations	Determine the impact of any deviation from sampling or analytical methods, SOP requirements, and matrix interferences on the analytical results.	Project Chemist or Data Validator, Tetra Tech

SAP Worksheet No. 36 -- Analytical Data Validation (Steps IIa and IIb) Summary Table

(UFP-QAPP Manual Section 5.2.2.1)

Step IIa/IIb	Matrix	Analytical Group	Validation Criteria	Data Validator (title and organizational affiliation)
IIa and IIb	Soil, Sediment, Surface Water, Groundwater[1]	VOCs	Data validation will be performed using criteria for SW-846 8260B listed in Worksheets Nos. 12, 15, 24, 25, and 28 and the current DoD QSM. If not included in the aforementioned, the logic outlined in the USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic Data Review, EPA-540/R-99-008 (USEPA, October 1999) will be used to apply qualifiers to data.	Project Chemist or Data Validator, Tetra Tech
IIa and IIb	Soil, Sediment, Surface Water, Groundwater[1]	PAHs	Data validation will be performed using criteria for SW-846 8270C-modified (SIM) listed in Worksheets Nos. 12, 15, 24, 25, and 28, and the current DoD QSM. If not included in the aforementioned, the logic outlined in the USEPA CLP National Functional Guidelines for Organic Data Review, EPA-540/R-99-008 (USEPA, October 1999) will be used to apply qualifiers to data.	Project Chemist or Data Validator, Tetra Tech
IIa and IIb	Soil, Sediment, Surface Water, Groundwater[1]	PCBs	Data validation will be performed using criteria for SW-846 8270C-modified (SIM) listed in Worksheets Nos. 12, 15, 24, 25, and 28, and the current DoD QSM. If not included in the aforementioned, the logic outlined in the USEPA CLP National Functional Guidelines for Organic Data Review, EPA-540/R-99-008 (USEPA, October 1999) will be used to apply qualifiers to data.	Project Chemist or Data Validator, Tetra Tech
IIa and IIb	Soil, Sediment, Surface Water, Groundwater[1]	Metals (including mercury)	Data validation will be performed using criteria for SW-846 6010B, 6020, 7470A, and 7471A listed in Worksheets Nos. 12, 15, 24, 25, and 28, and the current DoD QSM. If not included in the aforementioned, the logic outlined in USEPA CLP National Functional Guidelines for Inorganic Data Review, EPA 540-R-04-004 (2004) will be used to apply qualifiers to data.	Project Chemist or Data Validator, Tetra Tech
IIa and IIb	Sediment	TOC	Data validation will be performed using criteria for SW-846 9060 listed in Worksheets Nos. 12, 15, 24, 25, and 28, and the current DoD QSM. If not included in the aforementioned, the logic outlined in USEPA CLP National Functional Guidelines for Inorganic Data Review, EPA 540-R-04-004 (2004) will be used to apply qualifiers to data.	Project Chemist or Data Validator, Tetra Tech

1 Groundwater not applicable in Phase I; possibly applicable in Phase II (if necessary).

SAP Worksheet No. 37 -- Usability Assessment

(UFP-QAPP Manual Section 5.2.3)

Data Usability Assessment
The usability of the data generated during the RFI directly affects whether project objectives can be achieved. The following characteristics will be evaluated at a minimum, and 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 evaluator 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 Tetra Tech FOL acting on behalf of the Project Team will prepare a table listing planned samples/analyses compared to collected samples/analyses. If deviations from the scheduled sample collection or analyses are identified, the Tetra Tech PM and Project Risk Assessor will determine whether the deviations compromise the ability to meet project objectives. If they do, the Tetra Tech PM 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 Tetra Tech 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 Worksheet Nos. 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 if data have been flagged as estimated (J qualifier), limitations on the use of the data will be described in the project report. **Accuracy** The Tetra Tech 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 No. 28. This assessment will include an evaluation of field and laboratory contamination; instrument calibration variability; and analyte recoveries for surrogates, MSs, and LCSs. 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 also be described in the project report. • **Representativeness** A Tetra Tech Project Scientist identified by the Tetra Tech PM 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 Tetra Tech 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 Tetra Tech Project Chemist indicates that such quantitative analysis is required.

- **Sensitivity**
  The Tetra Tech Project Chemist acting on behalf of the Project Team will determine whether project sensitivity goals listed in Worksheet No. 15 were achieved. The overall sensitivity and LOQs 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 in the project report. The Tetra Tech Project Chemist may enlist the help of the Project Risk Assessor to evaluate deviations from planned sensitivity goals.

- **Project Assumptions and Data Outliers**
  The Tetra Tech PM 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. Quantitative assumptions include those related to data distributions (e.g., normal or log-normal) and estimates of data variability. Potential data outliers will be removed if a review of the associated data indicates that the results have an assignable cause that renders them inconsistent with the remainder of the data. During this evaluation, the team will consider whether outliers could be indications of unanticipated site conditions.

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

After the completion of data validation, the data and data quality will be reviewed to determine whether sufficient data of acceptable quality are available for decision making. In addition to the evaluations described above, a series of inspections and statistical analyses will be performed to estimate these DQI characteristics. The statistical evaluations will include simple summary statistics for target analytes, such as maximum concentration, minimum concentration, number of samples with non-detected results, number of samples with detected results, and the proportion of samples with detected and non-detected results. The Project Team members identified by the Tetra Tech PM will assess whether the data collectively support the attainment of project objectives. The Project Team will consider whether any missing or rejected data have compromised the ability to make decisions or to make decisions with the desired level of confidence. The data will be evaluated to determine whether missing or rejected data can be compensated for by other data. Although rejected data will generally not be used, there may be reason to use them in a weight-of-evidence argument, especially when they supplement data that have not been rejected. If rejected data are used, their use will be supported by technically defensible rationales.

For statistical comparisons and mathematical manipulations, non-detected values will be represented by a concentration equal to one-half of the sample-specific reporting limit. Duplicate results (original and duplicate) will not be averaged for the purpose of representing the range of concentrations; however, the average of the original and duplicate samples will be used to represent the concentration at a particular sampled location.

Identify the personnel responsible for performing the usability assessment:

The Tetra Tech PM, Project Chemist, FOL, and Project Scientist will be responsible for conducting the listed data usability assessments. The data usability assessment will be reviewed with the NSA Crane ERSM, Navy RPM, IDEM RPM, and USEPA RPM. If deficiencies affecting the attainment of project objectives are identified, the review will take place either in a face-to-face meeting or teleconference, depending on the extent of identified deficiencies. If no significant deficiencies are identified, the data usability assessment will simply be documented in the project report and reviewed during the normal document review cycle.

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

The data will be presented in tabular format, including data qualifications such as estimation (J, UJ) or rejection (R). Written documentation will support the non-compliance estimated or rejected data results. The project report will identify and describe the data usability limitations and suggest resampling or other corrective actions, if necessary.

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FIGURES

10-1 Base and Site Location Map
10-2 Site Layout – 2005 Aerial Photograph
10-3 Site Plan
10-4 Conceptual Site Model Schematic
10-5 Human Conceptual Exposure Model Diagram
10-6 Ecological Conceptual Exposure Model Diagram
11-1 Sampling Areas
17-1 Sampling Locations on Gravel Pad
17-2 Other Sampling Locations

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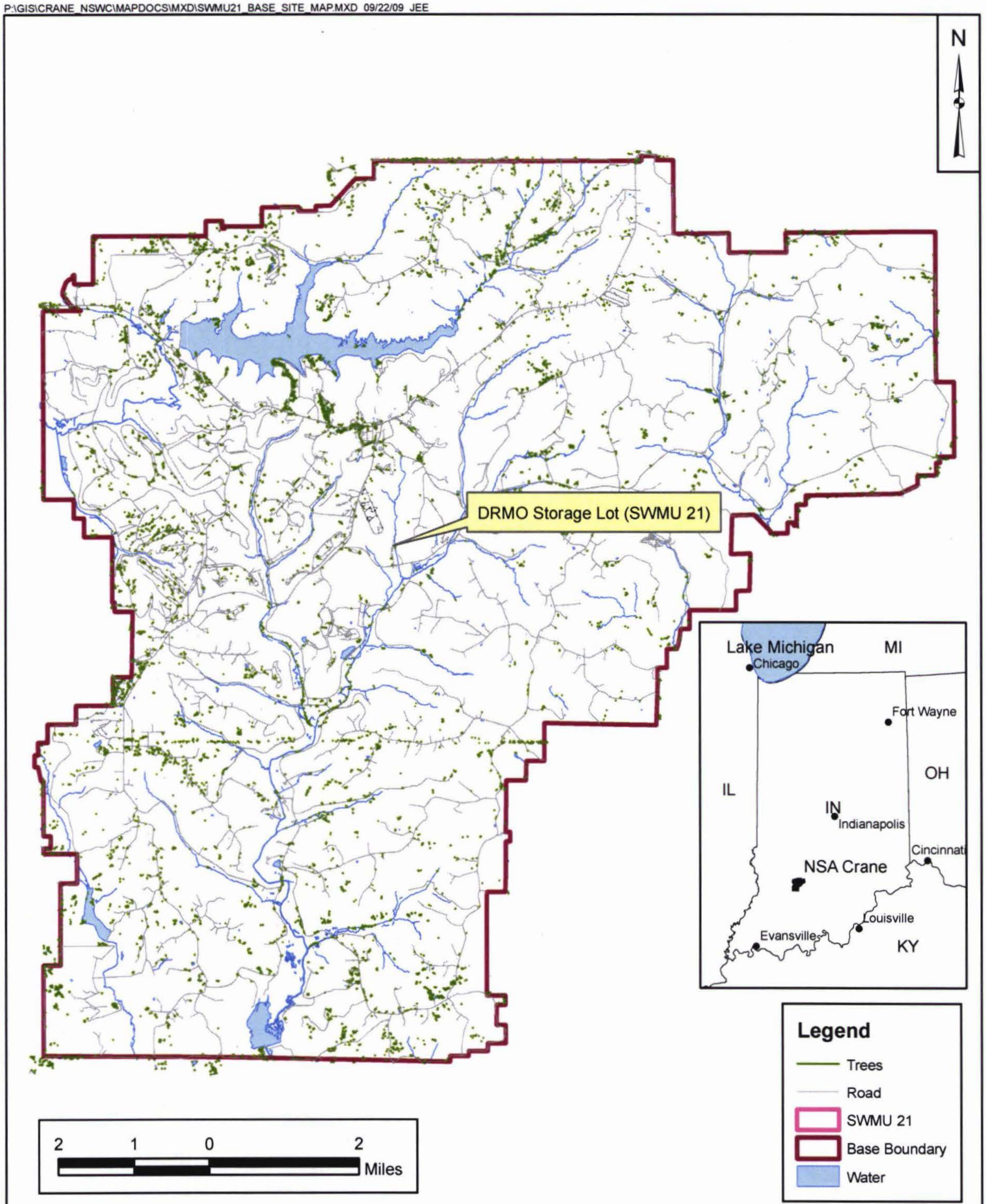

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K. MOORE	06/01/09		CTO 0271	
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L. FOSTER	09/22/09		—	—
REVISED BY	DATE		APPROVED BY	DATE
—	—		—	—
SCALE AS NOTED			FIGURE NO. FIGURE 10-1	REV 0

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CHECKED BY T. KLIMEK	DATE 7/10/09		APPROVED BY ___ DATE ___
REVISED BY K. MOORE	DATE 7/10/09		APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 10-2 — REV 0

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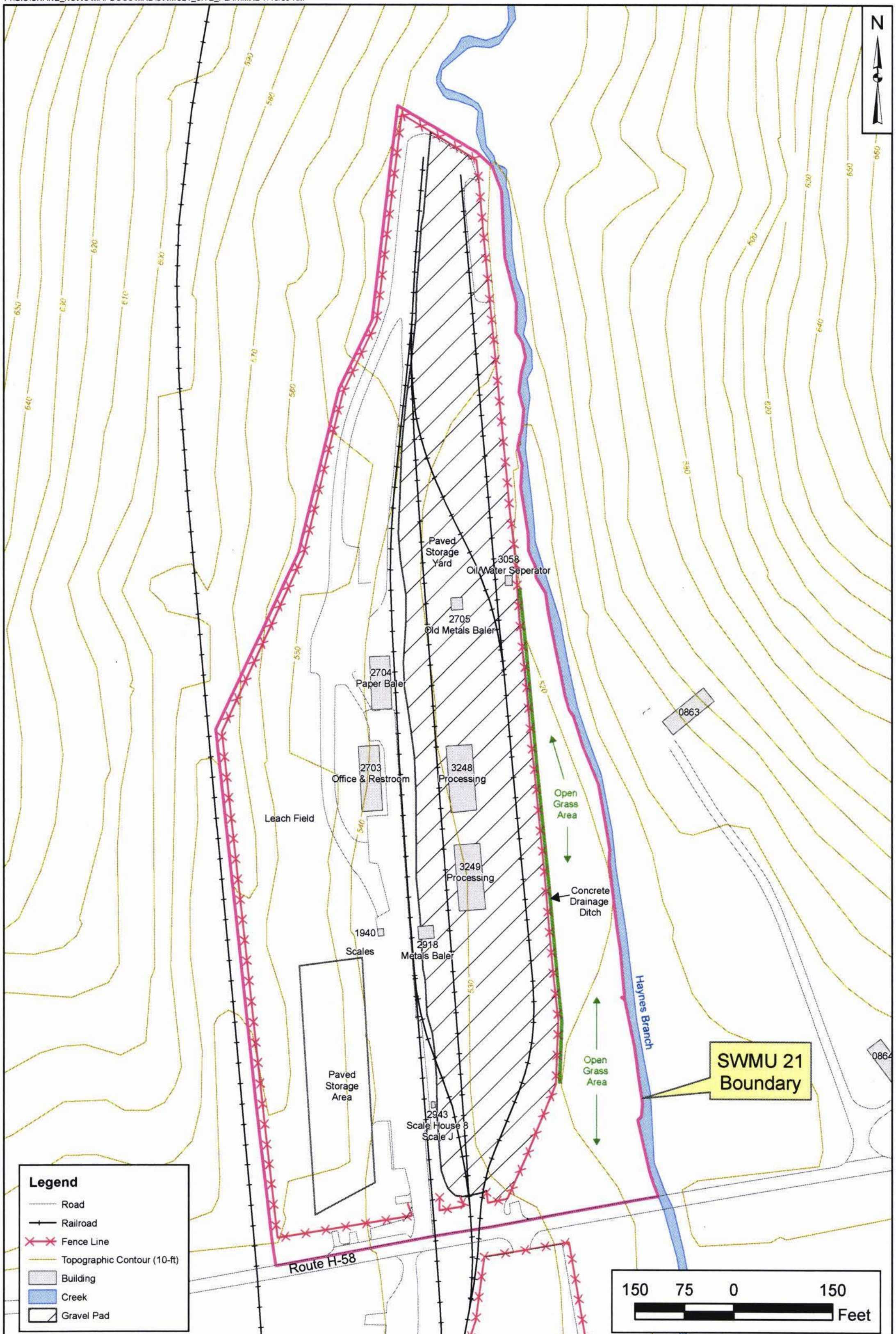

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REVISED BY K. MOORE	DATE 7/10/09		APPROVED BY / DATE
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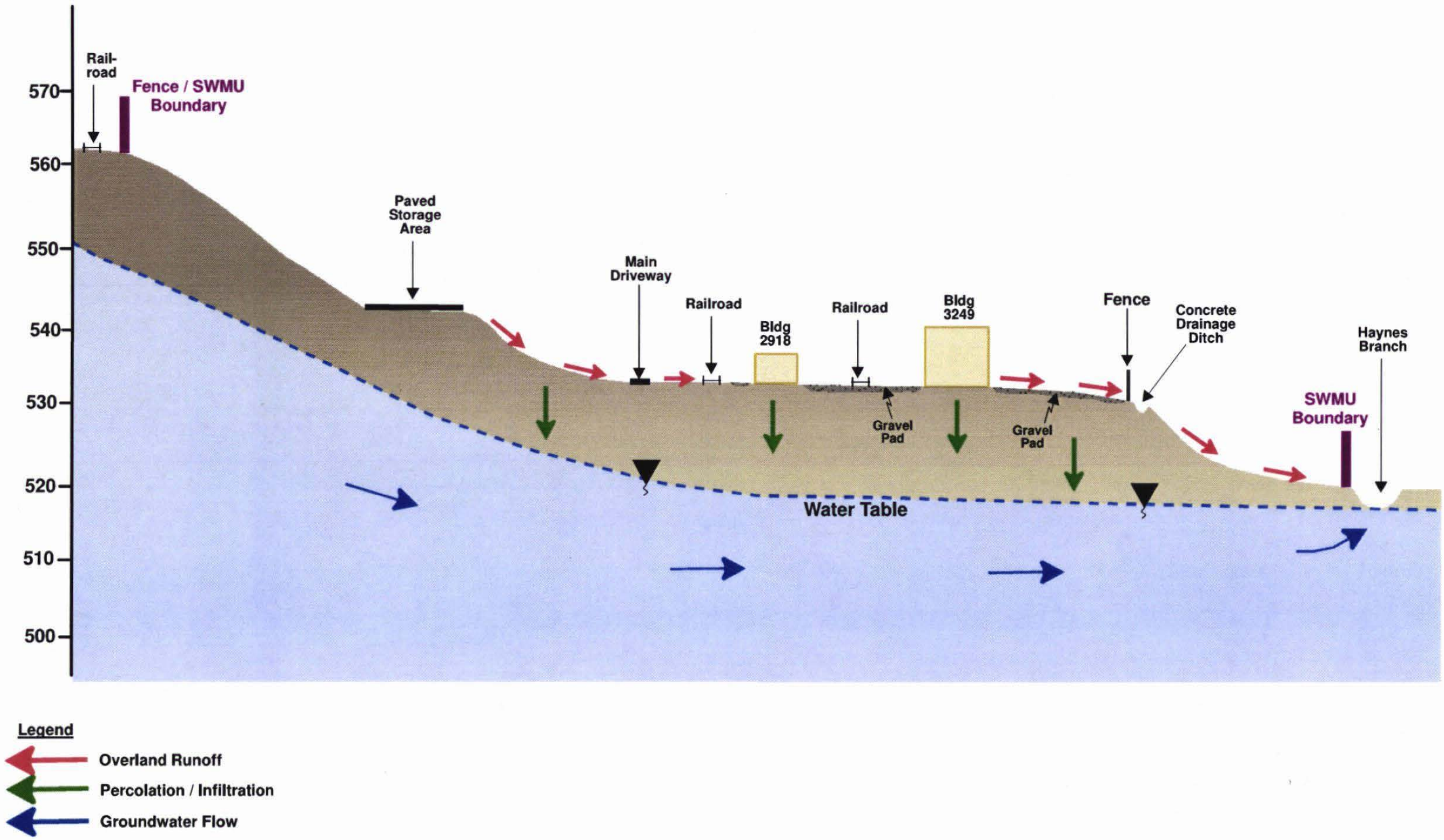

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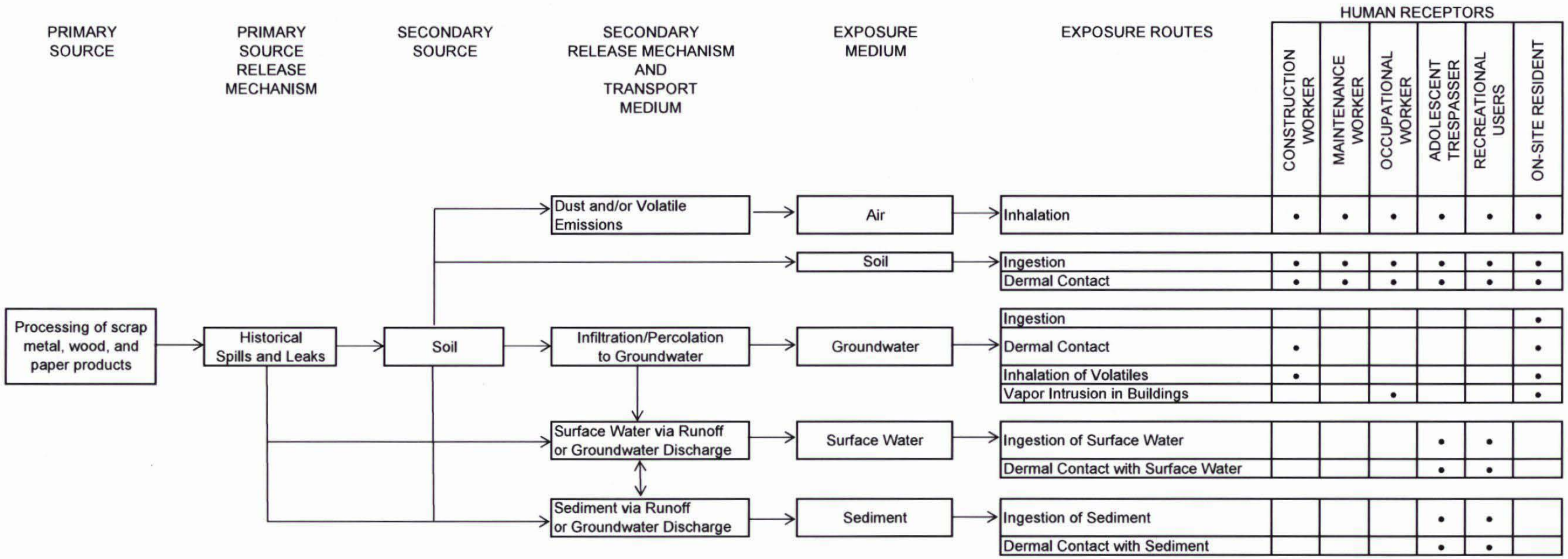
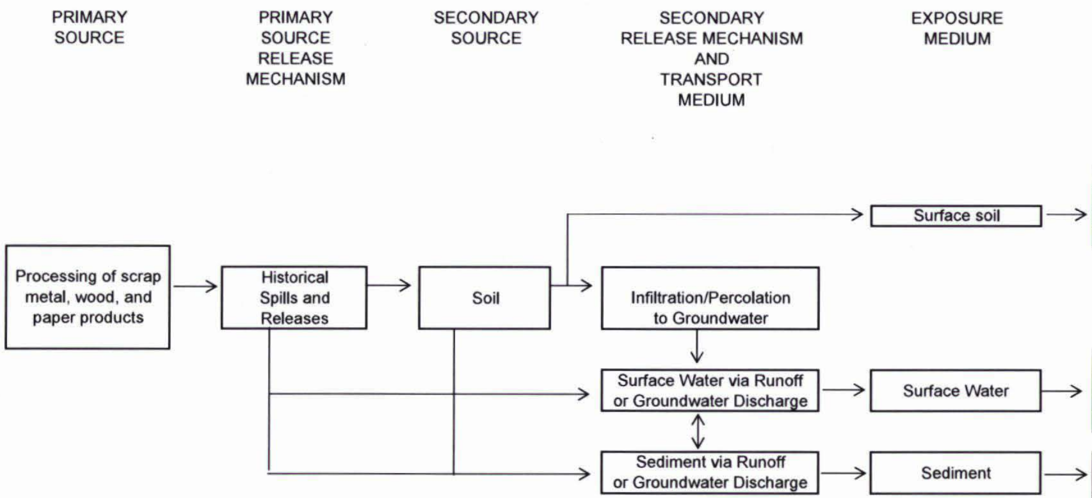
SCALE NOT TO SCALE		CRANE, INDIANA	FIGURE NO. FIGURE 10-4 / REV 0

FIGURE 10-5
HUMAN CONCEPTUAL EXPOSURE MODEL DIAGRAM
SWMU 21 - DRMO STORAGE LOT
NSA CRANE, INDIANA



• Indicates receptor for evaluation

FIGURE 10-6
ECOLOGICAL CONCEPTUAL EXPOSURE MODEL DIAGRAM
SWMU 21- DRMO STORAGE LOT
NSA CRANE, INDIANA



Exposure Medium	EXPOSURE ROUTES	TERRESTRIAL VERTEBRATES	TERRESTRIAL INVERTEBRATES	AQUATIC VERTEBRATES	AQUATIC INVERTEBRATES	TERRESTRIAL PLANTS
Surface soil	Direct Contact	•	•			•
	Ingestion of Soil	•	•			
	Ingestion of Plants	•	•			
	Ingestion of Prey	•	•			
Surface Water	Direct Contact	•		•	•	
	Ingestion of Surface Water	•		•	•	
	Ingestion of Prey	•		•	•	
Sediment	Direct Contact	•		•	•	
	Ingestion of Sediment	•		•	•	
	Ingestion of Prey	•		•	•	

ECOLOGICAL RECEPTORS

• Indicates receptor for evaluation

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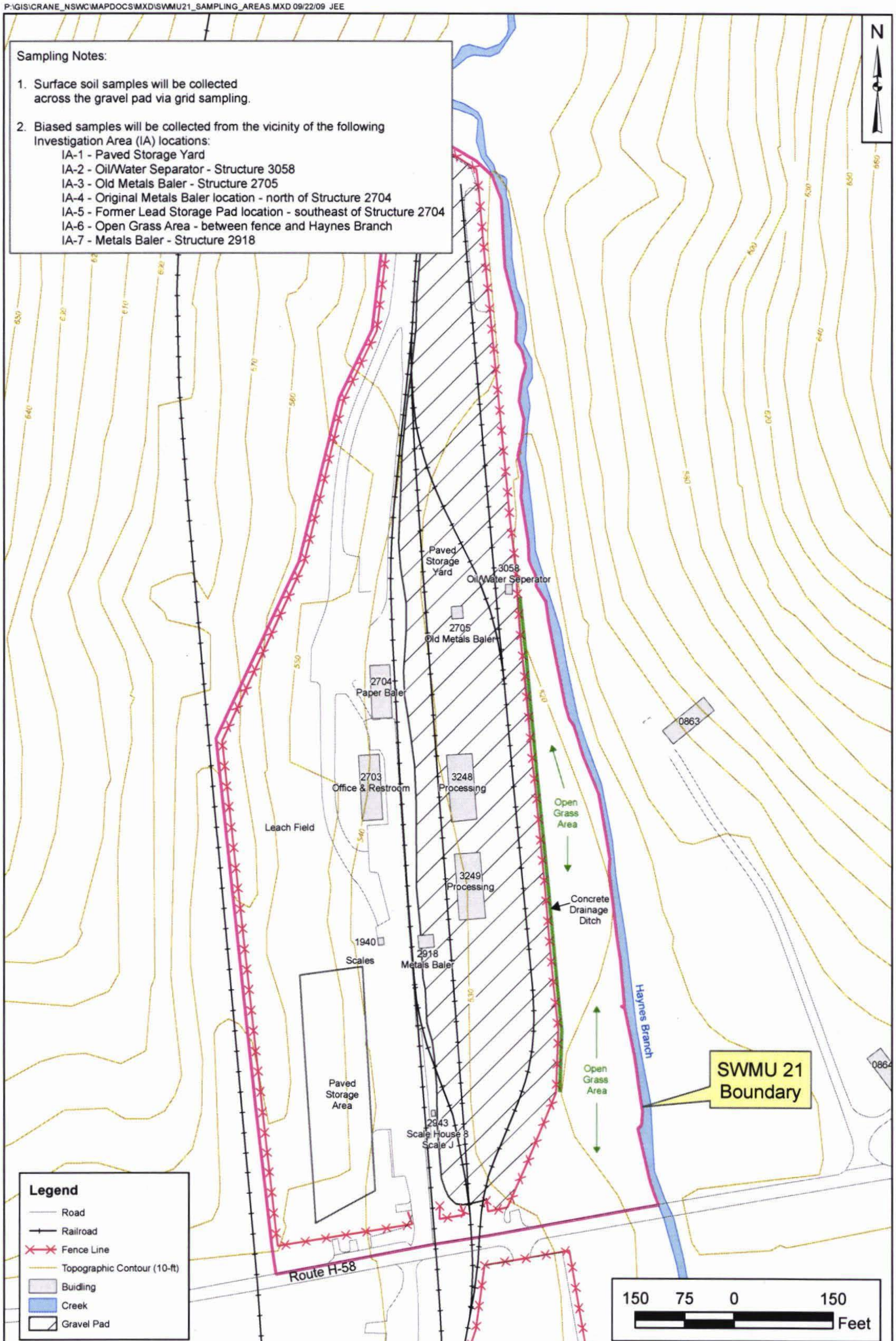

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K. MOORE	05/29/09
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T. KLIMEK	07/13/09
REVISED BY	DATE
J. ENGLISH	09/22/09
SCALE AS NOTED	

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SAMPLING AREAS
SWMU 21 - DRMO STORAGE LOT
NSA CRANE
CRANE, INDIANA

CONTRACT NUMBER CTO F274	
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO. FIGURE 11-1	REV 0

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1.) Gravel pad sampling locations are 21SS-GPxx. Only GPxx shown for brevity.
2.) Coordinate grid in State Plane NAD 1983 Indiana West (Feet).

Legend

- Surface soil sampling location on gravel pad
- SWMU Boundary

DRAWN BY T. WHEATON	DATE 10/20/09	SAMPLING LOCATIONS ON GRAVEL PAD SWMU 21 - DRMO STORAGE LOT NSA CRANE CRANE, INDIANA	CONTRACT NUMBER
CHECKED BY T. KLIMEK	DATE 10/20/09		APPROVED BY / DATE
REVISED BY	DATE		APPROVED BY / DATE
SCALE AS NOTED			FIGURE NO. FIGURE 17-1 / REV 0

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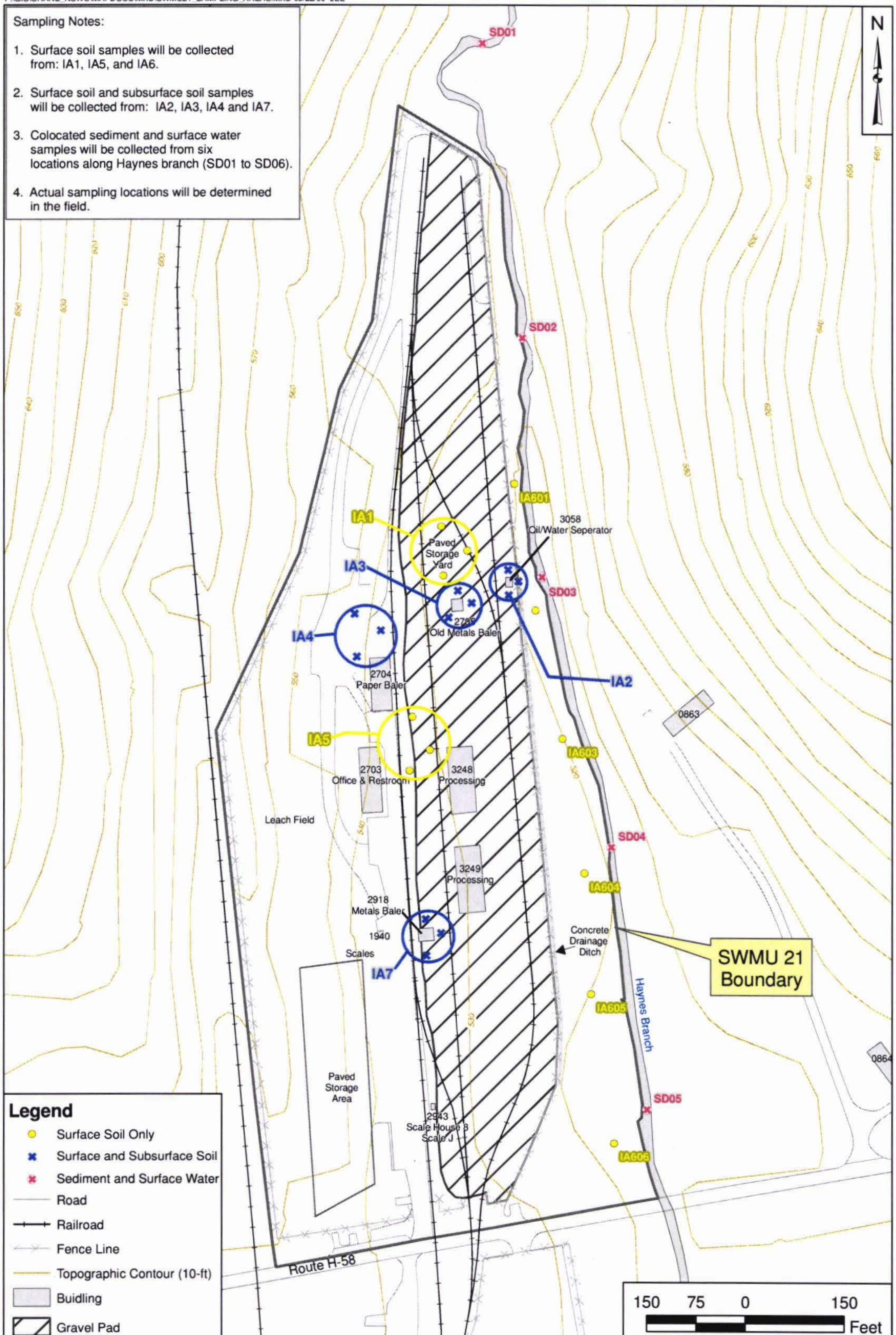

DRAWN BY T. WHEATON	DATE 10/20/09	OTHER SAMPLING LOCATIONS SWMU 21 - DRMO STORAGE LOT NSA CRANE CRANE, INDIANA	CONTRACT NUMBER CTO F274
CHECKED BY T. KLIMEK	DATE 10/20/09		APPROVED BY — DATE —
REVISED BY —	DATE —		APPROVED BY — DATE —
SCALE AS NOTED		NAVFAC	FIGURE NO. FIGURE 17-2 — REV 0

APPENDIX

Appendix A, B, C and D are contained on the enclosed CD